



भाट इंदिरा पुल के पास, गांधीनगर 382 428
Bhat, Nr Indira Bridge,
Gandhinagar - 382 428. GUJARAT
(INDIA)
Tel. : + 91 - 23962000
Fax : + 91 - 23962277

PART - II : TECHNICAL BID

काम का नाम
Name of work

इंस्टीट्यूट फॉर प्लाज़्मा रिसर्च परिसर, इंदिरा ब्रिज के पास, भाट, गांधीनगर -
382428 सड़क के पुनः सरफेसिंग के लिए निविदा

**Tender for Re-Surfacing of Road at Institute for Plasma Research
Campus, Near Indira Bridge, Bhat, Gandhinagar-382428**

Tender Notice No: IPR/TN/CIVIL/07/2021 dated: 4.7.2021

दो बोली प्रणाली
Two Bid System

Address of Tender: Chairperson, Infrastructure and Campus development
committee,
अध्यक्ष, अवसंरचना और कैम्पस विकास समिति
Inviting Authority INSTITUTE FOR PLASMA RESEARCH
Near Indira Bridge,
Bhat - Gandhinagar - Gujarat - 382428
Contact Person: Mr. Shailendra Trivedi,
Officer In-charge, e- Tender, IPR (E-mail id:
etender.icdc@ipr.res.in)
Telephone No. -079-2396 2000 - 2396 4009
Fax No. -079 -2396 2277

NOTE: In case of any conflict/contradiction between English and hindi version, English version will prevail.

INSTITUTE FOR PLASMA RESEARCH
NEAR INDIRA BRIDGE, BHAT, GANDHINAGAR – 382 428
CONTENTS

SECTION	NO	TITLE	PAGE
1	(i)	E-Tender Notice (Newspaper Advertisement)	03
	(ii)	Detailed Tender Notice	
		A) Instruction for online Submission	04 to 08
		B) Tender notice Details	09 to 10
		C) Requirements and Eligibility Criteria	11 to 12
		D) Documents to be Scanned & Uploaded	13 to 14
		E) Standard formats (A to k)	15 to 26
		(F) Tender Evaluation Process	27
	(iii)	Brief particular of work	28
	(iv)	Information and instruction for bidder	29 to 37
2		Conditions and Clauses of contract	38
	(i)	General guidelines	39
	(ii)	General rules and directions	40 to 43
	(iii)	Conditions of contract	44 to 46
	(iv)	General clause of contract	47 to 96
	(v)	Integrity Pact	97 to 103
	(vi)	Special Clauses of Contract	104 to 120
	(vii)	Proforma of Schedules	121 to 126
3	(i)	Safety code	127 to 132
	(ii)	Safety with scaffolding	133 to 138
	(iii)	IPR Safety code	139 to 191
	(iv)	Model rules for the protection of health and sanitary arrangements for workers employed by Institute or its contractors	192 to 197
	(v)	Contractor's Labour Regulations with annexures	198 to 220
4		Guarantee bonds/proformas	221
	(i)	Earnest Money Deposit	222
	(ii)	Performance Bank Guarantee	223 to 224
	(iii)	Mobilization Advance Bank Guarantee	225 to 226
	(iv)	Indenture for Secured Advance	227 to 229
	(v)	Guarantee bond for Anti-Termite Treatment	230 to 231
	(vi)	Guarantee bond for Waterproofing Works	232 to 233
5		List of drawings	234
6		Detailed specifications	
	(i)	Detailed specification for road work	236 to 362
7		IPR campus layout	363



प्लाज्मा अनुसंधान संस्थान

भाट, निकट इन्दिरा पुल, गांधीनगर - ३८२४२८, गुजरात (भारत)

Institute for **Plasma Research**

Bhat, Near Indira Bridge, Gandhinagar – 382428, Gujarat (INDIA)

Phone : +91-79-23962000, Fax: +91-79-23962277,

Web: <http://www.ipr.res.in>

SECTION - 1 (i) Tender Notice (Newspaper Advertisement)

INSTITUTE FOR PLASMA RESEARCH

Nr. Indira Bridge, Bhat, Gandhinagar – 382 428

Phone: 079-23962000/4009, Fax: 079-23962277

Tender Notice (Newspaper Advertisement)

TENDER NOTICE NO: IPR/TN/CIVIL/07/2021 (Two Bid System)

E-tendering के माध्यम से योग्यता प्राप्त ठेकेदार से निम्नलिखित कार्य के लिए दो भागों में ऑनलाइन निविदाएं आमंत्रित की जा रही हैं।

Online tenders are invited in two parts THROUGH e-tendering mode from and eligible contractors for the following.

Name of Work:	Tender for Re-Surfacing of Road at Institute for Plasma Research Campus, Near Indira Bridge, Bhat, Gandhinagar-382428
----------------------	--

निविदा दस्तावेज विस्तृत निविदा सूचना के साथ www.tenderwizard.com/DAE पर निशुल्क निदर्शन तथा डाउनलोड करने के लिए उपलब्ध है।

Detailed tender notice and Tender Document is available on website www.tenderwizard.com/DAE for free view and downloading.

इस निविदा सूचना की प्रति संस्थान की वेबसाइट पर भी उपलब्ध है।

A copy of this tender notice is also available on the Institute's website

<http://www.ipr.res.in/documents/tenders.html>



प्लाज़्मा अनुसंधान संस्थान

भाट, निवृत्त इन्दिरा पुल, गांधीनगर - ३८२४२८, गुजरात (भारत)

Institute for **Plasma Research**

Bhat, Near Indira Bridge, Gandhinagar – 382428, Gujarat (INDIA)

Phone : +91-79-23962000, Fax: +91-79-23962277,

Web: <http://www.ipr.res.in>

SECTION – 1 (ii) Detailed Tender Notice

भाग-ए: ऑनलाइन सबमिशन के लिए निर्देश

PART-A: INSTRUCTION FOR ONLINE SUBMISSION

1 डाउनलोड करने, अपलोड करने और मुफ्त दृश्य के लिए कदम-

1 Steps for downloading, uploading and free view-

संभावित बोलीदाता या सामान्य जनता वेबसाइट www.tenderwizard.com/DAE से निविदा दस्तावेजों के मुफ्त पीडीएफ प्रारूप को देख और डाउनलोड कर सकते हैं > डीआई के निविदा > प्लाज़्मा अनुसंधान संस्थान, गांधीनगर

Prospective bidders or General public can see and download free of cost **PDF format** of the tender documents from website www.tenderwizard.com/DAE > **Tender Of DAE > Institute for plasma research, Gandhinagar.**

निविदा में भाग लेने के लिए, संभावित बोलीदाता से अनुरोध है कि उपयोगकर्ता आईडी / पासवर्ड / कक्षा III डिजिटल हस्ताक्षर प्रमाणपत्र के साथ वेबसाइट www.tenderwizard.com/DAE के होम पेज में लॉगिन के बाद एक्सेल प्रारूप डाउनलोड करें। आईपीआर / डीआई में ई-निविदा के लिए सेवाएं मैसर्स आईटीआई लिमिटेड, निविदा विज़ार्ड हेल्प डेस्क सेंटर, # 24, पहला मंजिल, सुधा कॉम्प्लेक्स, हवनूर सर्किल के पास, तीसरी चरण, चौथा ब्लॉक, बसेश्वरनगर, बेंगलूर द्वारा प्रदान की जाती है। - 560 07 9, पीएच: 91-80-40482100, 91-80-45982100, टेलीफैक्स: 91-80-40482114, ईमेल:daehelpdesk@etenderwizard.com

To participate in the tender, Prospective Bidder are requested to download the Excel formats, after login in the Home page of the website www.tenderwizard.com/DAE with User **id/ Password /Class III Digital Signature Certificate**. The services for e-tendering in IPR/DAE is provided by M/s ITI Ltd., Tender wizard Help Desk Centre, # 24, 1st Floor, Sudha Complex, Near Havanoor Circle, 3rd Stage, 4th Block, Basaveshwaranagar, Bangalore - 560 079, Ph:91-80-40482100, 91-80-45982100, Telefax: 91-80-40482114, Email:daehelpdesk@etenderwizard.com.

विशेष निविदा के एक्सेल प्रारूपों को डाउनलोड करने के लिए कदम:

Steps to Download the excel formats of particular tender:

- a: लागू बटन पर क्लिक करें
- a: Click on **UNAPPLIED** button

- b: अनुरोध बटन पर क्लिक करें
- b: Click on **REQUEST** button

- c: इलेक्ट्रॉनिक मोड के माध्यम से ई-भुगतान के माध्यम से ऑनलाइन निविदा प्रसंस्करण शुल्क का भुगतान करें।
- c: Pay Tender Processing fee online via e-payment through electronic mode
- d: बटन पर क्लिक करें.
- d: Click on **SUBMIT** button,
- e: इन प्रोग्रेस बटन पर क्लिक करें (स्टेटस कॉलम बोलीदाता को निविदा के रूप में प्राप्त किया जाएगा)
- e: Click on **INPROGRESS** button (In status column bidder will find the tender as **RECEIVED**)
- f: बोलीदाता जमा करने की अंतिम तारीख तक किसी भी समय के लिए अनुलग्नक बटन संपादित करके आवश्यक निविदा दस्तावेज डाउनलोड करने में सक्षम हो जाएगा।
- f: Bidder will be able to download required Tender Documents by clicking **EDIT attachment** button for any number of times till last date of submission.
- 1 संभावित बोलीदाता को एक्सेल दस्तावेज भरना होगा और इसे नामित किए बिना अपलोड करना होगा। कृपया निविदा जमा करने के लिए सहायता पुस्तिका देखें या आईटीआई हेल्पडेस्क से संपर्क करें।
- 1 Prospective Bidder has to fill Excel Documents and upload the same without renaming it. Please refer Help Manual for Tender submission or contact ITI Helpdesk.
- 2 इच्छुक बोलीदाता को निविदा और सावधानी मानदंडों को ध्यान से आमंत्रित करने वाले नोटिस में नियम और शर्तें पढ़नी चाहिए। अगर वह खुद को योग्य मानता है तो उसे केवल अपनी बोली जमा करनी चाहिए और वह आवश्यक सभी दस्तावेजों के कब्जे में है।
- 2 The intending bidder must read the terms and conditions in the notice inviting tender & prequalification criteria carefully. He should only submit his bid if he considers himself eligible and he is in possession of all the documents required.
- 3 बोली जमा करने का मतलब बोलीदाता द्वारा Form "I". के रूप में संलग्न प्रारूप के अनुसार ऑनलाइन प्रस्तुत किए जाने वाले उपक्रम की स्वीकृति होगी।
- 3 Submission of bid shall mean acceptance of undertaking to be furnished online by bidder as per format enclosed as Form "I".
- 4 वेबसाइट पर पोस्ट बोलीदाताओं के लिए सूचना और निर्देश निविदा दस्तावेज का हिस्सा बनेंगे। आवश्यक प्रसंस्करण शुल्क का भुगतान करने के बाद निविदा डाउनलोड और अपलोड करने के लिए केवल www.tenderwizard.com/DAE पर अपलोड किया जाना है।
- 4 Information and Instructions for bidders posted on website shall form part of tender document. The tender is to be downloaded and uploaded only on www.tenderwizard.com/DAE after paying requisite processing fee.
- 5 बोली केवल अनिवार्य स्कैन किए गए दस्तावेजों को अपलोड करने के बाद ही प्रस्तुत की जा सकती है, "आईटीआई लिमिटेड, नई दिल्ली" के पक्ष में प्रसंस्करण शुल्क का भुगतान, आईपीआर के पक्ष में ईएमडी और निर्दिष्ट अन्य दस्तावेज। किसी भी मामले में प्रसंस्करण शुल्क वापस नहीं किया जाएगा।
- 5 The bid can only be submitted after uploading the mandatory scanned documents, payment of processing fee in favour of **"ITI LIMITED, NEW DELHI"**, Earnest Money Deposit in favour of IPR and other documents as specified. Processing fee shall not be refunded in any case.

6. बोलियां जमा करने के बाद ठेकेदार किसी भी समय संशोधित बोली को फिर से जमा कर सकता है लेकिन अधिसूचित किए गए बोली के ऑनलाइन जमा करने की तिथि निर्धारित करने की तारीख से पहले। बोलीदाता निर्धारित जमा तिथि और ऑनलाइन जमा करने के समय से पहले बोली वापस ले सकता है। लेकिन, जब बोलीदाता बोली वापस ले लेता है, तो उसे पुनः सबमिट नहीं किया जा सकता है।

देय तिथि और समय के बाद निविदा दस्तावेज जमा करने की अनुमति नहीं दी जाएगी। ई-टेंडरिंग पोर्टल पर प्रदर्शित होने वाला समय बोलीदाता पर अंतिम और बाध्यकारी होगा।

6. After submitting bids the contractor can re-submit revised bid any number of times but before stipulated closing time and date of online submission of bid as notified. The bidder can withdraw the bid before stipulated closing date and time of online submission. But, once the bidder withdraws the bid, it cannot be resubmitted.

Submission of the tender document after the due date and time shall not be permitted. Time being displayed on e-tendering portal shall be final and binding on the Bidder.

7. ठेकेदारों, जो www.tenderwizard.com/DAE वेबसाइट पर नामांकित नहीं हैं, को नामांकन प्राप्त करने की आवश्यकता है।

7. The contractors, who are not enrolled on www.tenderwizard.com/DAE website, are required to get enrolled.

8. इच्छुक बोली लगाने वाले को बोली जमा करने के लिए वैध कक्षा -3 डिजिटल हस्ताक्षर होना चाहिए।

8. The intending bidder must have valid class-III digital signature to submit the bid.

9. ठेकेदार को प्रत्येक आइटम की दर उद्धृत करना सुनिश्चित करना चाहिए। आंकड़ों में उद्धरण दर के लिए कॉलम का मतलब येलो रंग में दिखाई देता है और पल दर दर्ज की जाती है, यह स्काई ब्लू हो जाती है। इसके अलावा, किसी भी कोशिका का चयन करते समय एक चेतावनी प्रकट होती है कि यदि कोई भी सेल खाली छोड़ दिया जाता है तो उसे "0" के रूप में माना जाएगा। इसलिए, यदि कोई सेल खाली छोड़ दिया गया है और बोली लगाने वाले द्वारा कोई दर उद्धृत नहीं की जाती है, तो इस तरह की वस्तु की दर को "0" (शून्य) के रूप में माना जाएगा। बोली लगाने वाले को विनिर्देशों, मात्रा बिल और GCC प्रावधानों के अनुसार शून्य की उद्धृत दर पर ऐसी वस्तुओं को ज़िक्र करना होगा।

9. Contractor must ensure to quote rate of each item. The column meant for quoting rate in figures appears in **YELLOW** colour and the moment rate is entered, it turns **SKY BLUE**. In addition to this, while selecting any of the cells a warning appears that **if any cell is left blank the same shall be treated as "0"**. Therefore, if any cell is left blank and no rate is quoted by the bidder, rate of such item shall be treated as "0" (ZERO). The bidder shall be required to execute such items at his quoted rate of zero as per specifications, bill of quantity and GCC provisions.

10. निविदा प्रसंस्करण शुल्क के सफल ई-भुगतान पर, बोलीदाता ई-निविदा पोर्टल से निविदा दस्तावेज (एक्सेल शीट्स सहित, यदि कोई हो) डाउनलोड कर सकते हैं। बोलीदाताओं को ई-टेंडरिंग पोर्टल से केवल अंतिम तिथि और समय से पहले प्रसंस्करण शुल्क की ओर ई-भुगतान का विवरण अपलोड करना होगा और अन्यथा निविदा दस्तावेज (एक्सेल शीट्स सहित, यदि कोई हो) डाउनलोड करें, अन्यथा, यह संभव नहीं होगा उन्हें ई-निविदा पोर्टल पर ई-निविदा दस्तावेज अपलोड करने के लिए।

ध्यान दें: ऊपर दिए गए भुगतान विवरण की पुष्टि किए बिना निविदा दस्तावेज (एक्सेल शीट्स सहित, यदि कोई हो) डाउनलोड करना ई-निविदा पोर्टल वैध नहीं होगा और संक्षेप में अस्वीकार कर दिया जाएगा।

बोलीदाताओं को सलाह दी जाती है कि सर्वर पर अंतिम मिनटों या अपलोड करने में जटिलताओं से बचने के लिए समय पर अपने दस्तावेजों को अच्छी तरह से अपलोड करें। किसी भी मामले में आईपीआर दस्तावेजों को अपलोड करने में किसी भी प्रकार की समस्या के लिए ज़िम्मेदार नहीं होगा।

10. On successful e-payment of tender processing fees, the Bidders can download the tender document (including Excel sheets, if any) from the e-tendering portal. The Bidders have to upload the details of e-payment towards processing fees, before the last date & time and download the tender documents (including Excel sheets, if any) from the e-tendering portal only, otherwise, it will not be possible for them to upload the e-tender documents on the e-tendering portal.

Note: Downloading the tender documents (including Excel sheets, if any) without confirmation of payment details on above e-tendering portal shall not be valid and rejected summarily.

Bidders are advised to upload their documents well in time, to avoid last minutes rush on the server or complications in uploading. IPR, in any case, will not be responsible for any type of problem in uploading the documents.

11. बोलीदाता अपने ईमेल और बैंक खाते को सक्रिय रखने और परिवर्तन के मामले में अपनी प्रोफाइल को अपडेट करने के लिए पूरी तरह उत्तरदायी होते हैं। यह आवश्यक है क्योंकि संचार संस्थान द्वारा ई-मेल द्वारा अधिमानतः किया जाएगा। इसके अलावा, ई-निविदा पोर्टल द्वारा सभी ऑटो जनरेट किए गए मेल इस ई-मेल पते पर भेजे जाएंगे।
11. The bidders are solely responsible to keep their email and bank account active and to update their profile in case of change. This is essential as communication shall preferably be done by e- mail by Institute. Moreover, all the auto generated mail by e-tendering portal shall be sent on this e-mail address.
12. ठेकेदार JPG प्रारूप और PDF प्रारूप के रूप में दस्तावेज़ अपलोड कर सकते हैं।
12. Contractor can upload documents in the form of JPG format and PDF format.
13. बोलीदाताओं को सलाह दी जाती है कि वे अपने स्वयं के लाभ के लिए निविदा प्रसंस्करण शुल्क के ऑनलाइन भुगतान को सुविधाजनक बनाने के लिए कोर बैंकिंग समाधान शाखा (with NEFT / RTGS) के साथ बैंक खाता खोलें।
13. Bidders are advised to open bank account with core banking solution branch (with NEFT / RTGS) in order to facilitate online payment of tender processing fee for their own benefit.
14. विस्तृत एनआईटी और तकनीकी बोली समझौते का हिस्सा होगी। यदि किसी भी स्तर पर बोलीदाता इसे स्वीकार करने से इंकार कर देता है, तो बोली खारिज कर दी जाएगी और ईएमडी जब्त कर दी जाएगी। आगे अनुशासनात्मक कार्रवाई भी शामिल की जा सकती है।
14. The detailed NIT and Technical bid shall be part of agreement. If the bidder at any stage refuses to accept the same, the bid shall be rejected and Earnest Money Deposit shall be forfeited. Further disciplinary action is liable to be taken including.
15. निविदा दस्तावेज़ जमा करने में किसी भी समस्या के मामले में, बोलीदाता को सहायता डेस्क की सहायता हो सकती है या उस वेबसाइट या मोबाइल पर दिए गए सहायता पुस्तिका का उपयोग कर सकते हैं और कहीं और उल्लिखित ई-मेल का उपयोग किया जा सकता है।

15. In case of any problem with the submission of the tender document, the Bidder may have the assistance of help desk or use the help manual given on the said website or mobile and e-mail mentioned elsewhere.
16. निविदा ऑनलाइन जमा की जाएगी। इसे जमा करने का कोई अन्य तरीका स्वीकार्य नहीं है।
16. The tender shall be submitted online. No other mode of submission is acceptable.
17. नियत तारीख और समय के बाद निविदा प्रस्तुत करने की अनुमति नहीं दी जाएगी। ई-टेंडरिंग पोर्टल पर प्रदर्शित किया जा रहा समय आवेदक के लिए अंतिम और बाध्यकारी होगा।
17. Submission of the Tender after the due date and time shall not be permitted. Time being displayed on e-tendering portal shall be final and binding on the applicant.
18. खोलने पर, बोलीदाता अपनी बोली स्थिति देख सकते हैं। बोली के उद्घाटन के दौरान बोलीदाता के अधिकृत प्रतिनिधि उपस्थित रह सकते हैं (यदि ऐसी इच्छा हो तो)। अधिकृत प्रतिनिधि के पास उनकी कंपनी के सक्षम प्राधिकारी द्वारा जारी वैध फोटो पहचान और मूल अधिकार पत्र होना चाहिए।
18. On opening, the Bidders can see their bid status. The authorized representative of Bidders may remain present (if so desires) during opening of Bid. The authorized representative should have valid photo identity and original authority letter issued by competent authority of their company.
18. ई-टेंडरिंग संबंधित प्रश्नों / सेवाओं के लिए हेल्प डेस्क-
 - a) मेसर्स आईटीआई के प्रतिनिधि,
श्री सुनील के पटेल, मोबाइल नंबर 09714881992
ई-मेल : sunil.p@etenderwizard.com,
nodalofficer.et@ipr.res.in
 - b) अखिल भारतीय हेल्प लाइन नंबर: 91-80-40482100, 91-80-45982100
ई-मेल: daehelpdesk@etenderwizard.com
सभी कार्य दिवसों पर सुबह 10.00 बजे से शाम 6 बजे तक।
19. Help Desk for e-tendering related queries /services-
 - a) Representative of M/s ITI
Shri Sunil K Patel
Mobile No. 09714881992
e-mail : sunil.p@etenderwizard.com
nodalofficer.et@ipr.res.in
 - b) All India Help line No: 91-80-40482100, 91-80-45982100 e-mail:
daehelpdesk@etenderwizard.com;
From 10.00 AM to 6.00 PM on all working days.
20. आईपीआर किसी भी आवेदन के बिना किसी भी आवेदन को स्वीकार या अस्वीकार करने का अधिकार सुरक्षित रखता है। किसी भी शर्त के साथ आवेदन तुरंत अस्वीकार कर दिया जाएगा।
20. Institute reserves the right to accept or reject the tender(s) in full or in part, without assigning any reason thereof. Tenders with any conditions including conditional rebate shall be rejected forthwith.

भाग-बी: निविदा सूचना विवरण

PART-B: TENDER NOTICE DETAILS

Tender Notice No: IPR/TN/CIVIL/07/2021 (Two Bid System) dated 4.7.2021:

इंस्टीट्यूट फॉर प्लाज़्मा रिसर्च परिसर, इंदिरा ब्रिज के पास, भाट, गांधीनगर -382428 सड़क के पुनः सरफेसिंग के लिए निविदा

Tender notice for Re-Surfacing of Road at Institute for Plasma Research Campus, Near Indira Bridge, Bhat, Gandhinagar-382428

निदेशक की ओर से अध्यक्ष, अवसंरचना और कैम्पस विकास समिति द्वारा ई-निविदा मोड के माध्यम से ऑनलाइन आइटम दर निविदाएं आमंत्रित की जाती हैं, प्लाज़्मा रिसर्च संस्थान, पास। इंदिरा ब्रिज, भाट, गांधीनगर - गुजरात - 382 428, दो बोलियों में, योग्य ठेकेदारों से निम्नलिखित कार्यों के लिए।

Online item rate tenders are invited through e-tendering mode by the Chairperson, Infrastructure and Campus development committee, on behalf of Director, Institute for Plasma Research, **Nr. Indira Bridge, Bhat, Gandhinagar - Gujarat - 382 428**, in two bids, from eligible contractors for the following works.

1	NIT No.	IPR/TN/CIVIL/07/2021 dated 4.7.2021
2	Name of work	Tender notice for Re-Surfacing of Road at Institute for Plasma Research Campus, Near Indira Bridge, Bhat, Gandhinagar-382428
3	Estimated cost of Construction works (Rs)	₹ 74,68,593/-
4	Earnest Money Deposit (EMD)	EMD in the form of Bid Security Declaration form as per format given in this tender need to be submitted by Bidders Note: The bid can only be submitted after uploading the scanned copy of Bid Security Declaration form and original should be deposited in office of Tender Inviting Authority within the period of bid submission as mentioned. Bids received without requisite Bid Security Declaration form shall be summarily rejected.
5	Completion period	40 Days(Including monsoon period, if any)
6	Fee of Tender Document	NIL
7	Tender Processing Fee	₹ 4406/- should be paid only by e-payment through electronic mode to M/S ITI Limited
8	Performance Guarantee	3 % of Tendered Value to be provided upon issue of Letter of Acceptance and before placing Work Order
9	Availability of Tender Documents for view and download on website www.tenderwizard.com/DAE	From 10:00 Hours on 5.7.2021 and Up to 17:00 Hours on 19.7.2021
10	Site Visit, if any	Site visit by Agencies (if any) - up to 17:00 Hours on 26.7.2021. Contact officer Mr. Shailendra Trivedi officer in-charge, e-tender, Institute for Plasma Research, Near Indira Bridge, Bhat, Gandhinagar -382428. Preferably by email:

		etender.icdc@ipr.res.in or through Tel No:-079-2396 2000, 2396 4009
11	Seeking pre-bid clarification on Tender document	<p>The applicant can seek clarifications regarding Tender document up to 17:00 Hours on 2.8.2021 by uploading their queries on website www.tenderwizard.com/DAE.</p> <p>The clarifications will be uploaded on the same web portal by 17:00 Hours on 6.8.2021</p>
12	Last date and time of closing of online submission of tenders	18.8.2021 up to 13:00 Hours
13	Last date for submission of Original Instrument (Bid Security Declaration .) towards EMD.	On or before 13:00 Hours on 18.8.2021 in the Office of Mr. Shailendra Trivedi , Officer In-charge e-Tender, Institute for Plasma Research, Near Indira Bridge, Bhat, Gandhinagar -382428 Phone no. 079 2396 2000 – 2396 4009
14	Date and time of online opening of Technical Bid.	<p>On 18.8.2021 at 14:30 Hours</p> <p>Tender will be opened at Institute for Plasma Research, Near Indira Bridge, Bhat, Gandhinagar -382428 at the stipulated date and time above</p>
15	Date of opening of Financial Bids of qualified bidders	Will be notified at a later date.
16	Help Desk for e-tendering related queries /services	<p>a) Representative of M/s ITI Shri Sunil K Patel Mobile No. 09714881992 e-mail : sunil.p@etenderwizard.com nodalofficer.et@ipr.res.in</p> <p>b) All India Help line No: 91-80-40482100, 91-80-45982100 e-mail: daehelpdesk@etenderwizard.com; From 10.00 AM to 6.00 PM on all working days.</p>

PART-C: INITIAL ELIGIBILITY CRITERIA

बोलीदाता, जो स्वयं की निम्नलिखित आवश्यकताओं को पूरा करते हैं, केवल आवेदन करने के लिए पात्र होंगे। संयुक्त उद्यम स्वीकार नहीं किए जाते हैं।

The Bidders, who fulfill the following requirements on their own, shall only be eligible to apply. Joint ventures are not accepted.

Sr. No.	Eligibility Criteria	Documentary proof for the eligibility (To be Scanned and Uploaded) Note: The applicants are requested to fill up the facts & figure in the prescribed format. Simply filling like Yes or No shall not be accepted.
1.	Should have satisfactorily completed similar works (similar work means Bituminous Road work) during the last Seven years ending previous day of last day of submission of tender, of value as below (i) Three similar works each costing not less than Rs 29.87 in Lacs (40% of estimated cost) or (ii) Two similar works each costing not less than Rs 44.81 in Lacs (60% of estimated cost) or (iii) One similar work costing not less than Rs 59.75 in Lacs. (80% of estimated cost) Note: The value of executed works shall be brought to current costing level by enhancing the actual value of works at simple rate of 7% per annum; calculated from the date of completion to previous day of last day of submission of tenders.	Work orders and Completion certificates issued by the authority concerned Documentary Proof: 1. Work Orders & Completion certificate for qualifying completed work(s) issued by Engineer-in-Charge or Owner should be attached. 2. Completion certificates for works issued by Private parties shall be supported by TDS (Tax deducted at Source) Certificates.
2.	Should have had average annual turnover of Rs 37.42 in lacs (50 % of estimated cost) on construction work during the last three consecutive years ending 31 st March, 2020. Note: Year in which no turnover is shown would also be considered for working out the average.	Annexure -Form "A": Financial information, Chartered Accountant certificate for the Annual financial turnover showing Profit & Loss as submitted to Income Tax Department. Note: Balance sheet duly audited by chartered accountant to be submitted.
3	Should not have incurred any loss (profit after tax should be positive) in more than two years during the last five consecutive years ending on 31 st March, 2020.	Annexure -Form "A": Financial information, Chartered Accountant certificate for the Annual financial turnover showing Profit & Loss as submitted to Income Tax Department. Note: Balance sheet duly audited by chartered accountant to be submitted.
4.	Should have solvency of Rs 29.87 in Lacs (40% of estimated cost) issued by Bank.	Annexure Form "B" - Form of Bankers Certificate from a Bank

In addition to the supporting documents for eligibility criteria, information for the following to be submitted:

1.	List of Completed works during last 5 years ending on 31st March 2021 (As per Form "C")
2.	List of all ongoing Works. All works of any nature in hand must be furnished. No works shall be left out. (As per Form "D")
3.	List of construction plant, machinery, equipments, accessories & infrastructure facilities possessed by the Bidder and that proposed to complete the work in time. (As per Form "H")
4.	List of Administrative & Technical staff available with the Bidder and that proposed to be deployed to complete this work in time. (As per Form "G")
5	DOCUMENTS : (Scanned copy of original certificates to be uploaded) i) PAN (Permanent Account Number) Registration

Undertaking to be submitted :

	Undertaking as per Form "I" of Tender document should be submitted.
--	--

	<p>The Bidder may furnish any additional information, which they think necessary to establish their capabilities to successfully complete the envisaged work. No information shall be entertained after last date of online submission of tenders unless it is called by the competent authority.</p> <p>Short listing of the agencies shall be subject to thorough verification of their credentials and inspection of works carried out by them (if required), through a Technical Evaluation Committee, constituted by IPR. After evaluation of applications, a list of qualified tenderers shall be prepared for further opening of financial bid.</p> <p>If any information furnished by the Bidder is found incorrect at a later stage, they shall be liable to be debarred from tendering /taking up of work in IPR. IPR reserves the right to verify the particulars furnished by the Bidder independently and reject any application without assigning any reason.</p>
<p>NOTE: prospective agencies shall satisfy themselves of fulfilling all the NIT criteria before submission of tender. The Institute reserves the right to not consider the tender documents of the agencies not fulfilling the stipulated criteria.</p>	

भाग- डी: दस्तावेजों को स्कैन और अपलोड किया जाना चाहिए

PART- D: DOCUMENTS TO BE SCANNED & UPLOADED

संभावित बोलीदाता सभी पात्रता मानदंडों को पूरा करने और ऑनलाइन निविदा दस्तावेज जमा करने से पहले आवश्यक सभी दस्तावेजों के कब्जे में खुद को संतुष्ट करेंगे। इच्छुक एजेंसियों को बोली जमा करने की अवधि के भीतर निम्नलिखित सूचियों के अनुसार दस्तावेजों को स्कैन / भरना और अपलोड करना आवश्यक है:

Prospective Bidders shall satisfy themselves of fulfilling all the eligibility criteria and in possession of all the documents required before submission of online tender document. The interested agencies are required to scan / fill in and upload the documents as per following lists within the period of bid submission:

ध्यान दें: बोलीदाताओं से अनुरोध है कि वे निर्धारित प्रारूप में तथ्यों और आंकड़े को भरें। बस हां या नहीं भरना स्वीकार नहीं किया जाएगा।

Note: The Bidders are requested to fill up the facts & figure in the prescribed format. Simply filling like Yes or No shall not be accepted.

1	Proof of Eligibility Criteria No.1: Work orders and Completion certificates issued by the authority concerned Documentary Proof: 1. Work Orders & Completion certificate for qualifying completed work(s) issued by Engineer-in-Charge or Owner should be attached. 2. Completion certificates for works issued by Private parties shall be supported by TDS (Tax deducted at Source) Certificates.
2	Proof of Eligibility Criteria No. 2 & 3: Annexure -Form "A": Financial information, Chartered Accountant certificate for the Annual financial turnover as submitted to Income Tax Department. Note: Entire Balance sheet duly audited by chartered accountant to be submitted.
3	Proof of Eligibility Criteria No. 4: Annexure Form "B" - Form of Bankers Certificate from a Bank
4	Form "E" - Information about Organization Structure
5	Form "F" - List of Administrative & Technical staff available with the Bidder and that proposed to be deployed to complete this work in time
6	Form "G"- Information about construction plant, Machinery, Equipment, Accessories, infrastructure facility proposed by the bidder and that proposed to be deployed to complete this work in time.
7	Form "H" Mandate Form for Payment as per Format given.
8	Undertaking as per Form "I" to be furnished by Bidders
9	Form "J" - Letter of transmittal (To be up-loaded on their letter)
10	PAN (Permanent Account Number) Registration / TAN Registration details

11	GST Registration Certificate
12	Copy of Bid Security declaration Form “K”
13	Power of attorney of the signatory of bid as per relevant clause of NIT
14	Additional documents if any to meet the eligibility criteria
15	Integrity Pact: To be signed by the bidder and upload
Note : Scanned copy of original certificates to be uploaded	

Note:

1. The applicant may furnish any additional information, which they think necessary to establish their eligibility and capability to successfully complete the envisaged work. No information shall be entertained after last date of online submission of tenders unless it is called by the competent authority. If any information furnished by the applicant is found incorrect at a later stage, they shall be liable to be debarred from tendering / taking up of work in IPR. IPR reserves the right to verify the particulars furnished by the applicant independently and reject any application without assigning any reason. Prospective bidders shall satisfy themselves of fulfilling all the eligibility criteria before submission of the tender. The Institute reserves the right to not consider the tender documents of the bidders not fulfilling the stipulated criteria .
2. It is binding on the bidder to fill the data required for assessment of eligibility criteria in the excel sheet uploaded for the purpose. The technical evaluation shall be done based on the data provided in excel sheet and the relevant documents uploaded to support the same. In case where the relevant information is not filled in the uploaded excel sheets while commensurate supporting documents are uploaded, the supporting documents shall not be considered in evaluation. Therefore the bidders in their own interest shall fill all the relevant information in excel sheets and upload relevant documents. IPR shall not accept any new document after bid opening. IPR may ask for clarification and submission of documents in support of documents/information already submitted.

**PART - E: STANDARD FORMATS FOR ELIGIBILITY CRITERIA TO BE
UPLOADED**

FORM “J”: LETTER OF TRANSMITTAL

From:

To
Chairperson ICDC,
Institute for Plasma Research,
Bhat,
Gandhinagar – 382428

Kind Attention: Mr. Shailendra Trivedi Shailendra Trivedi, Officer In-charge e-tenders.

**Subject: Submission of bids for the Tender for Re-Surfacing of Road at Institute for Plasma Research
Campus, Near Indira Bridge, Bhat, Gandhinagar-382428**

Ref: E-Tender Notice No.: IPR/TN/CIVIL/07/2021

Sir,

Having examined the details given and bid document for the above work, I/We hereby submit the relevant information.

1. I/We hereby certify that all the statements made and information supplied in the enclosed Forms “A” to “I” and accompanying statements are true and correct.
2. I/We have furnished all information and details necessary for eligibility and have no further pertinent information to supply.
3. I/We submit the requisite certified solvency certificate and authorize IPR to approach the Bank issuing the solvency certificate to confirm the correctness thereof. I/We also authorize IPR officials to approach individuals, employers, firms and Institute to verify our competence and general reputation.
4. I/We submit the following certificates in support of our suitability, technical knowhow and capability for having successfully completed the following eligible similar works:

S. No.	Name of work	Certified by/from

Certificate : It is certified that the information given in the enclosed eligibility bid are correct. It is also certified that I / We shall be liable to be debarred , disqualified / cancellation of enlistment in case any information furnished by me / us is found to be incorrect.

Date of submission:

Seal and signature of bidder

**FORM "A": FINANCIAL
INFORMATION**

- I. Financial Analysis** - Details to be furnished duly supported by figures in balance sheet/ profit and loss account for the last five years duly certified by the Chartered Accountant, as submitted by the Bidder to the Income Tax Department (copies to be scanned & uploaded).

Particulars	Financial Year				
	2015-16	2016-17	2017-18	2018-19	2019-20
i) Gross Annual turnover on construction work					
ii) Certified by					

Signature of Chartered Accountant with seal

Signature of Bidder

**FORM "B": FORM OF BANKER'S CERTIFICATE FROM
SCHEDULED BANK**

This is to certify that to the best of our knowledge and information that M/s. _____ (with address) as a customer of our bank are / is respectable and can be treated as good for any engagement up to a limit of Rs. _____ (Rupees _____).

This certificate is issued without any guarantee or responsibility on the bank or any of the officers.

(Signature)
For the Bank

NOTE:

- (1) Bankers certificates should be on letter head of the Bank
- (2) In case of partnership firm, certificate should include names of all partners as recorded with the Bank.

FORM "C": PRESCRIBED FORMATS: DETAILS TO BE FURNISHED FOR COMPLETED WORKS DURING LAST FIVE YEARS ENDING ON 30th March, 2021

Details	Work -1	Work -2	Work- 3
Project name & Location:			
Owner or client: (Name and Address, contact Number of			
Officer to whom reference can be made)			
Project description:			
1. Type of Building:			
2. Type/nature of works details.			
Whether For Government/Semi Government/ Government undertaking/ Government autonomous bodies:			
Tendered Project Cost:			
Actual Project Cost:			
Project duration (as per contract): (in months)			
Start date (dd/mm/yy):			
Actual date of Completion (dd/mm/yy):			
Actual duration (Months):			
Reasons for delay (if any):			
Any penalty/ Bonus:			
Any Litigation/ Arbitration/claim/Dispute pending (with details of claim and award if any):			
Copy of Completion certificate & Work order received from client to be attached			

Note:

- 1) For similar completed works, Original or attested scanned copies of initial work order and final completion certificate from client have to be uploaded.
- 2) The final completion certificate shall mention Name of work, Work order value, Completion value, duration, Client name & Address, Location of work, Stipulated start and completion date, Actual Start and Completion date, Reasons for Delay (if any), Nature of Work etc.
- 3) Bidder should submit separate form for giving details of work completed for each year, separate sheets if any shall be numbered in sequence.
- 4) Certified that the above list of work complete and no work has been left-out and the information given is correct to knowledge and belief.

FORM “D”: INFORMATION ABOUT All ONGOING WORKS:

Details	Work -1	Work -2	Work- 3
a) Project name & Location :			
b) Owner or client: (Name and Address, contact Number of Officer to whom reference can be made):			
c) Project details in brief:			
d) Stipulated start date :			
e) Actual Start date :			
f) Time period :			
g) Stipulated completion date :			
h) Present Status of work in Percentage completion:			
i) Work Order Value (in lakhs) :			
j) Work done value (RA bill) of work (in lakhs):			
k) Type/nature of works details.			
l) slow progress if any and Reasons for Delay, if any:			
m) Copy of Work order received from client to be attached			

Note:

- 1) Original or attested scanned copies as well as hardcopies of initial work order from client have to be uploaded.
- 2) The certificate shall mention Name of work, Work order value, duration, Client name & Address, Location of work, Stipulated start and completion date, Actual Start and Completion date, Reasons for Delay (if any) , Nature of Work etc.
- 3) Certified that the above list of work is complete and no work has been left-out and the information given is correct to knowledge and belief.

FORM "E" INFORMATION ABOUT ORGANISATION STRUCTURE:

Sr. No.	Particulars	Details to be filled
1	Name of Firm	
2	Postal Address	
3	Contact Nos.	
	Office	
	Residence	
	Mobile	
4	Fax No.	
5	Name of Contact Person	
6	E - mail Address	
7	Legal status of Bidder : (Please tick and attach attested copies of original document defining the legal status)	
	(1) An Individual	
	(2) A Proprietary firm	
	(3) A Partnership firm	
	(4) A Pvt. Ltd. Company	
	(5) A Public Ltd. Company or Corporation	
	Dept./Organization & Place of registration, Registration No.	
	Names and Titles of Director & Officers with designation proposed to be concerned with this work	
	Designation of individuals authorised to act on behalf of the organization.	

Sr. No.	Particulars	Details to be filled
	Was the applicant ever required to suspend construction for a period of more than six months continuously after you commenced the construction? If so, give the name of the project and reasons of suspension of work.	
	Has the applicant or any constituent partner in case of partnership firm, ever abandoned the awarded work before its completion? If so, give name of the project and reasons for abandonment.	
	Has the applicant, or any constituent partner in case of partnership firm, ever been debarred / black listed for tendering in any organisation at any time? If so give details.	
	Has the applicant or any constituent partner in case of partnership firm, ever been convicted by a court of law? If so, give details.	
9	Any other information considered necessary but not included above.	

Note:

1. Bidder should attach separate sheets if required and if space given in the formats is not sufficient but strictly as per above formats only.

FORM "F": INFORMATION ABOUT ADMINISTRATIVE & TECHNICAL STAFF AVAILABLE WITH THE BIDDER AND THAT PROPOSED TO BE DEPLOYED TO COMPLETE THIS WORK IN TIME:

1.0 The bidders should submit list of technical and administrative employees for proper execution of project. The bidder should submit a list of these employees stating how these would be involved in the project.

Sr. No.	Name	Qualification	Designation	Professional experience and details of work carried out	Since when working in your firm	Total Experience (In years)	Capacity in which will be involved for this work (if to be deployed for this work)	Remarks

Note:

1. The bidders should submit list of technical and administrative employees for proper execution of project. The bidder should submit a list of these employees stating how these would be involved in the project.
2. Bidder should attach separate sheet if required and if space given in the formats is not sufficient but strictly as per above formats only.

FORM "G": INFORMATION ABOUT CONSTRUCTION PLANT, MACHINERY, EQUIPMENT, ACCESSORIES, INFRASTRUCTURE FACILITY POSSESSED BY THE BIDDER AND THAT PROPOSED TO BE DEPLOYED TO COMPLETE THIS WORK IN TIME

Sr. No	Name of Equipment/ Plant	Nos	Capacity or Type & make	Age	Condition	Ownership status				Current Location	How many Proposed for the Project	Remarks
						Presently owned	Leased	To be purchased	Proposed to be hired			
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Vibratory Roller											
2	Front End Loader											
3	Water tanker/sprinkler											
4	Dumper											
5	Tippers											
6	Plate compactor											
7	Generator											
8	Mechanical broomer / Air compressor											
9	Tractor Scraper											
10	Field Testing Laboratory											
11	Bitumen paver											
12	Hot mix plant											
13	Spreaders											
14	Fully/Semi Automatic road marking applicator											
15	Premeltor Machine											
16	List of site Laboratory Testing Machines (Attach Separate List)											
17	Tar boiler											

FORM "H": MANDATE FORM -FORMAT TO BE ENCLOSED

To,
The Accounts Officer, Institute for Plasma Research, Bhat, Gandhinagar - 382 428

Sub: Bank Details for Payment through Electronic Mode

Sir,

It is requested that our payment may please be arranged through Electronic Mode. The details of bank are as under:

1. IFSC CODE

--	--	--	--	--	--	--	--	--	--	--	--	--	--

2. NEFT Code

--	--	--	--	--	--	--	--	--	--	--	--	--	--

3. Account No.

--	--	--	--	--	--	--	--	--	--	--	--	--	--

Full Account No. for payment to be made through Electronic Mode.

4. Account Type. CURRENT A/C (11)/CASH CREDIT A/C (13)

5. MICR NO.

--	--	--	--	--	--	--	--	--	--	--

Note: 1st three digit & last of 3 digit of MICR No. should not be zero.

6. Name of Bank:

7. Name of Branch:

8. Address of Bank:

I hereby declare that the particulars given above are correct and complete. If the transaction is delayed or not effected at all for any reasons, I would not hold the user institution responsible and agree to discharge the responsibility expected of me as a participant under the scheme.

Yours faithfully,

(
Signature of authority

With Name, Designation & Company's seal.

FORM "I": UNDERTAKING TO BE FURNISHED ONLINE BY THE BIDDER

- TO BE UPLOADED BY THE BIDDER ON THEIR LETTER HEAD AFTER SIGNING THIS TEMPLATE (UNDERTAKING)

Name of Work: Tender for Re-Surfacing of Road at Institute for Plasma Research Campus, Near Indira Bridge, Bhat, Gandhinagar-382428

Tender number: IPR/TN/CIVIL/07/2021 dated 4.7.2021 (Two Bid System):

I DO HEREBY UNDERTAKE

- 1 That all the information being submitted by me is genuine, authentic, true and valid on the date of submission of tender and if any formation is found to be false at any stage of tendering or contract period I will be liable to the penal actions as prescribed in NIT.
- 2 That I accept all terms and conditions of NIT, including general terms and condition, special / additional terms and conditions, addendum, corrigendum, clarifications as stated there in the tender document as available on the website.
- 3 That I am giving my consent for e-payment.
- 4 That I do authorize IPR for seeking information / clarification from by bankers, clients having reference in this bid.
- 5 That I have uploaded photo copies of all relevant documents as prescribed in the tender document in support of the information and data furnished by me online.
- 6 That I accept all the undertakings as specified elsewhere in the tender document.
- 7 That this online agreement will be a part of my bid and if the work is awarded to me /us, this will be a part of our agreement with corporation.
- 8 That I hereby forward Bid security declaration form (against earnest money deposit) If I/we, fail to furnish the prescribed performance guarantee within prescribed period, I/we agree that the said Director, IPR or his successors in office shall without prejudice to any other right or remedy, be at liberty to act as per the Bid security declaration form. Further, if I/we fail to commence work as specified, I/we agree that Director, IPR or his successors in office shall without prejudice to any other right or remedy available in law, be at liberty to act as per the Bid security declaration form forfeit the performance guarantee absolutely, otherwise the said earnest money shall be retained by him towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to those in excess of that limit at the rates to be determined in accordance with the provision contained in Clause 12.2 and 12.3 of the tender form. Further, I/We agree that in case of action on bid security declaration form and & Performance Guarantee as aforesaid. I/We shall be debarred for participation in the re-tendering process of the work.
- 9 I/We undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to notice of Department, then I/We shall be debarred for tendering in The Institute in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee.

Signature of Bidder with Seal

FORM "K": BID SECURITY DECLARATION FORM

Date: _____ Tender No **IPR/TN/CIVIL/07/2021** dated: **4.7.2021**

To

Institute for plasma Research,

Near Indira Bridge, Bhat, Gandhinagar

I/ We. The undersigned, declare that:

I/We understand that, according to your conditions, bids must be supported by a Bid Securing Declaration.

I/We accept that I/We may be disqualified from bidding for any contract with you for a period of one year from the date of notification if I am /We are in a breach of any obligation under the bid conditions, because I/We

- a) have withdrawn/modified/amended, impairs or derogates from the tender, my/our Bid during the period of bid validity specified in the form of Bid; or
- b) having been notified of the acceptance of our Bid by the purchaser during the period of bid validity (i) fail or reuse to execute the contract, if required, or (ii) fail or refuse to furnish the Performance Security, in accordance with the Instructions to Bidders.

I/We understand this Bid Securing Declaration shall cease to be valid if I am/we are not the successful Bidder, upon the earlier of (i) the receipt of your notification of the name of the successful Bidder; or (ii) thirty days after the expiration of the validity of my/our Bid.

Signed: (insert signature of person whose name and capacity are shown)

in the capacity of (insert legal capacity of person signing the Bid Securing Declaration)

Name: (insert complete name of person signing the Bid Securing Declaration)

Duly authorized to sign the bid for an on behalf of (insert complete name of Bidder) Dated
on _____ day of _____ (insert date of signing)

Corporate Seal (where appropriate)

PART- F - Tender Evaluation Process

On opening of Technical bid, further detailed scrutiny / evaluation will be carried out. During the evaluation of technical bids, the documents furnished by the Bidders will be scrutinized in detail. Any tender, found as not fulfilling the eligibility criteria will be summarily rejected and such offers will not be considered for further processing.

The Bidders who satisfies the eligibility criteria mentioned as above shall be considered as technically qualified and eligible for further processing.

The price bid of only those Bidders who have been technically qualified will be opened separately on a specified date (with due intimation to the qualified bidders) and further processed, as per tender procedure/ stipulations of Tender.

SECTION – 1 (iii) BRIEF PARTICULARS OF THE WORK

प्रस्तावित साइट इंस्टीट्यूट फॉर प्लाज़्मा रिसर्च परिसर, इंदिरा ब्रिज के पास, भाट, गांधीनगर -382428 में स्थित है

The proposed site is located at Institute for Plasma Research campus, Near Indira bridge, Bhat, Gandhinagar - 382428

निविदाकार को सलाह दी जाती है कि शैलेन्द्र त्रिवेदी, ऑफिसर इंचार्ज ई-टेंडर, IPR (ईमेल): etender.icdc@ipr.res.in) से संपर्क करके अध्यक्ष, इन्फ्रास्ट्रक्चर और कैम्पस डेवलपमेंट कमेटी, प्लाज़्मा अनुसंधान संस्थान की पूर्व अनुमति से कार्य स्थल पर जाने की सलाह दी जाती है ताकि निर्माण पानी और बिजली के लिए संभावित दोहन बिंदुओं को ढेर करने के लिए साइटों के स्थान तक पहुंच के साथ खुद को / खुद को / खुद को परिचित किया जा सके। इस काम को पूरा करने वाले ठेकेदार संस्थान के सुरक्षा विनियमन और किसी भी उपकरण, संचालन, जल निकासी, सुरक्षा इत्यादि के हस्तांतरण के संबंध में संस्थान / पुलिस अधिकारियों द्वारा लगाए गए स्थानीय सांविधिक नियमों का सख्ती से पालन करेंगे।

The tenderer is advised to visit the site of work with prior permission of Chairperson, Infrastructure and Campus development committee, Institute for Plasma Research by contacting Mr. Shailendra trivedi, Offier Incharge e-tender, IPR (Email: etender.icdc@ipr.res.in) to acquaint himself/herself/themselves with access to sites location for stacking the materials probable tapping points for construction water and electric power. The contractor carrying out this work will strictly abide by security regulation of the Institute and also local statutory regulations imposed by the Institute / Police authorities regarding transshipment of any equipment, operation, drainage, security etc., wherever applicable.

TENTATIVE SCOPE OF WORK:

साइट इंस्टीट्यूट फॉर प्लाज़्मा रिसर्च परिसर, इंदिरा ब्रिज के पास, भाट, गांधीनगर -382428 के पास सड़क की पुनः सरफेसिंग, सतह की सफाई, पॉट के छेदों को समतल करना, अनडूलेसन, सतह की तैयारी, कालीन प्रदान करना जिसमें सील कोट, बमप का निर्माण, रोड मार्किंग पेंट और सड़क के री-कारपेटिंग से जुड़े अन्य कार्य शामिल हैं

Re-Surfacing of Road at Institute for Plasma Research Campus, Near Indira Bridge, Bhat, Gandhinagar-382428 including cleaning of the surface, leveling of the pot holes, undulations, preparing of the surface, providing of carpet including seal coat, making of bumps, road marking paints and other works related to Re-carpeting of Road

SECTION – 1 - (iv) INFORMATION & INSTRUCTIONS FOR BIDDERS

1.0 General:-

1.1. All information called for in the enclosed forms should be furnished against the relevant columns in the forms. If for any reason, information is furnished on a separate sheet, this fact should be mentioned against the relevant column. Even if no information is to be provided in a column, a “Nil” or “no such case” entry should be made in that column. If any particulars /queries are not applicable in case of the Bidder, it should be stated as “Not Applicable”. The Bidders may please note that giving incomplete/ unclear information called for in the forms, or making any change in the prescribed forms, or deliberately suppressing any information, may result in disqualification of the Bidder summarily. Applications duly filled in / scan copies of original shall be uploaded in web site: www.tenderwizard.com/DAE before closing date and time of online submission of tender. **No applications shall be received in physical form.**

1.2. The Bidder should sign each page on the application along with enclosures with rubber stamp before scanning / uploading.

1.3. Overwriting should be avoided. Corrections, if any, should be made by neatly crossing out and shall be rewritten with initials and date. Pages of the pre-qualification document are numbered. Additional sheets, if any added by the Bidder, should also be numbered by him. They should be uploaded along with letter of transmittal.

1.4. References, information and certificates from the respective clients certifying suitability, technical knowhow or capability of the Bidder should be signed by an officer not below the rank of Executive Engineer or equivalent.

1.5. The Bidder may furnish any additional information, which he thinks is necessary to establish his capabilities to successfully complete the envisaged work. He is, however, advised not to furnish superfluous information. No information shall be entertained after submission of tender document unless the Institute calls for it.

1.6. Any information furnished by the Bidder found to be incorrect either immediately or at a later date, would render him liable to be debarred from tendering/taking up of work in **IPR**.

1.7. Any clarification given by the Institute on the basis of queries raised by the Bidders shall be uploaded and shall become part of the tender condition.

1.8. The Bidder can seek clarifications regarding tender document up to 2.8.2021 **(17:00 Hours)** by uploading their queries on website www.tenderwizard.com/DAE. The clarifications will be uploaded on the same web portal by 6.8.2021 **(17:00 Hours)**. No request for clarification will be considered after 2.8.2021 **(17:00 Hours)**.

1.9. Confidentiality Clauses: -

i) Confidentiality:

No party shall disclose any information to any 'Third party' concerning the matters under this contract generally. In particular, any information identified as "Proprietary" in nature by the disclosing party shall be kept strictly confidential by the receiving party and shall not be disclosed to any third party without the prior written consent of the original disclosing party.

This clause shall apply to the sub-contractors, consultants, advisors or the employees engaged by a party with equal force.

ii) "Restricted information":-

Any contravention of the above-mentioned provisions by any contractor, sub-contractor, consultant, adviser or the employees of a contractor, will invite penal consequences under the above said legislation.

iii) Prohibition against use of **IPR's** name without permission for publicity purposes: The contractor or sub-contractor, consultant, adviser or the employees engaged by the contractor shall not use **IPR's** name for any publicity purpose through any public media like Press, Radio, TV or Internet without the prior written approval of IPR.

2.0 Method of Application:

2.1 If the Bidder is an individual, the application shall be signed by him above his full typewritten name and current address.

2.2 If the Bidder is a proprietary firm, the application shall be signed by the proprietor above his full typewritten name and the full name of his firm with its current address.

2.3 If the Bidder is a firm in partnership, the application shall be signed by all the partners of the firm above their full typewritten names and current addresses or alternatively by a partner holding power of attorney for the firm. In the latter case a certified copy of the power of attorney should accompany the application. In both cases a certified copy of the partnership deed and current address of all the partners of the firm should accompany the application.

2.4 If the Bidder is a limited company or corporation, the application shall be signed by a duly authorized person holding power of attorney for signing the application accompanied by a copy of the power of attorney. The Bidder should also upload a copy of the Memorandum of Articles of Association duly attested by a Public Notary.

3.0 Final Decision Making Authority:

The Director, IPR reserves the right to accept or reject any application/s and to annul the pre-qualification process and reject all applications at any time, without assigning any reason or incurring any liability to the Bidders.

4.0 Particulars provisional:

The particulars of the work given in Section-1 (iii) are provisional. They are liable to change and must be considered only as advance information to assist the Bidder.

5.0 The Bidder should **own construction equipment** as per list required for the proper and timely execution of the work. Else, he should certify that he would be able to manage the equipment by hiring, etc. and submit the list of firms from whom he proposes to hire.

6.0 The Bidder should have sufficient number of **Technical and Administrative employees** for the proper execution of the contract. The Bidder should submit list of well qualified and experienced Engineers and Supervisors stating clearly how those would be deployed for execution of works.

B - GENERAL RULES & DIRECTIONS

1.0 Scope of bid : The Chairperson I-CDC ,IPR invites bids for the work. The successful bidder should provide the services during the period of work as per the terms and conditions specified in the NIT, general condition of contract, technical specifications, special conditions of contract and schedules.

2.0 Eligible bidders

2.1 Bidding is open to all eligible bidders meeting the eligibility criteria as defined in prequalification criteria. Bidders are advised to note the eligibility criteria specified in the notice inviting tender.

2.2 Incomplete bids and bidders not meeting the minimum qualification criteria shall be summarily rejected. It may be noted that mere submission of bid does not imply that your offer shall be considered. Tenders are considered only after IPR themselves assess the document submitted along with the bid by the bidder meets the eligibility criteria as specified in notice inviting e-tender during evaluation of bid.

2.3 The bidder who has been blacklisted / de-registered / holiday at any of the sites of IPR, DAE, and any other government department shall not be eligible for participation in tenders of IPR for that period.

3.0 One bid per bidder

3.1 Each bidder shall submit only one bid. A bidder who submits or participates in more than one bid will cause the bidder's participation to be disqualified for all the proposals.

4.0 Cost of bidding

4.1 The bidder shall bear all costs associated with the preparation and submission of his bid and the Institute will in no case be responsible and liable for these costs.

5.0 Site visit

5.1 The bidder and any of his authorized personnel or agents may be granted permission by the IPR to enter upon its premises and lands for the purpose of site visit. The Bidder is advised to visit the site of work, at his own cost, and examine it and its surroundings by himself, collect all information that he considers necessary for proper assessment of the prospective assignment. He may contact **Mr. Shailendra Trivedi, officer in-charge, e-tender**, Institute for Plasma Research, Near Indira Bridge, Bhat, Gandhinagar -382428. Preferably by **email: etender.icdc@ipr.res.in** or through **Tel No:-079-2396 2000, 2396 4009**, for fixing appointment prior to visit the site. However, the bidder, his personnel and agents will be responsible against all liability in respect thereof, including death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.

5.2 The bidder should inform the Institute at least two days in advance about the proposed site visit.

5.3 The bidder, at his own responsibility and risk is encouraged to visit, inspect and survey the site and its surroundings and satisfy himself before submitting his bid as to the form and nature of the site, the means of access to the site, the accommodation he may require, etc.

5.4 In general, bidders shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid. A bidder shall be deemed to have full knowledge of the site, whether he inspects it or not and no extra claims due to any misunderstanding or otherwise shall be allowed.

5.5 The costs of visiting the site shall be at the bidders' own expense. Any report shared at the site, by the Institute is subject to verification by the contractor. Any deviations of information in the report and the actual site will not be the responsibility of the IPR.

5.6 The bidders are requested to bring photo identification like passport, voters' identity card, and driving license, PAN card, identity card issued by employer, Aadhar card etc. for security regulations. Any electronic devices like mobiles, radio, transistors, camera etc. are not allowed inside IPR premises.

5.7 The bidder shall forward any query/question by e-mail within the stipulated date and time given in NIT. The clarification given by the IPR shall be visible to all the bidders without disclosing the identity of the bidder raising the query. The questions/query received after stipulated date and time shall not be entertained and no response shall be forwarded. The submission of bid shall mean that the bidder has seen the response and accepts the content.

6.0 Content of bidding documents

6.1 Submission of a bid by a bidder implies that he has read this notice and all other contract documents, clarification, addendum, corrigendum and has made himself aware of the scope and specifications of the work to be executed and of conditions.

6.2 The bidder shall submit the bid, which satisfies each and every condition laid down in the bid documents, failing which, the bid is liable to be rejected.

6.3 The documents listed below comprise one set of bid document:

- Technical Bid
- Price Bid

7.0 Pre-bid meeting: Not applicable

8.0 Amendment of bid documents

8.1 Before the deadline for submission of bids, IPR may modify the bidding documents by issuing addendum on web site.

8.2 Any addendum so issued shall be part of the bid documents as well as contract document.

8.3 To give prospective bidders reasonable time to take an addendum into account in preparing their bids, the IPR may extend the date for submission of bids, if necessary.

8.4 Corrigendum, addendum or any other information regarding tender shall be uploaded only on web site. Hence, the bidders are requested to visit the web site (www.tenderwizard.com/DAE) regularly. The above documents shall become part of bid and agreement. Submission of bid shall imply that bidder has noted and accepted content of all the corrigendum/addendum/clarifications and effect of same has been included in price bid.

9.0 Language of the bid

9.1 All documents relating to the bid shall be in the English language, unless stated otherwise.

10.0 Earnest Money Deposit - (bid security declaration form to be submitted)

11.0 Bid prices, rates & taxes

11.1 The bidder should quote his rates in figures only.

11.2 In the case of item rate tenders, only rates quoted shall be considered. In case of lump sum tender, only lump sum quoted amount shall be considered.

11.3 The rates, prices and total bid price submitted by the contractor shall be inclusive of terminal or other duties, GST, VAT, CST, turnover tax, work contract tax, octroi, cess, or any other similar tax applicable under the existing laws or levy by the statutory authorities/state/central government in performance of this contract including GST. This is an indivisible works contract. The rates quoted shall include all taxes including Goods and Service Tax (GST) at applicable rates and levies, duties, cess etc., payable under respective statutes. Deductions as per statutes will be effected from the bill and remitted to the Department concerned.

11.4 Tax deduction at source

At the time of its payments due to the contractor under this contract, the statutory deduction of income tax at source (IT TDS) shall be made from time to time as may be required by the government.

IPR shall provide the necessary withholding tax certificates to the contractor within the time stipulated by the relevant law to enable the contractor to file the same with the government.

11.5 The evaluation of price bid will be done strictly on the basis of rates/total bid price quoted by bidder in the price bid format plus service tax as applicable.

12.0 Currencies of bid and payment

12.1 The unit rates and the prices shall be quoted by the bidder in Indian rupees, unless otherwise specified in the special conditions of contract.

13 Bid validity

13.1 The bids submitted shall remain valid for acceptance for a period of **120 days** from the date of opening of the bid. The bidder shall not be entitled during the period of validity, to revoke or cancel his bid or vary / modify the bid given or any item thereof. In case of bidder revoking or cancelling his bid, varying any terms in regard thereof, the full amount of Earnest Money Deposit paid by the bidder along with the bid shall be forfeited by IPR.

13.2 In exceptional circumstances, prior to expiry of the original bid validity period, IPR may request the bidders to extend the period of validity for a specified additional period. The request and the responses thereto shall be made in writing. A bidder may refuse the request without forfeiting its Earnest Money Deposit but his bid will not be considered. A bidder agreeing to the request will not be required or permitted to modify its bid, but will be required to extend the validity of its Earnest Money Deposit for the period of the extension.

14.0 Alternative proposals by bidders

14.1 Bidders shall submit offers that comply with the requirements of the bidding documents, including the basic technical design as indicated in the drawing and specifications. Alternatives will not be considered.

15.0 Submission of the bids

15.1 The date and time of on-line bid submission shall remain unaltered even if the specified date for the submission of the bid is declared as holiday for the office inviting tender.

15.2 The IPR may extend the deadline for submission of bids by issuing an amendment, in which case, all rights and obligations of the Institute and the bidders previously subject to the original deadline will then be subject to the new deadline.

15.3 Any bid received by the IPR after the deadline prescribed above will be rejected.

15.4 The bidders shall note the following before submission of bid

- (a) If the digital signature certificate (DSC) holder is sole proprietor of the firm, power of attorney need not be submitted.
- (b) In case DSC holder is bidding on behalf of partnership firm, joint venture, consortium etc. power of attorney or any other legally acceptable document viz. partnership deed, board resolution etc. authorizing DSC holder to bid on behalf of the bidder is to be uploaded. In case of non-submission the bid shall be summarily rejected.

16.0 Bid opening

16.1 Tender opening shall be done on-line. On opening, the Bidders can see their bid status. The authorized representative of Bidders may remain present (if so desires) during opening of Bid. The authorized representative should have valid photo identity and original authority letter issued by competent authority of their company. If the date of opening is declared as holiday then bid will be opened on next working day. In exceptional cases opening of tenders can be done on any day or time after scheduled date and time of opening. Corrigendum issued for opening of tender shall be uploaded on website.

16.2 The bids without stipulated Bid Security Declaration form attached with this tender and other mandatory documents as per NIT shall be summarily rejected.

16.3 In two part tenders financial bid of only qualified bidder shall be opened.

17.0 Clarification of bids

17.1 To assist in the examination and comparison of bids, the IPR may, at its discretion, ask any bidder for clarification of his bid, including breakdown of unit rates. The request for clarification and the response shall be in writing or by email / fax, but no change in the price or substance of the bid shall be sought, offered, or permitted. If the bidder does not respond within the stipulated time, then the bid of the bidder will be evaluated on its own merit.

17.2 Bidder shall not contact the IPR on any matter relating to his bid from the time of the bid opening to the time the contract is awarded.

17.3 Any effort by the bidder to influence the IPR bid evaluation, bid comparison or contract award decisions, may result in the rejection of his bid.

18.0 Examination of bids and determination of responsiveness

18.1 Prior to detailed evaluation of bids, the IPR will determine whether each bid(s) meets

- (a) The minimum requirements as per pre-qualification criteria
- (b) Is accompanied by the required Earnest Money Deposit
- (C) is responsive to the requirements of the bidding documents
- (d) Has been properly signed by authorized signatory as per clause-15.4.

18.2 A responsive bid is one which conforms to all the terms, conditions and specification of the bidding documents.

19.0—~~Evaluation and comparison of bids~~ - Not Applicable

~~19.1—The Institute reserves the right to accept or reject any offer. IPR also reserves the right to award only part of the work.~~

~~19.2—The estimated effect of the price adjustment conditions under variations and deviations of the conditions of contract, during the period of implementation of the contract, will not be taken into account in bid evaluation.~~

20.0—~~Award criteria~~ - Not Applicable

~~20.1—The IPR shall award the contract to the bidder whose evaluated offer / bid has been determined to be the technically suitable and financially lowest (L1) and is substantially responsive to the bidding document, provided further that the bidder is determined to be qualified to execute the contract satisfactorily. The technically and financially suitable bids in other types of bids shall be decided as per criteria given in eligibility requirement. In case of tie between two lowest bidders, both the bidders shall be given a chance to offer rebate to decide the lowest bid. If the situation still remains same the lottery shall be adopted to decide the award.~~

~~20.2—L-1 bidder will be required to produce the original documents in support of the information furnished by him on line for verification as specified in NIT/e tender notice. The bidder shall submit the same on any working day within specified period after issue of letter to this effect. In case the L-1 bidder fails to produce the documents within the specified period or if any of the information furnished by L-1 bidder on line is found to be false during verification of original document, which changes the eligibility status of the bidder, then the bid shall be disqualified with forfeiture of Earnest Money Deposit and banning of the concerned bidder for participation in future tenders for five years. The next financial lowest qualified bidder shall be awarded the work subject to producing original documents.~~

~~20.3—Submission of illegible or blank document may render the bid non-responsive and liable for rejection. Submission of bid will be recognized and accepted as a certificate regarding authentication of all information provided in the bid and acceptance of all terms & conditions, general condition of contract, notice inviting tender etc., since such acceptance by bidder with digital signature is legally tenable.~~

~~20.4—The IPR reserves the right not to award the work without assigning reason and without incurring any liability to the bidder or bidders.~~

21.0 Notification of award and signing of agreement

21.1 The bidder whose bid has been accepted will be notified of the award by the IPR prior to expiration of the bid validity period by issue of work order. The notification may also be made through letter of intent, wherein the work order shall follow.

21.2 The details of award can be seen on web site. The bidders can request for debriefing in writing within fifteen days of award. They shall be informed about suitable days to visit the office of the concerned officer. Requests beyond deadline shall not be entertained.

21.3 The work order will constitute the formation of the contract subject only to the furnishing of a performance guarantee within period as specified in schedule F.

21.4 An agreement shall be made and signed by both the parties. The agreement will incorporate all correspondence between the IPR and the successful bidder, bid documents etc. The bid document as uploaded on website www.tenderwizard.com/DAE shall be forming part of agreement. The successful bidder shall be responsible for compliance at his own cost with the stamp duty act of the state where the agreement is being executed. The non-judicial stamp paper of appropriate value after adjudication shall be submitted by the successful bidder at his own cost.

22.0 Corrupt or fraudulent practices

22.1 The IPR requires that bidders / suppliers / contractors under this contract, observe the highest standard of ethics during the procurement and execution of this contract. In pursuance of this policy, the IPR:

(a) Defines, for the purpose of these provisions, the terms set forth below as follows:

(i) "corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution; and

(ii) "fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the IPR, and includes collusive practice among bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the IPR of the benefits of free and open competition.

(b) Will reject a proposal for award of work if it determines that the bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question.

(c) will declare a bidder ineligible, either indefinitely or for a stated period of time, to be awarded a contract / contracts if at any time it determines that the bidder has engaged in corrupt or fraudulent practices in competing for, or in executing, the contract.

22.2 The bidder may make representation in connection with processing of tender directly and only to the competent authority (calling tender) as mentioned in the tender document. However, if such representation is found to be un-sustentative and/ or frivolous and if the tender has to be closed because of the delays / disruptions caused by such representations and the job has to be re-tendered, then such bidder will not be allowed to participate in the re-invited tender.

In case, any bidder while making such representation to competent authority also involves other officials of IPR and / or solicits/ invokes external intervention other than as may be permitted under the law and if the tender has to be closed because of the delays / disruptions caused by such interventions and has to be re-tendered, then the particular bidder will not be allowed to participate in the re-invited tender.

23.0 Disclosures

23.1 Any change in the constitution of the contractor's firm, where it is a partnership firm, joint venture or consortium partnerships as declared in the bid should be disclosed to the IPR, at any time between the submission of bids and the signing of the contract.

SECTION: 2

Conditions and Clause of Contract

SECTION: 2 - (i) - GENERAL GUIDELINES

- 1. This "General Conditions of Contract is applicable for Item rate Tenders.**
- 2. Schedule A to F, Additional Conditions of contract, Special Conditions of contract, Specifications and Drawings is provided separately. This GCC shall form part the Agreement to be drawn and signed by both the parties after acceptance of tender.**
- 3. All Blanks are confined to Notice Inviting Tender and Schedule A to F and duly filled Schedule A to F is attached.**
- 4. The intending bidders will quote their rates in Schedule A (Price Bid).**

**INSTITUTE FOR PLASMA RESEARCH
NEAR INDIRA BRIDGE
BHAT, GANDHINAGAR- 382 428**

ITEM RATE TENDER AND CONTRACT FOR WORKS

**SECTION: 2 - (ii) - GENERAL RULES & DIRECTIONS
GUIDELINES**

1. All work proposed for execution by contract will be notified in a form of invitation to tender posted in public places and signed by the officer inviting tender or by a publication in news papers as the case may be.

This form will state the work to be carried out, as well as the date for submitting and opening tenders and the time allowed for carrying out the work, also the amount of earnest money to be deposited with the tender, and the amount of the Security and Performance guarantee Deposit to be deposited by the successful tenderer and the percentage, if any, to be deducted from bills. Copies of the specifications, designs and drawings and any other documents required in connection with the work signed for the purpose of identification by the officer inviting tender shall also be open for inspection by the contractor at the office of officer inviting tender during office hours.

2. In the event of the tender being submitted by a firm, it must be signed separately by each partner thereof or in the event of the absence of any partner, it must be signed on his behalf by a person holding a power-of attorney authorising him to do so such power of attorney to be produced with the tenders and it must disclose that the firm is duly registered under the Indian Partnership Act, 1952.
3. Receipts for payment made on account of work, when executed by a firm, must also be signed by all the partners, except where contractors are described in their tender as a firm, in which case the receipts must be signed in the name of the firm by one of the partners, or by some other person having due authority to give effectual receipts for the firm.
4. Applicable for item rate tender only

The rate(s) must be quoted in decimal coinage. Amounts must be quoted in full rupees by Ignoring fifty paise and considering more than fifty paise as rupee one.

In case the lowest tendered amount (worked out on the basis of quoted rate of individual items) of two or more contractors is same , then such lowest contractors may be asked to submit sealed revised offer quoting rate of each item of the schedule of quantity for all sub sections /sub heads as the case may be ,but the revised quoted rate of each item of schedule of quantity for all sub sections /sub heads should not be higher than their respective original rate quoted already at the time of submission tender. The lowest tender shall be decided on the basis of revised offer.

If the revised tendered amount (worked out on the basis of quoted rate of individual items)of two or more contractor received in revised offer is again found to be equal , then the lowest tender, among such contractors, shall be decided by draw of lots in the presence of Chairperson, and the lowest contractors those have quoted equal amount of their tenders.

In case of any suchlowest contractor in his revised offer quotes rate of any item more than their respective original rate quoted already at the time of submission of tender, then such revised offer

shall be treated invalid. Such case of revised offer of the lowest contractor or case of refusal to submit revised offer by the lowest contractor shall be treated as withdrawal of his tender before acceptance and 50 % of his earnest money shall be forfeited.

In case all the lowest contractors those have same tendered amount (as a result of their quoted rate of individual items),refuse to submit revised offers, then tenders are to be recalled after forfeiting 50% EMD of each lowest contractors.

Contractors, those earnest money is forfeited because of non-submission of revised offer or quoting higher revised rate(s) of any item (S) than their respective original rates quoted already at the time of submission of bid shall not be allowed to participate in the retendering process of work.

4A Applicable for percentage Rate tender only

In case of Percentage Rate Tenders, contractor shall fill up the usual printed form, stating at what percentage below/above (in figures as well as in words) the total estimated cost given in Schedule of Quantities at Schedule-A, he will be willing to execute the work. The tender submitted shall be treated as invalid if :-

I. The contractor does not quote percentage above/below on the total amount of tender or any section/sub head of the tender.

II. The percentage above/below is not quoted in figures & words both on the total amount of tender or any section/sub head of the tender.

III. The percentage quoted above/below is different in figures & words on the total amount of tender or any section/sub head of the tender.

Tenders, which propose any alteration in the work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort including conditional rebates, will be summarily rejected.

4B. In case the lowest tendered amount (estimated cost + amount worked on the basis of percentage above/below) of two or more contractors is same, such lowest contractors will be asked to submit sealed revised offer in the form of letter mentioning percentage above/ below on estimated cost of tender including all sub sections/sub heads as the case may be, but the revised percentage quoted above/below on tendered cost or on each sub section/ sub head should not be higher than the percentage quoted at the time of submission of tender. The lowest tender shall be decided on the basis of revised offers.

In case any of such contractor refuses to submit revised offer, then it shall be treated as withdrawal of his tender before acceptance and 50% of earnest money shall be forfeited.

If the revised tendered amount of two more contractors received in revised offer is again found to be equal , the lowest tender, among such contractors, shall be decided by draw of lots in the presence of Chairperson, , & the lowest contractors those have quoted equal amount of their tenders.

In case all the lowest contractors those have quoted same tendered amount, refuse to submit revised offers, then tenders are to be recalled after forfeiting 50% of EMD of each contractor.

Contractor(s), whose earnest money is forfeited because of non-submission of revised offer, shall not be allowed to participate in the re-tendering process of the work.

5. The officer inviting tender or his duly authorized assistant will open tenders in the presence of any intending contractors who may be present at the time
6. The officers inviting tenders shall have the right of rejecting all or any of the tenders and will not be bound to accept the lowest or any other tender.
7. The receipt of an accountant or clerk for any money paid by the contractor will not be considered as any acknowledgment or payment to the officer inviting tender and the contractor shall be responsible for seeing that he procures a receipt signed by the officer inviting tender or a duly authorized Cashier.
8. In the case of Item Rate Tenders, only rates quoted shall be considered. Any tender containing percentage below/above the rates quoted is liable to be rejected. Rates quoted by the contractor in item rate tender in figures and words shall be accurately filled in so that there is no discrepancy in the rates written in figures and words. However, if a discrepancy is found, the rates which correspond with the amount worked out by the contractor shall unless otherwise proved be taken as correct. If the amount of an item is not worked out by the contractor or it does not correspond with the rates written either in figures or in words, then the rates quoted by the contractor in words shall be taken as correct. Where the rates quoted by the contractor in figures and in words tally, but the amount is not worked out correctly, the rates quoted by the contractor will unless otherwise proved be taken as correct and not the amount. In event no rate has been quoted for any item(s), leaving space both in figure(s), word(s), and amount blank, it will be presumed that the contractor has included the cost of this/these item(s) in other items and rate for such item(s) will be considered as zero and work will be required to be executed accordingly.

However, if a tenderer quotes nil rates against each item in item rate tender, the tender shall be treated as invalid and will not be considered as lowest tenderer **and earnest money deposited shall be forfeited**.

9. Applicable for percentage Rate tender only

In case of Percentage Rate Tenders only percentage quoted shall be considered. Any tender containing item rates is liable to be rejected. Percentage quoted by the contractor in percentage rate tender shall be accurately filled in figures and words, so that there is no discrepancy.

10. Applicable for percentage Rate tender only

In Percentage Rate Tender, the tenderer shall quote percentage below/above (in figures as well as in words) at which he will be willing to execute the work. He shall also work out the total amount of his offer and the same should be written in figures as well as in words in such a way that no interpolation is possible. In case of figures, the word 'Rs.' should be written before the figure of rupees and word 'P' after the decimal figures, e.g. 'Rs. 2.15P' and in case of words, the word 'Rupees' should precede and the word 'Paisa' should be written at the end.

11. (i) The Contractor whose tender is accepted, will be required to furnish performance guarantee of 3 % (Three Percent) of the tendered amount within the period specified in Schedule F. This guarantee shall be in the form of cash (in case guarantee amount is less than Rs. 10,000/-) or Deposit at call receipt of any scheduled bank/Banker's cheque of any scheduled bank/Demand Draft of any scheduled bank/Pay order of any scheduled bank (in case guarantee amount is less than Rs. 1,00,000/-) or Government Securities or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank

- (ii) The contractor whose tender is accepted will also be required to furnish by way of Security Deposit for the fulfillment of his contract, an amount equal to 2.5% of the tendered value of the work. The Security deposit will be collected by deductions from the running bills as well as final bill of the contractor at the rates mentioned above. The Security amount will also be accepted in cash or in the shape of Government Securities. Fixed Deposit Receipt of a Scheduled Bank or will also be accepted for this purpose provided confirmatory advice is enclosed.
12. On acceptance of the tender, the name of the accredited representative(s) of the contractor who would be responsible for taking instructions from the Engineer-in-Charge shall be communicated in writing to the Engineer-in-Charge.
13. GST or any other tax applicable in respect of inputs procured by the contractor for this contract shall be payable by the Contractor and Government will not entertain any claim whatsoever in respect of the same. However, component of GST at time of supply of service (as provided in CGST Act 2017) provided by the contract shall be varied if different from that applicable on the last date of receipt of tender including extension if any.
14. The contractor shall give a list of IPR employees related to him.
15. The tender for composite work includes, in addition to building work, all other works such as sanitary and water supply installations drainage installation, electrical work, horticulture work, roads and paths etc.
16. The contractor shall submit list of works which are in hand (progress) in the following form:-

Name of work	Name and particulars of Divnwhere work is being	Value of works	Position of work	Remarks
1	2	3	4	5

SECTION: 2 - (iii) - CONDITIONS OF CONTRACT

Definitions

1. The **Contract** means the documents forming the tender and acceptance thereof and the formal agreement executed between the Director, IPR and the Contractor, together with the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Engineer-in-Charge and all these documents taken together shall be deemed to form one contract and shall be complementary to one another.
2. In the contract, the following expressions shall, unless the context otherwise requires, have the meanings, hereby respectively assigned to them:
 - i. The expression **works or work** shall, unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent, and whether original, altered, substituted or additional.
 - ii. The **Site** shall mean the land/or other places on, into or through which work is to be executed under the contract or any adjacent land, path or street through which work is to be executed under the contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the contract.
 - iii. The **Contractor** shall mean the individual, firm or company, whether incorporated or not, undertaking the works and shall include the legal personal representative of such individual or the persons comprising such firm or company, or the successors of such firm or company and the permitted assignees of such individual, firm or company.
 - iv. The **Director or Director, IPR** means the Director of the Institute for Plasma Research.
 - v. **The Chairperson, ICDC, IPR** means chairman of the Infrastructure and campus development committee of the Institute for Plasma Research.
 - vi. The **Engineer-in-charge** means the Engineer or Officer who shall supervise and be in - charge of the work and who shall sign the contract on behalf of the Director, IPR as mentioned in Schedule 'F' hereunder.
 - vii. Department/**Institute**/IPR/Principal Employer shall mean the Institute for Plasma Research.
 - viii. **Accepting Authority** shall mean the authority mentioned in Schedule 'F'.
 - ix. **Excepted Risk** are risks due to riots (other than those on account of contractor's employees), war (whether declared or not), invasion, act of foreign enemies, hostilities, civil war, rebellion, revolution, insurrection, military or usurped power, any acts of the Institute/Government, damages from air-crafts, acts of God, such as earth-quake, lightening and unprecedented floods, and other causes over which the contractor has no control and accepted as such by the Accepting Authority or causes solely due to use or occupation by the Institute of the part of the works in respect of which a certificate of completion has been issued or a cause solely due to Institute's faulty design of works.
 - x. **Market Rate** shall be rate as decided by the Engineer-in-Charge on the basis of the cost of materials and labour at the site where the work is to be executed plus the percentage mentioned in Schedule 'F' to cover, all overheads and profits.
 - xi. **Schedule(s)** referred to in these conditions shall mean the relevant schedule(s) annexed to the tender papers or the Schedule of Rates mentioned in Schedule 'F' hereunder, with the amendments thereto issued up to the date of receipt of the tender by concerned competent authority.

- xii. **District Specifications** means the specifications followed by the State Government in the area where the work is to be executed.
- xiii. **Tendered value** means the value of the entire work as stipulated in the letter of award.
- xiv. **Date of commencement of work:** The date of commencement of work shall be the date of start as specified in schedule 'F' or the first date of handing over of the site, whichever is later, in accordance with the phasing if any, as indicated in the tender document.

Scope and Performance

3. Where the context so requires, words imparting the singular only also include the plural and vice versa. Any reference to masculine gender shall whenever required include feminine gender and vice versa.

4. Headings and Marginal notes to these General Conditions of Contract shall not be deemed to form part thereof or be taken into consideration in the interpretation or construction thereof or of the contract.

5. The contractor shall be furnished, free of cost one certified copy of the contract documents except standard specifications, Schedule of Rates and such other printed and published documents, together with all drawings as may be forming part of the tender papers. None of these documents shall be used for any purpose other than that of this contract.

6. Works to be carried out

The work to be carried out under the Contract shall, except as otherwise provided in these conditions, include all labour, materials, tools, plants, equipment and transport which may be required in preparation of and for and in the full and entire execution and completion of the works. The descriptions given in the Schedule of Quantities (Schedule-A) shall unless otherwise stated, be held to include wastage on materials, carriage and cartage, carrying and return of empties, hoisting, setting, fitting and fixing in position and all other labours necessary in and for the full and entire execution and completion of the work as aforesaid in accordance with good practice and recognized principles.

7. Sufficiency of Tender

The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices quoted in the Schedule of Quantities, which rates and prices shall, except as otherwise provided, cover all his obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the works.

8. Discrepancies and Adjustment of Errors

The several documents forming the Contract are to be taken as mutually explanatory of one another, detailed drawings being followed in preference to small scale drawing and figured dimensions in preference to scale dimensions and special conditions in preference to General Conditions.

8.1 In the case of discrepancy between the Schedule of Quantities, the Specifications and/or the Drawings, the following order of preference shall be observed:

- i) Description of Schedule of Quantities.
- ii) Particular Specification and Special Condition, if any.
- iii) Drawings.
- iv) C.P.W.D. Specifications.
- v) Indian Standard Specifications of B.I.S.

8.2 If there are varying or conflicting provisions made in any one document forming part of the contract, the Accepting Authority shall be the deciding Authority with regard to the intention of the document and his decision shall be final and binding on the contractor.

8.3 Any error in description, quantity or rate in Schedule of Quantities or any omission there from shall not vitiate the Contract or release the Contractor from execution of the whole or any part of the works comprised therein according to drawings and specifications or from any of his obligations under the contract.

9. Signing of Contract

The successful tenderer/contractor, on acceptance of his tender by the Accepting Authority, shall, within 15 days from the stipulated date of start of the work sign the contract consisting of:

i) The notice inviting tender, all the documents including drawings, if any, forming the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.

ii) Standard Form as mentioned in Schedule 'F' consisting of:

- a) Various standard clauses with corrections up to the date stipulated in Schedule 'F' along with annexure thereto.
- b) Safety Code.
- c) Model Rules for the protection of health, sanitary arrangements for workers employed by Institute or its contractors.
- d) Labour Regulations.
- e) List of Acts and omissions for which fines can be imposed.

iii) No Payment for the work done will be made unless contract is signed by the contractor.

10. Director or his representative may issue instruction/actions for the said works from time to time, which should be binding on the contractor.

SECTION - 2 - (iv) - CLAUSES OF CONTRACT

GENERAL CLAUSES OF CONTRACT (GCC)

CLAUSE 1 (Performance Guarantee)

- i) The contractor shall submit an irrevocable **Performance Guarantee of 3 %** (Three percent) of the tendered amount in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement, (notwithstanding and/or without prejudice to any other provisions in the contract) within the period specified in Schedule F from the date of issue of letter of acceptance. This period can be further extended by the Engineer-in-Charge up to a maximum period as specified in schedule 'F' on written request of the contractor stating the reason for delays in procuring the Performance Bank Guarantee, to the satisfaction of the Engineer-In-Charge. This guarantee shall be in the form of banker's cheque of any schedule bank /Demand draft of any schedule bank/pay order of any schedule bank or Fixed Deposit Receipt or Guarantee bond of any schedule bank in accordance with the form annexed hereto. In case a fixed deposit receipt is furnished by the contractor to the Institute as part of the Performance Bank Guarantee and the bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the Institute to make good the deficit.
- ii) The Performance Guarantee shall be initially valid up to the stipulated date of completion plus 60 days beyond that. In case the time for completion of work gets enlarged, the contractor shall get the validity of Performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor, without any interest. However, in case of contracts involving maintenance of building and services/any other work after construction of same building and services/other work, then 50% of Performance Guarantee shall be retained as Security Deposit. The same shall be returned year wise proportionately.
- iii) The Engineer-in-Charge shall not make a claim under the performance guarantee except for amounts to which the Director, IPR is entitled under the contract (notwithstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:
 - a) Failure by the contractor to extend the validity of the Performance Guarantee as described herein above, in which event the Engineer-in-Charge may claim the full amount of the Performance Guarantee.
 - b) Failure by the contractor to pay the Director, IPR any amount due, either as agreed by the contractor or determined under any of the Clauses/ Conditions of the agreement, within 30 days of the service of notice to this effect by the Engineer-in-Charge.
- iv) In the event of the contract being determined or rescinded under provision of any of the Clause/Condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of the Director, IPR.
- v) On substantial Completion of any work which has been completed to such an extent that the intended purpose of the work is met and ready to use, then a provisional Completion certificate shall be recorded by the Engineer-in-Charge. The provisional certificate shall have appended with a list of outstanding balance item of work that need to be completed in accordance with the provisions of the contract.

This provisional completion certificate shall be recorded by the concerned Engineer- in-charge with the approval of Chairperson I-CDC After recording of the provisional Completion Certificate for the work by the competent authority, the 80 % of performance guarantee shall be returned to the contractor, without any interest.

However in case of contracts involving Maintenance of building and services / any other work after construction of same building and services/ other work, then 40% of performance guarantee shall be returned to the contractor, without any interest after recording the provisional Completion certificate.

CLAUSE 1A (Recovery of Security Deposit)

The person / persons whose tender(s) may be accepted (hereinafter called the contractor) shall permit the Institute at the time of making any payment to him for work done under the contract to deduct a sum at the rate of 2.5% of the gross amount of each running bill and final bill till the sum along with the sum already deposited as earnest money, will amount to security deposit of 2.5% of the tendered value of the work.

Such deductions will be made and held by Institute by way of Security Deposit unless he /they has /have deposited the amount of Security at the rate mentioned above in Cash or in the form of / or Fixed Deposit Receipts. In case a fixed Deposit Receipt of any Scheduled bank is furnished by the contractor to the Institute as a part of the Security Deposit and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the government to make good the deficit.

All compensations or the other sums of money payable by the contractor under the terms of this contract may be deducted from, or paid by the sale of a sufficient part of his security deposit or from the interest arising there from, or from any sums which may be due to or may become due to the contractor by Institute on any account whatsoever and in the event of his Security Deposit being reduced by reason of any such deductions or sale as aforesaid, the contractor shall within 10 days make good, in cash or fixed deposit receipt tendered by the State Bank of India or by scheduled banks endorsed in favor of the Institute, any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof. The security deposit shall be collected from the running bills and final bill of the contractor at the rates mentioned above.

The security deposit as deducted above can be released against bank guarantee issued by a Scheduled bank on its accumulations to a minimum of Rs. 5 Lac subject to the condition that amount of such bank guarantee, except last one shall not be less than Rs. 5 Lac. Provided further that the validity of bank guarantee including the one given against the earnest money shall be in conformity with provisions contained in clause 17 which shall be extended from time to time depending upon extension of contract granted under provisions of clause 2 and clause 5.

In case of contracts involving maintenance of building and services/other work, then 50% of performance Guarantee shall be retained as Security Deposit. The same shall be returned year wise proportionately.

CLAUSE 2 (Compensation for Delay)

If the contractor fails to maintain the required progress in terms of clause 5 or to complete the work and clear the site on or before the contract or justified extended date of completion, as per clause 5(excluding any extension under Clause 5.5) as well as any extension granted under clauses 12 and 15, he shall, without prejudice to any other right or remedy available under the law to the Government on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below as the authority specified in schedule 'F' (whose decision in writing shall be final and binding) may decide on the amount of Tendered value of the work for every completed day/month (as applicable) that the progress remains below that specified in Clause 5 or that the work remains incomplete.

This will also apply to items or group of items for which a separate period of completion has been specified.

Compensation for delay of work @ 1.0 % per month of delay to be computed on per day basis.

Provided always that the total amount of compensation for delay to be paid under this Condition shall not exceed 10% of the Tendered Value of work or of the Tendered Value of the Sectional part of work as mentioned in Schedule 'F' for which a separate period of completion is originally given.

In case no compensation has been decided by the Authority in schedule 'F', during the progress of work, this shall be no waiver of right to levy compensation by the said authority if the work remains incomplete on final justified extended date of completion. If the Chairperson ICDC decides to give further extension of time allowing performance of work beyond the justified extended date, the contractor shall be liable to pay compensation for such extended period. If any variation in amount of contract takes place during such extended period beyond justified extended date and the contractor becomes entitled to additional time under clause 12, the net period for such variation shall be accounted for while deciding the period for levy of compensation. However, during such further extended period beyond the justified extended period, if any delay occurs by events under sub clause 5.2, the contractor shall be liable to pay compensation for such delay.

Provided that compensation during the progress of work before the justified extended date of completion for delay under this clause shall be for non-achievement of sectional completion or part handing over of work on stipulated/justified extended date for such part work or if delay affects any other works/services. This is without prejudice to right of action by the Engineer in Charge under clause 3 for delay in performance and claim of compensation under that clause.

In case action under clause 2 has not been finalized and the work has been determined under clause 3, the right of action under this clause shall remain post determination of contract but levy of compensation shall be for days the progress is behind the schedule on date of determination, as assessed by the authority in Schedule F, after due consideration of justified extension. The compensation for delay, if not decided before the determination of contract, shall be decided after of determination of contract.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the Institute /Government. In case, the contractor does not achieve a particular milestone mentioned in schedule F, or the re-scheduled milestone(s) in terms of Clauses 5.4, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied as above. - With-holding of this amount on failure to achieve a milestone, shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s), the withheld amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

CLAUSE 2A (Incentive for early completion) (Not applicable)

~~In case, the contractor completes the work ahead of updated stipulated date of completion or justified extended date of completion as determined under clauses 5.3, 12 & 15 a bonus @ 1% (one per cent) of the tendered value per month computed on per day basis, shall be payable to the contractor, subject to a maximum limit of 5% (five per cent) of the tendered value. Provided that justified time for extra work shall be calculated on pro-rata basis as cost of extra work X stipulated period / tendered value. The amount of bonus, if payable, shall be paid along with final bill after completion of work. Provided always that provision of the Clause 2A shall be applicable only when so provided in Schedule F'.~~

CLAUSE 3 (When Contract can be determined)

Subject to other provisions contained in this clause, Engineer-in-Charge may, without prejudice to his any other rights or remedy against the contractor in respect of any delay, inferior workmanship, any claims for damages, and/or any other provisions of this contract or otherwise, and whether the date of completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases:

- (i) If the contractor having been given by the Engineer-in-charge a notice in writing to rectify; reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or unworkman like manner shall omit to comply with the requirement of such notice for a period of seven days thereafter.
- (ii) If the contractor has, without reasonable cause, suspended the progress of the work or has failed to proceed with the work with due diligence so that in the opinion of the Engineer-in-Charge (which shall be final and binding) he will be unable to secure completion of the work by the date for completion and continues to do so after a notice in writing of seven days from the Engineer-in-Charge.
- (iii) If the contractor fails to complete the work or section of work with individual date of completion on or before the stipulated or justified extended date, on or before such date of completion; and the Engineer in Charge without any prejudice to any other right or remedy under any other provision in the contract has given further reasonable time in a notice given in writing in that behalf as either mutually agreed or in absence of such mutual agreement by his own assessment making such time essence of contract and in the option of Engineer-in-Charge the contractor will be unable to complete the same or does not complete the same within the period specified..
- (iv) If the contractor persistently neglects to carry out his obligations under the contract and/or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given to him in that behalf by the Engineer-in-Charge.
- (v) If the Contractor shall offer or give or agree to give to any person in Institute or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing of forbearing to do or for having done of forborne to do any act in relation to the obtaining or execution of this or any other contract for Institute.
- (vi) If the Contractor shall enter in to a contract with Institute in connection with which commission has been paid or agreed to be paid by him or to his knowledge, unless the particulars of any such commission and the terms of payment thereof have been previously disclosed in writing to the Engineer- in- Charge.
- (vii) If the contractor shall obtain a contract with Institute as a result of wrong tendering or other non-bonafide methods of competitive tendering or commits breach of Integrity Agreement.
- (viii) If the contractor being an individual, or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving order or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for

the purpose of amalgamation or reconstruction) under any Insolvency act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport so to do, or if any application be made under any insolvency Act for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors.

- (ix) If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the court or the creditors to appoint a receiver or a manager or which entitle the court to make a winding up order.
- (x) If the contractor shall suffer an execution being levied on his goods and allow it to be continued for a period of 21 days.
- (xi) If the contractor assigns,(excluding part(s) of work assigned to other agency(s) by the contractor as per terms of contract), transfers, sublets (engagement of labour on a piece work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with entire works or any portion thereof without the prior written approval of the Engineer- In charge.

When the contractor has made himself liable for action under any of the cases aforesaid, Engineer-in-Charge shall have powers:

- (a) To determine the contract as aforesaid so far as performance of work by the contractor in concerned(of which determination notice in writing to the contractor under the hand of the Engineer – in - Charge shall be conclusive evidence). Upon such determination the Earnest Money Deposit, Security Deposit already recovered and Performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the Institute.

(b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof, as shall be un-executed out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined or rescinded as above, shall not be allowed to participate in the tendering process for the balance work. In the event of above courses being adopted by the Engineer-in-Charge, the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements /agreements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer- in-Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

CLAUSE 3A

In case, the work cannot be started due to reasons not within the control of the contractor within 1/8th of the stipulated time for completion of work or one month whichever is more, either party may close the contract by giving notice to the other party stating reasons. In such eventuality, the Performance Guarantee of the contractor shall be refunded within following time limits:

- | | | |
|-------|--|----------|
| (i) | If the Tendered value of work is up to Rs. 45 Lac: | 15 days. |
| (ii) | If the Tendered value of work is more than Rs. 45 lac and up to 2.5 Crore: | 21 days. |
| (iii) | If the Tendered Value of work is more than Rs. 2.5 Crore: | 30 days. |

Neither party shall claim any compensation for such eventuality. This clause is not applicable for any breach of the contract by either party.

CLAUSE 4 (Contractor Liable to pay Compensation even if action not taken under Clause 3)

In any case in which any of the powers conferred upon the Engineer – in - Charge by Clause-3 thereof, shall have become exercisable and the same are not exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the contractor and the liability of the contractor for compensation shall remain unaffected. In the event of the Engineer-in-Charge putting in force all or any of the powers vested in him under the preceding clause he may, if he so desires after giving a notice in writing to the contractor, take possession of (or at the sole discretion of the Engineer-in-Charge which shall be final and binding on the contractor) use as on hire (the amount of the hire money being also in the final determination of the Engineer-in-Charge) all or any tools, plant, materials and stores, in or upon the works, or the site thereof belonging to the contractor, or procured by the contractor and intended to be used for the execution of the work/or any part thereof, paying or allowing for the same in account at the contract rates, or, in the case of these not being applicable, at current market rates to be certified by the Engineer-in-Charge, whose certificate thereof shall be final, and binding on the contractor, clerk of the works, foreman or other authorized agent to remove such tools, plant, materials, or stores from the premises (within a time to be specified in such notice) in the event of the contractor failing to comply with any such requisition, the Engineer-in-Charge may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and his risk in all respects and the certificate of the Engineer-in-Charge as to the expenses of any such removal and the amount of the proceeds and expenses of any such sale shall be final and conclusive against the contractor.

CLAUSE 5 (Time and Extension for Delay)

The time allowed for execution of the Works as specified in the Schedule 'F' or the extended time in accordance with these conditions shall be the essence of the Contract. The execution of the works shall commence from such time period as mentioned in schedule 'F' or from the date of handing over of the site notified by the Engineer-in-Charge, whichever is later. However the handing over of site by the Engineer-in-Charge, in full or in part (if so provided in contract), shall be completed within two months from issue of acceptance letter. If the contractor commits default in commencing the execution of the work as aforesaid, the performance guarantee shall be forfeited by the Engineer-in-Charge and shall be absolutely at the disposal of the Institute - without prejudice to any other right or remedy available in law, -

5.1 As soon as possible but within twenty one days of award of work and in consideration of

- a) Schedule of handing over of site as specified in the Schedule 'F'.
- b) Schedule of issue of designs as specified in the Schedule 'F'.

- (i) The Contractor shall submit a Time and Progress Chart for each milestone. The Engineer-in-Charge may within 30days thereafter, if required modify, and communicate the program approved to the contractor failing which the program submitted by the contractor shall be deemed to be approved by the Engineer-in-Charge. The work programme shall include all details of balance drawings and decision required to complete the contract with specific dates by which these details are required by contractor without causing any delay in execution of the work. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer-in-Charge and the Contractor within the limitations of time imposed in the Contract documents, and further to ensure good progress during the execution of the work, the contractor shall in all cases in

which the time allowed for any work, exceeds one month (save for special jobs for which a separate programme has been agreed upon) complete the work as per mile stones given in Schedule F.

- (ii) In case of non-submission of construction programme by the contractor the program approved by the Engineer-in-Charge shall be deemed to be final.
- (iii) The approval by the Engineer-in-Charge of such programme shall not relieve the contractor of any of the obligation under the contract.
- (iv) The Contractor shall submit the Time and Progress Chart and progress report using the mutually agreed software or in other format decided by the Engineer-in-Charge for the work done during previous month to the Engineer-in-charge on or before 5th day of each month failing which a recovery Rs. 2500/- (for work costing up to Rs. 20 Crores)/Rs. 5000/- (for work costing more than Rs. 20 Crores) shall be made on per week or part basis in case of delay in submission of the monthly progress report.

5.2 If the work(s) be delayed by:

- (i) force majeure, or
- (ii) abnormally bad weather, or
- (iii) serious loss or damage by fire, or
- (iv) civil commotion, local commotion of workmen, strike or lockout, affecting any of the trades employed on the work, or
- (v) delay on the part of other contractors or tradesmen engaged by Engineer-in-Charge in executing work not forming part of the Contract, or
- (vi) Non-availability of stores, which are the responsibility of Institute to supply or
- (vii) Non-availability or break down of tools and Plant to be supplied or supplied by the Institute or
- (viii) Any other cause like above which, in the reasoned opinion of the Engineer-in-Charge is beyond the Contractor's control.

then upon the happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the Engineer-in-Charge – for entry in the hindrance register (physical or web-based as prescribed in Schedule F but shall nevertheless use constantly his best endeavors to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer-in-Charge to proceed with the works.

The contractor shall have no claim of damages for extension of time granted or rescheduling of milestone/s for events listed in sub clause 5.2.

5.3 In case the work is hindered by any reasons, in the opinion of the contractor, by the Department or for someone for whose action the Department is responsible, the contractor may immediately give notice thereof in writing to the Engineer-in-Charge in the same manner as prescribed under sub Clause 5.2 seeking extension of time or rescheduling of milestone/s. The authority as indicated in Schedule 'F' shall, if justified, give a fair and reasonable extension of time and reschedule the mile stones for completion of work after due consideration of the same within 30 days of receipt of such request. In event of non-application by the contractor for extension of time, Chairperson I-CDC after affording opportunity to the contractor may give, supported with a programme, a fair and reasonable extension within a reasonable period of occurrence of the event.

Such extension of time or rescheduling of milestone/s shall be without prejudice to any other right or remedy of the parties in contract or in law; provided further that for concurrent delays under this sub clause and sub clause 5.2 to the extent the delay is covered under sub clause 5.2 the contractor shall be entitled to only extension of time and no damages.

5.4 Request for rescheduling of Mile stones or extension of time, to be eligible for consideration, shall be made by the Contractor in writing within fourteen days of the happening of the event causing delay on the prescribed forms i.e. Form of application by the contractor for seeking rescheduling of milestones (Appendix-XVI) or Form of application by the contractor for seeking extension of time (Appendix -XVII) respectively to the authority as indicated in Schedule 'F'. The Contractor shall indicate in such a request the period by which rescheduling of milestone/s or extension of time is desired.

With every request for rescheduling of milestones, or if at any time the actual progress of work falls behind the approved programme by more than 10% of the stipulated period of completion of contract, the contractor shall produce a revised programme which shall include all details of pending drawings and decisions required to complete the contract and also the target dates by which these details should be available without causing any delay in execution of the work. A recovery as specified in Schedule 'F' shall be made on per day basis in case of delay in submission of the revised programme.

5.4.1 In any such case the authority as indicated in Schedule 'F' may give a fair and reasonable extension of time for completion of work or reschedule the mile stones. Such extension or rescheduling of the milestones shall be communicated to the Contractor by the authority as indicated in Schedule 'F' in writing, within 30 days of the date of receipt of such request from the Contractor in prescribed form. In event of non-application by the contractor for extension of time Chairperson I-CDC after affording opportunity to the contractor, may give, supported with a programme (as specified under 5.4 above), a fair and reasonable extension within a reasonable period of occurrence of the event.

5.5 In case the work is delayed by any reasons, in the opinion of the Chairperson I-CDC, by the contractor for reasons beyond the events mentioned in clause 5.2 or clause 5.3 or clause 5.4 and beyond the justified extended date; without prejudice to right to take action under Clause 3, the Chairperson I-CDC may grant extension of time required for completion of work without rescheduling of milestones. The contractor shall be liable for levy of compensation for delay for such extension of time.

CLAUSE 6 (Measurement of Work Done) (Not Applicable)

~~Engineer in Charge shall, except as otherwise provided, ascertain and determine by measurement the value in accordance with the contract of work done.~~

~~All measurements of all the items having financial value shall be entered in Measurement Book and/or level field book so that a complete record is obtained of all the items of work performed under the contract.~~

~~All such measurements and levels shall be taken jointly by the Engineer in charge or his authorized representative and by the contractor or his authorized representative from time to time during the progress of the work and such measurements shall be signed and dated by the Engineer in Charge and the contractor or their representatives in token of their acceptance. If the contractor objects to any of the measurements recorded, a note shall be made to that effect with reason and signed by both the parties,~~

~~If for any reason the contractor or his authorized representatives is not available and the work of recording measurements is suspended by the Engineer in Charge or his representative, the Engineer in Charge and the Department shall not entertain any claim from contractor for any loss or damages on this account. If the contractor on his authorized representative does not remain present at the time of such measurements after the contractor or his authorized representative has been given a notice in writing three (3) days in advance or fails to countersign or to record objection within a week from the date of the measurement, then such measurements recorded in his absence by the Engineer in Charge or his representative shall be deemed to be accepted by the Contractor.~~

~~The contractor shall, without extra charge, provide all assistance with every appliance, labour and other things necessary for checking of measurements and recording levels~~

~~Except where any general or detailed description of the work expressly shows to the contrary. Measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian Standards and if for any item no such standard is available then a mutually agreed method shall be followed.~~

~~The contractor shall give not less than seven days' notice to the Engineer in charge or his authorized representative in charge of the work before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimensions thereof be taken before the same is covered up or placed beyond the reach of measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Engineer in charge or his authorized representative in charge of the work who shall within the aforesaid period of seven days inspect the work. And if any work shall be covered up or placed beyond the reach of measurements without such notice having been given or the Engineer in charge's consent being obtained in writing the same shall be uncovered at the contractor's expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.~~

~~Engineer in charge or his authorized representative may cause either themselves or through another officer of the department to check the measurements recorded jointly or otherwise as aforesaid and all provisions stipulated herein above shall be applicable to such checking of measurements or levels.~~

~~It is also a term of this contract that recording of measurement of any work in the measurement book and / or its payment in the interim, on account of final bill shall not be considered as conclusive evidence as to the sufficiency of any work or materials to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.~~

CLAUSE 6A (Computerized Measurement Book)

Engineer-in-charge shall, except as otherwise provided, ascertain and determine by measurement the value of work done in accordance with the contract.

All measurements of all items having financial value shall be entered by the contractor and compiled in the shape of the Computerized Measurement Book having pages of A-4 size as per the format of the department so that a complete record is obtained of all the items of works performed under the contract.

All such measurements and levels recorded by the contractor or his authorized representative from time to time, during the progress of the work, shall be got checked by the contractor from the Engineer-in-charge or his authorized representative as per interval or program fixed in consultation with Engineer-in-charge or his authorized representative. After the necessary corrections made by the Engineer-in-charge, the measurement sheets shall be returned to the contractor for incorporating the corrections and for resubmission to the Engineer-in-charge for the dated signatures by the Engineer-in-charge and the contractor or their representatives in token of their acceptance.

Whenever bill is due for payment, the contractor would initially submit draft computerized measurement sheets and these measurements would be got checked / test checked from the Engineer-in-Charge and/or his authorized representative. The Contractor will, thereafter, incorporate such changes as may be done during these checks/test checks in his draft computerized measurements, and submit to the department a computerized measurement book, duly bound, and with its pages machine numbered. The Engineer-in-Charge and / or his authorized representative would thereafter check this MB, and record the necessary certificates for their checks/ test checks.

The final, fair, computerized measurement given by the contractor duly bound, with its pages machine numbered should be 100% correct, and no cutting or over writing in the measurements would thereafter be allowed. If at all any error is noticed, the contractor shall have to submit a fresh computerized MB with its pages duly machine numbered and bound, after getting the earlier MB cancelled by the department. Thereafter the MB shall be taken in the Divisional Office Records, and allotted a number as per the Register of Computerized MBs. This should be done before the corresponding bill is submitted to the Division office for Payment. The contractor shall submit two spare copies of such computerized MBs for the purpose of reference and record by the various officers of the department.

The contractor shall also submit to the Institute separately his computerized abstract of cost and the bill based on these measurements, duly bound and its pages machine numbered along with two spare copies of the "bill". Thereafter, this bill will be processed by the Institute and allotted a number as per the computerized record in the same way as done for the measurement book meant for measurements.

The Contractor shall, without extra charge, provide all assistance with every appliance, labour and other things necessary for checking of measurements/ levels by the engineer-in-charge or his representative.

Except where any general or detailed description of the work expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications, notwithstanding any provision in the relevant standard method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the bureau of Indian standards and if for any item no such standard is available then a mutually agreed method shall be followed.

The contractor shall give not less than seven days' notice to the Engineer-in-charge or his authorized representative in charge of the work before covering up or otherwise placing beyond the reach of checking and/or test checking the measurement of any work in order that the same may be checked and /or test checked and correct dimensions thereof be taken before the same is covered up or placed beyond the reach of checking and /or test checking measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Engineer in charge or his authorized representative in charge of the work who shall within the aforesaid period of seven days inspect the work, and if any work shall be covered up or placed beyond the reach of checking and /or test checking measurements without such notice having been given or the engineer in charge's consent being obtained in writing the same shall be uncovered at the contractor's expense or in default thereof no payment or allowances shall be made for such work or the materials with the same was executed.

Engineer- in-charge or his authorized representative may cause either themselves or through another officer of the Institute to check the measurements recorded by contractor and all provisions stipulated herein above shall be applicable to such checking of measurements or levels.

It is also a term of this contract that checking and/or test checking the measurements of any item of work in the measurement book and / or its payment in the interim, on account of final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.

CLAUSE 7 (Payment on Intermediate Certificate to be regarded as Advances)

No payment shall be made for work, estimated to cost Rupees One Lac - or less till after the whole of the work shall have been completed and certificate of completion given. For works estimated to cost over one lac, the interim or running account bills shall be submitted by the contractor for the work executed on the basis of such recorded measurements on the format of the Institute in triplicate on or before the date of every month fixed for the same by the Engineer-in-Charge. The contractor shall not be entitled to be paid any such interim payment if the gross work done together with net payment adjustment of advances for material collected, if any, since the last such payment is less than the amount specified in Schedule 'F', in which case the interim bill shall be prepared on the appointed date of the month after the requisite progress is achieved. Engineer-in-Charge shall arrange to have the bill verified by taking or causing to be taken, where necessary, the requisite measurements of the work. In the event of the failure of the contractor to submit the bills no claims whatsoever due to delays on payment including that of interest shall be payable to the contractor. Payment on account of amount admissible shall be made by the Engineer- in-Charge certifying the sum to which the contractor is considered entitled by way of interim payment at such rates as decided by the Engineer-in-Charge. The amount admissible shall be paid by 10th working day after the day of presentation of the bill by the Contractor to the Engineer-in-Charge or his Asst. Engineer together with the account of the material issued by the Institute, or dismantled materials, if any. In the case of works outside the headquarters of the Engineer-in-Charge, the period of ten working days will be extended to fifteen working days. In case of delay in payment of intermediate bills after 45 days of submission of bill by the contractor provided the bill submitted by the contractor found to be in order, a simple interest @ 10% - per annum shall be paid to the contractor from the date of expiry of the prescribed time limit which will be compounded on yearly basis.

All such interim payments shall be regarded as payment by way of advances against final payment only and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be rejected, removed, taken away and reconstructed or re-erected. Any certificate given by the Engineer-in-Charge relating to the work done or materials delivered forming part of such payment, may be modified or corrected by any subsequent such certificate(s) or by the final certificate and shall not by itself be conclusive evidence that any work or materials to which it relates is/are in accordance with

the contract and specifications. Any such interim payment, or any part thereof shall not in any respect conclude, determine or affect in any way powers of the Engineer-in-Charge under the contract or any of such payments be treated as final settlement and adjustment of accounts or in any way vary or affect the contract.

Pending consideration of extension of date of completion, interim payments shall continue to be made as herein provided without prejudice to the right of the Institute to take action under the terms of this contract for delay in the completion of work, if the extension of date of completion is not granted by the competent authority.

The Engineer-in-Charge in his sole discretion on the basis of a certificate from the Assistant Engineer to the effect that the work has been completed up to the level in question make interim advance payments without detailed measurements for work done (other than foundations, items to be covered under finishing items) up to lintel level (including sunshade etc.) and slab level, for each floor working out at 75% of the assessed value. The advance payments so allowed shall be adjusted in the subsequent interim bill to be submitted by the contractor within 10 days of the interim payment. In case of delay in submission of bill by the contractor a simple interest @ 10% per annum shall be paid to the Institute from the date of expiry of prescribed time limit which will be compounded on yearly basis. **Payments in Composite Contracts:** In case of composite tenders, running payment for the major component shall be by Engineer-In-Charge of major discipline to the main contractor. Running payment for minor components shall be recommended by the Engineer-in Charge of the discipline of minor component directly to the main contractor.

In case main contractor fails to make the payment to the contractor associated by him within 15 days of receipt of each running account payment, then on the written Complaint of contractor associated for such minor component, Engineer in charge of minor component shall serve the show cause to the main contractor and if reply of main contractor either not received or found unsatisfactory, he may make the payment directly to the contractor associated for minor component as per terms and conditions of the agreement drawn between main contractor and associate contractor fixed by him, Such payment made to the associate contractor shall be recovered by Engineer-in-Charge of major or minor component from the next RA/ final bill to main contractor as the case may be.

CLAUSE 7A

No Running Account Bill Shall be paid for the work till the applicable labour licenses, registration with EPFO, ESIC and BOCW Welfare Board, whatever applicable are submitted by the contractor to the Engineer-in-Charge.

CLAUSE 8 (Completion Certificate and Completion Plans)

Within ten days of the completion of the work, the contractor shall give notice of such completion to the Engineer-in-Charge and within thirty days of the receipt of such notice the Engineer-in-Charge shall inspect the work and if there is no defect in the work, shall furnish the contractor with a final certificate of completion, otherwise a provisional certificate of physical completion indicating defects (a) to be rectified by the contractor and/or (b) for which payment will be made at reduced rates, shall be issued. But no final certificate of completion shall be issued, nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall be executed all scaffolding, surplus materials, rubbish and all huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the works as shall have been erected or constructed by the contractor(s) and cleaned off the dirt from all wood work, doors, windows, walls, floor or other parts of the building, in, upon, or about which the work is to be executed or of which they may have had possession for the purpose of the execution thereof, and not until the work shall have been measured by the Engineer-in-Charge. If the contractor shall fail to comply with the requirements

of this Clause as to removal of scaffolding, surplus materials and rubbish and all huts and sanitary arrangements as aforesaid and cleaning off dirt on or before the date fixed for the completion of work, the Engineer-in- Charge may at the expense of the contractor remove such scaffolding, surplus materials and rubbish etc., and dispose of the same as he thinks fit and clean off such dirt as aforesaid, and the contractor shall have no claim in respect of scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

CLAUSE 8 A (Contractor to keep Site Clean)

When the annual repairs and maintenance of works are carried out, the splashes and droppings from white washing, colour washing, painting etc., on walls, floor, windows, etc. shall be removed and toe surface cleaned simultaneously with the completion of these items of work in the individual rooms, quarters or premises etc. where the work is done without waiting to the actual completion of all the other items of work in the contract. In case the contractor fails to comply with the requirements of this clause, the Engineer-in- Charge shall have the right to get this work done at the cost of the contractor either departmentally or through any other agency. Before taking such action, the Engineer – in - Charge shall give ten days' notice in writing to the contractor.

CLAUSE 8 B (Completion Plans to be Submitted by Contractor)

The Contractor shall submit completion plan as required vide General Specification for Electrical works (Part-I internal) 2005 and (Part-II External) 1994 as applicable, within thirty days of the completion of the work.

In case, the contractor fails to submit the completion plan as aforesaid, he shall be liable to pay a sum of 0.1% of Tendered Value of limit prescribed in Schedule F Whichever is more as may be fixed by the Institute and in this respect the decision of the Institute shall be final and binding on the contractor.

The Contractor shall submit completion plan for Internal and External Civil, Electrical and Mechanical Services within thirty days of the completion of the work, provided that the service plans having been issued for execution by the Engineer-in-Charge, unless the contractor, by virtue of any other provision in the contract, is required to prepare such plans.

CLAUSE 9 (Payment of Final Bill)

The final bill shall be submitted by the contractor in the same manner as specified in interim bills within three months of physical completion of the work or within one month of the date of the final certificate of completion furnished by the Engineer-in-Charge whichever is earlier. No further claims shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Engineer-in-Charge, will, as far as possible be made within the period specified here in under, the period being reckoned from the date of receipt of the bill by the Engineer-in- Charge or his authorized Asst. Engineer, complete with account of materials issued by the Institute and dismantled materials.

- | | | |
|------|--|-----------|
| i) | If the Tendered value of work is up to Rs.45 lakhs : | :2 months |
| ii) | If the Tendered value of work is more than Rs.45 lakhs and up to Rs.2.5 Crore: | 3 months |
| iii) | If the Tendered value of work exceeds Rs.2.5 Crore: | :6 months |

In case of delay in payment of final bills after prescribed time limit, a simple interest @10% per annum shall be paid to the contractor from the date of expiry of prescribed time limit which will be compounded on yearly basis, provided the final bill submitted by the contractor found to be in order.

CLAUSE 9 A (Payment of Contractor's Bills to Banks)

Payments due to the contractor may, if so desired by him, be made to his bank, registered financial, Co-operative or thrift societies or recognized financial Institutions instead of direct to him provided that the contractor furnishes to the Engineer-in-Charge (1) an authorization in the form of a legally valid document such as a power of attorney conferring authority on the bank, registered financial, Co-operative or thrift societies or recognized financial Institutions to receive payments and (2) his own acceptance of the correctness of the amount made out as being due to him by Institute or his signature on the bill or other claim preferred against Institute before settlement by the Engineer-in-Charge of the account or claim by payment to the bank, registered financial, Co-operative or thrift societies or recognized financial Institutions. While the receipt given by such banks registered financial, Co-operative or thrift societies or recognized financial Institutions shall constitute a full and sufficient discharge for the payment, the contractor shall whenever possible present his bills duly receipted and discharged through his bank, registered financial, Co-operative or thrift societies or recognized financial Institutions

Nothing herein contained shall operate to create in favour of the bank, registered financial, Co-operative or thrift societies or recognized financial Institutions any rights or equities vise-verse the Director, IPR.

CLAUSE 10 (Materials Supplied by the Institute)

Materials which the Institute will supply are shown in Schedule 'B' which also stipulates quantum, place of issue and rate(s) to be charged in respect thereof. The contractor shall be bound to procure them from the Engineer-in-Charge.

As soon as the work is awarded, the contractor shall finalize the programme for the completion of work as per clause 5 of this contract and shall give his estimates of materials required on the basis of drawings/or schedule of quantities of the work. The Contractor shall give in writing his requirement to the Engineer-in-Charge which shall be issued to him keeping in view the progress of work as assessed by the Engineer-in-Charge, in accordance with the agreed phased programme of work indicating monthly requirements of various materials. The contractor shall place his indent in writing for issue of such materials at least 7 days in advance of his requirement.

Such materials shall be supplied for the purpose of the contract only and the value of the materials so supplied at the rates specified in the aforesaid schedule shall be set off or deducted, as and when materials are consumed in items of work (including normal wastage) for which payment is being made to the contractor, from any sum then due or which may therefore become due to the contractor under the contract or otherwise or from the security deposit. At the time of submission of bills, the contractor shall certify that balance of materials supplied is available at site in original good condition.

The contractor shall submit along with every running bill (on account or interim bill) material - wise reconciliation statements supported by complete calculations reconciling total issue, total consumption and certified balance (diameter/section-wise in the case of steel) and resulting variations and reasons therefore. Engineer-in-Charge shall (whose decision shall be final and binding on the contractor) be within his rights to follow the procedure of recovery in clause 42 at any stage of the work if reconciliation is not found to be satisfactory.

The contractor shall bear the cost of getting the material issued, loading, transporting to site, unloading, storing under cover as required, cutting assembling and joining the several parts together as necessary.

Notwithstanding anything to the contrary contained in any other clause of the contract and (or the CPWA Code) all stores/materials so supplied to the contractor or procured with the assistance of the Institute shall remain the absolute property of Institute and the contractor shall be the trustee of the stores/materials, and the said stores/materials shall not be removed/disposed off from the site of the work on any account and shall be at all times open to inspection by the Engineer-in-Charge or his authorized agent. Any such stores/materials remaining unused shall be returned to the Engineer-in-Charge in as good a condition in which they were originally supplied at a place directed by him, at a place of issue or any other place specified by him as he shall require, but in case it is decided not to take back the stores/materials the contractor shall have no claim for compensation on any account of such stores/materials so supplied to him as aforesaid and not used by him or for any wastage in or damage to in such stores/materials. On being required to return the stores/materials, the contractor shall hand over the stores/ materials.

On being required to return the stores / materials , the contractor shall hand over the stores/materials on being paid or credited such price as the Engineer-in-Charge shall determine, having due regard to the condition of the stores/materials. The price allowed for credit to the contractor, however, shall be at the prevailing market rate not exceeding the amount charged to him, excluding the storage charge, if any. The decision of the Engineer-in-Charge shall be final and conclusive. In the event of breach of the aforesaid condition, the contractor shall in addition to throwing himself open to account for contravention of the terms of the license or permit and/or for criminal breach of trust, be liable to Institute for all advantages or profits resulting or which in the usual course would have resulted to him by reason of such breach. Provided that the contractor shall in no case be entitled to any compensation or damages on account of any delay in supply or non-supply thereof all or any such materials and stores provided further that the contractor shall be bound to execute the entire work if the materials are supplied by the Institute within the original scheduled time for completion of the work plus 50% thereof or schedule time plus 6 months whichever is more if the time of completion of work exceeds 12 months, but if a part of the materials only has been supplied within the aforesaid period, then the contractor shall be bound to do so much of the work as may be possible with the materials and stores supplied in the aforesaid period. For the completion of the rest of the work, the contractor shall be entitled to such extension of time as may be determined by the Engineer-in-Charge whose decision in this regard shall be final and binding on the contractor.

The contractor shall see that only the required quantities of materials are got issued. Any such material remaining unused and in perfectly good/original condition at the time of completion or determination of the contract shall be returned to the Engineer-in-Charge at the stores from which it was issued or at a place directed by him by a notice in writing. The contractor shall not be entitled for loading, transporting. Unloading and stacking of such unused material except for the extra lead, if any involved, beyond the original place of issue.

CLAUSE 10A (Materials to be provided by the Contractor)

The contractor shall, at his own expense, provide all materials, required for the works other than those which are stipulated to be supplied by the Institute.

The contractor shall, at his own expense and without delay, supply to the Engineer-in-Charge samples of materials to be used on the work and shall get these approved in advance. All such materials to be provided by the Contractor shall be in conformity with the specifications laid down or referred to in the contract. The contractor shall, if requested by the Engineer-in-Charge furnish proof, to the satisfaction of the Engineer-in-Charge that the materials so comply. The Engineer-in-Charge shall within thirty days of supply of samples or within such further period as he may require intimate to the Contractor in writing whether samples are approved by him or not. If samples are not approved, the Contractor shall forthwith arrange to supply to the Engineer-in-Charge for his approval fresh samples complying with the specifications laid down in the contract. When materials are required to be tested in accordance with specifications, approval of the Engineer-in-Charge shall be issued after the test results are received.

The Contractor shall at his risk and cost submit the samples of materials to be tested or analyzed and shall not make use of or incorporate in the work any materials represented by the samples until the required tests or analysis have been made and materials finally accepted by the Engineer-in-Charge. The Contractor shall not be eligible for any claim or compensation either arising out of any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of materials.

The contractor shall, at his risk and cost, make all arrangements and shall provide all facilities as the Engineer-in-Charge may require for collecting, and preparing the required number of samples for such tests at such time and to such place or places as may be directed by the Engineer-in-Charge and bear all charges and cost of testing unless specifically provided for otherwise elsewhere in the contract or specifications. The Engineer-in-Charge or his authorized representative shall at all times have access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles or machinery are being obtained for the works and the contractor shall afford every facility and every assistance in obtaining the right to such access.

The Engineer-in-Charge shall have full powers to require the removal from the premises of all materials which in his opinion are not in accordance with the specifications and in case of default, the Engineer-in-Charge shall be at liberty to employ at the expense of the contractor, other persons to remove the same without being answerable or accountable for any loss or damage that may happen or arise to such materials. The Engineer-in-Charge shall also have full powers to require other proper materials to be substituted thereof and in case of default, the Engineer-in-Charge may cause the same to be supplied and all costs which may attend such removal and substitution shall be borne by the Contractor.

The Contractor shall at his own expense, provide a material testing lab at the site for conducting routine field tests. The lab shall be equipped at least with the testing equipment as specified in Schedule F.

CLAUSE 10 B

(i) Secured Advance on Non-perishable Materials

The contractor, on signing an indenture in the form to be specified by the Engineer-in-Charge, shall be entitled to be paid during the progress of the execution of the work up to 75% of the assessed value of any materials which are in the opinion of the Engineer-in-Charge **nonperishable, non-fragile and noncombustible and are in accordance with the contract** and which have been brought on the site in connection therewith and are adequately stored and/or protected against damage by weather or other

causes but which have not at the time of advance been incorporated in the works. When materials on account of which an advance has been made under this sub-clause are incorporated in the work, the amount of such advance shall be recovered / deducted from the next payment made under any of the clause or clauses of this contract.

Such secured advance shall also be payable on other items of perishable nature, fragile and combustible with the approval of the Engineer-in-Charge provided the contractor provides a comprehensive insurance cover for the full cost of such materials. The decision of the Engineer-in-Charge shall be final and binding on the contractor in this matter. No secured advance, shall however, be paid on high-risk materials such as ordinary glass, sand, petrol, diesel etc.

(ii) Mobilization Advance: (Not applicable)

~~Mobilization advance not exceeding 10% of the tendered value may be given, if requested by the contractor in writing within one month of the order to commence the work. Such advance shall be in two or more installments to be determined by the Engineer in Charge at his sole discretion. The first installment of such advance shall be released by the Engineer in charge to the contractor on a request made by the contractor to the Engineer in Charge in this behalf. The second and subsequent installments shall be released by the Engineer in Charge only after the contractor furnishes a proof of the satisfactory utilization of the earlier installment to the entire satisfaction of the Engineer in Charge.~~

~~Before any installment of advance is released, the contractor shall execute Bank Guarantee Bonds not more than 6 in number form Schedule Bank for the amount equal to 110% of the amount advance and valid for the period till recovery of advance. This (Bank Guarantee from Schedule Bank for the amount equal to 110% of the balance amount of advance) shall be kept renewed from time to time to cover the balance amount and likely period of complete recovery.~~

~~Provided always that provision of clause 10B (ii) shall be applicable only when so provided in schedule 'E'.~~

(iii) Plant Machinery & Shuttering Material Advance (Not applicable)

~~An advance for plant, machinery & shuttering material required for the work and brought to site by the Contractor may be given if requested by the contractor in writing within one month of bringing such plant and machinery to site. Such advance shall be given on such plant and machinery, which in the opinion of the Engineer in Charge will add to the expeditious execution of work and improve the quality of work. The amount of advance shall be restricted to 5% percent of the tender value. In the case of new plant and equipment to be purchased for the work, the advance shall be restricted to 90% of the price of such new plant and equipment paid by the contractor for which the contractor shall produce evidence satisfactory to the Engineer in Charge. In the case of second hand and used plants and equipment, the amount of such advance shall be limited to 50% of the depreciated value of plant and equipment as may be decided by the Engineer in Charge. The contractor shall, if so required by the Engineer in Charge, submit the statement of value of such old plant and equipment duly approved by a Registered Valuer recognized by the Central Board of Direct Taxes under the Income Tax Act, 1961. No such advance shall be paid on any plant and equipment of perishable nature and on any plant and equipment of a value less than Rs. 50,000/- Seventy five percent of such amount of advance shall be paid after the plant & equipment is brought to site and balance twenty five percent on successfully commissioning the same.~~

~~Leasing of equipment shall be considered at par with purchase of equipment and shall be covered by tripartite agreement with the following:~~

- ~~1. Leasing company which gives certificate of agreeing to lease equipment to the contractor.~~

2. Engineer in Charge, and
3. The contractor

~~This advance shall further be subject to the condition that such plant and equipment (a) are considered by the Engineer in Charge to be necessary for the works; (b) and are in working order and are maintained in working order; (c) hypothecated to the Institute as specified by the Engineer in Charge before the payment of advance is released. The contractor shall not be permitted to remove from the site such hypothecated plant and equipment without the prior written permission of the Engineer in Charge. The contractor shall be responsible for maintaining such plant and equipment in good working order during the entire period of hypothecation failing which such advance shall be entirely recovered in lump sum. For this purpose, steel scaffolding and form work shall be treated as plant and equipment.~~

~~The contractor shall insure the Plant and Machinery for which mobilization advance is sought and given, for a sum sufficient to provide for their replacement at site. Any amounts not recovered from the insurer will be borne by the contractor.~~

~~(iv) Interest & Recovery :~~

~~The mobilization advance and plant and machinery advance in (ii) & (iii) above bear simple interest at the rate of 10 per cent per annum and shall be calculated from the date of payment to the date of recovery, both days inclusive, on the outstanding amount of advance. Recovery of such sums advanced shall be made by the deduction from the contractor's bills commencing after first ten per cent of the gross value of the work is executed and paid, on pro rata percentage basis to the gross value of the work billed beyond 10% in such a way that the entire advance is recovered by the time eighty per cent of the gross value of the contract is executed and paid, together with interest due on the entire outstanding amount up to the date of recovery of the installment.~~

~~(v) If the circumstances are considered reasonable by the Engineer in Charge, the period mentioned in (ii) and (iii) for request by the contractor in writing for grant of mobilization advance and plant and equipment advance may be extended in the discretion of the Engineer in Charge.~~

CLAUSE 10 C (Payment on Account of Increase in Prices / Wages due to Statutory Order(s))

If after submission of the tender, if the price of any material incorporated in the works (excluding the materials covered under Clause 10CA and not being a material supplied from the Engineer-in-Charge's stores in accordance with Clause 10 hereof) and/or wages of labour increases as a direct result of the coming into force of any fresh law, or statutory rule or order (but not due to any variation of rate in GST applicable on such material(s) being consider under this clause) beyond the price/wages prevailing at the time of the last stipulated date of receipt of tenders including extensions, if any, for the work during contract period including the justified period extended under the provisions of clause 5 of the contract without any action under clause 2, then the amount of the contract shall accordingly be varied

If after submission of the tender, the price of any material incorporated in the works (excluding the materials covered under Clause 10CA and not being a material supplied from the Engineer-in-Charge's stores in accordance with Clause 10 thereof) and/or wages of labour as prevailing at the time of last stipulated date of receipt of tender including extensions, if any, is decreased as a direct result of the coming into force of any fresh law or statutory rules or order (but not due to any changes in sales tax/VAT Central/State Excise/Custom Duty) Institute shall in respect of materials incorporated in the works (excluding the materials covered under Clause 10CA and not being materials supplied from the Engineer-in-Charge's stores in accordance with Clause-10 hereof) and/or labour engaged on the execution of the work after the date of coming into force of such law statutory rule or order be entitled to deduct from the dues of the contractor, such amount as shall be equivalent to the difference between

the prices of the materials and/or wages as prevailed at the time of the last stipulated date for receipt of tenders including extensions if any for the work and the prices of materials and/or wages of labour on the coming into force of such law, statutory rule or order. This will be applicable for the contract period including the justified period extended under the provisions of clause 5 of the contract without any action under clause 2.

Engineer-in-Charge may call books of account and other relevant documents from the contractor to satisfy himself about reasonability of increase in prices of materials and wages.

The contractor shall, within a reasonable time of his becoming aware of any alteration in the price of any such materials and/or wages of labour, give notice thereof to the Engineer-in-Charge stating that the same is given pursuant to this condition together with all information relating thereto which he may be in position to supply.

For this purpose, the labour component of 85% of the value the work executed during period under consideration shall not exceed the percentage as specified in Schedule F, of the value of work done during that period the increase/decrease in labour shall be considered on the minimum daily wages in rupees of any unskilled adult male mazdoor, fixed under any law, statutory rule or order. The cost of work for which escalation is applicable (W) is same as cost of work done worked out as indicated in sub-para (ii) of clause 10CC except the amount of full assessed value of secured Advance.

CLAUSE 10 CA (Payment due to variation in prices of materials after receipt of tender) (not applicable)

~~If after submission of the tender, the price of materials specified in Schedule F increases/decreases beyond the price(s) prevailing at the time of the last stipulated date for receipt of tenders (including extensions, if any) for the work, then the amount of the contract shall accordingly be varied and provided further that any such variations shall be effected for stipulated period of Contract including the justified period extended under the provisions of Clause 5 of the Contract without any action under Clause 2.~~

~~However for work done during the justified period extended as above, it will be limited to indices prevailing at the time of updated stipulated date of completion considering the effect of extra work (extra time to be calculated on pro-rata basis only as cost of extra work x stipulated period/tendered cost).~~

~~The increase/decrease in prices of cement, steel reinforcement and structural steel and POL shall be determined by the price indices issued by the Director General (Works), CPWD. For other items provided in the Schedule 'F' shall be determined by the All India Wholesale Price Indices of Material as published by Economic Advisor to Government of India, Ministry of Commerce and Industry and base price for cement, steel reinforcement, structural steel & POL as issued under the authority of Director General (Works) CPWD applicable for Delhi including Noida, Gurgaon, Faridabad & Ghaziabad and base price of other materials issued as indicated in Schedule „F” as valid on the last stipulated date of receipt of tender, including extension if any and for the period under consideration. In case, price index of a particular material is not issued by the ministry of Commerce and Industry, then the price index of nearest similar material as indicated in Schedule 'F' shall be followed~~

~~The amount of the contract shall accordingly be varied for all such materials and will be worked out as per the formula given below for individual material:-~~

a) Adjustment for component of individual material

$$V = P \times Q \times (CI - CI_0) / CI_0$$

Where,

~~V = Variation in material cost i.e. increase or decrease in the amount in rupees to be paid or recovered.~~

~~P = Base Price of material as issued under authority of DG(W), as indicated in Schedule 'F'.~~

For Projects and Original works

~~Q = Quantity of material brought at site for bonafide use in the works since previous bill excluding such quantity consumed in the deviated quantities of items beyond deviation limit and extra/substituted item, paid /to be paid at rates derived on the basis of market rate under clause 12.2..~~

~~CI₀ = Price index for cement, steel reinforcement bars and structural steel and POL as issued by the DG, CPWD and corresponding to the time of base price of respective material indicated in Schedule 'F'. For other items, if any, provided in Schedule 'F', All India Wholesale Price Index for the material as published by the Economic Advisor to Government of India, Ministry of Industry and Commerce and corresponding to the time of base price of respective material indicated in Schedule 'F'.~~

~~CI = Price index for cement, steel reinforcement bars, structural steel and POL as issued under the authority of DG, CPWD for period under consideration. For other items, if any, provided in Schedule 'F' All India Wholesale Price Index for material for period under consideration as published by Economic Advisor to Institute of India, Ministry of Industry and Commerce.~~

~~(i) — In respect of the justified period extended under the provisions of clause 5 of the contract without any action under clause 2, the index prevailing at the time of updated stipulated date of completion considering the effect of extra work (extra time to be calculated on prorated basis only as cost of extra work x stipulated date of completion/ tendered cost) shall be considered.~~

~~Provided always that provisions of the preceding Clause 10-C shall not be applicable in respect of Materials covered in this clause.~~

~~(ii) — f during progress of work or at the time of completion of work, it is noticed that any material brought at site is in excess of requirement, then amount of escalation if paid earlier on such excess quantity of material shall be recovered on the basis of cost indices as applied at the time of payment of escalation or as prevailing at the time of effecting recovery, whichever is higher.~~

~~(iii) — Cement mentioned wherever in this clause includes Cement component used in RMC brought at site from outside approved RMC plants, if any.~~

~~(iv) — The date wise record of ready mix concrete shall be kept in a register and the cement consumption for the same shall be calculated accordingly.~~

~~(v) — If built-up steel items are brought at site from work shop, then the variation shall be paid for the structural steel up to the period when the built up item /finished product is brought at site.~~

CLAUSE 10-CC (Payment due to Increase/Decrease in Prices/Wages (Excluding materials covered under clause 10-CA) after receipt of Tender for works) (Not applicable)

If the prices of materials (not being materials supplied or services rendered at fixed prices by the Institute in accordance with clause 10 & 34 thereof) and/or wages of labour required for execution of the work increase, the contractor shall be compensated for such increase as per provisions detailed below and the amount of the contract shall accordingly be varied, subject to the condition that such compensation for escalation in prices and wages shall be available only for the work done during the stipulated period of the contract including the justified period extended under the provisions of clause 5 of the contract without any action under clause 2. However, for the work done during the justified period extended as above, the compensation as detailed below will be limited to prices/wages prevailing at the time of stipulated date of completion or as prevailing for the period under consideration, whichever is less. No such compensation shall be payable for a work for which the stipulated period of completion is equal to or less than the time as specified in Schedule F. Such compensation for escalation in the prices of materials and labour, when due, shall be worked out based on the following provisions:-

(i) The base date for working out such escalation shall be the last stipulated date of receipt of tenders including extension, if any.

(ii) The cost of work on which escalation will be payable shall be reckoned as below:

- a) Gross value of work done up to this quarter: (A)
 - b) Gross Value of work done up to the last quarter: (B)
 - c) Gross value of work done since previous quarter (A-B): (C)
 - d) Full assessed value of Secured Advance (excluding materials covered under clause 10CA) fresh paid in this quarter (D)
 - e) Full assessed value of Secured Advance (excluding materials covered under clause 10CA) recovered in this quarter: (E)
 - f) Full assessed value of Secured Advance for which escalation is payable in this quarter (D-E): (F)
 - g) Advance payment made during this quarter: (G)
 - h) Advance payment recovered during this quarter: (H)
 - i) Advance payment for which escalation is payable in this quarter (G-H): (I)
 - j) Extra Items/deviated quantities of items paid as per Clause 12 based on prevailing market rates during this quarter: (J)
- Then, — $M = C + F + I + J$
 $N = 0.85 M$
- k) Less cost of material supplied by the Institute as per Clause 10 and recovered during the quarter (K)
 - l) less cost of services rendered at fixed charges as per Clause 34 and recovered during the quarter (L)

Cost of work for which escalation is applicable: $W = N - (K + L)$

(iii) Components for materials (except cement, reinforcement bars, structural steel, POL or other materials covered under clause 10 CA), labour, etc. shall be pre-determined for every work and incorporated in the conditions of contract attached to the tender papers included in Schedule 'F'. The decision of the Engineer in-Charge in working out such percentage shall be binding on the contractors.

(iv) The compensation for escalation for other materials (excluding cement, reinforcement bars, structural steel, POL or other materials covered under clause 10 CA shall be worked as per the formula given below:

- (a) Adjustment for civil component (except cement, structural steel, reinforcement bars, POL and other materials covered under clause 10CA)/electrical component of construction 'Materials'

$$(b) V_m = W \times \frac{X_m}{100} \times \frac{M_1 - M_{10}}{M_{10}}$$

V_m = Variation in material cost i.e. increase or decrease in the amount in rupees to be paid or recovered.

W = Cost of Work done worked out as indicated in sub para (ii) of Clause 10CC

X_m = Component of 'materials' (except cement, structural steel, reinforcement bars, POL and other materials covered under clause 10CA) expressed as percent of the total value of work

M_1 = All India Wholesale Price Index for civil component/electrical component* of construction material as worked out on the basis of all India wholesale price index for individual commodities/group items for the period under consideration as published by the Economic Advisor to Gov. of India Ministry of Industry & Commerce and applying weightages to the individual commodities/group items. (In respect of the justified period extended under the provisions of clause 5 of the contract without any action under clause 2, the index prevailing at the time of stipulated date of completion considering the effect of extra work (extra time to be calculated on prorata basis only as cost of extra works x stipulated period / tendered cost, shall be considered.)

M_{10} = All India Wholesale Price Index for civil component/electrical component* of construction material as worked out on the basis of all India wholesale price index for individual commodities/group items valid on the last stipulated date of receipt of tender including extension, if any, as published by the Economic Advisor to Gov. of India Ministry of Industry & Commerce and applying weightages to the individual commodities/group items.

—*Note: relevant component only will be applicable.

(v) The following principles shall be followed while working out the indices mentioned in para (iv) above.

(a) The Compensation for escalation shall be worked out at quarterly intervals and shall be with respect to the cost of work done as per bills paid during the three calendar months of the said quarter. The date of preparation of bills as finally entered in measurement book by the Assistant Engineer/date of submission of bill finally by the contractor to the department in case of computerized measurement books shall be the guiding factor to decide the bills relevant to the quarterly interval. The first such payment shall be made at the end of three months after the month (excluding the month in which tender was accepted) and thereafter at three months' interval. At the time of completion of work, the last period for payment might become less than 3 months, depending on the actual date of completion.

(b) The index (M_1/FI etc.) relevant to any quarter /period for which such compensation is paid shall be the arithmetical average of the indices, relevant to the three calendar months. If the period up to date of completion after quarter covered by the last such installment of payment, is less than three months, the index M_1 and F_1 shall be the average of the indices for the months falling within that period.

(vi) The compensation for escalation for **labour** shall be worked out as per the formula given below:

$$V_L = W \times \frac{Y}{100} \times \frac{L_1 - L_{10}}{L_{10}}$$

V_L : Variation in labour cost i.e. amount of increase or decrease in rupees to be paid or recovered.

~~W=~~Value of work done, worked out as indicated in sub-para (ii) above.

~~Y:~~ Component of labour expressed as a percentage of the total value of the work.

~~LI:~~ Minimum wage in rupees of an unskilled adult male mazdoor fixed under any law, statutory rule or order as applicable on the last date of the quarter previous to the one under consideration. (In respect of the justified period extended under the provisions of clause 5 of the contract without any action under clause 2, the minimum wage prevailing on the last date of quarter previous to the quarter pertaining to updated stipulated date of completion considering effect of extra work (extra time to be calculated on prorata basis only as cost of extra work x stipulated period / tendered cost, shall be considered.)

~~LI0=~~ Minimum daily wage in rupees of an unskilled adult male mazdoor, fixed under any law, statutory rule or order as on the last stipulated date of receipt of tender including extension, if any.

~~(vii) The following principles will be followed while working out the compensation as per sub-para (vi) above.~~

~~(a) The minimum wage of an unskilled male mazdoor mentioned in sub-para (vi) above shall be the higher of the wage notified by Government of India, Ministry of Labour and that notified by the local administration both relevant to the place of work and the period of reckoning.~~

~~(b) The escalation for labour also shall be paid at the same quarterly intervals when escalation due to increase in cost of materials and/or P.O.L. is paid under this clause. If such revision of minimum wages takes place during any such quarterly intervals, the escalation compensation shall be payable at revised rates only for work done in subsequent quarters.~~

~~(c) Irrespective of variations in minimum wages of any category of labour, for the purpose of this clause, the variation in the rate for an unskilled adult male mazdoor alone shall form the basis for working out the escalation compensation payable on the labour component.~~

~~(viii) In the event the price of materials and/or wages of labour required for execution of the work decrease/s, there shall be a downward adjustment of the cost of work so that such price of materials and/or wages of labour shall be deductible from the cost of work under this contract and in this regard the formula herein before stated under this Clause 10CC shall mutatis mutandis apply, provided that:~~

~~(a) no such adjustment for the decrease in the price of materials and/or wages of labour aforementioned would be made in case of contracts in which the stipulated period of completion of the work is equal to or less than the time as specified in Schedule „F.~~

~~(b) The Engineer in Charge shall otherwise be entitled to lay down the procedure by which the provision of this sub-clause shall be implemented from time to time and the decision of the Engineer in Charge in this behalf shall be final and binding on the contractor.~~

~~(ix) Provided always that:-~~

~~(a) Where provisions of clause 10CC are applicable provisions of clause 10C will not be applicable but provisions of clause 10 CA will be applicable.~~

~~(b) Where provisions of Clause 10CC are not applicable, provisions of clause 10C and 10 CA will become applicable.~~

~~**Note:** Updated stipulated date of completion (period of completion plus extra time for extra work for compensation under clause 10 C, 10 CA and 10 CC, the factor of 1.25 taken in to account for calculating the extra item under clause 12.1 for extra time shall not be considered while calculating the updated stipulated date of completion for this purpose in clause 10 C, Clause 10 CA, and clause 10 CC.~~

CLAUSE 10D (Dismantled Material of Institute Property)

The contractor shall treat all materials obtained during dismantling of a structure, excavation of the site for a work, etc. as Institute's property and such materials shall be disposed off to the best advantage of the Institute according to the instructions in writing issued by the Engineer-in-Charge.

CLAUSE 11 (Work to be Executed in Accordance with Specifications, Drawings, Orders etc.)

The contractor shall execute the whole and every part of the work in the most substantial and workmanlike manner both as regards materials and otherwise in every respect in strict accordance with the specifications. The contractor shall also conform exactly, fully and faithfully to the design, drawings and instructions in writing in respect of the work signed by the Engineer-in-Charge and the contractor shall be furnished free of charge one copy of the contract documents together with specifications, designs, drawings and instructions that are not included in the standard specifications of works specified in Schedule 'F' or in any Bureau of Indian Standard or any other, published standard or code or, Schedule of Rates or any other printed publication referred to elsewhere in the contract.

The contractor shall comply with the provisions of the contract and with the care and diligence execute and maintain the works and provide all labour and materials, tools and plants including for measurements and supervision of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract. The Contractor shall take full responsibility for adequacy, suitability and safety of all the works and methods of construction.

CLAUSE 12: (Deviations / Variations Extent and Pricing)

The Engineer-in-Charge shall have power (i) to make alteration in, omissions from, additions to, or substitutions for the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and (ii) to omit a part of the works in case of non-availability of a portion of the site or for any other reasons and the contractor shall be bound to carry out the works in accordance with any instructions given to him in writing signed by the Engineer-in-Charge and such alterations, omissions, additions or substitutions shall form part of the contract as if originally provided therein and any altered, additional or substituted work which the contractor may be directed to do in the manner specified above as part of the works, shall be carried out by the contractor on the same conditions in all respects including price on which he agreed to do the main work except as hereafter provided.

The Completion cost of any agreement for Maintenance works including works of up gradation, aesthetic, special repair, and addition/alteration shall not exceed 1.25 times of the Tendered amount. Any further deviation beyond this limit up to 1.5 times of tendered amount shall be approved by Chairperson I-CDC with recorded reason and in exceptional case, The Director shall have full power to approve the deviation beyond 1.50 times of tendered amount with recorded reason and take suitable corrective action.

12.1 The time for completion of the works shall, in the event of any deviations resulting in additional cost over the tendered value sum being ordered be extended, if requested by the contractor, as follows:

- (i) In the proportion which the additional cost of the altered, additional or substituted work, bears to the original tendered value plus
- (ii) 25% of the time calculated in (i) above or such further additional time as may be considered reasonable by the Engineer-in-Charge.

12.2 Deviation, Extra Items and Pricing:

A. For Projects and original works :

In the case of extra item(s) (items that are completely new, and are in addition to the items contained in the contract), the contractor may within fifteen days of receipt of order or occurrence of the item(s) claim rates, supported by proper analysis, which shall include invoices, voucher etc. and Manufacturer's specification for the work failing which the rate approved later by the Engineer-in-Charge shall be binding and the Engineer-in-Charge shall within the prescribed time limit of the receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined, failing which it will be deemed to have been approved.

B. For Maintenance works including works of up gradation, aesthetic ,special repair, addition/alteration:

In the case of Extra Items(s) being the schedule items (**Space application Centre (SAC Ahmedabad SOR items)**), these shall be paid as per Schedule rate plus cost index (at the time of tender) plus / minus percentage above or below quoted contract amount.

Payment of extra items in case of non-scheduled items (**NON SAC SOR items**) shall be made as per the prevailing market rate.

12.2a Deviation, Substituted Items, Pricing:

A. For Project and Original works :

In the case of substituted items, (items that are taken up with partial substitution or in lieu of items of work in the contract), the rate for the agreement item (to be substituted) and substituted item shall also be determined in the manner as mentioned in the following para.

- (a) If the market rate for the substituted item so determined is more than the market rate of the agreement item (to be substituted) the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).
- (b) If the market rate for the substituted item so determined is less than the market rate of the agreement item (to be substituted) the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

B. For Maintenance works including works of up gradation, aesthetic, special repair, addition/alternation:

In the case of substituted item(s) being the schedule items (CPWD DSR items) these shall be paid as per the schedule rate plus cost index (at the time of tender) plus /minus percentage above /below quoted contract amount. Payment of Substitute in case of non-schedule items (**NON CPWD DSR items**) shall be made as per prevailing market rate.

12.2b Deviation, Deviated Quantities, Pricing

A. For Project and original works:

In the case of contract items, substituted items, contract cum substituted items, which exceed the limits laid down in schedule F, the contractor may within fifteen days of receipt of order or occurrence of the excess, claim revision of the rates, supported by proper analysis, for the work in excess of the above mentioned limits, provided that if the rates so claimed are in excess of the rates specified in the schedule of quantities the Engineer-in-Charge shall within prescribed time limit of receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

B. For Maintenance works including works of up gradation, aesthetic, special repair, addition/alteration:

In the case of contract items, which exceed the limits laid down in schedule F, the contractor shall be paid rates specified in the schedule of quantities.

The prescribed time limit for finalizing rates for extra item(s), Substitute item (s) and Deviated quantities of contract items is within 30days after submission of proposal by the contractor without observation of the Engineer-in-Charge.:

12.3 A. For Project and Original works:

The provisions of the preceding paragraph shall also apply to the decrease in the rates of items for the work in excess of the limits laid down in Schedule F, and the Engineer-in- Charge shall after giving notice to the contractor within one month of occurrence of the excess and after taking into consideration any reply received from him within fifteen days of the receipt of the notice, revise the rates for the work in question within one month of the expiry of the said period of fifteen days having regard to the market rates.

B. For Maintenance works including works of up gradation, aesthetic, special repair, addition/alteration:

In case of decrease in the rates prevailing in the market of items for the work in excess of the limits laid down in Schedule F, the Engineer-In-Charge shall after giving notice to the contractor within one month of occurrence of excess and after taking into consideration any reply received from him within fifteen days of the receipt of the notice, revise the rate for the work in question within one month of the expiry of the said period of fifteen days having regard to the market rates.

12.4 The contractor shall send to the Engineer-in-Charge once every three months an up to date account giving complete details of all claims for additional payments to which the contractor may consider himself entitled and of all additional work ordered by the Engineer-in-Charge which he has executed during the preceding quarter failing which the contractor shall be deemed to have waived his right. However, the Engineer in charge may authorize consideration of such claims on merits.

12.5 For the purpose of operation of Schedule F, the following works shall be treated as works relating to foundation unless & otherwise defined in the contract:

- i) For building: All works up to 1.2 meters above ground level or up to floor 1 level whichever is lower.,
- ii) For abutments, piers, and well staining: All works up to 1.2 m above the bed level.
- iii) For retaining walls, wing walls, compound walls, chimneys, overhead reservoirs/tanks and other elevated structures: All works up to 1.2 meters above the ground level.
- iv) For reservoirs/tanks (other than overhead reservoirs/tanks): All works up to 1.2 meters above the ground level.
- v) For basement: All works up to 1.2 m above ground level or up to floor 1 level whichever is lower.
- vi) For Roads all items of excavation and filling including treatment of sub-base.

12.6 Any operation incidental to or necessarily has to be in contemplation of tenderer while filling tender, or necessary for proper execution of the item included in the Schedule of Quantities or in the schedule of rates mentioned above, whether or not, specifically indicated in the description of the item and the relevant specifications, shall be deemed to be included in the rates quoted by the tenderer or the rate given in the said schedule of rates, as the case may be. Nothing extra shall be admissible for such operations.

CLAUSE 13 (Foreclosure of Contract due to Abandonment or Reduction in Scope of Work)

If at any time after acceptance of the tender or during the progress of the work, the purpose or object for which the work is being done changes due to any supervening cause and as a result of which the work has to be abandoned or reduced in scope the Engineer-in-Charge shall give notice in writing to that effect to the contractor stating the decision as well as the cause for such decision and the contractor shall act accordingly in the matter. The contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the works in full but which he did not derive in consequence of the foreclosure of the whole or part of the works.

The contractor shall be paid at contract rates full amount for works executed at site and, in addition, a reasonable amount as certified by the Engineer-in-Charge for the items hereunder mentioned which could not be utilized on the work to the full extent in view of the foreclosure:

- i) Any expenditure incurred on preliminary site work, e.g. temporary access roads, temporary labour huts, staff quarters and site office; storage accommodation and water storage tanks.
- ii) Institute shall have the option to take over contractor's materials or any part thereof either brought to site or of which the contractor is legally bound to accept delivery from suppliers (for incorporation in or incidental to the work) provided, however, Institute shall be bound to take over the materials or such portions thereof as the contractor does not desire to retain. For materials taken over or to be taken over by Institute, cost of such materials as detailed by Engineer-in-Charge shall be paid. The cost shall, however, take into account purchase price, cost of transportation and deterioration or damage which may have been caused to materials whilst in the custody of the contractor.
- iii) If any materials supplied by Institute are rendered surplus, the same except normal wastage shall be returned by the contractor to Institute at rates not exceeding those at which these were originally issued less allowance for any deterioration or damage which may have been caused whilst the materials were in the custody of the contractor. In addition, cost of transporting such materials from site to Institute stores, if so required by Institute, shall be paid.

- iv) Reasonable compensation for transfer of T & P from site to contractor's permanent stores or to his other works, whichever is less. If T & P are not transported to either of the said places, no cost of transportation shall be payable.
- v) Reasonable compensation for repatriation of contractor's site staff and imported labour to the extent necessary.

The contractor shall, if required by the Engineer- in-Charge furnish to him books of account, wage books, time sheets and other relevant documents and evidence as may be necessary to enable him to certify the reasonable amount payable under this condition.

The reasonable amount of items on (i), (iv) and (v) above shall not be in excess of 2% of the cost of the work remaining incomplete on the date of closure, i.e. total stipulated cost of the work as per accepted tender less the cost of work actually executed under the contract and less the cost of contractor's materials at site taken over by the Institute as per item (ii) above. Provided always that against any payments due to the contractor on this account or otherwise, the Engineer-in-Charge shall be entitled to recover or be credited with any outstanding balances due from the contractor for advance paid in respect of any tool, plants and materials and any other sums which at the date of termination were recoverable by the Institute from the contractor under the terms of the contract.

In the event of action being taken under Clause 13 to reduce the scope of work, the contractor may furnish fresh Performance Guarantee on the same conditions, in the same manner and at the same rate for the balance tendered amount and initially valid up to the extended date of completion or stipulated date of completion if no extension has been granted plus 60 days beyond that. Wherever such a fresh Performance Guarantee is furnished by the contractor the Engineer-in-Charge may return the previous Performance Guarantee.

CLAUSE 14: Carrying out part work at risk & cost of contractor:

If contractor,

- (i) At any time makes default during currency of work or does not execute any part of the work with the due diligence and continues to do so even after a notice in writing of 7 days from the Engineer-in-Charge; or
- (ii) Commits default to complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given in that behalf by the Engineer-in-Charge; or
- (iii) Fails to complete the works or items of work with individual dates of completion, on or before the date(s) so determined, and does not complete them within the period specified in a notice given in writing in that behalf by the Engineer-in-Charge;

The Engineer-in-Charge without invoking action under clause 3 may, without prejudice to any other right or remedy against the contractor which have either accrued or accrue thereafter to Institute, by a notice in writing to take the part work/part incomplete work of any item(s) out of his hands and shall have powers to:

- (a) Take possession of the site and any materials, constructional plant, implements, stores, etc., thereon; and/or
- (b) Carry out the part work/ part incomplete work of any item(s) by any means at the risk and cost of the contractor.

The Engineer-in-Charge shall determine the amount, if any, is recoverable from the contractor for completion of the part work/part incomplete work of any items(s) taken out of his hands and execute

at the risk and cost of the contractor, the liability of contractor on account of loss or damage suffered by Institute because of action under this clause shall not exceed 10% of the tendered value of the work.

In determining the amount, credit shall be given to the contractor with the value of work done in all respect in the same manner and at the same rate as if it had been carried out by the original contractor under the terms of his contract, the value of contractor's materials taken over and incorporated in the work and use of plant and machinery belonging to the contractor. The certificate of the Engineer-in-Charge as to the value of work done shall be final and conclusive against the contractor provided always that action under this clause shall only be taken after giving notice in writing to the contractor. Provided also that if the expenses incurred by the department are less than the amount payable to the contractor at his agreement rates, the difference shall not be payable to the contractor.

Any excess expenditure incurred or to be incurred by the Institute in completing the part works/ part incomplete work of any item(s) or the excess loss or damages suffered or may be suffered by the Institute as aforesaid after allowing such credit shall without prejudice to any other right or remedy available to Institute in law or as per agreement be recovered from any money due to the contractor on any account and if such money is insufficient, the contractor shall be called upon in writing and shall be liable to pay the same within 30 days.

If the contractor fails to pay the required sum within the aforesaid period of 30 days, the Engineer-in-Charge shall have the right to sell any or all of the contractor's unused materials, constructional plant implements temporary building at site, etc. and adjust the proceeds of sale thereof towards the dues recoverable from the contractor under the contract and if thereafter there remains any balance outstanding, it shall be recovered in accordance with the provisions of the contract.

In the event of above course being adopted by the Engineer-in-Charge, the contractor shall have no claims to compensation for any loss sustained by him by reason of his having purchased any materials or entered into any engagements or made any advance on any account or with view to the execution of the work or the performance of the contract.

CLAUSE 15 (Suspension of Work)

(i) The contractor shall, on receipt of the order in writing of the Engineer-in-Charge, (whose decision shall be final and binding on the contractor) suspend the progress of the works or any part thereof for such time and in such manner as the Engineer-in-Charge may consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof for any of the following reasons:

- (a) On account of any default on the part of the contractor or;
- (b) For proper execution of the works or part thereof for reasons other than the default of the contractor; or
- (c) For safety of the works or part thereof.

The contractor shall, during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Engineer-in-Charge.

ii) If the suspension is ordered for reasons (b) and (c) in sub-para (i) above:

(a) the contractor shall be entitled to an extension of time equal to the period of every such suspension PLUS 25%, for completion of the item or group of items of work for which a separate period of completion is specified in the contract and of which the suspended work forms a part, and;

(b) If the total period of all such suspensions in respect of an item or group of items or work for which a separate period of completion is specified in the contract exceeds thirty days, the contractor

shall, in addition, be entitled to such compensation as the Engineer-in-Charge may consider reasonable in respect of salaries and/or wages paid by the contractor to his employees and labour at site, remaining idle during the period of suspension, adding thereto 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Engineer-in-Charge within fifteen days of the expiry of the period of 30 days.

iii) If the works or part thereof is suspended on the orders of the Engineer-in-Charge for more than three months at a time, except when suspension is ordered for reason (a) in sub-para (i) above, the contractor may after receipt of such order serve a written notice on the Engineer-in-Charge requiring permission within fifteen days from receipt by the Engineer-in-Charge of the said notice, to proceed with the work or part thereof in regard to which progress has been suspended and if such permission is not granted within that time, the contractor, if he intends to treat the suspension, where it affects only a part of the works as an omission of such part by the Institute or where it affects whole of the works, as an abandonment of the works by the Institute, shall within ten days of expiry of such period of 15 days give notice in writing of his intention to the Engineer-in-Charge. In the event of the contractor treating the suspension as an abandonment of the contract by the Institute, he shall have no claim to payment of any compensation on account of any profit or advantage which he might have derived from the execution of the work in full but which he could not derive in consequence of the abandonment. He shall, however, be entitled to such compensation, as the Engineer-in-Charge may consider reasonable, in respect of salaries and/or wages paid by him to his employees and labour at site, remaining idle in consequence adding to the total thereof 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Engineer-in-Charge within 30 days of the expiry of the period of 3 months.

CLAUSE 15 A (Compensation in case of Delay of Supply of Material by Institute)

The contractor shall not be entitled to claim any compensation from Institute for the loss suffered by him on account of delay by Institute in the supply of materials in schedule "B" where such delay is covered by difficulties relating to the supply of wagons, force majeure or any reasonable cause beyond the control of Institute.

This clause 15 A will not be applicable for works where no material is stipulated.

CLAUSE 16 (Action in case Work not done as per Specifications)

All works under or in course of execution or executed in pursuance of the contract shall at all times be open and accessible to the inspection and supervision of the Engineer-in-charge, his authorized subordinates in charge of the work and all the superior officers, officer of the Quality Assurance unit of the Institute or any organization engaged by the Institute for Quality Assurance and of the Chief Technical Examiner's Office, and the contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has been given to the contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing, present for that purpose. Orders given to the Contractor's agent shall be considered to have the same force as if they had been given to the contractor himself.

If it shall appear to the Engineer-in-charge or his authorized subordinates in-charge of the work or to the Chief Engineer in charge of Quality Assurance or his subordinate officers or the officers of the organization engaged by the Institute for Quality Assurance or to the Chief Technical Examiner or his subordinate officers, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with materials or articles provided by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract the contractor shall, on demand in writing which shall be made (six months in the case of work costing Rs. 10 Lac and below except road work) of the completion of the work from the Engineer-in-Charge

specifying the work, materials or articles complained of, notwithstanding that the same may have been passed, certified and paid for forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of the failing to do so within a period specified by the Engineer-in-charge in his demand aforesaid, then the contractor shall be liable to pay compensation at the same rate as under clause 2 of the contract (for non-completion of the work in time) for this default.

In such case the Engineer-in-Charge may not accept the item of work at the rates applicable under the contract but may accept such items at reduced rates as the authority specified in Schedule 'F' may consider reasonable during the preparation of on account bills or final bill if the item is so acceptable without detriment to the safety and utility of the item and the structure or he may reject the work outright without any payment and/or get it and other connected and incidental items rectified, or removed and re-executed at the risk and cost of the contractor. Decision of the Engineer-in-Charge to be conveyed in writing in respect of the same will be final and binding on the contractor.

CLAUSE 17 (Contractor Liable for Damages, defects during maintenance period) I

If the contractor or his working people or servants shall break, deface, injure or destroy any part of building in which they may be working, or any building, road, road kern, fence, enclosure, water pipe, cables, drains, electric or telephone post or wires, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within twelve months (six months in the case of work costing Rs. Ten lacs and below except road work) after a certificate, final or otherwise, of its completion shall have been given by the Engineer-in-Charge as aforesaid arising out of defect or improper materials or workmanship the contractor shall upon receipt of a notice in writing on that behalf make the same good at his own expense or in default the Engineer-in-Charge shall cause the same to be made good by other workmen and deduct the expense from any sums that may be due or at any time thereafter may become due to the contractor, or from his security deposit or the proceeds of sale thereof or of a sufficient portion thereof. The security deposit of the contractor shall not be refunded before the expiry of twelve months (six months in the case of work costing Rs. Ten lacs and below except road work) after the issue of the certificate, final or otherwise, of completion of work, or till the final bill has been prepared and passed whichever is later. Provided that in the case of road work if in the opinion of the Engineer-in-Charge, half of the security deposit is sufficient, to meet all liabilities of the contractor under this contract, half of the security deposit will be refundable after six months and the remaining half after twelve months of the issue of the said certificate of completion or till the final bill has been prepared and passed whichever is later.

In case of Maintenance and Operation works of E&M services, the security deposit deducted from contractors shall be refunded within one month from the date of final payment or within one month from the date of completion of the maintenance contract whichever is earlier.

CLAUSE 18 (Contractor to Supply Tools & Plants, etc.)

The contractor shall provide at his own cost all materials (except such special materials, if any, as may in accordance with the contract be supplied from the Engineer-in-Charge's stores), machinery, tools & Plants as specified in Schedule F. In addition to this, appliances, implements, other plants ladders, cordage, tackle, scaffolding and temporary works required for the proper execution of the work, whether original, altered or substituted and whether included in the specifications or other documents forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-Charge as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require

together with carriage therefore to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials, necessary for the purpose of setting out works, and counting, weighing and assisting the measurement for examination at any time and from time to time of the work or materials. Failing his so doing, the same may be provided by the Engineer-in-Charge at the expense of the contractor and the expenses may be deducted, from any money due to the contractor, under this contract or otherwise and/or from his security deposit or the proceeds of sale thereof, or of a sufficient portions thereof.

CLAUSE 18 A (Recovery of Compensation paid to Workmen)

In every case in which by virtue of the provisions sub-section (1) of Section 12, of the Workmen's Compensation Act, 1923, Institute is obliged to pay compensation to a workman employed by the contractor, in execution of the works, Institute will recover from the contractor, the amount of the compensation so paid; and, without prejudice to the rights of the Institute under sub-section (2) of Section 12, of the said Act, Institute shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by Institute to the contractor whether under this contract or otherwise. Institute shall not be bound to contest any claim made against it under sub-section (1) Section 12, of the said Act, except on the written request of the contractor and upon his giving to Institute full security for all costs for which Institute might become liable in consequence of contesting such claim.

CLAUSE 18 B (Ensuring Payment and Amenities to Workers if Contractor fails)

In every case in which by virtue of the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and of the Contract Labour (Regulation and Abolition) Central Rules, 1971, Institute is obliged to pay any amounts of wages to a workman employed by the contractor in execution of the works, or to incur any expenditure in providing welfare and health amenities required to be provided under the above said Act and the rules under Clause 19 H or under the Contractors Labour Regulations, or under the Rules framed by Institute from time to time for the protection of health and sanitary arrangements for workers employed by Contractors. Institute will recover from the contractor, the amount of wages so paid or the amount of expenditure so incurred; and without prejudice to the rights of the Institute under sub-section(2) of Section 20, and sub-section (4) of Section 21, of the Contract Labour (Regulation and Abolition) Act, 1970, Institute shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by Institute to the contractor whether under this contract or otherwise Institute shall not be bound to contest any claim made against it under sub-section (1) of Section 20, sub-section (4) of Section 21, of the said Act, except on the written request of the contractor and upon his giving to the Institute full security for all costs for which Institute might become liable in contesting such claim.

CLAUSE 19 (Labour Laws to be complied by the Contractor)

The contractor shall obtain a valid license under the Contract Labour (R&A) Act 1970, and the Contract Labour (Regulation and Abolition) Central Rules 1971, before the commencement of the work, and continue to have a valid license until the completion of the work. **The contractor shall also comply with provision of the Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979.**

The contractor shall also abide by the provisions of the Child Labour (Prohibition and Regulation) Act, 1986.

The contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1996.

Any failure to fulfill these requirements shall attract the penal provisions of this contract arising out of the resultant non-execution of the work.

CLAUSE 19 A

No labour below the age of Eighteen years shall be employed on the work.

CLAUSE 19 B (Payment of wages)

Payment of wages:

(i) The contractor shall pay to labour employed by him either directly or through sub contractors, wages not less than fair wages as defined by the Government, Contractor's Labour Regulations or as per the provisions of the Contract Labour (Regulation and Abolition) Act 1970 and the contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.

(ii) The contractor shall, notwithstanding the provisions of any contract to the contrary, cause to be paid fair wage to labour indirectly engaged on the work, including any labour engaged by his sub-contractors in connection with the said work, as if the labour had been immediately employed by him.

(iii) In respect of all labour directly or indirectly employed in the works for performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with the contractor's Labour Regulations made by Government from time to time in regard to payment of wages, wage period, deductions from wages recovery of wages not paid and deductions unauthorized made, maintenance of wage books or wage slips, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the Contract Labour (Regulation and Abolition) Act 1970, and the Contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.

(iv) (a) The Engineer-in-Charge concerned shall have the right to deduct from the moneys due to the contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-fulfillment of the conditions of the contract for the benefit of the workers, non-payment of wages or of deductions made from his or their wages which are not justified by their terms of the contract or non-observance of the Regulations.

(b) Under the provision of Minimum Wages (Central) Rules 1950, the contractor is bound to allow to the labours directly or indirectly employed in the works one day rest for 6 days continuous work and pay wages at the same rate as for duty. In the event of default, the Engineer-in-Charge shall have the right to deduct the sum or sums not paid on account of wages for weekly holidays to any labours and pay the same to the persons entitled thereto from any money due to the contractor by the Engineer-in-Charge concerned.

In the case of Union Territory of Delhi, however, as the all-inclusive minimum daily wages fixed under Notification of the Delhi Administration No.F.12(162)MWO/DAB/ 43884-91, dated 31-12-1979 as amended from time to time are inclusive of wages for the weekly day of rest, the question of extra payment for weekly holiday would not arise.

(v) The contractor shall comply with the provisions of the Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees Liability Act, 1938, Workmen's Compensation Act, 1923, Industrial Disputes Act, 1947, Maternity Benefits Act, 1961, and the Contractor's Labour (Regulation and Abolition) Act 1970, or the modifications thereof or any other laws relating thereto and the rules made there under from time to time.

(vi) The contractor shall indemnify and keep indemnified the Institute against payments to be made under and for the observance of the laws aforesaid and the Contractor's Labour Regulations without prejudice to his right to claim indemnity from his sub-contractors.

(vii) The laws aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.

(viii) Whatever is the minimum wage for the time being, or if the wage payable is higher than such wage, such wage shall be paid by the contractor to the workmen directly without the intervention of Jamadar and that Jamadar shall not be entitled to deduct or recover any amount from the minimum wage payable to the workmen as and by way of commission or otherwise.

(ix) The contractor shall ensure that no amount by way of commission or otherwise is deducted or recovered by the Jamadar from the wage of workmen.

CLAUSE 19 C

In respect of all labour directly or indirectly employed in the work for the performance of the contractor's part of this contract, the contractor shall at his own expense arrange for the safety provisions as per C.P.W.D. Safety Code framed from time to time and shall at his own expense provide for all facilities in connection therewith. In case the contractor fails to make arrangement and provide necessary facilities as aforesaid, he shall be liable to pay a penalty of Rs.200/- for each default and in addition the Engineer-in-Charge shall be at liberty to make arrangement and provide facilities as aforesaid and recover the costs incurred in that behalf from the contractor.

CLAUSE 19D

The contractor shall submit by the 4th and 19th day of every month, to the Engineer-in-Charge a true statement showing in respect of the second half of the preceding month and the first half of the current month respectively:

- (1) The number of labourers employed by him on the work,
- (2) Their working hours,
- (3) The wages paid to them,
- (4) The accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them, and
- (5) The number of female workers who have been allowed maternity benefit according to Clause 19 F and the amount paid to them.

Failing which the contractor shall be liable to pay to the Institute, a sum not exceeding Rs.200/- for each default or materially incorrect statement. The decision of the Engineer-In-Charge shall be final in deducting from any bill due to the contractor the amount levied as fine and be binding on the contractor.

CLAUSE 19 E

In respect of all labour directly or indirectly employed in the works for the performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with all the rules framed by Government from time to time for the protection of health and sanitary arrangements for workers employed by the Institute and its contractors.

CLAUSE 19 F

Leave and pay during leave shall be regulated as follows

1. Leave:

(i) in the case of delivery - maternity leave not exceeding 8 weeks, 4 weeks up to and including the day of delivery and 4 weeks following that day.

(ii) In the case of miscarriage – up to 3 weeks from the date of miscarriage.

2. Pay:

(i) In the case of delivery - leave pay during maternity leave will be at the rate of the women's average daily earnings, calculated on total wages earned on the days when full time work was done during a period of three months immediately preceding the date on which she gives notice that she expects to be confined or at the rate of Rupee one only a day whichever is greater.

(ii) In the case of miscarriage - leave pay at the rate of average daily earning calculated on the total wages earned on the days when full time work was done during a period of 3 (three) months immediately preceding the date of such miscarriage.

3. Conditions for the grant of Maternity Leave:

No maternity leave benefit shall be admissible to a woman unless she has been employed for a total period of not less than 6 (six) months immediately preceding the date on which she proceeds on leave.

4. The contractor shall maintain a register of Maternity (Benefit) in the Prescribed Form as shown in Appendix - I and II, and the same shall be kept at the place of work.

CLAUSE 19 G

In the event of the contractor(s) committing a default or breach of any of the provisions of the Contractor's Labour Regulations and Model Rules for the protection of health and sanitary arrangements for the workers as amended from time to time or furnishing any information or submitting or filing any statement under the provisions of the above Regulations and Rules which is materially incorrect, he/they shall, without prejudice to any other liability, pay to the Institute a sum not exceeding Rs.200/- for every default, breach or furnishing, making, submitting, filing such materially incorrect statements and in the event of the contractor(s) defaulting continuously in this respect, the penalty may be enhanced to Rs.200/- per day for each day of default subject to a maximum of 5 % of the estimated cost of the work put to tender. The decision of the Engineer in-Charge shall be final and binding on the parties.

Should it appear to the Engineer-in-Charge that the contractor(s) is/are not properly observing and complying with the provisions of the Contractor's Labour Regulations and Model Rules and the provisions of the Contract Labour (Regulation and Abolition) Act 1970, and the Contract Labour (R&A) Central Rules 1971, for the protection of health and sanitary arrangements for work-people employed by the contractor(s) (hereinafter referred as "the said Rules") the Engineer-in-Charge shall have power to give notice in writing to the contractor(s) requiring that the said Rules be complied with and the amenities prescribed therein be provided to the work-people within a reasonable time to be specified in the notice. If the contractor(s) shall fail within the period specified in the notice to comply with and/observe the said Rules and to provide the amenities to the work-people as aforesaid, the Engineer-in-Charge shall have the power to provide the amenities herein before mentioned at the cost

of the contractor(s). The contractor(s) shall erect, make and maintain at his/their own expense and to approved standards all necessary huts and sanitary arrangements required for his/their work-people on the site in connection with the execution of the works, and if the same shall not have been erected or constructed, according to approved standards, the Engineer-in-Charge shall have power to give notice in writing to the contractor(s) requiring that the said huts and sanitary arrangements be remodeled and/or reconstructed according to approved standards, and if the contractor(s) shall fail to remodel or reconstruct such huts and sanitary arrangements according to approved standards within the period specified in the notice, the Engineer-in-Charge shall have the power to remodel or reconstruct such huts and sanitary arrangements according to approved standards at the cost of the contractor(s).

CLAUSE 19 H

The contractor(s) shall at his/their own cost provide his/their labour with a sufficient number of huts (hereinafter referred to as the camp) of the following specifications on a suitable plot of land outside Institute campus. (Note: Labour camp is not permitted inside Institute campus)

(i) (a) the minimum height of each hut at the eaves level shall be 2.10 m (7 ft.) and the floor area to be provided will be at the rate of 2.7 sqm. (30 sq.ft.) For each member of the worker's family staying with the labourer.

(b) The contractor(s) shall in addition construct suitable cooking places having a minimum area of 1.8 m x 1.5 m (6'x5') adjacent to the hut for each family.

(c) The contractor(s) shall also construct temporary latrines and urinals for the use of the labourers each on the scale of not less than four per each one hundred of the total strength, separate latrines and urinals being provided for women.

(d) The contractor(s) shall construct sufficient number of bathing and washing places, one unit for every 25 persons residing in the camp. These bathing and washing places shall be suitably screened.

(ii)(a) All the huts shall have walls of sun-dried or burnt-bricks laid in mud mortar or other suitable local materials as may be approved by the Engineer-in-Charge. In case of sun-dried bricks, the walls should be plastered with mud gobri on both sides. The floor may be kutcha but plastered with mud gobri and shall be at least 15cm (6") above the surrounding ground. The roofs shall be laid with thatch or any other materials as may be approved by the Engineer-in-Charge and the contractor shall ensure that throughout the period of their occupation the roofs remain water-tight.

(b) The contractor(s) shall provide each hut with proper ventilation.

(c) All doors, windows, and ventilators shall be provided with suitable leaves for security purposes.

(d) There shall be kept an open space of at least 7.2m (8 yards) between the rows of huts which may be reduced to 6m (20 ft.) according to the availability of site with the approval of the Engineer-in-Charge. Back to back construction will be allowed.

(iii) **Water Supply** - The contractor(s) shall provide adequate supply of water for the use of labourers. The provisions shall not be less than two gallons of pure and wholesome water per head per day for drinking purposes and three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available, supply shall be at stand posts and where the supply is from wells or river, tanks which may be of metal or masonry, shall be provided. The contractor(s) shall also at his/ their own cost make arrangements for laying pipe lines for water supply to his/their labour camp from the existing mains wherever available, and shall pay all fees and charges therefore.

(iv) The site selected for the camp shall be high ground, removed from jungle.

(v) Disposal of Excreta-

The contractor(s) shall make necessary arrangements for the disposal of excreta from the latrines by trenching or incineration which shall be according to the requirements laid down by the Local Health Authorities. If trenching or incineration is not allowed, the contractor(s) shall make arrangements for the removal of the excreta through the Municipal Committee/authority and inform it about the number of labourers employed so that arrangements may be made by such Committee/authority for the removal of the excreta. All charges on this account shall be borne by the contractor and paid direct by him to the Municipality/authority. The contractor shall provide one sweeper for every eight seats in case of dry system.

(vi) **Drainage -** The contractor(s) shall provide efficient arrangements for draining away sludge water so as to keep the camp neat and tidy.

(vii) The contractor(s) shall make necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers.

(viii) **Sanitation** - The contractor(s) shall make arrangements for conservancy and sanitation in the labour camps according to the rules of the Local Public Health and Medical Authorities.

CLAUSE 19 I

The Engineer-in-Charge may require the contractor to dismiss or remove from the site of the work any person or persons in the contractors' employ upon the work who may be incompetent or misconduct himself and the contractor shall forthwith comply with such requirements. In respect of maintenance/repair or renovation works etc. where the labour have an easy access to the individual houses, the contractor shall issue identity cards to the labourers, whether temporary or permanent and he shall be responsible for any untoward action on the part of such labour. Engineer in Charge will display a list of contractors working in the colony/Blocks on the notice board in the colony and also at the service center, to apprise the residents about the same.

CLAUSE 19 J

It shall be the responsibility of the contractor to see that the building under construction is not occupied by anybody unauthorized during construction, and is handed over to the Engineer-in-Charge with vacant possession of complete building. If such building though completed is occupied illegally, then the Engineer-in-Charge shall have the option to refuse to accept the said building/buildings in that position. Any delay in acceptance on this account will be treated as the delay in completion and for such delay a levy up to 5% of tendered value of work may be imposed by the Chairperson ICDC, IPR whose decision shall be final both with regard to the justification and quantum and be binding on the contractor.

However, the Chairperson I-CDC IPR, through a notice, may require the contractor to remove the illegal occupation any time on or before construction and delivery.

CLAUSE 19K (Employment of skilled /semi-skilled workers)

The Contractor shall, at all stages of work, deploy skilled / semiskilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training Institute /National institute of Construction Management & Research (NICMAR) / National Academy of

Construction, CIDC or any similar reputed and recognized institutes managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in each respect of the trade, it's scheduling and list of qualified tradesman along with requisite certificates from recognized institute to Engineer-in-charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesman within two days of written notice from Engineer-in- Charge. Failure on the part of contractor to obtain approval of Engineer-In-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by the contractor at the rate of Rs.100 per such tradesman per day. Decision of Engineer-in-Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

Provided always, that the provisions of this clause shall not be applicable for works with estimated cost put to tender being less than Rs. 5 Crores.

CLAUSE 19L (Contributions of EPF and ESI)

The ESI and EPF contributions on the part of employer in respect of this contract shall be paid by the contractor.

CLAUSE 20 (Minimum Wages Act to be Complied with)

The contractor shall comply with all the provisions of the Minimum Wages Act, 1948, and Contract Labour (Regulation and Abolition) Act, 1970, amended from time to time and rules framed there under and other labour laws affecting contract labour that may be brought into force from time to time.

CLAUSE 21 (Work not be sublet. Action in case of insolvency)

The contract shall not be assigned or sublet without the written approval of the Engineer-in-Charge. And if the contractor shall assign or sublet his contract, or attempt to do so, or become insolvent or commence any insolvency proceedings or make any composition with his creditors or attempt to do so, or if any bribe, gratuity, gift, loan, perquisite, reward or advantage pecuniary or otherwise, shall either directly or indirectly, be given, promised or offered by the contractor, or any of his servants or agent to any public officer or person in the employ of Institute in any way relating to his office or employment, or if any such officer. or person shall become in any way directly or indirectly interested in the contract, the Engineer-in-Charge on behalf of the Director, IPR shall have power to adopt the course specified in Clause 3 hereof in the interest of Institute and in the event of such course being adopted, the consequences specified in the said Clause 3 shall ensue.

CLAUSE 22

All sums payable by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied to the use of Institute without reference to the actual loss or damage sustained and whether or not any damage shall have been sustained.

CLAUSE 23 (Changes in firm's Constitution to be intimated)

Where the contractor is a partnership firm, the previous approval in writing of the Engineer- in-Charge shall be obtained before any change is made in the constitution of the firm. Where the contractor is an individual or a Hindu undivided family business concern such approval as aforesaid shall likewise be obtained before the contractor enters into any partnership agreement where under the partnership firm would have the right to carry out the works hereby undertaken by the contractor. If previous approval

as aforesaid is not obtained, the contract shall be deemed to have been assigned in contravention of Clause 21 hereof and the same action may be taken, and the same consequences shall ensue as provided in the said Clause 21.

CLAUSE 24

All works to be executed under the contract shall be executed under the direction and subject to the approval in all respects of the Engineer-in-Charge who shall be entitled to direct at what point or points and in what manner they are to be commenced, and from time to time carried on.

CLAUSE 25 (Settlements of Disputes & Arbitration)

Except where otherwise provided in the contract, all questions and disputes relating to the meaning of the specifications, design, drawings and instructions here-in before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instructions, orders or these conditions or otherwise concerning the works or the execution or failure to execute the same whether arising during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter:

(i) If the contractor considers any work demanded of him to be outside the requirements of the contract, or disputes any drawings, record or decision given in writing by the Engineer-in-Charge or if the Engineer in Charge considers any act or decision of the contractor on any matter in connection with or arising out of the contract or carrying out of the work, to be unacceptable and is disputed, such party shall promptly within 15 days of the arising of the disputes request the Chairperson I-CDC who shall refer the disputes to Dispute Redressal Committee (DRC) within 15 days along with a list of disputes with amounts claimed if any in respect of each such dispute. The Dispute Redressal Committee (DRC) shall give the opposing party two weeks for a written response, and, give its decision within a period of 60 days extendable by 30 days by consent of both the parties from the receipt of reference from Chairperson I-CDC. The constitution of Dispute Redressal Committee (DRC) shall be as indicated in Schedule 'F'. Provided that no party shall be represented before the Dispute Redressal Committee by an advocate/legal counsel etc.

If the Dispute Redressal Committee (DRC) fails to give its decision within the aforesaid period or any party is dissatisfied with the decision of Dispute Redressal Committee (DRC) or expiry of time limit given above, then either party may within a period of 30 days from the receipt of the decision of Dispute Redressal Committee (DRC), give notice to the Director IPR, for appointment of arbitrator on prescribed proforma as per Appendix XV under intimation to the other party.

It is a term of contract that each party invoking arbitration must exhaust the aforesaid mechanism of settlement of claims/disputes prior to invoking arbitration.

The Director IPR, shall in such case appoint the sole arbitrator within 30 days of receipt of such a request and refer such disputes to arbitration. It is a term of this contract that the party invoking arbitration shall give a list of disputes with amounts claimed, if any, in respect of each such dispute along with the notice for appointment of arbitrator and giving reference to the decision of the DRC.

Parties, before or at the time of appointment of Arbitrator may agree in writing for fast track arbitration as per the Arbitration and Conciliation Act, 1996 (26 of 1996) as amended in 2015.

Subject to provision in the Arbitration and Conciliation Act, 1996 (26 of 1996) as amended in 2015 whereby the counter claims if any can be directly filed before the arbitrator without any requirement of reference by the appointing authority,

The arbitrator shall adjudicate on only such disputes as are referred to him by the appointing authority and give separate award against each dispute and claim referred to him and in all cases where the total amount of the claims by any party exceeds Rs. 1,00,000/-, the arbitrator shall give reasons for the award. It is also a term of the contract that if any fees are payable to the arbitrator, these shall be paid as per the Act.

The place of arbitration shall be as mentioned in Schedule F.

CLAUSE 26 (Contractor to indemnify Institute against Patent Rights)

The contractor shall fully indemnify and keep indemnified the Director, IPR against any action, claim or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract. In the event of any claims made under or action brought against Institute in respect of any such matters as aforesaid, the contractor shall be immediately notified thereof and the contractor shall be at liberty, at his own expense, to settle any dispute or to conduct any litigation that may arise there from, provided that the contractor shall not be liable to indemnify the Director, IPR if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Engineer-in-Charge in this behalf.

CLAUSE 27 (Lump sum Provisions in Tender)

When the estimate on which a tender is made includes lump sum in respect of parts of the work, the contractor shall be entitled to payment in respect of the items of work involved or the part of the work in question at the same rates as are payable under this contract for such items, or if the part of the work in question is not, in the opinion of the Engineer-in-Charge payable of measurement, the Engineer-in-Charge may at his discretion pay the lump-sum amount entered in the estimate, and the certificate in writing of the Engineer-in-Charge shall be final and conclusive against the contractor with regard to any sum or sums payable to him under the provisions of the clause.

CLAUSE 28 (Action where no Specifications are specified)

In the case of any class of work for which there is no such specifications as referred to in Clause 11, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications. In case there are no such specifications in Bureau of Indian Standards, the work shall be carried out as per manufacturer's specifications, if not available then as per District Specifications. In case there are no such specifications as required above, the work shall be carried out in all respects in accordance with the instructions and requirements of the Engineer-in-Charge.

CLAUSE 29 (With-holding and lien in respect of sums due from contractor)

(i) Whenever any claim or claims for payment of a sum of money arises out of or under the contract or against the contractor, the Engineer-in-Charge or the Institute shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from the security, if any deposited by the contractor and for the purpose aforesaid, the Engineer-in-Charge or the Institute shall be entitled to withhold the security deposit, if any, furnished as the case may be and also have a lien over the same pending finalization or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if no security has been taken from the contractor, the Engineer-in-Charge or the Institute shall be entitled to withhold and have a lien to retain to the extent of such claimed amount or amounts referred to above, from any sum or sums found payable or which may at any time thereafter become payable to the contractor under the same contract or any other contract with the Engineer-in-Charge of the Institute or any contracting person through the Engineer-in-Charge pending finalization of adjudication of any such claim.

It is an agreed term of the contract that the sum of money or moneys so withheld or retained under the lien referred to above by the Engineer-in-Charge or Institute will be kept withheld or retained as such by the Engineer-in-Charge or Institute till the claim arising out of or under the contract is determined by the arbitrator (if the contract is governed by the arbitration clause) by the competent court, as the case may be and that the contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to above and duly notified as such to the contractor. For the purpose of this clause, where the contractor is a partnership firm or a limited company, the Engineer-in-Charge or the Institute shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner limited company as the case may be, whether in his individual capacity or otherwise.

(ii) Institute shall have the right to cause an audit and technical examination of the works and the final bills of the contractor including all supporting vouchers, abstract etc. to be made after payment of the final bill and if as a result of such audit and technical examination any sum is found to have been overpaid in respect of any work done by the contractor under the contract or any work claimed to have been done by him under the contract and found not to have been executed, the contractor shall be liable to refund the amount of over payment and it shall be lawful for Institute to recover the same from him in the manner prescribed in sub-clause (i) of this clause or in any other manner legally permissible; and if it is found that the contractor was paid less than what was due to him under the contract in respect of any work executed by him under it the amount of such under payment shall be duly paid by Institute to the contractor without any interest thereon whatsoever

Provided that the Institute shall not be entitled to recover any sum overpaid nor the contractor shall be entitled to payment of any sum paid short where such payment has been agreed upon between the Chairperson I-CDC IPR on the one hand and the contractor on the other under any term of the contract permitting payment for work after assessment by the Chairperson I-CDC IPR

CLAUSE 29A (Lien in respect of claims in other contracts)

Any sum of money due and payable to the contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Engineer-in-Charge or the Institute or any other contracting person or persons through Engineer-in-Charge against any claim of the Engineer-in-Charge or Institute or such other person or persons in respect of payment of a sum of money arising out of or under any other contract made by the contractor with the Engineer- in-Charge or the Institute or with such other person or persons.

It is an agreed term of the contract that the sum of money so withheld or retained under this clause by the Engineer-in-Charge or the Institute will be kept withheld or retained as such by the Engineer-in-Charge or the Institute or till his claim arising out of the same contract or any other contract is either mutually settled or determined by the arbitration clause or by the competent court, as the case may be and that the contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the contractor.

CLAUSE 30 Employment of coal mining or controlled area labour not permissible

The contractor shall not employ coal mining or controlled area labour falling under any category whatsoever on or in connection with work or recruit labour from area within a radius of 32 km (20 miles) of the controlled area. Subject as above the contractor shall employ imported labour only i.e., deposit imported labour or labour imported by contractors from area, from which import is permitted.

Where ceiling price for imported labour has been fixed by state or Regional Labour Committee not more than that ceiling price shall be paid to the labour by the contractor.

The contractor shall immediately remove any labourer who may be pointed out by the Engineer-in-charge as being a coal mining or controlled area labourer. Failure to do so shall render the contractor liable to pay to Government a sum calculated at the rate of Rs. 10/- per day per labourer. The certificate of the Engineer-in Charge about the number of coal mining or controlled area labourer and the number of days for which worked shall be final and binding upon all parties to this contract.

It is declared and agreed between the parties that the aforesaid stipulation in this clause is one in which the public are interested within the meaning of the exception in Section 74 of Indian Contract Act, 1872.

Explanation: - Controlled Area means the following areas:

Districts of Dhanbad, Hazaribagh, Jamtara - a Sub-Division under Santhal Pargana Commissioner, Districts of Bankura, Birbhum, Burdwan, District of Bilaspur.

Any other area which may be declared a controlled Area by or with the approval of the Central Government.

CLAUSE 31 (Unfiltered water supply)

The contractor(s) shall make his/their own arrangements for water required for the work and nothing extra will be paid for the same. This will be subject to the following conditions.

- i) That the water used by the contractor(s) shall be fit for construction purposes to the satisfaction of the Engineer-in-Charge.
- ii) The Engineer-in-Charge shall make alternative arrangements for supply of water at the risk and cost of contractor(s) if the arrangements made by the contractor(s) for procurement of water are in the opinion of the Engineer-in-Charge, unsatisfactory.

CLAUSE 31 A (Institute water supply, if available) - Not Applicable

~~Water if available may be supplied to the contractor by the Institute subject to the following conditions:~~

- ~~(i) The water charges @ 1% shall be recovered on gross amount of the work done.~~
- ~~(ii) The contractor(s) shall make his/their own arrangement of water connection and laying of pipelines from existing main of source of supply.~~
- ~~(iii) The Institute do not guarantee to maintain uninterrupted supply of water and it will be incumbent on the contractor(s) to make alternative arrangements for water at his/ their own cost in the event of any temporary break down in the Institute water main so that the progress of his/their work is not held up for want of water. No claim of damage or refund of water charges will be entertained on account of such break down.~~

CLAUSE 32 (Alternate water arrangements)

(i) Where there is no piped water supply arrangement and the water is taken by the contractor from the wells or hand pump constructed by the Institute, no charge shall be recovered from the contractor on that account. The contractor shall, however, draw water at such hours of the day that it does not interfere with the normal use for which the hand pumps and wells are intended. He will also be responsible for all damage and abnormal repairs arising out of his use, the cost of which shall be recoverable from him. The Engineer-in-Charge shall be the final authority to determine the cost recoverable from the contractor on this account and his decision shall be binding on the contractor.

(ii) The contractor shall be allowed to construct temporary wells in Institute land for taking water for construction purposes only after he has got permission of the Engineer-in-Charge in writing. No charges shall be recovered from the contractor on this account, but the contractor shall be required to provide necessary safety arrangements to avoid any accidents or damage to adjacent buildings, roads and service lines. He shall be responsible for any accidents or damage caused due to Construction and subsequent maintenance of the wells and shall restore the ground to its original condition after the wells are dismantled on completion of the work.

CLAUSE 33 (Return of Surplus materials)

Notwithstanding anything contained to the contrary in this contract where any materials for the execution of the contract are procured with the assistance of Institute either by issue from Institute stocks or purchase made under orders or permits or licenses issued by Institute the contractor shall hold the said materials economically and solely for the purpose of the contract and not dispose them off without the written permission of the Institute and return, if required by the Engineer-in-Charge, all surplus or unserviceable materials that may be left with him after the completion of the contract or at its termination for any reason whatsoever on being paid or credited such price as the Engineer-in-Charge shall determine having due regard to the condition of the materials. The price allowed to the contractor however shall not exceed the amount charged to him excluding the element of storage charges. The decision of the Engineer- in-Charge shall be final and conclusive. In the event of breach of the aforesaid condition, the contractor shall in addition to throwing himself open to action for contravention of the terms of the license or permit and/or for criminal breach of trust, be liable to Institute for all moneys, advantages or profits resulting or which in the usual course would have resulted to him by reason of such breach.

CLAUSE 34 (Hire of Plant & Machinery)

(i) The contractor shall arrange at his own expense all tools, plant, machinery and equipment (hereinafter referred to as T&P) required for execution of the work except for the Plant & Machinery listed in Schedule 'C' and stipulated for issue to the contractor. If the contractor requires any item of T&P on hire from the T&P available with the Institute over and above the T&P stipulated for issue, the Institute will, if such item is available, hire it to the contractor at rates to be agreed upon between him and the Engineer-in-Charge. In such a case all the conditions hereunder for issue of T&P shall also be applicable to such T&P as is agreed to be issued.

(ii) Plant and Machinery when supplied on hire charges shown in Schedule 'C' shall be made over and taken back at the Departmental equipment yard/shed shown in Schedule 'C' and the contractor shall bear the cost of carriage from the place of issue to the site of work and back. The contractor shall be responsible to return the plant and machinery with condition in which it was handed over to him, and he shall be responsible for all damage caused to the said plant and machinery at the site of work or elsewhere in operation and otherwise during transit including damage to or loss of plant and for all losses due to his failure to return the same soon after the completion of the work for which it was issued. Chairperson I-CDC, IPR shall be the sole judge to determine the liability of the contractor and its extent in this regard and his decision shall be final and binding on the contractor.

(iii) The plant and machinery as stipulated above will be issued as and when available and if required by the contractor. The contractor shall arrange his program of work according to the availability of the plant and machinery and no claim what-so-ever will be entertained from him for any delay in supply by the Institute.

(iv) The hire charges shall be recovered at the prescribed rates from and inclusive of the date the plant and machinery were made over up to and inclusive of the date of the return in good order even though

the same may not have been working for any cause except major breakdown due to no fault of the contractor or faulty use requiring more than three working day continuously (excluding intervening holidays and Sundays) for bringing the plant in order the contractor shall immediately intimate in writing to the Engineer-in-Charge when any plant or machinery gets out of order requiring major repairs as aforesaid. The Engineer-in-Charge shall record the date and time of receipt of such intimation in the log-sheet of the plant or machinery. Based on this, if the break-down before lunch period or major break-down will be computed considering half a day's break-down on the day of complaint. If the break-down occurs in the post-lunch period of major break-down will be computed starting from the next working day. In case of any dispute under this clause the decision of the Chairperson I-CDC IPR shall be final and binding on the contractor.

(v) The hire charges shown above are for each day of 8 hours (inclusive of the one hour lunch break) or part thereof.

(vi) Hire charges will include service of operating staff as required and also supply of lubricating oil and stores for leaning purposes. Power fuel of approved type, firewood, kerosene oil etc. for running the plant and machinery and also the full time chowkidar for guarding the plant and machinery against any loss or damage shall be arranged by the contractor who shall be fully responsible for the safeguard and security of plant and machinery. The contractor shall on or before the supply of plant and machinery sign an agreement indemnifying the Institute against any loss or damage caused to the plant and machinery either during transit or at site of work.

(vii) Ordinarily, no plant and machinery shall work for more than 8 hours a day inclusive of one hour lunch break. In case of an urgent work however, the Engineer-in- Charge may, at his discretion, allow the plant and machinery to be worked for more than normal period of 8 hours a day. In that case, the hourly hire charges for overtime to be borne by the contractor shall be 50% more than the normal proportionate hourly charges (1/8th of the daily charges) subject to a minimum of half day's normal charges on any particular day. For working out hire charges for over time, a period of half an hour and above will be charged as one hour and a period of less than half an hour will be ignored.

(viii) The contractor shall release the plant and machinery every seventh day for periodical servicing and/or wash out which may take about three to four hours or more. Hire charges for full day shall be recovered from the contractor for the day of servicing wash out irrespective of the period employed in servicing.

(ix) The plant and machinery once issued to the contractor shall not be returned by him on account of lack of arrangements of labour and materials, etc. on his part, the same will be returned only when they are required for major repairs or when in the opinion of the Engineer-in-Charge the work or a portion of work for which the same was issued is completed.

(x) Log Book for recording the hours of daily work for each of the plant and machinery supplied to the contractor will be maintained by the Institute and will be countersigned by the contractor or his authorized agent daily. In case the contractor contests the correctness of the entries and/or fails to sign the Log Book, the decision of the Engineer-in-Charge shall be final and binding on him. Hire charges will be calculated according to the entries in the Log Book and will be binding on the contractor. Recovery on account of hire charges for road rollers shall be made for the minimum number of days worked out on the assumption that a roller can consolidate per day and maximum quantity of materials or area surfacing as noted against each in the annexed statement (see attached annexure)

(xi) In the case of concrete mixers the contractors shall arrange to get the hopper cleaned and the drum washed at the close of the work each day or each occasion. a) In case rollers for consolidation are employed by the contractor himself, log book for such rollers shall be maintained in the same manner as is done in case of Departmental rollers, maximum quantity of any items to be consolidated for each

roller-day shall also be same as in Annexure to Clause 34(x) For less use of rollers, recovery for the less roller days shall be made at the stipulated issue rate.

(xii) The contractor shall be responsible to return the plant and machinery in the condition in which it was handed over to him and he shall be responsible for all damage caused to the said plant and machinery at the site of work or elsewhere in operation or otherwise or during transit including damage to or loss of parts, and for all losses due to his failure to return the same soon after the completion of the work for which it was issued. Chairperson I-CDC, IPR shall be the sole judge to determine the liability of the contractor and its extent in this regard and his decision shall be final and binding on the contractor.

(xiii) The Contractor will be exempted from levy of any hire charges for the number of the days he is called upon in writing by the Engineer-In-Charge to suspend execution of the work, provided Institute plant and machinery in question have, in fact, remained idle with the contractor because of suspension.

(xiv) In the event of the contractor not requiring any item of plant and machinery issued by Institute though not stipulated for issue in Schedule 'C' any time after taking delivery at the place of issue, he may return it after two days written notice or at any time without notice if he agrees to pay hire charges for two additional days without, in any way, affecting the right of the Engineer-in-Charge to use the said plant and machinery during the said period of two days as he likes including hiring out to a third party.

CLAUSE 35 (Condition relating to use of asphaltic material)

(i) The contractor undertakes to make arrangement for the supervision of the work by the firm supplying the tar or bitumen used.

(ii) The contractor shall collect the total quantity of tar or bitumen required for the work as per standard formula, before the process of painting is started and shall hypothecate it to the Engineer-in-Charge. If any bitumen or tar remains unused on completion of the work on account of lesser use of materials in actual execution for reasons other than authorized changes of specifications and abandonment of portion of work, a corresponding deduction equivalent to the cost of unused materials as determined by the Engineer-in-Charge shall be made and the material return to the contractors. Although the materials are hypothecated to Institute, the contractor undertakes the responsibility for their proper watch, safe custody and protection against all risks. The materials shall not be removed from site of work without the consent of the Engineer-in-Charge in writing.

(iii) The contractor shall be responsible for rectifying defects noticed within a year from the date of completion of the work and the portion of the security deposit relating to asphaltic work shall be refunded after the expiry of this period.

CLAUSE 36 (Employment of Employees Technical Staff and employees)

Contractors Superintendence, Supervision, Technical Staff and Employees

(i) The contractor shall provide all necessary superintendence during execution of the work and as along thereafter as may be necessary for proper fulfilling of the obligations under the contract.

The contractor shall immediately after receiving letter of acceptance of the tender and before commencement of the work, intimate in writing to the Engineer-in-Charge the name, qualifications, experience, age, address and other particulars along with certificates, of the principal technical representative to be in charge of the work and other technical representative(s) and their qualifications and experience shall not be lower than specified in Schedule 'F'. The Engineer-in-Charge shall within 3 days of receipt of such communication intimate in writing his approval or otherwise of such a

representative to the contractor. Any such approval may at any time be withdrawn and in case of such withdrawal, the contractor shall appoint another such representative according to the provisions of this clause. Decision of the tender accepting authority shall be final and binding on the contractor in this respect. Such a principal technical representative shall be appointed by the contractor soon after receipt of the approval from Engineer-in-charge and shall be available at Site before start of work.

All the provisions applicable to the principal technical representative under the clause will also be applicable to other technical representative(s). The principal technical representative and other technical representative(s) shall be present at site of work for supervision at all times when any construction activity is in progress and also present himself/ themselves, as required, to the Engineer in charge and/ or his designated representative to take instructions. Instructions given to the principal technical representative or other technical representative(s) shall be deemed to have the same force as if these have been given to the contractor. The principal technical representative and other technical representative(s) shall be actually available the decision of the Engineer-in -Charge as recorded in the site order book and measurement recorded checked/ test checked in measurement books shall be final and binding on the contractor. Further if the contractor fails to appoint suitable technical principal technical representative and/or other technical representative(s) and if such appoint person are not effectively present or are absent by more than two days without duly approved substitute or do not discharge their responsibilities satisfactorily, the Engineer-in-charge shall have full powers to suspend the execution of the work until such date as suitable other technical representative(s) is/are appointed and the contractor shall be held responsible for the delay so caused to the work. The contractor shall submit a certificate of employment of the technical representative(s) along with every on account bill/final bill and shall produce evidence if at any time so required by the Engineer-in-Charge at site fully during all stages of execution of work, during recording/ checking/ test checking of measurements of works and whenever so required by the Engineer In charge and shall also note down instructions conveyed by the Engineer-in-charge or his designated representative(s) in the site order book and shall affix his/ their signature in token of noting down the instructions and in token of acceptance of measurements/ checked measurements/ test checked measurements. The representative(s) shall not look after any other work. Substitutes, duly approved by Engineer-in-charge of the work in similar manner as aforesaid shall be provided in event of absence of any of the representative(s) by more than two days.

If the Engineer-in-Charge, whose decision in this respect is final and binding on the contractor, is convinced that no such technical representative is/are effectively appointed or is/are effectively attending or fulfilling the provision of this clause, a recovery (non-refundable) shall be effected from the contractor as specified in Schedule 'F'. And the decision of the Engineer-In-Charge as recorded in the site order book and measurement recorded checked/ test checked in measurement books shall be final and binding on the contractor. Further , if the contractor fails appoint suitable technical Principal technical representative and/or other technical representative(s) and if such appointed persons are not effectively present or are absent by more two days without duly approved substitute or do not discharge their responsibilities satisfactorily, the Engineer-in-Charge shall have full powers to suspend the execution of work until such date as suitable other technical representative(s)is /are appointed and the contractor shall be held responsible for the delay so caused to the work. The Contractor shall submit a certificate of employment of the technical representative (s) (in the form of copy Form -16 or CPF deduction issued to the Engineer employed by him) along with every on account bill final bill and shall produce evidence if at any time so required by the Engineer-in-charge.

(ii) The contractor shall provide and employ on the site only such technical assistants as are skilled and experienced in their respective fields and such foremen and supervisory staff as are competent to give proper supervision to the work.

The contractor shall provide and employ skilled, semiskilled and unskilled labour as is necessary for proper and timely execution of the work.

The Engineer-in-Charge shall be at liberty to object to and require the contractor to remove from the works any person who in his opinion misconducts himself, or is incompetent or negligent in the performance of his duties or whose employment is otherwise considered by the Engineer-in-Charge to be undesirable. Such person shall not be employed again at works site without the written permission of the Engineer-in-Charge and the persons so removed shall be replaced as soon as possible by competent substitutes.

CLAUSE 37 (Levy / Taxes payable by Contractor)

(i) GST, Building and other Construction Workers Welfare Cess or any other tax, levy or Cess in respect of input for or output by this contract shall be payable by the contractor and Government shall not entertain any claim whatsoever in this respect except as provided under Clause 38.

(ii) The contractor shall deposit royalty and obtain necessary permit for supply of the red bajri, stone, kankar, etc. from local authorities.

If pursuant to or under any law, notification or order any royalty cess or the like becomes payable by the Institute / Government of India and does not any time become payable by the contractor to the State Government, Local authorities in respect of any material used by the contractor in the works then in such a case, it shall be lawful to the Institute / Government of India and it will have the right and be entitled to recover the amount paid in the circumstances as aforesaid from dues of the contractor.

CLAUSE 38 (Conditions for reimbursement of levy / taxes if levied after receipt of tenders)

(i) All tendered rates shall be inclusive any tax, levy or cess applicable on last stipulated date of receipt of tender including extension if any. No adjustment i.e. increase or decrease shall be made for any variation in the rate of GST, Building and Other Construction Workers Welfare Cess or any tax, levy or cess applicable on inputs.

However, effect of variation in rates of GST or Building and Other Construction Workers Welfare Cess or imposition or repeal of any other tax, levy or cess applicable on output of the works contract shall be adjusted on either side, increase or decrease.

Provided further that for Building and Other Construction Workers Welfare Cess or any tax (other than GST), levy or cess varied or imposed after the last date of receipt of tender including extension if any, any increase shall be reimbursed to the contractor only if the contractor necessarily and properly pays such increased amount of taxes/levies/ cess.

Provided further that such increase including GST shall not be made in the extended period of contract for which the contractor alone is responsible for delay as determined by authority for extension of time under Clause 5 in Schedule F.

(ii) The contractor shall keep necessary books of accounts and other documents for the purpose of this condition as may be necessary and shall allow inspection of the same by a duly authorized representative of the Institute and/or the Engineer-in-Charge and further shall furnish such other information/document as the Engineer-in-Charge may require from time to time.

(iii) The contractor shall, within a period of 30 days of the imposition of any such further tax or levy or cess, , give a written notice thereof to the Engineer-in-Charge that the same is given pursuant to this condition, together with all necessary information relating thereto.

CLAUSE 39 (Termination of Contract on death of contractor)

Without prejudice to any of the rights or remedies under this contract if the contractor dies, Chairperson I-CDC IPR on behalf of the Director, IPR shall have the option of terminating the contract without compensation to the contractor.

CLAUSE 40 (If Relative working in Institute then the contractor not allowed to tender)

The contractor shall not be permitted to tender for works in the Institute (Division in case of contractors of Horticulture/Nursery categories) responsible for award and execution of contracts) in which his near relative is posted as Accountant or as an officer in any capacity. He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any officer in the Institute. Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of Institute. If however the contractor is registered in any other department, he shall be debarred from tendering in Institute for any breach of this condition.

NOTE: By the term “near relatives” is meant wife, husband, parents and grandparents, children and grandchildren, brothers and sisters, uncles, aunts and cousins and their corresponding in-laws.

CLAUSE 41 (No Gazetted Engineer to work as Contractor within one years of retirement)

No engineer of gazette rank or other officer employed in engineering or administrative duties in an engineering department of Government of India shall work as a contractor or employee of a contractor for a period of one year after his retirement from government service without the previous permission of Government of India in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found at any time to be such a person who had not obtained the permission of Government of India as aforesaid, before submission of the tender or engagement in the contractor's service, as the case may be.

CLAUSE 42 (Return of material & recovery for excess material issued.)

(i) After completion of the work and also at any intermediate stage in the event of non-reconciliation of materials issued, consumed and in balance - (see Clause 10), theoretical quantity of materials issued by the Government for use in the work shall be calculated on the basis and method given hereunder:

(a) Quantity of cement & bitumen shall be calculated on the basis of quantity of cement & bitumen required for different items of work as shown in the Schedule of Rates mentioned in Schedule 'F'. In case any item is executed for which standard constants for the consumption of cement or bitumen are not available in the above mentioned schedule/statement or cannot be derived from the same shall be calculated on the basis of standard formula to be laid down by the Engineer-in-Charge.

(b) Theoretical quantity of steel reinforcement or structural steel sections shall be taken as the quantity required as per design or as authorized by Engineer-in- Charge, including authorized laps, chairs etc. plus 3% wastage due to cutting into pieces, such theoretical quantity being determined and compared with the actual issues each diameter wise, section wise and category wise separately.

(c) Theoretical quantity of G.I. & Cl. or other pipes, conduits, wires and cables, pig lead and G. I. / M S. sheets shall be taken as quantity actually required and measured plus 5% for wastage due to cutting into pieces (except in the case of G. I. / M. S. sheets it shall be 10%), such determination & comparison being made diameter wise & category wise.

(d) For any other material as per actual requirements.

(ii) Over the theoretical quantities of materials so computed a variation shall be allowed as specified in Schedule 'F'. The difference in the net quantities of material actually issued to the contractor and the theoretical quantities including such authorized variation, if not returned by the contractor or if not fully reconciled to the satisfaction of the Engineer – in - Charge within fifteen days of the issue of written notice by the Engineer- in-charge to this effect shall be recovered at the rates specified in Schedule 'F', without prejudice to the provision of the relevant conditions regarding return of materials governing the contract. Decision of Engineer-in-Charge in regard to theoretical quantities of materials which should have been actually used as per the Annexure of the standard schedule of rates and recovery at rates specified in Schedule 'F' shall be final & binding on the contractor.

For non-scheduled items, the decision of the Chairperson I-CDC, IPR regarding theoretical quantities of materials which should have been actually used, shall be final and binding on the contractor.

(iii) The said action under this clause is without prejudice to the right of the Institute to take action against the contractor under any other conditions of contract for not doing the work according to the prescribed specifications.

CLAUSE 43 (Compensation during warlike situations)

The work (whether fully constructed or not) and all materials, machines, tools and plants, scaffolding, temporary buildings and other things connected therewith shall be at the risk of the contractor until the work has been delivered to the Engineer-in-Charge and a certificate from him to that effect obtained. In the event of the work or any materials properly brought to the site for incorporation in the work being damaged or destroyed in consequence of hostilities or warlike operation, the contractor shall when ordered (in writing) by the Engineer-in-Charge to remove any debris from the site, collect and properly stack or remove in store all serviceable materials salvaged from the damaged work and shall be paid at the contract rates in accordance with the provision of this agreement for the work of clearing the site of debris, stacking or removal of serviceable material and for reconstruction of all works ordered by the Engineer- in-Charge, such payments being in addition to compensation up to the value of the work originally executed before being damaged or destroyed and not paid for. In case of works damaged or destroyed but not already measured and paid for, the compensation shall be assessed by the Chairperson I-CDC, IPR up to Rs. 5000/- and by the Director concerned for a higher amount. The contractor shall be paid for the damages/destruction suffered and for the restoring the material at the rate based on analysis of rates tendered for in accordance with the provision of the contract. The certificate of the Engineer-in-Charge regarding the quality and quantity of materials and the purpose for which they were collected shall be final and binding on all parties to this contract.

Provided always that no compensation shall be payable for any loss in consequence of hostilities or warlike operations (a) unless the contractor had taken all such precautions against air raid as are deemed necessary by the Engineer-in-Charge (b) for any material etc. not on the site of the work or for any tools, plant, machinery, scaffolding, temporary building and other things not intended for the work.

In the event of the contractor having to carry out reconstruction as aforesaid, he shall be allowed such extension of time for its completion as is considered reasonable by the Chairperson I-CDC/ IPR.

CLAUSE 44 (Apprentices Act provisions to be complied with)

The contractor shall comply with the provisions of the Apprentices Act, 1961 and the rules and orders issued there under from time to time. If he fails to do so. His failure will be a breach of the contract and the Chairperson I-CDC, IPR may, in his discretion, cancel the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.

CLAUSE 45 (Release of Security deposit after labour clearance)

Security Deposit of the work shall not be refunded till the contractor produces a clearance certificate from the Labour Officer. As soon as the work is virtually complete the contractor shall apply for the clearance certificate to the Labour Officer under intimation to the Engineer-in-Charge. The Engineer-in-Charge, on receipt of the said communication, shall write to the Labour Officer to intimate if any complaint is pending against the contractor in respect of the work. If no complaint is pending, on record till after 3 months after completion of the work and/or no communication is received from the Labour Officer to this effect till six months after the date of completion, it will be deemed to have received the clearance certificate and the Security Deposit will be released if otherwise due.

SECTION: 2 - (v) (a) Integrity Pact.

To,

Subject: NIT No. _____ For the work _____

Dear Sir,

It is hereby declared that Institute for Plasma Research is committed to follow the principle of transparency, equity and competitiveness in public procurement.

The subject Notice Inviting Tender is an invitation to offer made on the condition that the Bidder will sign the integrity Agreement, which is an integral part of tender/bid document, failing which the tenderer/bidder will stand disqualified from the tendering process and the bid of the bidder would be summarily rejected.

This declaration shall form part and parcel of the Integrity Agreement and signing of the same shall be deemed as acceptance and signing of Integrity Agreement on the behalf of Institute for Plasma Research.

Yours faithfully,

Chairperson I-CDC, IPR

Integrity Pact

To,
Chairperson I-CDC IPR

Subject: Submission of Tender for the work of _____

Dear Sir,

I/We acknowledge that Institute for Plasma Research is committed to follow the principles thereof as enumerated in the Integrity Agreement enclosed with the tender /bid document.

I/We agree that the Notice Inviting Tender (NIT) is an invitation to offer made on the condition that I/We will sign the enclosed integrity Agreement, which is an integral part of tender documents, failing which I /We will stand disqualified from the tendering process. I/We acknowledge that THE MAKING OF THE BID SHALL BE REARDED AS AN UNCONDITIONAL AND ABSOLUTE ACCEPTANCE OF THIS CONDITION OF THE NIT.

I/We confirm acceptance and compliance with the Integrity Agreement in letter and spirit and further agree that execution of the said Integrity Agreement shall be separate and distinct from the main contract, which will come into existence when tender/bid is finally accepted by Institute for Plasma Research. I/We acknowledge and accept the duration of the Integrity Agreement, which shall be in the line with Article 1 of the enclosed Integrity Agreement.

I/We acknowledge that in the event of my /our failure to sign and accept the Integrity Agreement, while submitting the tender/bid, IPR shall have unqualified, absolute and unfettered right to disqualify the tenderer /bidder and reject the tender/bid in accordance with terms and conditions of the tender/bid.

Yours faithfully,

(Duly Authorized signatory of the Bidder)

**To be signed by the bidder and same signatory competent / authorized to sign
The relevant contract on behalf of IPR**

INTEGRITY AGREEMENT

This Integrity Agreement is made at on thisday of20.....

BETWEEN

Director, IPR represented through Chairperson I-CDC Institute for Plasma Research, Bhat Gandhinagar-382428....., (Hereinafter referred as the '**Principal/Owner**', which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns)

AND

.....
(Name and Address of the Individual/firm/Company)

Through..... (Hereinafter referred to as the
(Details of duly authorized signatory)

"Bidder/Contractor" and which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns).

Preamble

WHEREAS the Principal / Owner has floated the Tender (NIT No.) (hereinafter referred to as "Tender/Bid") and intends to award, under laid down organizational procedure, contract for

.....
(Name of Work)

Hereinafter referred to as the "Contract".

AND WHEREAS the Principal/Owner values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness/transparency in its relation with its Bidder(s) and Contractor(s).

AND WHEREAS to meet the purpose aforesaid both the parties have agreed to enter into this Integrity Agreement (hereinafter referred to as "Integrity Pact" or "Pact"), the terms and conditions of which shall also be read as integral part and parcel of the Tender/Bid documents and Contract between the parties.

NOW, THEREFORE, in consideration of mutual covenants contained in this Pact, the parties hereby agree as follows and this Pact witnesses as under:

Article 1: Commitment of the Principal/Owner

(1) The Principal/Owner commits itself to take all measures necessary to prevent corruption and to observe the following principles:

(a) No employee of the Principal/Owner, personally or through any of his/her family members, will in connection with the Tender, or the execution of the Contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

(b) The Principal/Owner will, during the Tender process, treat all Bidder(s) with equity and reason. The Principal/Owner will, in particular, before and during the Tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the Tender process or the Contract execution.

(c) The Principal/Owner shall endeavor to exclude from the Tender process any person, whose conduct in the past has been of biased nature.

(2) If the Principal/Owner obtains information on the conduct of any of its employees which is a criminal offence under the Indian Penal code (IPC)/Prevention of Corruption Act, 1988 (PC Act) or is in violation of the principles herein mentioned or if there be a substantive suspicion in this regard, the Principal/Owner will inform the Chief Vigilance Officer and in addition can also initiate disciplinary actions as per its internal laid down policies and procedures.

Article 2: Commitment of the Bidder(s)/Contractor(s)

(1) It is required that each Bidder/Contractor (including their respective officers, employees and agents) adhere to the highest ethical standards, and report to the Government / Department all suspected acts of fraud or corruption or Coercion or Collusion of which it has knowledge or becomes aware, during the tendering process and throughout the negotiation or award of a contract.

(2) The Bidder(s)/Contractor(s) commits himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the Tender process and during the Contract execution:

(a) The Bidder(s)/Contractor(s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal/Owner's employees involved in the Tender process or execution of the Contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the Tender process or during the execution of the Contract.

(b) The Bidder(s)/Contractor(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to cartelize in the bidding process.

(c) The Bidder(s)/Contractor(s) will not commit any offence under the relevant IPC/PC Act. Further the Bidder(s)/Contractor(s) will not use improperly, (for the purpose of competition or personal gain), or pass on to others, any information or documents provided by the Principal/Owner as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

(d) The Bidder(s)/Contractor(s) of foreign origin shall disclose the names and addresses of agents/representatives in India, if any. Similarly Bidder(s)/Contractor(s) of Indian Nationality shall disclose names and addresses of foreign agents/representatives, if any. Either the Indian agent on behalf of the foreign principal or the foreign principal directly could bid in a tender but not both. Further, in cases where an agent participate in a tender on behalf of one manufacturer, he shall not be

allowed to quote on behalf of another manufacturer along with the first manufacturer in a subsequent/parallel tender for the same item.

(e) The Bidder(s)/Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the Contract.

(3) The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

(4) The Bidder(s)/Contractor(s) will not, directly or through any other person or firm indulge in fraudulent practice means a willful misrepresentation or omission of facts or submission of fake/forged documents in order to induce public official to act in reliance thereof, with the purpose of obtaining unjust advantage by or causing damage to justified interest of others and/or to influence the procurement process to the detriment of the Government interests.

(5) The Bidder(s)/Contractor(s) will not, directly or through any other person or firm use Coercive Practices (means the act of obtaining something, compelling an action or influencing a decision through intimidation, threat or the use of force directly or indirectly, where potential or actual injury may befall upon a person, his/ her reputation or property to influence their participation in the tendering process).

Article 3: Consequences of Breach

Without prejudice to any rights that may be available to the Principal/Owner under law or the Contract or its established policies and laid down procedures, the Principal/Owner shall have the following rights in case of breach of this Integrity Pact by the Bidder(s)/Contractor(s) and the Bidder/ Contractor accepts and undertakes to respect and uphold the Principal/Owner's absolute right:

(1) If the Bidder(s)/Contractor(s), either before award or during execution of Contract has committed a transgression through a violation of Article 2 above or in any other form, such as to put his reliability or credibility in question, the Principal/Owner after giving 14 days' notice to the contractor shall have powers to disqualify the Bidder(s)/Contractor(s) from the Tender process or terminate/determine the Contract, if already executed or exclude the Bidder/Contractor from future contract award processes. The imposition and duration of the exclusion will be determined by the severity of transgression and determined by the Principal/Owner. Such exclusion may be forever or for a limited period as decided by the Principal/Owner.

(2) Forfeiture of EMD/Performance Guarantee/Security Deposit: If the Principal/Owner has disqualified the Bidder(s) from the Tender process prior to the award of the Contract or terminated/determined the Contract or has accrued the right to terminate/determine the Contract according to Article 3(1), the Principal/Owner apart from exercising any legal rights that may have accrued to the Principal/Owner, may in its considered opinion forfeit the entire amount of Earnest Money Deposit, Performance Guarantee and Security Deposit of the Bidder/Contractor.

(3) Criminal Liability: If the Principal/Owner obtains knowledge of conduct of a Bidder or Contractor, or of an employee or a representative or an associate of a Bidder or Contractor which constitutes corruption within the meaning of IPC Act, or if the Principal/Owner has substantive suspicion in this regard, the Principal/Owner will inform the same to law enforcing agencies for further investigation.

Article 4: Previous Transgression

(1) The Bidder declares that no previous transgressions occurred in the last 5 years with any other Company in any country confirming to the anticorruption approach or with Central Government or

State Government or any other Central/State Public Sector Enterprises in India that could justify his exclusion from the Tender process.

(2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the Tender process or action can be taken for banning of business dealings/ holiday listing of the Bidder/Contractor as deemed fit by the Principal/ Owner.

(3) If the Bidder/Contractor can prove that he has resorted / recouped the damage caused by him and has installed a suitable corruption prevention system, the Principal/Owner may, at its own discretion, revoke the exclusion prematurely.

Article 5: Equal Treatment of all Bidders/Contractors/Subcontractors

(1) The Bidder(s)/Contractor(s) undertake(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact. The Bidder/Contractor shall be responsible for any violation(s) of the principles laid down in this agreement/Pact by any of its Subcontractors/sub-vendors.

(2) The Principal/Owner will enter into Pacts on identical terms as this one with all Bidders and Contractors.

(3) The Principal/Owner will disqualify Bidders, who do not submit, the duly signed Pact between the Principal/Owner and the bidder, along with the Tender or violate its provisions at any stage of the Tender process, from the Tender process.

Article 6- Duration of the Pact

This Pact begins when both the parties have legally signed it. It expires for the Contractor/Vendor 12 months after the completion of work under the contract or till the continuation of defect liability period, whichever is more and for all other bidders, till the Contract has been awarded.

If any claim is made/lodged during the time, the same shall be binding and continue to be valid despite the lapse of this Pacts as specified above, unless it is discharged/determined by the Competent Authority, IPR.

Article 7- Other Provisions

(1) This Pact is subject to Indian Law, place of performance and jurisdiction is the Headquarters of the Division of the Principal/Owner, who has floated the Tender.

(2) Changes and supplements need to be made in writing. Side agreements have not been made.

(3) If the Contractor is a partnership or a consortium, this Pact must be signed by all the partners or by one or more partner holding power of attorney signed by all partners and consortium members. In case of a Company, the Pact must be signed by a representative duly authorized by board resolution.

(4) Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

(5) It is agreed term and condition that any dispute or difference arising between the parties with regard to the terms of this Integrity Agreement / Pact, any action taken by the Owner/Principal in accordance with this Integrity Agreement/ Pact or interpretation thereof shall not be subject to arbitration.

Article 8- LEGAL AND PRIOR RIGHTS

All rights and remedies of the parties hereto shall be in addition to all the other legal rights and remedies belonging to such parties under the Contract and/or law and the same shall be deemed to be cumulative and not alternative to such legal rights and remedies aforesaid. For the sake of brevity, both

the Parties agree that this Integrity Pact will have precedence over the Tender/Contact documents with regard any of the provisions covered under this Integrity Pact.

IN WITNESS WHEREOF the parties have signed and executed this Integrity Pact at the place and date first above mentioned in the presence of following witnesses:

.....
(For and on behalf of Principal/Owner)

.....
(For and on behalf of Bidder/Contractor)

WITNESSES:

1.
(Signature, name and address)
2.
(Signature, name and address)

Place:

Dated:

SECTION: 2 - (vi) - SPECIAL CLAUSES OF CONTRACT (SCC)

1. GENERAL:

The following special clauses of contract shall be read in conjunction with general clauses of contract enclosed herein before. The following clauses shall be considered as an extension and not limitation of the obligations of the contractor. In case the discrepancy between these special clauses of contract and the General Clauses of contract, these Special Clauses shall take precedence over the General clauses of the Contract.

2. SCOPE AND LOCATION OF WORK: (Please refer to Schedule "A")

The contractor carrying out this works will be strictly abide by the Local /Municipal / Statutory Bodies/Police/ Institute's regulations as well as security regulations imposed by such authorities from time to time regarding transshipment of equipment ,operations, drainage, late hour working , working on holidays, bringing /taking away of materials ,disposal of debris , excavated /surplus materials etc. as and wherever applicable.

The contractor for this work shall co-ordinate for his work along with other contractors who will be simultaneously carrying out the work in same area.

All workmen working at height beyond 1st floor shall be provided with safety belts and the workers should be directed to wear safety belts as long as they are working. The instructions issued by the Engineer-In-Charge with regard to security of workmen from time to time to be strictly followed. All other safety measures stipulated in the tender document shall be strictly followed failing which the Engineer-In -Charge shall take immediate action deemed fit and the same shall be binding on the contractor.

The work shall be completed as per the detailed time schedule which shall be prepared after the issue of work order. However, the entire work shall be completed within the stipulated completion period as specified in the Tender Notice.

3. SITE INVESTIGATIONS:

The tenderer is advised to visit the site of work with prior permission of Chairperson I-CDC or his authorized representative of Institute for Plasma Research to acquaint themselves as to the nature and location of the work, access to the site, the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labour, water, electric power and road, as also uncertainties of weather or similar physical conditions of the site, the formation and conditions of the ground, the character, quality and quantity of surface and sub-surface materials to be encountered, including subsoil water levels, the character of equipment and facilities needed preliminary to and during the progress of the work, and all other matters which can be, in any way, effect the work or the cost thereof under the contract.

4. STAKING OUT BASE LINES AND LEVELS:

The contractor shall establish at site the layout of the building/road etc. for the work from base lines and grids established by the Institute and shall be responsible for all measurements in connection therewith. The contractor shall, at his own expenses, furnish all stakes, templates, platform, equipment's, ranges and labour that may be required in setting out or laying out any part of the work. The contractor to carry out the Centre lines of the proposed buildings with the total station (survey equipment) and to set out with no extra cost. The contractor shall be held responsible for the proper execution of the work to such lines, levels and grids as may be established or indicated on the drawings

and specifications, the contractor shall check the bench marks and stakes existing at the site for laying out lines and levels.

The contractor has to construct and maintain proper bench marks at all salient positions in order that the lines and levels may be accurately checked at all times.

Total Station, Theodolite, levels, prismatic compass, chain, steel and metallic tapes and all other surveying instruments found necessary on the works shall be provided by the contractors for use at site in connection with this work.

5. COMMENCEMENT AND COMPLETION OF WORK AND PROPER SCHEDULE:

The work shall be completed within the stipulated period of completion.

The Contractor shall submit detailed time schedule within 15 days from the date of issue of work order, for completion of work, indicating all the important activities of execution of the work/ group of the items in sequence of its operation etc. including making ready the sample finishes / finished sample flat for building works, in consultation with Engineer-In-Charge and submit the same for approval of the work awarding authority. This time schedule, after approval, shall form part of the contract and the work in all respect shall be carried out as per this time schedule.

Time shall be the essence of the contract. The rate of progress of the whole work as well as for all the important individual items of work shall not be slower than as laid down in the attached progress schedule.

The contractor shall properly assess his capability and fully satisfy himself before tendering that he will be able to adhere the specified schedule. In this connection the attention of the tenderer is specially invited to clause 2 of the General Conditions of the Contract.

The contractor shall furnish to the Engineer-in-Charge weekly progress report in triplicate on Saturday of every week indicating the following:

Sr.No.	Item of work for the	Schedule progress week	Actual short fall if any	Reason for make-up the short fall	Steps taken to make up the short fall

5 (a) The contractor shall employ sufficient number of skilled and unskilled labour required for the work for maintaining the progress of work as stipulated in the time schedule. The trade -wise labour strength should be intimated to the Engineer-in-Charge every day in writing. The skilled labour shall be increased if required by Engineer-in-Charge to maintain the progress of work.

6. SEQUENCE OF WORK:

The contractor shall execute the work as per the sequence given by the Engineer-in-Charge from time to time so that the other items of work to be executed by other agencies are completed progressively along with the main work.

7. CO-OPERATION WITH OTHER CONTRACTORS:

The contractor shall extend all facilities and give complete co-operation for the execution of various connected work if required to be carried out simultaneously by other agencies while his own work is

in progress. The co-ordination will be effected in consultation with the Engineer-in-Charge of the work. Other contractors are also likely to be authorized by the Institute to work in the same area during the construction stage for work.

Since Electrical/ Air-conditioning/ other agencies will have to carry out their works such as installations of conduits, junction boxes, wiring, distribution boxes, switches, fittings and fixtures etc. in a planned manner in stages which will be in relation the status and progress of civil construction works, the civil contractor shall accept and take over the inventories of installation of Electrical/ Air-conditioning/ other agencies when their works are in part/full completion stage. The same inventory in the same condition will have to be handed over back to the electrical/ air-conditioning/ other agencies for carrying out their remaining works after the stage wise completion of the civil works. During final handing over of the building(s) to the Institute / Users, the civil contractor will again take over the installation/inventories of fittings and fixtures of electrical/ air-conditioning/ other agencies and will complete all his balance finishing works and hand over his works along with the installations of other agencies to Institute/Users.

The contractor shall afford all facilities:

- (a) For the installation of embedded parts, sleeves with its accessories in slabs, beams and walls by the other agencies before the reinforcement is placed necessary cut-outs in the shuttering will have to be provided by the civil contractor for purpose for which no extra payment will be admissible.
- (b) For the installation of various service lines in the walls, floors, slabs, ducts etc.
- (c) For using approach road etc. by the other contractors.

No extra claims on account of facilities provided for carrying out the work mentioned above will be entertained.

8. CO-ORDINATION:

The contractor will carry out the entire work in a planned manner by coordinating his work, with the other contractors, who will simultaneously carrying out the work in the same area and also co-ordinate in connection with the position of various fixtures, inserts, embedment's and other allied work connected with the completion of building / subject work.

In case of any dispute between the contractors engaged on the same work, decision of Engineer-in-Charge shall be final and binding.

9. APPROACH ROADS AND TRANSPORTATION OF EQUIPMENT AND MATERIALS:

Contractor will be permitted to use the existing roads in the establishment area for the purpose of transporting equipment and materials and for use of labour etc. The Engineer-in-Charge, however, will not undertake to provide any approach roads to the actual site of work. It shall be the entire responsibility of the contractor to provide and maintain such temporary approach roads including cross drainage works if any at his own cost for the purpose of movement of men, materials and equipment. Layout of such approach roads shall be submitted to Engineer-in-Charge for his approval before undertaking the construction of the same. Such approach roads shall be made available to other agencies for carrying out the work in the same area in consultation with the Engineer-in-Charge of the works without any cost.

10. OPERATIONS AND STORAGE AREAS:

All operations of the contractor shall be confined to areas authorized by the Engineer-in-Charge and storage of materials shall be over the areas specially indicated by the Engineer-in-Charge. Materials like sand and metal of different sizes shall be stored in properly constructed bins with hard floor to avoid inter mixing as well as mixing with objectionable materials. The contractor shall be obliged to keep the premises in hygienic conditions by proper drainages of the area provided with suitable approaches throughout the period of contract. He shall rectify all damages caused to the Institute property within the areas thus allotted. He shall be responsible to clear all rank, vegetation at site at his own cost.

11. CONTRACTOR'S STORAGE AND SITE OFFICE:

Suitable area near the site of work shall be allocated to the contractor, @ Re.1/- per month as token compensation for storing his equipment, plant, materials etc. and for his site office and cement godown. He will, however, be solely responsible for watching or guarding his property and materials issued to him by the Institute. Contractor shall cover all materials at site with requisite insurance against theft, larceny, dacoits, fire tempest and flood. He, however, will have to dismantle the shed and vacate the land after the receipt of due notice from the Engineer-in-Charge if the same is obstructing any work.

The tenderer should obtain necessary permission/approval from statutory authorities of Local bodies for construction of temporary structures at site of work such as cement godown, stores, site office etc. It will be responsibility of the tenderers to prepare proper plans, to pay any requisite fees to statutory authorities and to execute the work for the temporary structure at their own cost as per the conditions and rules laid by statutory authorities.

12. TEMPORARY BUILDINGS:

Warehouse, shed, workshop and office facilities as required by the contractor shall be provided by him at his own expense. Area for the same will be made available by the Institute @ Re.1/- per month as token compensation. Prior approval of the Engineer-in-Charge shall be obtained in respect of location and layout and details of those buildings. After the work is over all these temporary facilities shall be removed by the contractor at his own expense to the satisfaction of the Engineer-in-Charge within 10 days from the date of completion.

No labour shall be permitted to stay at site or in the partly completed building at any time and no land for erection of temporary huts for labourers will be made available by the Institute. The contractor shall make his own arrangements for labour hutments elsewhere outside the Institute's premises/area at his own cost. Unauthorized occupation of any area/partly completed building by the contractor's labourer will be treated as trespass and action will be taken to evict them including termination of contract if deemed fit. Sanitary as well as water supply and drainage facilities as required by the labour laws in force, are to be provided by the contractor at his own cost.

13. TRAFFIC INTERFERENCE & INCONVENIENCE TO THE PUBLIC:

The contractor shall conduct his operations so as to interfere as little as possible with the traffic/public. When interfere to traffic is inevitable, a notice of such Interference shall be given to the Engineer-in-Charge well In advance (at least 2 days at any stage, if it becomes necessary to divert the traffic, the contractor shall obtain permission from the local traffic authorities at his own expense. The Institute will render reasonable assistance in the matter. The contractor shall take all precaution and other measure, such as providing warning signals, temporary diversion etc. all as directed by the Engineer-in-Charge.

The Contractor shall not deposit materials anywhere at work site which will seriously inconvenience the public. The Engineer-In-Charge may require the contractor to remove any materials which are

considered to be a danger or in convenience to the public or cause them to be removed at the contractor's cost.

The contractor shall exercise full care to ensure that no damage is caused by him or his workmen during the operation to the existing water supply and power lines. The cost of any such damage and risks arising out of this shall be entirely borne by the contractor.

14. DRAINAGE AROUND THE BUILDING AND FOUNDATION FOR OTHER WORKS:

The contractor shall be entirely responsible for the provision and maintenance of efficient drainage arrangements in the work site to lead of all water whatsoever pumped from the excavations on account of rains, floods, springs or any other source whatsoever. The foundation trenches shall be kept free from water while all the works below ground level are in progress.

Flooding or ponding of water in the work site shall not be permitted under any circumstances whatsoever and the contractor shall take all necessary precautions to prevent the same by providing suitable pumps and other dewatering arrangement.

The cost of repairing damages if any, to the work under execution or to any Institute property in and around the site shall be entirely borne by the contractor where such damages are due to his noncompliance with the above conditions.

15. SPECIFICATIONS AND DRAWINGS:

15.1 The drawings furnished to the contractor for this work shall be interpreted by the use of given dimensions and nomenclature only and the drawings shall not be scaled. Drawings to a large scale shall have precedence over those to a smaller scale. Prior to the execution of the work, the contractor shall check all drawings, specifications and shall immediately report all errors, discrepancies and/or omissions discovered therein to the Engineer-in-Charge and obtain appropriate orders on same. Any adjustment made by the contractor without prior approval of the Engineer-in-Charge shall be at his own risk. Description of item in the schedule of quantities is brief and therefore, shall be read in conjunction with the relevant drawings and the specifications and the contractor's rate shall be deemed to be for such complete work unless otherwise specified by the contractor while tendering.

15.2 In case any difference or discrepancy between the description in the schedule of quantities and the specifications, the schedule of quantities shall take precedence.

In case any difference or discrepancy between the description in the schedule of quantities and the drawing, the description in schedule of quantities shall take precedence.

In case of any difference or discrepancy between drawing and specifications the specifications shall take precedence.

15.3 Prior to submission of drawing called for as per specifications or any other drawings, contractor may intend to submit for approval, the contractor shall be responsible for thoroughly checking of all drawings to ensure that they comply with the intend and the requirements of the contract specifications and that they fit in with the overall layout. Drawing found to be inaccurate or otherwise in error will be returned to the contractor for corrections.

15.4 For all drawings to be submitted by the contractor, for the approval of the Engineer-in-Charge, the contractor shall submit 6 (six) copies of each drawing & soft copy (pdf as well as editable) of drawing.

15.5 The approval of the drawings by the Engineer-in-Charge shall not be construed as a complete dimensional check but will indicate only that the general method of construction as detailed is

satisfactory. The contractor shall be responsible for the dimensions and designs of adequate connection supports, details and satisfactory construction of the work.

15.6 Cost of all shop drawings, fabrication drawings or formwork drawings and details to be furnished by the contractor shall be deemed to be included in his tendered rates. Approval of shop drawings shall not be construed as authorized additional work of increased costs to the Institute.

16. SAMPLES:

Samples of all materials to be incorporated in the work shall be submitted to the Engineer-in-Charge for his approval without any extra cost. The approved samples will be kept with Engineer-in-Charge till the completion of the work. Materials not conforming strictly to the approved samples will be rejected.

Samples of various materials required for testing shall be provided free of charge by the contractor. Testing charges if any shall be borne by the contractor. All other expenses required to be incurred for taking the samples; conveyance packing etc. shall be borne by the contractor.

16.1 in addition to submission of samples of materials, The contractor, shall make as sample flat (Sample finishing in case of Non-Residential buildings) ready in all respect, including finishing items of works of civil works including installation of fittings as well as those of water supply, plumbing and sanitation work and electrical work, internal fittings, fixtures and wiring etc. to determine the acceptable standard of material and workmanship. The sample flat with all final finishes items of work in the building (s). Each of these samples of items of work/ trade / materials approved by the Engineer-In Charge will be endorsed as " Guide line samples", as per which further works shall be executed in strict conformity with standard of materials and workmanship.

The Provision of co-ordination and co-operation with other agencies shall be mutatis-mutandis applicable to the above mentioned "Sample flat / sample finishing works" also.

17. EXECUTION OF WORK AND INSPECTION:

The work shall be conducted under the general direction of the Engineer-in-Charge and is subject to inspection by his appointed representative to ensure strict compliance with the terms of the contract. No failure of the Engineer-in-Charge or his designated representative during the progress of the work to discover or to reject materials, or work not in accordance with the requirement of this contract shall be deemed as an acceptance thereof or a waiver of defects therein and no payment by the Engineer-in-Charge or partial or entire occupancy of the premises shall be construed to be an acceptance of work or materials which are not strictly in accordance with the requirements of the contract. No changes whatsoever to any provision of specifications shall be made without authorization from the Engineer-in-Charge.

18. SUPPLY OF WATER FOR CONSTRUCTION PURPOSE:

Note : In case of non-stipulation of departmental (Institute) water supply as per Schedule -"B" of Schedules (Salient Governing features of Tender / work) the contractor shall make his own arrangement of water required for this work, at his own cost, subject to the approval of Engineer-In-Charge.

The contractor shall arrange to provide a minimum storage of 5000 Ltrs. (or two days requirement whichever is higher) of water at building location and all necessary pumps for storage of water shall be built by the contractor at his own cost at location to be approved by the Engineer-in Charge.

The water storage tanks should be leak proof and wastage and misuse of water is strictly prohibited. Contamination and pollution of water to be strictly avoided. Construction water should not be used for drinking or for domestic purpose. Contractor will make his own arrangement for water required for drinking purposes at site of work and for all purposes at the labour camp at his own cost.

19. SUPPLY OF ELECTRICITY FOR CONSTRUCTION PURPOSE:

In case of stipulation of departmental (Institute) supply of Electricity for construction purpose under Schedule "B" of Schedules (Salient Governing features of Tender /work), the same shall be dealt with as under:

(In case of non-stipulation of departmental supply of Electricity for construction purpose in **Schedule "B"**, the contractor shall make his own arrangement for the same as required at his own cost.)

19.1 General:

Temporary electric power, if required by the contractor shall be provided for bonafide construction purpose required for the site job but limited to a total max. Of **5 KW (connected) at 3 phase, 410 volts, and 50 cps**. Some of the important conditions governing the power supply are as follows:

(a) The power will be supplied (on receipt of application in prescribed form) at one point within **1000 M.** of the building premises. The contractor shall install his own main switch, cables, electric cupboard/switch room etc. of adequate capacity of suitable type to receive, control and further distribute the power involved. The exact location and further details about supply point will on receipt of the contractor's application, be decided upon by the Institute, whose decision in the matter will be final and binding. The total final connected load and the anticipated maximum demand shall be furnished by the contractor about a month in advance of the actual initial requirement and for any addition in load subsequent to the initial supply, date, at least one week's notice from the date of submission of installation test report for the said additional load will be given.

(b) The contractor shall provide his own switches, a tested KWH Meter, earth station, earth leakage circuit breakers cable/lines of approved make and of adequate capacity from the aforesaid supply point to the various utilization points and also be responsible to maintain the same in good and safe condition at all times as per relevant codes and electricity rules. He will also be fully responsible at all times for any accident/mishap in his electrical installation/appliances etc. (including the consequential aspects) if the same are found to be due to defective construction/maintenance etc. of his installation or negligence in observation of rules, or safety precautions. The layout and other details of these lines shall be got approved in advance by the Institute and no change in the same shall be subsequently carried out without Institute prior approval. The Institute's Electrical Engineer may any time summarily disconnect, in the interest of safety, the power supply without notice, if any dangerous situation is seen in the contractor's installation or if the contractor has failed to maintain the installation satisfactorily in spite of a written notice served on him. The responsibility for such a disconnection will always be with the contractor who will have no claim whatsoever in this respect on the Institute.

(c) The contractor's electrical installation shall conform in all respects to the relevant rules, regulations, statutory provision and codes of practice as also be in accordance with the rules of the local licensee undertaking (as the case may be) as existing new or as may be amended/enforced from time to time in the future. Installation test reports shall invariably be furnished by the contractor before any load is connected. Periodical test reports by every 3 months for the complete installation shall also be submitted by the contractor in accordance with I.E.E Rules for temporary installation.

(d) Power will be supplied at the point mentioned in para (a) above at the usual 400 V, 3 Phase, 50 cycles. 4 wire or single phase 230 V, 2-wire system as the case may be subject to permissible variations

in voltage and frequency. In case 3 phase supply the individual single phase loads if any shall be suitably connected so that the total load over three phases at the supply point is balanced as much as possible. No individual single phase equipment or a single phase system shall normally exceed a rating of 2 K.W.

(e) The Institute may install, depending on availability, in the covered space provided by the contractor at the aforesaid supply point necessary energy meter (additional) for registering the electricity (i.e. KWH) supplied. It may be necessary to install separate Institutes meter (rental amount as mentioned above) for lighting consumption and in that case the contractor shall have to provide separate lighting circuits.

(f) The supply of electricity shall be charged at the rates specified in the **Schedule "B"** at the rate fixed by the Institute from time to time which will be generally at par with the temporary/supply tariff of State Electricity Board. The contractor shall be responsible for the safety of the Institute's meter, cut outs etc. installed at his site.

NOTE:

The electricity will normally be billed once every month at the prevailing supply rate from time to time. In case if any increase in supply rate, the same shall be charged with an addition of departmental charges as per **Schedule -"B"**.

(g) The power supply shall be subject to all such restrictions, regulations etc., as are in existence now and as may be (enforced from time to time in future by the licensee/Government/Department or by any other competent authority for which the contractor have no claim whatsoever. Although all efforts shall be made to provide a continuous supply, the contractor shall have no claim whatsoever due to any breakdown or interruption etc. in the supply at any time.

19.2 CONSTRUCTION AND MAINTENANCE BY THE CONTRACTOR:

As mentioned above, the contractor shall maintain his entire electrical installation, appliances etc. in good and safe condition as required under relevant rules and codes of practice. However, the following precautions and directives shall be followed in addition to observing other essential rules:

(i) The minimum clearance (measured at the lowest sag point) to be maintained for all overhead lines shall be 4 Mtrs. cross country or along roads and 6.1 meters across roads.

(ii) Metallic poles as a general rule should be avoided and if used should be earthed individually.

(iii) All loose hanging of wires and cables should be avoided. The line wires should be properly supported and an approved method of fixing shall be adopted.

(iv) Installation shall not cause any hindrance to the normal movement of men and materials at site.

(v) All cables and wires should be adequately protected against mechanical damage during construction activity of all contractors, working at site.

(vi) In case the cable is required to be laid in ground, it should be adequately protected by covering the same with bricks, R.C.C. tiles or any other approved means and cable markers provided at suitable intervals as per approval of the Institute.

(vii) Laying of cable and wires directly on floor shall not be allowed but if absolutely necessary for some very short lengths, the same shall be taken through suitable mechanical covering like G.I. /M.S. Pipes etc.

- (viii) All the outdoor switch boards, equipment's etc., should be adequately protected against rain or preferably they should not be exposed to weather.
- (ix) If overhead lines using bare conductors are installed, a guard wire system of adequate size shall run along the cables /wires and earthed effectively.
- (x) The connection for portable machines shall be taken only through suitably rated 3 pin socket points. Iron clad industrial type outlets are preferred. While taking supply through socket outlet a plug top must be used, avoiding inserting of loose wires in the sockets. The third pin of the plug shall invariably be earthed and 3 core wire of appropriate specifications and capacity shall be used.
- (xi) All three phase equipment shall be provided with duplicate earthing. All metallic frames, light fixtures, portable equipment's etc. should be effectively earthed to main earthing.
- (xii) Duly authorized persons having valid wireman's license/competence certificate must be employed under the supervision of a qualified and experienced Electrical Supervisor for carrying out electrical work and repair of electrical equipment's, installation and maintenance etc. at site.

19.3 Additional Power:

Power in excess of the limit stipulated above, May subject to availability, be provided if applied for by the contractor by installing additional cables/lines from the changeover nearby. These additional lines along with necessary switches etc. shall be provided by the contractor.

20. TENDERED RATES:

The rates quoted by the tenderer in the schedule shall be inclusive of all taxes including GST, Sales Tax, VAT, Purchase Tax, workers welfare cess and other statutory levies imposed by the Government or other public bodies from time to time. The rates quoted shall also cover the cost of necessary protection including labour, materials and equipment to ensure safety and protection against risk or accident, compensation for injury to life and damage to property if any, caused by the contractor's operations connected with this work. The rates shall be firm and shall not be subject to change due to variations during the entire period of execution of the work in cost of materials, labour and conditions, or any other conditions whatsoever except for the provisions contained in clause 10 C, 10 CA and 10 CC of General conditions of contract as applicable for this work.

The rates quoted by the tenderer shall also be inclusive of State Sales Tax on the transfer of property in goods involved in execution of works contract Act (in other words WCT/ Turn over Tax), if any which is to be paid by the tenderer to the government from time to time during the execution of the contract/works. No separate claim on this account will be entertained by the Institute. Also no certificate(s) for exemption of Octroi / Entry tax shall be issued by the Institute.

Unless otherwise stated in schedule of quantities, rates for item quoted by the tenderer should be for the complete work including supply and fixing with all materials and should be for all heights and depths, lifts and leads, lengths and widths involved in the work.

Any cement slurry added over the base surface (or) for continuation of concreting , for better bond , is added to have been in-built in the item (unless otherwise explicitly stated and nothing extra shall be payable and no extra cement considered in consumption on this account.)

Rate for all items, in which use of cement is involved, shall include charges for curing.

The contractor when called for by the Institute should furnish detailed rate analysis in support of the rates quoted by him against each item of the tender. The Institute reserves the right to utilize the analysis thus supplied in setting any deviations or claims arising on this contract.

For any deviations or claims or extra items arising out of this contract, the contractor will be entitled for overheads and profits of 2.5% (Two and half) only towards handling, storing etc. of such materials which are supplied by the Institute under schedule 'B' at fixed issue rates/procurement rates in case of free issue materials.

21. CLAIMS AGAINST THE CONTRACTOR:

Whenever any claim against the contractor for the payment of a sum or money arises out of or under the contract, Institute shall be entitled to recover such sum by appropriating in part or whole, the security deposit of the contractor and to sell any Institute promissory notes etc. forming the whole or part of such security. In the event of the security deposit having been taken from the contractor, the balance or the total sum recoverable, as the case may be, shall be deducted from any sum then due or which at any time thereafter may become due from the contractor, under this or any other contract with Institute, should this sum be not sufficient to cover the full amount recoverable, the contractor shall pay to Institute on demand the balance remaining due. Institute shall have the right to cause an audit and technical examination of the work and the final bill of the contractor including all supporting vouchers, abstracts etc. to be made after payment of the final bill and if as a result of the due audit and technical examination any sum is found to have been over paid in respect of any work done by the contractor under the contract or any work claimed by him to have been done under the contract and found not have been executed, the contractor shall be liable to refund the amount of the over payment and it shall be lawful for Institute to recover the same from him in the manner prescribed above of this clause or in any other manner legally permissible and if it is found that the contractor was paid less than what was due to him under the contract in respect of any work executed by him under it, amount of such under payment shall be duly paid by Institute to the contractor.

Provided that Institute shall not be entitled to recover any sum overpaid, nor the contractor shall be entitled to payment of any such paid short where such payment has been agreed upon between the Engineer-in-Charge on one hand and the contractor on the other, under any term of the contract permitting payment for work after assessment by the Engineer-in-Charge.

Provided further no recovery of an over payment and no payment of any sum paid short shall be made where such over payment or under payment has remained undiscovered for a period of three years after the date of payment of the final bill.

22. MODE OF MEASUREMENTS:

Measurements for all hidden items once taken jointly and so accepted by the tenderer in the bills, in writing shall be final and binding. No re-recording of measurements for hidden items of work be permitted.

The contractor shall provide at his own cost suitable weighing and measuring arrangements at site for checking the weight/ dimensions as may be necessary for execution of the work. All measuring tapes (of steel), scaffolding and ladders which may be required for taking measurements shall be supplied by the contractor.

If the contractor fails to accompany the Engineer-in-Charge or his authorized person to take measurements then he shall be bound by the measurements recorded by the Engineer-in-Charge or his representative.

23. STORES AND MATERIALS AT SITE:

Stores and materials required for the works are to be deposited by the contractor only in places to be indicated by the Engineer-in-Charge. The Engineer-in-Charge shall have a right at any time to inspect and examine any stores and materials intended to be used in or on the works either on the site or at any factory or workshops or other places where such stores or materials are being constructed or manufactured or processed or any place from where they are being obtained and the contractor shall give such facilities as required to be given for such inspection and examination.

The Engineer-in-Charge shall be entitled to have tests made without any extra cost to the Institute at an approved laboratory for any stores and or materials supplied by the Contractor, who shall provide at his own expense all the facilities which the Engineer-in-Charge may require for this purpose.

Any stores and materials brought to site for use on the work shall not be removed off the site without prior written approval of the Engineer-in-Charge, but on final completion of the work, the contractor shall at his own expenses remove from the site all surplus stores and materials originally brought by him.

24. PROPER DRAWINGS AND INSTRUCTIONS:

The Engineer-In-charge shall have full powers and authority to supply to the contractor from time to time during progress of the work such further drawings and instructions as shall be necessary for the purpose of proper and adequate execution and maintenance of the work and the contractor shall carry out the work and be bound by the same.

One copy each of the drawings furnished to the contractor shall be kept by the contractor at the site and the same shall at all reasonable times be made available for inspection and use by the Engineer-In-Charge and any other person authorized by the Engineer-In-charge

25. EMPLOYMENT OF STAFF FOR PLUMBING & ELECTRICAL WORKS:

25.1 Employment of certified plumber:

Certified plumbers should be employed by the contractor on the work for main sewer, filtered and unfiltered main.

25.2 Employment of licensed electrical foreman:

The contractor should employ a licensed electrical foreman to supervise the Electrical works.

26. GOVERNMENT LABOUR ACT:

The contractor has to follow strictly the Government labour Acts, which are and will be in force during the period of execution of work, all necessary arrangement for labourer's safety, insurance will have to be made by the contractor as per Municipal rules / Contractor's Labour regulations / other Central or Local statutory body / Institute' rules. **The Contractor shall insure his labourers with Insurance Policy and all risk insurance policies etc. at his own cost.**

27. DEDUCTION OF INCOME TAX:

As per Section 194-C of Income tax Act 1961, as amended from time to time the, income tax and Surcharge thereon will be deducted at the rate prescribed by Ministry of Finance , Department of

Revenue, Central board of Direct Taxes from time to time, of the gross value of the work done from the bills. A certificate for the amount so deducted will be issued by the Institute.

28. URGENT REPAIRS:

If by reason of any accident or failure or other event occurring to or in connection with the work or any part thereof either during the period of maintenance, any remedial or other work or repair shall in the opinion of the Engineer-in-Charge be urgently necessary for security and the contractor is unable or unwilling, at once, to do such work or repair, the Engineer-in-Charge may be his own or other workmen do such work or repair as he may consider necessary. If the work or repair so done which in the opinion of the Engineer-in-Charge the contractor was liable to do at his own expenses under the contract and all cost and charges properly incurred by the Engineer-in-Charge in so doing shall on demand be paid by the contractor or may be deducted from any sum due or which may become due to the contractor provided always that the Engineer-in-Charge shall soon after the occurrence of any such emergency as may be reasonable, practicable, notify the contractor thereof in writing.

29. SECURITY REGULATIONS:

The contractors have to strictly follow the regulations of the Institute at the work site regarding entry of personnel, material etc. and any other regulation that might be enforced from time to time. All materials and articles brought by the contract to the work site shall have to declare at the security gate. Similarly no materials shall be taken out from the Institute premises without proper gate pass, which will be issued by the Engineer-in-Charge to the contractor on written request. It is to be noted that loading of contractor's materials in vehicles and trucks shall be done in the presence of Institute personnel. The contractor's representative will have to escort the materials till the security check is over.

The contractors, suppliers, vendors, workers engaged in work/business will be issued with renewable entry permit to avoid unauthorized entry in the Institute premises/site on scrutiny of applications in prescribed form.

For working on Saturdays, Sundays, Holidays and late hours even though permission will be accorded by the Engineer-in-Charge, the contractor will have to make application to the Institute and keep them informed well in advance.

The area where the proposed work is to be carried is area under the control of Security authorities of Institute. Entry to the site of work shall be through the main gate of Institute only. The contractor shall follow strictly the security regulations of the Institute at site of work regarding entry of personnel, materials etc. and other regulations of the Institute that might be enforced from time to time at the work site and also in the campus for smooth and efficient operation. The Contractor, his agents, representatives, workmen etc. and his materials, carts, trucks or other means of transport etc., will be allowed to enter through and leave from such point of entry/exit at such times, the authorities in-charge of the area at their sole discretion may permit.

The contractor, his agents and representatives are required to be in possession of the individual identity /muster cards passes. The muster cards or passes are examined by the security staff at the time entry/exit inside the Institute area and also at any time or number of times within such area.

The contractor will have to apply for entry/muster permits of likely number of labour to be engaged during the week for the workers and authorize their representatives to collect the entry permits for labour from the Institute Authority.

It will be the responsibility of the contractor to maintain the list of labourers permitted to work inside the premises a register and the representative of contractor's labour will have to issue entry pass to each labour after making necessary entry in the registers.

The contractor, his agents, representatives, workmen shall strictly observe the orders pertaining to fire precautions prevailing within the area.

In addition to the above, other regulations as may be imposed by the security authorities / Engineer-In charge shall be complied with / observed by the contractor and his workmen.

Any breach of above security regulations and rules in force from time to time will be viewed seriously. No claim whatsoever will be entertained by the department on account of the observations of the Security regulations.

Special Notes:

(a) The Contractor should submit an undertaking to assume responsibility in respect of all the workers / persons deployed by him at site. In case, if it is more than 15 days, a copy of police verification certificate in respect of those all labours / persons to be deployed at site should be furnished along with undertaking well in advance.

(b) The entry and exit of contractor's labours / workers / persons should be in presence of contractors authorized supervisor who will issue muster / entry passes/ identity card after proper entry in the muster at the main gate.

(c) It will be the responsibility of the contractor for proper safety and security of their materials including materials & laborer's for which secured advances have been given by the Institute at his own cost.

(d) The contractor should ensure that his workers / personnel should not enter in to the other area of Institute campus other than specified as site.

(e) No housing colony/ labour colony will be permitted inside Institute campus. Any person/labour will not be allowed to stay inside the Institute campus after working hours.

(f) No staff or worker of the contractor will be permitted to enter the premises without valid photo Identity card / entry pass duly attested by the Administrative officer of IPR.

30. WATCH AND WARD AND LIGHTING:

The contractor shall in connection with the works provide and maintain at his own cost all lights, guards, fencing and watching when and where necessary or as required by the Engineer-in-Charge and duly constituted authority for the protection of the workers or for safety and convenience of the public or others. The contractor shall be responsible for all damages and accidents caused due to negligence in this regard. It will be the entire responsibility of the contractor to protect the work(s) carried out by them including the fittings, fixtures and other accessories provided by them till the entire work is satisfactorily handed over to the users.

31. INSTITUTE'S DRAWINGS, SPECIFICATIONS, PROTO-TYPE ETC.:

All drawings, specifications, patterns, samples, models and proto-types furnished to the contractor by the Institute are intended to be complementary and to provide for and comprise everything necessary for the completion of work/supply and are the property of the Institute. These are not to be used for

any work or purpose other than those for which these have been provided and shall be returned to the Institute immediately on completion of work/supply in good condition.

32. CONFIDENTIAL INFORMATION:

The drawings, specifications, proto-type, samples and such other information furnished to the contractor relating to the supply/work, sub-systems/equipment etc. are to be treated as confidential which shall be held by the contractor in confidence and shall not be divulged to any third party without the prior written consent of the Institute. The contractor, therefore, binds himself, his successors, heirs, executors, administrators, employees and the permitted assignees or such other persons or agents directly or indirectly concerned with the work/supply to the confidential nature of the drawings, specifications, proto-type samples etc. It is a further condition of the contract that the contractor shall not, without prior written permission from the Institute, transmit, transfer, exchange, and gift or communicate any such confidential information, and also the component, sub assembly, products, by-products etc. pursuant to the fabrication undertaken by the contractor, to any third party.

32. (a) Patents and Patent Rights Indemnification:

All specifications, drawings, patents and such other relevant information furnished to the contractor by the Institute shall be the property of the Institute. If, during the process of execution of the contract, any improvement, refinement or technical changes and modifications are affected by the contractor, such changes shall not affect the title to the property of the Institute and all the information, specifications, drawings etc. including the improvement/modifications, affected by the contractor shall continue to be the property of the Institute. The Institute shall also have the absolute right to assign, transfer, sublet, use and transmit all such information and details to the Institute's consultants, agents and collaborators and the contractor shall not have any claim or rights whatsoever in respect of the Institute's drawings, specifications, patents, prototypes etc. even where improvement, refinement, modifications etc. were affected by the contractor.

32. (b) Endorsement to be made by the Contractor on Fabrication Drawings for the protection of Institutes Interest:

This design/drawing is the property of Institute and it must be returned with quotation or upon delivery of the materials/equipment and must not be used except with the permission of the owner.

33. Jurisdiction:

This Contract/Agreement shall be subject to the jurisdiction of courts at Ahmedabad/Gandhinagar only.

34. Engagement of Specialized Agencies:

Contractor should submit the credentials of Water Proofing, Anti Termite Treatment, HVAC works , Firefighting works & Electrical Work specialized agencies to be engaged (from the list of approved make / manufacturer / vendor) by the contractor for the approval of Engineer- In-Charge. For the approval the contractor should submit the complete details of agencies along with the credentials including their experience of similar works to be executed immediately on receipt of the work order.

35. Labour Colony/ Labour camp:

No housing colony/labour colony will be permitted inside Institute campus. Any person/labour will not be allowed to stay inside the Institute campus.

36. Temporary Fencing around Site: (Not Applicable)

~~Contractor should erect a temporary GI corrugated sheet fencing with MS framing of at least 6.0 ft. height on Periphery of the proposed construction site to restrict the entry of laborers in the existing campus from start of the work till the completion of entire work and same shall be removed after completion of work. The quoted total amount should be inclusive of the cost for the same.~~

37. Engagement of Construction Management Consultant (CMC/ PMC) for day to day supervision & project management:

Institute may engage project Management consultant (PMC) / Construction Management Consultant (CMC) for the day to day supervision, project management and other related activities pertaining to the project management and execution of work. In such case, PMC/ CMC shall be considered as an authorized representative of Engineer -in Charge. The contractor has to carry out as per instruction of PMC / CMC in addition to Engineer-In-Charge. Final Authority rests with the Engineer-In-charge of the Institute.

38. Validity of quoted Tender:

The quoted tender by the Tenderers shall be valid for a minimum period of 120 days from the date of opening of tender.

39. Contractor to maintain Site records & Registers:

The Contractor should maintain all the records pertaining to the project at site such as Daily reports , Material registers& File, Drawing Register , Labour registers, site Instruction book, Test Registers , Test Report files etc. as per instructions of EIC.

The Contractor should submit the Daily report of site activities, Labours strength, Material inward, etc. in the approved format to the EIC through e-mail as well as duly signed in hard copy duly countersigned by supervising agency of the Institute. The Contractors should also submit the photo Copy of material receipt Challans along with daily reports.

The said registers shall be handed over to EIC after the completion of works.

If the Institute demands the bill of any / all materials, the contractor should provide the photocopy of the bill (s) along with original bill for verification. Original bill shall be returned after verification.

40. Contractor to attend the meetings related to site progress:

The Contractor should attend all the periodical (Weekly or every Ten days or Fortnightly) site meetings and Progress Review meetings (Monthly) and any other the meetings related to the project as per the schedule decided by EIC at the Institute either at site / Institute for Plasma Research or at Architects office as and when decided upon at his own cost. The Necessary documents / data including progress of work etc. may be submitted by the Contractor as and when asked. The meeting shall be attended by the authorized person of Contractor.

41. INCONVENIENCE TO INSTITUTE'S ACTIVITIES:

The contractor shall not deposit materials on any site which will seriously inconvenience to any of the Institute's activities. The Engineer-in-Charge may require the contractor to remove any materials which are considered by him to be dangerous or inconvenient to the activities of the Institute or get them removed at the contractor's cost.

42. Employees Provident Funds:

The Contractor shall abide by the provisions of the Employees Provident Funds and misc. provisions act 1952. The Contractor should provide the copy of registration under the above act and ensure fulfillment of the said act in addition to all the regulations mentioned in the General Clauses of contract and contractor's Labour Regulations.

43 Environment Protection:

The Contractor should also comply following conditions related to environment protection during construction phase:

WATER:

- a) The Contractors shall make his own arrangement of water required for construction.
- b) Sewage generated during the construction phase shall be disposed off through the septic tank - soak pit.
- c) Water demand during construction shall be reduced by use of curing agents, super plasticizers and other best construction practices.

AIR:

- e) Peripheral barricading shall be done to prevent dust emission spreading outside the project premises.
- f) Water sprinkling shall be done in vulnerable areas for controlling fugitive emission.
- g) Material shall be covered during transportation to avoid the fugitive emission.
- h) The roads inside the project area and roads connected to the main road shall be paved or shall be water sprinkled to avoid the fugitive emissions during construction.
- i) The ambient air quality shall be monitored in and around the project area during construction phase.
- j) The construction materials and debris shall be properly stored and handled to avoid negative impacts such as air pollution and public nuisances by blocking the roads and public passages.

SAFETY:

- k) Structural design of the project shall strictly adhere to the seismic zone norms for earthquake resistant structures.
- l) During construction Personal Protective Equipment shall be provided to the construction workers and its usage shall be ensured and supervised.
- m) First Aid Box shall be made readily available in adequate quantity at all the times.
- n) Training shall be given to all workers on construction safety aspects.

NOISE:

- o) The overall noise level in and around the project area shall be kept well within the prescribed standards by providing noise control measures including acoustic insulation, hoods, silencers, enclosures vibration dampers etc. on all sources of noise generation. The ambient noise levels shall confirm to the standards prescribed under the Environment (Protection) Act and Rules.
- p) The noise generating equipment's, machinery and vehicles shall not be operated during the night hours and shall be maintained properly to avoid generation of high noise due to lack of wear and tear.

q) Use of diesel generator sets during construction phase shall be strictly with acoustic enclosure and shall confirm to EPA Rules for air and noise emission standards.

OTHER:

r) The safe disposal of wastewater and solid wastes generated during the construction phase shall be ensured.

s) Barricade of adequate height shall be provided on the periphery of the construction site with adequate signages.

t) Vehicles hired for bringing construction material at site shall be in good conditions and confirm to applicable air and noise emission standards and shall be operated only during day time and non-peak hours.

u) Necessary sanitary, hygiene and first aid measures shall be provided before starting the construction activities and to be maintained throughout the construction phase.

v) Adequate accommodation, drinking water, sanitary facilities, first aid center, utensils and cooking fuel shall be provided for construction workers at the site.

44 Door-Window Hardware – The Contractor to procure all the Hardware's and accessories of same make from the list of approved makes.

45 SITE TO BE CLEAN:

The contractor undertakes to have the site clean, free from rubbish to the satisfaction of the Engineer-in-Charge. All surplus materials, rubbish, etc. will be removed to the place fixed by the Engineer-in-Charge and nothing extra will be paid. Mud or debris obtained during the course of construction by way of dismantling or on completion of the various items of work or otherwise, shall be disposed off by the contractor at the low lying areas, anywhere in the project site/colony area without any extra cost to the Institute, as directed by the Engineer-in-Charge and the contractor shall not be permitted to take the dismantled materials/debris outside the Project site/Colony Area.

SECTION: 2 - (vii) PROFORMA OF SCHEDULES

Salient Governing Features of the Tender / Work

SCHEDULE 'A' :	Schedule of quantities		
Schedule of Quantities -		Attached	<i>As per price bid</i>
	Location : Institute for plasma research, Near Indira bridge, Bhat, Gandhinagar – 382 428		

SCHEDULE 'B' :		Schedule of Materials to be issued to the contractor – No materials to be supplied to the contractor.		
<i>Sr. No</i>	<i>Description of item</i>	<i>Quantity</i>	<i>Rates in figures and words at which the material will be charged to the contractor.</i>	<i>Place of issue</i>
1	2	3	4	5
1.	Grey Cement in bags		Contractor own arrangement.	-----
2.	Re-Bars for RCC		Contractor own arrangement.	-----
3.	Water for construction Purpose		Department supply on request as per conditions of contract - Free of Cost.	-----
4.	Electricity for construction purpose		Department supply on request as per conditions of contract @ Rs. 6.50 per Unit. / - Free of Cost.	-----

SCHEDULE 'C' :	Tools and Plants to be hired to the contractor		
Sr.No	Description	Hire charges	Place of issue
1	2	3	4
	NIL	NIL	NIL
Note	Labour hutments / labour camp		No labour hutment permitted at site within campus

SCHEDULE 'D'	Extra schedule for specific requirements / documents for the work, if any		Particularly for Security Regulations as per Conditions of contract
---------------------	---	--	---

SCHEDULE 'E' :	Reference to General Conditions of Contract.	As per Tender document
Name of Work:		
Estimated cost of work :		Rs. ₹ 74,68,593/-
i) Earnest money		Bid Security Declaration form needs to be submit
ii) Performance Guarantee		3 % of tendered value
iii) Security Deposit		2.5% of tendered value

SCHEDULE 'F' :**General Rules & Directions :**

Officer inviting tender :	On the behalf of Director , IPR by Chairperson I-CDC Institute for Plasma Research, Near Indira Bridge, Bhat, Gandhinagar -382428 Contact Person: Mr Prashant. Singh Officer, In-charge e- Tender. Phone No : 079- 2396 2000, 2396 2069 Fax – 079- 2396 2377
---------------------------	--

Maximum percentage for quantity of Items of work to be executed beyond which rates are to be determined in accordance with Clauses 12.2 & 12.3.	See below
---	-----------

Definitions : Conditions of Contract

15 2(v)	Engineer-in-charge	Engineer-in-Charge or his representatives who shall supervise the work
16 2(viii)	Accepting Authority	Director, Institute for Plasma Research
17 2(x)	Percentage on cost of materials and labour to cover all overheads & profits	15% (Fifteen percent)
18 2(xi)	Standard Schedule of Rates (SOR)	Delhi Schedule of Rates (DSR) -2019
19 2(xii)	Department / Institute	Institute for Plasma Research
20 9(ii)	Standard Contract Form	Item Rate Tender as per tender document

Clause - 1

i) Time allowed for submission of Performance Guarantee from the date of issue of letter of acceptance	15 days
ii) Maximum allowable extension with late fee @0.1% per day of Performance Guarantee amount beyond the period (provided in - i) above.	7 days

Clause - 2	Authority for fixing compensation under clause 2.	Chairperson I-CDC IPR
------------	---	-----------------------

Clause - 2A	Whether Clause 2A shall be applicable	NO
-------------	---------------------------------------	-----------

Clause - 5	Number of days from the date of issue of WO for reckoning date of start.	7 days
------------	--	---------------

Mile stone(s) as per table given below:

TABLE OF MILE STONE(S)

Sl. No.	Description of Milestone (Physical)	Time Allowed in days (from	Amount to be with-held in case of non-achievement of milestone
---------	-------------------------------------	----------------------------	--

		date of start) Work order	
	-	-	-
	-	-	-
	-	-	-
	-	-	-
TIME ALLOWED FOR EXECUTION OF WORK			40 Days (including monsoon period , if any)

Authority to decide:

- | | |
|--|--------------------------|
| (vi) Extension of time | : Chairperson I-CDC, IPR |
| (vii) Rescheduling of mile stones | : Chairperson I-CDC, IPR |
| (viii) Shifting of start in case of delay in handing over site | : Chairperson I-CDC, IPR |

Clause applicable - (6 or 6A):	Clause 6 for Manual Billing or Clause 6A for Computerized Billing	Clause 6A : Computerized Billing is applicable
---------------------------------------	--	---

Clause - 7	Gross work to be done together with net payment / adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment.	Monthly Running Bill
-------------------	---	-----------------------------

21 Clause - 10A:	List of testing equipment's to be provided by the contractor at hot mix plant /testing laboratory / site as required.	
	<ol style="list-style-type: none"> 1. Balances <ol style="list-style-type: none"> (i) 7 kg to 10 kg capacity, semi-self indicating type - accuracy 10 gm. (ii) 500 gm capacity, semi-self indicating type, accuracy 1 gm. (iii) Chemical balance, 100 gm capacity - accuracy- 0.1 gm. (iv) Pan balance - 5 kg. capacity - 10 gm accuracy. (v) Platform scale- 300 kg capacity. 2. Oven electrically operated, thermostatically controlled. <ol style="list-style-type: none"> (i) Upto 200°C for determination of loss on heating of bitumen. 3. Sieves as per IS 460-1962. <ol style="list-style-type: none"> (i) I.S. sieves - 450 mm of internal dia of sizes 100 mm, 80mm, 63mm, 50mm, 40mm, 25mm, 20mm, 12.5mm, 10mm, 6.3mm, 1.75mm, complete with lid and pan. (ii) I.S. sieves - 200 mm internal dia (brass frame) consisting of 2.36mm, 1.18mm, 600 microns, 425 microns, 300 microns, 212 microns, 150 microns, 90 microns and 75 microns with lid and pan. 4. Sieves shaker capable for shaking 200mm and 300mm dia sieves, electrically operated with timer. 5. Dial gauge 	

- (i) 25mm travel - 0.01mm/division.
6. Load frame-5 tones capacity, electrically operated with speed control.
 7. Aggregate impact test apparatus as per IS 2386-Part IV-1963.
 8. Compaction apparatus (Proctor) as per IS 2720-Part VII-1974.
 9. Modified ASHO compaction apparatus as per IS 2720-Part-III-1974.
 10. Sand pouring cylinder with control funnel and tube complete as per IS 2720-Part XXVIII-1974.
 11. Sampling tins with rods 100mm dia × 50mm ht., 1/2kg capacity, and miscellaneous items like moisture tins etc.
 12. Constant temperature bath for accommodating bitumen test specimen electrically operated and thermostatically controlled.
 13. Penetro-meter with automatic time controller and with adjustable weight accessories and needles as per IS 1203-1958.
 14. Oxhlet extraction apparatus complete with extraction thimbles etc.
 15. Laboratory mixer, about 0.02 cu-meter capacity, electrically operated with heating jacket.
 16. Hubbard field stability test apparatus complete.
 17. Marshall compaction apparatus as per ASTM 1559-62T, and complete with electrically operated leading unit, compaction pedestal bearing head assembly, dial micrometer, and bracket for flow measurement, load transfer bar, specimen mould (4 inch. dia) with base plate, columns, mould (4 inch, dia) with base plate, collars, specimen extracted. Compaction hammer, 4.53 kg (10lb)/457 mm (18inch) fall.
 18. Distant reading thermometers.
 19. Graduated cylinder 1000 ml. capacity.
 20. Enamel tray.

Clause - 10B(ii): Mobilization Advance

Not Applicable

Clause - 10B(iii): Plant Machinery & Shuttering Material Advance

Not applicable

Clause - 10C:

Component of labour expressed as percent of value of work

5%

Component of P.O.L. expressed as percent of value of work

5%

Clause - 10CA:Not applicable			
Sr. No	Materials Covered under this Clause	Nearest Materials (other than cement* reinforcement bars ,the structural steel and POL) for which All India Wholesale Price Index is to be followed	Base price and its corresponding period of all the materials covered under clause 10CA*
	Not applicable	Not applicable	Not applicable

***Includes Cement component used in RMC brought at site from outside approved RMC Plants, if any.**

Note: Base price for materials given above are only for regulating operation of clause 10-CA. The tenderers are requested to consider prevailing market rates while quoting the rates.

Clause - 10CC:This CLAUSE NOT APPLICABLE			
Clause 10 CC to be applicable in contracts with stipulated period of completion exceeding the period shown in next column.			This CLAUSE NOT APPLICABLE
Schedule of component of other materials, labour etc. for price escalation.			
	Component of civil (except materials covered under clause 10CA) / Electrical construction value of work:	Xm	---%
	Component of Labour	Y	---%

Note: Xm percentage should be equal to (100) – (Materials covered under clause 10CA i.e. cement, still, POL and other materials specified in clause 10CA +component of Labour)

Clause - 11:	
Specifications to be followed for execution of this work	Tender Specifications

Clause - 12: Type of Work -Maintenance Work		
12.2 & 12.3	Deviation Limit beyond which clauses 12.2 & 12.3	
	(i) Superstructure & foundation work (except items mentioned in earthwork and related items)	30 %
	(ii) Items mentioned in earth work and related items.	100%

Clause - 16:	Competent Authority for deciding reduced rates :	Chairperson I-CDC, IPR
---------------------	--	-------------------------------

Clause - 18:	List of mandatory machinery, tools & plants to be deployed by the contractor at site

Note: The list of machinery, tools & plants to be deployed by the contractor at site are minimum. The contractor shall deploy additional machinery, tool & plants in order to maintain the progress of the work without any extra cost to the department.

Clause 25	Constitute of Dispute Redressal Committee (DRC)	To be appointed by Director IPR as and when required.
------------------	---	--

	Place of Arbitration	Institute For Plasma Research (IPR), Bhat Gandhinagar- 382428 (Gujarat)
--	----------------------	---

Clause - 36(i):			Requirement of Technical Representative(s) & recovery Rate			
Sl. No.	Minimum Qualification of Technical Representative	Discipline	Designation (Principal Technical / Technical representative)	Min. Exp.	No.	Rate at which recovery shall be made from the contractor in the event of not fulfilling provision of clause 36(i).
1	Graduate (Degree)/ Diploma Engineer	Civil	Project Manager cum planning/ quality/Site/billing Engineer	2- 5	1	Rs. 15,000/-

Note: Assistant Engineer retired from Government services that are holding Diploma will be treated at par with Graduate Engineers

Clause - 42:		
(i)	(a) Schedule / statement for determining theoretical quantity of cement & bitumen on the basis of Delhi Schedule Rates----- Printed by CPWD:	Schedule/statement for determining theoretical quantity of cement & bitumen on the basis given in the tender
(ii)	Variations permissible on theoretical quantities.	
A	Cement	
	i) For works with estimated cost put to tender not more than Rs.5 Lakhs	3% plus / minus
	ii) for works with estimated cost put to tender more than Rs.5 Lakhs	2% plus / minus
b	Bitumen for All works	2.5% plus & only & nil on minus side
c	Steel reinforcement and structural steel sections for each diameter, section and category.	2.0% plus /minus
D	All other materials.	Nil

RECOVERY RATES			
S. No.	Description of Item	Rates in figures & words at which recovery shall be made from the Contractor	
		Excess beyond permissible variation	Less use Beyond permissible variation
1	Cement OPC	Nil	Rs.554/- per bag of 50 kg
2	Cement PPC	NIL	Rs.532/- per bag of 50 kg
3	Rebar's	Nil	Rs. 98/- per Kg.

SECTION: 3

Safety Codes and labour Regulations

SECTION: 3 - (i) SAFETY CODE

1. Suitable scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used, an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and hand-hold shall be provided on the ladder and the ladder shall be given an inclination not steeper than 1/4 to 1 (1/4 horizontal and 1 vertical.)
2. Scaffolding of staging more than 3.6 m (12ft.) above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached or bolted, braced and otherwise secured at least 90 cm. (3ft.) high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such opening as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
3. Working platforms, gangways and stairways should be so constructed that they should not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.6 m (12ft.) above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (2) above.
4. Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 90 cm. (3ft.)
5. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9m. (30ft.) in length while the width between side rails in rung ladder shall in no case be less than 29 cm. (11½") for ladder up to and including 3 m. (10 ft.) in length. For longer ladders, this width should be increased at least 1/4" for each additional 30 cm. (1 foot) of length. Uniform step spacing of not more than 30 cm shall be kept. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites or work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lights to protect the public from accident and shall be bound to bear the expenses of defense of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in any such suit, action or proceedings to any such person or which may, with the consent of the contractor, be paid to compensate any claim by any such person.
6. (a) Excavation and Trenching - All trenches 1.2 m. (4ft.) or more in depth, shall at all times be supplied with at least one ladder for each 30 m. (100 ft.) in length or fraction thereof Ladder shall extend from bottom of the trench to at least 90 cm. (3ft.) above the surface of the ground. The side of the trenches which are 1.5 m. (5ft.) or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5 m. (5ft.) of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.

(b) Safety measures for digging Boreholes:-
(i) If the bore well is successful .It should be safely capped to avoid caving and collapse of the bore well. The failed and the abandoned one should completely refilled to avoid caving and collapse;

(ii) During drilling, Sign boards should be erected near the site with the address of the drilling contractor and the Engineer-In-Charge of the work.

(iii) Suitable fencing should be erected around the well during the drilling and after the Installation of the rig on the point of drilling, flags shall be put 50m around the point of drilling to avoid entry of people;

(iv) After drilling the bore well, cement platform (0.50m x 0.50 m x 1.20 m) 0.60 m above ground level and 0.60 m below ground level should be constructed around well casing;

(v) After the completion of the bore well, the contractor should cap the bore well properly by welding steel plate, cover the bore well with drilled wet soil and fix thorny shrubs over the soil. This should be done even while repairing the pump;

(vi) After the bore well is drilled the entire site should be brought to the ground level.

7. Demolition - Before any demolition work is commenced and also during the progress of the work,

(i) All roads and open areas adjacent to the work site shall either be closed or suitably protected.

(ii) No electric cable or apparatus which is liable to be a source of danger or a cable or apparatus used by the operator shall remain electrically charged.

(iii) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

8. All necessary personal safety equipment as considered adequate by the Engineer-in-Charge should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate use, and the contractor should take adequate steps to ensure proper use of equipment by those concerned: - The following safety equipment shall invariably be provided.

(i) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.

(ii) Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes shall be provided with protective goggles.

(iii) Those engaged in welding works shall be provided with welder's protective eye-shields.

(iv) Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

(v) When workers are employed in sewers and manholes, which are in active use, the contractors shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into the manholes and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public. In addition, the contractor shall ensure that the following safety measure are adhered to :-

(a) Entry for workers into the line shall not be allowed except under supervision of the JE or any other higher officer.

(b) At least 5 to 6 manholes upstream and downstream should be kept open for at least 2 to 3 hours before any man is allowed to enter into the manhole for working inside.

- (c) Before entry presence of Toxic gases should be tested by inserting wet lead acetate paper which changes colour in the presence of such gases and gives indication of their presence.
- (d) Presence of Oxygen should be verified by lowering a detector lamp into the manhole. In case, no Oxygen is found inside the sewer line, workers should be sent only with Oxygen kit.
- (e) Safety belt with rope should be provided to the workers. While working inside the manholes such rope should be handled by two men standing outside to enable him to be pulled out during emergency.
- (f) The area should be barricaded or cordoned off by suitable means to avoid mishaps of any kind. Proper warning signs should be displayed for the safety of the public whenever cleaning works are undertaken during night or day.
- (g) No smoking or open flames shall be allowed near the blocked manhole being cleaned.
- (h) The malba obtained on account of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on account of slippery nature of the malba.
- (I) Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Engineer-in-Charge may decide the time up to which a worker may be allowed to work continuously inside the manhole.
- (j) Gas masks with Oxygen Cylinder should be kept at site for use in emergency.
- (k) Air-blowers should be used for flow of fresh air through the manholes. Whenever called for portable air blowers are recommended for ventilating the manholes. The Motors for these shall be vapour proof and of totally enclosed type. Non sparking gas engines also could be used but they should be placed at least 2 meters away from the opening and on the leeward side protected from wind so that they will not be a source of friction on any inflammable gas that might be present.
- (l) The workers engaged for cleaning the manholes/sewers should be properly trained before allowing to work in the manhole.
- (m) The workers shall be provided with Gumboots or non-sparking shoes bump helmets and gloves non sparking tools safety lights and gas masks and portable air blowers (when necessary). They must be supplied with barrier cream for anointing the limbs before working inside the sewer lines.
- (n) Workmen descending a manhole shall try each ladder stop or rung carefully before putting his full weight on it to guard against insecure fastening due to corrosion of the rung fixed to manhole well.
- (o) If a man has received a physical injury, he should be brought out of the sewer immediately and adequate medical aid should be provided to him.
- (p) The extent to which these precautions are to be taken depend on individual situation but the decision of the Engineer-in-Charge regarding the steps to be taken in this regard in an individual case will be final.
- (vi) The Contractor shall not employ men and women below the age of 18 years on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, the following precaution should be taken:
- (a) No paint containing lead or lead .Products shall be used except in the form of paste or readymade paint.

(b) Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint is dry rubbed and scraped.

(c) Overalls shall be supplied by the contractors to the workmen and adequate facilities shall be provided to enable the working painters to wash during and on the cessation of work.

9. An additional clause (viii) (i) of Institute Safety Code (iv) the Contractor shall not employ women and men below the age of 18 on the work of painting with product containing lead in any form. Where ever men above the age of 18 are employed on the work of lead painting, the following principles must be observed for such use:

(i) White lead, sulphate of lead or product containing these pigment, shall not be used in painting operation except in the form of pastes or paint ready for use.

(ii) Measures shall be taken, wherever required in order to prevent danger arising from the application of a paint in the form of spray.

(iii) Measures shall be taken, wherever practicable, to prevent danger arising out of from dust caused by dry rubbing down and scraping.

(iv) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.

(v) Overall shall be worn by working painters during the whole of working period.

(vi) Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.

(vii) Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by medical man appointed by competent authority of Institute.

viii) Institute may require, when necessary medical examination of workers.

(ix) Instructions with regard to special hygienic precautions to be taken in the painting trade shall be distributed to working painters.

10. When the work is done near any place where there is risk of drowning, all necessary equipment's should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision, should be made for prompt first aid treatment of all injuries likely to be obtained during the course of the work.

11. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions

(i) (a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defects and shall be kept repaired and in good working order.

(b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.

(ii) Every crane driver or hoisting appliance operator, shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding winch or give signals to operator.

(iii) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load each safe working load and the condition under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

(iv) In case of departmental machines, the safe working load shall be notified by the Electrical Engineer-in-Charge. As regards contractor's machines the contractors shall notify the safe working load of the machine to the Engineer-in-Charge whenever he brings any machinery to site of work and get it verified by the Electrical Engineer concerned.

12. Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Hoisting appliances should be provided with such means as will reduce to the minimum the risk of accidental descent of the load. Adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided. The worker should not wear any rings watches and carry keys or other materials which are good conductors of electricity

13 All scaffolds ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.

14. These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.

15. To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Labour Officer or Engineer in Charge of the department or their representatives.

16. notwithstanding the above clauses from (1) to (15) there is nothing in these to exempt the contractor from the operations of any other Act or Rule in force in the Republic of India.

SECTION: 3 - (ii) SAFETY WITH SCAFFOLDINGS:

INTRODUCTION:

1. Following paragraphs deals with the safety regulations and precautions to be followed in the construction use, maintenance, etc. of scaffolds. This will serve as a guide to users of scaffolds in the construction and maintenance operation.
2. Suitable scaffolds are used for performing work that cannot be done from the ground, part of a permanent structure a ladder or other available means of support.

Scaffolds are used in many construction and maintenance operations. Fall of person is the most common hazard accompanying the use of scaffolds because of the height usually involved.

1. General Requirements:

- 1.1 Every scaffold and its supporting members should be designed to support given load, with a safety factor of at least four. No alterations should be made that might impair the strength of such structures, no improvised, make-shift or substandard scaffold should be permitted even for the most temporary use.
- 1.2 All work in connection with such structures, including construction, alteration and removal should be carefully done under the direction and supervision of persons who have had experience in such works.

2. Materials of Construction:

- 2.1 Every scaffold and every part thereof, including supports, should be of good construction, sound material, of adequate strength for the purpose which it is meant to be used and should be properly maintained. Planks should be laid flat with an overlap, lengthwise, of at least 30 cm. with the center of the overlap directly over a bearer. Boards and planks used for the floors should be of uniform thickness, closely laid and securely fastened in place.
- 2.2 All lumber used in the construction of scaffolds should be sound, straight-grained, free from cross-grains, shakes and loose or dead knots. It should also be free from dry rot, large checks, worm holes, or other defects impairing its strength or durability.
- 2.3 All nails used in the construction of scaffolds, staging and supports should be of ample size and used in sufficient quantities at each connection to develop the designed strength of scaffold. Nails should penetrate to the holding piece to a depth of at least 12 times the diameter of nail.
- 2.4 Barrels, boxes, loose tile blocks, loose piles of bricks or other unstable objects should not be used to support planks used as working platforms.

3. Platforms, Railings and Tee-Boards:

- 3.1 The minimum uniformly distributed design load per Sq. m. of platforms should be 250 kg. Any concentrated load at any point in the span should not exceed the designed uniformly distributed load. Planks should not be less than 50 mm thick.
- 3.2 The rear of outer side of every scaffolding, platform and ramp more than 2M above the surrounding ground or solid construction, or adjacent to deep holes, excavations, railroad tracks, high tension electrical wires, should be provided with a substantial guard rail of standard construction consisting of top and

intermediate rails, and toe-boards all supported by posts and securely connected to scaffold at intervals of not more than 2.4 M (See figure - 1).

3.3 The width of the scaffolds should be such as to provide a clear walkway 50 cm. wide. If part of the width of scaffold is to be used for keeping materials such as brick, mortar or lumber, the scaffold should be made wider so as to provide a walkway of the required width.

3.4 Where scaffolds are erected over sidewalks or over areas in which persons must work or pass, the space between the railing and toe-board should be fitted with side screens.

3.5 There should be a screen or other protection suspended from the scaffold to catch materials that may fall from above. Screens should extend beyond the edge of the scaffold to catch any materials that may fall over the edges.

4. Means of Access:

4.1 A safe and convenient means of access should be provided to the platform or scaffold. This requirement does not apply to swinging scaffolds or those with convenient access from adjacent floors (see figure - 2). Means of access may be a portable ladder. Fixed ladder, ramp or it may be a stairway. The use of cross braces or frame work as means of access to the working surface should not be permitted.

4.2 If scaffolds are to be used to a great extent or for a long period of time, a regular plank stairway, wide enough to allow two persons to pass, should be erected. Such stairways should have handrails on both sides.

4.2.1 No stairway or run of slope exceeding 2 in 3 should be used.

4.2.2 Where the slope of a stairway or run renders additional foot hold necessary, and in every case where the slope is more than 1 in 4, there should be provided proper stepping laths which should:

(a) Have a minimum section of 50 x 30 mm and be placed at maximum interval of 45 cm and

(b) Be of length to cover the full width of the stairway of run except that they may be interrupted over a width of not more than 10 cm to facilitate the movement of barrows.

5. Overhead Protection:

5.1 Overhead protection should be provided on the scaffold whenever persons are working at higher places. This protection should be not more than 3m above the scaffold floor and should be of planks or other suitable materials.

6. Use of Scaffolds:

6.1 Good housekeeping should be maintained at all times upon scaffolding, platforms and ramps. Excessive storage of materials thereon should be avoided. Care must be taken to avoid accumulating of small objects, such as boards, tools, pieces of reinforcing steel, waste concrete which may easily be disturbed or knock off. Hand rails should be kept in good repair and securely nailed or otherwise fastened down. Scaffold should be cleared of all tools, materials and rubbish at the end of each working day/shift.

6.2 Persons should not be permitted on scaffolds when the platform or guard rails are slippery. Persons should not be permitted to work on scaffolds during a storm or strong winds.

6.3 Suspended scaffolds should never be used for the storage of stone or heavy materials. Two or more swinging scaffolds should not at any time be combined into one by bridging the distance between them with planks or any other form of connection. Life lines securely fastened from above should be provided for each person working on a swinging scaffold. Safety belts should be tied to the life lines (See figure - 3).

7. Inspection:

7.1 As scaffolds have to remain in position normally for many weeks, they must be inspected at least once a week to make sure that nothing has gone wrong since erection. In addition, they must always be inspected after a spell of bad weather which might have affected their stability.

7.2 The inspections must be carried out by someone who knows the faults to look for and how they may be put right. It is important to know that the work of inspection has been completed and what faults have been found, the results of each Inspection must, therefore be recorded. Any scaffold damaged or weakened from any cause should be immediately repaired and persons should not be allowed to use it until repairs have been completed.

8. Dismantling:

8.1 The dismantling of scaffold should be carefully done under experienced supervision. Care should be taken not to drop small, loose objects when removing scaffold planks. All nails should be promptly removed from scaffold planks and the planks safely piled.

9. Precautions against particular Hazards:

9.1 Care should be taken to see that no un-insulated electric wire exists within 3M. Of the working platform, stairway etc. of the scaffold.

9.2 While carrying bars, rods or pipes of any conducting material of length greater than 3 M. in the vicinity of electric wires, special care should be taken that these bars do not touch the electric wires.

9.3 Care should be taken against any possibility of wooden scaffold catching fire. In suspended scaffolds, if a blow torch or other flame is used for removing paints, only wire ropes not less than 10mm in diameter should be used.

9.4 Care should be taken to see that no part of a scaffold is struck by a truck or other heavy moving equipment and no material should be dumped against it.

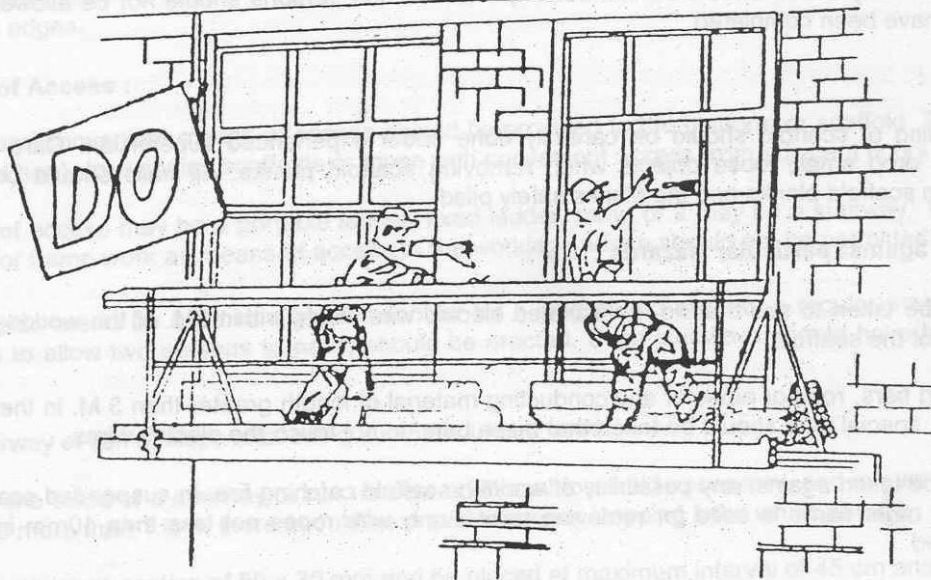
9.5 Scaffolds on thoroughfare should be provided with light.

9.6 Access to cable tunnels, hydrants, etc. should remain free at all times.

9.7 Care should be taken from damaging underground cables and equipment. This is especially important when parts of scaffolds for other fasteners have to be driven in the ground.

• GUARD RAILS •

THE REAR ON OUTER SIDE OF THE SCAFFOLD SHOULD BE PROVIDED WITH A SUBSTANTIAL GUARD RAIL OF STANDARD CONSTRUCTION



PERSONS SHOULD NOT BE ALLOWED TO WORK ON SCAFFOLDS WHERE THE EDGES ARE UNGUARDED. A SLIGHT SLIP WILL RESULT IN SERIOUS INJURY OR EVEN DEATH

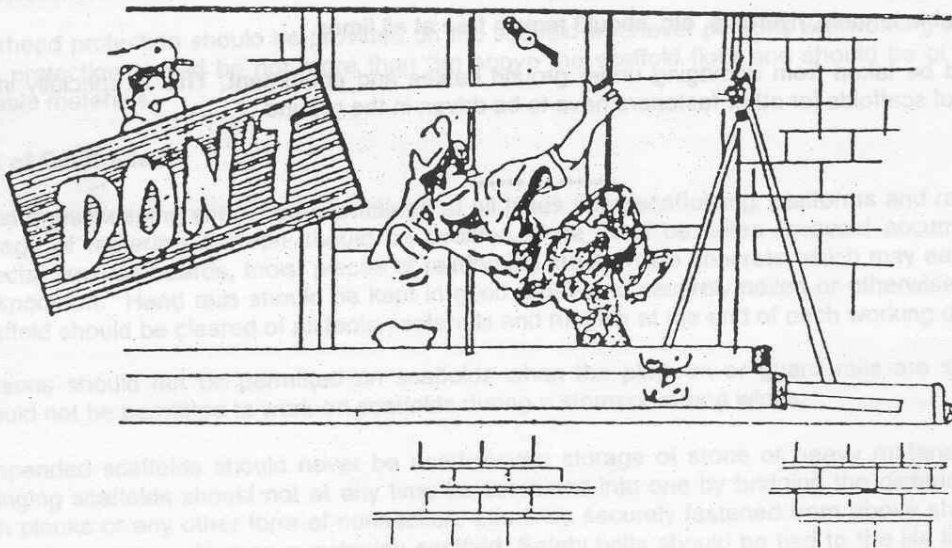
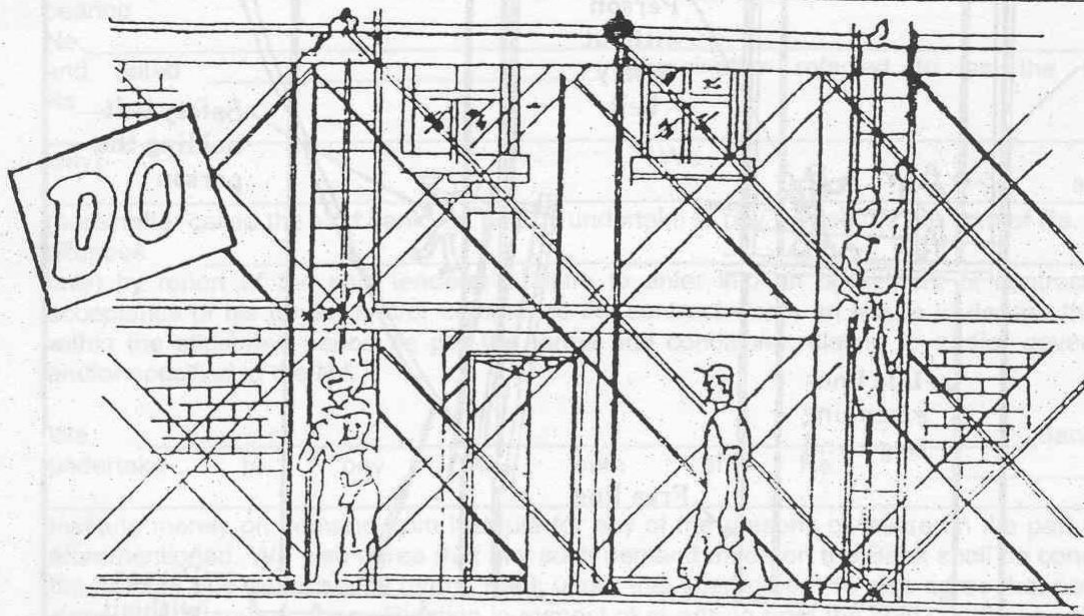


FIGURE — 1

FROM INDUSTRIAL SAFETY CHARTS-US DEPT. OF LABOUR.

• ACCESS •

A SAFE CONVENIENT MEANS OF ACCESS SHOULD BE PROVIDED TO THE SCAFFOLD



THE USE OF CROSS BRACES OR FRAME WORK AS MEANS OF ACCESS TO THE WORKING SURFACE SHOULD NOT BE PERMITTED

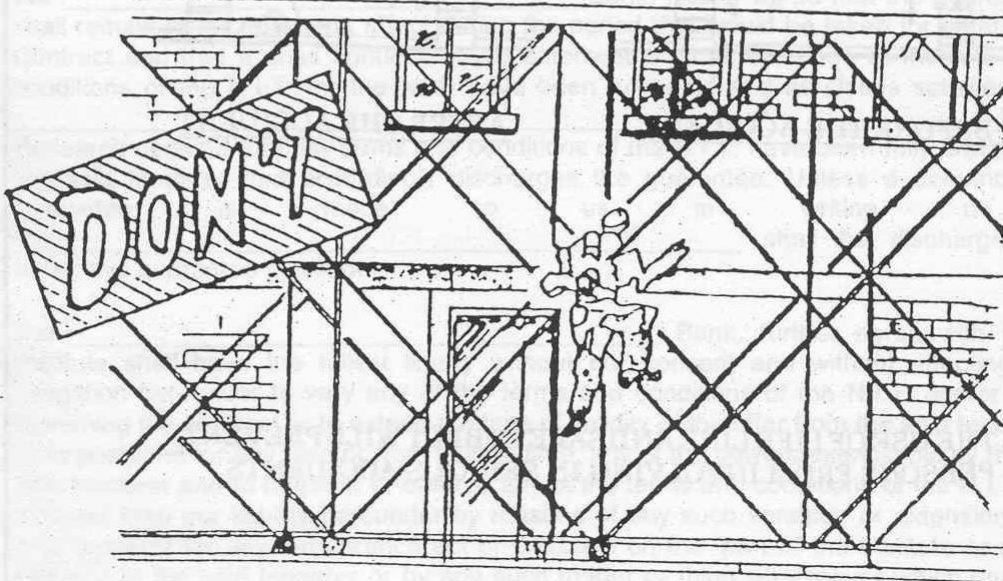
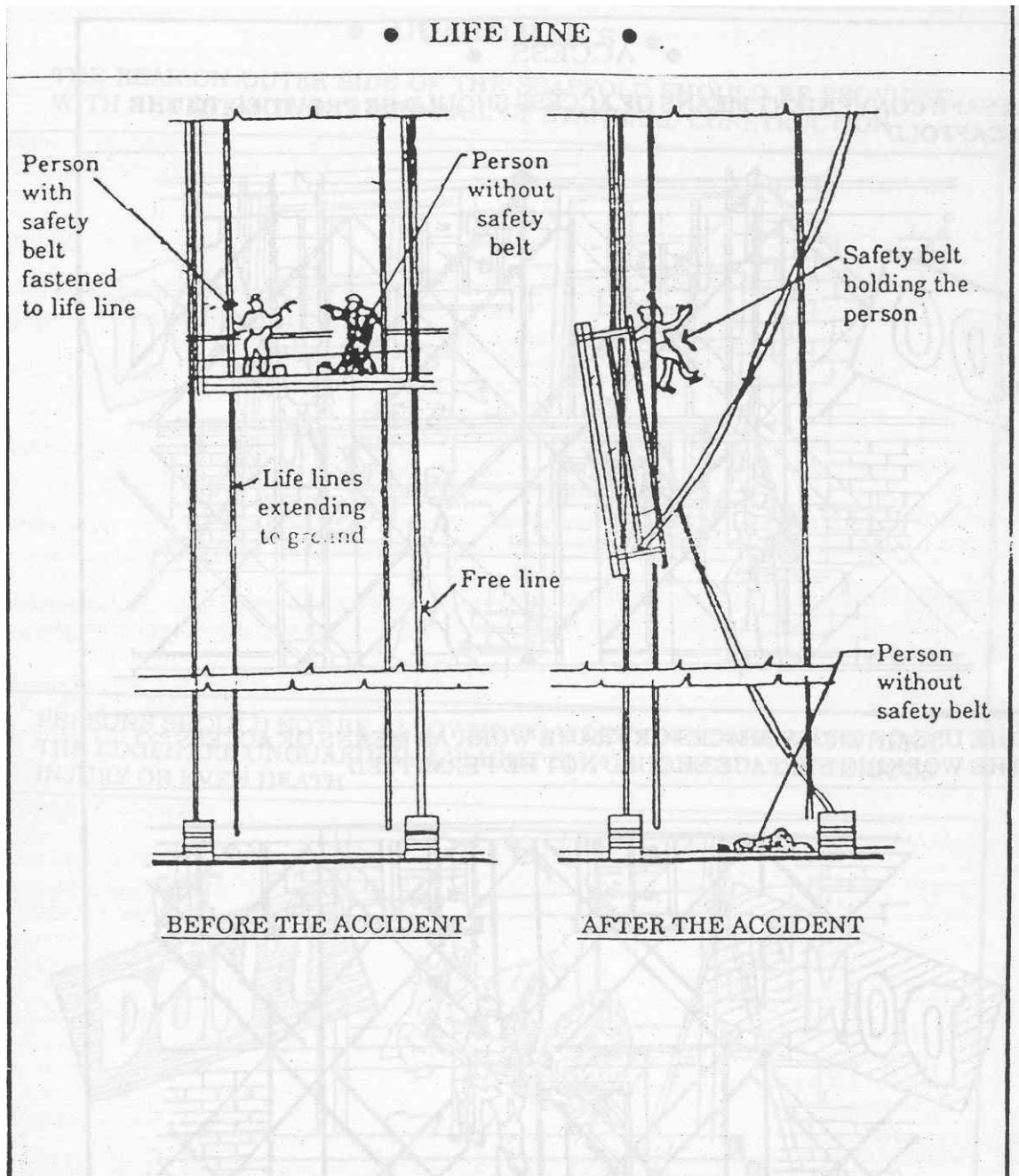


FIGURE — 2

FROM INDUSTRIAL SAFETY CHARTS-US DEPT. OF LABOUR.


• LIFE LINE •



**THE USE OF LIFE LINE AND SAFTEY BELT WILL PREVENT
PERSON FORM INVOLVING IN SERIOUS ACCIDENT**

SECTION: 3 - (iii) IPR Additional Safety Code

Note: In case of discrepancy between Safety code, Safety with Scaffolding and IPR Additional Safety code, the stringent one shall be followed.

	INSTITUTE FOR PLASMA RESEARCH	Revision: 00
	SAFETY PROTOCOL FOR CONTRACTORS OF CIVIL/CONSTRUCTION AND OTHER RELATED ACTIVITIES	Eff. Date: 20.03.2014

1. PURPOSE:

The purpose of this protocol is to establish, implement and execute a safe and effective program for the prevention of incidents that may cause injury to persons or damage to the property. The specified responsibilities remain with the contractor for compliance.

1. SCOPE:

1.1 This protocol shall be considered minimum requirements necessary for all works performed inside the Institute for Plasma Research (IPR) and associated centers/units/departments.

1.2 All the contractor while at IPR and associated centers/units/departments work site are required to ensure that themselves, their workers and employees, sub-contractors, suppliers, vendors and visitors, must comply with the provisions of this protocol.

1.3 The contractor shall review and educate their workers and employees about the stipulations of this protocol.

1.4 This protocol is in addition to the responsibility of the contractor towards safety, health and environmental compliance envisaged under law, code or statutory requirements.

2. PROTOCOL:

2.1 The contractor has to provide appropriate Personal Protective Equipment's (PPE) like safety shoes, safety helmets, goggles, hand gloves, full body safety harnesses, etc. as required for safety of themselves, their workers and employees, sub-contractors, suppliers, vendors and visitors at site. All PPE must conform to relevant Indian and/or International Standards. These should be maintained in recommended condition by suitable storage, maintenance and inspection. IPR shall have right to examine the PPE and determine their suitability, reliability, acceptability and adaptability.

2.2 The contractor shall provide and maintain proper illumination, fencing, guards, stairs, ladders, scaffolding, warning signs, caution boards, etc. As required to ensure safe working conditions at site.

2.3 The contractor shall ensure that all floor and wall openings are fixed and properly guarded/barricaded during the course of work and at the end of each day's work with appropriate caution board.

2.4 The contractor must adhere to the requirements of Safety, Health and Environment (SHE) Policy of IPR, salient features of which are:

- Continual improvement in its Safety, Health & Environment Performance,
- Conservation of natural resources,
- Waste minimization,

- d. Compliance with applicable statutory and regulatory requirements,
- e. Creating safety & environmental awareness to its employees and associates.

2.5 The contractor has to ensure to employ only persons who are medically fit and having sufficient skills for execution of work. The contractor must ensure efficient job supervision through educated, qualified, experienced and responsible supervisors to ensure safety at site.

2.6 All staff persons including workers must undergo Safety Induction Training prior to depute them at IPR and associated centers/units/departments for any kind of work. Training module may include video film, clippings, photographs etc. related to work execution. In addition to this, Job specific training must be imparted to the concerned workers periodically.

2.7 The contractor has to ensure that Daily Tool Box Talk shall be conducted at least for new workers by responsible work in-charge/supervisor for each activity and its record to be maintained.

2.8 The contractors themselves, their workers and employees, sub-contractors, if any, shall comply with the instructions given by the Safety Officer or his authorized nominee or IPR's representative regarding safety precautions, protective measures, housekeeping requirements, etc. IPR shall have the right at its sole discretion to stop the work, if the work is being carried out in such a way that it may cause accidents or harm to the workers or damage to the equipment's. Contractor shall get the unsafe condition removed and report to IPR.

2.9 The contractor shall have no right to claim any damages/compensations for stoppage of work due to safety reasons as provided in para 3.8 .The period of such stoppage of work will not be taken as an extension of time for completion of work or exemption from liquidated damages/compensation delay.

2.10 The contractor should ensure that water, fuel and energy are used judiciously. The water & power points must be closed / put off when not in use.

2.11 Good housekeeping practices must be followed strictly.

2.12 All equipment's used for construction, fabrication and assembly work, etc. by the contractor must meet Indian/International standards. In case such standards do not exist, the contractor must ensure these to be absolutely safe. All equipment's shall be strictly operated and maintained in accordance with manufacturers' operation manual and safety instructions.

2.13 The contractor must not interfere or disturb electric, fuses, cables and other electrical equipment's belonging to IPR or another agency under any circumstances whatsoever unless expressly permitted in writing by IPR.

2.14 Contractor shall arrange adequate facilities for first aid, medical aid and treatment for his staff and workers engaged at the work site.

2.15 The contractor has to fully be responsible for the behavior and conduct of themselves, their workers and employees and sub-contractors. Any cost of loss or damage to client's property caused by contractor's employees or workers will be recovered from the contractor.

2.16 In case of any accident that occurs during the maintenance/ fabrication/erection or associated activities undertaken by the contractor thereby causing any minor or major or fatal injury to themselves,

their workers and employees, sub-contractors due to any reason, it shall be the responsibility of the contractor to promptly inform IPR's Work in-charge and Safety Officer in prescribed form of IPR. This should also be informed to statutory authority, if required, under the applicable laws. The contractor shall maintain a register of accidents.

2.17 In case the contractor fails to fulfill statutory requirements, IPR shall have the right to withhold contractors payments till the requirement are fulfilled.

2.18 The contractor shall plan his activities so as to avoid interference with the assignments of other departments and contractors at the site. In case of any interference, necessary coordination must be sought by the contractor from IPR for safe and smooth working.

2.19 All necessary precautions shall be taken to prevent outbreak of fires at the site. Adequate provisions or as recommended by Safety Officer of IPR must be made by the contractor to extinguish fires.

2.20 The contractor shall issue photo identity card for themselves, their workers and employees, sub-contractors to be deployed at site. They are required to be displayed prominently during the period of their stay within IPR and associated centers/units/departments.

2.21 The contractor shall obtain gate pass from IPR and associated centers/units/departments for entries and exists of all materials and equipment's.


2.22 Smoking and eating/chewing of tobacco is strictly prohibited at site.

2.23 Any person under the influence of any intoxicating beverage, even to the slightest degree shall not be permitted at work site.

2.24 Person below the age of 16 years must not be employed for any work at site. But, it is always suggested to employ the person of minimum 18 years old.

2.25 IPR may from time to time, add or amend to these protocols and issue directions.

2.26 The contractor shall comply with Safety Instructions as laid down in as per Annexure-I.

	INSTITUTE FOR PLASMA RESEARCH	Revision: 00
	SAFETY INSTRUCTIONS FOR CONTRACTORS OF CIVIL/CONSTRUCTION AND OTHER RELATED ACTIVITIES	Eff. Date: 20.03.2014

CONTENTS

SR. NO.	TITLE
1.	GENERAL INFORMATION
2.	ROLE OF THE CONTRACTOR
2.1	Top Management of the Contractor
2.2	Contractor Safety Officer, Safety Supervisor and/or Job Supervisor
2.3	Contractor Employees
3.	PENALTY FOR NON-COMPLIANCE
4.	PROVISION FOR SAFETY SUPERVISOR/SAFETY OFFICER OF CONTRACTOR
5.	GENERAL SAFETY PROVISIONS
5.1	Personal Protective Equipment
5.2	Electricity
5.3	House Keeping
5.4	Fire Safety
5.5	Scaffolding
5.6	Excavation, Trenching and Earth Removal
5.7	Concreting
5.8	Demolition
5.9	Welding and Gas Cutting
5.10	Grinding
5.11	Painting
6.	REPORTING FORMS
6.1	Near Miss Reporting Form
6.2	Incident Reporting Form

1. GENERAL INFORMATION

- 1.1** The purpose of safety instruction document is to establish, implement and execute a practical and effective method for preventing accidents, injuries and property damage.
- 1.2** This document will help contractors and their associates to recognize, evaluate and control hazardous activities within their areas of responsibility.
- 1.3** This document defines the procedure with which safety practice will be administered, identifies responsibilities and ensures control of work area safety.
- 1.4** Contract agreement signed with contractors and the provisions of this document are intended to complement each other to ensure safe working conditions.
- 1.5** The provisions of this document apply to IPR and associated centers/units/departments.
- 1.6** Throughout this document, reference to a contractor means the contractor's company and the associated subcontractors, consultants, vendors and suppliers. Reference to contractor's management means personnel responsible for managing, supervising or directing contract activities and employees.
- 1.7** Non-compliance of this document is treated as non-compliance of contract agreement that may result in warning/penalty. Willful or repeated non-compliance may result in contractor dismissal and contract termination.
- 1.8** This document for contractors is a supplementary document to statutory rules, codes and regulations having jurisdiction, and does not negate, abrogate or minimize any provisions of these rules, codes and regulations. It is intended to supplement and enforce the individual program of the contractor and to coordinate the overall safety effort. Contractors are responsible for the safety and health of their employees, subcontractors, consultants, vendors, suppliers, and visitors while in IPR and associated centers/units/departments.
- 1.9** Contractor's managers and supervisors are responsible for preventing incidents or conditions that could lead to incidents, injuries, illness or fatalities. The ultimate success of the safety program depends on the cooperation of everyone. The contractor's management must ensure that safety provisions are enforced and that effective training and education programs are employed.

2. ROLE OF THE CONTRACTOR

2.1 Top Management of the Contractor

The commitment of top management of the contractor towards safety is very important. Top management needs to ensure the following:

- 2.1.1** To implement safe methods and practices, deploy appropriate machineries, tools & tackles, experienced supervision and skilled workforce, etc. required for execution.
- 2.1.2** To ensure that employees and workers deployed are physically and mentally fit. They should possess requisite skill, qualification, experience etc.
- 2.1.3** To deploy qualified and trained safety supervisor, safety officers and/or safety manager reporting to site In-charge for supervision, co-ordination and liaison for the implementation of safety.
- 2.1.4** To ensure that the employees and workers have appropriate health and safety training. The certification of such training should be produced for verification, on demand.
- 2.1.5** To obtain all necessary and applicable licenses, permits, and insurance policy of his employees and workers before executing any work. A copy of the same must be submitted to the relevant authority at IPR.
- 2.1.6** To ensure that all incidents (minor/major injuries, fatality, fire, property damage etc.) including near misses shall be reported to the relevant authority at IPR immediately verbally as well as in written format of IPR. Also, keep record for the same.

- 2.1.7 The liability for any compensation on account of injury sustained by an employee of the contractor will be exclusively that of the contractor.
- 2.1.8 To provide personal protective equipment's required for the safety and first-aid kits at worksite.
- 2.1.9 To maintain appropriate records of all employees and workers deployed to carry out the work at site.
- 2.1.10 Contractor shall not employ any labour below 18 years of age.
- 2.1.11 A photo gate pass duly approved by IPR administration shall be issued by the contractor to their personnel, employees, subcontractors, etc.
- 2.1.12 To co-operate with all the security arrangements of IPR.
- 2.1.13 Contractor may ask for clarifications required in safety related issues, whenever a need arises.
- 2.1.14 To follow and implement all the safety rules and regulations of the local bodies, state, national and international. Contractor shall also comply with all the statutory requirements and notifications, as applicable, in relation to employment of his employees issued time to time by the concerned authorities.

2.2 Contractor Safety Officer, Safety Supervisor and/or Job Supervisor

The duties and responsibilities of the contractor safety officer, safety supervisor and/or job supervisor shall include the following:

- 2.2.1 To assess the hazards associated with work at site in consultation with all concerned and establish safe working procedure.
- 2.2.2 To establish a written records of factors that can cause injuries, illness or other safety related problems.
- 2.2.3 To undertake routine/surprise inspections of all work sites to ensure compliance with safety standards, codes, rules, regulations and orders applicable to the work concerned.
- 2.2.4 To check whether the proposed working arrangements/procedures are safe and satisfactory, particularly at the interface between contractors planned work and IPR facilities.
- 2.2.5 To ensure that required guards and protective equipment are provided, used and properly maintained.
- 2.2.6 To ensure that the workers understand the working procedures for carrying out the work safety and the hazards that may be encountered.
- 2.2.7 To take immediate actions to correct any violation of safety rules observed or reported.
- 2.2.8 To ensure that appropriate warning signboards and tags are displayed.
- 2.2.9 To report each incident and/or injury in accordance with established procedures and assists during investigation.
- 2.2.10 To arrange tool box meeting daily and shall continue this process to make workmen safety conscious. To keep a constant liaison with the relevant authority at IPR on safety issues.

2.3 Contractor Employees

The duties & responsibilities of the contractor employees should include the following:

- 2.3.1 The contractors' employees must be trained for safety standards, procedure to carry out high risk job (if involved), use of Personal Protective Equipment's (PPEs) in general and specific for a particular job, emergency preparedness and fire extinguisher and medical first-aid.
- 2.3.2 To perform work safely as per the job requirements/instructions and wear appropriate PPEs.
- 2.3.3 To inform promptly to their management regarding all work related incidents resulting in personal injury, illness and/or property damage, etc.

2.3.4 To take all necessary and appropriate safety precautions to protect themselves, other personnel and the environment.

3. PENALTY FOR NON-COMPLIANCE

The following penalties shall be imposed on the contractor by the IPR and shall be deducted from his running/final bill.

Sr. No.	Non-Compliance/Violation of Safety Protocols/Rules/Norms	Penalty
1.	Non-use of PPE like Safety Helmet / Safety Shoes etc.	Rs. 100 per day/person
2.	Over speeding (> 30Km/Hr.) / rash driving or improper parking	Rs. 100 per occasion
3.	Non-use ELCB/MCB, Use of non-standard socket, poor cable joint, laying wire/cables on floor, non-use of socket, electrical jobs by incompetent person	Rs. 200 per day/case
4.	Working at height without full body safety harness, using non-standard scaffolding and not arranging fall protection arrangement	Rs. 500 per day/case
5.	Handling of compressed gas cylinders without trolley and double gauge regulator, Improper keeping/storage of gas cylinder	Rs. 200 per day/case
6.	Use of domestic LPG for cutting purpose.	Rs. 200 per day/case
7.	No fencing/barricading of excavated/open areas.	Rs. 200 per day/case
8.	No provision of firefighting equipment during hot works. Use of firewater for purpose other than firefighting.	Rs. 200 per day/case
9.	No reporting of Nearmiss/First-aid/Injury/Property damage/Minor fire etc. incidents	Rs. 500 per case
10.	Poor Housekeeping	Rs. 200 per day/case
11.	No deployment of safety officer/safety supervisor responsible for safety at work site as mentioned in Chapter No. 5	Rs. 500 per day

Safety Officer or any other officer authorized by IPR will report safety violation to the concerned Engineer In-charge for imposing necessary penalty. Engineer-in-charge shall ensure that the penalty amount has been deducted from the running bill of contractor. Imposing any penalty for violation of safety norms does not absolve the contractors from their contractual obligation/ responsibility. Contractor shall be fully responsible for any accident and/or injury to their employees or property due to violation of safety norms.

4. PROVISION FOR SAFETY SUPERVISOR/SAFETY OFFICER OF CONTRACTOR

The contractor shall depute at least one Safety Supervisor / Safety Officer for critical activities as follows,

- Any excavation more than 1.5 mtr. depth
- Work at height (working beyond 2.5 mtr. above ground)
- Materials and Material Handling which includes movement of material by crane, movement of tractor trolley on slopes, etc.
- Working near high voltage lines, electrical installations, etc.
- Painting at height (beyond 2.5 mtr. above ground) and painting at confined space

In addition to above list, IPR may also recommend for some specific tasks, which are not covered, to depute Safety Officer/Safety Supervisor.

Safety supervisor shall be qualified of minimum Diploma in Engineering/ Graduate in Science with approved course in the field of safety and/or fire. He shall able to read and understand English and speak regional/national language. He shall have experience as safety supervisor for a period of minimum one year.

Safety Officer shall be qualified of minimum Bachelor in Engineering/ Post Graduate in Science with approved course in the field of Safety and/or Fire. Safety Officer shall have good communication and written skill to liaison with the client. He shall have good command in English and regional/national language. He shall have experience for a period of minimum three years of supervisory level.

5. GENERAL SAFETY PROVISIONS

5.1 Personal Protective Equipment

The contractor is responsible to provide all necessary standard make (ISI marked) personal protective equipment (PPE) suitable to give sufficient protection against hazards involved in their work / job to their employees, as per the job requirement and insist/enforce their staff to put on the same while atworks and ensure that the PPEs are properly used and maintained in a condition suitable for immediate use. The contractor shall have sufficient stock of various PPEs to avoid any shortage of supply and shall take adequate steps to ensure proper use of equipment by those concerned. The ongoing work is liable to be stopped at any time if the contractor's staff is found working without PPEs.

- 5.1.1 All persons employed at site shall use safety helmets. For other types of works, persons working in that area shall also use safety helmets, if advised by Safety Engineer/Engineer-In-Charge.
- 5.1.2 Persons engaged in welding and gas-cutting works shall use suitable welding face shields. The persons who assist the welders shall use suitable goggles. Protective goggles shall be worn while chipping and grinding.
- 5.1.3 All persons working at heights more than 2.5 m above ground or floor and exposed to risk of falling down shall use full body safety harness, unless otherwise protected by cages, guard railings, etc. In places where the use of safety harness is impractical, suitable net of adequate strength fastened to substantial supports shall be employed.
- 5.1.4 When workers are employed in sewers and inside manholes, which are in use, the Contractor shall ensure that the manholes are opened and are adequately ventilated at least for an hour. After it has been well ventilated, the atmosphere inside the space shall be checked for the presence of any toxic gas or oxygen deficiency and recorded in the register before the workers are allowed to get into the manholes. The manholes opened shall be cordoned off with suitable railing and provided with warning signals or caution boards to prevent accidents. There shall be proper illumination in the night.
- 5.1.5 The following is the list of various PPEs to be used for various works/worksites,

List of Safety Equipment's

Sr. No.	PPE	Purpose
01	Industrial Safety Helmet	For protection of head against falling objects or during fall of person from height.
02	Safety Goggles (Grinding, Welding, etc.).	For protection of eyes against flying particles / dust, chemical splash, spark, arc, flashover etc.
03	Face shield	For protection of face against flying particles / dust, chemical splash, spark, arc, flashover etc.
04	Ear plug / Ear muffs	For ear / hearing system protection while working in high noise level area.
05	Apron(PVC / cry/Cotton)	For body protection against chemicals, oils, cryogenics, sharp edged objects, heat, hot objects etc.
06	Gloves (Nitrile/Leather, cry, Electrical shock proof)	For protection of hands against chemicals, oils, cryogenics, sharp edged objects, heat, hot metals/objects, electricity etc.
07	Safety Shoes	For protection of leg/feet against falling objects, sharp edged objects, heat, hot metals/objects, electricity etc.
08	Full body safety harness/I Rope /Life line/ Fall prevention system etc.	For fall prevention while working at heights or in depth, working in vessel or in confined space.
09	Dust Respirator	Protection of respiratory system against dust.
10	Self-contained breathing apparatus (SCBA) set	Working in oxygen deficient areas.

5.2 Electricity

The following are provided for general guidance of the Contractor and shall be read as specific requirement, in addition to complying with Indian Electricity Act, Indian Electricity Rules and IS Specifications.

- 5.2.1 Only qualified electricians familiar with code requirements are allowed to perform electrical work.
- 5.2.2 Employees are not permitted to work near an unprotected electrical power circuit unless they are protected against electrical shock by de-energizing the circuit and grounding it, or are protected by effective insulation or other means, and are wearing .required personal protective equipment.
- 5.2.3 The electric power supply will be generally made available at one point in the works site of the contractor by the IPR.
- 5.2.4 All three phase equipment shall be provided with double earthing. All light fixtures and portable equipment shall be effectively earthed to main earthing.
- 5.2.5 All earth terminals shall be visible. No gas pipes and water pipes shall be used for earth connection. Neutral conductor shall not be treated as earth wire.
- 5.2.6 The contractor shall not connect any additional load without prior permission of IPR.
- 5.2.7 Joints in earthing conductors shall be avoided. Loop earthing of equipment shall not be allowed. However tapings from an earth bus may be done.
- 5.2.8 Electrical equipment and installations shall be installed and maintained as to prevent danger from contact with live conductors and to prevent fires originating from electrical causes like short circuits, overheating etc. Installation shall not cause any hindrance to movement of men and materials.
- 5.2.9 Materials for all electrical equipment shall be selected with regard to working voltage, load and working environment. Such equipment shall conform to the relevant standards.

- 5.2.10 Electric fuses and/or circuit breakers installed in equipment circuits for short circuit protection shall be of proper rating. It is also recommended that high rupturing capacity (HRC) fuses be used in all circuits. For load of 5 KW or more earth leakage circuit breaker of proper rating shall be provided in the circuits.
- 5.2.11 Wires and cables shall be properly supported and approved method of fixing shall be adopted. Cables shall not be left on floor/ground. Loose hanging of wires & cables shall be avoided. Lightning and power circuits shall be kept distinct and separate.
- 5.2.12 Reinforcement rods or any metallic part of structure shall not be used for supporting wires and cables, fixtures, equipment, earthing etc.
- 5.2.13 All cables and wires shall be adequately protected mechanically against damages. In case, the cable required to be laid underground, it shall be adequately protected by covering the same with bricks, Plain Cement Concrete (PCC), tile or any other approved means.
- 5.2.14 All armored cables shall be properly terminated by using suitable cable glands. Multi-stranded conductor cables shall be connected by using cable lugs/ sockets. Cable lugs shall preferably be crimped. They shall be of proper size and shall correspond to the current rating and size of the cable. Twisted connections will not be allowed.
- 5.2.15 All the Distribution Boards, Switch Fuse units, Bus bar chambers, ducts, cubicles etc. shall have MS enclosures and shall be dust, vermin and waterproof. The Distribution Boards, switches etc. shall be so fixed that they shall be easily accessible.
- 5.2.16 The Contractor shall provide proper enclosures/covers of approved size and shape for protection of all switch boards, equipment etc. against rain.
- 5.2.17 Isolating switches shall be provided close to equipment for easy disconnection of electrical equipment or conductors from the source of supply, when repair or maintenance work has to be done.
- 5.2.18 All connections to lighting fixtures, starters or other power supplies shall be provided with PVC insulated, PVC sheathed twin/three/four core wires to have better mechanical protection for preventing possible damage to equipment or injury to personnel. Taped joints shall not be allowed and the connections may be made in looping system. Electric starter of motors, Switches shall not be mounted on .wooden boards. Only sheet steel mounting or iron framework shall be used.
- 5.2.19 Only PVC insulated and PVC sheathed wires or armored PVC insulated and sheathed cables shall be used for external power supply connections of temporary nature. Weatherproof rubber wires shall not be used for any temporary power supply connections. Taped joints in the wires shall not be used.
- 5.2.20 All portable appliances shall be provided with three-core cable and three-pin plug. The third pin of the plug shall invariably be earthed. It shall be ensured that the metal part of the equipment shall be effectively earthed.

5.3 House Keeping

- 5.3.1 The Contractor shall at all times keep his work spot, site office and surroundings clean and tidy from rubbish, scrap, surplus materials and unwanted tools and equipment so as not to create unsafe condition or fire hazard.
- 5.3.2 Welding and other electrical cables shall be properly routed.
- 5.3.3 No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public.
- 5.3.4 Cleaning of the work area at the end of the day and upon completion of work is a part of the job.
- 5.3.5 The Engineer-in-charge has the right to stop work if the Contractor fails to improve upon the housekeeping after having been notified.

5.4 Fire Safety

- 5.4.1 All necessary precautions shall be taken to prevent outbreak of fires at the site. Adequate provisions shall be made to extinguish fires, if it still breaks out.
- 5.4.2 Quantities of combustible materials like timber, bamboos, coal, paints, etc., shall be kept minimum in order to avoid unnecessary accumulation of combustibles at site.
- 5.4.3 Containers of paints, thinners and allied materials shall be stored in a separate room which shall be well ventilated and free from excessive heat, sparks, flame or direct rays of the sun. The containers of paint shall be kept covered or properly fitted with lid and shall not be kept open except while using.
- 5.4.4 Fire extinguishers shall be located at the site at appropriate places.
- 5.4.5 Adequate number of workmen shall be given education and training in firefighting and extinguishing methods.

5.5 Scaffolding

Accidents are also caused by the ladders falling or the climber losing his balance or failure of scaffolds. As such, utmost care should be taken as ladder and scaffolding are extensively used for maintenance and construction purpose. Some of the safe practices as listed below are to be observed before commencement of work.

- 5.5.1 Adequate and safe means of access and exit shall be provided for all work places, at all elevations. Using of scaffolding members (avoiding a ladder) for approach to high elevations shall not be permitted.
- 5.5.2 Suitable scaffolds shall be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short duration work as can be done safely from ladders. Ladder shall be of rigid construction having sufficient strength for the intended loads and made either of good quality wood or metal and all ladders shall be maintained well for safe working condition.
- 5.5.3 Short ladder must not be tied together to give greater lengths. All ladders of 6 m or above should be tied to the structure on which they are resting to prevent from. An extra worker shall be engaged for holding the ladder if ladder is not securely fixed. If the ladder is used for carrying materials, suitable foot holds and handholds shall be provided on the ladder. The ladder shall be given an inclination not steeper than 1 in 4 (1 horizontal and 4 vertical). Ladders shall not be used for climbing carrying materials in hands. While climbing both the hands shall not be free.
- 5.5.4 The free length must extend by 1.5 meters above the point of landing but should not be more than 1/4th of the ladder length. No portable single ladder shall be over 9 meter in length. Metal ladders may not be used for electrical work.
- 5.5.5 Scaffolding or staging more than 3.5 m above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a standard guard rail properly attached, bolted, braced or otherwise secured at least 1.0 m high above the floor or platform of such scaffolding or staging. The guard rail shall extend along the entire exposed length of the scaffolding with only such opening as may be necessary for the delivery of materials. Standard railing shall have posts not more than 2 m apart and an intermediate rail halfway between the floor and platform of the scaffolding and the top rail. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure. Scaffolding and ladder shall conform to relevant IS specification (IS: 3696). Timber/Bamboo scaffolding shall not be used.
- 5.5.6 Working platforms of scaffolds shall have toe boards at least 15 cm in height to prevent materials from falling down.

- 5.5.7 Every part of scaffolding must be of sound construction. Steel planks used in scaffolds should be carefully inspected and should be tied on both sides with suitable fixing arrangements to the pipes. Scaffolding must not be overloaded.
- 5.5.8 The Steel pipe & clamp to be used must be of good quality. The spacing between the vertical & horizontal members of the scaffolding should not be more than 1.5m and 1 meter respectively. The scaffolding should be further strengthened with cross bracing and stays.
- 5.5.9 The scaffolds should be provided with short climbs ladders for safe ascending/ descending of workmen in the job. Only those workmen who are well trained/ experienced in erecting scaffolding should be engaged for scaffolding work. The men working in the actual erection/dismantling of the scaffolding and all persons using the scaffolding must use appropriate PPEs.
- 5.5.10 A sketch of the scaffolding proposed to be used shall be prepared and approved by the Engineer-in charge, prior to start of erection of scaffolding. All scaffolds shall be examined by Engineer-In-Charge before use.
- 5.5.11 Working platform, gangways and stairways shall be so constructed that they shall not sag unduly or unequally and if the height of the platform or gangway or stairway is more than 3.5 m above ground level or floor level, they shall be closely boarded, shall have adequate width for easy movement of persons and materials and shall be suitably guarded.
- 5.5.12 The planks used for working platform shall not project beyond the end supports to a distance exceeding four times the thickness of the planks used. The planks shall be rigidly tied at both ends to prevent sliding and slippage. The thickness of the planks shall be adequate to take load of men and materials and shall not collapse.
- 5.5.13 Each opening in the floor of a building or at a working platform shall be provided with suitable means to prevent fall of persons or materials by providing suitable fencing or railing.
- 5.5.14 Safe means of access shall be provided to all working platforms and other elevated working places. Every ladder shall be securely fixed. No single portable ladder shall be over 9 m in length. For ladders up to 3m in length the width between side rails in the ladder shall in no case be less than 300 mm. For longer ladders this width shall be increased by at least 20 mm for each additional meter of length. Step spacing shall be uniform and shall not exceed 300 mm.
- 5.5.15 Adequate precautions shall be taken to prevent danger from electrical lines and equipment. No scaffolding, ladder, working platform, gangway runs, etc. shall exist within 3 meters of any uninsulated electric wire. Whenever electric power and lighting cables are required to run through (pass on) the scaffolding or electrical equipment's are used, such scaffolding structures shall have minimum two earth connections with earth continuity conforming to IS Code of Practice.

5.6 Excavation, Trenching and Earth Removal

All excavation work should be planned. The method of excavation and type of support work required should be decided considering the stability of the ground & effect on adjoining buildings, roads, underground pipes, cables or any other structures.

- 5.6.1 All excavation work should be supervised by responsible person and inspected for any defect regularly.
- 5.6.2 Safe angle of repose while excavating trenches exceeding 1.5m depth up to 3.0m should be maintained. Based on site conditions, provide proper slope, usually 45° and suitable bench of 0.5m width at every 1.5m depth of excavation in all soils except hard rock or provide proper shoring and strutting to prevent cave-in or slides. The excavated material shall not be placed within 1.5 m of the edges of the trench or half of the depth of the trench, whichever is more. Cutting shall be done from top to bottom. Under no circumstances mining or under-cutting shall be done.

- 5.6.3 All trenches 1.2 m or more in depth shall be supplied with at least one ladder for each spacing of 30m in length or fraction thereof. Ladder shall be extended from bottom of the trench to at least 1.0 m above the surface of the ground.
- 5.6.4 Open excavations shall be fenced off by suitable railing and warning signals installed, so as to prevent persons slipping or falling into the excavations. Don't allow vehicles to operate too close to excavated area. Barricade should be provided.
- 5.6.5 The Contractor shall ensure the stability and safety of the excavation, adjacent structures, services and the works.

5.7 Concreting

Shuttering and supporting structures shall be of adequate strength and approved by Engineer-In-Charge. This shall be ensured before concrete is poured. The procedure approved by Engineer-In-Charge shall be followed for mixing, transporting and pouring of concrete.

5.8 Demolition

Before any demolition work is commenced and also during the progress of the work:

- 5.8.1 All roads and open area adjacent to the work site shall either be closed or suitably protected. Appropriate warning signs shall be displayed for cautioning approaching persons.
- 5.8.2 Before demolition operations begin, the Contractor shall ensure that the power on all electric service lines is shut off and the lines-cut or disconnected at or outside the demolition site. If it is necessary to maintain electric power during demolition operation, the required service lines shall be adequately protected against damage. Persons handling heavy materials/equipment shall wear safety shoes.
- 5.8.3 No floor, roof or other part of the building shall be overloaded with debris or materials as to render it unsafe.
- 5.8.4 Entries to the demolition area shall be restricted to authorized persons only.

5.9 Welding and Gas Cutting

- 5.9.1 Welding and gas cutting operations shall be done only by qualified and authorized persons and as per IS specifications and Code of Practice.
- 5.9.2 Welding and gas cutting shall not be carried out in places where flammable or combustible materials are kept and where there is danger of explosion due to presence of gaseous mixtures.
- 5.9.3 Welding and gas cutting equipment including hoses and cables shall be maintained in good condition.
- 5.9.4 Barriers shall be erected to protect other persons from harmful rays from the work. When welding or gas cutting is in elevated positions, precautions shall be taken to prevent sparks or hot metal falling on persons or flammable materials. Adequate ventilation shall be provided while welding in confined space.
- 5.9.5 Suitable type of protective clothing consisting of fire resistant gauntlet gloves, leggings, boots and aprons shall be provided to workers as protection from heat and hot metal splashes. Welding shields with filter glasses of appropriate shade shall be worn as face protection.
- 5.9.6 Welding and gas cutting shall not be done on drums, barrels, tanks or other containers unless they have been emptied, cleaned thoroughly and it is made certain that no flammable material is present.
- 5.9.7 Fire extinguisher shall be available near the location of welding operations. Prior permission shall be obtained from safety section for working at vulnerable areas and operating areas before flame cutting/welding is taken up.

- 5.9.8 Tarpaulin, if used should be of fire retardant.
- 5.9.9 For electric (Arc) welding the following additional safety precautions shall be taken:
- When electrical welding is undertaken near pipe lines carrying flammables, such pipe lines shall not be used as part of earth conductor but a separate earth conductor shall be connected to the machine directly from the job.
 - Personnel contact with the electrode or other live parts of electric welding equipment shall be avoided.
 - Extreme caution shall be exercised to prevent accidental contact of electrodes with ground.
- 5.9.10 The cylinders containing poisonous/toxic or inflammable / explosive gas like Oxygen, Acetylene, Hydrogen, Ammonia, Chlorine, CO₂ etc. shall be handled safely taking due cares. To handle / shift such cylinders a special trolley / cage meant for it must be used but in no case it should be rolled.
- 5.9.11 No domestic LPG cylinder is allowed for Hot Work such as Gas Welding / Gas Cutting.
- 5.9.12 A person must remain in the area for a minimum period of 30 minutes after hot work is completed to ensure the site is safe. Welding machine shall be switched off after the completion of work.

5.10 Grinding

- 5.10.1 All portable grinders shall be used only with their wheel guards in position to reduce the danger from flying fragments should the wheel break during the use.
- 5.10.2 Grinding wheels of specified diameter only shall be used on a grinder- portable or pedestal - in order not to exceed the prescribed peripheral speed.
- 5.10.3 Goggles shall be used during grinding operation.

5.11 Painting

- 5.11.1 The Contractor shall not employ women on the work of painting with products containing lead in any form. Only men above the age of 18 years shall be employed on the work with lead paint.
- 5.11.2 Smoking, open flames or sources of ignition shall not be allowed in places where paints and other flammable substances are stored, mixed or used. A caution board, with the instructions written in national/ regional language, "SMOKING - STRICTLY PROHIBITED" shall be displayed in the vicinity where painting is in progress or where paints are stored.
- 5.11.3 When painting work is done in a closed room or in a confined space, adequate ventilation shall be provided. If adequate ventilation cannot be provided, workers shall wear suitable respirators.
- 5.11.4 Epoxy resins and their formulations used for painting shall not be allowed to come in contact with the skin. The workers shall use plastic gloves and/or suitable barrier creams.
- 5.11.5 Workers shall thoroughly wash hands and feet before leaving the work. Work clothes shall be changed and laundered frequently.

6. REPORTING FORM

6.1 Near Miss Reporting Form

(This form may be filled and submitted to the Safety Section within 48 hours from the incident time)

1. Name of Person Affected/Observed Near miss:	2. Group/Division/Section:
3. Designation:	4. Location of Near Miss:
5. Date & Time of Near Miss:	6. Contact no:/Ext. No.:

<p>7. Near Miss Description: <i>(Describe fully, the protocol / procedure been followed including all substances, equipment and machinery being used which was related to the near miss.)</i></p> <p>-----</p> <p>-----</p> <p>-----</p> <p>-----</p> <p>-----</p>	
<p>8. Possible Damage that might have happened:</p> <p>(i)</p> <p>(ii)</p>	
<p>9. Corrective Actions Proposed to prevent reoccurrence of such near miss incident(s):</p>	

Submitted By:

Signature:

Name:

Date:

6.2 Incident Reporting Form

(This form is to be filled and submitted for all incidents except near miss to safety section within 72 hours from the incident time)

A. PERSONNEL INFORMATION

Name of Injured:		PR No.:
Group:		Contact No./ Ext. No.:
Incident Site:	Employee Category: () Permanent Employee () Project Employee () Contract () AMC () TPIA () Service Provider/Vendor () Other Category	

B. CATEGORY OF INCIDENT

First aid case	
Medical case	
Asset/Equipment/Property damage	
Vehicle incident	
Fire	
Fatal Accident	

C. INCIDENT INFORMATION

Date / Time of Incident	Date/Time Reported To Group Leader
Person Reporting Incident	
Incident Description:	
Injury / Illness Description:	

D. TREATMENT INFORMATION

Treatment Description		
Treatment Administered By	Date Of Treatment	Time Of Treatment
Phone No of clinic / hospital	Name of Clinic/Hospital:	
Pl. attach medical officer's prescription for medical treatment: -	Released from Hospital Date / Time: -	

E. INITIAL CORRECTIVE ACTION INFORMATION

Immediate Causes of incident:

Initial Corrective actions taken

1.

2.

3.

Prepared By:

Sign:

Name:

Designation:

Date:


Reviewed By:

Sign:

Name:

Designation:

Date:

	INSTITUTE FOR PLASMA RESEARCH	Revision: 00
	SAFETY PROTOCOL FOR CONTRACTORS OF ELECTRICAL/MAJOR INSTALLATION OF ELECTRICAL EQUIPMENTS/ MACHINARIES AND OTHER RELATED ACTIVITIES	Eff. Date: 20.03.2014

1. PURPOSE

The purpose of this protocol is to establish, implement and execute a safe and effective program for the prevention of incidents that may cause injury to persons or damage to the property. The specified responsibilities remain with the contractor for compliance.

2. SCOPE


- 2.1 This protocol shall be considered minimum requirements necessary for all works performed inside the Institute for Plasma Research (IPR) and associated centers/units/departments.
- 2.2 All the contractor while at IPR and associated centers/units/departments work site are required to ensure that themselves, their workers and employees, sub-contractors, suppliers, vendors and visitors, must comply with the provisions of this protocol.
- 2.3 The contractor shall review and educate their workers and employees about the stipulations of this protocol.
- 2.4 This protocol is in addition to the responsibility of the contractor towards safety, health and environmental compliance envisaged under law, code or statutory requirements.

3. PROTOCOL

- 3.1 The contractor has to provide appropriate Personal Protective Equipment's (PPE) like safety shoes, safety helmets, goggles, hand gloves, full body safety harnesses, etc. as required for safety of themselves, their workers and employees, sub-contractors, suppliers, vendors and visitors at site. All PPE must conform to relevant Indian and/or International Standards. These should be maintained in recommended condition by suitable storage, maintenance and inspection. IPR shall have right to examine the PPE and determine their suitability, reliability, acceptability and adaptability.
- 3.2 The contractor shall provide and maintain proper illumination, fencing, guards, stairs, ladders, scaffolding, warning signs, caution boards, etc. As required to ensure safe working conditions at site.
- 3.3 The contractor shall ensure that all floor and wall openings are fixed and properly guarded/barricaded during the course of work and at the end of each day's work with appropriate caution board.
- 3.4 The contractor must adhere to the requirements of Safety, Health and Environment (SHE) Policy of IPR, salient features of which are:
 - f. Continual improvement in its Safety, Health & Environment Performance,
 - g. Conservation of natural resources,
 - h. Waste minimization,
 - i. Compliance with applicable statutory and regulatory requirements,
 - j. Creating safety & environmental awareness to its employees and associates.

- 3.5 The contractor has to ensure to employ only persons who are medically fit and having sufficient skills for execution of work. The contractor must ensure efficient job supervision through educated, qualified, experienced and responsible supervisors to ensure safety at site.
- 3.6 All staff persons including workers must undergo Safety Induction Training prior to depute them at IPR and associated centers/units/departments for any kind of work. Training module may include video film, clippings, photographs etc. related to work execution. In addition to this, Job specific training must be imparted to the concerned workers periodically.
- 3.7 The contractor has to ensure that Daily Tool Box Talk shall be conducted at least for new workers by responsible work in-charge/supervisor for each activity and its record to be maintained.
- 3.8 The contractors themselves, their workers and employees, sub-contractors, if any, shall comply with the instructions given by the Safety Officer or his authorized nominee or IPR's representative regarding safety precautions, protective measures, housekeeping requirements, etc. IPR shall have the right at its sole discretion to stop the work, if the work is being carried out in such a way that it may cause accidents or harm to the workers or damage to the equipment's. Contractor shall get the unsafe condition removed and report to IPR.
- 3.9 The contractor shall have no right to claim any damages/compensations for stoppage of work due to safety reasons as provided in para 3.8 .The period of such stoppage of work will not be taken as an extension of time for completion of work or exemption from liquidated damages/compensation delay.
- 3.10 The contractor should ensure that water, fuel and energy are used judiciously. The water & power points must be closed / put off when not in use.
- 3.11 Good housekeeping practices must be followed strictly.
- 3.12 All equipment's used for electrical work, installation of electrical equipment's/machineries and other related work by the contractor must meet Indian/International standards. In case such standards do not exist, the contractor must ensure these to be absolutely safe. All equipment's shall be strictly operated and maintained in accordance with manufacturers' operation manual and safety instructions.
- 3.13 The contractor must not interfere or disturb electric, fuses, cables and other electrical equipment's belonging to IPR or another agency under any circumstances whatsoever unless expressly permitted in writing by IPR.
- 3.14 Contractor shall arrange adequate facilities for first aid, medical aid and treatment for his staff and workers engaged at the work site. The contractor has to fully be responsible for the behavior and conduct of themselves, their workers and employees and sub-contractors. Any cost of loss or damage to client's property caused by contractor's employees or workers will be recovered from the contractor.
- 3.15 In case of any accident that occurs during the maintenance/ fabrication/erection or associated activities undertaken by the contractor thereby causing any minor or major or fatal injury to themselves, their workers and employees, sub-contractors due to any reason, it shall be the responsibility of the contractor to promptly inform IPR's Work in-charge and Safety Officer in prescribed form of IPR. This should also be informed to statutory authority, if required, under the applicable laws. The contractor shall maintain a register of accidents. In case the contractor fails to fulfil statutory requirements, IPR shall have the right to withhold contractors payments till the requirement are fulfilled.
- 3.16 The contractor shall plan his activities so as to avoid interference with the assignments of other departments and contractors at the site. In case of any interference, necessary coordination must be sought by the contractor from IPR for safe and smooth working.
- 3.17 All necessary precautions shall be taken to prevent outbreak of fires at the site. Adequate provisions or as recommended by Safety Officer of IPR must be made by the contractor to extinguish fires.

- 3.18 The contractor shall issue photo identity card for themselves, their workers and employees, sub-contractors to be deployed at site. They are required to be displayed prominently during the period of their stay within IPR and associated centers/units/departments.
- 3.19 The contractor shall obtain gate pass from IPR and associated centers/units/departments for entries and exists of all materials and equipment's.
- 3.20 Smoking and eating/chewing of tobacco is strictly prohibited at site.
- 3.21 Any person under the influence of any intoxicating beverage, even to the slightest degree shall not be permitted at work site.
- 3.22 Person below the age of 18 years must not be employed for any work at site
- 3.23 IPR may from time to time, add or amend to these protocols and issue directions.
- 3.24 The contractor shall comply with Safety Instructions as laid down in as per Annexure-I.

	INSTITUTE FOR PLASMA RESEARCH	Revision: 00
	SAFETY INSTRUCTIONS FOR CONTRACTORS OF ELECTRICAL/MAJOR INSTALLATION OF ELECTRICAL EQUIPMENTS/ MACHINARIES AND OTHER RELATED ACTIVITIES	Eff. Date: 20.03.2014

CONTENTS

SR. NO.	TITLE
1.	GENERAL INFORMATION
2.	ROLE OF THE CONTRACTOR
2.1	Top Management of the Contractor
2.2	Contractor Safety Officer, Safety Supervisor and/or Job Supervisor
2.3	Contractor Employees
3.	PENALTY FOR NON-COMPLIANCE
4.	PROVISION FOR SAFETY SUPERVISOR/SAFETY OFFICER OF CONTRACTOR
5.	GENERAL SAFETY PROVISIONS
5.1	Personal Protective Equipment
5.2	Electricity
5.3	House Keeping
5.4	Fire Safety
5.5	Scaffolding
5.6	Lifting/Hoisting Equipment & Erection
5.7	Welding and Gas Cutting
5.8	Grinding
5.9	Electrical Equipment - Installation and/or Maintenance
6.	REPORTING FORMS
6.1	Near Miss Reporting Form
6.2	Incident Reporting Form

1. GENERAL INFORMATION

- 1.1** The purpose of safety instruction document is to establish, implement and execute a practical and effective method for preventing accidents, injuries and property damage.
- 1.2** This document will help contractors and their associates to recognize, evaluate and control hazardous activities within their areas of responsibility.
- 1.3** This document defines the procedure with which safety practice will be administered, identifies responsibilities and ensures control of work area safety.
- 1.4** Contract agreement signed with contractors and the provisions of this document are intended to complement each other to ensure safe working conditions.
- 1.5** The provisions of this document apply to IPR and associated centers/units/departments.
- 1.6** Throughout this document, reference to a contractor means the contractor's company and the associated subcontractors, consultants, vendors and suppliers. Reference to contractor's management means personnel responsible for managing, supervising or directing contract activities and employees.
- 1.7** Non-compliance of this document is treated as non-compliance of contract agreement that may result in warning/penalty. Willful or repeated non-compliance may result in contractor dismissal and contract termination.
- 1.8** This document for contractors is a supplementary document to statutory rules, codes and regulations having jurisdiction, and does not negate, abrogate or minimize any provisions of these rules, codes and regulations. It is intended to supplement and enforce the individual program of the contractor and to coordinate the overall safety effort. Contractors are responsible for the safety and health of their employees, subcontractors, consultants, vendors, suppliers, and visitors while in IPR and associated centers/units/departments.
- 1.9** Contractor's managers and supervisors are responsible for preventing incidents or conditions that could lead to incidents, injuries, illness or fatalities. The ultimate success of the safety program depends on the cooperation of everyone. The contractor's management must ensure that safety provisions are enforced and that effective training and education programs are employed.

2. ROLE OF THE CONTRACTOR

2.1 Top Management of the Contractor

The commitment of top management of the contractor towards safety is very important. Top management needs to ensure the following:

- 2.1.1** To implement safe methods and practices, deploy appropriate machineries, tools & tackles, experienced supervision and skilled workforce, etc. required for execution.
- 2.1.2** To ensure that employees and workers deployed are physically and mentally fit. They should possess requisite skill, qualification, experience etc.
- 2.1.3** To deploy qualified and trained safety supervisor, safety officers and/or safety manager reporting to site In-charge for supervision, co-ordination and liaison for the implementation of safety.
- 2.1.4** To ensure that the employees and workers have appropriate health and safety training. The certification of such training should be produced for verification, on demand.
- 2.1.5** To obtain all necessary and applicable licenses, permits, and insurance policy of his employees and workers before executing any work. A copy of the same must be submitted to the relevant authority at IPR.
- 2.1.6** To ensure that all incidents (minor/major injuries, fatality, fire, property damage etc.) including near misses shall be reported to the relevant authority at IPR immediately verbally as well as in written format of IPR. Also, keep record for the same.

- 2.1.7 The liability for any compensation on account of injury sustained by an employee of the contractor will be exclusively that of the contractor.
- 2.1.8 To provide personal protective equipment's required for the safety and first-aid kits at worksite.
- 2.1.9 To maintain appropriate records of all employees and workers deployed to carry out the work at site.
- 2.1.10 Contractor shall not employ any labour below 18 years of age.
- 2.1.11 A photo gate pass duly approved by IPR administration shall be issued by the contractor to their personnel, employees, subcontractors, etc.
- 2.1.12 To co-operate with all the security arrangements of IPR.
- 2.1.13 Contractor may ask for clarifications required in safety related issues, whenever a need arises.
- 2.1.14 To follow and implement all the safety rules and regulations of the local bodies, state, national and international. Contractor shall also comply with all the statutory requirements and notifications, as applicable, in relation to employment of his employees issued time to time by the concerned authorities.

2.2 Contractor Safety Officer, Safety Supervisor and/or Job Supervisor

The duties and responsibilities of the contractor safety officer, safety supervisor and/or job supervisor shall include the following:

- 2.2.1 To assess the hazards associated with work at site in consultation with all concerned and establish safe working procedure.
- 2.2.2 To establish a written records of factors that can cause injuries, illness or other safety related problems.
- 2.2.3 To undertake routine/surprise inspections of all work sites to ensure compliance with safety standards, codes, rules, regulations and orders applicable to the work concerned.
- 2.2.4 To check whether the proposed working arrangements/procedures are safe and satisfactory, particularly at the interface between contractors planned work and IPR facilities.
- 2.2.5 To ensure that required guards and protective equipment are provided, used and properly maintained.
- 2.2.6 To ensure that the workers understand the working procedures for carrying out the work safety and the hazards that may be encountered.
- 2.2.7 To take immediate actions to correct any violation of safety rules observed or reported.
- 2.2.8 To ensure that appropriate warning signboards and tags are displayed.
- 2.2.9 To report each incident and/or injury in accordance with established procedures and assists during investigation.
- 2.2.10 To arrange tool box meeting daily and shall continue this process to make workmen safety conscious. To keep a constant liaison with the relevant authority at IPR on safety issues.

2.3 Contractor Employees

The duties & responsibilities of the contractor employees should include the following:

- 2.3.1 The contractors' employees must be trained for safety standards, procedure to carry out high risk job (if involved), use of Personal Protective Equipment's (PPEs) in general and specific for a particular job, emergency preparedness and fire extinguisher and medical first-aid.
- 2.3.2 To perform work safely as per the job requirements/instructions and wear appropriate PPEs.
- 2.3.3 To inform promptly to their management regarding all work related incidents resulting in personal injury, illness and/or property damage, etc.

2.3.4 To take all necessary and appropriate safety precautions to protect themselves, other personnel and the environment.

3. PENALTY FOR NON-COMPLIANCE

The following penalties shall be imposed on the contractor by the IPR and shall be deducted from his running/final bill.

Sr. No.	Non-Compliance/Violation of Safety Protocols/Rules/Norms	Penalty
1.	Non-use of PPE like Safety Helmet / Safety Shoes etc.	Rs. 100 per day/person
2.	Over speeding (> 30Km/Hr.) / rash driving or improper parking	Rs. 100 per occasion
3.	Non-use ELCB/MCB, Use of non-standard socket, poor cable joint, laying wire/cables on floor, non-use of socket, electrical jobs by incompetent person	Rs. 200 per day/case
4.	Working at height without full body safety harness, using non-standard scaffolding and not arranging fall protection arrangement	Rs. 500 per day/case
5.	Handling of compressed gas cylinders without trolley and double gauge regulator, Improper keeping/storage of gas cylinder	Rs. 200 per day/case
6.	Use of domestic LPG for cutting purpose.	Rs. 200 per day/case
7.	No fencing/barricading of excavated/open areas.	Rs. 200 per day/case
8.	No provision of firefighting equipment during hot works. Use of firewater for purpose other than firefighting.	Rs. 200 per day/case
9.	No reporting of Nearmiss/First-aid/Injury/Property damage/Minor fire etc. incidents	Rs. 500 per case
10.	Poor Housekeeping	Rs. 200 per day/case
11.	No deployment of safety officer/safety supervisor responsible for safety at work site as mentioned in Chapter No. 5	Rs. 500 per day

Safety Officer or any other officer authorized by IPR will report safety violation to the concerned Engineer In-charge for imposing necessary penalty. Engineer-in-charge shall ensure that the penalty amount has been deducted from the running bill of contractor. Imposing any penalty for violation of safety norms does not absolve the contractors from their contractual obligation/ responsibility. Contractor shall be fully responsible for any accident and/or injury to their employees or property due to violation of safety norms.

4. PROVISION FOR SAFETY SUPERVISOR/SAFETY OFFICER OF CONTRACTOR

The contractor shall depute at least one Safety Supervisor / Safety Officer for critical activities as follows,

- Work at height (working beyond 2.5 mtr. above ground).
- Materials and Material Handling which includes movement of heavy material by crane, movement of tractor trolley on slopes, Manual lifting of heavy material to height, erection of heavy machinery, equipment, etc.
- Loading and unloading of equipment, structural materials, machineries, etc., Fabrication and erection work.
- Working near high voltage lines, electrical installations, etc., charging of electrical system, transformers, switch yard, switch gears, etc.
- Work related to welding, gas cutting, grinding, etc.

In addition to above list, IPR may also recommend for some specific tasks, which are not covered, to depute Safety Officer/Safety Supervisor.

Safety supervisor shall be qualified of minimum Diploma in Engineering/ Graduate in Science with approved course in the field of safety and/or fire. He shall able to read and understand English and speak regional/national language. He shall have experience as safety supervisor for a period of minimum one year.

Safety Officer shall be qualified of minimum Bachelor in Engineering/ Post Graduate in Science with approved course in the field of Safety and/or Fire. Safety Officer shall have good communication and written skill to liaison with the client. He shall have good command in English and regional/national language. He shall have experience for a period of minimum three years of supervisory level.

5. GENERAL SAFETY PROVISIONS

5.1 Personal Protective Equipment

The contractor is responsible to provide all necessary standard make (ISI marked) personal protective equipment (PPE) suitable to give sufficient protection against hazards involved in their work / job to their employees, as per the job requirement and insist/enforce their staff to put on the same while atworks and ensure that the PPEs are properly used and maintained in a condition suitable for immediate use. The contractor shall have sufficient stock of various PPEs to avoid any shortage of supply and shall take adequate steps to ensure proper use of equipment by those concerned. The ongoing work is liable to be stopped at any time if the contractor's staff is found working without PPEs.

- 5.1.1 All persons employed at site shall use safety helmets. For other types of works, persons working in that area shall also use safety helmets, if advised by Safety Engineer/Engineer-In-Charge.
- 5.1.2 Persons engaged in welding and gas-cutting works shall use suitable welding face shields. The persons who assist the welders shall use suitable goggles. Protective goggles shall be worn while chipping and grinding.
- 5.1.3 All persons working at heights more than 2.5 m above ground or floor and exposed to risk of falling down shall use full body safety harness, unless otherwise protected by cages, guard railings, etc. In places where the use of safety harness is impractical, suitable net of adequate strength fastened to substantial supports shall be employed.
- 5.1.4 When workers are employed in sewers and inside manholes, which are in use, the Contractor shall ensure that the manholes are opened and are adequately ventilated at least for an hour. After it has been well ventilated, the atmosphere inside the Space shall be checked for the presence of any toxic gas or oxygen deficiency and recorded in the register before the workers are allowed to get into the manholes. The manholes opened shall be cordoned off with suitable railing and provided with warning signals or caution boards to prevent accidents. There shall be proper illumination in the night.
- 5.1.5 The following is the list of various PPEs to be used for various works/worksites,

List of Safety Equipment's

Sr. No.	PPE	Purpose
01	Industrial Safety Helmet	For protection of head against falling objects or during fall of person from height.
02	Safety Goggles (Grinding, Welding, etc.).	For protection of eyes against flying particles / dust, chemical splash, spark, arc, flashover etc.
03	Face shield	For protection of face against flying particles / dust, chemical splash, spark, arc, flashover etc.
04	Ear plug / Ear muffs	For ear / hearing system protection while working in high noise level area.
05	Apron(PVC /cry/Cotton)	For body protection against chemicals, oils, cryogenics, sharp edged objects, heat, hot objects etc.
06	Gloves (Nitrile/Leather, cry, Electrical shock proof)	For protection of hands against chemicals, oils, cryogenics, sharp edged objects, heat, hot metals/objects, electricity etc.
07	Safety Shoes	For protection of leg/feet against falling objects, sharp-edged objects, heat, hot metals/objects, electricity etc.
08	Full body safety harness/ I Rope/Life line/ Fall prevention system etc.	For fall prevention while working at heights or in depth, working in vessel or in confined space.
09	Dust Respirator	Protection of respiratory system against dust.
10	Self-contained breathing apparatus (SCBA) set	Working in oxygen deficient areas.

5.2 Electricity

The following are provided for general guidance of the Contractor and shall be read as specific requirement, in addition to complying with Indian Electricity Act, Indian Electricity Rules and IS Specifications.

- 5.2.1 Only qualified electricians familiar with code requirements are allowed to perform electrical work.
- 5.2.2 Employees are not permitted to work near an unprotected electrical power circuit unless they are protected against electrical shock by de-energizing the circuit and grounding it, or are protected by effective insulation or other means, and are wearing .required personal protective equipment.
- 5.2.3 The electric power supply will be generally made available at one point in the works site of the contractor by the IPR.
- 5.2.4 All three phase equipment shall be provided with double earthing. All light fixtures and portable equipment shall be effectively earthed to main earthing.
- 5.2.5 All earth terminals shall be visible. No gas pipes and water pipes shall be used for earth connection. Neutral conductor shall not be treated as earth wire.
- 5.2.6 The contractor shall not connect any additional load without prior permission of IPR.
- 5.2.7 Joints in earthing conductors shall be avoided. Loop earthing of equipment shall not be allowed. However tapings from an earth bus may be done.
- 5.2.8 Electrical equipment and installations shall be installed and maintained as to prevent danger from contact with live conductors and to prevent fires originating from electrical causes like short circuits, overheating etc. Installation shall not cause any hindrance to movement of men and materials.
- 5.2.9 Materials for all electrical equipment shall be selected with regard to working voltage, load and

working environment. Such equipment shall conform to the relevant standards.

- 5.2.10 Electric fuses and/or circuit breakers installed in equipment circuits for short circuit protection shall be of proper rating. It is also recommended that high rupturing capacity (HRC) fuses be used in all circuits. For load of 5 KW or more earth leakage circuit breaker of proper rating shall be provided in the circuits.
- 5.2.11 Wires and cables shall be properly supported and approved method of fixing shall be adopted. Cables shall not be left on floor/ground. Loose hanging of wires & cables shall be avoided. Lightning and power circuits shall be kept distinct and separate.
- 5.2.12 Reinforcement rods or any metallic part of structure shall not be used for supporting wires and cables, fixtures, equipment, earthing etc.
- 5.2.13 All cables and wires shall be adequately protected mechanically against damages. In case, the cable required to be laid underground, it shall be adequately protected by covering the same with bricks, Plain Cement Concrete (PCC), tile or any other approved means.
- 5.2.14 All armored cables shall be properly terminated by using suitable cable glands. Multi-stranded conductor cables shall be connected by using cable lugs/ sockets. Cable lugs shall preferably be crimped. They shall be of proper size and shall correspond to the current rating and size of the cable. Twisted connections will not be allowed.
- 5.2.15 All the Distribution Boards, Switch Fuse units, Bus bar chambers, ducts, cubicles etc. shall have MS enclosures and shall be dust, vermin and waterproof. The Distribution Boards, switches etc. shall be so fixed that they shall be easily accessible.
- 5.2.16 The Contractor shall provide proper enclosures/covers of approved size and shape for protection of all switch boards, equipment etc. against rain.
- 5.2.17 Isolating switches shall be provided close to equipment for easy disconnection of electrical equipment or conductors from the source of supply, when repair or maintenance work has to be done.
- 5.2.18 All connections to lighting fixtures, starters or other power supplies shall be provided with PVC insulated, PVC sheathed twin/three/four core wires to have better mechanical protection for preventing possible damage to equipment or injury to personnel. Taped joints shall not be allowed and the connections may be made in looping system. Electric starter of motors, Switches shall not be mounted on wooden boards. Only sheet steel mounting or iron framework shall be used.
- 5.2.19 Only PVC insulated and PVC sheathed wires or armored PVC insulated and sheathed cables shall be used for external power supply connections of temporary nature. Weatherproof rubber wires shall not be used for any temporary power supply connections. Taped joints in the wires shall not be used.
- 5.2.20 All portable appliances shall be provided with three-core cable and three-pin plug. The third pin of the plug shall invariably be earthed. It shall be ensured that the metal part of the equipment shall be effectively earthed.

5.3 House Keeping

- 5.2.1 The Contractor shall at all times keep his work spot, site office and surroundings clean and tidy from rubbish, scrap, surplus materials and unwanted tools and equipment so as not to create unsafe condition or fire hazard.
- 5.2.2 Welding and other electrical cables shall be properly routed.
- 5.2.3 No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public.
- 5.2.4 Cleaning of the work area at the end of the day and upon completion of work is a part of the job.
- 5.2.5 The Engineer-in-charge has the right to stop work if the Contractor fails to improve upon the housekeeping after having been notified.

5.3 Fire Safety

- 5.2.6 All necessary precautions shall be taken to prevent outbreak of fires at the site. Adequate provisions shall be made to extinguish fires, if it still breaks out.
- 5.2.7 Quantities of combustible materials like timber, bamboos, coal, paints, etc., shall be kept minimum in order to avoid unnecessary accumulation of combustibles at site.
- 5.2.8 Containers of paints, thinners and allied materials shall be stored in a separate room which shall be well ventilated and free from excessive heat, sparks, flame or direct rays of the sun. The containers of paint shall be kept covered or properly fitted with lid and shall not be kept open except while using.
- 5.2.9 Fire extinguishers shall be located at the site at appropriate places.
- 5.2.10 Adequate number of workmen shall be given education and training in firefighting and extinguishing methods.

5.4 Scaffolding:

- 5.2.11 Accidents are also caused by the ladders falling or the climber losing his balance or failure of scaffolds. As such, utmost care should be taken as ladder and scaffolding are extensively used for maintenance and construction purpose. Some of the safe practices as listed below are to be observed before commencement of work.
- 5.2.12 Adequate and safe means of access and exit shall be provided for all work places, at all elevations. Using of scaffolding members (avoiding a ladder) for approach to high elevations shall not be permitted.
- 5.2.13 Suitable scaffolds shall be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short duration work as can be done safely from ladders. Ladder shall be of rigid construction having sufficient strength for the intended loads and made either of good quality wood or metal and all ladders shall be maintained well for safe working condition.
- 5.2.14 Short ladder must not be tied together to give greater lengths. All ladders of 6 m or above should be tied to the structure on which they are resting to prevent from. An extra worker shall be engaged for holding the ladder if ladder is not securely fixed. If the ladder is used for carrying materials, suitable foot holds and handholds shall be provided on the ladder. The ladder shall be given an inclination not steeper than 1 in 4(1 horizontal and 4 vertical). Ladders shall not be used for climbing carrying materials in hands. While climbing both the hands shall not be free.
- 5.2.15 The free length must extend by 1.5 meters above the point of landing but should not be more than 1/4th of the ladder length. No portable single ladder shall be over 9 meter in length. Metal ladders may not be used for electrical work.
- 5.2.16 Scaffolding or staging more than 3.5 m above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a standard guard rail properly attached, bolted, braced or otherwise secured at least 1.0 m high above the floor or platform of such scaffolding or staging. The guard rail shall extend along the entire exposed length of the scaffolding with only such opening as may be necessary for the delivery of materials. Standard railing shall have posts not more than 2 m apart and an intermediate rail halfway between the floor and platform of the scaffolding and the top rail. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure. Scaffolding and ladder shall conform to relevant IS specification (IS: 3696). Timber/Bamboo scaffolding shall not be used.
- 5.5.1 Working platforms of scaffolds shall have toe boards at least 15 cm in height to prevent materials from falling down.
- 5.5.2 Every part of scaffolding must be of sound construction. Steel planks used in scaffolds should be

carefully inspected and should be tied on both sides with suitable fixing arrangements to the pipes. Scaffolding must not be overloaded.

- 5.5.3 The Steel pipe & clamp to be used must be of good quality. The spacing between the vertical & horizontal members of the scaffolding should not be more than 1.5m and 1 meter respectively. The scaffolding should be further strengthened with cross bracing and stays.
- 5.5.4 The scaffolds should be provided with short climbs ladders for safe ascending/ descending of workmen in the job. Only those workmen who are well trained/ experienced in erecting scaffolding should be engaged for scaffolding work. The men working in the actual erection/ dismantling of the scaffolding and all persons using the scaffolding must use appropriate PPEs.
- 5.5.5 A sketch of the scaffolding proposed to be used shall be prepared and approved by the Engineer-in charge, prior to start of erection of scaffolding. All scaffolds shall be examined by Engineer-In-Charge before use.
- 5.5.6 Working platform, gangways and stairways shall be so constructed that they shall not sag unduly or unequally and if the height of the platform or gangway or stairway is more than 3.5 m above ground level or floor level, they shall be closely boarded, shall have adequate width for easy movement of persons and materials and shall be suitably guarded.
- 5.5.7 The planks used for working platform shall not project beyond the end supports to a distance exceeding four times the thickness of the planks used. The planks shall be rigidly tied at both ends to prevent sliding and slippage. The thickness of the planks shall be adequate to take load of men and materials and shall not collapse.
- 5.5.8 Each opening in the floor of a building or at a working platform shall be provided with suitable means to prevent fall of persons or materials by providing suitable fencing or railing.
- 5.5.9 Safe means of access shall be provided to all working platforms and other elevated working places. Every ladder shall be securely fixed. No single portable ladder shall be over 9 m in length. For ladders up to 3m in length the width between side rails in the ladder shall in no case be less than 300 mm. For longer ladders this width shall be increased by at least 20 mm for each additional meter of length. Step spacing shall be uniform and shall not exceed 300 mm.
- 5.5.10 Adequate precautions shall be taken to prevent danger from electrical lines and equipment. No scaffolding, ladder, working platform, gangway runs, etc. shall exist within 3 meters of any uninsulated electric wire. Whenever electric power and lighting cables are required to run through (pass on) the scaffolding or electrical equipment's are used, such scaffolding structures shall have minimum two earth connections with earth continuity conforming to IS Code of Practice.

5.5 Lifting/Hoisting Equipment and Erection

Accidents do happen while working overhead or due to failure or unsafe use of hoisting equipment. As such, adequate care must be taken to prevent it. The following are some of the precautions to ensure safety of the workmen engaged by the contractor:

- 5.5.1 Contractors involved in handling of any material overhead must install necessary barricades, warning signs or take any other steps necessary to prevent others from walking/standing beneath the load.
- 5.5.2 Hoisting machines, tackles including their attachments, anchorage and supports must conform to the good mechanical construction, sound materials and adequate strength and free from patent defect and shall be preserved in good condition.
- 5.5.3 All equipment's like crane, chain blocks, sling, and rope including all other material handling equipment's must have valid load test certificates.

- 5.5.4 Thorough inspection and load testing of lifting machines and tackles shall be done by a competent person at least once every 12 months and records of such inspection and testing shall be maintained.
- 5.5.5 Every crane driver or hoisting appliances operator shall be properly qualified and no person below the age 21 years should be in charge of any hoisting machine.
- 5.5.6 Every hoisting machine and all gears shall be plainly marked with the safe working load. No part of any machine or gear shall be loaded beyond the safe working load (SWL).
- 5.5.7 In case of IPR's machines, the safe working load shall be notified by Engineer-in-charge. For contractor's machines, the contractor shall notify the safe working load to Engineer-in-charge.
- 5.5.8 Motors, gearing transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with safe guards.
- 5.5.9 No cranes shall be left unattended with hanging load and on completion of work, the boom/jib of the crane may be brought down and kept in horizontal condition.
- 5.5.10 No crane including hydra crane shall be allowed to move on road with suspended load.

5.6 Welding and Gas Cutting

- 5.6.1 Welding and gas cutting operations shall be done only by qualified and authorized persons and as per IS specifications and Code of Practice.
- 5.6.2 Welding and gas cutting shall not be carried out in places where flammable or combustible materials are kept and where there is danger of explosion due to presence of gaseous mixtures.
- 5.6.3 Welding and gas cutting equipment including hoses and cables shall be maintained in good condition.
- 5.6.4 Barriers shall be erected to protect other persons from harmful rays from the work. When welding or gas cutting is in elevated positions, precautions shall be taken to prevent sparks or hot metal falling on persons or flammable materials. Adequate ventilation shall be provided while welding in confined space.
- 5.6.5 Suitable type of protective clothing consisting of fire resistant gauntlet gloves, leggings, boots and aprons shall be provided to workers as protection from heat and hot metal splashes. Welding shields with filter glasses of appropriate shade shall be worn as face protection.
- 5.6.6 Welding and gas cutting shall not be done on drums, barrels, tanks or other containers unless they have been emptied, cleaned thoroughly and it is made certain that no flammable material is present.
- 5.6.7 Fire extinguisher shall be available near the location of welding operations. Prior permission shall be obtained from safety section for working at vulnerable areas and operating areas before flame cutting/welding is taken up.
- 5.6.8 Tarpaulin, if used should be of fire retardant.
- 5.6.9 For electric (Arc) welding the following additional safety precautions shall be taken:
 - When electrical welding is undertaken near pipe lines carrying flammables, such pipe lines shall not be used as part of earth conductor but a separate earth conductor shall be connected to the machine directly from the job.
 - Personnel contact with the electrode or other live parts of electric welding equipment shall be avoided.
 - Extreme caution shall be exercised to prevent accidental contact of electrodes with ground.
- 5.6.10 The cylinders containing poisonous/toxic or inflammable / explosive gas like Oxygen, Acetylene, Hydrogen, Ammonia, Chlorine, CO₂ etc. shall be handled safely taking due cares. To handle / shift such cylinders a special trolley / cage meant for it must be used but in no case it should be rolled.
- 5.6.11 No domestic LPG cylinder is allowed for Hot Work such as Gas Welding / Gas Cutting.
- 5.6.12 A person must remain in the area for a minimum period of 30 minutes after hot work is completed to ensure the site is safe. Welding machine shall be switched off after the completion of work.

5.7 Grinding

- 5.7.1 All portable grinders shall be used only with their wheel guards in position to reduce the danger from flying fragments should the wheel break during the use.
- 5.7.2 Grinding wheels of specified diameter only shall be used on a grinder- portable or pedestal - in order not to exceed the prescribed peripheral speed.
- 5.7.3 Goggles shall be used during grinding operation.

5.8 Electrical Equipment – Installation and/or Maintenance

- 5.8.1 Consider all the equipment as live before touching until they are proved to be dead.
- 5.8.2 Before attempting maintenance on electrical equipment, ensure electrical isolation & earthing. Follow “permit to work on electrical system” procedures.
- 5.8.3 Be sure about isolation by physical verification. Check isolation tags on feeders/breakers.
- 5.8.4 Keep electrical insulating mat/ paint in front of electrical panel/ switches.
- 5.8.5 Inspect the equipment thoroughly before normalization.
- 5.8.6 Follow SIDE rule before starting maintenance work on electrical equipment. (S=Switch off, I=Isolate, D=Discharge, E=Earthing).
- 5.8.7 Have minimum number of cable joints and insulate properly all the cable joints.
- 5.8.8 If water cooling is used, ensure that water connections are fitted correctly with no chance of leakage onto HV system.
- 5.8.9 Supply of energy to every electrical installation, other than low voltage installation below 5 kW, shall be controlled by an earth leakage protective device so as to disconnect the supply instantly on the occurrence of earth fault or leakage current.
- 5.8.10 Don't work alone in and around high voltage system.
- 5.8.11 Lifting of electrical equipment as per manufacturer's instructions.
- 5.8.12 Do not allow visitors to enter into high voltage zones without escorting by an authorized person.
- 5.8.13 Never depend on verbal communication for isolation of electrical equipment.
- 5.8.14 Do not wear metallic ornament while working on electrical equipment.
- 5.8.15 Do not overload the power cable beyond its current carrying capacity.
- 5.8.16 Do not insert bare wires of appliances in the plug socket.
- 5.8.17 Only trained, experience and authorized personnel should carrying out maintenance, repair, adjustment etc.
- 5.8.18 Identified tools should be used to carry out such works.
- 5.8.19 Eli Chips and debris must be swept up and properly disposed.

6. REPORTING FORM

6.1 Near Miss Reporting Form

(This form may be filled and submitted to the Safety Section within 48 hours from the incident time)

1. Name of Person Affected/Observed Near miss:	2. Group/Division/Section:
3. Designation:	4. Location of Near Miss:
5. Date & Time of Near Miss:	6. Contact no:/Ext. No.:
7. Near Miss Description: <i>(Describe fully, the protocol / procedure been followed including all substances, equipment and machinery being used which was related to the near miss.)</i> ----- ----- ----- ----- ----- ----- -----	
8. Possible Damage that might have happened: (i) (ii)	
9. Corrective Actions Proposed to prevent reoccurrence of such near miss incident(s): 	

Submitted By:

Signature:

Name:

Date:

6.2 Incident Reporting Form

(This form is to be filled and submitted for all incidents except near miss to safety section within 72 hours from the incident time)

B. PERSONNEL INFORMATION

Name of Injured:		PR No.:
Group:		Contact No./ Ext. No.:
Incident Site:	Employee Category: () Permanent Employee () Project Employee () Contract () AMC () TPIA () Service Provider/Vendor () Other Category	

B. CATEGORY OF INCIDENT

First aid case	
Medical case	
Asset/Equipment/Property damage	
Vehicle incident	
Fire	
Fatal Accident	

C. INCIDENT INFORMATION

Date / Time of Incident	Date/Time Reported To Group Leader
Person Reporting Incident	
Incident Description:	
Injury / Illness Description:	

F. TREATMENT INFORMATION

Treatment Description		
Treatment Administered By	Date Of Treatment	Time Of Treatment
Phone No of clinic / hospital	Name of Clinic/Hospital:	
Pl. attach medical officer's prescription for medical treatment: -	Released from Hospital Date / Time: -	

G. INITIAL CORRECTIVE ACTION INFORMATION

Immediate Causes of incident:

Initial Corrective actions taken


- 1.
- 2.
- 3.

Prepared By:

Sign:
Name:
Designation:
Date:

Reviewed By:

Sign:
Name:
Designation:
Date:

	INSTITUTE FOR PLASMA RESEARCH	Revision: 00
	SAFETY PROTOCOL FOR CONTRACTORS OF MECHANICAL/ MAINTENANCE/ FABRICATION/ERECTION AND OTHER RELATED ACTIVITIES	Eff. Date: 20.03.2014

1. PURPOSE

The purpose of this protocol is to establish, implement and execute a safe and effective program for the prevention of incidents that may cause injury to persons or damage to the property. The specified responsibilities remain with the contractor for compliance.

2. SCOPE

- 2.1 This protocol shall be considered minimum requirements necessary for all works performed inside the Institute for Plasma Research (IPR) and associated centers/units/departments.
- 2.2 All the contractor while at IPR and associated centers/units/departments work site are required to ensure that themselves, their workers and employees, sub-contractors, suppliers, vendors and visitors, must comply with the provisions of this protocol.
- 2.3 The contractor shall review and educate their workers and employees about the stipulations of this protocol.
- 2.4 This protocol is in addition to the responsibility of the contractor towards safety, health and environmental compliance envisaged under law, code or statutory requirements.


3. PROTOCOL

- 3.1 The contractor has to provide appropriate Personal Protective Equipment's (PPE) like safety shoes, safety helmets, goggles, hand gloves, full body safety harnesses, etc. as required for safety of themselves, their workers and employees, sub-contractors, suppliers, vendors and visitors at site. All PPE must conform to relevant Indian and/or International Standards. These should be maintained in recommended condition by suitable storage, maintenance and inspection. IPR shall have right to examine the PPE and determine their suitability, reliability, acceptability and adaptability.
- 3.2 The contractor shall provide and maintain proper illumination, fencing, guards, stairs, ladders, scaffolding, warning signs, caution boards, etc. As required to ensure safe working conditions at site.
- 3.3 The contractor shall ensure that all floor and wall openings are fixed and properly guarded/barricaded during the course of work and at the end of each day's work with appropriate caution board.
- 3.4 The contractor must adhere to the requirements of Safety, Health and Environment (SHE) Policy of IPR, salient features of which are:
 - k. Continual improvement in its Safety, Health & Environment Performance,
 - l. Conservation of natural resources,
 - m. Waste minimization,
 - n. Compliance with applicable statutory and regulatory requirements,
 - o. Creating safety & environmental awareness to its employees and associates.

- 3.5 The contractor has to ensure to employ only persons who are medically fit and having sufficient skills for execution of work. The contractor must ensure efficient job supervision through educated, qualified, experienced and responsible supervisors to ensure safety at site.
- 3.6 All staff persons including workers must undergo Safety Induction Training prior to depute them at IPR and associated centers/units/departments for any kind of work. Training module may include video film, clippings, photographs etc. related to work execution. In addition to this, Job specific training must be imparted to the concerned workers periodically.
- 3.7 The contractor has to ensure that Daily Tool Box Talk shall be conducted at least for new workers by responsible work in-charge/supervisor for each activity and its record to be maintained.
- 3.8 The contractors themselves, their workers and employees, sub-contractors, if any, shall comply with the instructions given by the Safety Officer or his authorized nominee or IPR's representative regarding safety precautions, protective measures, housekeeping requirements, etc. IPR shall have the right at its sole discretion to stop the work, if the work is being carried out in such a way that it may cause accidents or harm to the workers or damage to the equipment's. Contractor shall get the unsafe condition removed and report to IPR.
- 3.9 The contractor shall have no right to claim any damages/compensations for stoppage of work due to safety reasons as provided in para 3.8 .The period of such stoppage of work will not be taken as an extension of time for completion of work or exemption from liquidated damages/compensation delay.
- 3.10 The contractor should ensure that water, fuel and energy are used judiciously. The water & power points must be closed / put off when not in use.
- 3.11 Good housekeeping practices must be followed strictly.
- 3.12 All equipment's used for maintenance, fabrication and assembly work, etc. by the contractor must meet Indian/International standards. In case such standards do not exist, the contractor must ensure these to be absolutely safe. All equipment's shall be strictly operated and maintained in accordance with manufacturers' operation manual and safety instructions.
- 3.13 The contractor must not interfere or disturb electric, fuses, cables and other electrical equipment's belonging to IPR or another agency under any circumstances whatsoever unless expressly permitted in writing by IPR.
- 3.14 Contractor shall arrange adequate facilities for first aid, medical aid and treatment for his staff and workers engaged at the work site.
- 3.15 The contractor has to fully be responsible for the behavior and conduct of themselves, their workers and employees and sub-contractors. Any cost of loss or damage to client's property caused by contractor's employees or workers will be recovered from the contractor.
- 3.16 In case of any accident that occurs during the maintenance/ fabrication/erection or associated activities undertaken by the contractor thereby causing any minor or major or fatal injury to themselves, their workers and employees, sub-contractors due to any reason, it shall be the responsibility of the contractor to promptly inform IPR's Work in-charge and Safety Officer in prescribed form of IPR. This should also be informed to statutory authority, if required, under the applicable laws. The contractor shall maintain a register of accidents.
- 3.17 In case the contractor fails to fulfil statutory requirements, IPR shall have the right to withhold contractors payments till the requirement are fulfilled.
- 3.18 The contractor shall plan his activities so as to avoid interference with the assignments of other departments and contractors at the site. In case of any interference, necessary coordination must be sought by the contractor from IPR for safe and smooth working.
- 3.19 All necessary precautions shall be taken to prevent outbreak of fires at the site. Adequate provisions or as recommended by Safety Officer of IPR must be made by the contractor to extinguish fires.
- 3.20 The contractor shall follow the stipulated procedure regarding work in the radiation area and other works related with radiography. The contractor shall be fully responsible for the safe storage and

handling of his and his sub-contractor's radio-active sources in accordance with AERB rules and other applicable provisions.

- 3.21 The contractor shall issue photo identity card for themselves, their workers and employees, sub-contractors to be deployed at site. They are required to be displayed prominently during the period of their stay within IPR and associated centers/units/departments.
- 3.22 The contractor shall obtain gate pass from IPR and associated centers/units/departments for entries and exists of all materials and equipment's.
- 3.23 Smoking and eating/chewing of tobacco is strictly prohibited at site.
- 3.24 Any person under the influence of any intoxicating beverage, even to the slightest degree shall not be permitted at work site.
- 3.25 Person below the age of 18 years must not be employed for any work at site
- 3.26 IPR may from time to time, add or amend to these protocols and issue directions.
- 3.27 The contractor shall comply with safety instructions as laid down in as per Annexure-I.

	INSTITUTE FOR PLASMA RESEARCH	Revision: 00
	SAFETY INSTRUCTIONS FOR CONTRACTORS OF MECHANICAL/MAINTENANCE/FABRICATION/ ERECTION AND OTHER RELATED ACTIVITIES	Eff. Date: 20.03.2014

CONTENTS

SR. NO.	TITLE
1.	GENERAL INFORMATION
2.	ROLE OF THE CONTRACTOR
2.1	Top Management of the Contractor
2.2	Contractor Safety Officer, Safety Supervisor and/or Job Supervisor
2.3	Contractor Employees
3.	PENALTY FOR NON-COMPLIANCE
4.	PROVISION FOR SAFETY SUPERVISOR/SAFETY OFFICER OF CONTRACTOR
5.	GENERAL SAFETY PROVISIONS
5.1	Personal Protective Equipment
5.2	Electricity
5.3	House Keeping
5.4	Fire Safety
5.5	Scaffolding
5.6	Lifting/Hoisting Equipment & Erection
5.7	Welding and Gas Cutting
5.8	Grinding
5.9	Painting
5.10	Radiography
5.11	Maintenance of Equipment
6.	REPORTING FORMS
6.1	Near Miss Reporting Form
6.2	Incident Reporting Form

1. GENERAL INFORMATION

- 1.1 The purpose of safety instruction document is to establish, implement and execute a practical and effective method for preventing accidents, injuries and property damage.
- 1.2 This document will help contractors and their associates to recognize, evaluate and control hazardous activities within their areas of responsibility.
- 1.3 This document defines the procedure with which safety practice will be administered, identifies responsibilities and ensures control of work area safety.
- 1.4 Contract agreement signed with contractors and the provisions of this document are intended to complement each other to ensure safe working conditions.
- 1.5 The provisions of this document apply to IPR and associated centers/units/departments.
- 1.6 Throughout this document, reference to a contractor means the contractor's company and the associated subcontractors, consultants, vendors and suppliers. Reference to contractor's management means personnel responsible for managing, supervising or directing contract activities and employees.
- 1.7 Non-compliance of this document is treated as non-compliance of contract agreement that may result in warning/penalty. Willful or repeated non-compliance may result in contractor dismissal and contract termination.
- 1.8 This document for contractors is a supplementary document to statutory rules, codes and regulations having jurisdiction, and does not negate, abrogate or minimize any provisions of these rules, codes and regulations. It is intended to supplement and enforce the individual program of the contractor and to coordinate the overall safety effort. Contractors are responsible for the safety and health of their employees, subcontractors, consultants, vendors, suppliers, and visitors while in IPR and associated centers/units/departments.
- 1.9 Contractor's managers and supervisors are responsible for preventing incidents or conditions that could lead to incidents, injuries, illness or fatalities. The ultimate success of the safety program depends on the cooperation of everyone. The contractor's management must ensure that safety provisions are enforced and that effective training and education programs are employed.

2. ROLE OF THE CONTRACTOR

2.1 Top Management of the Contractor

The commitment of top management of the contractor towards safety is very important. Top management needs to ensure the following:

- 2.1.1 To implement safe methods and practices, deploy appropriate machineries, tools & tackles, experienced supervision and skilled workforce, etc. required for execution.
- 2.1.2 To ensure that employees and workers deployed are physically and mentally fit. They should possess requisite skill, qualification, experience etc.
- 2.1.3 To deploy qualified and trained safety supervisor, safety officers and/or safety manager reporting to site In-charge for supervision, co-ordination and liaison for the implementation of safety.
- 2.1.4 To ensure that the employees and workers have appropriate health and safety training. The certification of such training should be produced for verification, on demand.
- 2.1.5 To obtain all necessary and applicable licenses, permits, and insurance policy of his employees and workers before executing any work. A copy of the same must be submitted to the relevant authority at IPR.
- 2.1.6 To ensure that all incidents (minor/major injuries, fatality, fire, property damage etc.) including near misses shall be reported to the relevant authority at IPR immediately verbally as well as in written format of IPR. Also, keep record for the same.

- 2.1.7 The liability for any compensation on account of injury sustained by an employee of the contractor will be exclusively that of the contractor.
- 2.1.8 To provide personal protective equipment's required for the safety and first-aid kits at worksite.
- 2.1.9 To maintain appropriate records of all employees and workers deployed to carry out the work at site.
- 2.1.10 Contractor shall not employ any labour below 18 years of age.
- 2.1.11 A photo gate pass duly approved by IPR administration shall be issued by the contractor to their personnel, employees, subcontractors, etc.
- 2.1.12 To co-operate with all the security arrangements of IPR.
- 2.1.13 Contractor may ask for clarifications required in safety related issues, whenever a need arises.
- 2.1.14 To follow and implement all the safety rules and regulations of the local bodies, state, national and international. Contractor shall also comply with all the statutory requirements and notifications, as applicable, in relation to employment of his employees issued time to time by the concerned authorities.

2.2 Contractor Safety Officer, Safety Supervisor and/or Job Supervisor

The duties and responsibilities of the contractor safety officer, safety supervisor and/or job supervisor shall include the following:

- 2.2.1 To assess the hazards associated with work at site in consultation with all concerned and establish safe working procedure.
- 2.2.2 To establish a written records of factors that can cause injuries, illness or other safety related problems.
- 2.2.3 To undertake routine/surprise inspections of all work sites to ensure compliance with safety standards, codes, rules, regulations and orders applicable to the work concerned.
- 2.2.4 To check whether the proposed working arrangements/procedures are safe and satisfactory, particularly at the interface between contractors planned work and IPR facilities.
- 2.2.5 To ensure that required guards and protective equipment are provided, used and properly maintained.
- 2.2.6 To ensure that the workers understand the working procedures for carrying out the work safety and the hazards that may be encountered.
- 2.2.7 To take immediate actions to correct any violation of safety rules observed or reported.
- 2.2.8 To ensure that appropriate warning signboards and tags are displayed.
- 2.2.9 To report each incident and/or injury in accordance with established procedures and assists during investigation.
- 2.2.10 To arrange tool box meeting daily and shall continue this process to make workmen safety conscious. To keep a constant liaison with the relevant authority at IPR on safety issues.

2.3 Contractor Employees

The duties & responsibilities of the contractor employees should include the following:

- 2.3.1 The contractors' employees must be trained for safety standards, procedure to carry out high risk job (if involved), use of Personal Protective Equipment's (PPEs) in general and specific for a particular job, emergency preparedness and fire extinguisher and medical first-aid.
- 2.3.2 To perform work safely as per the job requirements/instructions and wear appropriate PPEs.
- 2.3.3 To inform promptly to their management regarding all work related incidents resulting in personal injury, illness and/or property damage, etc.

2.3.4 To take all necessary and appropriate safety precautions to protect themselves, other personnel and the environment.

3. PENALTY FOR NON-COMPLIANCE

The following penalties shall be imposed on the contractor by the IPR and shall be deducted from his running/final bill.

Sr. No.	Non-Compliance/Violation of Safety Protocols/Rules/Norms	Penalty
1.	Non-use of PPE like Safety Helmet / Safety Shoes etc.	Rs. 100 per day/person
2.	Over speeding (> 30Km/Hr.) / rash driving or improper parking	Rs. 100 per occasion
3.	Non-use ELCB/MCB, Use of non-standard socket, poor cable joint, laying wire/cables on floor, non-use of socket, electrical jobs by incompetent person	Rs. 200 per day/case
4.	Working at height without full body safety harness, using non-standard scaffolding and not arranging fall protection arrangement	Rs. 500 per day/case
5.	Handling of compressed gas cylinders without trolley and double gauge regulator, Improper keeping/storage of gas cylinder	Rs. 200 per day/case
6.	Use of domestic LPG for cutting purpose.	Rs. 200 per day/case
7.	No fencing/barricading of excavated/open areas.	Rs. 200 per day/case
8.	No provision of firefighting equipment during hot works. Use of firewater for purpose other than firefighting.	Rs. 200 per day/case
9.	No reporting of Nearmiss/First-aid/Injury/Property damage/Minor fire etc. incidents	Rs. 500 per case
10.	Poor Housekeeping	Rs. 200 per day/case
11.	No deployment of safety officer/safety supervisor responsible for safety at work site as mentioned in Chapter No. 5	Rs. 500 per day

Safety Officer or any other officer authorized by IPR will report safety violation to the concerned Engineer In-charge for imposing necessary penalty. Engineer-in-charge shall ensure that the penalty amount has been deducted from the running bill of contractor. Imposing any penalty for violation of safety norms does not absolve the contractors from their contractual obligation/ responsibility. Contractor shall be fully responsible for any accident and/or injury to their employees or property due to violation of safety norms.

4. PROVISION FOR SAFETY SUPERVISOR/SAFETY OFFICER OF CONTRACTOR

The contractor shall depute at least one Safety Supervisor / Safety Officer for critical activities as follows,

- Work at height (working beyond 2.5 mtr. above ground)
- Materials and Material Handling which includes movement of heavy material by crane, movement of tractor trolley on slopes, Manual lifting of heavy material to height, erection of heavy machinery, equipment, etc.
- Loading and unloading of equipment, structural materials, machineries, etc., Fabrication and erection work
- Working near high voltage lines, electrical installations, etc., charging of electrical system,

- transformers, switch yard, switch gears, etc.
- v. Work on pressure vessels/lines.
- vi. Work in confined space
- vii. Radiography work
- viii. Work related to welding, gas cutting, grinding, etc.
- ix. Work with pneumatic tools/compressed air
- x. Leak detection testing / Hydraulic testing

In addition to above list, IPR may also recommend for some specific tasks, which are not covered, to depute Safety Officer/Safety Supervisor.

Safety supervisor shall be qualified of minimum Diploma in Engineering/ Graduate in Science with approved course in the field of safety and/or fire. He shall able to read and understand English and speak regional/national language. He shall have experience as safety supervisor for a period of minimum one year.

Safety Officer shall be qualified of minimum Bachelor in Engineering/ Post Graduate in Science with approved course in the field of Safety and/or Fire. Safety Officer shall have good communication and written skill to liaison with the client. He shall have good command in English and regional/national language. He shall have experience for a period of minimum three years of supervisory level.

5. GENERAL SAFETY PROVISIONS

5.1 Personal Protective Equipment

The contractor is responsible to provide all necessary standard make (ISI marked) personal protective equipment (PPE) suitable to give sufficient protection against hazards involved in their work / job to their employees, as per the job requirement and insist/enforce their staff to put on the same while atworks and ensure that the PPEs are properly used and maintained in a condition suitable for immediate use. The contractor shall have sufficient stock of various PPEs to avoid any shortage of supply and shall take adequate steps to ensure proper use of equipment by those concerned. The ongoing work is liable to be stopped at any time if the contractor's staff is found working without PPEs.

- 5.1.1 All persons employed at site shall use safety helmets. For other types of works, persons working in that area shall also use safety helmets, if advised by Safety Engineer/Engineer-In-Charge.
- 5.1.2 Persons engaged in welding and gas-cutting works shall use suitable welding face shields. The persons who assist the welders shall use suitable goggles. Protective goggles shall be worn while chipping and grinding.
- 5.1.3 All persons working at heights more than 2.5 m above ground or floor and exposed to risk of falling down shall use full body safety harness, unless otherwise protected by cages, guard railings, etc. In places where the use of safety harness is impractical, suitable net of adequate strength fastened to substantial supports shall be employed.
- 5.1.4 When workers are employed in sewers and inside manholes, which are in use, the Contractor shall ensure that the manholes are opened and are adequately ventilated at least for an hour. After it has been well ventilated, the atmosphere inside the space shall be checked for the presence of any toxic gas or oxygen deficiency and recorded in the register before the workers are allowed to get into the manholes. The manholes opened shall be cordoned off with suitable railing and provided with warning signals or caution boards to prevent accidents. There shall be proper illumination in the

night.

5.1.5 The following is the list of various PPEs to be used for various works/worksites,

List of Safety Equipment's

Sr. No.	PPE	Purpose
01	Industrial Safety Helmet	For protection of head against falling objects or during fall of person from height.
02	Safety Goggles (Grinding, Welding, etc.).	For protection of eyes against flying particles / dust, chemical splash, spark, arc, flashover etc.
03	Face shield	For protection of face against flying particles / dust, chemical splash, spark, arc, flashover etc.
04	Ear plug / Ear muffs	For ear / hearing system protection while working in high noise level area.
05	Apron(PVC /cry/Cotton)	For body protection against chemicals, oils, cryogenics, sharp edged objects, heat, hot objects etc.
06	Gloves (Nitrile/Leather, cryogenics, Electrical shock proof)	For protection of hands against chemicals, oils, cryogenics, sharp edged objects, heat, hot metals/objects, electricity etc.
07	Safety Shoes	For protection of leg/feet against falling objects, sharp edged objects, heat, hot metals/objects, electricity etc.
08	Full body safety harness/ I Rope /Life line/ Fall prevention system etc.	For fall prevention while working at heights or in depth, working in vessel or in confined space.
09	Dust Respirator	Protection of respiratory system against dust.
10	Self-contained breathing apparatus (SCBA) set	Working in oxygen deficient areas.

5.2 Electricity

The following are provided for general guidance of the Contractor and shall be read as specific requirement, in addition to complying with Indian Electricity Act, Indian Electricity Rules and IS Specifications.

- 5.2.1 Only qualified electricians familiar with code requirements are allowed to perform electrical work.
- 5.2.2 Employees are not permitted to work near an unprotected electrical power circuit unless they are protected against electrical shock by de-energizing the circuit and grounding it, or are protected by effective insulation or other means, and are wearing .required personal protective equipment.
- 5.2.3 The electric power supply will be generally made available at one point in the works site of the contractor by the IPR.
- 5.2.4 All three phase equipment shall be provided with double earthing. All light fixtures and portable equipment shall be effectively earthed to main earthing.
- 5.2.5 All earth terminals shall be visible. No gas pipes and water pipes shall be used for earth connection. Neutral conductor shall not be treated as earth wire.
- 5.2.6 The contractor shall not connect any additional load without prior permission of IPR.
- 5.2.7 Joints in earthing conductors shall be avoided. Loop earthing of equipment shall not be allowed. However tapings from an earth bus may be done.

- 5.2.8 Electrical equipment and installations shall be installed and maintained as to prevent danger from contact with live conductors and to prevent fires originating from electrical causes like short circuits, overheating etc. Installation shall not cause any hindrance to movement of men and materials.
- 5.2.9 Materials for all electrical equipment shall be selected with regard to working voltage, load and working environment. Such equipment shall conform to the relevant standards.
- 5.2.10 Electric fuses and/or circuit breakers installed in equipment circuits for short circuit protection shall be of proper rating. It is also recommended that high rupturing capacity (HRC) fuses be used in all circuits. For load of 5 KW or more earth leakage circuit breaker of proper rating shall be provided in the circuits.
- 5.2.11 Wires and cables shall be properly supported and approved method of fixing shall be adopted. Cables shall not be left on floor/ground. Loose hanging of wires & cables shall be avoided. Lightning and power circuits shall be kept distinct and separate.
- 5.2.12 Reinforcement rods or any metallic part of structure shall not be used for supporting wires and cables, fixtures, equipment, earthing etc.
- 5.2.13 All cables and wires shall be adequately protected mechanically against damages. In case, the cable required to be laid underground, it shall be adequately protected by covering the same with bricks, Plain Cement Concrete (PCC), tile or any other approved means.
- 5.2.14 All armored cables shall be properly terminated by using suitable cable glands. Multi-stranded conductor cables shall be connected by using cable lugs/ sockets. Cable lugs shall preferably be crimped. They shall be of proper size and shall correspond to the current rating and size of the cable. Twisted connections will not be allowed.
- 5.2.15 All the Distribution Boards, Switch Fuse units, Bus bar chambers, ducts, cubicles etc. shall have MS enclosures and shall be dust, vermin and waterproof. The Distribution Boards, switches etc. shall be so fixed that they shall be easily accessible.
- 5.2.16 The Contractor shall provide proper enclosures/covers of approved size and shape for protection of all switch boards, equipment etc. against rain.
- 5.2.17 Isolating switches shall be provided close to equipment for easy disconnection of electrical equipment or conductors from the source of supply, when repair or maintenance work has to be done.
- 5.2.18 All connections to lighting fixtures, starters or other power supplies shall be provided with PVC insulated, PVC sheathed twin/three/four core wires to have better mechanical protection for preventing possible damage to equipment or injury to personnel. Taped joints shall not be allowed and the connections may be made in looping system. Electric starter of motors, Switches shall not be mounted on wooden boards. Only sheet steel mounting or iron framework shall be used.
- 5.2.19 Only PVC insulated and PVC sheathed wires or armored PVC insulated and sheathed cables shall be used for external power supply connections of temporary nature. Weatherproof rubber wires shall not be used for any temporary power supply connections. Taped joints in the wires shall not be used.
- 5.2.20 All portable appliances shall be provided with three-core cable and three-pin plug. The third pin of the plug shall invariably be earthed. It shall be ensured that the metal part of the equipment shall be effectively earthed.

5.3 House Keeping

- 5.3.1 The Contractor shall at all times keep his work spot, site office and surroundings clean and tidy from rubbish, scrap, surplus materials and unwanted tools and equipment so as not to create unsafe condition or fire hazard.
- 5.3.2 Welding and other electrical cables shall be properly routed.
- 5.3.3 No materials on any of the sites of work shall be so stacked or placed as to cause danger or

inconvenience to any person or the public.

5.3.4 Cleaning of the work area at the end of the day and upon completion of work is a part of the job.

5.3.5 The Engineer-in-charge has the right to stop work if the Contractor fails to improve upon the housekeeping after having been notified.

5.4 Fire Safety

5.4.1 All necessary precautions shall be taken to prevent outbreak of fires at the site. Adequate provisions shall be made to extinguish fires, if it still breaks out.

5.4.2 Quantities of combustible materials like timber, bamboos, coal, paints, etc., shall be kept minimum in order to avoid unnecessary accumulation of combustibles at site.

5.4.3 Containers of paints, thinners and allied materials shall be stored in a separate room which shall be well ventilated and free from excessive heat, sparks, flame or direct rays of the sun. The containers of paint shall be kept covered or properly fitted with lid and shall not be kept open except while using.

5.4.4 Fire extinguishers shall be located at the site at appropriate places.

5.4.5 Adequate number of workmen shall be given education and training in firefighting and extinguishing methods.

5.5 Scaffolding

5.5.1 Accidents are also caused by the ladders falling or the climber losing his balance or failure of scaffolds. As such, utmost care should be taken as ladder and scaffolding are extensively used for maintenance and construction purpose. Some of the safe practices as listed below are to be observed before commencement of work.

5.5.2 Adequate and safe means of access and exit shall be provided for all work places, at all elevations. Using of scaffolding members (avoiding a ladder) for approach to high elevations shall not be permitted.

5.5.3 Suitable scaffolds shall be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short duration work as can be done safely from ladders. Ladder shall be of rigid construction having sufficient strength for the intended loads and made either of good quality wood or metal and all ladders shall be maintained well for safe working condition.

5.5.4 Short ladder must not be tied together to give greater lengths. All ladders of 6 m or above should be tied to the structure on which they are resting to prevent from. An extra worker shall be engaged for holding the ladder if ladder is not securely fixed. If the ladder is used for carrying materials, suitable foot holds and handholds shall be provided on the ladder. The ladder shall be given an inclination not steeper than 1 in 4 (1 horizontal and 4 vertical). Ladders shall not be used for climbing carrying materials in hands. While climbing both the hands shall not be free.

5.5.5 The free length must extend by 1.5 meters above the point of landing but should not be more than 1/4th of the ladder length. No portable single ladder shall be over 9 meter in length. Metal ladders may not be used for electrical work.

5.5.6 Scaffolding or staging more than 3.5 m above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a standard guard rail properly attached, bolted, braced or otherwise secured at least 1.0 m high above the floor or platform of such scaffolding or staging. The guard rail shall extend along the entire exposed length of the scaffolding with only such opening as may be necessary for the delivery of materials. Standard railing shall have posts not more than 2 m apart and an intermediate rail halfway between the floor and platform of the scaffolding and the top rail. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure. Scaffolding and ladder shall conform to relevant IS

specification (IS: 3696). Timber/Bamboo scaffolding shall not be used.

- 5.5.7 Working platforms of scaffolds shall have toe boards at least 15 cm in height to prevent materials from falling down.
- 5.5.8 Every part of scaffolding must be of sound construction. Steel planks used in scaffolds should be carefully inspected and should be tied on both sides with suitable fixing arrangements to the pipes. Scaffolding must not be overloaded.
- 5.5.9 The Steel pipe & clamp to be used must be of good quality. The spacing between the vertical & horizontal members of the scaffolding should not be more than 1.5m and 1 meter respectively. The scaffolding should be further strengthened with cross bracing and stays.
- 5.5.10 The scaffolds should be provided with short climbs ladders for safe ascending/ descending of workmen in the job. Only those workmen who are well trained/ experienced in erecting scaffolding should be engaged for scaffolding work. The men working in the actual erection/ dismantling of the scaffolding and all persons using the scaffolding must use appropriate PPEs.
- 5.5.11 A sketch of the scaffolding proposed to be used shall be prepared and approved by the Engineer-in charge, prior to start of erection of scaffolding. All scaffolds shall be examined by Engineer-In-Charge before use.
- 5.5.12 Working platform, gangways and stairways shall be so constructed that they shall not sag unduly or unequally and if the height of the platform or gangway or stairway is more than 3.5 m above ground level or floor level, they shall be closely boarded, shall have adequate width for easy movement of persons and materials and shall be suitably guarded.
- 5.5.13 The planks used for working platform shall not project beyond the end supports to a distance exceeding four times the thickness of the planks used. The planks shall be rigidly tied at both ends to prevent sliding and slippage. The thickness of the planks shall be adequate to take load of men and materials and shall not collapse.
- 5.5.14 Each opening in the floor of a building or at a working platform shall be provided with suitable means to prevent fall of persons or materials by providing suitable fencing or railing.
- 5.5.15 Safe means of access shall be provided to all working platforms and other elevated working places. Every ladder shall be securely fixed. No single portable ladder shall be over 9 m in length. For ladders up to 3m in length the width between side rails in the ladder shall in no case be less than 300 mm. For longer ladders this width shall be increased by at least 20 mm for each additional meter of length. Step spacing shall be uniform and shall not exceed 300 mm.
- 5.5.16 Adequate precautions shall be taken to prevent danger from electrical lines and equipment. No scaffolding, ladder, working platform, gangway runs, etc. shall exist within 3 meters of any uninsulated electric wire. Whenever electric power and lighting cables are required to run through (pass on) the scaffolding or electrical equipment's are used, such scaffolding structures shall have minimum two earth connections with earth continuity conforming to IS Code of Practice.

5.6 Lifting/Hoisting Equipment and Erection

Accidents do happen while working overhead or due to failure or unsafe use of hoisting equipment. As such, adequate care must be taken to prevent it. The following are some of the precautions to ensure safety of the workmen engaged by the contractor:

- 5.6.1 Contractors involved in handling of any material overhead must install necessary barricades, warning signs or take any other steps necessary to prevent others from walking/standing beneath the load.
- 5.6.2 Hoisting machines, tackles including their attachments, anchorage and supports must conform to the good mechanical construction, sound materials and adequate strength and free from patent defect and shall be preserved in good condition.
- 5.6.3 All equipment's like crane, chain blocks, sling, and rope including all other material handling equipment's must have valid load test certificates.

- 5.6.4 Thorough inspection and load testing of lifting machines and tackles shall be done by a competent person at least once every 12 months and records of such inspection and testing shall be maintained.
- 5.6.5 Every crane driver or hoisting appliances operator shall be properly qualified and no person below the age 21 years should be in charge of any hoisting machine.
- 5.6.6 Every hoisting machine and all gears shall be plainly marked with the safe working load. No part of any machine or gear shall be loaded beyond the safe working load (SWL).
- 5.6.7 In case of IPR's machines, the safe working load shall be notified by Engineer-in-charge. For contractor's machines, the contractor shall notify the safe working load to Engineer-in-charge.
- 5.6.8 Motors, gearing transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with safe guards.
- 5.6.9 No cranes shall be left unattended with hanging load and on completion of work, the boom/jib of the crane may be brought down and kept in horizontal condition.
- 5.6.10 No crane including hydra crane shall be allowed to move on road with suspended load.

5.7 Welding and Gas Cutting

- 5.7.1 Welding and gas cutting operations shall be done only by qualified and authorized persons and as per IS specifications and Code of Practice.
- 5.7.2 Welding and gas cutting shall not be carried out in places where flammable or combustible materials are kept and where there is danger of explosion due to presence of gaseous mixtures.
- 5.7.3 Welding and gas cutting equipment including hoses and cables shall be maintained in good condition.
- 5.7.4 Barriers shall be erected to protect other persons from harmful rays from the work. When welding or gas cutting is in elevated positions, precautions shall be taken to prevent sparks or hot metal falling on persons or flammable materials. Adequate ventilation shall be provided while welding in confined space.
- 5.7.5 Suitable type of protective clothing consisting of fire resistant gauntlet gloves, leggings, boots and aprons shall be provided to workers as protection from heat and hot metal splashes. Welding shields with filter glasses of appropriate shade shall be worn as face protection.
- 5.7.6 Welding and gas cutting shall not be done on drums, barrels, tanks or other containers unless they have been emptied, cleaned thoroughly and it is made certain that no flammable material is present.
- 5.7.7 Fire extinguisher shall be available near the location of welding operations. Prior permission shall be obtained from safety section for working at vulnerable areas and operating areas before flame cutting/welding is taken up.
- 5.7.8 Tarpaulin, if used should be of fire retardant.
- 5.7.9 For electric (Arc) welding the following additional safety precautions shall be taken:
- When electrical welding is undertaken near pipe lines carrying flammables, such pipe lines shall not be used as part of earth conductor but a separate earth conductor shall be connected to the machine directly from the job.
 - Personnel contact with the electrode or other live parts of electric welding equipment shall be avoided.
 - Extreme caution shall be exercised to prevent accidental contact of electrodes with ground.
- 5.7.10 The cylinders containing poisonous/toxic or inflammable / explosive gas like Oxygen, Acetylene, Hydrogen, Ammonia, Chlorine, CO₂ etc. shall be handled safely taking due cares. To handle / shift such cylinders a special trolley / cage meant for it must be used but in no case it should be rolled.
- 5.7.11 No domestic LPG cylinder is allowed for Hot Work such as Gas Welding / Gas Cutting.
- 5.7.12 A person must remain in the area for a minimum period of 30 minutes after hot work is completed

to ensure the site is safe. Welding machine shall be switched off after the completion of work.

5.8 Grinding

- 5.8.1 All portable grinders shall be used only with their wheel guards in position to reduce the danger from flying fragments should the wheel break during the use.
- 5.8.2 Grinding wheels of specified diameter only shall be used on a grinder- portable or pedestal - in order not to exceed the prescribed peripheral speed.
- 5.8.3 Goggles shall be used during grinding operation.

5.9 Painting

- 5.9.1 The Contractor shall not employ women on the work of painting with products containing lead in any form. Only men above the age of 18 years shall be employed on the work with lead paint.
- 5.9.2 Smoking, open flames or sources of ignition shall not be allowed in places where paints and other flammable substances are stored, mixed or used. A caution board, with the instructions written in national/regional language, "SMOKING - STRICTLY PROHIBITED" shall be displayed in the vicinity where painting is in progress or where paints are stored.
- 5.9.3 When painting work is done in a closed room or in a confined space, adequate ventilation shall be provided. If adequate ventilation cannot be provided, workers shall wear suitable respirators.
- 5.9.4 Epoxy resins and their formulations used for painting shall not be allowed to come in contact with the skin. The workers shall use plastic gloves and/or suitable barrier creams.
- 5.9.5 Workers shall thoroughly wash hands and feet before leaving the work. Work clothes shall be changed and laundered frequently.

5.10 Radiography

- 5.10.1 Only properly trained, qualified personnel shall be allowed to use radiation producing equipment or handle radioactive source.
- 5.10.2 Radiography works may be carried out preferably after office hours or on holidays.
- 5.10.3 The following are some basic rules to be followed:
 - The ionization radiation source shall not be left unattended.
 - Radiation film and dose meter shall be used.
 - The exposed area shall be clearly identified, barricaded by rope or other effective means and internationally recognized symbol for radiation shall be placed around the perimeter of any area which may be affected by radiation.
 - Contractor shall coordinate with safety officer to ensure that the dose rate at barricade does not exceed 0.75 milirems per hour.

5.11 Maintenance of Equipment

- 5.11.1 Disconnect the electrical power before starting the mechanical maintenance of the equipment/machine.
- 5.11.2 During the maintenance of equipment/machine, it should be doubly ensured that the machine does not move unexpectedly causing injury to the person involved.
- 5.11.3 Full proof lockout system or power lock off system should be followed. Power lock off system shall include the electrical power, energy stored in springs, suspended parts or any other potential power sources.
- 5.11.4 A highly legible information plate should be kept near the equipment/ machine under maintenance giving the details of work being carried-out, warning instructions etc., to enable the

workers, supervisors or any visitors to keep away.

5.11.5 Removal of such plates immediately after the maintenance, repair etc., shall be -insured.

5.11.6 Instructions from the machine manufacturers' service/installation book should be followed during maintenance of the equipment.

5.11.7 Only trained personnel should be employed for carrying out maintenance, repair, adjustment etc.

5.11.8 Identified tools should be used to carry out such works.

5.11.9 Guards should be replaced immediately after the maintenance work.

5.11.10 Eli Chips and debris must be swept up and properly disposed.

6. REPORTING FORM

6.1 Near Miss Reporting Form

(This form may be filled and submitted to the Safety Section within 48 hours from the incident time)

1. Name of Person Affected/Observed Near miss:	2. Group/Division/Section:
3. Designation:	4. Location of Near Miss:
5. Date & Time of Near Miss:	6. Contact no:/Ext. No.:
7. Near Miss Description: <i>(Describe fully, the protocol / procedure been followed including all substances, equipment and machinery being used which was related to the near miss.)</i> ----- ----- ----- ----- ----- ----- -----	
8. Possible Damage that might have happened: (i) (ii)	
9. Corrective Actions Proposed to prevent reoccurrence of such near miss incident(s): 	

Submitted By:

Signature:

Name:

Date:

6.3 Incident Reporting Form

(This form is to be filled and submitted for all incidents except near miss to safety section within 72 hours from the incident time)

C. PERSONNEL INFORMATION

Name of Injured:		PR No.:
Group:		Contact No./ Ext. No.:
Incident Site:	Employee Category: () Permanent Employee () Project Employee () Contract () AMC () TPIA () Service Provider/Vendor () Other Category	

B. CATEGORY OF INCIDENT

First aid case	
Medical case	
Asset/Equipment/Property damage	
Vehicle incident	
Fire	
Fatal Accident	

C. INCIDENT INFORMATION

Date / Time of Incident	Date/Time Reported To Group Leader
Person Reporting Incident	
Incident Description:	
Injury / Illness Description:	

H. TREATMENT INFORMATION

Treatment Description		
Treatment Administered By	Date Of Treatment	Time Of Treatment
Phone No of clinic / hospital	Name of Clinic/Hospital:	
Pl. attach medical officer's prescription for medical treatment: -	Released from Hospital Date / Time: -	

I. INITIAL CORRECTIVE ACTION INFORMATION

Immediate Causes of incident:

Initial Corrective actions taken

1.

2.

3.

Prepared By:

Sign:

Name:

Designation:

Date:

Reviewed By:

Sign:

Name:

Designation:

Date:

SECTION: 3 - (iv) Model Rules for the Protection of Health and Sanitary Arrangements for Workers Employed by Institute or its Contractors

1. APPLICATION

These rules shall apply to all buildings and construction works in charge of Institute for Plasma Research in which twenty or more workers are ordinarily employed or are proposed to be employed in any day during the period during which the contract work is in progress.

2. DEFINITION

Work place means a place where twenty or more workers are ordinarily employed in connection with construction work on any day during the period during which the contract work is in progress.

3. FIRST-AID FACILITIES

(i) At every work place there shall be provided and maintained, so as to be easily accessible during working hours, first-aid boxes at the rate of not less than one box for 150 contract labour or part thereof ordinarily employed.

(ii) The first-aid box shall be distinctly marked with a red cross on white back ground and shall contain the following equipment:

(a) For work places in which the number of contract labour employed does not exceed 50 - Each first-aid box shall contain the following equipment's:-

1. 6 small sterilized dressings.
2. 3 medium size sterilized dressings.
3. 3 large size sterilized dressings.
4. 3 large sterilized burn dressings.
5. 1 (30 ml.) bottle containing a two per cent alcoholic solution of iodine.
6. 1 (30 ml.) bottle containing salvolatile having the dose and mode of administration indicated on the label.
7. 1 snakebite lancet.
8. 1 (30 gms.) bottle of potassium permanganate crystals.
9. 1 pair scissors.
10. 1 copy of the first-aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.
11. 1 bottle containing 100 tablets (each of 5 gms.) of aspirin.
12. Ointment for burns.
13. A bottle of suitable surgical antiseptic solution.

(b) For work places in which the number of contract labour exceed 50.
Each first-aid box shall contain the following equipment's.

1. 12 small sterilized dressings.
2. 6 medium size sterilized dressings.
3. 6 large size sterilized dressings.

4. 6 large size sterilized burn dressings.
5. 6 (15 gms.) packets sterilized cotton wool.
6. 1 (60 ml.) bottle containing a two per cent alcoholic solution iodine.
7. 1 (60 ml.) bottle containing salvolatile having the dose and mode of administration indicated on the label.
8. 1 roll of adhesive plaster.
9. 1 snake bite lancet.
10. 1 (30 gms.) bottle of potassium permanganate crystals.
11. 1 pair scissors.
12. 1 copy of the first-aid leaflet issued by the Director General Factory Advice Service and Labour Institutes/Government of India.
13. A bottle containing 100 tablets (each of 5 gms.) of aspirin.
14. Ointment for burns.
15. A bottle of suitable surgical antiseptic solution.

(iii) Adequate arrangements shall be made for immediate recoupment of the equipment when necessary.

(iv) Nothing except the prescribed contents shall be kept in the First-aid box.

(v) The first-aid box shall be kept in charge of a responsible person who shall always be readily available during the working hours of the work place.

(vi) A person in charge of the First-aid box shall be a person trained in First-aid treatment, in the work places where the number of contract labour employed is 150 or more.

(vii) In work places where the number of contract labour employed is 500 or more and hospital facilities are not available within easy distance from the works. First-aid posts shall be established and run by a trained compounder. The compounder shall be on duty and shall be available at all hours when the workers are at work.

(viii) Where work places are situated in places which are not towns or cities, a suitable motor transport shall be kept readily available to carry injured person or person suddenly taken ill to the nearest hospital.

4. DRINKING WATER

(i) In every work place, there shall be provided and maintained at suitable places, easily accessible to labour, a sufficient supply of cold water fit for drinking.

(ii) Where drinking water is obtained from an intermittent public water supply, each work place shall be provided with storage where such drinking water shall be stored.

(iii) Every water supply or storage shall be at a distance of not less than 50 feet from any latrine drain or other source of pollution. Where water has to be drawn from an existing well which is within such proximity of latrine, drain or any other source of pollution, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with a trap door which shall be dust and waterproof.

(iv) A reliable pump shall be fitted to each covered well, the trap door shall be kept locked and opened only for cleaning or inspection which shall be done at least once a month.

5. WASHING FACILITIES

(i) In every work place adequate and suitable facilities for washing shall be provided and maintained for the use of contract labour employed therein.

(ii) Separate and adequate cleaning facilities shall be provided for the use of male and female workers.

(iii) Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition.

6. LATRINES AND URINALS

(i) Latrines shall be provided in every work place on the following scale namely:-

(a) Where female are employed there shall be at least one latrine for every 25 females.

(b) Where males are employed, there shall be at least one latrine for every 25 males.

Provided that where the number of males or females exceeds 100, it shall be sufficient if there is one latrine for 25 males or females as the case may be up to the first 100, and one for every 50 thereafter.

(ii) Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings.

(iii) Construction of latrines: The inside walls shall be constructed of masonry or some suitable heat-resisting materials and shall be cement washed inside and outside at least once a year, Latrines shall not be of a standard lower than borehole system.

(iv)(a) Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men only" or "For Women Only" as the case may be.

(b) The notice shall also bear the figure of a man or of a woman, as the case may be.

(v) There shall be at least one urinal for male workers up to 50 and one for female workers up to fifty employed at a time, provided that where the number of male or female workmen, as the case may be exceeds 500, it shall be sufficient if there is one urinal for every 50 males or females up to the first 500 and one for every 100 or part thereafter.

(vi)(a) The latrines and urinals shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times.

(b) Latrines and urinals other than those connected with a flush sewage system shall comply with the requirements of the Public Health Authorities.

(vii) Water shall be provided by means of tap or otherwise so as to be conveniently accessible in or near the latrines and urinals.

(viii) Disposal of excreta:-Unless otherwise arranged for by the local sanitary authority, arrangements for proper disposal of excreta by incineration at the work place shall be made by means of a suitable incinerator. Alternately excreta may be disposed of by putting a layer of night soil at the bottom of a pucca

tank prepared for the purpose and covering it with a 15 cm. layer of waste or refuse and then covering it with a layer of earth for a fortnight (when it will turn to manure).

(ix) The contractor shall at his own expense, carry out all instructions issued to him by the Engineer-in-Charge to effect proper disposal of night soil and other conservancy work in respect of the contractor's workmen or employees on the site. The contractor shall be responsible for payment of any charges which may be levied by Municipal or Cantonment Authority for execution of such on his behalf.

7. PROVISION OF SHELTER DURING REST

At every place there shall be provided, free of cost, four suitable sheds, two for meals and the other two for rest separately for the use of men and women labour. The height of each shelter shall not be less than 3 meters (10 ft.) from the floor level to the lowest part of the roof. These shall be kept clean and the space provided shall be on the basis of 0.6 sq.m. (6 sq. ft) per head.

Provided that the Engineer-in-Charge may permit subject to his satisfaction, a portion of the building under construction or other alternative accommodation to be used for the purpose.

8. CRECHES

(i) At every work place, at which 20 or more women worker are ordinarily employed, there shall be provided two rooms of reasonable dimensions for the use of their children under the age of six years. One room shall be used as a play room for the children and the other as their bedroom. The rooms shall be constructed with specifications as per clause 19H (ii) a, b & c.

(ii) The rooms shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision of sweepers to keep the places clean.

(iii) The contractor shall supply adequate number of toys and games in the play room and sufficient number of cots and beddings in the bed room.

(iv) The contractor shall provide one ayaa to look after the children in the crèche when the number of women workers does not exceed 50 and two when the number of women workers exceeds 50.

(v) The use of the rooms earmarked as crèches shall be restricted to children, their attendants and mothers of the children.

9. CANTEENS

(i) In every work place where the work regarding the employment of contract labour is likely to continue for six months and where in contract labours numbering one hundred or more are ordinarily employed, an adequate canteen shall be provided by the contractor for the use of such contract labour.

(ii) The canteen shall be maintained by the contractor in an efficient manner.

(iii) The canteen shall consist of at least a dining Hall, kitchen, storeroom, pantry and washing places separately for workers and utensils.

(iv) The canteen shall be sufficiently lighted at all times when any person has access to it.

(v) The floor shall be made of smooth and impervious materials and inside walls shall be lime-washed or colour washed at least once in each year. Provided that the inside walls of the kitchen shall be lime-washed every four months.

(vi) The premises of the canteen shall be maintained in a clean and sanitary condition.

(vii) Waste water shall be carried away in suitable covered drains and shall not be allowed to accumulate so as to cause a nuisance.

(viii) Suitable arrangements shall be made for the collection and disposal of garbage.

(ix) The dining hall shall accommodate at a time 30 per cent of the contract labour working at a time.

(x) The floor area of the dining hall, excluding the area occupied by the service counter and any furniture except tables and chairs shall not be less than one square meter (10 sft) per diner to be accommodated as prescribed in sub-Rule 9.

(xi) (a) A portion of the dining hall and service counter shall be partitioned off and reserved for women workers in proportion to their number.

(b) Washing places for women shall be separate and screened to secure privacy.

(xii) Sufficient tables stools, chair or benches shall be available for the number of diners to be accommodated as prescribed in sub-Rule 9.

(xiii) (a)1. There shall be provided and maintained sufficient utensils crockery, furniture and any other equipment's necessary for the efficient running of the canteen.

2. The furniture utensils and other equipment shall be maintained in a clean and hygienic condition.

(b)1. Suitable clean clothes for the employees serving in the canteen shall be provided and maintained.

2. A service counter, if provided, shall have top of smooth and impervious material.

3. Suitable facilities including an adequate supply of hot water shall be provided for the cleaning of utensils and equipment's.

(xiv) The food stuffs and other items to be served in the canteen shall be in conformity with the normal habits of the contract labour.

(xv) The charges for food stuffs, beverages and any other items served in the canteen shall be based on No profit, No loss" and shall be conspicuously displayed in the canteen.

(xvi) In arriving at the price of foodstuffs, and other article served in the canteen, the following items shall not be taken into consideration as expenditure namely:

(a) The rent of land and building.

(b) The depreciation and maintenance charges for the building and equipment's provided for the canteen.

(c) The cost of purchase, repairs and replacement of equipment's including furniture, crockery, cutlery and utensils.

(d) The water charges and other charges incurred for lighting and ventilation.

- (e) The interest and amounts spent on the provision and maintenance of equipment's provided for the canteen.
- (xvii) The accounts pertaining to the canteen shall be audited once every 12 months by registered accountants and auditors.

10. ANTI-MALARIAL PRECAUTIONS

The contractor shall at his own expense, conform to all anti-malarial instructions given to him by the Engineer-in-Charge including the filling up of any borrow pits which may have been dug by him.

11. The above rules shall be incorporated in the contracts and in notices inviting tenders and shall form an integral part of the contracts.

12. AMENDMENTS

Institute may, from time to time, add to or amend these rules and issue directions, it may consider necessary for the purpose of removing any difficulty which may arise in the administration thereof.

SECTION: 3 - (v) Contractor's Labour Regulations with Annexures.

1. SHORT TITLE

These regulations may be called the Institute Contractors Labour Regulations.

2. DEFINITIONS

(i) **Workman** means any person employed by Institute or its contractor directly or indirectly through a subcontractor with or without the knowledge of the Institute to do any skilled, semiskilled or unskilled manual, supervisory, technical or clerical work for hire or reward, whether the terms of employment are expressed or implied but does not include any person:-

(a) Who is employed mainly in a managerial or administrative capacity: or

(b) Who, being employed in a supervisory capacity draws wages exceeding five hundred rupees per mensem or exercises either by the nature of the duties attached to the office or by reason of powers vested in him, functions mainly of managerial nature : or

(c) Who is an out worker, that is to say, person to whom any article or materials are given out by or on behalf of the principal employers to be made up cleaned, washed, altered, ornamental finished, repaired adopted or otherwise processed for sale for the purpose of the trade or business of the principal employers and the process is to be carried out either in the home of the out worker or in some other premises, not being premises under the control and management of the principal employer. No person below the age of 18 years shall be employed to act as a workman.

(ii) **Fair Wages** means wages whether for time or piece work fixed and notified under the provisions of the Minimum Wages Act from time to time.

(iii) **Contractors** shall include every person who undertakes to produce a given result other than a mere supply of goods or articles of manufacture through contract labour or who supplies contract labour for any work and includes a subcontractor.

(iv) **Wages** shall have the same meaning as defined in the Payment of Wages Act.

3(i) normally working hours of an adult employee should not exceed 9 hours a day. The working day shall be so arranged that inclusive of interval for rest, if any, it shall not spread over more than 12 hours on any day.

(ii) When an adult worker is made to work for more than 9 hours on any day or for more than 48 hours in any week, he shall be paid over time for the extra hours put in by him at double the ordinary rate of wages.

(iii)(a) Every worker shall be given a weekly holiday normally on a Sunday, in accordance with the provisions of the Minimum Wages (Central) Rules 1960 as amended from time to time irrespective of whether such worker is governed by the Minimum Wages Act or not.

b) Where the minimum wages prescribed by the Government under the Minimum Wages Act are not inclusive of the wages for the weekly day of rest, the worker shall be entitled to rest day wages at the rate applicable to the next preceding day, provided he has worked under the same contractor for a continuous period of not less than 6 days.

(c) Where a contractor is permitted by the Engineer-in-Charge to allow a worker to work on a normal weekly holiday, he shall grant a substituted holiday to him for the whole day on one of the five days immediately before or after the normal weekly holiday and pay wages to such worker for the work performed on the normal weekly holiday at overtime rate.

4. DISPLAY OF NOTICE REGARDING WAGES ETC.

The contractor shall before he commences his work on contract, display and correctly maintain and continue to display and correctly maintain in a clear and legible condition in conspicuous places on the work, notices in English and in the local Indian languages spoken by the majority of the workers giving the minimum rates of wages fixed under Minimum Wages Act, the actual wages being paid, the hours of work for which such wage are earned, wages periods, dates of payments of wages and other relevant information as per Appendix 'III'.

5. PAYMENT OF WAGES

- (i) The contractor shall fix wage periods in respect of which wages shall be payable.
- (ii) No wage period shall exceed one month.
- (iii) The wages of every person employed as contract labour in an establishment or by a contractor where less than one thousand such persons are employed shall be paid before the expiry of seventh day and in other cases before the expiry of tenth day after the last day of the wage period in respect of which the wages are payable.
- (iv) Where the employment of any worker is terminated by or on behalf of the contractor the wages earned by him shall be paid before the expiry of the second working day from the date on which his employment is terminated.
- (v) All payment of wages shall be made on a working day at the work premises and during the working time and on a date notified in advance and in case the work is completed before the expiry of the wage period, final payment shall be made within 48 hours of the last working day.
- (vi) Wages due to every worker shall be paid to him direct or to other person authorized by him in this behalf.
- (vii) All wages shall be paid in current coin or currency or in both.
- (viii) Wages shall be paid without any deductions of any kind except those specified by the Central Government by general or special order in this behalf or permissible under the Payment of Wages Act 1956.
- (ix) A notice showing the wages period and the place and time of disbursement of wages shall be displayed at the place of work and a copy sent by the contractor to the Engineer-in-Charge under acknowledgment.
- (x) It shall be the duty of the contractor to ensure the disbursement of wages in the presence of the Junior Engineer or any other authorized representative of the Engineer in-Charge who will be required to be present at the place and time of disbursement of wages by the contractor to workmen.
- (xi) The contractor shall obtain from the Junior Engineer or any other authorized representative of the Engineer-in-Charge as the case may be, a certificate under his signature at the end of the entries in the "Register of Wages" or the "Wage-cum Muster Roll" as the case may be in the following form:
"Certified that the amount shown in column No..... has been paid to the workman concerned in my presence on..... at....."

6. FINES AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES

- (i) The wages of a worker shall be paid to him without any deduction of any kind except the following
 - (a) Fines
 - (b) Deductions for absence from duty i.e. from the place or the places where by the terms of his employment he is required to work. The amount of deduction shall be in proportion to the period for which he was absent.
 - (c) Deduction for damage to or loss of goods expressly entrusted to the employed person for custody, or for loss of money or any other deduction which he is required to account, where such damage or loss is directly attributable to his neglect or default.
 - (d) Deduction for recovery of advances or for adjustment of overpayment of wages, advances granted shall be entered in a register.
 - (e) Any other deduction which the Central Government may from time to time allow.
- (ii) No fines should be imposed on any worker save in respect of such acts and omissions on his part as have been approved of by the Chief Labour Commissioner. Note: - An approved list of Acts and Omissions for which fines can be imposed is enclosed at Appendix-X
- (iii) No fine shall be imposed on a worker and no deduction for damage or loss shall be made from his wages until the worker has been given an opportunity of showing cause against such fines or deductions.
- (iv) The total amount of fine which may be imposed in any one wage period on a worker shall not exceed an amount equal to three paise in a rupee of the total wages, payable to him in respect of that wage period.
- (v) No fine imposed on any worker shall be recovered from him by installment, or after the expiry of sixty days from the date on which it was imposed.
- (vi) Every fine shall be deemed to have been imposed on the day of the act or omission in respect of which it was imposed.

7. LABOUR RECORDS

- (i) The contractor shall maintain a **Register of persons employed** on work on contract in Form XIII of the CL (R&A) Central Rules 1971 (Appendix IV)
- (ii) The contractor shall maintain a **Muster Roll** register in respect of all workmen employed by him on the work under Contract in Form XVI of the CL (R&A) Rules 1971 (Appendix V).
- (iii) The contractor shall maintain a **Wage Register** in respect of all workmen employed by him on the work under contract in Form XVII of the CL (R&A) Rules 1971 (Appendix VI)
- (iv) **Register of accidents** - The contractor shall maintain a register of accidents in such form as may be convenient at the work place but the same shall include the following particulars:
 - a) Full particulars of the labourers who met with accident.
 - b) Rate of Wages.
 - c) Sex
 - d) Age
 - e) Nature of accident and cause of accident.
 - f) Time and date of accident.
 - g) Date and time when admitted in Hospital.
 - h) Date of discharge from the Hospital.

- i) Period of treatment and result of treatment.
- j) Percentage of loss of earning capacity and disability as assessed by Medical Officer.
- k) Claim required to be paid under Workmen's Compensation Act.
- l) Date of payment of compensation.
- m) Amount paid with details of the person to whom the same was paid.
- n) Authority by whom the compensation was assessed.
- o) Remarks

(v) The contractor shall maintain a **Register of Fines** in the Form XII. of the CL (R&A) Rules 1971 (Appendix-XI)

The contractor shall display in a good condition and in a conspicuous place of work the approved list of acts and omissions for which fines can be imposed (Appendix-X)

(vi) The contractor shall maintain a **Register of deductions for damage or loss** in Form XX of the CL (R&A) Rules 1971 (Appendix-XII)

(vii) The contractor shall maintain a **Register of Advances** in Form XXIII of the CL (R&A) Rules 1971 (Appendix-XIII)

(viii) The contractor shall maintain a **Register of Overtime** in Form XXIII of the CL (R&A) Rules 1971 (Appendix-XIV)

8. ATTENDANCE CARD-CUM-WAGE SLIP

(i) The contractor shall issue an **Attendance card-cum-wage slip** to each workman employed by him in the specimen format (Appendix-VII)

(ii) The card shall be valid for each wage period.

(iii) The contractor shall mark the attendance of each workman on the card twice each day, once at the commencement of the day and again after the rest interval, before he actually starts work.

(iv) The card shall remain in possession of the worker during the wage period under reference...

(v) The contractor shall complete the wage slip portion on the reverse of the card at least a day prior to the disbursement of wages in respect of the wage period under reference.

(vi) The contractor shall obtain the signature or thumb impression of the worker on the wage slip at the time of disbursement of wages and retain the card with himself.

9. EMPLOYMENT CARD

The contractor shall issue an **Employment Card** in Form XIV of the CL (R&A) Central Rules 1971 to each worker within three days of the employment of the worker (Appendix-VIII).

10. SERVICE CERTIFICATE

On termination of employment for any reason whatsoever the contractor shall issue to the workman whose services have been terminated, a **Service certificate** in Form XV of the CL (R&A) Central Rules 1971 (Appendix-IX)

11. PRESERVATION OF LABOUR RECORDS

All records required to be maintained under Regulations Nos. 6&7 shall be preserved in original for a period of three years from the date of last entries made in them and shall be made available for inspection by the Engineer-in-Charge or Labour Officer or any other officers authorized by the Ministry of Urban Development in this behalf.

12. POWER OF LABOUR OFFICER TO MAKE INVESTIGATIONS OR ENQUIRY

The Labour Officer or any person authorized by Central Government on their behalf shall have power to make enquires with a view to ascertaining and enforcing due and proper observance of Fair Wage Clauses and the Provisions of these Regulations. He shall investigate into any complaint regarding the default made by the contractor or subcontractor in regard to such provision.

13. REPORT OF LABOUR OFFICER

The Labour Officer or other persons authorized as aforesaid shall submit a report of result of his investigation or enquiry to the Executive Engineer concerned indicating the extent, if any, to which the default has been committed with a note that necessary deductions from the contractors bill be made and the wages and other dues be paid to the labourers concerned. In case an appeal is made by the contractor under Clause 13 of these regulations, actual payment to labourers will be made by the Engineer in Charge after the Chairperson I-CDC IPR has given his decision on such appeal.

i) The Chief Administrative Officer shall arrange payments to the labour concerned within 45 days from the receipt of the report from the Labour Officer or the Chairperson I-CDC IPR as the case may be.

14. APEAL AGAINST THE DECISION OF LABOUR OFFICER

Any person aggrieved by the decision and recommendations of the Labour Officer or other person so authorized may appeal against such decision to the Chairperson I-CDC IPR within 30 days from the date of decision, forwarding simultaneously a copy of his appeal to the Chief Administrative Officer but subject to such appeal, the decision of the officer shall be final and binding upon the contractor.

15. PROHIBITION REGARDING REPRESENTATION THROUGH LAWYER

(i) A workman shall be entitled to be represented in any investigation or enquiry under these regulations by:

- a) An officer of a registered trade union of which he is a member.
- b) An officer of a federation of trade unions to which the trade union referred to in clause (a) is affiliated.
- c) Where the employer is not a member of any registered trade union, by an officer of a registered trade union, connected with the industry in which the worker is employed or by any other workman employed in the industry in which the worker is employed.

(ii) An employer shall be entitled to be represented in any investigation or enquiry under these regulations by:-

- a) An officer of an association of employers of which he is a member.

b) An officer of a federation of associations of employers to which association referred to in clause (a) is affiliated.

c) Where the employers is not a member of any association of employers, by an officer of association of employer connected with the industry in which the employer is engaged or by any other employer, engaged in the industry in which the employer is engaged.

(iii) No party shall be entitled to be represented by a legal practitioner in any investigation or enquiry under these regulations.

16. INSPECTION OF BOOKS AND SLIPS

The contractor shall allow inspection of all the prescribed labour records to any of his workers or to his agent at a convenient time and place after due notice is received or to the Labour Officer or any other person, authorized by the Central Government on his behalf.

17. SUBMISSIONS OF RETURNS

The contractor shall submit periodical returns as may be specified from time to time.

18. AMENDMENTS

The Institute / Government may from time to time add to or amend the regulations and on any question as to the application/ Interpretation or effect of those regulations the decision of the Chairperson I-CDC , IPR shall be final.

PROFORMA OF REGISTERS

Appendix 'I' Register of Maternity Benefits (Clause 19F)

1. Name and address of the contractor:

2. Name and location of the work:-

Name of the Employ	Father's / Husband's Name	Nature of employment	Period of actual employment	Date on which notice of confinement given
1	2	3	4	5

Date of delivery /miscarriage	Date on which maternity leave commenced and ended			
	In case of Delivery		in case of miss-carriage	
	Commenced	Ended	Commenced	Ended
	7	8	9	10

Leave pay paid to the employee

In case of delivery		In case of miscarriage		Remarks
Rate of leave pay	Amount paid	Rate of leave pay	Pay amount paid	
11	12	13	14	15

Appendix 'II'

SPECIMEN FORM OF THE REGISTER, REGARDING MATERNITY BENEFIT ADMISSIBLE TO THE CONTRACTOR'S LABOUR

Name and address of the contractor

Name and location of the work

1. Name of the woman and her husband's name:
2. Designation:
3. Date of appointment:
4. Date with months and year in which she is employed:
5. Date of discharge / dismissal, if any:
6. Date of Production of certificates in respect of pregnancy:
7. Date on which woman informs about the expected delivery:
8. Date of delivery / miscarriage/ death:
9. Date of production of certificate in respect of delivery / miscarriage:
10. Date with amount of maternity / death benefit paid in advance of expected delivery:
11. Date with amount of subsequent payment of maternity benefit:
12. Name of person nominated by the women to receive the payment of the maternity benefit after her death:
13. If the woman dies, the date of her death, the name of the person to whom maternity benefit amount was paid, the month thereof and the date of payment:
14. Signature of the contractor authenticating entries in the register:
15. Remark column for the use of inspecting officer:

Appendix 'III'

Labour Board

1. Name of Work:
2. Name of Contractor:
3. Address of contractor
4. Name of Labour Officer of institute:
5. Name of Labour Enforcement Officer:
6. Address of Enforcement officer;

Sl. No.	Category	Minimum Wage fixed	Actual Wage paid	Number Present	Remarks

Weekly Holiday:

Wage Period:

Date of Payment of wages:

Working Hours:

Rest interval:

Appendix ' IV'

Form XIII (See Rule 75)

Register of workmen employed by contractor

Name and Address of contractor

Name and address of establishment under which contract is carried on.

Nature and location of work.

Name and address of Principal Employer.

Sr. No.	Name and surname of workmen	Age as on	Father's / Husband's name	Nature of employment / designation	Permanent home address of workmen (Village and Tehsil, Taluk and District)	Local Address	Date of commencement of employment	Signature or thumb impression of Workmen	Date of termination of employment	Reason for terminations	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Appendix 'V'

Form XVI

Muster Roll

Name and Address of contractor:

Name and address of establishment under which contract is carried on.

Nature and location of work.

Name and address of Principal Employer.

For the month of / fortnight:

Sr. No	Name of Workmen	Father's / Husband's Name	Sex	Dates					Remarks
1	2	3	4	5					6
				1	2	3	4	5	

Appendix 'VI'

Form XVII (see rule 78(2)(a))

REGISTER OF WAGES

Name and Address of contractor:

Name and address of establishment under which contract is carried on.

Nature and location of work.

Name and address of Principal Employer.

Wages period ----- Monthly/fortnight

S r. N o	Na me of wor kme n	Serial No. in the regist er of work men	Desig natio n/nat ure of work done	No. of days wor ked	Unit s of wor k done	Dail y rate of wag es price rate	Amount of wages earned						Ne t am ou nt pai d	Signat ure or thumb impres sion of the workm en	Initi al of cont racto r or his repe senti ve
							Basi c Wag e	Dear ness allo wan ce	Ov er Ti me	Other Cash paym ents (Indica te natur e)	T o t a l	Ded uctio n(If any Indi cate natu re)			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Appendix 'VII'

(Observe)

Wage Card No.

WAGE CARD

Name and address of contractor

Date of Issue

Name and location of work

Designation

Name of workmen

Month/Fortnight

Rate of wages

1 2 3 4 5 6 7 8 9 10 11 12 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Morning:

Rate:

Evening:

Amount

Initial:

Received from

the sum of Rs.

On amount of my wages

The wages card is valid for one month from the date of issue.

Signature

Appendix 'VII'

(Reserve)

FORM XIX

(See Rule 78(2)(b))

WAGES SLIP

Name and address of contractor:

Name and Father's/Husband's name of workman:

Nature and location of work:

For the week/Fortnight/Month ending:

1. No. of days worked:
2. No. of units worked in case of piece:
3. Rate of daily wages/piece rate:
4. Amount of overtime wages:
5. Gross wages payable:
6. Deduction, if any:
7. Net amount of waged paid:

Initial of the contractor or his representative

Appendix 'VIII'

FORM XIV

(See Rule 76)

EMPLOYMENT CARD

Name and address of Contractor:

Name and address of establishment in under:

Name of work and location of work:

Name and address of principal employer:

1. Name of the workmen:
2. Sr.No. in the register of workman:
3. Nature of employment/designation
4. Wage rate (with particulars of unit in:
Case of piece work)
5. Wage period
6. Tenure of employment
7. Remark:

Signature of Contactor

Appendix 'IX'

FORM XV

(See Rule 77)

SERVICE CERTIFICATE

Name and Address of contractor:

Nature and location of work:

Name and address of establishment under which contract is carried on.

Name and address of workmen.

Name and address of principal employer

Age or date of birth.

Identification Mark.

Father's / Husband's Name.

Sr.No	Total period for which employed		Nature of work	Rate of wage (with particulars of unit in case of piece work)	Remark
	From	To			
1	2	3	4	5	6

Signature:

Appendix 'X'

LIST OF ACTS AND OMISSIONS FOR WHICH FINES CAN BE IMPOSED

In accordance with rule 7 (v) of the Contractor's Labour Regulations to be displayed prominently at the site of work both in English and local Language

1. Wilful insubordination or disobedience, whether alone or in combination with other.
2. Theft fraud or dishonesty in connection with the contractors beside a business or property of Institute
3. Taking or giving bribes or any illegal gratifications
4. Habitual late attendance.
5. Drunkenness lighting, riotous or disorderly or indifferent behavior.
6. Habitual negligence.
7. Smoking near or around the area where combustible or other materials are locked.
8. Habitual indiscipline.
9. Causing damage to work in the progress or to property of the Institute or of the contractor.
10. Sleeping on duty.
11. Malingering or slowing down work.
12. Giving of false information regarding name, age father's name, etc.
13. Habitual loss of wage cards supplied by the employers.
14. Unauthorized use of employer's property of manufacturing or making of unauthorized particles at the workplace.
15. Bad workmanship in construction and maintenance by skilled workers which is not approved by the Department and for which the contractors are compelled to undertake rectifications.
16. Making false complaints and / or misleading statements.
17. Engaging on trade within the premises of the establishments.
18. Any unauthorized divulgence of business affairs of the employees.
19. Collection or canvassing for the collection of any money within the premises of an establishment unless authorized by the employer.
20. Holding meeting inside the premises without previous sanction of the employers.
21. Threatening or intimating any workman or employer during the working hours within the premises.

Appendix 'XI'

FORM XII

(See Rule 78(2)(d))

REGISTER FINE

Name and Address of contractor:

Name and address of establishment under which contract is carried on.

Name and location of work.

Name and address of principal employer

Sr. No.	Name of work men	Father's/H usband's name	Designatio n/nature of employe nt	Act/om ission of which fine impose d	Date of Offe nce	Whether Work men show ed cause again st fine	Name of person in whose presen ce emplo yee's explan ation was heard	Wage peri od and wage pay able	Amount of fine Imp osed	Date on whi ch fine rele ased	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Appendix 'XII'

FORM XX

(See Rule 78(2)(b))

REGISTER OF DEDUCTION FOR DAMAGE OR LOSS

Name and Address of contractor:

Name and address of establishment in/under which contract is carried on.

Name and location of work.

Name and address of principal employer

Sr. No.	Name of workmen	Father's/Husband's name	Designation/nature of employment	Particular of damage or loss	Date of damage or loss	Whether Workmen showed cause against deduction	Name of person in whose presence employee's explanation was heard	Amount of deduction imposed	No. of Installment	Date of Recovery		Remarks
										First Installment	Last Installment	
1	2	3	4	5	6	7	8	9	10	11	12	13

Appendix 'XIII'

FORM XXII

(See Rule 78(2)(d))

REGISTER OF ADVANCES

Name and Address of contractor:

Name and address of establishment in under which contract is carried on.

Name and location of work.

Name and address of principal employer

Sr. No.	Name of work men	Father's/Hu sband's name	Designation /nature of employment	Wag e peri od and wag es paya ble	Date of amo unt of adva nce give n	Purpo sed for which advan ce made	No. of instal ment by which advan ce to be paid	Date and amou nt of each instal ment Repai d	Date on which last instal ment was repaid	Rema rks
1	2	3	4	5	6	7	8	9	10	11

Appendix 'XIV'

FORM XXIII

(See Rule 78(2)(d))

REGISTER OF OVERTIME

Name and Address of contractor:

Name and address of establishment under which contract is carried on.

Name and location of work.

Name and address of principal employer

Sr. No.	Name of work men	Father's/Hu sband's name	Se x	Designat ion/ nature of employ ment	Dates on whic h overti me work ed	Total over time worke d on produc tion in case of price rated	Nor mal rates of wag es	Overt ime rates of wage s	Overt ime earn ing	Rates on whic h overti me paid	Rema rks
1	2	3	4	5	6	7	8	9	10	11	12

APPENDIX XV

Note for appointment of Arbitrator [Refer Clause 25]

To

The Director, Institute for Plasma Research, Bhat, Gandhinagar -382 428

Dear Sir,

In terms of clause 25 of SECTION -2-(ii)-CLAUSES OF CONTRACT, GENERAL CLAUSES OF CONTRACT (GCC) of the agreement, particulars of which are given below, I/we hereby give notice to you to appoint an arbitrator for settlement of disputes mentioned below:

1. Name of applicant
2. Whether applicant is Individual/Prop. Firm/Partnership Firm/Ltd. Co.
3. Full address of applicant
4. Name of the work and contract number in which arbitration sought
5. Name of the Division which entered into contract
6. Contract amount in the work
7. Date of contract
8. Date of initiation of work
9. Stipulated date of completion of work
10. Actual date of completion of work (if completed)
11. Total number of claims made
12. Total amount claimed
13. Date of intimation of final bill (if work is completed)
14. Date of payment of final bill (if work is completed)
15. Amount of final bill (if work is completed)
16. Date of request made to Chairperson I-CDC for decision
17. Date of receipt of Chairperson I-CDC decision
18. Date of appeal to you
19. Date of receipt your decision.

Specimen signatures of the applicant
signed the contract should sign)

(only the person/authority who

I/we certify that the information given above is true to the best of my/our knowledge, I/we enclose following documents.

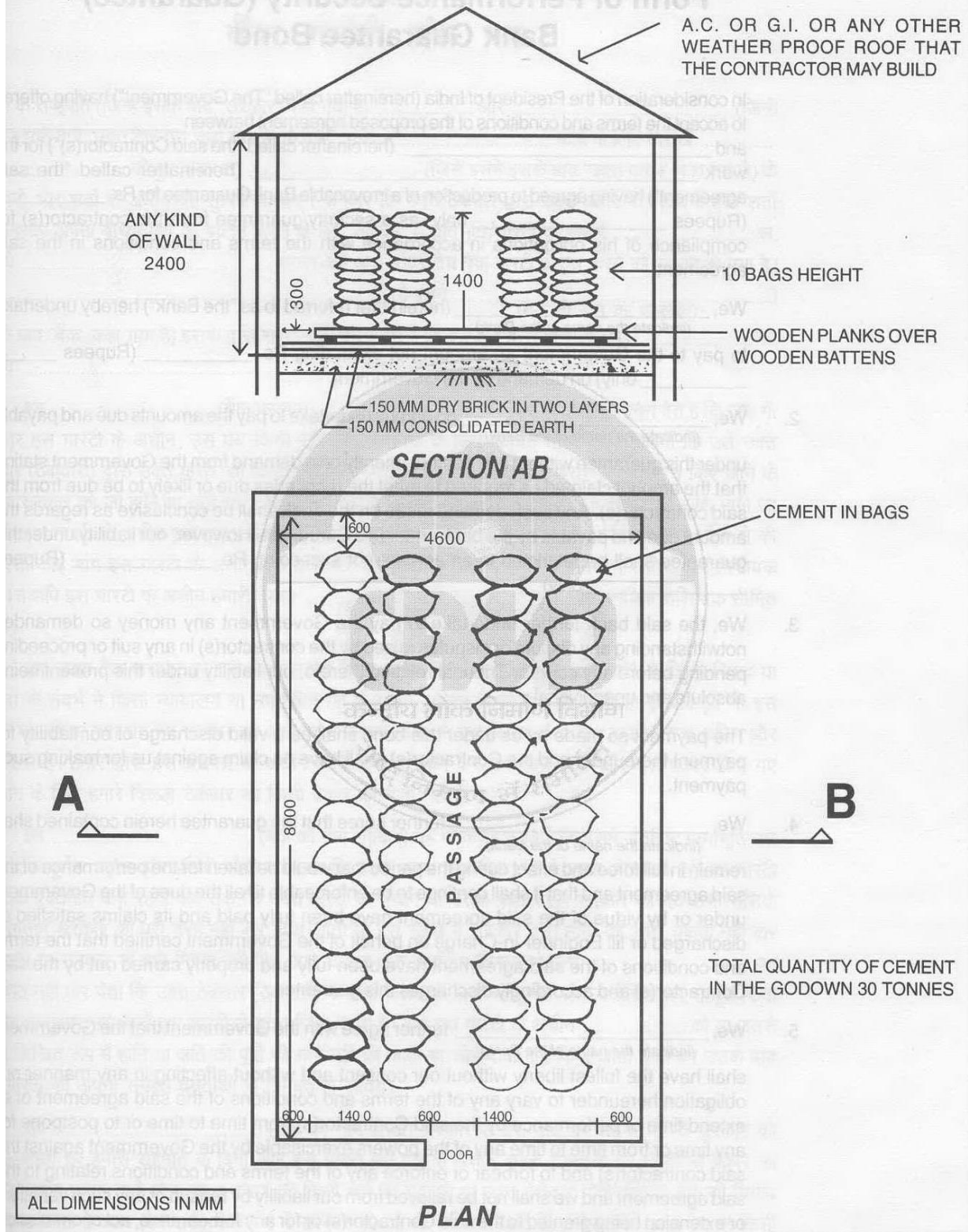
1. Statement of claims with amount of claims.
- 2.

Yours faithfully,

(Signatures)

Copy in duplicate to: The Chairperson I-CDC of Institute,

सीमेन्ट गोदाम का रेखाचित्र / SKETCH OF CEMENT GODOWN



SECTION: 4

Format / Performa/ Guarantee Bonds

Form of Earnest Money Deposit

Bank Guarantee Bond

WHEREAS, contractor..... (Name of Contractor) (hereinafter called "the Contractor") has submitted his tender dated.....(date) for the construction of.....(Name of work) (hereinafter called "the tender")

KNOW ALL PEOPLE by these presents that we.....(name of Bank) having our registered office at.....(hereinafter called "the bank") are bound unto(Name and division of Executive Engineer)) (**hereinafter called the Engineer-In-Charge**) in the sum of Rs.....(Rs. In words.....) for which payment well and truly to be made to the said Institute the bank binds itself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this..... day of20.....

THE CONDITIONS of this obligation are:

- 1) If after tender opening the Contractor withdraws, his tender during the period of validity of tender (including extended validity of tender) specified in the form of Tender;
- 2) If the contractor having been notification of the acceptance of his tender by the Institute ;
 - (a) Fails or refuses to execute the form of Agreement in accordance with the Instruction to contractor, if required;

OR

- (b) Fails or refuses to furnish the performance Guarantee, in accordance with the provisions of tender document and instructions to contractor,

We undertake to pay to the Institute for Plasma Research either up to the above amount or part thereof upon receipt of his first written demand, without the Institute having to substantiate his demand, provided that in his demand the Institute will note that the amount claimed by him is due to him owing to the occurrence of one or any of the above conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date*..... After the deadline for submission of tender as such deadline is stated in the Instructions to contractor or as it may be extended by the Institute for Plasma Research, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this Guarantee should reach the Bank not later than the above date.

DATE.....

SIGNATURE OF THE BANK

WITNESS.....

SEAL

(SIGNATURE, NAME AND ADDRESS)

*Date to be worked out on the basis of validity period of 6 months from last date of receipt of tender.

Form of Performance Security (Guarantee)
Bank Guarantee Bond

Inconsideration of the Director ,IPR (hereinafter called The Institute) having offered to accept the terms and conditions of the proposed agreement between **Institute For Plasma Research, Bhat, Gandhinagar** and _____ (hereinafter called "the said Contractor(s)") for the work _____ (hereinafter called "the said agreement") having agreed to production of an irrevocable Bank Guarantee for Rs. _____ (Rupees _____ only) as a security/guarantee from the contractor(s) for compliance of his obligations in accordance with the terms and conditions in the said agreement.

1. We, _____ (hereinafter referred to as "the Bank") hereby undertake to pay to the Institute an amount not exceeding Rs. _____ (Rupees only) on demand by the Institute.
2. We, _____ (indicate the name of the Bank) do hereby undertake to pay the amounts due and payable under this guarantee without any demure, merely on a demand from the Institute /Government stating that the amount claimed as required to meet the recoveries due or likely to be due from the said contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____ (Rupees _____ only)
3. We, the said bank further undertake to pay the Institute / Government any money so demanded notwithstanding any dispute or disputes raised by the contractor(s) in any suit or proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the Contractor(s) shall have no claim against us for making such payment.
4. We, _____ (indicate the name of the Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the Institute / Government under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till Engineer-in-Charge on behalf of the Institute / Government certified that the terms and conditions of the said agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.
5. We, _____ (indicate the name of the Bank) further agree with the Institute / Government that the Institute / Government) shall have the fullest liberty without our consent and without affecting in any manner our obligation hereunder to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Institute/Government against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor(s) or for any forbearance, act of omission on the part of the Institute/Government or any indulgence by the Institute/Government to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.
6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

7. We, _____ (indicate the name of the Bank) lastly undertake not to revoke this guarantee except with the previous consent of the Institute / Government in writing.
8. This guarantee shall be valid up to _____ unless extended on demand by the Institute / Government. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs. _____ (Rupees _____ only) and unless a claim in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this guarantee all our liabilities under this guarantee shall stand discharged.

Dated the ____ day of _____ for _____ (indicate the name of the Bank)

Form of Mobilization advance (Guarantee)
Bank Guarantee Bond

Inconsideration of the Director ,IPR (hereinafter called The Institute) having offered to accept the terms and conditions of the proposed agreement between **Institute For Plasma Research, Bhat, Gandhinagar** and _____ (hereinafter called "the said Contractor(s)") for the work of _____ (hereinafter called „the said agreement“) having agreed to production of an irrevocable Bank Guarantee for Rs. _____ (Rupees _____ only) as a security/guarantee from the contractor(s) for Mobilization advance to compliance of his obligations in accordance with the terms and conditions in the said agreement.

1. We, _____ (hereinafter referred to as "the Bank") hereby undertake (indicate the name of the Bank) to pay to the Institute an amount not exceeding Rs. _____ (Rupees only) on demand by the Institute.
2. We, _____ (indicate the name of the Bank) do hereby undertake to pay the amounts due and payable under this guarantee without any demure, merely on a demand from the Institute /Government stating that the amount claimed as required to meet the recoveries due or likely to be due from the said contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____ (Rupees _____ only)
3. We, the said bank further undertake to pay the Institute / Government any money so demanded notwithstanding any dispute or disputes raised by the contractor(s) in any suit or proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor(s) shall have no claim against us for making such payment.
4. We, _____ (indicate the name of the Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the Institute / Government under or by virtue of the said agreement for Mobilization advance including interest have been fully paid and its claims satisfied or discharged or till Engineer-in-Charge on behalf of the Institute / Government certified that the terms and conditions of the said agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.
5. We, _____ (indicate the name of the Bank) further agree with the Institute / Government that the Institute / Government) shall have the fullest liberty without our consent and without affecting in any manner our obligation hereunder to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Institute/Government against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor(s) or for any forbearance, act of omission on the part of the Institute/Government or any indulgence by the Institute/Government to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.
6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

7. We, _____ (indicate the name of the Bank) agree that in case of encashment of this Bank Guarantee, the requisite amount shall be drawn in favour of " Institute for Plasma Research, Bhat, Gandhinagar" or any other authority as demanded by him and shall be payable by demand draft at location specified by him at such time.
8. We, _____ (indicate the name of the Bank) lastly undertake not to revoke this guarantee except with the previous consent of the Institute / Government in writing.
9. This guarantee shall be valid up to _____ unless extended on demand by the Institute / Government. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to As. _____ (Rupees only) and unless a claim in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this guarantee all our liabilities under this guarantee shall stand discharged.

Dated the ____ day of _____ for _____ (indicate the name of the Bank)

INDENTURE FOR SECURED ADVANCE

(For use in cases in which the contract is for finished work and the contractor has entered into an agreement for the execute of a certain specified quantity of work in a given time.)

Institute for Plasma Research

State: Gujarat **Administration:** Institute for plasma research

THIS INDENTURE made the _____ day of _____ 20 ____ BETWEEN (hereinafter called the Contractor which expression shall where the context so admits or implies be deemed to include his executors, administrators and assigns) of the one part and the Institute (hereinafter called the Institute which expression shall where the context so admits or implies be deemed to include his successors in office and assigns) of the other part.

WHEREAS by an agreement dated _____ (hereinafter called the said agreement) the contractor has agreed.

AND WHEREAS the contractor has applied to the Institute that he may be allowed advance on the security of materials absolutely belonging to him and brought by him to the site of the works, he subject of the said agreement for use in the construction of such of the works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges).

AND WHEREAS the Institute has agreed to advance to the contractor the sum of Rupees _____ on the security of materials, the quantities and other particulars of which are detailed in -Part-II of a Running Account Bill (B) for the said works signed by the contractor on and the Institute has reserved to himself the option of making any further advances on the security of other materials brought by the contractor to the site of the said works.

NOW THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees _____ on or before the execution of these presents paid to the contractor by the Institute (the receipt where of the contractor both hereby acknowledge and of such further advance, if any, as may be made to him as aforesaid the contractor both hereby convenient and agree with the Institute and declare as follows:

1. That the said sum of Rupees _____ so advanced by the Institute to the contractor as aforesaid and all or any further sum or sums advanced as aforesaid shall be employed by the contractor in or towards expenditure the execution of the said works and for no other purpose whatsoever.
2. That the materials detailed in the said Running Account Bill (B) which have been offered to and accepted by the Institute as security are absolutely the contractor's own property and free from encumbrances of any kind and the contractor will not make any application for or receives a further advance on the security of materials which are not absolutely his own property and free from encumbrance of any kind and the contractor indemnifies and Institute against all claims to any materials in respect of which an advance has been made to him as aforesaid.
3. That the materials detailed in the said Running Account Bill (B) and all other materials on the security of which any further advance or advances may hereafter to be made as aforesaid (hereinafter called the said materials) shall be used by the contractor solely in the execution of the said works in accordance with the directions of the Engineer-in charge of the said works, Institute (hereinafter called "the Engineer-in charge) and in the terms of the said agreement.
4. That the contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe- custody and protections against all risks of the said materials and that until used in

construction as aforesaid said materials shall remain at the site of the said works in the contractor's custody and on his own responsibility and shall at all times be open to inspection by the Engineer-in charge or any officer authorized by him. In the event of the materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree that is due to reasonable use and wear thereof the contractor will forthwith replace the same with other materials of like quality or repair and make good the same as required by the Engineer-in charge.

5. That the said materials shall not on any account be removed from the site of the works except with the written permission of the Engineer-in charge or an officer authorized by Institute.
6. That the advance shall be repayable in full when or before contractor receives payment from the Institute of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the contractor on account of work done thereon the occasion of each such payment the Institute will be at liberty to make a recovery from the contractor's bill for such payment by deduction there from the value of the said materials than actually used in the construction and in respect of which recovery has not been made previously the value for this purpose being determined in respect of the each description of materials at the rates at which the amounts of the advances made under these presents were calculated.
7. That if the contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances what may still be owing to the Institute shall immediately on the happening of such default be repayable by the contractor to the Institute together with interest thereon at twelve percent per annum from the date of respective dates of such advance or advances to the date of repayment and with all costs, charges, damages and expenses incurred by the Institute in or for the recovery thereof or the enforcement of this security or otherwise by reasons of the default of the contractor and contractor hereby convenient and agrees with the Institute to repay and pay the same respectively, to him accordingly.
8. That the contractor hereby charges all the said materials with the repayment to the Institute of the said sum of Rs. _____, and any further sum or sums advanced as aforesaid and all costs, charges, damages and expenses payable under these presents PROVIDED ALWAYS and it is-hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and whenever the convenient for Payment and repayment herein before contained shall become enforceable and the money owing shall not be paid in accordance there with the Institute may at any time thereafter adopt all or any of the following courses as he may deemed best.
 - a) Seize and utilize the said materials or any part thereof in the completion of the said works on behalf of the contractor in accordance with the provisions in that behalf contained in the said agreement debiting the contractor with the actual cost of effecting such completion and the amount due in respect of advances under these present and crediting the contractor with the value of work done as if he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the contractor he is to pay same to the Institute on demand.
 - b) Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sum, aforesaid repayable or payable to the Institute under these presents and pay over the surplus (if any) to the contractor.
 - c) Deduct all or any part of the money owing out of the security deposit or any sum due to the contractor under the said agreement.

9. That except in the event of such default on the part of the contractor as aforesaid interest on the said advances shall not be payable.
10. That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been herein before expressly provided for the same shall be referred to the Project Administrator / Associate Dean/ Dean / Director of the Institute, time being in force shall apply to any such reference.

IN WITNESS thereof the said _____ and _____ by the order under the direction of the Institute have hereinto set their respective hands the day and year first above written. Signed, sealed and delivered by the said contractor in the presence of:

Signature

Name

Address

Witness

Signed by

By the order and direction of the Institute in the presence of:

Signature

Name

Address

Witness

GUARANTEE BOND FOR ANTI-TERMITE TREATMENT

(For Guarantee to be executed by contractors for removal of defects after completion of anti-termite treatment works)

This agreement made this _____ day _____ of two thousand and _____ between M/s. _____ (hereinafter called "the Guarantor of the one part) and the Institute for Plasma Research (hereinafter called "the Institute" the other part.)

Whereas this agreement is supplementary to a contract (hereinafter called "the Contract) dated _____ and made between the Guarantor of the one part and the Institute of the other part whereby the Contractor inter alia undertook to render the buildings and structure completely termite proof. AND WHEREAS THE GUARANTOR agreed to give a guarantee to the effect that the said structure will remain termite proof for ten years from the date of handing over of the building and or completion date of contract whichever is later.

NOW THE GUARANTOR hereby guarantees that the anti-termite treatment provided by him will render the structure completely termite proof and the minimum life of such anti-termite treatment shall be ten years to be reckoned from the date of handing over of the building and/or completion of the building whichever is later.

Provided that the Guarantor will not responsible for damages caused due to structural defects or misuse of premises/area.

a) Misuse of premises shall mean any operation which will disturb the chemical barrier like excavation under floors breaking of walls at G.L. disturbing the treatment already carried out.

The decision of the Engineer-in-Charge with regard to cause of damage shall be final.

During this period of guarantee the guarantor shall make all the arrangements to do the post constructional anti-termite treatment in all the buildings in case of any termite nuisance being found in the building, to the satisfaction of the Engineer-in-Charge at the cost of guarantor and shall commence the work for such treatment within seven days from the date of calling upon him to rectify the defects, by the Engineer-in-Charge, failing which the work shall be got done by the Institute by some other contractor at the GUARANTOR'S COST and risk. The decision of the Engineer-in-Charge as to the cost payable by the Guarantor shall be final and binding.

That if the Guarantor fails to execute the anti-termite treatment or commits breach thereunder then the Guarantor will indemnify the principal and his successors against all loss, damage, cost, expense or otherwise which may be incurred by the Institute by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and/or cost incurred by the Institute the decision of the Engineer-in-Charge will be final and binding on the parties.

IN WITNESS WHEREOF these presents have been executed by the Obligator _____ and by _____ and for and on behalf of the Institute for Plasma Research on the day, month and year first above written.

SIGNED, sealed and delivered by (OBLIGATOR) in the presence of :

1.

2.

SIGNED FOR AND ON BEHALF OF THE INSTITUTE FOR PLASMA RESEARCH BY _____ in the

Presence of: _____

1.

2.

GUARANTEE BOND FOR WATERPROOFING WORKS

(For Guarantee to be executed by contractors for removal of defects after completion of water-proofing works.)

This agreement made this _____ day of _____ two thousand and _____ between M/s. _____ (hereinafter called "the Guarantor of the one part) and the Institute for Plasma Research (hereinafter called "the Institute" of the other part.)

Whereas this agreement is supplementary to a contract (hereinafter called "the Contract) dated and made between the Guarantor of the one part and the Institute of the other part whereby the Contractor inter alia undertook to render the buildings and structure such as roof of buildings, overhead water tanks, underground tanks, lift pits, basement, toilets, etc. in the said contract recited completely water and leak proof.

AND WHEREAS THE GUARANTOR agree to give a guarantee to effect that at the said structure will remain water and leak proof for ten years from the date of handing over of the building and/or actual date of completion of work as recorded whichever is later.

NOW THE GUARANTOR hereby guarantee that waterproofing treatment provided by him will render the structures completely leak proof and the minimum life of such waterproofing treatment shall be ten years to be reckoned from the date of handing over of the building and/or actual date of completion of the work as recorded whichever is later.

Provided that the Guarantor will not be responsible for leakage caused by earthquake or structural defects or misuse of roof or other structures or alteration and for such purpose:

- a) Misuse of structure shall mean any operation which will damage water-proofing treatment, like chopping of fire wood and things of the same nature which might cause damage to the structure;
- b) Alteration shall mean construction of an additional story or a part of the roof or construction adjoining to existing roof whereby water-proofing treatment is removed in parts;
- c) Damaging or puncturing of the waterproofing treatment provided to overhead tanks or basement or underground tank or lift pit, for providing any P .H./Electric connections or any other reasons whatsoever;
- d) The decision of the Engineer-in-Charge with regard to cause of leakage shall be final.

During this period of guarantee the guarantor shall make good all the defects and in case of any defect being found, render the building waterproof to the satisfaction of the Engineer-in-Charge at the cost of the guarantor and shall commence the work for such rectification within seven days from the date of issue of the notice, from the Engineer-in-Charge calling upon him to rectify the defects, failing which the work shall be got done by the Institute by some other contractor at the GUARANTOR'S COST and risk. The decision of the Engineer-in-Charge as to the cost payable by the Guarantor shall be final and binding.

That if the Guarantor fails to execute the waterproofing or commits breach there under then the Guarantor will indemnify the Principal and his successors against all loss, damage, cost expense or otherwise which may be incurred by the Institute by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and/or cost incurred by the Institute the decision of the Engineer-in-Charge will be final and binding on the parties.

IN WITNESS WHEREOF these presents have been executed by the Obligator _____
and by _____ and for and on behalf of the Institute for Plasma
Research on the day, month and year first above written.

SIGNED, sealed and delivered by (OBLIGATOR) in the presence of: 1.2.

SIGNED FOR AND ON BEHALF OF THE INSTITUTE FOR PLASMA RESEARCH BY
_____, in the presence of:

- 1.
- 2.

SECTION: 5

List of Drawings

Section – 5: List of Drawings: (Drawings separately attached)

List of Drawings:

Sr No.	Drawing No.	Description of Drawing
1		IPR campus layout

SECTION: 6

Detailed Specifications

SECTION - 6 - Detailed Specifications – Road Works

1. The specification for various items of work shall be same as specified for such items in the MORTH SPECIFICATIONS FOR ROAD AND BRIDGE WORKS, FIFTH REVISION, published in April 2013.
2. The inclusions and exclusions from quoted rates are specified in the details of each item of work in the specifications and the Bill of Quantities. In case there is no specific mention of a particular detail, the mode of specification as prescribed in MORTH SPECIFICATIONS for such an item shall be followed.
3. In the event of contradiction between the MORTH specifications referred to above and this Contract document, the provisions of this Contract document shall prevail.

SPECIAL CONDITION FOR BITUMINOUS SURFACE WORK WITH USE OF HOT MIX PLANT AND PAVER FINISHER

- a. The hot mix plant and accessories to be used for the work shall be in conformity with the specifications, prescribed vide Govt. of India, Ministry of Transport Circular No. RW/RMP/1613784, dt. 1.1.87. The plant shall be equipped with all units and accessories as per latest I.S 3066/1955, as amended from time to time. The Contractors will have to modify their plants suitably within a period of six months from the date of issue of latest I.S. specification or codes.
- b. The work of laying aggregate mixed with bitumen shall start on site of work only after 8.00 hours in the morning and continue upto 17.00 hours in winter season and upto 18.30 hours in summer. No work shall be done except during the period mentioned above and also on Sunday and National Holidays viz. 26th January, 15th August and 2nd October.
- c. The Contractor shall invariably get the job mix formula for the mix approved by the Engineer-in-charge before starting the work
- d. The contractor obtain and submit the certificate for proportion and grade of bitumen, aggregate and sand etc from the hot mix plant. He is also suppose to carry out test at site for the same if required.

LIST OF MANDATORY TESTS

Material/ work	Clause / Para No.	Test	Field/ Laboratory	Test Procedure	Frequency of Testing
1) Coarse Aggregate	16.1.1	Los Angeles Abrasion Value or Aggregate Impact Value	Laboratory	IS 2386 (Part 4)	Per 200 m ³
		Specific gravity, Water absorption & Density	Laboratory	IS 2386 (Part 3)	
		Combined Flakiness and Elongation Indices	Field	IS 2386 (Part 1)	Per 100 m ³
	16.1.1 Table 16.2	Size and grading of aggregate	Field	IS 2386 (Part 1)	Per 100 m ³
2) Fine Aggregate	16.1.2	Deleterious materials	Field	IS 2386 (Part 2)	As required by the Engineer-in-Charge.
		Specific gravity, Water absorption & Density	Laboratory	IS 2386 (Part 3)	
		Size and grading of aggregate	Field	IS 2386 (Part 1)	
3) Bitumen	16.1.5	As prescribed in IS 73 or IRC:SP:53, IS:15462	Laboratory	As prescribed in IS 73	As required by the Engineer-in-Charge.
4) Embankment under (O.M.C. conditions)	16.3.1	(a) Moisture content	Laboratory	IS 2720 (Part 2)	250 m ³
		(b) Density	Field	IS 2720 (Part 28)	250 m ³
	16.3.4.4	c) Control test on borrow pits.			
		(i) Gradation	Laboratory	IS 2720 (Part 4)	One to two tests per 8000 m ³
		(ii) Plasticity	Laboratory	IS 2720 (Part 5)	-do-
		(iii) Proctor Test	Laboratory	IS 2720 (Part 8)	-do-
		(iv) Deleterious content	Laboratory	IS 2386 (Part 2)	As required by the Engineer-in-Charge
		(v) Moisture contents	Laboratory	IS 2720 (Part 2)	250 m ³
5) Prime Coat / Tack Coat / Fog Spray		(i) Quality of Binder	Laboratory	IS:73	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable
		(ii) Binder temperature for application	Field		At regular close intervals
		(iii) Rate of spread of Binder	Field		Three tests per day
6) Seal Coat / Surface Dressing		(i) Quality of binder	Laboratory	IS:73	Same as mentioned under Serial No. 5
		(ii) Aggregate Impact Value or Los Angeles Abrasion Value	Laboratory	IS:2386 (Part 4)	One test per 200 cu.m of each source and whenever there is change in the quality of aggregate
		(iii) Combined Flakiness Index and Elongation Indices	Field	IS:2386 (Part 1)	One test per 100 cu.m of aggregate for each source and whenever there is change in the quality of aggregate
		(iv) Stripping value of aggregates (Immersion Tray Test)	Laboratory	IS:6241	One test of each source and whenever there is change in the quality of aggregate

Material/ work	Clause / Para No.	Test	Field/ Laboratory	Test Procedure	Frequency of Testing
		(v) Water absorption of aggregates	Laboratory	IS:2386 (Part 3)	-- do --
		(vi) Grading of aggregates	Field	IS:2386 (Part 1)	Two tests per day
		(vii) Soundness test (Magnesium and Sodium Sulphate)	Laboratory	IS:2386 (Part 5)	One test for each source and whenever there is change in the quality of aggregate
		(viii) Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction	Field		At regular intervals
		(ix) Rate of spread of materials	Field		Same as mentioned under Serial No. 5
		(x) Percentage of fractured faces (When gravel is used)	Field		One test per 100 cu.m of aggregate
7) Bitumen Macadam	16.32 & 16.47	(i) Quality of binder	Field	IS 73	Same as mentioned under Serial No. 5
		(ii) Aggregate Impact Value/ Los Angeles Abrasion Value	Laboratory	IS 2386 (Part 4)	Same as mentioned under Serial No. 6
		(iii) Combined Flakiness Index and Elongation Indices	Laboratory	IS 2386 (Part 1)	One test per 350 cu.m for each source
		(iv) Stripping value of aggregates	Laboratory	IS 6241	Same as mentioned under Serial No. 6
		(v) Water absorption of aggregates	Field or Laboratory	IS 2386 (Part 3)	Same as mentioned under Serial No. 6
		(vi) Deleterious material	Field	IS:2386 (Part 2)	Once in the month
		(vii) Grading of aggregates	Field	IS 2386 (Part 1)	Same as mentioned under Serial No. 6
		(viii) Soundness test (Magnesium and Sodium Sulphate)	Laboratory	IS:2386 (Part 5)	Same as mentioned under Serial No. 6
		(ix) Binder content	Laboratory		Two test per day per plant
		(x) Control of temperature of binder and aggregate for mix and of the mix at the time of laying and rolling	Field		Same as mentioned under Serial No. 6
		(xi) Density of Comp layer	Laboratory	IS 2386 (Part 3)	One test per 700 sq.m area
		(xii) Rate of spread of Mixed materials	Field		At regular intervals.
8) Dense Bituminous Macadam / Bituminous Concrete		(i) Quality of binder	Laboratory	IS:73	Number of samples per lot and tests as per IS:73 or IRC:SP:53, IS:15462
		(ii) Aggregate Impact Value / Los Angeles Abrasion Value	Laboratory	IS:2386 (Part 4)	One test per 350 cu.m of aggregate for each sour and whenever there is change in the quality of aggregate
		(iii) Flakiness and Elongation Indices	Laboratory	IS:2386 (Part 1)	One test per 350 cu.m of aggregate for each source and whenever there is change in the quality of aggregate
		(iv) Soundness test (Sodium or Magnesium Sulphate test)	Laboratory	IS:2386 (Part 5)	One test for each source and whenever there is change in the quality of aggregate
		(v) Water absorption of aggregates	Laboratory	IS:2386 (Part 3)	One test for each source and whenever there is change in the quality of aggregate

Material/ work	Clause / Para No.	Test	Field/ Laboratory	Test Procedure	Frequency of Testing
		(vi) Plasticity Index	Laboratory	IS:2386 (Part 5)	One test for each source and whenever there is change in the quality of aggregate
		(vii) Mix grading	Laboratory		One set for individual constituent and mixed aggregate from dryer for each 400 tonnes of mix subject to minimum of two tests per day per plant
		(viii) Stability and voids analysis of mix including theoretical maximum specific of loose mix	Laboratory		Three tests for stability, flow value, density and void contents for each 400 tonnes of mix subject to minimum of two tests per day per plant.
		(ix) Moisture Susceptibility of mix (AASHTO T283)	Laboratory		One test for each mix type whenever there is change in the quality or source of coarse or fine aggregate
		(x) Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction	Field		At regular intervals
		(xii) Binder content	Laboratory		One set for each 400 tonnes of mix subject to minimum of two tests per day per plant
		(xii) Rate of spread of mix material	Field		After every 5 th truck load
		(xiii) Density of compacted layer	Laboratory		One test per 700 sq.m area
9) Slurry seal and Micro surfacing		(i) Quality of aggregate sand equivalent value water absorption soundness test (Sodium / Magnesium Sulphate Test)	Laboratory		One per source / site
		(ii) Quality of Emulsion	Laboratory		One per lot of 20 t as per IS:8887
		(iii) Aggregate Moisture	Laboratory		Two per day
		(iv) Aggregate Gradation	Field	IS:2386 (Part 1)	Two per day at site
		(v) Binder Content	Laboratory		Two per lane per Km
		(vi) Calibration of Machine	Laboratory		Once per Project
		(vii) Quantity of Slurry (By weight of aggregate)	Field		Daily (Travel time of Machine)
10) Mastic asphalt		(i) Quality of binder	Laboratory		Same as mentioned under serial No. 8
		(ii) Aggregate Impact Value or Los Angeles Abrasion Value	Laboratory	IS:2386 (Part 4)	Same as mentioned under serial No. 8
		(iii) Combined Flakiness and Elongation Indices	Field	IS:2386 (Part 1)	Same as mentioned under serial No. 8
		(iv) Stripping value	Laboratory	IS:6241	Same as mentioned under serial No. 6
		(v) Deleterious material	Field	IS:2386 (Part 2)	One in a month
		(vi) Grading of aggregates	Field	IS:2386 (Part 1)	Two tests per day per plant on the individual constituent and mixed aggregates from the dryer
		(vii) Water absorption of	Laboratory	IS:2386 (Part 3)	Same as mentioned under serial No. 8

Material/ work	Clause / Para No.	Test	Field/ Laboratory	Test Procedure	Frequency of Testing
		aggregates			
		(viii) Soundness test (Magnesium Sulphate / Sodium Sulphate)	Laboratory	IS:2386 (Part 5)	Same as mentioned under serial No. 8
		(ix) Binder content	Laboratory		Two test per day per plant
		(x) Control of temperature of binder and aggregate for mixing and of the mix at the time of laying and rolling	Field		At regular close intervals
		(xi) Rate of Spread of Mixed Material	Field		Regular control through check of layer thickness
		(xii) Hardness number	Laboratory		Minimum two tests per day
11) Recycled Material		Grading of aggregate	Field	IS:2386 (Part 1)	Two tests per day
12) Cold Mixes			Laboratory		All tests as per S. No. 8
13) Quality of Modified Binder			Laboratory		Number of samples per lot and tests as per IS:15462
14) Geo textiles			Laboratory		The requirements of Section 700 of MORTH Specification shall apply
15) Granular Sub Base (GSB)		(i) Gradation	Field	IS:2386 (Part 1)	One test per 400 cu.m.
		(ii) Atterberg limits	Laboratory	IS:2720 (Part 5)	One test per 400 cu.m.
		(iii) Water absorption	Laboratory		One test per 400 cu.m.
		(iv) Density of compacted layer	Laboratory		One test per 1000 cu.m.
		(v) Deleterious constituents	Field	IS:2386 (Part 2)	As required
		(vi) Soundness test	Field	IS:2386 (Part 5)	Same as mentioned under serial No. 8
		(vii) CBR	Laboratory		As required
16) Lime / Cement Stabilised Soil Sub-base		(i) Quality of lime / Cement	Laboratory		One test for each consignment subject to a minimum of one test per 5 tonnes
		(ii) Lime / Cement content	Laboratory		Regularly, through procedural checks
		(iii) Degree of pulverization	Laboratory		Periodically as considered necessary
		(iv) CBR or Unconfined Compressive Strength Test on a set of 3 specimens	Laboratory		As required
		(v) Moisture content prior to compaction	Laboratory		One set of two tests per 500 sq.m.
		(vi) Density of compacted layer	Laboratory		One set of two tests per 500 sq.m.
		(vii) Deleterious constituents	Field		As required
17) Water Bound Macadam		(i) Aggregate Impact Value	Laboratory	IS:2386 (Part 4)	One tests per 1000 cu.m of aggregate
		(ii) Grading of aggregate	Field	IS:2386 (Part 1)	One test per 250 cu.m
		(iii) Combined Flakiness and Elongation Indices	Laboratory	IS:2386 (Part 1)	One tests per 500 cu.m of aggregate
		(iv) Atterberg limits of binding material	Laboratory	IS:2386 (Part 4)	One test per 50 cu.m of binding material

Material/ work	Clause / Para No.	Test	Field/ Laboratory	Test Procedure	Frequency of Testing
		(v) Atterberg limits of screenings	Laboratory	IS:2720 (Part 5)	One tests per 100 cu.m of aggregate
		(vi) Water absorption of aggregate	Laboratory	IS:2386 (Part 3)	Once in a month
		(vii) Deleterious material	Field	IS:2386 (Part 2)	As required, once in a month
18) Wet Mix Macadam		(i) Aggregate Impact Value or Los Angeles Abrasion value	Laboratory	IS:2386 (Part 4)	One tests per 1000 cu.m of aggregate
		(ii) Grading of aggregate	Field	IS:2386 (Part 1)	One tests per 200 cu.m of aggregate
		(iii) Combined Flakiness and Elongation Indices	Laboratory	IS:2386 (Part 1)	One tests per 500 cu.m of aggregate
		(iv) Atterberg limits of portion of aggregate passing 425 micron sieve	Laboratory	IS:2720 (Part 5)	One tests per 200 cu.m of aggregate
		(v) Density of compacted layer	Field		One set of three tests per 1000 sq.m.
		(vi) Water absorption of aggregate	Laboratory	IS:2386 (Part 3)	Once in a month
		(vii) Deleterious material	Field	IS:2386 (Part 2)	As required, once in a month
19) Cement concrete pavement under controlled conditions	16.37.19	Coarse aggregate 1. Flakiness Index	Laboratory	IS 2386 (Part 1)	Before approval of the quarry and every subsequent change in the source of supply and one test per 100 cum.
		2. Impact Value	-do-	IS 2386 (Part 4)	-do-
		3. Loss Angles abrasion Value	-do-	-do-	-do-
		4. Deleterious material	-do-	IS 2386 (Part 2)	Before approval of the quarry and at every subsequent change in the source of supply
		5. Moisture content	-do-	IS 2386 (Part 3)	Regularly as required subject to a minimum of one test per day
		Fine Aggregate			
		1. Silt content	Field	As per CPWD specification Vol. I.	One test per 15 cum.
		2. Gradation of sand	-do-	IS 2386 (Part 2)	-do-
		3. Deleterious material	-do-	IS 2386 (Part 2)	Before approval of the quarry and at every subsequent change in the source of supply
		4. Moisture content	-do-	IS 2386 (Part 3)	Regularly as required subject to a minimum of two tests per day
		5. Mix Aggregate	Field	IS 2386 (Part 1)	One test per 15 cum of concrete
		6. Flexural strength	Laboratory	IS 526	One test consisting of 8 specimen for 30 cum. of concrete

LIST OF BUREAU OF INDIAN STANDARDS CODES AND IRC STANDARDS

S. No.	BIS. No.	Subject
1.	IS 73	Specification for paving bitumen
2.	IS 164	Ready mixed paint for road marking
3.	IS 217	Specification for cut back bitumen
4.	IS 8112	Specification for 43 grade ordinary Portland Cement
5.	IS 278	Specification for galvanized steel barbed wire for fencing
6.	IS 334	Glossary of terms relating to bitumen and tar
7.	IS 383	Specification for coarse and fine aggregate from natural sources for concrete
8.	IS 460	Specification for test sieves
9.	IS 516	Method of test for strength of concrete
10.	IS 702	Specification for industrial bitumen
11.	IS 712	Specification for building limes
12.	IS 1195	Specification for bitumen mastic for flooring
13.	IS 1199	Methods of sampling and analysis of concrete
14.	IS 1203	Method of testing tar and bituminous material, determination of penetration
15.	IS 1205	Method of testing tar and bituminous material determination of softening point
16.	IS 1208	Method of testing tar and bituminous material determination of ductility
17.	IS 1212	Method of testing tar and bituminous material determination of loss of heating
18.	IS 1216	Method of testing tar and bituminous material determination of solubility in carbon-di-sulphide, trichloroethylene
19.	IS 1834	Specification for hot applied sealing compound for joint in concrete
20.	IS 1838 (Pt. 1)	Specification for preformed fillers for expansion joint in concrete pavements and structures (non extruding and resilient type/ bitumen impregnated fibre)
21.	IS 2386 (Pt. 1)	Method of test for aggregate for concrete particle size and shape
22.	IS 2386 (Pt. 2) 1963	Method of test for aggregate for concrete estimation of deleterious materials and organic impurities
23.	IS 2386 (Pt. 3)	Method of test for aggregate for concrete specific gravity, density, voids, absorption and bulking
24.	IS 2386 (Pt. 4)	Method of test for aggregate for concrete mechanical properties

25.	IS 2720 (Pt.V)	Method of test for soil: Determination of liquid and plastic limit.
26.	IS 2720 (Pt. VII)	Methods of test for soils: part VII determination of water content dry density relation using light compaction
27.	IS 2720 (Pt. XXVIII)	Method of test for soil: determination of dry density of soils in place, by sand replacement method
28.	IS 3812	Specification for fly ash for use as pozzolana and admixture
29.	IS 5317	Specification for bitumen mastic for bridges decking and roads
30.	IS 5640	Method of test for determining aggregate impact value of soft coarse aggregates
31.	IS 6241	Method of test for determination of stripping value of road aggregates

IRC STANDARDS:

1.	IRC 10	Recommended practice for borrow pits for road embankments constructed by manual operation
2.	IRC 29	Specification for bituminous concrete for road pavements
3.	IRC 36	Recommended practice for construction of earth embankments for road works
4.	IRC 60	Tentative guidelines for the use of lime flyash concrete as pavement base of sub base
5.	IRC 88	Recommended practice for lime flyash stabilized soil base/ sub base in pavement construction
6.	IRC 107	Tentative specification for bitumen mastic wearing courses

16.0 ROAD WORK

16.0 TERMINOLOGY

Asphalt : A natural or artificial mixture in which bitumen is associated with mineral matter. The word 'Asphalt' should always be qualified by indication of its origin or nature.

Asphalt Mastic : An intimate mixture of mineral fillers, well graded sand and/or stone chippings with a hard grade of bitumen, cooked and laid hot manually by means of wooden float. The mixture settles to a coherent, void less and impermeable solid or semi-solid mass under normal temperature condition.

Binder: The binder shall be an appropriate type of bituminous materials complying with the relevant Indian Standard (IS) as defined in the appropriate clauses of these specifications or as otherwise specified herein. The choice of binder shall be stipulated in the contract or by the Engineer-in-charge.

Bitumen: A black or dark brown non crystalline solid or viscous material, having adhesive properties derived from petroleum either by natural or refinery processes and substantially soluble in carbon disulphide.

Bitumen shall be paving bitumen of viscosity grade complying with Indian Standard Specifications for "Paving bitumen" IS:73:2006 of grade appropriate for the traffic and climatic conditions of the Project Highway. The heavily trafficked roads in hot areas may find harder grade bitumen more appropriate while pavements in mountainous regions subject to sub-zero temperatures during winter months carrying relatively lower traffic loads subject to the phenomenon of "Frost Heave" may find less viscous bitumen resistant to fatigue and cold cracking more appropriate.

Bitumen-Cutback : Bitumen, the viscosity of which has been reduced by a volatile diluent when blended with kerosene or naphtha type diluent or fuel oil, is called, medium or rapid or slow curing cut backs respectively.

Bitumen-Emulsion : A liquid product in which a substantial amount of bitumen is suspended in a finely divided condition in an aqueous medium containing an emulsifier and stabiliser. The emulsion is termed 'Anionic' when the bitumen particles are negatively charged and the aqueous phase is alkaline. The emulsion is termed 'cationic' when the particles are positively charged and the aqueous phase is acidic.

Bitumen Mastic Filler : Inorganic mineral material all of which will pass through specified IS sieve used in admixture with solid or semi-solid bituminous material.

Road tar : A product obtained by treating at high temperature coal tar in such a manner that it conforms to a specification which defines its suitability for road construction.

Tar : A viscous material having adhesive properties and resulting from the distinctive distillation of certain type of organic material. The term Tar should be preceded by the name of the material from which it is produced
e.g. coal, shale, peat, vegetable matter and its mode of production shall be indicated.

Flash point : The lowest temperature at which the vapour of a substance can be ignited in air by a flame under specified conditions of test. The substance itself does not continue to burn.

Tack Coat : It shall consist of application of a single coat of low viscosity liquid bituminous material to an existing road surface preparatory to further bituminous construction.

Bitumen concrete (Asphaltic concrete) : A well graded mixture of high quality aggregates with designated proportion of bitumen, hot mixed, hot laid and hot rolled into a uniform dense mass with specified design criteria.

Ductility : The property by which a material can be drawn out without breaking, for bitumen it is measured by the distance in centimetres to which it will elongate before breaking, when two ends of a briquette specimen of the material of the specified form and cross-section are pulled apart under water at a specified speed and temperature.

Viscosity : The property of a liquid by which it resists flow due to internal friction and is measured by the ratio of the shearing stress to the rate of shear.

MATERIALS

16.0.1 Aggregate Coarse

Coarse aggregate as specified in the item shall be either crushed/broken stone, crushed slag, over burnt (Jhama) brick aggregate or one of the naturally occurring aggregates such as kanker or laterite of suitable quality as stated hereinafter and approved by the Engineer-in-Charge.

The stone aggregate shall conform to the physical requirements set forth in Table 16.1. The type and size range of the aggregate shall be specified in the contract.

If the water absorption value of the coarse aggregate is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS:2386 (Part-5).

TABLE 16.1
Physical Requirements of Coarse Aggregate for Water Bound Macadam for Sub-Base / Base Courses

S. No	Test	Test method	Requirements
1.**	Los Angeles Abrasion value or Aggregate impact value	IS 2386 (Part-4) IS 2386 (Part-4) or IS 5640*	40% (Max.) 30% (Max.)
2.	Combined flakiness and Elongation Indices (Total)**	IS 2386 (Part-1)	35% (Max.)

* Aggregates which get softened in presence of water shall be tested for impact value under wet conditions in accordance with IS:5640.

** The requirements of flakiness index and elongation index shall be enforced only in case of crushed/broken stone and crushed slag.

*** In case water bound macadam is used for sub-base, the requirements in respect of Los Angeles Value and Aggregate Impact Value shall be relaxed to 50 percent and 40 percent maximum respectively.

The coarse aggregate shall conform to one of the gradings given in Table 16.2 as specified. For crushable type of aggregates such as brick metal, kankar and laterite, grading shall not be regarded as very important, but the material should generally be within the specified range.

TABLE 16.2
Grading Requirements of Coarse Aggregate for W.B.M.

Grading No.	Size Range	IS Sieve Designation	Percent by weight passing the sieve
1	90 mm to 45 mm	125 mm	100
		90 mm	90 - 100
		63 mm	25 - 60
		45 mm	0 - 15
		22.4 mm	0 - 5
2	63 mm to 45 mm	90 mm	100
		63 mm	90 - 100
		53 mm	25 - 75
		45 mm	0 - 15
		22.4 mm	0 - 5
3	53 mm to 22.4 mm	63 mm	100
		53 mm	95 - 100
		45 mm	65 - 90
		22.4 mm	0 - 10
		11.2 mm	0 - 5

Note: The compact thickness for a layer with Grading 1 shall be 100 mm while for layer with other Gradings i.e. 2 & 3, it shall be 75 mm.

160.11 Overburnt (Jhama) Brick Aggregates: Brick aggregate shall be made from over-burnt bricks and dense brick bats. It shall be homogeneous in texture, roughly cubical in shape, clean and free from dust, dirt and other objectionable and deleterious materials.

160.12 Crushed or Broken Stone : When crushed or broken stone is specified as the coarse aggregate, it shall be hard, durable and free from excess of flat, elongated, soft, disintegrated particles, dirt and other objectionable matter. The total quantity of such deleterious material including clay lumps, soft fragment, foreign material etc. shall not exceed 5% of the weight of the aggregate.

160.13 Crushed Slag : Crushed slag shall be made from air-cooled blast furnace slag. It shall be of angular shape, reasonably uniform in quality and density and generally free from thin, elongated and soft pieces, dirt or other deleterious materials. The weight of the crushed slag shall not be less than 11.2 kN per cubic metre (1120 kg per cubic metre) and the percentage of glossy material shall not be more than 20. Water absorption of slag shall not exceed 10% (IS 2386 Pt.III).

160.14 Kankar : Kankar shall be tough, having a blue almost opalescent fracture. It shall not contain any clay in the cavities between nodules.

160.15 Laterite : Laterite shall be hard, compact, heavy and of dark colour. The light coloured sandy laterite as well as those containing much ochreous clay shall be rejected.

16.0.2 Aggregate-Fine

The fine aggregate shall be the fraction passing 2.8 mm sieve and retained on 90 micron sieve. It shall consist of crusher run screenings, natural sand or a mixture of both. These shall be clean, hard, durable, uncoated, dry and free from injurious, soft or flaky pieces and organic or deleterious substance.

The contents of organic and deleterious materials shall not exceed the limits specified in Table 16.3.

TABLE 16.3

	<i>Uncrushed</i>	<i>Crushed</i>
Coal and lignite	1%	1%
Clay lumps	1%	1%
Material passing through 75 microns (I.S.S.) Sieve	3%	3%
Shale	1%	1%

The sum of the percentages of all deleterious material shall not exceed 5%. Tests for estimation of deleterious materials and organic impurities shall be done as per IS 2386 (Pt. II).

16.0.3 G.I. Barbed Wire

The barbed wire shall be of galvanised steel as specified and it shall conform to IS 278. The sampling criteria is given in Table 16.4. The wire shall be manufactured from steel by any process and shall not contain sulphur and phosphorous exceeding 0.065 per cent. The galvanised steel barbed wires shall be of two types: Type A (Lowa Type) and Type B (Glidden Type).

Type A (Lowa Type) : The barbs shall have four points and shall be formed by twisting two point wires, each two turns, tightly around both line wires making altogether four complete turns.

Type B (Glidden Type) : The barbs shall have four points and shall be formed by twisting two point wires, each two turns, tightly around one line wire making altogether four complete turns.

Details of G.I. Barbed wire

The galvanised steel barbed wire shall be of the size designations given in Table 16.4.

TABLE 16.4

Size Designation	Nominal dia. of wire				Mass of completed Barbed Wire		Distance between two barbs	No. of lays between the two consecutive barbs
	Line Wire		Point Wire					
	Nom	Tol	Nom	Tol	Max	Min		
	(mm)	(mm)	(mm)	(mm)	(g/m)	(g/m)	(mm)	(mm)
1.	2.50	± 0.08	2.50	± 0.08	155	136	75 ± 12	2 to 7
2.	2.50	± 0.08	2.50	± 0.08	120	108	150 ± 12	2 to 7
3.	2.50	± 0.08	2.00	± 0.08	125	108	75 ± 12	2 to 7
4.	2.50	± 0.08	2.00	± 0.08	103	89	150 ± 12	2 to 7
5.	2.24	± 0.08	2.00	± 0.08	106	97	75 ± 12	2 to 7
6.	2.24	± 0.08	2.00	± 0.08	85	78	150 ± 12	2 to 7

Note : The mass in g/m shall be obtained by dividing the total mass of the reel by the linear length in metres.

The number of lays between the two consecutive barbs shall vary between 2 to 7.

The barbed wire shall be formed by twisting together two line wires, one or both containing the barbs. The size of the line and point wires and barb spacings shall be as specified. The permissible deviation from the nominal diameter of the line wire and the point wire shall not exceed ± 0.08 mm. The line and point wires shall be circular in section, free from scales and other defects and shall be uniformly galvanised. The line wire, shall be in continuous lengths, and shall not contain any welds other than those in the rod before it is drawn. The distance between two successive splices shall not be less than 15 metres. It shall have the tensile properties as specified in Table 16.5.

TABLE 16.5
Tensile Properties

Size of Line Wire	Tensile Strength of line wire	Minimum Breaking Load of Completed Barbed Wire
mm	kgf/sq. mm	kgf
2.50	40 to 60	375
2.24	40 to 60	300

The number of reels to be selected at random for this purpose shall be in accordance with Table 16.6.

TABLE 16.6
Sampling Criteria

No. of Reels in the Lot	No. of Reels to be selected
Up to 25	3
26 to 50	4
51 to 150	5
151 to 300	7
301 and above	10

16.0.4 Binding Material

Binding materials to prevent ravelling of water bound macadam construction shall consist of a fine grained material possessing plasticity index value of 4 to 9 when the water bound macadam is to be used as a wearing course, and 4 to 6 when W.B.M. is being adopted as a sub-base/base course with bituminous surfacing on top of it. The plasticity index shall be determined in accordance with IS 2720 (Pt. V). The quantity of binding material used in each layer shall be as per direction of Engineer- in-Charge. Application of binding material may be dispensed with the approval of Engineer-in-Charge, where screenings consisting of crushable type material like moorum or gravel are used. Where earth cut for sub-grade formation is used as binder with the approval of Engineer-in-Charge, no separate payment shall be made for collection of this binder material.

16.0.5 Bitumen Straight Run

A range of grades, from a very soft to a very hard consistency, can be produced by varying the temperature and the rate of flow during distilling process. It shall conform to IS 73. Grades of bitumen for different uses is given in Table 16.7.

TABLE 16.7
Bitumen Grades

<i>Grade</i>		<i>Temperature to which it shall be heated</i>
I.	FOR PAINTING (Surface Dressing)	
	1. Paving bitumen of grade VG- 10	177 deg. C to 190 deg. C
	2. Paving bitumen of grade VG- 30	177 deg C to 190 deg. C
	3. Bitumen emulsion min. 50% bitumen content:- RS grade IS 8837	(Cold application)
	4. Cut backs RC-3 (rapid curing) IS 217	— do —
II.	FOR PREMIX CARPETING	
	1. Paving asphalt 30/40 S-35 or 80/100 S-90	149 deg. C to 177 deg. C
	2. Bitumen Emulsion min. 60% bitumen contents RS grade IS 8837	(Cold application)
	3. Cut back MC (medium curing) IS 4545	(Cold application)
III.	FOR ASPHALTIC CONCRETE STRAIGHT RUN BITUMEN 60/70 (S-65) CONFORMING TO IS 73	150 deg. C to 177 deg. C

Note : For premix carpeting with paving asphalt, extra shall be paid if solvent is used.

16.0.6 Bricks

Bricks shall be of class designation 75 unless otherwise stated. The specifications of bricks shall be as sub head brick work as detailed in subhead 6.0 Vol – I, CPWD Specification – 2019.

16.0.7 Filler

The filler, where specified, shall be an inert material, the whole of which passes through a 710 micron sieve, atleast 90 per cent passing through a 180 micron sieve and not less than 70 per cent passing through a 90 micron sieve. The filler shall be cement, stone dust, hydrated lime, lime stone dust, flyash or any other non-plastic mineral matter approved by the Engineer-in-Charge.

TABLE 16.8
Aggregate Gradation including Filler

Sieve designation	Percent by weight passing the sieve	
	For 25 mm thickness	For 20 mm thickness
20.0 mm	100	-
12.5 mm	75-100	100
10.0 mm	60-85	75 - 100
4.75 mm	35-55	35 - 55
2.36 mm	20-35	20 - 35
600 micron	10-22	10 - 22
300 micron	6-16	6 - 16
150 micron	4-12	4 - 12
75 micron	2- 8	2 - 8

16.0.8 Flyash

Flyash shall conform to IS 3812

16.0.9 Lime

Lime shall be of specifications as directed by Engineer-in-Charge.

16.0.10 Moorum

It shall be obtained from pits of weathered disintegrated rocks. It should preferably contain silicious material and natural mixture of clay of calcarious origin. The size of moorum shall not be more than 20 mm.

16.0.11 Posts, Rails and Pales

These shall be of standard size and length of posts being 1.8 m, rails 2.25 m and pales 1.25 m unless otherwise specified. A tolerance of 12 mm in length and 3 mm in other dimensions shall be permissible. These shall be cast in cement concrete 1:1 ½ :3 (1 cement : 1 ½ coarse sand : 3 graded stone aggregate 12.5 mm nominal size) with slots and reinforced with tor steel bars of diameters 10 mm in the case of posts and pales and 8 mm in the case of rails or as directed and finished with cement mortar 1:2 (1 cement :2 fine sand). The specifications for R. C. C. work shall apply.

For the whole of their length below the top of the rail the paling shall have a projecting dovetail shape at the back which shall fit into dovetail grooves in each of the rails. That part of the palings projecting above the top rail shall be left square to prevent the dropping right through the rails. The posts, rails and pales shall be free from cracks, twists and such other defects.

16.0.12 Posts and Struts – R.C.C.

All posts and struts shall be of standard size, the length of posts being 1.8 m or as specified and that of struts being minimum of 2.0 m. These shall be cast in cement concrete 1:1 ½ :3 (1 cement : 1 ½ coarse sand : 3 graded stone aggregate 12.5 mm nominal size) reinforced with 10 mm diameter tor steel bars as directed and finished smooth with cement mortar 1:2 (1 cement: 2 fine sand). The specifications for R.C.C. work shall apply. The posts and struts shall be free from cracks, twists and such other defects. G.I. staples on wooden plugs or 6 mm bar nibs will be provided as directed by Engineer-in-Charge while casting the posts. Quantity of RCC post, struts, Rails and Pales to be measured in cubic content.

16.0.13 Premoulded Joint Filler

It shall conform to IS 1838, the thickness shall be 20 mm or 25 mm as specified and shall be of the maximum available standard length. During the casting of the slab the premoulded joint filler shall be placed accurately in position against the finished end of concrete slab. The filler shall remain 20 mm below the top surface of the pavement and shall extend upto the subgrade.

16.0.14 Red Bajri

This shall be disintegrated rock dark red in colour consisting of coarse grains, free from mica, dust and other foreign matter.

16.0.15 Screenings

Screening to fill voids in the coarse aggregate shall generally consist of the same material as the coarse aggregate. However, where permitted, predominantly non-plastic material such as moorum or gravel (other than river borne rounded material) may be used for this purpose provided liquid limit and plasticity index of such material is below 20 and 6 respectively and fraction passing 75 micron sieve does not exceed 10 percent.

As far as possible screenings shall conform to the gradings set forth in Table 16.9. Screenings of type A shall be used with coarse aggregate of grade I of Table 16.2. Screenings of type A or B as specified shall be used with coarse aggregates of grading 2. Type B screenings shall be used with coarse aggregates of grading 3. The use of screenings may be omitted in the case of soft aggregates such as brick metal, kankar and laterite. For screenings like moorum or gravel the gradings given in Table 16.9 shall not be binding.

TABLE 16.9
Grading for Screenings

<i>Grading Classification</i>	<i>Size of Screenings</i>	<i>IS Sieve Designation</i>	<i>Percent by Weight Passing Sieve</i>
A	13.2 mm	13.2 mm	100
		11.2 mm	95 -100
		5.6 mm	15 - 35
		180 micron	0 - 10
B	11.2 mm	11.2 mm	100
		9.5 mm	80-100
		5.6 mm	50 - 70
		180 micron	05 - 25

16.0.16 Sealing Compound

After the curing period is over the joint portion above the filler board shall be cleaned thoroughly as directed by the Engineer-in-Charge. The joints shall be filled with hot applied sealing compound. Grade A (Normal) for concrete constructions other than those which are subjected to spillage of kerosene or other heavy petroleum oils and Grade B (Jet fuel resistant) for concrete constructions of runways for jet air crafts, conforming to IS 1834.

16.0.17 Soil

Soil having a plasticity index (PI) between 5 and 20 shall be suitable. At least one test for 200 cubic metre of soil for determining P.I. shall be conducted.

16.0.18 Stones

These shall be clean, hard, sound and durable stones, free from decay and weathering. They shall be in blocks and hammer dressed on all sides. The size of pitching stones shall be approximately 22.5 cm in depth and not less than 15 cm in any other direction.

16.0.19 Stone Chippings For Surface Dressing/Painting

The stone chipping shall consist of fairly cubical fragment of clean, hard, tough and durable rock of uniform quality throughout. These shall be obtained by crushing stone river gravel (shingle) or other approved materials. Rounded gravel shall be used only if specifically permitted by the Engineer-in-Charge. The chipping shall be free of elongated or flaky pieces, soft or disintegrated stone, salt, alkali, vegetable matter, dust and adherant coatings. They shall conform to the quality requirements of Table 16.10.

However, the total quantity of such deleterious material including clay lumps, soft fragments, foreign material shall not exceed 5% of the weight of the aggregate.

The aggregate shall be got tested to ensure the requirements specified in Table 16.10.

TABLE 16.10

Physical Requirements of Aggregates for Surface Dressing

<i>Sl. No.</i>	<i>Test</i>	<i>Test method</i>	<i>Requirements</i>
1.	Los Angles Abrasion Value	IS 2386 (Part-4)	40% (Max.)
2.	Aggregate Impact Value*	IS 2386 (Part-4)	30% (Max.)
3.	Flakiness Index	IS 2386 (Part-1)	25% (Max.)
4.	Stripping Value	IS 6241	25% (Max.)
5.	Water Absorption	IS 2386 (Part-3)	1% (Max.)

* Aggregates may satisfy requirements of either of the two tests.

16.0.20 Stones for Kerb and Channels (Fig. 16.12)

Kerb and channel stones are provided on roads having raised berms for foot path etc. These shall be of selected hard stone, sound, durable free from laminations and other structural defects. The length of each kerb and channel stone shall be not less than 49.5 cm except that 29.5 cm long stones shall be permitted for closures and for curves. The other dimensions shall be 30 x 20 cm for kerb stones and 30 x 10 cm for channel stones, unless specified otherwise. Kerb and channel stones shall be chisel dressed on exposed surface and edges. The dimensions of the exposed faces of kerb and channel stones shall be of sizes as specified with a tolerance of 10 mm in width and depth. In the case of kerb stones a tolerance of 5 cm shall be allowed in the dimensions of unexposed back and bottom faces and in the case of channel stones a tolerance of 10 mm shall be allowed in thickness.

16.0.21 Boundary Stone (Fig. 16.4)

The boundary stones shall be of either hard stone or sound and durable quality or precast R.C.C. These shall be in blocks of size 15 x 15 x 90 cm unless directed otherwise by the Engineer-in-Charge. A tolerance of 12.5 mm shall be permitted in the specified size. In the case of boundary stones of hard stone, the upper 30 cm shall be chisel dressed on all the four sides and on the top.

The R.C.C. boundary stones shall be cast in cement concrete 1 : 1 ½ : 3 (1 cement : 1 ½ coarse sand : 3 graded stone aggregate 20 mm nominal size), reinforced with 10 mm diameter tor steel bars or as directed and finished smooth with cement mortar 1 : 3 (1 cement : 3 fine sand). The specifications for R.C.C. work shall apply.

16.0.22 Kilometer stone (Fig.16.7)

Standard design of kilometer stones are given in Fig. 16.7. Ordinary kilometer stone for National Highways, State highways and Major District shall be of the size 35 x 111 x 25 cm. One cm offset shall be provided around the stone slab in 10 cm height above the formation level to serve as the pedestal. The kilometer stones shall be fixed at right angle to the centre line of the carriage way. The kilometre stone shall indicate the name and distance of the next (intermediate) important town only. On the side of the kilometre stone facing the carriage way, the number of the kilometre stone shall be inscribed (without the name of any place) which shall be painted later on.

Kilometre stones for every fifth kilometre on National Highways, State highways and major district roads shall be of the size 50 x 152.5 x 25 cm. One cm offset shall be provided around the stone slab in 13 cm height above the formation level to serve as the pedestal. This kilometre stone shall be fixed at right angles to the centre line of carriage way. It shall show the name and distance of the terminal or the starting station also above those of intermediate towns. On the side facing the carriage way, the number of the kilometre stone in continuity of ordinary kilometre stone shall be inscribed (without the name of any place) which shall be painted later on.

Kilometre stone for other district roads and village roads shall be of the size 35 x 93.5 x 18 cm. One cm offset shall be provided around the stone slab in 10 cm. height above the formation level to serve as the pedestal. It shall be fixed at right angles to the centre line of carriage way and shall indicate the name and the distance of the next important station. On the side facing the carriage way, the number of the kilometre stone shall be inscribed (without the name of any place).

The kilometre stones shall be fixed at the edge of the road way outside the shoulder on especially erected platforms, if necessary. In cutting these shall be fixed clear of the shoulder and the side drain as per Fig. 16.7(A). On existing roads the stones shall be fixed on the side of the road other than that on which miles stones exist. On new roads, these shall be located on left hand side of the road as one proceeds from the station from which kilometre count starts.

Kilometre stones shall be of approved design of R.C.C. or stone slabs.

- (a) *Kilometre Stones in R.C.C.* : It shall be cast in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) with reinforcement as directed and finished smooth with cement mortar 1 : 3 (1 cement : 3 fine sand) on exposed surfaces above the ground. The specifications for R.C.C. work shall apply.
- (b) *Kilometre Stone Slabs* : The stone slabs shall be of red or white sand stone unless otherwise specified. The slab shall be hard, even, sound and durable. The stone slabs shall have been sawn or chiseled in a plane parallel to the natural bed of the stone. The slabs shall be chisel dressed on the exposed surfaces above ground facing road side, so that the dressed face shall not be more than 3 mm from a straight edge placed on it. The thickness of the slab shall be uniform and as specified in the item with a permissible tolerance of 1.5 mm. The thickness shall be measured correct to 3 mm.

16.1 SUB-GRADE: PREPARATION AND CONSOLIDATION

16.2.0 In sub-grade composed of clay, fine sand or other soils that may be forced up into the coarse aggregate during rolling operation, an insulation layer of suitable thickness of granular materials or over size brick aggregate not less than 10 cm thick shall be provided for blanketting the sub-grade, which shall be paid for separately, unless otherwise specified in the agreement.

In slushy soils or in areas that are water logged, special arrangements shall be made to improve the sub-grade and the total pavement thickness shall be designed after testing the properties of the sub-grade soil. Necessary provision for the special treatment required shall be made in the project and paid for separately.

16.2.1 Preparation of Sub-Grade

The surface of the formation for a width of sub-base, which shall be 15 cm more on either side of base course, shall first be cut to a depth equal to the combined depth of sub-base and surface courses below the proposed finished level (due allowance being made for consolidation). It shall then be cleaned of all foreign substances. Any ruts or soft yielding patches that appear due to improper drainage conditions, traffic hauling or from any other cause, shall be corrected and the sub-grade dressed off parallel to the finished profile.

16.2.2 Consolidation

The sub- grade shall be consolidated with a power road roller of 8 to 12 tonnes. The roller shall run over the sub grade till the soil is evenly and densely consolidated and behaves as an elastic mass (the roller shall pass a minimum of 5 runs on the sub grade). All undulations in the surface that develop due to rolling shall be made good with material or quarry spoils as the cases may be and the sub-grade is rerolled.

16.2.3 Surface Regularity

The finished surface shall be uniform and conform to the lines, grades and typical cross section shown in the drawings, when tested with the template and straight edge, the variation shall be within the tolerances specified in Table 16.11.

TABLE 16.11
Permissible Tolerances of Surface Evenness of Sub Grade

<i>Longitudinal profile maximum permissible undulation when measured with a 3 metre straight edge</i>	<i>Cross profile maximum permissible variation from specified profile when measured with a camber template</i>
24 mm	15 mm

Where the surface irregularity of the sub grade falls outside the specified tolerances, the contractor shall be liable to rectify these with fresh material or quarry spoils as the case may be, and the sub- grade rerolled to the satisfaction of Engineer-in-Charge.

16.2.4 Measurements

The length and width shall be measured correct to a cm. The area shall be worked out in square metre, correct to two places of decimal.

16.2.5 Rate

The rate for preparation and consolidation of sub grade shall include the cost of materials and labour involved for all the operations mentioned in above unless otherwise specified.

16.2 EMBANKMENT CONSTRUCTION (UNDER OPTIMUM MOISTURE CONDITIONS)

16.2.1 In the case of earth work consolidated under optimum moisture conditions each layer of earth shall be carefully moistened to give field moisture content of about +1% to -2% of the optimum moisture content (OMC). The OMC shall be determined according to IS 2720 (Pt.VIII) Methods of Tests for Soils. Each layer shall then be compacted by rolling with 8 to 10 tonnes power road roller and a sheep foot roller if required. The required amount of water shall be added during consolidation to keep the moisture content of the soil at the optimum as per test. The density to be achieved for each layer of the material shall not be less than 95% of the density obtained in the laboratory (Proctor Method).

16.3.2 Each compacted layer shall be tested in the field for density and accepted before the operations for next layer are begun.

16.3.3 Control on compaction in the field shall be exercised through frequent moisture content and density determinations. A systematic record of these shall be maintained. At all times during construction the top of the embankment shall be maintained at such cross fall as will shed water and prevent ponding.

16.3.4 Density Measurement and Acceptance Criteria

16.3.4.1 One measurement of density shall be made for each 500 sqm of compacted area or for a smaller area as decided by the Engineer-in-Charge. Each measurement shall consist of atleast 5 density determinations tests and the average of these 5 determinations shall be treated as the field density achieved. The determination of density shall be as per IS 2720 (Pt. XXVIII).

16.3.4.2 In general the control at the top 40 cm thickness of the formation shall be more strict with density measurements being done at the rate of one measurement for 250 sqm of compacted area. Further for the determination of the mean density the number of tests in one measurement shall not be less than 10 and the work will be accepted if the mean dry density equals or exceeds the specified density.

16.3.4.3 When density measurements reveal any soft areas in the embankment, the Engineer-in- Charge shall direct that these be compacted further. If in-spite of that the specified compaction is not achieved the material in the soft areas shall be removed and replaced by approved materials and compacted to the satisfaction of the Engineer-in-Charge.

16.3.4.4 Control Tests on Borrow Material

16.3.4.5 Soil suitable for consolidation under O.M.C. conditions should preferably have the following characteristics :

- | | | |
|-----|--|-----|
| (a) | Minimum percentage of clay | 10% |
| (b) | Liquid limit | 14 |
| (c) | Plasticity index | 4 |
| (d) | Percentage of silt should not exceed | 50% |
| (e) | Peat, muck and organic soils are unsuitable. | |

16.3.4.6 The Engineer-in-Charge may, however, relax these requirements taking into account availability of materials, cost of transportation and other relevant factors.

16.3.4.7 Various test required to be conducted on the borrow material with their recommended frequency are indicated below. All the test need not be stipulated on every project. Depending upon site condition etc. only some may be found necessary at a particular project. The frequency of testing indicated refers generally to the minimum number of tests to be conducted. The rate of testing must be stepped up as found necessary depending upon the variability of the materials and compaction methods employed at a project.

- (a) *Gradation* : At least one test for each kind of soil. Usual rate of testing 1 to 2 tests per 8000 cum of soil.
- (b) *Plasticity* : At least one test for each kind of soil. Usual rate of testing 1 to 2 tests per 8000 cum of soil.
- (c) *Proctor Tests* : At the rate of 1 to 2 tests per 8000 cum of soil.
- (d) *Deleterious Contents* : As required.
- (e) *Moisture contents* : One test for every 250 cum of soil.

16.3.4.8 Measurements : The filling shall be measured and quantity of earth work computed from cross sections of filling or the embankment. No deduction shall be made for voids.

16.3.4.9 Rate shall include the cost of all operations described above including operation mentioned in 16.3 to the extent applicable.

16.4 SUPPLYING AND STACKING OF MATERIALS

16.4.1 Aggregates/Red Bajri

16.4.1.0 The item of work shall specify stone aggregate/brick aggregate/red bajri etc., as the case may be.

16.4.1.1 Stacking : Ground where stacks are proposed to be made shall be cleared, levelled or dressed to a uniform slope and all lumps, depressions etc. shall be removed. The stacked material shall be free from vegetation and other foreign matter. Coarse aggregates stack shall be made at places as directed by the Engineer-in-Charge. All rejected stone material shall be removed from the site.

The aggregate shall be stacked in convenient units of one metre top width, 2.2 m bottom width, 60 cm height and of length in multiples of 3 m for new roads. Where berm width is limited or for repair works it shall be stacked in units of 40 cm top width 1.4 m bottom width, 50 cm height and length in multiples of 3 m. Template of steel shall be used for making the stacks and shall always be kept at site for check measurements. The Engineer-in-Charge may permit stacking in different sizes and height ranging between 45 to 75 cm for new roads and 40 to 60 cm for repair work, in case the site conditions so demand. In a particular reach of road as decided by the Engineer-in-Charge, the quantity of stacked material shall be comparable to the theoretical quantity required for W.B.M. to be laid in that reach.

The stacks shall be uniformly distributed along the road and shall be numbered serially. The number plate shall be planted on each stack, which shall remain in position until the stack is used in the work. A register showing daily consumption of stacks shall be maintained at site of work. The collection of stone metal shall be for completed length of one km (for each layer of W.B. macadam) or as directed by the Engineer-in-Charge in writing.

16.4.1.2 Measurements : Length, breadth and height shall be measured correct to a cm. The total quantity so arrived shall be reduced by 7.5% to arrive at the net quantity for payment, in cases of aggregates. No such reduction shall be made in case of fine aggregate i.e. Red Bajri & screening etc. as defined under clause 16.1.1 to 16.1.2.

16.4.2 Binder

16.4.2.1 Stacking : Specified binder shall be brought to the site of work in the sealed original containers. Binder brought in damaged containers shall not be allowed. The material shall be stacked in fenced enclosures, as directed by the Engineer-in-Charge, on one side of the roadway. The material shall be purchased from reputed firms or their authorised dealer. All the drums brought to site shall be serially numbered and used in the same order. The materials shall be brought in at a time in adequate quantities to suffice for the whole work or for atleast a fortnight's work.

For major bituminous road works, supply of bitumen in bulk may be taken for economical reasons, or if the contingencies of the work so require. Sufficient storage arrangement shall be made at site for atleast ten days requirement.

Materials shall be kept in the joint custody of the contractor and the representative of the Engineer-in-Charge. The empty containers shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Engineer-in-Charge. A few drums may be removed before completion of work for heating bitumen and mixing aggregates etc. with the permission to the Engineer-in-Charge.

Empty drums required to be returned to stores shall be in good condition. Recovery rate for non-return of the empty drums or for the damaged drums shall be as decided by the Engineer-in-Charge.

16.4.2.2 Measurements : The materials shall be recorded as per standard weights of different type of container as intimated by manufacturers. The material shall be weighed where containers are found leaking.

16.4.2.3 Rate : The rate shall include the cost of all labour and materials involved in all the operations described above.

16.4.3 Moorum/Stone Chippings/Good Earth

16.4.3.0 The item of work shall specify moorum/stone chippings/Good Earth as the cases may be.

16.4.3.1 Stacking : Ground where stacks are proposed to be made, shall be dressed to a uniform slope and all lumps, depressions etc. shall be removed. Sample of moorum shall be got approved from the Engineer-in-Charge, before the material in bulk is brought to site.

Moorum/Good Earth shall be stacked in convenient units of one cubic metre in between aggregate stacks in each length of 100 m as per requirement. The stacks shall be made with wooden boxes open at both ends and of 2 × 2 × 0.25 m dimensions. These shall always be kept at site for stacking and check measurement.

The stacks shall be uniformly distributed along the road. The supply of moorum shall be completed for the entire work or for a complete length of one km or as directed by the Engineer-in-Charge in writing.

16.4.3.2 Measurements : Length and breadth of boxes shall be measured correct to a cm. Volume shall be calculated in cubic metres, correct to two places of decimal.

16.4.3.3 Rate : The rate shall include the cost of all materials and labour involved in all the operations described above.

16.5 EARTHWORK IN ROAD CONSTRUCTION

16.5.1 Earthwork connected with road construction fall broadly into three categories.

- (a) Earthwork in cutting including borrow pits.
- (b) Earthwork in fillings in embankments (without optimum moisture conditions).
- (c) Earthwork in fillings in embankments (under optimum moisture conditions).

16.5.2 Detailed specifications relating to Earthwork already described in subhead Earth Work, CPWD Specification Vol- I, 2019 so far as the various options in the earthwork for road construction as indicated below shall be applicable.

- Site clearance
- Setting out and making profile
- Blasting operations
- Excavation in all kinds of soils
- Excavation in ordinary/hard rock
- Earthwork in filling
- Measurements
- Rates
- Surface excavation
- Rough excavation and filling

16.5.3 In addition to the above, there are certain special requirements of earthwork for road constructions, especially in embankments and excavations from borrow pits. These shall broadly conform to.

- (a) IRC : 36 Recommended practice for construction of earth embankments for road works.
- (b) IRC : 10 Recommended practice for borrow pits for road embankments by manual operations.

Excavation from borrow pits shall conform to provisions in para 3 of IRC: 10 and the road embankment shall generally conform to section, slopes and location of borrow pits as per Fig. given in CPWD Specifications Vol. I, 2019.

16.6 EMBANKMENT CONSTRUCTION (WITHOUT OPTIMUM MOISTURE CONDITIONS)

16.6.0 In addition to what is described in 16.5 above, the following shall apply : materials used in embankments shall be earth moorum, gravel, a mixture of these or any other material approved by the Engineer-in-Charge. Such materials shall be free of logs, stumps, roots, rubbish or any other ingredient likely to deteriorate or affect the stability of the embankment. The work shall be so planned and executed that the best available materials are saved for the top portion of the embankment.

Highly expansive clays exhibiting marked swell and shrinkage properties may be deposited only at the bottom of the embankment and no such material shall be placed nor permitted to remain in the top 500 mm portion of the embankment below the sub-grade.

16.6.1 Preparation of Foundations

The foundations of the embankment shall be ploughed to a depth of 15 to 25 cm. All clods shall be broken into fine earth and the area roughly levelled. The surface shall then be well watered before the earth work is started.

16.6.2 Source of Supply

16.6.2.1 The material used in embankment shall be obtained either from cutting high ground or from borrow pits as directed by the Engineer- in-Charge. In case of road embankments, the borrow pits may be excavated

along the sides of the road so as to form road side drains with proper slopes and sections. The clear berm width between the toe of the bank and the inner edge of the borrow pits shall be specified by the Engineer-in-Charge but it shall not be less than 5 metres after making due allowance for future development.

16.6.2.2 Borrow pits shall be rectangular in shape with one side parallel to the centre line of the road. If on road land, these shall be dug as near the boundary as possible. Borrow pits shall not be dug continuously. Ridges of not less than 8 metres width should be left at intervals not exceeding 300 metres. Small drains should be cut through the ridges to facilitate drainage. Borrow pits shall be well drained. The bed level of the borrow pits, shall, as far as possible, slope down progressively towards the nearest cross drain, if any and shall not be lower than the bed of the cross drain. Borrow pits shall not be dug within 0.8 km of towns or villages. If unavoidable these shall not exceed 30 cm in depth and shall be drained.

16.6.2.3 Where it becomes necessary to borrow filling materials from temporarily acquired cultivable lands the depth of borrow pits shall not exceed 45 cm. The top soil to a depth of 15 cm shall be stripped and stacked aside. Thereafter soil shall be dug out to a further depth not exceeding 30 cm and used in forming the embankment. The top soil shall then be spread back on the land.

16.6.2.4 In case of flood and marginal banks, earth shall be obtained from borrow pits on the river side of the banks. No borrow pit shall be excavated on the land side of the bank, unless permitted by the Engineer-in-Charge in writing depending upon the depth of borrow pits and height of embankment. However the minimum berm width between the toe of the bank and the edge of the borrow pits on the river side shall be 15 metres and that between the toe of the bank and the edge of the borrow pits on the land side 25 metres.

16.6.2.5 Guide-banks shall be constructed from material obtained from excavation for laying stone aprons and further borrow pits excavated if necessary, according to the directions of the Engineer-in-Charge.

16.6.3 Earth Filling and Compactions

16.6.3.1 Before commencement of filling the toe lines of the embankment shall be marked by pegs driven into the ground at 15 metres intervals and by continuous nicking (dab balings) to indicate the limits of the side slopes. Bamboo and string profiles shall be erected at every 60 metres interval in straight reaches and 15 metres apart in curved portions.

16.6.3.2 Embankment material shall be laid in 20 cm layers which shall be continuous and parallel to the finished grade. The placing of earth fill shall be done in the full width of embankment including slopes, and the section of formation shall be kept slightly sloping away from the centre to avoid pools of water forming due to rain. The height of filling in different sections shall be uniform as far as possible. All clods shall be broken while the earth is being placed. Organic matter of any kind shall be removed and disposed off as directed by the Engineer-in-Charge.

16.6.3.3 Joining of old and new embankments shall be done by stepping in an overall slope of about 1 to 5.

16.6.3.4 Each layer of earth shall be adequately watered to aid compaction.

16.6.3.5 If the material delivered to the road bed is too wet it shall be dried by aeration and exposure to the sun, till the moisture content is acceptable for compaction. It shall then be rolled with roller of minimum 1/2 tonne weight, not less than 5 times, till it gets evenly and densely consolidated with wooden or steel rammers of 7 to 10 kg weight having a base of 20 cm square or 20 cm diameter. The labour for ramming shall be at least one rammer to six diggers. Every third layer of earth and the top most layer shall be well consolidated with a power roller of minimum 8 tonnes weight, rolled not less than 5 times, till the soil behaves as an elastic material and gets compressed only elastically under the load of roller.

16.6.3.6 Dressing: The embankment shall be dressed neatly to the required level as per designed section and grade, after it has been completed and thoroughly consolidated. The top and slopes shall be protected from any damage and maintained, till the work is completed and handed over to the Engineer-in-Charge.

16.6.4 Embankment Around Structures

16.6.4.1 To avoid interference with the construction of abutments, wing walls or return walls of culvert/bridge structure, the contractor shall at points to be determined by the Engineer-in-Charge suspend work on embankments forming approaches to such structures, until such time as the construction of the latter of sufficiently advanced to permit the completion of approaches without the risk of interference of damage to the bridge works.

16.6.4.2 Unless directed otherwise, the filling around culverts, bridges and other structures upto a distance of twice the height of the embankment shall not be done. The fill material shall not be placed against any abutment or wing wall unless permission has been given by the Engineer-in-Charge but in any case not until the concrete or masonry has been in position for 14 days. The embankment shall be brought up simultaneously in equal layers on each side of the structure to avoid displacement and unequal pressure. The sequence of work in this regard shall be got approved from the Engineer-in-Charge.

16.6.4.3. Where the provision of any filter medium is specified behind the abutment, the same shall be laid in layers simultaneously with the laying of fill material. The material used for filter material shall conform to the requirements for filter medium as specified. Payment for providing filter material shall be made separately under relevant items.

16. 6.4.4. Where it may be impracticable to use power roller or other heavy equipment, compaction shall be carried out by mechanical tampers or other methods approved by the Engineer-in-Charge. Care shall be taken to see that the compaction equipments does not hit or come too close to any structural member so as to cause any damage to it.

16.6.5 Earth Work for Widening Existing Road Embankment

16.6.5.1 When an existing embankment is to be widened and its slope is steeper than 4:1 continuous horizontal benches each at least 0.3 metre wide, shall be cut into the old slope for ensuring adequate bond with the fresh embankment material to be added. The material obtained from cutting of benches could be utilised in the widening of the embankment. However, when the existing slope against which the fresh material is to be placed is flatter than 4:1 the slope surface may only be ploughed or scarified instead of resorting to benching.

16.6.5.2 Where the width of the widened portion is insufficient to permit the use of standard rollers compaction shall be carried out with the help of sheep's foot roller mechanical tampers or other approved equipment. End dumping of material from trucks for widening operations shall be avoided except in difficult circumstances when the extra width is too narrow to permit the movement of any other type of hauling equipment.

16.6.6 Cutting

Where the formation level of the road is lower than the ground level, cutting shall be done up to formation level. Side slopes except in rock cutting shall be evenly and truly dressed.

16.6.6.1 Disposal of Surplus Earth: Earth from cutting shall be utilized for filling in embankment as directed by the Engineer-in-Charge. Earth not required for embankment shall be disposed off as directed by the Engineer-in-Charge. The area where the surplus earth is disposed off shall be levelled and neatly dressed. When the surplus earth is disposed off at a distance of more than 50 metres the extra lead shall be paid for.

16.6.6.2 Measurements: The quantity of earth work shall be calculated by measuring the volume of earth excavated from the borrow pits and shall be done as specified where it is not possible or convenient to take measurements from cutting the filling shall be measured and the quantity of earth work computed from cross sections of the filling. The quantity of earth work so computed shall be reduced by 5% to arrive at the quantity for payment.

For the purpose of taking measurements of earth work in cutting or embankment, ground levels of the area shall be recorded as specified in 16.5.

16.6.6.3 Rate : It includes the cost of all the operations described above. The lead and lift for depositing the earth or disposal of unsuitable material shall be as described in the description of item. It also includes the Sub Head 2.0 EarthWork.

16.7 WATER BOUND MACADAM WITH STONE AGGREGATE

16.7.1 Water Bound Macadam with Stone Aggregate

Stone aggregate of specified size is used. This is a standard sub base/base and is used where stone aggregate is available at reasonable rates. This consists of clean crushed coarse aggregate mechanically interlocked by rolling and voids thereof filled with screening and binding material with the assistance of water, laid on a prepared sub grade, sub-base, base or existing pavement as the case may be. Water bound macadam may be used as a sub base, base course or surfacing course.

16.7.2 Approximate Quantities of Materials

Quantities of coarse aggregate, screening and binding material required to be stacked for 100 mm approximate compacted thickness of W.B.M. for 10 sqm shall be as per table 16.12 for stone aggregate of the size 90 mm to 45 mm. For stone aggregate of other size, 63 mm to 45 mm and 53 mm to 22.4 mm quantity of coarse aggregate and stone screening for 75 mm approximate compacted thickness of WBM base for 10 sqm. shall be as per Table 16.13.

TABLE 16.12

Coarse Aggregate			Stone Screenings		Binding Material
Classification	Size Range	Loose Quantities	Grading/classification and size	Loose Quantity	Quantity
Grading 1	90 mm to 45 mm	1.21 cum to 1.28 cum	Type A 13.2 mm	0.27 cum to 0.30 cum	0.08 cum to 0.10 cum

Note : Net quantity = Loose quantity measured in stacks minus 7.5%.

TABLE 16.13

Coarse Aggregate				Stone Screenings		
Classification	Size Range	Compacted Thickness	Loose Quantity	Grading Classification & Size	For WBM Sub-base/Base Course (Loose Quantity)	For WBM surface course (Loose Quantity)
Grading 2	63-45 mm	75 mm	0.91 to 0.96 m ³	Type A 13.2 mm	0.12 cum to 0.15 cum	0.10 cum to 0.12 cum
-Do-	-do-	-do-	-do-	Type B 11.2 mm	0.20 cum to 0.22 cum	0.16 cum to 0.18 cum
Grading 3	53-22.4 mm	75 mm	-do-	Type B 11.2 mm	0.18 cum to 0.21 cum	0.14 cum to 0.17 cum

- * **Note :**
1. The quantity of metal measured in stacks and reduced by 7.5% to calculate net quantity.
 2. The above mentioned quantities should be taken as a guide only for estimation of quantities for construction etc.

16.7.3 The quantity of binding material required for 75 mm (approximate) compacted thickness will be 0.09 cum/10 sqm in the case of W.B.M. base course and 0.13 cum/10 sqm when the W.B.M. is to function as a surface course.

16.7.4 Preparation of Foundation

In the case of an existing unsurfaced road, where new materials is to be laid, the surface shall be scarified and reshaped to the required grade, camber and shape as necessary. Weak places shall be strengthened, corrugations removed and depressions and pot holes made good with suitable materials, before spreading the aggregate for W.B.M.

Where the existing surface over which the sub base of W.B.M. is to be laid is black topped, to ensure effective internal drainage, furrows 50 mm x 50 mm (depth of furrows increased to reach bottom of bituminous layer where necessary) at one metre intervals shall be cut in the existing bituminous surface at 45 degree C to the central line of the carriageway before the W.B.M. is laid.

16.7.5 Provision of Lateral Confinement of Aggregates

Before starting with W.B.M. construction, necessary arrangements shall be made for lateral confinement of aggregates. One method is to construct side shoulders in advance to a compacted layer of the W.B.M. coarse (Fig.16.1). Inside edges may be trimmed vertical and the included area cleaned off all spilled materials thereby setting the stage for spreading the coarse aggregate.

The practice of laying W.B.M. after excavating a trench section in the finished formation must be completely avoided.

16.7.6 Spreading Aggregate

The coarse aggregate shall be spread uniformly and evenly upon the prepared base in required quantities with a twisting motion to avoid segregation. In no case shall these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed base be permitted. The aggregates shall be spread uniformly to proper profile by using templates placed across the road six metres apart. Where specified, approved mechanical devices may be used to spread the aggregates uniformly. The levels along the longitudinal direction upto which the metal shall be laid, shall be first obtained at site to the satisfaction of Engineer-in-Charge, and these shall be adhered to.

The surface of the aggregate spread shall be carefully trued up and all high or low spots remedied by removing or adding aggregate as may be required.

The W.B.M. sub-base shall be normally constructed in layer of 100 mm compacted thickness and W.B.M. base shall be normally constructed in layers of 75 mm compacted thickness. No segregation of large or fine particles shall be allowed and the coarse aggregate as spread shall be of uniform gradation with no pockets of fine material.

The coarse aggregate shall normally not be spread in lengths exceeding three days average work ahead of the rolling and blending of the proceeding section.

16.7.7 Rolling

Immediately following at spreading of the coarse aggregate, it shall be compacted to the full width by rolling with either the three- wheel- power -roller of 8 to 10 tonnes capacity or an equivalent vibratory roller. Initially, light rolling is to be done, which shall be discontinued when the aggregate is partially compacted with sufficient void space in them to permit application of screenings.

The rolling shall begin from the edges with the roller running forward and backward and adding the screenings simultaneously until the edges have been firmly compacted. The roller shall then progress gradually from the edges to the centre, parallel to the centre line of the road and overlapping uniformly each preceding rear wheel track by one half width and shall continue until the entire area of the course has been rolled by the rear wheel. Rolling shall continue until the road metal is thoroughly keyed with no creeping of metal ahead of the roller. Only slight sprinkling of water may be done during rolling, if required. On superelevated curves, the rolling shall proceed from the lower edge and progress gradually continuing towards the upper edge of the pavement.

Rolling of sub base shall not be done when the sub-grade is soft or yielding or when the rolling causes a wave like motion in the sub-base or sub-grade. When rolling develops irregularities that exceed 12 mm when tested with a three metre straight edge, the irregular surface shall be loosened and then aggregate added to or removed from it as required and the area rolled until it gives a uniform surface conforming to the desired cross-section and grade. The surface shall also be checked transversely by template for camber and any irregularities corrected in the manner described above. In no case shall the use of screenings to make up depressions be permitted.

16.7.8 Application of Screenings

After the coarse aggregate has been lightly rolled to the required true surface, screenings shall be applied gradually over the surface to completely fill the interstices. Dry rolling shall be continued while the screenings are being spread so that the jarring effect of the roller causes them to settle into the voids of the coarse aggregates. The screenings shall not be dumped in piles on the coarse aggregate but shall be spread uniformly in successive thin layers either by the spreading motion of the hand, shovels or a mechanical spreader.

The screenings shall be applied at a slow rate (in three or more applications) so as to ensure filling of all voids. Rolling and brooming shall continue with the spreading of the screenings. Either mechanical brooms or hand brooms or both may be used. In no case shall the screenings be applied, so fast and thick as to form cakes, ridges on the surface making the filling of voids difficult, or to prevent the direct bearing of the roller on the coarse aggregates. The spreading, rolling and brooming of screenings shall be performed on sections which can be completed within one day's operation and shall continue until no more screenings can be forced into the voids of the coarse aggregate. Damp and wet screenings shall not be used under any circumstances.

16.7.9 Sprinkling and Grouting

After spreading the screening and rolling the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to sweep the wet screening into the voids and to distribute them evenly. The sprinkling, sweeping and rolling operations shall be continued and additional screenings applied where necessary until the coarse aggregates are well bonded and firmly set for the entire depth and until a grout has been formed of screenings and water that will fill all voids and form a wave of grout ahead of the wheels of the roller. The quantity of water to be used during the construction shall not be excessive so as to cause damage to the sub-base or sub-grade.

16.7.10 Application of Binding Material

After the application of screenings and rolling, a suitable binding material shall be applied at a uniform and slow rate in two or more successive thin layers. After each application of binding material, the surface shall be copiously sprinkled with water and the resulting slurry swept in with hand brooms or mechanical brooms or both so as to fill the voids properly. The surface shall then be rolled by a 8-10 tonne roller, water being applied to the wheels in order to wash down the binding material that may get stuck to the wheels. The spreading of binding material, sprinkling of water, sweeping with brooms and rolling shall continue until the slurry that is formed will, after filling the voids form a wave ahead of wheels of the moving roller.

16.7.11 Setting and Drying

After final compaction of the course, the road shall be allowed to cure overnight. Next morning defective spots shall be filled with screenings or binding material, lightly sprinkled with water, if necessary and rolled. No traffic shall be allowed till the macadam sets.

16.7.12 Surface Evenness

The surface evenness of completed W.B.M. sub -base in the longitudinal and transverse directions shall be as specified in Table 16.14 for sub base with stone aggregate of size 90-45 mm and above.

TABLE 16.14

	Longitudinal profile measured with a 3 metre straight edge	Cross profile
--	--	---------------

Size of Coarse aggregates	Maximum permissible undulation	Max. No. of Undulations permitted in any 300 m length exceeding		Max. permissible undulation when measured with a camber template
		15 mm	10 mm	
90-45 mm & above	15 mm	-	30	12 mm

The longitudinal profile shall be checked using a 3 meter long straight edge and graduated wedge at the middle of each traffic lane along a line parallel to the Centre line of the road. The transverse profile shall be checked with adjustable template at intervals of 10 meters. For base with stone aggregate of size 63 to 45 mm and 53 to 22.4 mm surface evenness to be as per Table 16.15.

TABLE 16.15

Size of Coarse aggregates	Longitudinal profile measured with a 3 metre straight edge			Cross profile
	Maximum permissible undulation	Max. No. of Undulations permitted in any 300 m length exceeding		Max. permissible undulation when measured with a camber template
		15 mm	10 mm	
63-45 mm and 53-22.4 mm	12 mm	-	30	8 mm

The longitudinal profile shall be checked with a three metre long straight edge and graduated wedge at the middle of each traffic lane along a line parallel to the centre line of the road. The transverse profile shall be checked with adjustable templates at intervals of 10 metres.

16.7.13 Rectification of Defective Construction

Where the surface irregularity of the W.B.M. sub-base course exceeds the tolerances specified in Table 16.14 or where the course is otherwise defective due to sub grade soil mixing with the aggregates, the layer to its full thickness shall be scarified over the affected area, reshaped with added material or removal and replaced with fresh materials as applicable, and recompacted. The area treated in the aforesaid manner shall not be less than 10 sqm. In no case shall depressions be filled up with screenings and binding materials.

16.7.14 Measurements

The length and breadth shall be measured to the nearest centimetre. The depth of consolidated layer shall be computed to nearest half centimetre by taking average of depths at the centre and at 30 cm from the left and right edges at a cross section taken at 100 metre interval or less as decided by the Engineer-in-Charge by making small pits. The consolidated cubical contents shall be calculated in cubic metres correct to two places of decimal. The cubical contents shall be compared with net quantity of stone aggregates paid (that is stacked quantity – 7.5%). If the cubical contents are within (\pm) 5% of the paid net stacked quantity of stone aggregates, the work shall be treated as acceptable. If the cubical contents is short of net stacked quantity by more than 5% then the payment shall be restricted to the quantities derived from cubical content.

16.7.15 Rate

The rate shall include the cost of all labour and materials involved in all the operations described above, except cost of stone aggregate, kankar moorum, screenings and bajri, for which separate payments shall be made. Where W.B.M. is to be laid over an existing road, scarifying and consolidation of the aggregate received from scarifying shall be paid for separately.

16.8 WATER BOUND MACADAM WITH BRICK AGGREGATE (OVERBURNT (JHAMA) BRICK AGGREGATE)

16.8.0 Over burnt (jhama) brick aggregate of size 120 mm to 40 mm or 90 mm to 45 mm is used. This is used when stone aggregate is costly and over burnt brick aggregate is available at reasonable rates. This is also used over soft clayey sub grade with high moisture contents and low CBR values.

16.8.1 Quantities of Materials

Approximate quantity of brick aggregate (to be paid for separately) required to be stacked for 100 mm average compacted thickness of W.B.M. sub-base shall be 1.60 cum (approximate). The quantity of binding material, if required shall be as specified by the Engineer-in-Charge. Brick aggregate shall be broken from overburnt or well burnt brick bats. It shall be homogeneous in texture, roughly cubical in shape, clean and free from dirt and other foreign matter.

Foundation shall be prepared as specified in 16.7.4.

16.8.2 For spreading aggregate clause 16.7.6 shall apply except that the quantities of materials shall be as given above.

16.8.3 The rolling shall be done as specified in 16.7.7 except that rolling shall be done with the light power roller. The use of screenings shall also be omitted. Rolling shall be done 3 to 5 times for each layer.

16.8.4 For rolling with Binding material clause 16.7.10 shall apply except that rolling shall be done with a light power roller instead of a heavy road roller and water shall not be used during rolling. Rolling shall be done 3 to 5 times for each layer.

16.8.5 Surface Evenness rectification of Defective construction, Measurements and Rate shall be as specified under 16.7.12 to 16.7.15.

16.9 BAJRIPATHS

16.9.1 Preparation of Sub-Grade

The formation for a width equal to that of the bajri path shall first be cut to a depth, below the proposed finished level, equal to the thickness of the course of brick aggregate (due allowance being made for consolidation) and dressed off in level to the finished profile.

In case of made up soil, adequate watering shall be done so that earth settles down as much as possible and the same rolled up with a minimum three tonnes or light power roller, as directed by the Engineer-in-Charge.

16.9.2 Laying and Packing Brick Aggregate : Shall be as specified in 16.7.6 except that brick aggregate shall be used instead of stone aggregate and laid to 7.5 cm depth unless specified otherwise.

16.9.3 Consolidation : Shall be as specified in 16.7.7 except that rolling shall be done by three tonnes or light power roller instead of by heavy road roller as directed by the Engineer-in-Charge.

16.9.4 Rolling with Blinding Materials : Shall be as specified in 16.7.10 except that rolling shall be done by three tonnes or light power roller instead of by heavy road roller as directed by the Engineer-in-Charge.

16.9.5 Measurements

The finished work shall be measured between the kerb or channel stones or brick edging etc. as the case may be. Length and breadth shall be measured, correct to a cm. The area shall be calculated in square metres, correct to two places of decimal.

16.9.6 Rate

The rate shall include the cost of materials and labour involved in all the operations described above.

16.10 BRICK EDGING

16.10.1 Edging

Trenches of specified width and depth shall first, be made along the edges of the wearing course of the road to receive the bricks. The bed of trenches shall be compacted to a firm and even surface and then the bricks shall be laid with its length at right angle or parallel to the side of the road depending upon the

width of edging as specified in the item. The bricks shall be abutting against the wearing course, true to line, gradient and in camber with the finished road surface at the edge.

16.10.2 Finishing

Berms and road edges shall be restored with excavated earth and consolidated by manually. All surplus earth including rubbish etc. shall be disposed off as directed by the Engineer-in-Charge.

16.10.3 Measurements

Length of the finished work shall be measured in running metres along the edges of the road correct to a cm.

16.10.4 Rate

The rate shall include the cost of materials and labour involved in all the operations described above.

16.11 SCARIFYING METALLED (WATER BOUND) SURFACE

16.11.1 Scarifying

All dirt, dust, cacked up mud, slush, animal droppings, vegetation and all other rubbish shall be removed from the water bound macadam surface.

The macadam surface shall be scarified to a depth of approximately 5 cm with such additional picking of high parts of the road as may be necessary to the required camber and gradient as directed by the Engineer-in-Charge. Any hollows that remain after picking shall be filled with new aggregate 50 mm nominal size and well consolidated to bring the surface to template.

16.11.2 Finishing

The scarified aggregate shall be raked to bring smaller stones on the top and surface brought to the required camber and gradient with tolerance of 12 mm longitudinally as well as transversely.

All rubbish etc. shall be disposed off as directed by the Engineer-in-Charge. Scarifying operation will also include consolidation with road roller the aggregate received from scarifying, although this aggregate will be consolidated along with aggregate of new wearing course to be paid separately.

16.11.3 Measurements

The finished work shall be measured between the kerb or channel stones or brick edging etc. as the case may be. Length and breadth shall be measured correct to a cm. The area shall be calculated in square metres correct to two places of decimal.

16.11.4 Rate

The rate shall include the cost of labour and materials involved in all the operations described above except the cost of stone aggregate which shall be paid for separately.

16.12 DRY STONE PITCHING

16.12.1 Stones

These shall be clean, hard stones, free from decay and weathering. They shall be in block and hammer dressed on all sides.

The size of the pitching stones shall be approximately 22.5 cm. in depth and not less than 15 cm. in any other direction.

16.12.2 Preparation of surface

The sides and bottom of earth work to be pitched, shall be brought to the required slope and gradient and shall be compacted to a firm and even surface.

16.12.3 Pitching

Pitching shall be of 22.5 depth unless specified otherwise. Profiles shall be put up by means of pegs and strings or by placing stones, at intervals of not more than 15 cm. Stones shall then be laid closely in position in between the profile and firmly embedded with joints staggered and with exposed faces true to line, gradient and in uniform slope throughout.

Cross bands of approximately 22.5 cm. width through bond stones equal to the full depth of pitching shall be provided at an interval of approximately 3 metres centre to centre both longitudinally and transversely.

The interestices between adjacent stones shall be filled in with stones of proper size, well driven in with crow bars to ensure tight packing and complete filling of all interestices. Such filling shall be carried on simultaneously with the placing in position of the large stones and shall in no case be permitted to fall behind. Final wedging shall be done with the largest sized chip practicable, each chip being well driven home with a hammer so that no chip is possible of being picked up or removed by hand.

16.12.4 Measurements

The measurements shall be taken in sqm. The area of pitching for drains shall be calculated by multiplying the perimeter (bed width plus side slopes) by the length of the pitching. The length, width and side slope shall be measured correct to a cm.

16.12.5 Rate

The rate shall include the cost of the materials and labour involved in all the operations described above, except pitching stone, if specified, shall be paid for separately.

16.13 BRICK PITCHING

16.13.1 Bricks shall be all class designation 75 unless otherwise specified. The specification of bricks shall be as per SH 6.00 (Brick work) CPWD Specification – 2019.

16.13.2 Preparation of Surface

The sides and bottom of earth work to be pitched, shall be brought to the required slope and gradients and shall be compacted to a firm and even surface.

16.13.3 Pitching

Pitching shall be 10 cm. in depth or in multiples of 10 cm. as specified. Profiles shall first be put up by means of pegs and strings or by placing bricks at intervals not more than 15 cm. Bricks shall then be laid in parallel rows breaking bond or Herring –bone bond pattern as directed. In the case of drains, bricks shall be laid on bed width in parallel rows breaking bond and on sides in either of the above manner. At the top, the toe and at every 3 m. intervals, brick courses shall be laid with bricks on ends. All bricks shall be laid closely in position and firmly embedded, true to line, gradient and in uniform slope through out pitching work.

16.13.4 Measurements

Para 16.12.4 shall apply, except that the measurements of the dry pitching 10 cm. deep for the drains shall be taken by adding 10 cm. on either side to the perimeter of the drain so as to allow for the top 20 cm. courses. In this case the perimeter of the drain (bed width plus sides slopes) plus 20 cm. multiplied with the length of the pitching shall give the area of the pitching in sqm.

16.13.5 Rate

The rate shall include the cost of material and labour involved in all the operations described above.

16.14 CUTTING W.B.M. ROADS AND MAKING GOOD

16.14.1 Cutting

All road crossings shall be cut in half the width at a time and repaired, unless otherwise permitted by the Engineer-in-Charge. Cutting shall be straight and uniform in width. Soling stone and aggregate obtained from cutting macadam shall be stacked separately, clear of the road surface. Aggregate shall be screened. Stones of size below 20 mm and with rounded edges shall be discarded and disposed.

16.14.1.2 Making Good

16.14.1.2.1 After the trenches have been filled in with excavated earth in layers of 15 cm thickness, watered, well consolidated with heavy iron rammers and brought to sub grade level, soling stone obtained from cutting shall be laid as per existing soling and consolidated with heavy iron rammers. Where the earth consolidation is well done, no settlement need occur subsequently, for this excess watering should be avoided.

16.14.1.2.2 New aggregate 50 mm nominal size or as required, shall be added to old aggregate and spread over to a depth of 7.5 cm as specified in 16.7.6. This shall then be consolidated with hand roller or heavy iron rammers, as directed, first with light sprinkling then with sufficient application of water till the aggregate has become adequately consolidated and does not get displaced. All undulations shall be loosened by hand picking, surplus aggregate removed from high spots and depressions filled with surplus and new aggregate and the surface compacted again. When thoroughly consolidated, kankar moorum and red bajri, freshly collected shall be spread over it in 12 mm layer and consolidated with hand roller or heavy iron rammers, with sufficient application of sufficient water till a uniform surface is obtained.

16.14.2.3 The finished surface shall be in camber and left a little higher than the adjoining road surface to allow for any settlement on drying.

16.14.1.3 Measurement : Length and width of cutting shall be measured correct to a cm. The area shall be calculated in square metre, correct to two places of decimal.

16.14.1.4 Rate : The rate shall include the cost of materials and labour involved in all the operations described above.

16.14.2 Cutting Bituminous Roads and Making Good

16.14.2.1 Cutting, making good and measurements shall be as specified in 16.14.1 except the top bituminous surface shall be finished as per the existing surface or as directed by the Engineer-in-Charge. The item shall include cutting and restoration of W.B.M. portion as well as Bitumen portion.

16.14.2.2 Rate : The rate shall include the cost of materials and labour involved in all the operations described above.

16.15 CUTTING BAJRI PATHS AND MAKING GOOD

16.15.1 Cutting

Cutting shall be straight and uniform in width. Brick aggregate obtained from cutting shall be screened, aggregates of smaller size discarded and disposed off and rest stacked clear off pathway.

16.15.2 Making Good

After the trench has been filled in with excavated earth, consolidated and brought to sub-grade level, brick aggregates obtained from cutting and mixed with new aggregates 50 mm nominal size, as required shall be spread to a depth of 7.5 cm as specified in 16.9.2. This shall then be consolidated with blinding materials and finished as specified in 16.14.1.2

16.15.3 Measurements

Length and width of cutting shall be measured correct to a cm. The area shall be calculated in square metre correct to two places of decimal.

16.15.4 Rate

The rate shall include the cost of materials and labour involved in all the operations described above.

16.16 FENCING WITH G.I. BARBED WIRE AND RCC POSTS (FIG.16.9)

16.16.1 Materials

R.C.C. posts and struts shall be as specified in 16.1.12. G.I. Barbed wire shall be as per IS 278.

16.16.2 Spacing of Posts and Struts

The spacing between posts shall be three metres centre to centre, unless otherwise specified, or as directed by the Engineer -in-Charge to suit the dimensions of the area to be fenced. Every 15th, last but one end post and corner posts shall be strutted on both sides and end posts on one side only.

16.16.3 Fixing of Posts and Struts

Pits 45 x 45 cm and 75 cm deep or as directed shall first be excavated true to line and level to receive the posts. In the case of struts, pits 70 x 45 x 75 cm deep or as directed shall be excavated to suit the inclination of the strut so that it is surrounded by concrete by not less than 15 cm at any point. The pits shall be filled with a layer of 15 cm thick cement concrete 1:3:6 (1 cement: 3 fine sand: 6 graded stone aggregate 40 nominal size) . The posts and struts shall then be placed in the pits, the posts projecting 1.2 m or to the specified height above ground, true to line and position. The cement concrete 1:3:6 shall be filled in upto 15 cm for posts and 25 cm for struts below ground level at the base of the concrete so that the posts are embedded in the cement concrete block of size 45 x 45 x 60 cm and strut in block of size 70 x 45 x 50 cm. The concrete in foundations shall be watered for at least 7 days to ensure proper curing. The remaining portions of pits shall be filled up with excavated earth and the surplus earth disposed off as directed by the Engineer-in-Charge and site cleared.

16.16.4 Fixing G.I. Barbed Wire

The barbed wire shall be stretched and fixed in specified number of rows and two diagonals. The bottom row shall be 14 cm above ground and the rest at 12.5 cm centre to centre. The diagonals shall be stretched between adjacent posts from top wire of one post to the bottom wire of the second post. The diagonal wires will be interwoven with horizontal wires by fixing the odd- rows of wires first , then the diagonal cross wires and lastly the even rows of wires. The barbed wire shall be held to the R.C.C. posts by means of G.I. staples fixed to wooden plugs or G.I. binding wire tied to 6 mm barnibs fixed while casting the posts. Turn buckles and straining bolts shall be used at the end posts, if so specified.

16.16.5 Measurements

Total length of G.I. barbed wire shall be measured in running meter correct to a cm.

16.16.6 Rate

The rate shall include the cost of labour and materials involved in all the operations described above but excluding the cost of posts, struts, turn buckle, straining bolts and excavation and concrete in foundations for which separate payments shall be made under respective items.

16.17 G.I. BARBED WIRE FENCING WITH ANGLE IRON POSTS

16.17.1 Materials

G.I. Barbed wire shall be as per IS 278 and angle iron shall be as per subhead – 10.00 steel work of CPWD Specification Vol. I- 2019. The angle shall be of size 40 x 40 x 6 mm.

16.17.2 Spacing of Posts and Struts

The spacing of posts shall be 3.00 m centre to centre, unless otherwise specified or as directed by the Engineer-in-Charge to suit the dimensions of the area to be fenced. Every 15th, last but one end posts and corner post shall be strutted on both sides and end post on one side only.

16.17.3 Fixing of Posts and Struts

This shall be as per 16.16.3. In addition, angle iron post at bottom shall be split and banded at right angle in opposite direction for 10 cm length to get proper grip.

16.17.4 Fixing G.I. Barbed Wire

The barbed wire shall be stretched and fixed in specified number of rows and two diagonals. The bottom row should be 14 cm above ground and the rest at spacing of 2.5 cm centre to centre. The diagonal shall be stretched between adjacent posts from the top wire of one post to the bottom wire of 2nd post. The diagonal wire will be inter woven with horizontal wires by fixing the odd rows of wires first, then the diagonal cross wires and lastly even rows of wires. The barbed wire shall be held by tearing the holes of 10 mm dia in the post and tied with G.I. wire, turn buckles and straining bolts shall be used at the end post, if so specified.

16.17.5 Measurements

This shall be as per 16.16.5.

16.17.6 Rates

The rate shall include the cost of labour and materials involved in all the operations described above but excluding the cost of post struts turn buckle straining bolts and excavation and concrete in foundation for which separate payments shall be made under respective item. Angle iron post shall be paid as per similar item of subhead Steel work of CPWD Specification 2019 Vol-I. No extra payment shall be made for making holes in angle and nothing shall be deducted on account of holes.

16.18 WELDED STEEL WIRE FABRIC FENCING WITH RCC POSTS

16.18.1 Materials

RCC posts and struts shall be as specified in 16.1.12. Welded steel wire fabric will conform to IS 4948 and shall be of rectangular mesh 75 × 25 mm size weighing not less than 7.75 kg/sqm.

16.18.2 Fixing of RCC posts and struts shall be as described in 16.16.3.

16.18.3 Steel wire fabric 90 cm wide will be fixed to the posts by means of G.I. staple on wooden plugs or tied to 6 mm bar ribs with binding wire. The steel fabric shall be fixed to leave 15 cm clearance at the bottom and top of the posts.

16.18.4 Finishing

The steel wire fabric shall be painted with two or more coats of approved shade of enamel paint over a coat of steel primer as for new work.

16.18.5 R.C.C. Posts, Rails and Pales (Fig. 16.10)

16.18.5.1 Materials : R.C.C. posts, rails and pales shall be as described in 16.1.11 & 16.1.12.

16.18.5.2 Spacing of Posts : The spacing of post shall be as specified, or as directed by the Engineer- in-Charge to suit the dimensions of the area to be fenced.

16.18.5.3 Fixing Posts : Pits 45 × 45 cm and 70 cm deep or as directed shall first be excavated true to line and level to receive the posts.

16.18.5.4 Fixing Rails and Pales : The rails shall be slotted into the slots left in the posts, while the pales shall be simply dovetailed into the rails. The pales shall be fixed by pouring a little grout of 1:2 mix (1 cement : 2 fine sand) into the dovetails. The fencing shall be so erected that on completion is truly in line and level and top of the fence shall then follow approximately the profile of the ground.

16.18.6 Measurements

Fencing to be measured in square metre correct to two places of decimal after taking length and width of the finished work in metre.

16.18.7 Rates

As per item No. 16.16.6.

16.19 ENGRAVING LETTERS IN HARD STONES (FIG. 16.5 & 16.6)

16.19.1 Size of Letters

The letters shall be 13 cm, 10 cm or 8 cm high as per figure respectively.

16.19.2 Engraving

Engraving of the letters to the specified height and thickness shall be done by cutting with snap incision in V shape, about 12 mm deep or as directed by the Engineer-in-Charge.

16.19.3 Finishing

The engraved portion of the letters shall be painted with black enamel or as directed by the Engineer-in-Charge.

16.19.4 Measurements

The height of each letter shall be measured correct to a cm.

16.19.5 Rate

The rate shall include the cost of materials and labour involved in all the operations described above except the cost of stones and paint for lettering unless specified otherwise.

16.20 BOUNDARY STONES (HARD STONE) (FIG. 16.4)

16.20.1 Boundary stones shall be as described in 16.1.21 or of size otherwise specified or directed by the Engineer-in-Charge.

16.20.2 Spacing and Fixing

The boundary stones shall be fixed as directed by Engineer-in-Charge at intervals of 200 m or less, where the boundary is in a curve or the land is costly and is likely to be encroached upon, and (ii) at all angular points of the road boundary.

The boundary stones shall be firmly fixed in ground to a depth of 60 cm and the side filling shall be thoroughly watered and consolidated.

The lower 60 cm portion of the boundary stones shall be encased on all sides by at least 15 cm of foundation concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm nominal size) in case (a) where wet cultivation abuts the road land and boundary stones are likely to be displaced during agricultural operations (b) where the road runs in built up area, and (c) where the boundary stones are intended to serve as permanent land marks.

16.20.3 Measurements & Rate

Boundary stone shall be enumerated. The rate shall include the cost of materials and labour involved in all the operations described above.

16.21 PRECAST RCC BOUNDARY STONE (FIG. 16.4)

16.21.1 RCC Boundary stones shall be manufactured as per standard design or as specified in item and directed by Engineer-in-Charge.

These shall be of reinforced cement concrete 1:1 ½ : 3 (1 cement : 1 ½ coarse sand : 3 graded stone aggregate 20 mm nominal size), 90 cm high and 15 cm dia at the top and 20 cm. dia at bottom with necessary steel reinforcement as per standard design or as directed by the Engineer-in-Charge. The precast RCC Stones shall be finished smooth with cement mortar 1:3 (1 cement : 3 fine sand).

16.21.2 Spacing, fixing, measurements and rate shall be as described in 16.20.

16.22 KILOMETERS STONES (FIG.16.7)

16.22.0 Kilometer stone of precast RCC of grade 1: 1 ½ : 3 (1 cement : 1 ½ : 3 coarse aggregate 20 mm nominal size) of specified size to be used.

16.22.1 Fixing

Trenches 50 cm wide and 45 cm deep shall first be excavated to receive the kilometer stone, the lower 45 portion of kilometer stone shall then be firmly fixed in position in ground and the sides filled with earth, thoroughly watered and consolidated.

Where so specified the kilometer stone shall be fixed in cement concrete 1:3:6 (1 cement : 3 fine sand : 6 graded stone aggregate 40 mm nominal size) so that there is 15 cm thick concrete in the bottom and 15 cm thick all round upto formation level. Trench excavation in this case will be made according to the requirements.

16.22.2 Finishing

Precast RCC stone to be finished smooth in cement Mortar 1:3 (1 cement 3 fine sand). The exposed surfaces above ground shall be painted with two or more coats of required colour or as specified over a coat of primer as for new work, the background colour shall be white with black letters and numerals for names of stations and distances. The semi circular portions of kilometer stones on National Highways, State Highways and Major District Roads shall be painted canary yellow (I.S. shade 221) and white respectively. The route numbers to be written shall be in black on the canary yellow and white back grounds and in white on the brilliant green backgrounds.

The place names shall be inscribed in different scripts in the order described in Table 16.16. Only one script shall be used on any one kilometer stone.

TABLE 16.16

Km. No.	Script
0	Roman
1	Hindi (Devanagari Script)
2	Local Language
3	Hindi (Devanagari script)
4	Local Language
5	Roman and so on repeated in the same order

- (a) On kilometer stones fixed in other district roads and Village road the inscription may be in the National language i.e. Hindi in Devnagari script or the script of the recognised regional language of the place, at the discretion of the Local Road Authority.
- (b) Inscription in the Roman script is not necessary unless such a road leads to a place of tourist

or archaeological interest.

- (c) The shape and spacing of letters in the Roman script other than Roman, the style of lettering shall be one in general use. The spacing between single or compound of lettering shall be the one in general use. The spacing between single or compound letter shall be at least equal to the thickness of the vertical strokes or the thickness of strokes of letters in the scripts having no vertical strokes as in Oriya, Telegu and Kannada.
- (d) On the kilometre stones which are inscribed in script other than Roman, the style of lettering shall be one in general use. The spacing between single or computed of lettering shall be the one in general use. The spacing between single of letters in the scripts having no vertical strokes as in Oriya, Telegu and Kannada.

16.22.3 Measurements

Kilometer stones shall be enumerated.

16.22.4 Rate

The rate shall include the cost of materials and labour involved in all the operations described above, but excluding the costs of excavation, concrete in foundations painting and lettering for which payment shall be made separately.

16.23 SURFACEDRESSINGONNEWSURFACEWITHHOTBITUMENOFGRADEVG-10ONECOAT

16.23.0 This type of treatment shall consist of cleaning the existing water bound macadam kankar or gravel surfaces, and applying one coat of hot bitumen of grade VG- 10 of approved quality using 2.25 kg of bitumen per sqm with 1.65 cum of stone chippings 13.2 mm nominal size per 100 sqm of road surface on the prepared base, blinding it with stone chippings of 13.2 mm nominal size and consolidation with a road roller of 6 to 8 tonne capacity. This type of treatment is normally done for a road with light density rubber tyred traffic and roads for temporary construction. This treatment is also done on existing water bound macadam before applying the final surface treatment. In the latter case, after applying a coat of painting the road is thrown open to traffic till the road is consolidated. The final treatment is then given after making good the undulations etc. in the road surface.

16.23.1 Preparation of surface (Repairs and Cleaning) shall be as specified under 16.24.2(a).

16.23.2 Applying binder, blinding, consolidation, surface finishing, measurements and rates shall be as specified under 16.24 except that binder shall be applied at the rate of 2.25 kg of bitumen per sqm and stone chippings of size 13.2 mm at 1.65 cum per 100 sqm unless otherwise specified.

16.24 SURFACEDRESSINGONNEWSURFACEUSINGHOTBITUMENOFGRADEVG-10 – TWO COATS

16.24.0 This consists of the application of two coats of surface dressing each coat consisting of a layer of bituminous binder sprayed on a base prepared previously, followed by a cover of stone chippings properly rolled to form a wearing course. The existing water-bound macadam, kankar or gravel surface shall be cleaned thoroughly before application of bituminous binder. The work shall be carried out only when the atmospheric temperature in shade is 16 deg C or above. No bituminous material shall normally be applied when the road surface or material is damp, when the weather is foggy or rainy, or during dust storms.

16.24.1 Materials

Binder i.e. bitumen of grade VG- 10 confirming to IS : 73 shall be as specified and shall conform to Table 16.7 and stone chippings shall conform to grading as the Table 16.17. Unless otherwise specified or directed by the Engineer -in- Charge the quantities of materials shall be as specified in Table 16.17. A proper record will be kept to ensure that the daily out-turn of work is co-related with the quantity of bitumen used as per proforma given in Appendix 'A'.

TABLE 16.17

Type of coat	Stone Chipping			Bitumen Quantity VG- 10
	Nominal Size	Specification	Quantity	
First Coat	13.2 mm	100 per cent passing through IS sieve 22.4 mm square mesh and retained on IS Sieve 11.2 mm square mesh	1.5 cum/100 sqm of road surface	1.8 kg per sqm of road surface
Second coat	11.2 mm	100 per cent passing through IS sieve 13.2 mm square mesh and retained on IS sieve 5.6 mm square mesh	1.0 cum/100 sqm of road surface	1.1 kg per sqm of road surface

16.24.2 First Coat**(a) Preparation of Surface**

Repairs : Pot holes or patches and ruts in the water bound macadam base or surface course which is to be surface treated, shall be repaired by removal of all loose and defective material by cutting in rectangular patches and replacement with suitable material.

For the purpose of repairs the area of pot holes shall be taken upto 0.75 sqm and depth upto 5 cm. All pot holes, patches and ruts upto 2.5 cm deep shall be repaired and brought to level with premix and properly consolidated while those of depths greater than 2.5 cm shall be repaired with similar specifications as adopted originally.

Cleaning : Prior to the application of the binder, all dust, dirt, caked mud, animal dung, loose and foreign material etc. shall be removed 30 cm on either side, beyond the full width to be treated, by means of mechanical sweepers and blowers, if available or otherwise with wire brushes, small picks, brooms etc. The material so removed shall be disposed off as directed by the Engineer-in-Charge.

For a water bound macadam surface, the interstices between the road metal shall be exposed upto a depth of about 10 mm by means of wire brushes. The surface shall then be brushed with soft brooms to remove all loose aggregate. Finally the traces of fine dust which get accumulated while brushing shall be thoroughly removed from the surface by blowing with gunny bags.

The prepared surface shall be closed to traffic and maintained fully clean till the binder is applied.

(b) Applying Binder (Hot Bitumen) VG- 10 (confirming to IS : 73)

The binder shall be heated in a boiler to a temperature as specified under Table 16.7 for the grade used and maintained at the temperature, the use of a thermometer being essential.

The binder shall be applied evenly to the clean dry surface by means of a pressure sprayer at the rate specified. The binder shall be applied longitudinally along the length of the road and never across it. The edges of the binder surface shall be defined by wire or a rope stretched in position.

Heating in cut out drums and pouring from perforated tins, cans and such other methods shall not be permitted. Except in the case of petty works and repairs with the specific approval of the Engineer-in-Charge.

Excessive deposits of binder caused by stopping or starting of the sprayer or through leakage or any other reason shall be suitably corrected before the stone chippings are spread.

(c) *Blinding or Spreading Stone Chippings*

Immediately after the binder is applied and while it is still hot, stone chippings free from dust and in a dry and clean state shall be spread evenly over the surface at the rate specified above. Spreading shall be done preferably by means of a mechanical gritter, otherwise manually with a twisting motion to avoid segregation which otherwise shall have to be removed by brushing the excess stone chippings over the surface into hungry spots to obtain a uniform surface, free from waviness, depressions and other irregularities. The surface shall be checked by means of a camber board laid across the road and a three metre straight edge laid parallel to the centre line of the road, and undulations if any shall be corrected by addition or removal of blindage till a surface free from undulation is obtained.

If a uniform surface is assured at this stage, the completed surface should be normally free from undulations and unevenness.

(d) *Consolidation of Blindage*

Immediately following the application of the stone chippings and light brooming, the road surface shall be compacted by a power roller of 6 to 8 tonnes, starting at edges and working towards the centre (or to the outside edge in case of superelevated curve). Each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. The roller shall be worked or started and stopped without jerks and shall not be stopped or reversed each time at the same location to cause displacement of stone and other irregularities. Consolidation shall be considered complete when the stone chippings are firmly embedded.

Generally five to six trips shall be made for thorough compaction of the surface or as may be specified by the Engineer-in-Charge.

Along kerbs, manholes and all places not accessible to the roller, compaction shall be secured by means of steel rammers or hand rollers.

16.24.3 Second Coat

- (a) *Cleaning the Road Surface*** : The surface shall be examined and any loose material and foreign matter shall be removed by brooming or blowing off by fanning with gunny bags, care being taken not to loosen the blindage already set.
- (b) *Applying Binder (Hot Bitumen of Grade VG- 10)*** : The second coat of binder shall be applied immediately after the blinding has been set and the surface has been cleaned. The binder shall be applied at the specified rate in the manner specified for the first coat 16.24.2(b).
- (c) *Blinding or Spreading Stone Chippings*** : Immediately after the second application of binder, the stone chippings shall be spread at the rate specified as above in the manner described in 16.24.2(c).
- (d) *Consolidation of Blindage*** : The specifications described in 16.24.2(d) shall apply. Further the prepared finished surface shall be protected from traffic for 24 hours or such period as may be specified by the Engineer-in-Charge.

16.24.4 Surface Finishing

The finished surface shall be uniform and conform to the lines, grades and typical cross-sections shown in the drawings.

16.24.5 The finished surface shall be thrown open to traffic on the following day. Controlling traffic shall be done by suitable methods like barricading posting of watchman etc.

16.24.6 Measurements

The length and width of the finished work shall be measured correct to a cm along the finished surface of the road. The area shall be calculated in square metre, correct to two places of decimal.

For record purposes, the measurement for binder and stone chippings shall be taken as specified in 16.4.2 and 16.4.3 before they are actually used on the work. Premeasurements of materials taken for record purposes shall simply serve as a guide and shall not form the basis for payment.

16.24.7 Rate

The rate shall include the cost of materials and labour involved in all the operations described above, except for repairs described under 16.24.2.

16.25 SURFACE DRESSING ON OLD SURFACE WITH HOT BITUMEN OF GRADE VG- 10 (CONFIRMING TO IS : 73) ONE COAT

16.25.0 This treatment consists of cleaning old painted surfaces and applying a coat of hot bitumen of grade VG- 10 on the prepared base, blinding with stone chippings and consolidation with road roller of 6 to 8 tonne capacity.

16.25.1 Materials

Binder shall be as specified and conform to Table 16.7 stone chipping shall conform to grading given Table 16.17 for 11.2 mm. Unless otherwise specified or directed by the Engineer-in-Charge stone Chippings of 11.2 mm nominal size shall be used @ 1.50 cum per 100 sqm area and bitumen @ 1.95 kg per square metre area. A proper record shall be kept to ensure that the daily turn out of work is correlated with the quantity of bitumen used as per proforma given in Appendix 'A'.

16.25.2 Preparation of Surface (Repairs and cleaning) shall be as specified under 16.24.2.

16.25.3 Applying binder, Blinding, Consolidation, Surface Finishing, Measurement and Rate shall be as specified under 16.24 except that the binder and chippings shall be applied at the rate specified above.

16.26 SURFACE DRESSING ON NEW SURFACE WITH BITUMEN EMULSION (MINIMUM 50% BITUMEN CONTENT RS GRADE CONFIRMING TO IS : 8887) ONE COAT

16.26.0 This treatment consists of cleaning the existing water bound macadam, kankar gravel or stabilized base and other black top surfaces, applying a coat of bitumen emulsion at atmospheric temperature, blinding it with stone chippings including consolidation with a road roller.

This type of treatment is normally applied under damp conditions and for minor repair works during rainy season for roads with medium density, rubber tyred traffic such as service roads. This treatment is also done on existing water bound macadam before applying the final surface treatment. In the latter case, the road is consolidated. The final treatment is then given after making good the undulations depressions etc. in the road surface.

16.26.1 Materials

Binder shall be as specified and shall conform to RS grade confirming to IS : 8887. Stone chipping of 13.2 mm size shall conform to Table 16.17. Unless otherwise specified or directed by the Engineer-in-Charge 13.2 mm stone chippings shall be used @ 1.5 cum per 100 sqm area and bitumen @ 1.95 kg/sqm area. A proper record shall be kept to ensure that the daily out turn of work is correlated with the quantity of bitumen used as per proforma given in Appendix 'A'.

16.26.2 Preparation of Surface

The specification described in 16.24.2 (a) shall apply except that the binder used for patch repairs etc. shall be bitumen emulsion.

Applying Binder

The specification described in 16.24.2 (b) shall apply except that bitumen emulsion is not heated in boilers but it shall be spread at atmospheric temperature at the specified rate. In case the road surface is very dry the surface shall be very lightly sprinkled with water just before applying the binder.

16.26.3 Blinding including consolidation, Measurements and Rate shall be as specified under 16.24 except that the stone chippings shall be spread at the specified rate immediately after the bitumen emulsion on application breaks i.e. changes colour from brown to black.

16.27 SURFACE DRESSING ON OLD SURFACE WITH BITUMEN EMULSION (MINIMUM 50% BITUMEN CONTENT RS GRADE CONFIRMING TO IS : 8887) ONE COAT

16.27.0 This treatment consists of cleaning old painted surfaces and applying a coat of bitumen emulsion on the prepared base, blinding with stone chippings and consolidation with a road roller. This type of treatment is normally done under damp conditions.

16.27.1 Materials

Binder shall be as specified and shall conform to RS grade confirming to IS : 8887. Unless otherwise specified or directed by the Engineer- in-Charge 11.2 mm the stone chippings shall be used @ 1.10 cum per 100 sqm area and bitumen @ 1.22 kg per sqm area. A proper record shall be kept to ensure that the daily out turn of work is correlated with the quantity of bitumen used as per proforma given in Appendix 'A'.

16.27.2 Preparation of surface shall be as specified in 16.24.2 (a) except that the binder used for patch repairs etc. shall be bitumen emulsion.

16.27.3 Applying binder, bitumen emulsion, blinding or Spreading to it including consolidation of blindage, measurement etc. shall be as specified under 16.24 except for preparation of surface and that the binder and stone chippings shall be used at the rates prescribed in 16.26.1.

16.28 TACK COAT OF HOT STRAIGHT RUN BITUMEN OF GRADE VG- 10

16.28.0 The rate of application of binder which shall be as specified and which shall conform to 16.1.5 shall depend on the surface on which the premix carpet is to be laid.

(a) 0.75 kg/sqm on W.B.M./ W.M.M. Surface

(b) 0.50 kg/sqm on bitumen surface.

16.28.1 Materials

Bitumen : This shall be straight-run bitumen of grade VG- 10 conforming to IS 73 specifications.

16.28.2 Preparation of Surface

16.28.3 Cleaning

Prior to the application of bitumen, all vegetation, loose sealing compound, caked mud, animal dung, dust, dirt and foreign material shall be removed from the entire surface of the pavement and from existing dummy, construction and expansion joints (wherever existing) by means of mechanical sweepers and blowers, otherwise with steel wire brushes, small picks, brooms or other implements as approved by the Engineer-in-Charge. The material so removed shall be disposed off as directed by the Engineer-in-Charge.

16.28.4 Weather and Seasonal Limitations

The tack coat shall not be applied nor any bitumen work done during rainy weather or when the surface is damp or wet or when the atmospheric temperature in the shade is not more than 16° C.

16.28.5 Application of Tack Coat

16.28.5.1 Heating : Bitumen shall be heated in a boiler to a temperature of 165 deg. C to 175 deg. C and maintained at that temperature. Temperature shall be checked at regular intervals with the help of a thermometer.

16.28.5.2 Application of Bitumen : Hot bitumen shall be applied evenly to the clean, dry surface by means of a pressure sprayer at specified rate. Even and uniform distribution of bitumen shall be ensured. Bitumen shall be applied longitudinally along the length of the pavement and never across it. Excessive deposits of bitumen caused by stopping or starting of the sprayer or through leakage or any other reason shall be suitably rectified.

16.28.6 Measurements

Length and breadth shall be measured correct to a cm, along the surface of pavement. Area shall be worked out in sqm correct to two places of decimal.

16.28.7 Rate

Rate shall include the cost of all materials and labour involved in all the operations described above.

16.29 TACK COAT WITH BITUMEN - EMULSION/ HOT BITUMEN OF GRADE VG- 10

16.29.1 Scope

The work shall consist of the application of single coat of low viscosity liquid bituminous material to existing bituminous, cement concrete or primed granular surface preparatory to the superimposition of a bituminous mix, as specified in the contract or as instructed by the Engineer-in-Charge and applied as specified in the nomenclature of item.

16.29.2 Materials

The binder used for tack coat shall be either cationic bitumen emulsion (RS1) complying with IS:8887 or suitable low viscosity paving bitumen of VG 10 grade conforming to IS:73. The use of cutback bitumen RC:70 as per IS:217 shall be restricted only for sites at sub-zero temperatures or for emergency applications as directed by the Engineer-in-Charge. The type and grade of binder for tack coat shall be as specified in the contract or as directed by the Engineer-in-Charge.

16.29.3 Construction

16.29.3.1 Equipment

The tack shall be applied by a self propelled or towed bitumen pressure sprayer, equipped for spraying the material uniformly at specified rate. Hand spraying shall not be permitted except in small areas, inaccessible to the distributor, or narrow strips, shall be sprayed with a pressure hand sprayer, or as directed by the Engineer-in-Charge.

16.29.3.2 Preparation of Base

The surface on which the tack coat is to be applied shall be clean and free from dust, dirt and any extraneous material, and be otherwise prepared in accordance with the requirements. The granular or stabilized surfaces shall be primed as per **Para 16.65** clause (priming coat) immediately before the application of the tack coat, the surface shall be swept clean with a mechanical broom, and high pressure air jet, or by other means as directed by the Engineer-in-Charge.

16.29.3.3 Application of Tack Coat

The application of tack coat shall be at the rate specified in **Table 16.17A** and it shall be applied uniformly. If rate of application of tack coat is not specified in the contract, then it shall be the rate specified in **Table 16.17A**. No dilution or heating at site RS1 bitumen emulsion shall be permitted. Paving bitumen if use for tack coat shall be heated to appropriate temperature in bitumen boilers to achieve viscosity less than 2 poise. The normal range of spraying temperature for a bituminous emulsion shall be 20 C to 70 C and for cutback, 50 C to 80 C. The method of application of tack coat will depend on the type of equipment to be used, size of nozzles, pressure at the spray bar and speed or forward movement. The contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray, within the tolerances specified.

Table 16.17A

Rate of application of tack coat

Type of Surface	Rate of Spray of Binder in Kg per sq.m
Bituminous surfaces	0.20-0.30
Granular surfaces treated with primer	0.25-0.30
Cement concrete pavement	0.30-0.35

16.29.3.4 Curing of Tack Coat

The tack coat shall be left to cure until all the volatiles have evaporated before any subsequent construction is started. No plant or vehicles shall be allowed on the tack coat other than those essential for the construction.

16.29.4 Measurement of Payment

Tack coat shall be measured in terms of surface area of application in square metres.

16.29.5 Rate

The contract unit rate for tack coat shall be payment in full for carrying out the required operations including for all components i.e. labour, equipments and machinery as described above.

16.30 PREMIX CARPET WITH HOT BITUMEN OF PAVING ASPHALT GRADE VG- 10/ VG-30

16.30.0 This type of treatment is normally applied on roads where the motor traffic is of medium intensity, but bullock cart traffic is fairly heavy. This treatment is suitable for district roads and for internal and service road in colonies. The consolidated thickness of this type of treatment shall be 2 cm or 2.5 cm as specified.

This treatment consists of applying a tack coat on the prepared base followed immediately by spreading aggregates pre-coated with specified binder to camber and consolidated.

Premix carpet shall not be laid during rainy weather or when the base course is damp or wet or, when the atmospheric temperature in the shade is not more than 16°C.

16.30.1 Preparation of Surface

This shall be done as described in 16.26.

16.30.2 Materials

Grading of stone chipping shall be as per Table 16.17. Binder shall be as specified in nomenclature of item and shall conform to Table 16.7. Quantities of materials shall be as given in Table 16.18. A proper record shall be kept to ensure that the daily out turn of work is correlated with the quantity of bitumen used as per proforma given in Appendix 'A'.

TABLE 16.18

Consolidated thickness of premix carpet	Binder Hot Bitumen of grade VG- 10/ VG- 30 (kg/ cum of stone chipping)	Stone Chippings (in cum/ 100 sqm)	
		13.2 mm size	11.2 mm size
2.00 cm	(52 kg/cum of 13.2 mm size and 56 kg per cum of 11.2 mm	1.8	0.90
2.50 cm	-Do-	2.25	1.12

16.30.3 Tack Coat

The rate of application of binder for tack coat shall be as specified in the nomenclature of item. The rate will be depending upon the surface on which the premix carpet is to be laid i.e. water bound macadam surface or existing black topped surface. Tack coat shall be applied as described in 16.28.

16.30.4 Preparation of Premix

The aggregate shall be dry and suitably heated to temperature as directed by Engineer-in- Charge before these are placed in the mixer to facilitate mixing with the binder.

Mixers of approved type shall be employed for mixing the aggregates with the bituminous binder.

The binder shall be heated to the temperature appropriate to the grade of bitumen approved by the Engineer-in-Charge, in boilers of suitable design avoiding local overheating and ensuring a continuous supply.

The aggregates shall be dry and suitably heated to a temperature as directed by Engineer-in- Charge before these are placed in the mixer. After about 15 seconds of dry mixing, the heated binder shall be distributed over the aggregates at the rate specified.

The mixing of binder with chippings shall be continued until the chippings are thoroughly coated with the binder. The mix shall be immediately transported from the mixer to the point of use in suitable vehicles or wheel barrows. The vehicles employed for transport shall be cleaned and be covered over in transit if so directed.

16.30.5 Spreading and Rolling

The premixed material shall be spread on the road surface with rakes to the required thickness and camber or distributed evenly with the help of a drag spreader, without undue loss of time. The camber shall be checked by means of camber boards and inequalities evened out. As soon as sufficient length of bituminous material has been laid, rolling shall commence with 6 to 9 tonne power rollers, preferably of smooth wheel tandem type, or other approved power roller. Rolling shall begin at the edges and progress towards the centre longitudinally. Except on the super elevated portions rolling shall progress from the lower to upper edge, parallel to the centre line of the pavement. The consolidated thickness shall not at any place be less than the specified thickness by more than 25%. However, the average thickness shall not be less than that specified in the item.

When the roller has passed over the whole area once, any high spots or depressions which become apparent shall be corrected by removing or adding premixed materials. Rolling shall then be continued until the entire surface has been rolled to compaction and all the roller marks eliminated. In each pass of the roller, preceding track shall be overlapped uniformly by at least 1/3 width. The roller wheels shall be kept damp to prevent the premix from adhering to the wheels and being picked up. In no case shall fuel/lubricating oil be used for this purpose.

Rollers shall not stand on newly laid material as it may get deformed thereby.

The edges along and transverse of the carpet, laid and compacted earlier shall be cut to their full depth so as to expose fresh surface which shall be painted with a thin surface coat of appropriate binder before the new mix is placed against it.

Further, the prepared finished surface shall be protected from traffic for 24 hours or such period as may be directed by the Engineer-in-Charge.

16.30.6 Surface Finishing

The surface regularity both in longitudinal and transverse directions shall be within the tolerances specified in Table 16.19.

TABLE 16.19

Longitudinal profile Max. permissible undulation when measured with 3 M straight edge	Cross profile Max. permissible variation from specified profile when measured with a camber template
10 mm	6 mm

The longitudinal profile shall be checked during rolling with a three metres long straight edge and graduated wedge at the middle of each traffic lane along the road. Similarly the transverse profile shall be checked with adjustable templates at intervals of 10 metres.

16.30.7 Rectification

Where the surface irregularity fall outside the specified tolerances limit the contractor shall be liable to rectify it to the satisfaction of Engineer-in-Charge by adding fresh material and recompacting to specifications where the surface is low. Where the surface is high the full depth of the layer shall be removed and replaced with fresh material and compacted to specifications.

16.30.8 Measurements

The length and width of the finished work shall be measured correct to a cm along the finished surface of the road. The area shall be calculated in square metre, correct to two places of decimal.

For record purposes, the measurement for binder and stone chippings shall be taken as specified in 16.4.2.2 and 16.4.3.2 before they are actually used on the work. Premeasurements of the materials taken for record purposes shall simply serve as a guide and shall not form the basis for payment.

16.30.9 Rate

The rate shall include the cost of materials, machinery and labour involved in all the operations described above for the particular item, except for the cost of Repairs described under para 16.24.2(a).

16.31 PREMIX CARPET WITH BITUMEN EMULSION

16.31.0 This type of work is not ordinarily recommended but may be done in case of urgent repairs under damp conditions.

16.31.1 Materials

Binder shall be as specified and shall conform to RS grade as per IS 8837 grading of 11.2 mm stone chipping shall be as per Table 16.17. Quantities of bitumen emulsion and stone chippings shall be as specified in Table 16.20. A proper record shall be kept to ensure that the daily out turn of work is correlated with the quantity of bitumen used as per proforma given in Appendix 'A'.

TABLE 16.20
Bitumen Emulsion

Consolidated thickness of premix Carpet	Bitumen Emulsion (medium setting minimum 65% bitumen content)	Stone Chippings
	For Carpet in kg/cum of chippings	cum per 100 sqm
2 cm	96	2.4 (11.2 mm nominal size)
2.5 cm	96	3.0 (11.2 mm nominal size)

16.31.2 Preparation of surface and binder application shall be as specified under 16.26 except that the rate of application of bitumen for tack coat shall be 0.75 kg per sqm on water bound macadam surface and 0.5 kg per sqm on black topped surface.

16.31.3 Preparation, spreading, consolidating mix, surface finishing, measurements and rate shall be as specified under 16.30 except that the bitumen emulsion shall not be heated but it shall be poured over the aggregate at atmospheric temperature at the correct rate before spreading on the road surface. The rolling with road roller of 6 to 9 tone capacity shall commence 24 hours after spreading the mixture. The surface shall be protected by a suitable device such as barricading and posting of watchmen for closing the traffic.

16.32 BITUMINOUS PENETRATION MACADAM

16.32.0 Scope

The work shall consist of construction of one or more layers of compacted crushed coarse aggregates with alternate applications of bituminous binder and key aggregates in accordance with the requirements of these specifications to be used as a base course on roads, subject to the requirements of the overall pavement design, in conformity with the lines, grades and cross-sections shown on the drawings or as directed by the Engineer-in-Charge. Thickness of an individual course shall be 50 mm or 75 mm or otherwise as specified.

16.32.1 Materials

16.32.1.1 Bitumen : The binder shall be paving bitumen of specified penetration grade conforming to IS 73 or approved cutback satisfying the requirement of IS 217 or 454 as specified in item. The actual grade of bitumen or cutback to be used shall be as specified in item or as directed by the Engineer-in-charge.

16.32.1.2 Aggregates: The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on the 2.36 mm IS sieve. They shall be clean, hard, durable, of cubical shape, free from dust and soft or friable matter, organic or other deleterious matter. Where the contractors selected source of aggregate have poor affinity for bitumen, as a condition for approval of the source, the bitumen shall be treated with approved anti-stripping agents, as per the manufacturers recommendations, without additional payment. Before approval of the source the aggregate shall be tested for stripping. The coarse aggregate shall conforming to Table 16.31. The coarse and key aggregates shall conform to the grading given in Table 16.21.

16.32.1.3 Quantities of Material : The quantities of materials used for this work shall be as specified in Table 16.21.

16.32.2 Construction Operations

16.32.2.1 Weather and Seasonal Limitations: Laying shall be suspended while free standing water is present on the surface to be covered, or during rains, fog and dust storm. After rain, the bituminous surface, tack coat shall be blown off with a high pressure of air jet to remove excess moisture, or the surface left to dry before laying shall start. Laying of bituminous mixture shall not be carried out when the air temperature at the surface on which it is to be laid is below 10°C.

16.32.2.2 Equipment : A mechanical broom, compressor, self propelled or trailed bitumen heater/distributor, mechanical aggregate spreader and 8 to 10 tonne smooth steel wheel roller or vibrating roller are required for the preparation of Penetration Macadam.

16.32.2.3 Preparation of the Base : The base on which the Penetration Macadam Course is to be laid shall be prepaid, shaped and compacted to the specified lines, grades and sections as appropriate or directed by Engineer-in-Charge. A prime coat, where specified shall be applied over the base as directed by the Engineer-in-charge.

16.32.2.4 Spreading Coarse Aggregate : The coarse aggregate shall be dry and clean and free from dust, and shall be spread uniformly and evenly at the rate specified in Table 16.21. It shall be spread by a self-propelled or tripper tail mounted aggregate spreader capable of spreading aggregate uniformly at the specified rates over the required widths. The surface of the layer shall be carefully checked with camber templates to ensure correct line and level and cross fall. The spreading shall be carried out such that the rolling and penetrating operations can be completed on the same day. Segregated aggregates or aggregates contaminated with foreign material shall be removed and replaced.

TABLE 16.21
Composition of Penetration Macadam

IS Sieve Designation (mm)	Cumulative percent by weight of total aggregate passing			
	For 50 mm compacted Thickness		For 75 compacted Thickness	
	Coarse Aggregate	Key Aggregate	Coarse Aggregate	Key Aggregate
(1)	(2)	(3)	(4)	(5)
63	-	-	100	-
45	100	-	58-82	-
26.5	37-72	-	-	100
22.4	-	100	5-27	50-75
13.2	2-20	50-75	-	-
11.2	-	-	-	5-25
5.6	-	5-25	-	-
2.8	0-5	0-5	0-5	0-5
Approx. Loose Aggregate quantities cm/m ²	0-06	0.015	0.09	0.018
Binder Quantity (Penetration Grade) ⁽¹⁾ (Kg./m ²)	As specified in item		As specified in item	

Note : (1) If cutback bitumen is used, adjust binder quantity such that the residual bitumen is equal to the values in this table.

16.32.2.5 Compaction : After the spreading of coarse aggregates, dry rolling shall be carried out with an 8-10 tonne smooth steel wheel roller. After initial dry rolling the surface shall be checked with a crown and 3 metre straight edge. The surface shall not vary more than 10 mm from the template or straight edge. All surface irregularities exceeding the above limit shall be corrected by removing or adding aggregate as required the rolling shall continue until the compacted coarse aggregate has a firm surface, true to cross-section shown on the plans and has a texture that will allow free and uniform penetration of the bitumen material.

Compaction shall be done as per following procedure.

Bituminous materials shall be laid and compacted in layers which enable the specified thickness, surface level, regularity requirements and compaction to be achieved.

Compaction of bituminous materials shall commence as soon as possible after laying. Compaction shall be substantially completed before the temperature falls below the minimum rolling temperatures stated in the relevant part of these specifications. Rolling of the longitudinal joints shall be done immediately behind the paving operation. After this, rolling shall commence at the edges and progress towards the centre longitudinally except that on super elevated and uni-directional cambered portions, it shall progress from

the lower to the upper edge parallel to the centre line of the pavement. Rolling shall continue until all roller marks have been removed from the surface. All deficiencies in the surface after laying shall be made good by the attendants behind the paver, before initial rolling is commenced. The initial or breakdown rolling shall be done with 8-10 tonnes dead weight smooth- wheeled rollers. The intermediate rolling shall be done with 8-10 tonnes dead weight or vibratory roller or with a pneumatic tyred roller of 12 to 15 tonnes weight having nine wheels, with a type pressure of at least 5.6 kg/sqcm. The finish rolling shall be done with 6 to 8 tonnes smooth wheeled tandem rollers.

Where compaction is to be determined by density of cores the requirements to prove the performance of rollers shall apply in order to demonstrate that the specified density can be achieved. In such cases the Contractor shall nominate the plant, and the method by which he intends to achieve the specified level of compaction and finish at temperature above the minimum specified rolling temperature. Laying trials shall then demonstrate the acceptability of the plant and method used.

Bituminous materials shall be rolled in a longitudinal direction, with the driven rolls nearest the paver. The roller shall first compact material adjacent to joints and then work from the lower to the upper side of the layer, overlapping on successive passes by at least one-third of the width of the rear roll or, in the case of a pneumatic-tyred roller, at least the nominal width of 300 mm.

In portions with super-elevated and uni-directional camber, after the edge has been rolled, the roller shall progress from the lower to the upper edge.

Rollers should move at a speed of not more than 5 km per hour. The roller shall not be permitted to stand on pavement which has not been fully compacted, and necessary precautions shall be taken to prevent dropping of oil, grease, petrol or other foreign matter on the pavement either when the rollers are operating or standing. The wheels of rollers shall be kept moist with water and the spray system provided with the machined shall be in good working order, to prevent the mixture from adhering to the wheels. Only sufficient moisture to prevent adhesion between the wheels of rollers and the mixture should be used. Surplus water shall not be allowed to stand on the partially compacted pavement.

After initial dry rolling, the surface shall be checked with a crown template and a 3 metre straight-edge. The surface shall not vary more than 10mm from the template or straight-edge. All surface irregularity exceeding the above limit shall be corrected by removing or adding aggregates as required.

The rolling shall continue until the compacted coarse aggregate has a firm surface true to the cross section shown on the plans and has a texture that will allow free and uniform penetration of the bitumen material.

16.32.2.6 Application of Bituminous Material : After the coarse aggregate has been rolled and checked, the bituminous binder shall be applied at the rate given in Table 16.21, at a temperature directed by Engineer-in-Charge.

At the time of applying the binder, the aggregates shall be surface dry for the full depth of the layer.

In certain circumstances, depending on the type and size of aggregate used, the Engineer-in- Charge may direct the placing of a bed of clean sand or quarry fines, not exceeding 10 mm in thickness, on the prepared foundation before placing the coarse aggregate. The sand or fine material shall be slightly wetted, just sufficient for it to slurry up during the compaction process. Where cut back is used, if flooding of the binder occurs it should be applied in two operations, or as directed by the Engineer-in-charge.

Application of Key Aggregates : Immediately after the first application of bitumen, the key aggregates, which shall be clean, dry and free from dust shall be spread uniformly over the surface by means of an approved mechanical spreader or by approved manual methods at the rate specified in Table 16.21.

Where directed by the Engineer-in-charge, the surface shall be swept and the quantity of key aggregate adjusted to ensure uniform application, with all the surface voids in the coarse aggregate being filled without excess. The entire surface shall then be rolled with a 8- 10 tonnes smooth steel wheel roller (or vibrating roller operating in non-vibratory mode) in accordance with the procedure specified in above para 16.32.2.5.

16.32.3 Surface Finish and Quality Control

The surface finish of the completed construction shall conform to the requirements of section 900 of MORTH specifications. For control of the quality of materials supplied and the works carried out the relevant provisions of Section 900 of MORTH specifications.

16.32.4 Surfacing

The penetration Macadam shall be provided with a surfacing (binder/wearing course) within a maximum of forty-eight hours. If there is to be any delay, the penetration macadam shall be covered by a seal coat as specified and directed by Engineer-in-charge. The seal coat in such cases shall be considered incidental to the work and shall not be paid for separately.

16.32.5 Arrangements for Traffic

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of specification and as per direction of Engineer-in-Charge.

16.32.6 Measurement for Payment

Penetration Macadam base course shall be measured as finished work in square metres.

16.32.7 Rate

The rate includes the cost of all materials, labours and equipment involved in all the operations described above.

16.33 BITUMEN MASTIC WEARING COURSES

16.33.1 Definition

The bitumen mastic is an intimate homogeneous mixture of mineral fillers and well graded fine and coarse aggregates with a hard grade bitumen, cooked and laid hot, troweled and floated by means of a wooden float. The mixture settles to a coherent, void less and impermeable solid mass under normal temperature conditions.

The bitumen mastic is normally used as a wearing course. Over the mastic laid surface, hard stone chips pre-coated with bitumen are grafted or spread and rolled to provide a skid resistant surface.

Bitumen mastic is used as a wearing course in different situation of heavy duty road pavements. However, use of this material is not recommended in places where abundant fuel oil dripping is expected on the pavement surfaces like bus depots, fuel filling and service stations etc.

16.33.2 Materials

16.33.2.1 The bitumen shall be industrial bitumen conforming to IS 702 of grade 85 /25 or suitable consistency satisfying the requirements of physical properties as given in Table 16.22.

TABLE 16.22
Physical Properties of Bitumen

S.No.	Characteristics	Requirements	Method of Test
1.	Penetration at 25 deg. C in 1/10 mm	15 ± 5	IS 1203
2.	Softening point (R&B)	65 ± 10	IS 1205
3.	Ductility at 27 deg.C (Minimum in cms.)	3	IS 1208
4.	Loss on heating, per cent (Maximum)	2	IS 1212
5.	Solubility in trichloroethylene per cent by mass (minimum)	95	IS 1216
6.	Ash (mineral matter) %age by mass	1.0	IS 1217

16.33.2.2 Coarse Aggregates : The coarse aggregates shall consist of clean, hard, durable, crushed rock free of disintegrated pieces, organic and other deleterious matter and adherent coatings. They shall be hydrophobic, of low porosity, and satisfy the physical requirements set forth in Table 16.23.

TABLE 16.23
Physical Requirements of Coarse Aggregates for Bitumen Mastic

S.No	Test	Test Method	Acceptance Criteria
1.	(a) Los Angeles Abrasion Value or (b) Aggregate impact value	IS 2386 (Pt.4) -do-	40% (Max.) or 30% (Max.)
2.	Flakiness Index	IS 2386 (Pt.1)	30% (Max)
3.	Stripping Value	IS 6241	25% (Max)
4.	Soundness		
	(i) Loss with Sodium Sulphate 5 cycles	IS 2386 (Pt.5)	12% (Max)
	(ii) Loss with Magnesium Sulphate 5 cycles	-do-	18%(Max)
5.	Water Absorption	IS 2386 (Pt.3)	2% (Max)
6.	Retained tensile strength	-	80% (Min)

The percentage and grading of the coarse aggregates to be used in the bitumen mastic depending upon the thickness of the finished course shall be as in Table 16.24. The minimum and maximum thickness of the bitumen mastic for wearing course shall be 25 mm and 50 mm respectively except for footpaths of bridges where it shall be 20 mm and 25 mm respectively.

TABLE 16.24
Grading and Percentage of Coarse Aggregates for Bitumen Mastic in Wearing Course and Footpath

S. No	Type of work	Grading of coarse aggregate		Thickness of finished mastic surface course	Percentage of coarse aggregates(mm)
		IS Sieve	%age passing IS sieve		
1.	Wearing course for road pavement and bridge decks	19 mm	100	(a) 25-40	(a) 30-40
		13.2 mm	88-96	or	or
		2.36 mm	0-5	(b) 41-50	(b) 40-50
2.	Footpaths	6.7 mm	100	20-25	15-30
		600 micron	0.15		

16.33.2.3 Fine Aggregates : The fine aggregates shall consist of crushed hard rock or natural sand or a mixture of both. The grading of fine aggregates inclusive of filler material passing 75 micron shall be as given in Table 16.25.

TABLE 16.25
Grading of Fine Aggregate I/C Filler

<i>Passing IS Sieve</i>	<i>Retained on IS Sieve</i>	<i>% age by Weight</i>
2.36 mm	600 micron	0-25
600 micron	212 micron	10-30
212 micron	75 micron	10-20
75 micron	—	30-50

16.33.2.4 Filler : The filler shall be limestone powder passing 75 micron and shall have a calcium carbonate content of not less than 80 per cent when determined in accordance with IS 1514.

16.33.3 Equipment for Bitumen Mastic

16.33.3.1 There are two ways of preparing a mastic. The conventional method is by using a mastic cooker which is dealt with in this specification. The other method using fully mechanized units needed for large scale work, as is generally practiced in Germany (Gussasphalt), may form the subject of a separate document.

16.33.3.2 Mastic cookers are very similar to tar boilers. These are insulated tanks mounted on wheeled chassis. The heating of the bitumen and material is generally done by oil fired burners. Mastic cookers have compartments. The central and main compartment is used for heating bitumen and for preparing the mix. The side pockets or compartments are meant for pre-heating of the coarse and fine aggregates. Since heating is by oil fired burners, the temperature can be easily controlled by controlling the flames or supply of the fuel.

16.33.3.3 Mastic cookers of various capacities ranging from 1/2 tonne to 3 tonne are used depending on the amount of work involved. These are not being marketed commercially because it is not a common specification but can be easily got made from manufactures of tar boilers.

Fig. 16.13 indicates the broad details of equipment and components of cooker presently in common use.

16.33.3.4 Apart from mastic cooker, the following equipments are required for transportation and laying.

- (1) Wheel barrows and flat mortar pans (for short distance haul) and small dumpers (for long distance haul).
- (2) Wooden trowels, heavy wooden floats, suitable hand tools gauge, straight edge and hand level.
- (3) Angle irons, required to contain the mastic in desired width and thickness.

16.33.4 Manufacture of Bitumen Mastic

16.33.4.1 The manufacture of bitumen mastic involves different stages. Initially the filler alone shall be heated to a temperature of 175 deg. C to 210 deg. C in mechanically agitated mastic cooker and half the required quantity of bitumen heated at 175 deg. C to 180 deg. C added. They shall be mixed and cooked for one hour. After that the fine aggregates and the balance bitumen at 175 deg. C to 180 deg. C shall be added to that mixture in the cooker and heated upto 175 deg. C to 200 deg. C and further mixed for another one hour. In the final stage, the coarse aggregates shall be added and heating of mix shall continue for another one hour. Thus a total period of minimum three hours will be needed to prepare the mastic. During mixing and cooking, care shall be taken to ensure that the contents in the cooker are at no time heated to a temperature exceeding 210 deg. C.

16.33.4.2 In case the material is not required for immediate use, the bitumen mastic with filler, fine aggregates and bitumen shall be cast into blocks each weighing about 25 kg. The bitumen mastic blocks (without coarse aggregates) shall show on analysis a composition with the limits as given in Table 16.26. These blocks when intended to be used subsequently shall be transported to site, broken into pieces of size not exceeding 60 mm cube and remelted in the cooker at a temperature ranging from 175 deg. C. to 210 deg. C thoroughly incorporating the requisite quantity of coarse aggregates as indicated in Table 16.26 and mixed continuously

for at least an hour. Mixing shall be continued until the laying operations are completed so as to maintain the coarse aggregates in suspension. At any stage the temperature during the process of mixing shall not exceed 210 deg. C.

TABLE 16.26
Composition of Bitumen Mastic Blocks without Coarse Aggregates

IS Sieve		% age by weight	
Passing	Retained	Minimum	Maximum
2.36 mm	600 micron	0	22
600 micron	212 micron	4	30
212 micron	75 micron	8	18
75 micron	-	25	45
Bitumen content		14	17

16.33.5 Hardness Number

The hardness number of bitumen mastic shall be determined at 25 deg. C in accordance with IS 5317 and with the method specified in Appendix D of IS 1195. It shall conform to the following requirements:

- | | |
|--|-------|
| (1) Without coarse aggregates at 25 deg. C | 60-80 |
| (2) With coarse aggregates at 25 deg. C | 10-20 |

16.33.6 Laying the Bitumen Mastic

16.33.6.1 Preparation of the Base : The base on which bitumen mastic is to be laid shall be prepared, shaped and conditioned to the specified levels, grade and camber as directed. If the existing surface is too irregular and wavy, it shall be made good by providing a corrective course of bituminous concrete mix as per IRC:29. The surface shall be thoroughly swept clean and made free of dust and other deleterious matter. Spots rich in binder shall be scrapped and repaired. Under no circumstances the bitumen mastic sheet be spread on a base containing a binder which will soften under high application of temperature. If any such spot exists, the same shall be cut out and repaired before the bitumen mastic is laid. To receive and contain the mastic, angle irons of sizes 25 or 50 mm are placed at required spacing till finish of the job.

16.33.6.2 Transportation of Mix : When the bitumen mastic, duly prepared including addition of coarse aggregates at the manufacturing point, is to be transported over a long distance and delivered to the laying site, arrangements for transport shall be made in a towed mixer transporter with adequate provision for heating and stirring so as to keep the aggregates and filler suspended in the mix till the time of laying. However for small works and where the laying site is near the manufacturing point, the mix can be transported in wheel barrows/flat mortar pans. To prevent the molten material from sticking to the wheel barrows/pans, the inside of the transport may be sprinkled with a minimum quantity of inorganic fine material like limestone dust. However, cement, ash or oil shall not be used.

16.33.6.3 Laying of Mix

16.33.6.3.1 The bitumen mastic shall be discharged into containers sprinkled with limestone dust or provided with lime-wash. The bitumen mastic shall be deposited directly on the prepared base immediately in front of the spreader where it is spread uniformly by means of wooden floats to the required thickness. The mix shall be laid in one metre widths confined between standard angle irons of size 25 mm to 50 mm to receive and contain the mastic of required thickness. The temperature of the mix at the time of laying shall be 175 deg. C. In case blowing takes place while laying the bitumen mastic, the bubbles shall be punctured while the mastic is hot and the surface made good. Since mastic asphalt is an expansive material, extreme care shall be taken while fixing the angle irons and their level checked with instrument at suitable intervals.

16.33.6.3.2 Laying Bitumen Mastic Surfacing over Old Existing Bridge Deck : Before laying bitumen mastic over old existing bridge deck, the existing cross fall/camber, expansion joint members and water drainage spouts shall be carefully examined for their proper functioning in the bridge deck structure and any deficiency found shall first be removed. Loose elements in the expansion joint shall be firmly secured. The

cracks in the concrete surface, if any, shall be repaired and filled up properly or replaced by new concrete of specified grade before laying the bitumen mastic over bridge deck.

Laying over New Bridge Deck : New concrete bridge deck which is not in camber/cross fall shall first be provided with required camber and cross fall by suitable concrete or bituminous treatment. In case of laying over concrete surface, following measures shall be taken:

- (1) For proper bond with new concrete deck, surface shall be roughened by means of stiff broom or wire brush and it shall be free from ridges and troughs.
- (2) A thin bituminous tack coat (with bitumen of grade 80/100) shall be applied on the concrete deck before pouring mastic. The quantity of bitumen for tack coat shall not exceed 5-6 kg per 10 sqm.
- (3) On surface in longitudinal slope, after applying tack coat, chicken-mesh reinforcement of 1.5 mm dia steel wire with hexagonal or rectangular openings of 20-25 mm shall be placed and held properly in position on the concrete surface before pouring mastic.

16.33.7 Joints

All construction joints shall be properly and truly made. These joints shall be made by warming the existing bitumen mastic by the application of an excess quantity of hot bitumen mastic which afterwards shall be trimmed off to make it flush with surface on the either side.

16.33.8 Surface Finish

The bitumen mastic surfacing has got a very fine texture which on initial laying provides very little resistance to skidding. Therefore, the bitumen mastic after spreading and while still hot and in plastic condition shall be spread over with bitumen precoated fine grained hard stone chips/aggregates of approved quality of 13.2 mm size complying with quality requirement as per Table 16.27 depending upon the thickness of mastic, using bitumen at the rate of 2 to 3 percent of S-65 or S-90 grades and aggregates at the rate of 0.005 cum (1/200 cum) per 10 sqm. and at a spacing of 10 cm c/c in both directions and pressed into the surface when the temperature of bitumen mastic is between 80 deg. C. and 100 deg. C. Such precoated aggregates when laid should protrude 2 to 4 mm over the mastic surface. Flakiness index of stone aggregates used for anti-skid measures shall be less than 25 per cent. The addition of 2% filler complying with Table 16.28/16.30 may be required to enable the quantity of bitumen to be held without draining.

TABLE 16.27

Sl.No.	Name of Test	I.S.Code	Acceptance Criteria
1.	Grain size analysis	IS 2386 Part 1	Max. 5% passing IS sieve 75 micron
2.	Flakiness or elongation Index	IS 2386 Part 4	Max. 30% *
3.	Los Angeles Abrasion Value	-do-	Max. 30%
4.	Polished Stone Value	B.S. 812 (Part 114)	Min. 55
5.	Soundness (a) Sodium Sulphate (b) Magnesium Sulphate	IS 2386 (Part 5)	Max. 12% Max. 18%
6.	Water absorption	IS 2386 Part 3	Max. 2%
7.	Coating and stripping of bitumen aggregate mixture	IS 6241	Min retained coating 95%
8.	Water sensitivity retained tensile strength	AASHTO T 283	Min. 80% **

* The elongation test to be done only on non-flaky aggregate to the sample.

** This test is only required if the maximum retained coating in the stripping test is less than 95%.

TABLE 16.28

Sl. No.	IS Sieve (MM)	Cummulative percent passing by weight of total aggregate
1.	0.6	100
2.	0.3	95-100

3.	0.075	85-100
----	-------	--------

The traffic may be allowed after completion of work when the bitumen mastic has cooled down to the ambient temperature.

16.33.9 Controls

16.33.9.1 Sieve analysis of each type of the aggregate used shall be made at least once a day to see that the gradation of the aggregates follows the original gradation as approved. Additional tests shall be carried out in case of variation in grading or receipt of supply of material from new source. The number of samples to be tested per day would depend upon the bulk supply of aggregates made in a day at the plant site. Physical properties such as aggregate impact values, flakiness index, water absorption etc. shall be determined at the rate of one test for every 25-50 cum of aggregates or as directed by the Engineer at site.

16.33.9.2 Two sets of test shall be carried out on each lot of supply of bitumen for checking penetration and softening point as per IS 1203 and IS 1205.

16.33.9.3 For filler material calcium carbonate content and fineness shall be tested at the rate of one set of tests for each consignment subject to a minimum of one set of test per 5 tonne or part thereof.

16.33.9.4 It shall be ensured that the aggregates are not wet before heating, otherwise it would affect the output adversely. During heating the aggregate temperature shall be recorded periodically to see that it does not exceed the limits prescribed.

16.33.9.5 Material in block form shall be sampled by taking approximately equal amount in pieces, from not less than six blocks chosen at random. The total weight of specimen to be tested shall not be less than 5 kg. In case the preparation of the mix is at site, then at least one sample of every 10 tonne of bitumen mastic discharged from the mastic cooker or at least one sample for each cooker per day shall be collected and following tests done:

- (1) Two specimens each of 10 cm dia or 10 cm square and 2.5 cm thick shall be prepared and tested for hardness number.
- (2) Bitumen shall be extracted from about 1000 gm of the mastic sample and bitumen content determined as specified in Appendix C of IS 1195.
- (3) A sieve analysis of the aggregates after the bitumen is extracted, shall be done and the gradation determined according to the procedure laid down in IS 2386 (Pt.I).

16.33.9.6 The temperature of the bitumen mastic at the time of laying shall not exceed 210 deg. C and shall not be less than 175 deg. C.

16.33.9.7 The longitudinal profile of the finished surface shall be tested with a straight edge 3 m long and transverse profile with a camber template while the mastic laid is still hot. Irregularities greater than 4 mm in the longitudinal and transverse profile shall be corrected by picking up the mastic in full depth and full area of the affected panel and relaying.

16.33.9.8 Bitumen mastic shall not be laid on a damp or wet surface or when the atmospheric temperature in the shade is 15 deg. C or less.

16.33.10 Measurements

The length & breadth of the area where bitumen mastic wearing course of specified thickness has been provided shall be measured correct to a centimeter and the area shall be calculated in square metres correct to two decimal places.

16.33.11 Rate

The rate per square metre shall include cost of all the operations described above including anti- skid treatment mentioned in para 16.33.1 above.

BITUMINOUS SHEET WITH HOT BITUMEN

16.34.0 This type of treatment is normally done for garden paths, driveways, footpaths and playgrounds and roads. The treatment is also useful in providing a thin wearing course over existing cement concrete roads. This is sometimes capable of standing with very heavy traffic. This can also be used over worn out cement concrete pavements, the concrete surface is roughened before laying the binder coat. It is also useful as a corrosion resistant flooring in shade and godowns for storing salt, fertilizer etc. This treatment consists of a mixture of coarse sand and stone chippings with bituminous binder, spread and consolidated to a specified thickness on prepared surface after the application of a tack coat.

The consolidated thickness of this type of treatment shall be 2.5 cm or 4 cm, as specified.

The work shall be carried out only when the atmospheric temperature in shade is 16 deg. C or above. No bituminous material shall normally be applied when the road surface or material is damp or when the weather is foggy or rainy, or during dust storms. Bitumen of specified grade and consistency to be used.

16.34.1 Quantities of Materials

The quantities of materials shall be as specified in Table 16.29.

TABLE 16.29

Consolidated thickness of bituminous sheet	Bitumen VG- 10/ VG-30/ Refinery modified bitumen (RMB 55)			Stone chippings cum/100 sqm of road surface	Coarse sand cum/100 sqm of road surface
	Kg/sqm of surface area (For Tack Coat)	Kg/cum of stone chipping	Kg/cum of sand		
2.5 cm	0.75	56	128	1.65*	1.65
4 cm	0.75	56	128	2.60*	2.60

* 60% with 12.5 mm Nominal size and

* 40% with 10 mm Nominal size

A proper record shall be kept to ensure that the daily turn out of work is correlated with the quantity of bitumen used as per proforma prescribed in Appendix 'A' .

16.34.2 Preparation of surface and application of binder (tack coat) shall be as specified under 16.28.2 to 16.30.5.

16.34.3 Preparation of Mix, laying and Consolidation

Para 16.30.4 and 16.30.5 shall generally apply except that the mixing shall be done in two stages. Stone aggregate of the correct standard size and in the proportion shown in table 16.29 shall be fed into the mixer to which 2/3 rd of the total specified quantity of bitumen heated to the appropriate temperature shall be added. When the stone metal is well coated, the sand in the specified proportion and then the balance 1/3rd quantity of total bitumen shall be fed into the mixer. Mixing shall be continued until a homogeneous mix is produced and all particles are uniformly coated with bitumen.

Any high spots or depressions which become apparent shall be corrected by addition or removal of premixed materials. The rolling shall continue until the maximum consolidation to the satisfaction of Engineer-in -Charge is obtained. The wheels of the roller shall be moistened with gunny bags to prevent the mixture from sticking to the wheel while rolling.

16.34.4 Surface finishing and rectification shall be as specified under 16.30.6 and 16.30.7.

16.34.5 Permitting Traffic

Traffic shall be allowed on the road after a lapse of 24 hours to 48 hours after laying, as decided by the Engineer-in-Charge.

16.34.6 Measurements

The length and width of the finished work shall be measured correct to a cm along the finished surface of the road. The area shall be calculated in square metre, correct to two places of decimal.

For record purposes measurements for binder, stone aggregate, stone chippings and sand as described under 16.3 shall be taken before they are actually used on the work. Premeasurements shall simply serve as a guide and shall not form the basis for payment. The thickness of surface treatment shall be the ruling criterion for payment.

16.34.7 Rate

The rate shall include the cost of materials and labour involved in all the operations described above.

16.34 SEAL COAT

16.34.1 Scope

This work shall consist of the application of a seal coat for sealing the voids in a bituminous surface laid to the specified levels, grade and cross fall (camber).

16.34.2 Seal coat shall be of either of the two types specified below:

- (A) Liquid seal coat comprising of an application of all layer of bituminous binder followed by a cover of stone chips.
- (B) Premixed seal coat comprising of a thin application of the aggregate premixed with bituminous binder.

16.34.3 Materials

16.34.3.1 Binder : The binder and its quantity shall be a penetration bitumen of a suitable grade as specified in the item or as directed by the Engineer-in-charge.

16.34.3.2 Stone Chips for Seal Coat : The stone chips shall consist of angular fragments of clean, hard, tough and durable rock of uniform quality throughout. They should be free of soft or disintegrated stone, organic or other deleterious matter. Stone chips shall be of 6.7 mm size defined as 100 per cent passing through 11.2 mm sieve and retained on 2.36 mm sieve. The quantity used for spreading shall be 0.09 cubic metre per 100 square metre area. The stone chips shall satisfy the quality requirements in Table 16.31 bituminous except that the upper limit for water absorption value shall be 1 per cent.

TABLE 16.30

<i>Sl. No.</i>	<i>I.S. Sieve (mm)</i>	<i>Cumulative % passing by weight of total aggregate</i>
1.	0.6	100
2.	0.3	95-100
3.	0.075	85-100

TABLE 16.30

Sl. No.	Name of Test	I.S. Code	Acceptance Criteria
1.	Grain size analysis	IS 2386 Part 1	Max 5% passing IS sieve 75 micron
2.	Flakiness and elongation Index	IS 2386 (Part 4)	Max 30%
3.	Los Angeles Abrasion Value	IS 2386 (Part 4)	Max 30%
4.	Polished stone value	B.S. 812 (part 114)	Min 55%
5.	Soundness (a) Sodium sulphate (b) Magnesium sulphate	IS 2386 (Part 5)	Max 12% Max 18%
6.	Water absorption	IS 2386 (Part 3)	Max 2%
7.	Coating and stripping of Bitumen aggregate mixture	IS 6241	Min retained coating 95%
8.	Water sensitivity retained tensile strength	AASHTOT 283	Min 80%

* The elongation test to be done only on non-flaky aggregate on the sample.

** This test is only required if the minimum retained coating in the stripping test is less than 95%.

16.34.3.3 Fine Aggregate : The aggregate shall be sand or grit and shall consist of clean, hard durable, uncoated dry particles and shall be free from dust, soft or flaky/elongated material, organic matter or other deleterious substances. The aggregate shall pass 2.36 mm sieve and be retained on 180 micron sieve. The quantity used for premixing shall be 0.06 cubic metres per 100 square metres area. Stones or fine aggregate shall be used as specified in item.

16.34.4 Construction Operations

16.34.4.1 Weather and Seasonal Limitations : Ref. Item No. 16.32.2.1.

16.34.4.2 Preparation of Surface : The seal coat shall be applied immediately after laying the bituminous course which is required to be sealed. Before application of seal coat materials, the surface shall be cleaned free of any dust or other extraneous matter.

16.34.4.3 Construction of Seal Coat with Stone Chips : Bitumen shall be heated to 150°C - 163°C and sprayed at the rate specified on the dry surface in a uniform manner with a self-propelled mechanical sprayer

Immediately after the application of binder, stone chips which shall be clean and dry, shall be spread uniformly at the rate specified on the surface preferably by means of a self-propelled or towed mechanical grit spreader so as to cover the surface completely. If necessary, the surface shall be brushed to ensure uniform spread of chips.

Immediately after the application of the cover material, the entire surface shall be rolled with a 8-10 tonne smooth wheeled steel roller, 8-10 tonne static weight vibratory roller, or other equipment approved by the Engineer after laying trials if required. Rolling shall commence at the edges and progress towards the centre except in super elevated and unidirectional cambered portions where it shall proceed from the lower edge to the higher edge. Each pass of the roller shall uniformly overlap not less than one-third of the track made in the proceeding pass. While rolling is in progress, additional chips shall be spread by hand in necessary quantities required to make up irregularities. Rolling shall continue until all aggregate particles are firmly embedded in the binder and present a uniform closed surface.

16.34.4.4 Construction of Seal Coat with Premixed Fine Aggregate: A mixer of appropriate capacity and type approved by the Engineer-in-charge shall be used for preparation of the mixed material. The plan shall have separate dryer arrangements for heating aggregate.

The binder shall be heated in boilers of suitable design, approved by the Engineer-in-Charge to the temperature appropriate to the grade of bitumen or as directed by the Engineer-in-Charge. The aggregates shall be dry and suitably heated to a temperature between 150°C and 165°C or as directed by the Engineer-in-charge before these components are placed in the mixer. Mixing of binder with aggregates to the specified proportions shall be continued until the latter are thoroughly coated with the former.

The mix shall be immediately transported from the mixing plant to the point of use and spread uniformly on the bituminous surface to be sealed.

As soon as a sufficient length has been covered with the premixed material, the surface shall be rolled with an 8-10 tonne smooth-wheeled roller. Rolling shall be continued until the premixed material completely seals the voids in the bituminous course and a smooth uniform surface is obtained.

16.34.5 Opening to Traffic

In the case of seal coat with premixed fine aggregate traffic may be allowed soon after final rolling when the premixed material has cooled down to the surrounding temperature. In the case of seal coat with stone chips traffic shall not be permitted to run on any newly sealed area until the following day. In special circumstances, however, the Engineer-in-charge may open the road to traffic immediately after rolling, but in such case traffic speed shall be rigorously limited to 16 km. per hour until the following day

16.34.6 Measurement for Payment

Seal coat, for both items shall be measured as finished work over the area specified to be covered, in square metres at the thickness specified in the item.

16.34.7 Rate

The rate for seal coat shall be cost of all materials, labour and equipment involved in operation described above.

16.35 CEMENT CONCRETE PAVEMENT (UNDER ORDINARY CONDITIONS)

Specifications of item 16.37 to be followed except that cement concrete of grade 1:2:4 or specified otherwise to be prepared and compacted.

16.36 CEMENT CONCRETE PAVEMENT UNDER CONTROLLED CONDITIONS

16.36.1 Materials

16.36.1.1 Cement

- (a) Cement used on work shall be as per sub head cement concrete of CPWD specifications- 2019 (Vol. – I).

16.36.1.2 Water: Water used on work shall conform to SH: cement concrete of CPWD, Specification 2019-Vol. I.

16.36.1.3 Coarse Aggregate : These shall be crushed or broken from hard stones obtained from approved quarry. These shall be clean strong, durable of fairly cubical shape and free from soft, friable, thin elongated and laminated disintegrated pieces. These shall also be free from dirt, organic deleterious and any other foreign matter and adherent coatings and shall satisfy the physical requirements laid down in para 16.37.19 under quality control.

Fine Aggregate : This shall be coarse sand conforming to CPWD Specification 2019 Vol.I.

16.36.1.4 Grading of Mixed Aggregates : The grading of all aggregates (coarse and fine aggregates) to be used in the work shall be determined in the laboratory. The coarse and fine aggregates shall be mixed in suitable proportions so that the grading of the mixed aggregates shall be in the range indicated in Table 16.32.

TABLE 16.32

<i>I.S. Sieve Size (IS 460)</i>	<i>% age passing by weight</i>
45 mm	100
22.4 mm	55 - 60
11.2 mm	45 - 50
5.6 mm	35 - 40
2.8 mm	30 - 35
1.4 mm	20 - 25
710 microns	15 - 20
355 microns	10 - 14
180 microns	2 - 5

16.36.2 Mix Design

16.36.2.1 The mix shall be approved by Engineer-in- Charge so as to obtain the following mean strength that exceeds the minimum specified flexural strength by 1.64 times the designed standard deviation.

Minimum works beam	
flexural strength at 28 days	= 300 kg/sqm. for M-30 or specified in item
Designed standard deviation	= 60 kg/sqm. for M-30 or for specified grade(s)
Design flexural strength at 28 days	= $300 + 60 \times 1.64$
Water cement ratio by weight	= $398.4 \text{ kg/sqm. (f + 1.64 s)}$ says 400 kg.
Water cement ratio by weight	= 0.5
Minimum slump not more than 25 mm	

16.36.2.2 For the purpose of tendering the contractor shall base his rate on the assumption that the quantity of cement used for one cum. of finished concrete shall be 340 kg. or M - 30. If the actual quantity of cement required to be used as a result of the laboratory test is different from that assumed above, necessary adjustment in the cost due to short cement used shall be made on the basis of issue rate of cement including storage charges plus 2.5% for handling charges. However, under no circumstances the quantity of cement to be used shall either exceed 350 kg./cum or fall below 330 kg. per cum of finished concrete.

16.36.3 Statistical Field Check

16.36.3.1 Samples of concrete shall be taken at the mixer and works beams, made, cured and tested in accordance with IS 1199 and IS 516.

16.36.3.2 When a mix is used for the first time, it is important to get a large number of results, as soon as possible, in order to establish the level of control and then suitability of the mix proportions. A sample of concrete shall be taken at random on eight separate occasions during each of the first five days of using that mix. From each sample two beams shall be made one for test at 7 days and the other for test at 28 days.

16.36.3.3 The work beam results shall be examined both individually and in consecutive (but not overlapping) sets of four, for which the average and the range of each set is calculated. The mix proportions shall be modified to increase the strength, if in the first ten consecutive (but not overlapping) sets any of the following conditions are not satisfied.

- (I) Each sample has a test strength not less than the minimum specified strength i.e. 30 kg/sq. cm. (or otherwise specified in item).

OR

- (II) (a) Not more than two individual results (Not more than one of first twenty) of the 40 beams tests shall fall below the minimum work beam strength but they shall not be less than 80% of the specified beam strength of 30 kg./sq. cm (or otherwise specified in item) or the minimum specified strength minus 1.35 times the standard deviation whichever is greater.

- (b) No value of the range in any set shall exceed 3 times the designed standard deviation.

- (c) The average for all samples (10 sets) shall not be less than the minimum specified strength i.e. 30 kg/sq. cm (or otherwise specified in item) plus 1.64 times the designed standard deviation 60 kg./sq.cm M-30.

16.36.3.4 If either of these conditions (16.37.3.3 I or 16.37.3.3 II) are not satisfied, the mix shall be modified and the procedure described above shall be repeated till results satisfying the above criterias are obtained.

16.36.3.5 Subsequently samples shall be taken at the rate of one for every 30 cubic metre of concrete laid. Eight beam specimen shall constitute one sample. A set of 4 specimen shall be tested after 7 days and another set of 4 specimen shall be tested after 28 days. These test results shall be checked individually and in sets of four as the work progresses. If at any stage it is found that either of conditions 16.43.4.3,I or 16.4.3,II are not satisfied, the overall average and the standard deviation of the previous consecutive 40 beam test results including the non-complying set shall be calculated. If the overall average strength minus 1.64 times the standard deviation is more than the specified beam strength (30 kgm/sq.cm) (or otherwise specified in item) the concrete shall be accepted. But if it is less than the concrete work corresponding to these 40 beams tests shall be rejected and the mix proportion shall be modified forth with for further work. The rejected work shall be replaced by the contractor immediately at his own cost and expense.

16.36.3.6 The statistical field checks described in 16.37.3.1 to 16.37.3.2 are meant to control the quality of concrete. The standard of acceptance of concrete shall be governed by the provision of para 16.37.3.3 to 16.37.3.5.

16.36.4 Slump Test

The test shall be carried out as per IS 1199. A slump test shall be carried out at each mixer at least one in fifty batches mixed or more frequently if directed by the Engineer- in-Charge. Any batch from which slump test is being made shall not be transferred to the place of laying till the slump test has been completed. Not only the batch which gives a slumps in excess of that specified shall be rejected but the concrete already laid immediately preceding the batch tested upto the nearest last transverse joint may be rejected by the Engineer-in-Charge or his subordinate, if he is satisfied that such preceding batches were substandard in this respect. The decision of the Engineer-in-Charge in this respect shall be final and binding on the contractor. Such rejected concrete shall be removed by the contractor immediately and replaced with proper slump concrete at his cost and expense.

16.36.5 Steel Forms

16.36.5.1 All side forms shall be of mild steel. The steel forms shall be of M.S. Channel sections and their depth shall be equal to the thickness of the pavement.

16.36.5.2 The side forms shall have a length of at least 3.0 metres except on curves of less than 4.5 metres radius where shorter lengths may be used. When set to grade and stacked in place the maximum deviation of the top surface of any section from a straight line shall not exceed 3 mm. The method of connection between sections shall be such that the joint formed shall be free from play or movement in any direction. The use of bent, twisted or worn out forms shall not be permitted. At least three stake pockets for bracing pins or stakes shall be provided for each 3.0 M length of forms. Bracing and supports must be ample to prevent the springing of forms under pressure of concrete or weight or thrust of the machinery (like screed vibrator) operating on the forms. Support to the forms shall be sufficiently rigid to hold them in position during the entire operation of laying and compacting and finishing and that they shall not at any time deviate more than 3 mm from straight edge 3 metres in length. Forms which show a variation from the required rigidity of the alignment and levels shown on the plans shall be reset or removed as directed. The length and number of pins or stakes shall be such as to maintain the forms at the correct line and grade.

16.36.5.3 The supply of forms shall be sufficient to permit their remaining in place for at least 12 hrs. after the concrete has been placed or longer, if in the opinion of the Engineer-in-Charge, it is necessary.

16.36.5.4 The top line of the forms is not to vary from the correct level or alignment and the levels and alignment of the forms are to be checked and corrected as necessary immediately prior to the placing of concrete. The top edges and faces of the forms are to be carefully cleaned and maintained in clean condition.

16.36.5.5 While removing the steel forms, care shall be taken to withdraw them gradually, any damage to the bull nosed edges shall be made good while the concrete is still green.

16.36.5.6 *Setting of Forms*

- (a) Setting of forms shall be according to the slab plan subject to the approval of Engineer-in-Charge and concreting shall not commence until the setting of forms is approved.
- (b) Forms shall be set for at least 50 metres in advance of the point where the concrete is being laid and shall not be removed until at least 12 hrs. of placing of the concrete or longer if in the opinion of Engineer-in-Charge is necessary.
- (c) After setting, the working faces shall be thoroughly oiled by using approved oil before concrete is placed against them.
- (d) The pavement joints of overlay layer would overlap with the joints of underlay cement concrete.

16.36.6 *Batching and Mixing*

As detailed in SH: 5 of reinforced cement concrete work of CPWD specifications 2019.

16.36.7 *Placing of Concrete*

As detailed in SH: 5 of reinforced cement concrete work of CPWD specifications 2019.

16.36.8 *Compaction of Concrete*

16.36.8.1 Compaction shall be carried out by electrically (or) diesel operated needle and screed vibrators as stipulated hereafter. Needle vibrator should be used all over the area for obtaining initial compaction of concrete. These should be of diameter not less than 4.5 cm. If the vibrator are pneumatic the pressure must not be below 4 kg/sq.cm. If electrically operated, they should have a minimum frequency of 3500 impulses per minute.

16.36.8.2 There should be at least three needle vibrators working in any bay. A vibrating screed consisting of a steel or timber section weighing not less than 15 kg. per metre with a tamping edge of not less than 7 cm width and having a vibrator mounted thereon shall follow needle vibrators to obtain full compaction. The face of the wooden tamping edge of the screed shall be lined with M.S. Plate rigidly fixed by means of counter sunk screw. Where screed vibrators are used for compaction, a standby unit shall always be maintained ready for use, should the other one go out of order. Where electrically driven vibrators are employed, a standby diesel pneumatic unit shall be kept ready for use in case of power failure. At the discretion of the Engineer-in-Charge, for compaction at edges and joints, vibrators may be supplemented by hand tamping and rodding for securing satisfactory results. Under no circumstances, honey combing of concrete at joints or elsewhere shall be permitted.

16. 37.8.3 When using screed vibrator for compaction it should not be dragged over the concrete. During the initial passes it shall be lifted to the adjacent forward position in short steps, subsequently, it shall be slowly slid over the surface with its axis slightly tilted away from the direction of sliding and the operation repeated until a close, dense surface is obtained.

16.37.8.4 Concreting shall be carried out in one operation between the expansion joints and construction joints without any break at the dummy joints.

16.37.8.5 Concrete shall be deposited on the base as near the joints as possible without touching them. It shall then be shoveled against the sides, maintaining equal pressure and deposited approx. 50 mm higher than the depth of the joints, care being taken that it is worked well around the joints. The concrete shall not be dumped from the bucket directly upon or against the joints.

16.37.8.6 Workmen shall not be allowed to walk on freshly laid concrete and proper cat walk shall be provided with independent supports beyond concreting bays.

16.36.9 Finishing of Concrete

16.36.9.1 During compaction, any low or high spots shall be made up by adding or removing concrete. After longitudinal floating has been completed but while concrete is still plastic, the slab surface shall be tested for trueness with a 3 m straight edge. Any depressions or high spots showing departure from the true surface shall be immediately rectified. High spots shall be cut down and refinished. Depressions shall be enlarged to about 8-10 cm and filled up with fresh concrete, compacted and finished.

16.36.9.2 The straight edge testing the refloating is to continue until the entire surface:

- (a) is free from observable departure from the straight edge,
- (b) conforms to the required levels and across section, and
- (c) shall conform to the specified surface when the concrete has hardened.

16.36.9.3 The foregoing work is to be carried out while the concrete is still plastic and workable.

16.36.10 Belting

16.36.10.1 Just before concrete becomes non-plastic, the surface shall be belted with a two ply canvas belt not less than 20 cm wide and at least 1 metre longer than the width of the slab. Hand belts shall have suitable handles to permit controlled uniform manipulation. The belt shall be operated with short strokes transversed to the centre line of the pavement and with rapid advance parallel to the centre line.

16.36.11 Brooming

16.36.11.1 After belting and as soon as the surplus water, if any, has risen to the surface, the pavement shall be given a broom finish with an approved steel or fiber broom not less than 45 cm wide. The broom shall be pulled gently over the surface of the pavement from edge to edge. Adjacent strokes shall be slightly overlapped. Brooming shall be perpendicular to the centre line of the pavement and so executed that the corrugations formed shall be uniform in character and width and not more than 1.5 mm deep.

16.36.11.2 Brooming shall be completed before the concrete reaches such a stage that the surface is likely to be torn or unduly roughened by the operation. The broomed surface shall be free from porous or rough spots, irregularities, depressions, and small pockets such as may be caused by accidental disturbing of particles of coarse aggregates embodied near the surface. The brooming shall be of uniform pattern all through.

16. 37.11.3 Edging : After belting/brooming has been completed but before the initial setting of concrete, the edges of the slab shall be carefully finished with an edger of 6 mm radius, and the pavement edges shall be left smooth and true to line.

16.36.12 Honey Combing

16.36.12.1 The side forms shall not be removed until 12 hours or such longer period as the Engineer- in-Charge may decide after the laying of concrete.

16.36.12.2 As soon as the side forms are removed, any minor honey combed area shall be filled with mortar composed of one part of cement and two parts of fine aggregate. Major honey combing areas or segregated concrete or other defective work or areas damaged by removal of the forms or concrete damaged by rain or due to any other reason whatsoever shall be considered as defective work and shall be removed and replaced by the contractor at his own expense. The total area of honey combed surface shall not exceed 4 per cent of the area of the slab side. However, no individual honeycomb patch shall exceed 0.1 sqm. Engineer-in-Charge's decision as to whether the concrete is defective or not shall be final and binding.

16.36.13 Surface Accuracy

16. 37.13.1 After the concrete has sufficiently hardened after about 12 hours and not later than 24 hours, the surface shall be tested again for high spots. All high spots shall be marked and those exceeding 3 mm shall be ground down immediately. Care shall be taken to see that the grinding does not in any way damage the concrete surface.

16.37.13.2 The final surface finish is to be such that when tested with a profilograph/roughness indicator/or a 3 metre long straight edge or an equivalent mechanical unevenness indicator placed anywhere within the same or adjoining slab in any direction on the surface, there shall be no variation greater than 3 mm.

16.37.13.3 If the surface irregularity exceeding 3 mm still remains despite grinding as per para 16.37.13.2 the concrete shall be removed to its full depth. The area of concrete to be removed shall be complete slab between the nearest joints, where the defective slab is less than 4.5 metres from the expansion joint, the whole area upto the expansion joint shall be removed to the full depth. The concrete so removed shall not be reused in the work. Fresh concrete shall be laid in the manner already de-scribed in above paras and shall again be subject to test for surface accuracy and other quality control measures. Nothing extra shall be paid on this account.

16.37.13.4 Every slab shall bear an impression not exceeding 3 mm in depth comprising the number allotted to the slab and the date on which it is laid. This impression shall be formed by the contractor when the concrete is green so as to leave permanent mark on setting.

16.37.13.5 Initial Curing

16.37.13.5.1 Immediately after completion of the finishing operations, the surface of the pavement shall be entirely covered with wetted burlap, cotton or jute mats. The mats used shall be of such length (or width) that as laid they shall extend at least 45 cm beyond the edges of the slab. The mats shall be placed so that the entire surface and both edges of the slab are completely covered. This covering shall be placed as soon as, in the judgment of the Engineer-in-Charge the concrete has set sufficiently to prevent damage to the surface prior to being placed, the mats shall be thoroughly saturated with water and shall be placed with the wettest side down. The mats shall be so placed and weighed down as to cause them to remain in intimate contact with the surface covered, and the covering shall be maintained full wetted and in position for 24 hours after the concrete has been placed or until the concrete is sufficiently hard to be walked on without suffering damage. Water shall be gently sprayed so as to avoid damage to the fresh concrete. If it becomes necessary to remove a mat for any reason, the concrete slab shall not be exposed for a period of more than half an hour.

16.37.13.5.2 Worn burlap or burlap with holes shall not be permitted. Burlap reclaimed from previous use other than curing concrete shall be thoroughly washed prior to use for curing purposes. If burlap is obtained in strips, shall be laid to overlap by at least 150 mm.

16.36.14 Burlap shall be placed from suitable bridges. Walking on freshly laid concrete to facilitate placing burlap shall not be permitted.

16.36.15 Final Curing

16.36.15.1 Upon the removal of the burlaps, the slab shall be thoroughly wetted and then cured as follows:-

All joints shall be filled with filler in order to prevent the edges of joints from getting damaged and entry of clay materials into the joints during final curing. Exposed edges of the slab shall be banked with a substantial berm of earth. Upon the slab shall then be laid a system of transverse and longitudinal dykes of clay about 50 mm high immediately covered with a blanket of sandy soil free from stones to prevent the drying up and cracking of clay. The rest of slab shall then be covered with sufficient sandy soil so as to produce a blanket of earth not less than 40 mm deep after wetting. The earth covering shall be thoroughly wetted while it is being placed on the surface and against the sides of the slab and kept thoroughly saturated with water for 21 days and thoroughly wetted down during the morning of the 22nd day and shall thereafter remain in place until the concrete has attained the required strength and permission is given by the Engineer-in-Charge. Thereafter the covering shall be removed and the pavement cleaned and swept. If the earth covering becomes displaced during the curing period, it shall be replaced to the original depth and resaturated.

16.36.15.2 Contractor shall appoint chowkidars at his expense to prevent workmen, cattle, etc., straying on the pavement concrete.

16.36.15.3 Concrete shall not be subjected to any load or weight of any plant until at least 28 days after laying.

16.36.16 Construction Joints

16.36.16.1 Construction joints shall be provided as shown in the drawing and also at places where concreting is stopped due to unforeseen circumstances. The joints shall be straight and vertical through the full thickness of the slab. While concrete in adjacent bay is still green, flats of suitable size shall be drawn along the edge and a groove of size 10 mm × 25 mm deep shall be neatly formed and finished. The edges of the groove shall be full nosed. After curing of concrete is complete, this

groove shall be thoroughly cleaned of all sand dust and shall be perfectly dried and filled with hot poured sealing compound conforming to grade B of IS 1834. Before filling with sealing compound the faces of concrete of the joint shall be coated with primer of approved brand to a depth of 25 mm at the rate of 2.6 liters per 10 square meters. Bitumen emulsion shall not be used as primer.

16.36.17 Dummy Joints

16.36.17.1 The joints shall be 10 mm wide and shall extend vertically from the surface of the slab to a depth equal to 1/3rd of the thickness of the slab but not less than 4 cm in any case. The joint may be formed by depressing into the soft but compacted concrete a high tensile M.S. or other approved Tee or flat bar of depth not less than required depth of the joint plus 25 mm. The bar used for forming the groove shall be coated with soft soap or other suitable lubricant to facilitate its removal when the steel Tee or flat is removed joints shall be neatly formed with proper tools and mortar/fine material from the slab itself. No additional cement mortar (rich or otherwise) shall be used.

16.36.17.2 Cutting or sawing by a saw mounted on a movable frame and driven mechanically shall also be permitted as a method for making the joint. In this case the width may be reduced to 6 mm. any other method for making joints can be followed with the prior approval of the Engineer-in-Charge.

16.36.17.3 In all cases, except where cutting is done with saw, the joint edges shall be bullnosed. Care should be taken to see that the edges of the grooves are not damaged.

16.36.17.4 The grooves shall be filled with hot poured sealing compound conforming to Grade B of IS:1834. Prior to filling with sealing compound, the joints shall be cleaned by compressed air and primed with Shalijet primer or equivalent at the rate specified in Para 16.37.16.1

16.36.17.5 All joints shall be sealed as soon as practicable after 28 days of casting of cc pavement. Joints shall be sealed flush with the adjacent pavement surface in summer and 3-4 mm below finished concrete surface in winter. The pavement shall be opened to traffic only after joint sealing over the entire pavement. To prevent tackiness or pickup under traffic, the exposed surfaces of the sealing compound shall be dusted with hydrated lime, if directed by Engineer-in-Charge, for which nothing extra shall be paid to the contractor.

16.36.17.6 In case of sudden rain or storm, the work can be concluded at the dummy joints but these will then be formed as construction joints.

16.36.17.7 Before sealing of joints, it may be ensured that the groove extends fully across the bay between consecutive longitudinal joints, in the case of transverse joints and is continuous in the case of longitudinal joints. Any concrete or other foreign matter must be removed from the groove.

16.36.18 Concreting during Rains

16.36.18.1 To prevent damage to freshly laid concrete during monsoon, or sudden rains, the contractor shall provide an adequate supply of tarpaulins or other water proof covering material. Any concrete damaged by rain shall be removed and replaced by the contractor at his own cost as directed by the Engineer-in-Charge.

16.36.19 Quality Control

The following quality control tests shall be carried out at frequencies specified against each as in Table 16.33.

TABLE 16.33

S.No	Test	Test Method	Frequency	Acceptance Criteria
1	2	3	4	5
(i) COARSE AGGREGATE				
(a)	Flakiness index	IS 2386 (Pt.1)	Before approval of the quarry and at every subsequent change in the source of supply and one test per 100 cum of aggregates	Not more than 15%
(b)	Impact value	IS 2386 (Pt.4)	-do-	Not more than 30%
(c)	Los angle abrasion value.	IS 2386 (Pt.4)	-do-	Not more than 40%
(d)	Deleterious materials.	IS 2386 (Pt.2)	Before approval of the quarry and at every subsequent change in the source of supply	As per table 1 of IS 383
(e)	Moisture content.	IS 2386 (Pt.3)	Regularly as required subject to a min. one test per day	-do-
(ii) FINE AGGREGATES				
(a)	Silt content.	CPWD specifications 2019, Vol. I, SH: CC	One test per 15 cum	Not more than 8%
(b)	Gradation of sand	IS 2386 (Pt.1)	-do-	Fineness modulus between 2.5 to 3.9
(c)	Deleterious materials.	IS 2386 (Pt.2)	Before approval of the quarry and at every subsequent change in the source of supply	As per table 1 of IS 383
(d)	Moisture content.	IS 2386 (Pt.3)	Regularly as required subject to a min. 2 test/day	-do-
(iii) MIXED AGGREGATES				
(a)	Grading	IS 2386 (Pt. 1)	1 test per 15 cum	As per para 16.37.1.5
(iv)	Slump test of concrete	IS 1199	At least once in 50 batches at each mixer or more frequently if directed by the Engineer-in-Charge	Not more than 25 mm
(v)	Flexural strength	IS 516	One test of sample consisting of eight specimen for every 30 cum of concrete	As per para 16.37.3.5.
(vi)	Surface accuracy	As prescribed	Regularly	As per para 16.37.13

16.36.20 Equipments

16.36.20.1 Equipments as per list at Appendix C shall be provided by the contractor in the field testing laboratory. Nothing extra shall be paid to him on this account. Records as required shall be maintained at site. All tests details in support of mix design shall be maintained as part of records of the contract and shall be signed both by the contractor and the Engineer-in-Charge. The contractor shall provide all labour, materials and equipment required for all tests to be carried out at his own cost.

16.36.20.2 The Engineer-in-Charge reserves the right to test any part of concrete laid regarding quality soundness, compactness, thickness, strength and finish of the concrete, at any time before the expiry of the "Defect liability period" notwithstanding that necessary tests had been carried out and found satisfactory at the time of execution.

16.36.20.3 All defective unsound sub-standard work and concrete of sub-standard strength and quality etc. as established vide paras 16.37.3 shall be rejected and shall be replaced by the contractor at his own expense in the manner as detailed in para 16.37.3. Where due to operational or any other reason such replacement does not become possible (decision of Engineer-in-Charge in this respect being final and binding on the contractor), the cost of removal and replacement of such rejected work shall be recovered from the contractor whether such rejected work is subsequently replaced by the Government or not.

16.36.21 Defects Liability Period

16.36.21.1 This period shall be reckoned in the case of this work as one year from the date of completion of work and it shall be the liability of the contractor to repair, strengthen or reconstruct any portion of the work which has shown damage or any defect, arising out of any bad workmanship or defective material used in the work during this period. In the case of this rectification not being commenced by the contractor within 7 days from the date of notice from the Engineer-in-Charge and completed expeditiously the Engineer-in-Charge reserves the right to get the repair work executed at the risk and cost of the contractor.

16.36.22 Measurements

16.36.22.1 For the purpose of ascertaining the quantity of concrete in the pavement, thickness shall be measured by means of a scale correct to the nearest 2 mm. The thickness of the concrete pavement slabs shall be taken on either side of the pavement at each dummy joint at four corners of the slab immediately after removal of the side forms. In case the average thickness of the slab exceeds the specified thickness, payment shall be restricted to the specified thickness.

16.36.22.2 The dimensions of each slab of pavement shall be measured as follows to the nearest 5 mm.

(a) Length

- (i) Between the end of a pavement to the centre line of the expansion joints.
- (ii) Between the centre lines of consecutive expansion joints.

(b) Width

- (i) Between the edge of a pavement and the centre line of the construction joints.
- (ii) Between the centre lines of construction joints and expansion joints.
- (iii) Between the centre lines of consecutive construction joints.

Note : The quantity of concrete in the pavement slab shall be worked out by multiplying the area of the slab and its average thickness or specified thickness whichever is less. No deduction shall be made for any joints in the concrete slab.

16.36.22.3 Measurements of concrete slabs shall be recorded jointly by the Engineer-in-Charge or his authorised subordinate and the contractor or his authorised agent.

16.36.23 Rate

The rate of the item for concrete in pavement shall include the cost of all materials and labour including charges for machinery tools & plants required in all the operations described above. The rate also includes all cost of setting up the laboratory at site and carrying out the quality control measures/tests enumerated above by the contractor at his own cost in the presence of Engineer-in-Charge or his authorized representative and submission of test results on completion of tests to the Engineer-in-Charge thereof.

16.37 HARD CRETE

Hard crete of approved quality and brand to be used. It shall be mixed in ratio and method as recommended by manufacturer and approved by Engineer-in-charge in cement concrete for laying in paramount. Quantity shall be measured in litre used in cement concrete. Hardcrete to be brought in sealed container and proper record of quantity be maintained. Empty containers of hardcrete shall not be removed from site with but prior permission of Engineer-in-Charge.

16.38 EXPANSION JOINT

16.39.0 Materials

Premoulded Joint Filler in Expansion Joint : It shall conform to IS 1838 (Pt. I). The thickness shall be 25 mm with tolerance 1.5 mm. and shall be of the maximum available standard length not less than one lane width. The filler board shall be positioned vertically with the prefabricated joint assemblies along the line of the joint within tolerance of ± 10 mm from the intended line of the joint. The depth of board shall be 25 mm less than thickness of slab within a tolerance of ± 3 mm so that the top of the board shall be below the surface or will not impend the passage of the finishing straight edge or oscillating beam of the paving machine.

Bitumine Hot Sealing Compound : The joint sealing compound shall be fuel and heat resistant type complying to grade B of IS 1834. It shall be capable of adhering to the concrete without cracking, spalling and disintegration.

16.39 CONSTRUCTION PROCEDURE

16.39.1 Expansion joints shall be provided as shown in the drawing and as per directions of Engineer-in-Charge. All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement. The joint shall be 20 mm wide. The depth of the non-extruding filler pad shall be 25 mm less than the depth of the concrete slab.

16.39.2 Before the provision of expansion joint, the face of the already laid concrete slab shall be painted with primer at the rate of 2.6 liters per 10 square metres. The expansion pad shall be properly cut to shape and shall then be placed in position abutting the painted face of the already laid concrete slab. The adjacent slab shall then be concreted. The face of the pad against which the new concrete slab is to be laid shall also be painted with primer before laying the concrete, while concreting a neat groove of size 20 mm x 25 mm as per drawing shall be formed on top of the pad taking care that the edges are absolutely straight and that the groove so made does not get filled with any material like concrete, mortar and other rubbish.

16.39.3 Before the curing process is started, the top of expansion joint shall be filled with bitumen sand mixture in order to ensure that no foreign material used in curing enters into the joint. This filling shall be removed before filling the joints with sealing compound.

16.39.3.1 For sealing the joints following operations shall be carried out :—

- (a) The joints are cleared of any foreign matter to the full depth upto the top of expansion pad with steel spatula.
- (b) The joints are blown with compressed air.
- (c) Cleaning is done with Kerosene oil.
- (d) Priming is done with spray gun @ 2.6 liters per 10 sqm of the surface to be primed.
- (e) The primer is allowed to dry completely before pouring the sealing compound.
- (f) The sealing compound grade 'A' is heated to the required temperature ranging between 155 deg. C to 165 deg. C or to the temperature range specified by the manufacturer. Over

heating shall be avoided. Pouring shall be done from vessel with spout in such a manner that the material will not get spilled on the exposed surface of the concrete, any excess filler on the surface of the pavement shall be removed immediately and the pavement surface cleaned.

- (g) The filling shall be worked into the joints with hot flats to ensure escape of trapped air.
- (h) The filling is then ironed with hot iron. It is recommended that while in summer the joints may be sealed flush with the adjacent pavement surface, in winter the sealing compound may be filled to a depth 3-4 mm below the surface.
- (i) The edges of the joints are then cut and trimmed to ensure neat and straight line finish.
- (j) To prevent tackiness or pick up under traffic, the exposed surfaces of the sealing compound shall be dusted with hydrated lime, if directed by Engineer-in-Charge (Nothing extra shall be paid for the same).

16.39.3.2 Measurements : The measurement of the specified depth of joint shall be recorded in metres correct to two places of decimals.

16.39.4 Rate

Rate for the item shall include the cost of all materials, plant, machinery and labour involved in all operations described above, including all cartages and lifts.

16.40 PAINTING ROAD/RUNWAYS MARKINGS

16.40.1 Materials

16.40.1.1 Special Road marking paint of approved brand and manufacture shall be used. The paint shall conform to IS 164. Ready mixed paint as received from the manufacturer shall be used without adding any admixture.

16.40.1.2 During work, if the consistency of the paint gets thick and thinning becomes necessary it shall be done by use of thinner of the approved brand of paint recommended by the manufacturer and with the approval of the Engineer-in-Charge.

16.40.1.3 The paint shall be brought to the site of work by the contractor in original sealed containers. The material shall be brought in one lot in adequate quantity to suffice for the entire work. The material shall be kept in the joint custody of the contractor and the Engineer-in-Charge. The empty container shall not be removed from the site of work, till the work has been completed and permission obtained from the Engineer-in-Charge.

16.40.2 Preparation of Surface

The surface shall be thoroughly cleaned and free from dust. All the dirt, scales, oil and grease shall be thoroughly removed before painting is started. The prepared surface shall be inspected and approved by the Engineer-in-Charge before painting is commenced.

16.40.3 Application

16.40.3.1 Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its original container. The paint shall be continuously stirred in the smaller container while applying to runway surface so that its consistency is kept uniform.

16.40.3.2 The painting shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternatively in opposite direction, two or three times and then finally brushing lightly in a direction at right angle to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

16.40.3.3 Each coat shall be allowed to dry out thoroughly before the next coat is applied.

16.40.3.4 Earlier applied coat shall be cleaned off dust before the next coat is laid.

16.40.3.5 No left over paint shall be put back into the stock tins. When not in use, the containers shall be kept properly closed.

16.40.3.6 No hair marks from the brush or clogging of paint puddles shall be left on the work.

16.40.3.7 The surface shall ordinarily not be painted until it has dried up completely. Trial patches of paint shall be laid at intervals to check if drying is satisfactory.

16.40.3.8 The runway marking shall be done in accordance with the drawing unless otherwise instructed by the Engineer-in-Charge.

16.40.4 Brushes and Containers

16.40.4.1 After work, the brushes shall be completely cleaned of paint by rinsing with turpentine. A brush in which paint has dried up is spoiled and shall on no account be reused for painting work. On no account kerosene oil shall be used for washing the brush.

16.40.4.2 When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth so that they are clean, and can be used again.

16.40.5 Measurement

16.40.5.1 Length and breadth shall be measured correct to a cm. Area shall be worked out in square metre, correct to two places of a decimal.

16.40.6 Rate

16.40.6.1 Rate shall include cost of all materials, tools and labour involved in all the operations described above including all cartages and lifts.

16.41 PAINTING ROAD SURFACE (WITH READY MIXED ROAD MARKING PAINT)

Specifications of item no. 16.41 to be followed except that road surface to be painted with ready mixed road marking paint of approved brand instead of paint of superior make.

16.42 LIME FLYASH STABILISED SOIL SUB BASE

16.42.1 The thickness of lime flyash soil layer for use as sub base should be designed in accordance with IRC 37. The minimum thickness shall not be less than 15 cm.

16.42.2 Soil

Granular soils free from high concentration of organic matter or deleterious salts and sand with fine silts produce better mixes than fine grained soil with high clay content. Clay, silts and low plastic clays with plasticity index between 5 and 20 and liquid limit less than 25 are however, suitable the minimum proportion of particles smaller than 425 micron should be between 15 and 25 percent by dry weight of the soil lime flyash mixture. Selection of material and their gradation should be such as would be conducive to compaction to high density.

16.42.3 Lime

Should be commercial dry lime slaked at site or pre-slaked and delivered in airtight sacks. Suitable approved lime should have purity (CaO content) of not less than 50 percent. Only hydrated high calcium and mono hydration dolomitic limes are to be used. Quick lime is not recommended for use. Where in exceptional circumstances, when with 50% purity is not available, the deficiency can be compensated by using larger proportion of lime.

16.42.4 Flyash

Shall conform to IS 3812. If it is partially set due to long storage, it should be pulverised and dry sieved before mixing, to conform to following grading.

<i>Sieve Size mm)</i>	<i>Percent passing</i>
12.5	100
9.5	95 (min)
2.0	75 (min)

Flyash should be fine enough to have a specific surface are of 3200 sq.cm/gm or 320 sqm/kg. It should be ensured before its use, that flyash possesses lime relativity of not less than 35 kg/sq.cm. Flyash should be stored in covered area safe from moisture.

16.42.5 Mix Proportioning

The mix proportion shall be determined in conformity with IRC -88 through laboratory tests for meeting the strength requirements. A typical mix proportion of soil lime, flyash is given below :

Soil 85 parts by weight Lime

3 parts by weight

(based on 80% purity of lime) Flyash

12 parts by weight

16.42.6 Tolerance

Limits of tolerance for various materials in percentage by weight shall be as follows

Lime	± 0.3
Flyash	± 1.5
Soil	± 2.0

16.42.7 Surface Irregularities

The finish surface should be checked for line, level and grade and surface finish. The maximum permissible undulation in longitudinal profile shall not exceed 15 mm when checked with 3 metre straight edge and in cross profile the variation from specified profile shall not exceed 12 mm.

The quantity of water shall be as per the O.M.C. requirements determined on soil lime flyash mixture by proctor density method.

16.42.8 Construction Operation

Mixing shall preferably be done by mechanical plant either of the single pass or multiple pass type, where such plant is not available, manual method may be adopted with rigorous control over quality of construction. In the manual method, the soil shall be pulverised by means of crowbars, pick axes, bullock drawn ploughs etc. and deposited on the road bed in stacks of suitable size, about 30 cm in height. Water in requisite quantities shall be sprinkled on the soil for aiding pulverisation. The degree of pulverisation shall be as given in Table 16.34.

TABLE 16.34

<i>Sieve Designation</i>	<i>% by weight passing the sieve.</i>
25 mm	100
4.75 mm	60

On the pulverised soil stacks, lime and flyash in a thoroughly mixed form and in the requisite quantities shall be spread uniformly and mixed by cutting with spade till the whole mass is uniform. The mixed soil shall then be spread over the prepared sub-grade to the required thickness and rolled. Before rolling, the moisture content shall be adjusted to be within + 1% and -2% of the O.M.C.

16.42.9 Rolling

Rolling shall be done with a 8-10 tonne roller. Rolling is continued till the required density (100% of Lab. Proctor density as per IS 2720 Pt.VII) and a smooth surface obtained without leaving any roller marks on the surface. During rolling surface should be checked for grade and camber and irregularities corrected.

16.42.10 Curing

The compacted surface shall be cured for a minimum period of 7 days before the next layer is placed. Curing is done by sprinkling water over the surface five or six times a day. The surface shall not be allowed to dry during the curing period. Curing by ponding shall not be adopted.

16.42.11 Measurements

The length and breadth shall be taken to the nearest centimeter and the thickness to the nearest half centimeter. The consolidated cubical contents shall be calculated in cubic metres, correct to two places of decimals.

16.42.12 Rate

The rate shall include the cost of materials and labour involved in all the operations described above.

16.43 PRECAST LIME FLY ASH CONCRETE BLOCKS

16.43.1 Material

Precast lime fly ash concrete blocks 1:2:3:6 (1 lime : 2 fly ash : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) finished with 10 mm, thick cement mortar 1:3 (1 cement : 3 coarse sand).

16.43.1.1 Laying : Prepare the sub grade with a hand rammer and laying 10 mm thick levelling course of fine sand (Jamuna sand). Laying the precast lime flyash concrete blocks as specified over base as described above and filling the joints with fine sand.

16.43.2 Measurement

Length breadth & thickness of block shall be measured of finished work. Correct to a cm. and calculated in cubic metre. Correct to two decimal places.

16.43.3 Rate

The rate shall include the cost of material & labour involved in all operations described above.

16.44 CONCERTINA COIL FENCING

16.44.1 Material : Angle iron post & strut shall be as specified in 16.18.

Concertina coil fencing shall be dia 610 mm (having 15 nos round per 6 mtre. length), spring core (2.5 mm thick) wire of high tensile strength of 165 kg./sq.mm with tape (0.52 mm thick) and weight 43.478 gm/metre.

16.44.2 Spacing of Posts & Struts: The spacing of posts shall be 2.4 m or 3.00 m apart centre to centre, unless otherwise specified or as per Engineer-in -Charge to suit the dimension of the area to be fenced. Every 15th last but one end posts and corner posts shall be struted on both sides and end posts on one side only.

16.44.3 Fixing of Posts and Struts : As specified in the 16.17.3.

16.44.4 Fixing Concertina coil fencing shall be fixed on angle iron shaped with 9 horizontal reinforced barbed tape (RBT) stud tied with GI staples and GI clips to retain horizontal including necessary bolts or GI barbed wire tied to angle iron all complete as per directions of Engineer-in-Charge with reinforced barbed tape.

16.44.5 Measurements

The length of fencing shall be measured correct to a cm. for finished work.

16.44.6 Rate

The rate shall include the cost of labour and materials involved in all the operation described above but excluding the cost of M.S. angle and excavation and concrete in foundation for which separate payment shall be made under respective items.

16.46 DENSE GRADED BITUMINOUS MACADAM (DBM)

16.46.1 Scope

Dense Bituminous Macadam (DBM) for use mainly but not exclusively, for in base/binder and profile corrective courses. DBM is also used as road base material. This work shall consist of construction in a single or multiple layers of DBM on a previously prepared base or sub-base. The thickness of a single layer shall be 50 mm to 100 mm.

16.46.2 Material

16.46.2.1 Bitumen: The bitumen shall be viscosity grade paving bitumen complying with the Indian Standard Specification IS:73, or as otherwise specified in the item. The type and grade of bitumen to be used shall be specified in the item of Contract. Where modified bitumen is specified, it shall conform to the requirements of IRC:SP:53 and IS:15462.

Section criteria for viscosity grade bitumen, based on highest and lowest daily mean temperatures at a particular site are given in **Table 16.40A**.

Selection criteria for modified bitumen shall be in accordance with IRC:SP53.

16.46.2.2 Coarse Aggregates : The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on the 2.36 mm IS Sieve. They shall be clean, hard, durable, or cubical shape, free from dust and soft or friable matter, organic or other deleterious substance. Before approval of the source, the aggregates shall be tested for stripping. The aggregates shall satisfy the physical requirements specified in **Table 16.35**, for dense bituminous macadam.

Where crushed gravel is proposed for use as aggregate, not less than 90% by weight of the crushed material retained on the 4.75 mm IS Sieve shall have at least two fractured faces.

16.46.2.3 Fine Aggregates: Fine aggregates shall consist of crushed or naturally occurring mineral material, or a combination of the two, passing the 2.36 mm IS Sieve and retained on the 75 micron sieve. These shall be clean, hard, durable, dry and free from dust and soft or friable matter, organic or other deleterious matter. Natural sand shall not be allowed in binder courses. However, natural sand upto 50 percent of the fine aggregate may be allowed in base courses.

The fine aggregate shall have a sand equivalent value of not less than 50 when tested in accordance with the requirements of IS 2720 (Part 37).

The plasticity index of the fraction passing the 0.425 mm IS Sieve shall not exceed 4, when tested in accordance with IS 2720 (Part 5).

TABLE 16.35
Physical Requirements for Coarse Aggregate for Dense Bituminous Macadam

<i>Property</i>	<i>Test</i>	<i>Specification</i>	<i>Method of Test</i>
Cleanliness (dust)	Grain size analysis ⁷	Max 5% passing 0.075mm sieve.	IS:2386 Part 1
Particle shape	Combined Flakiness and Elongation Indices*	Max 35%	IS:2386 Part 1
Strength	Los Angeles Abrasion Value or Aggregate Impact Value	Max 35% Max 27%	IS:2386 Part 4
Durability	Soundness either: Sodium Sulphate or Magnesium Sulphate	Max 12% Max 18%	IS:2386 Part 5
Water Absorption	Water Absorption	Max 2%	IS:2386 Part 3
Stripping	Coating and stripping of Bitumen aggregate Mix	Minimum retained coating 95%	IS:6241
Water sensitivity	Retained Tensile Strength**	Min 80%	AASHTO 283

* To determine this combined proportion, the flaky stone from a representative sample should first be separated out. Flakiness index is weight of flaky stone metal divided by weight of stone sample. Only the elongated particles be separated out from the remaining (non-flaky) stone metal. Elongation index is weight of elongated particles divided by total non-flaky particles. The values of flakiness index and elongation index so found are added up.

** If the minimum retained tensile test strength falls below 80 percent, use of anti stripping agent is recommended to meet the requirement.

16.46.2.4 Filler : Filler shall consist of finely divided mineral matter such as rock dust, hydrated lime or cement approved by the Engineer-in-Charge. The filler shall be graded within the limits indicated in **Table 16.36**.

TABLE 16.36
Grading Requirements for Mineral Filler

<i>Is Sieve (mm)</i>	<i>Cumulative per cent passing by weight of total aggregate</i>
0.6	100
0.3	95-100
0.075	85-100

The filler shall be free from organic impurities and have a plasticity index not greater than 4. The Plasticity Index requirements shall not apply if filler is cement or lime. Where the aggregates fail to meet the requirements of the water sensitivity test in Table 16.35, then 2 percent by total weight of aggregate, of hydrated lime shall be used and percentage of fine aggregate reduced accordingly.

16.46.2.5 Aggregate Grading and Binder Content : When tested in accordance with IS 2386 Part 1 (wet sieving method), the combined grading of the coarse and fine aggregates and added filler for the particular mixture shall fall within the limits shown in **Table 16.37** for dense bituminous macadam. To avoid gap grading the combined aggregate grading shall not vary from the low limit on one sieve to the high limit on the adjacent sieve.

TABLE 16.37
Composition of Dense Graded Bituminous Macadam Pavement Layers

Mix Designation	Grading 2
Nominal aggregate size*	26.5 mm
Layer Thickness	50-75 mm
IS Sieve ¹ (mm)	Cumulative % by weight of total aggregate passing
37.5	100
26.5	90-100
19	71-95
13.2	56-80
4.75	38-54
2.36	28-42
0.3	7-21
0.075	2-8
Bitumen content percent by mass of total mix (Marshall method)	Min 4.5** or as specified in the item
Bitumen grade	As specified in item or directed otherwise.

* The nominal maximum particle size is the largest specified sieve size upon which any of the aggregate is retained.

** Corresponds to specific gravity of aggregates being 2.7. In case aggregate have specific gravity more than 2.7, the minimum bitumen content can be reduced proportionately. Further the region where highest daily mean air temperature is 30° C or lower and lowest daily air temperature is – 10 ° C or lower, the bitumen content may be increased by 0.5 percent.

16.46.2.6 Bitumen content indicated in **Table 16.37** is the minimum quantity. The quantity shall be determined in accordance with the Mix Design. Para 16.46.3

16.46.3 Mix Design

The bitumen content required shall be determined following the Marshall mix design procedure contained in Asphalt Institute Manual MS-2.

The Fines to Bitumen (F/B) ratio by weight of total mix shall range from 0.6 to 1.2.

16.46.3.1 Requirement for the Mix: The mix shall meet the requirements as given in **Table 16.38**.

TABLE 16.38
Requirements for Dense Bituminous Macadam

Properties	Viscosity Grade Paving Bitumen	Modified bitumen		Test Method
		Hot climate	Cold climate	
Compaction level	75 blows on each face of the specimen			
Minimum stability (kN at 60° C)	9.0	12.0	10.0	AASHTO T245
Marshall flow (mm)	2 – 4	2.5 - 4	3.5 - 5	AASHTO T245
<div>Marshall Quotient</div> <div>Stability Flow</div>	2 – 5	2.5 - 5		MS-2 and ASTM D2041
% air voids	3 – 5			
% Voids Filled with Bitumen (VFB)	65 – 75			
Coating of aggregate particle	95% Min.			IS:6241
Tensile Strength ratio	80% Min.			AASHTO T283
% Voids in Mineral Aggregate (VMA)	Minimum percent voids in mineral aggregate (VMA) are set out in Table 16.40			

TABLE 16.39
Minimum Percent Voids in Mineral Aggregate (VMA)

Nominal Maximum Particle size ¹ (mm)	Minimum VMA, Percent Related to Design Percentage Air voids		
	3.0	4.0	5.0
26.5	11.0	12.0	13.0
37.5	10.0	11.0	12.0

Note: Interpolate minimum voids in the mineral aggregate (VMA) for designed percentage air voids values between those listed.

16.46.3.2 Binder Content : The binder content shall be optimized to achieve the requirements of the mix set out in Table 16.38. The binder content shall be selected to obtain 4 percent air voids in the mix design. The Marshall method for determining the optimum binder content shall be adopted as described in the Asphalt Institute Manual MS-2.

Where maximum size of the aggregate is more than 26.5 mm, the modified Marshall method using 150 mm diameter specimen described in MS-2 and ASTM D 5581 shall be used. This method requires modified equipment and procedures. When the modified Marshall test is used, the specified equipment and procedures. When the modified Marshall test is used, the specified minimum stability values in Table 16.39 as above shall be multiplied by 2.25 and the minimum flow shall be 3 mm.

16.46.3.3 Job Mix Formula : The contractor shall inform the Engineer-in-Charge in writing, at least 21 days before the start of the work, of the job mix formula proposed for use in the works, and shall give the details of Source and location of all materials, their sizes, grading, binder type and percentage by weight of total mix, Coarse aggregate / Fine aggregate / Mineral filler as percentage by weight of total aggregate including mineral filler and Mixing temperature and compacting temperature and test results.

While establishing the job mix formula, the Contractor shall ensure that it is based on a correct and truly representative sample of the materials that will actually be used in the work and that the mix and its different ingredients satisfy the physical and strength requirements of these Specifications.

Approval of the job mix formula shall be based on independent testing by the Engineer-in-Charge for which samples of all ingredients of the mix shall be furnished by the Contractor as required by the Engineer-in-Charge.

Job mix formula shall be revised if there is a change in source of material and be got approved by Engineer-in-Charge.

16.46.3.4 Plant Trials – Permissible Variation in Job Mix Formula: Once the laboratory job mix formula is approved, the Contractor shall carry out plant trials at the mixer to establish that the plant can be set up to produce a uniform mix conforming to the approved job mix formula. The permissible variations of the individual percentages of the various ingredients in the actual mix from the job mix formula to be used shall be within the limits as specified in Table 16.40.

TABLE 16.40
Permissible Variations in the Actual Mix from the Job Mix Formula

Description	Permissible Variation	
	Base/Binder Course	Wearing Course
Aggregate passing 19 mm sieve or larger	± 8%	± 7%
Aggregate passing 13.2 mm, 9.5 mm	± 7%	± 6%
Aggregate passing 4.75 mm	± 6%	± 5%
Aggregate passing 2.36 mm, 1.18 mm, 0.6 mm	± 5%	± 4%
Aggregate passing 0.3 mm, 0.15 mm	± 4%	± 3%
Aggregate passing 0.075 mm	± 2%	± 1.5%
Binder content	± 0.3%	± 0.3%
Mixing temperature	± 10°C	± 10°C

16.46.3.5 Laying Trials : Once the plant trials have been successfully completed and approved, the Contractor shall carry out laying trials, to demonstrate that the proposed mix can be successfully laid and compacted.

16.46.4 Construction Operations

16.46.4.1 Preparation of Base : The base on which DBM is to be laid shall be prepared, shaped and compacted to the required profile as appropriate or as directed by the Engineer-in-charge. The surface shall be thoroughly swept clean by a mechanical broom, and the dust removed by compressed air, in locations where mechanical broom cannot get access, other approved methods shall be used as directed by the Engineer-in-charge.

16.46.4.2 Tack Coat : Where the material on which the dense bituminous macadam is to be laid is **either** bitumen bound layer or primed granular layer, tack coat shall be applied as specified, in accordance with the provisions of **para 16.29**, or as directed by the Engineer-in-Charge.

16.46.4.3 Mixing and Transportation of the Mixture : The provisions are as specified in the **para 16.47.3.3** shall apply. **Table 16.41A** gives the mixing laying and rolling temperature for dense mixes using viscosity grade bitumen. In case of modified bitumen, the temperature of mixing and compaction shall be higher than the mix with viscosity grade bitumen. The exact temperature depends upon the type and amount of modifier used and shall be adopted as per the recommendations of the manufacturer. In order to have uniform quality, the plant shall be calibrated from time to time.

16.46.4.4 Spreading : The provisions are as specified in the **para 16.47.3.5** shall apply. The paver finisher shall be fitted with electronic sensor device.

16.46.4.5 Rolling/Compaction & Joints : The provisions are as specified in the **para 16.47.3.6 and 16.47.3.7** shall apply, as modified by the approved laying trials. The compaction process shall be carried out by the same plant, and using the same method, as approved in the laying trials, which may be varied only with the express approval of the Engineer-in-charge in writing.

16.46.5 Opening to Traffic : The newly laid surface shall not be open to traffic for at least 24 hours after laying the completion of compaction, without the approval of the Engineer-in-Charge in writing, on the surface until the DBM layer has cooled to the ambient temperature.

16.46.6 Surface Finish and Quality Control of Work : The surface finish of the completed construction shall conform to the requirements of section 900 of MORTH Specifications. For control of the quality of materials supplied and the works carried out the relevant provisions of Section 900 of MORTH Specifications.

16.46.7 Arrangement for Traffic : During the period of construction, arrangements for traffic shall be made in accordance with the provisions of specification and as per direction of the Engineer-in-charge.

16.46.8 Measurement

Dense Bituminous Macadam shall be measured as finished work in cubic meters, correct to two places of decimal.

16.46.9 Rate

The rate includes the cost of all material, labour, machineries and equipments in all the operations described above.

16.47 BITUMINOUS MACADAM

16.47.1 Scope

This work shall consist of construction in a single course having 60 mm to 100 mm thickness or in multiple courses of compacted crushed aggregates premixed with a bituminous binder on a previously prepared base to the requirements of these Specifications. Since the bituminous macadam is an open-graded mix, there is a potential that it may trap water or moisture vapour within the pavement system. Therefore, adjacent layer (shoulders) should have proper drainage quality to prevent moisture-induced damage to the BM.

16.47.2 Material

16.47.2.1 Bitumen : The bitumen shall be viscosity grade paving bitumen complying with the Indian Standard Specification IS:73, or as otherwise specified in the item. The type and grade of bitumen to be used shall be specified in the Contract. The type and grade of bitumen to be used would depend upon the climatic conditions and the traffic. Guidelines for selection of bitumen are given in **Table 16.40A**.

Table 16.40A
Selection Criteria For Viscosity-Graded (VG) Paving Bitumen Based On
Climatic Conditions

Lowest Daily Mean Air Temperature °C	Highest Daily Mean Air Temperature, °C		
	Less than 20°C	20 to 30°C	More than 30°C
More than -10°C	VG-10	VG-20	VG-30
-10°C or lower	VG-10	VG-10	VG-20

16.47.2.2 Coarse Aggregates - same as 16.46.2.2 excepting strength which shall be max 40% for Los Angeles Abrasion Value and Aggregate Impact Value of max 30%.

16.47.2.3 Fine Aggregates : Same as 16.46.2.3.

16.47.2.4 Proportioning of Material:

The combined aggregate grading shall not vary from the lower limit on one sieve to the higher limit on the adjacent sieve to avoid gap grading. The aggregate may be proportioned and blended to produce a uniform mix complying with the requirements in Table 16.41. The bitumen content and appropriate thickness are as per Table 16.41.

TABLE 16.41
Composite of Bituminous Macadam

Mix Designation	Grading 2
Nominal maximum aggregate size*	19 mm
Layer Thickness	50-75 mm
IS Sieve (mm)	Cumulative % by weight of total aggregate passing
26.5	100
19	90-100
13.2	56-88
4.75	16-36
2.36	4-19
0.3	2-10
0.075	0-8
Bitumen content** percent by mass to total mix	3.4** or as specified in the item
Bitumen grade	As specified in item or directed otherwise

* Nominal maximum aggregate size is the largest specified sieve size upon which any of the aggregate material is retained.

** Corresponds to specific gravity of the Aggregate being 2.7. In case aggregates have specific gravity more than 2.7, bitumen content can be reduced proportionately. Further, for regions where highest daily mean air temperature is 30° C or lower and lowest daily mean air temperature is – 10° C or lower, the bitumen content may be increased by 0.5 percent.

16.47.2.5 Aggregate Grading and Binder Content : When tested in accordance with IS 2386 Part 1 (wet sieving method), the combined grading of the coarse and fine aggregates and added filler for the particular mixture shall fall within the limits shown in Table 16.41 for bituminous macadam.

16.47.3 Construction Operation

16.47.3.1 Preparation of the Base: The base on which bituminous macadam is to be laid shall be prepared, shaped and compacted to the required profile as appropriate, and a prime coat, shall be applied as specified, in accordance with the provisions or as directed by the Engineer-in-charge. The surface shall be thoroughly swept clean by a mechanical broom, and the dust removed by compressed air, in locations where mechanical broom cannot get access, other approved methods shall be used as directed by the Engineer-in-charge.

16.47.3.2 Tack Coat : Where the material on which the bituminous macadam is to be placed is bitumen bound surface, a tack coat shall be applied as specified, in accordance with **Para 16.29**, or as directed by the Engineer-in-Charge.

16.47.3.3 Mixing and Transportation of the Mixture : Pre-mixed bituminous materials, shall be prepared in a hot mix plant of adequate capacity and capable of yielding a mix of proper and uniform quality with thoroughly

coated aggregates. Appropriate mixing temperatures are given in **Table 16.41A** of these Specifications; the difference in temperature between the binder and aggregate should at no time exceed 14°C. In order to ensure uniform quality of the mix and better coating of aggregates, the hot mix plant shall be calibrated from time to time. The essential features of the hot mix plants are given in Annex. A of IRC:27.

If a continuous type mixing plant is used, the Contractor must demonstrate by laboratory analysis that the cold feed combined grading is within the grading limits specified for that bituminous bound material. In the case of a designed job mix, the bitumen and filler content shall be derived using this combined grading.

Bituminous materials shall be transported in clean insulated vehicles, and unless otherwise agreed by the Engineer, shall be covered while in transit or awaiting tipping. Subject to the approval of the Engineer, a thin coating of diesel or lubricating oil may be applied to the interior of the vehicle to prevent sticking and to facilitate discharge of the material.

TABLE 16.41A
Mixing, Laying and Rolling Temperatures for Bituminous Mixes (Degree Celsius)

Bitumen Viscosity Grade	Bitumen Temperature	Aggregate Temperature	Mixed Material Temperature	Laying Temperature	*Rolling Temperature
VG-40	160-170	160-175	160-170	150 Min.	100 Min.
VG-30	150-165	150-170	150-165	140 Min.	90 Min.
VG-20	145-165	145-170	145-165	135 Min.	85 Min.
VG-10	140-160	140-165	140-160	130 Min.	80 Min.

* Rolling must be completed before the mat cools to these minimum temperatures.

16.47.3.4 Cleaning of Surface : The surface on which the bituminous work is to be laid shall be cleaned of all loose and extraneous matter by means of a mechanical broom and air jet. or any other approved equipment/ method as specified in the contract. The use of a high pressure air jet from a compressor to remove dust or loose matter shall be available full time on the site, unless otherwise specified in the Contract.

16.47.3.5 Spreading : Prior to spreading the mix, the base shall be prepared by carrying out the required operation. Except in areas where a mechanical paver cannot get access, bituminous materials shall be spread, leveled and tamped by an approved self-propelled paving machine equipped with an electronic sensing device. The essential features of the paver finisher shall conform to Annex A of IRC:27. As soon as possible after arrival at site, the materials shall be supplied continuously to the paver and laid without delay.

The rate of delivery of material to the paver shall be regulated to enable the paver to operate continuously. The travel rate of the paver, and its method of operations, shall be adjusted to ensure an even and uniform flow of bituminous material across the screed, free from dragging, tearing and segregation of the material. In areas with restricted space where a mechanical paver cannot be used, the material shall be spread, raked and leveled with suitable hand tools by experienced staff, and compacted to the satisfaction of the Engineer-in-charge.

The minimum thickness of material laid in each paver pass shall be in accordance with the minimum values given in the relevant parts of these Specifications. When laying binder course or wearing course approaching an expansion joint of a structure, machine laying shall stop 300 mm short of the joint. The remainder of the pavement up to the joint, and the corresponding area beyond it, shall be laid by hand, and the joint or joint cavity shall be kept clear of surfacing material.

Bituminous material, with a temperature greater than 145°C, shall not be laid or deposited on bridge deck waterproofing systems, unless precautions against heat damage have been approved by the Engineer-in-charge.

16.47.3.6 Rolling/ Compaction : Bituminous materials shall be laid and compacted in layers which enable the specified thickness, surface level, regularity requirements and compaction to be achieved.

Compaction of bituminous materials shall commence as soon as possible after laying. Compaction shall be substantially completed before the temperature falls below the minimum rolling temperatures stated in the relevant part of these Specifications. Rolling of the longitudinal joints shall be done immediately behind the paving operation. After this, rolling shall commence at the edges and progress towards the center longitudinally except that on super elevated and unidirectionally cambered portions, it shall progress from the lower to the upper edge parallel to the center line of the pavement. Rolling shall continue until all roller marks have been removed from the surface. All deficiencies in the surface after laying shall be made good by the attendants behind the paver, before initial rolling is commenced. The initial or breakdown rolling shall be done with 8 – 10 tonnes dead weight smooth-wheeled rollers. The intermediate rolling shall be done with 8 – 10 tonnes dead weight or vibratory roller or with a pneumatic tyred roller of 12 to 15 tonnes weight having nine wheels, with a tyre pressure of at least 5.6 kg/sqcm or 0.56 MPa. The finish rolling shall be done with 6 to 8 tonnes smooth wheeled tandem rollers. Rolling shall be continued until the specified density is achieved, or where no density is specified, until there is no further movement under the roller.

Where compaction is to be determined by density of cores the requirements to prove the performance of rollers shall apply in order to demonstrate that the specified density can be achieved. In such cases the Contractor shall nominate the plant, and the method by which he intends to achieve the specified level of compaction and finish at temperatures above the minimum specified rolling temperature. Laying trials shall then demonstrate the acceptability of the plant and method used.

Bituminous materials shall be rolled in a longitudinal direction, with the driven rolls nearest the paver. The roller shall first compact material adjacent to joints and then work from the lower to the upper side of the layer, overlapping on successive passes by at least one-third of the width of the rear roll or, in the case of a pneumatic-tyred roller, at least the nominal width of 300 mm.

In portions with super elevated and unidirectional camber, after the edge has been rolled, the roller shall progress from the lower to the upper edge.

Rollers should move at a speed of not more than 5 km per hour. The roller shall not be permitted to stand on pavement which has not been fully compacted, and necessary precautions shall be taken to prevent dropping of oil, grease, petrol or other foreign matter on the pavement either when the rollers are operating or standing. The wheels of rollers shall be kept moist with water, and the spray system provided with the machine shall be in good working order, to prevent the mixture from adhering to the wheels. Only sufficient moisture to prevent adhesion between the wheels of rollers and the mixture should be used. Surplus water shall not be allowed to stand on the partially compacted pavement.

16.47.3.7 Joints : Where joints are made, the material shall be fully compacted and the joint made flush in one of the following ways:

- (a) All joints shall be cut vertical to the full thickness of the previously laid mix. All loosened material shall be discarded and the vertical face coated with a suitable viscosity grade hot bitumen, or cold applied emulsified bitumen. While spreading the material along the joint the material spread shall overlap 25 mm to 50 mm on the previously laid mix beyond the vertical face of the joint. The thickness of the loose overlap material should be approximately a quarter more than the final compacted thickness. The overlapped mix shall be dragged back to the hot lane so that the roller can press the small excess into the hot side of the joint to obtain a high joint density.
- (b) By using two or more pavers operating in echelon, where this is practicable, and in sufficient proximity for adjacent widths to be fully compacted by continuous rolling

All longitudinal joints shall be offset at least 300 mm from parallel joints in the layer beneath or as directed, and in a layout approved by the Engineer-in-charge. Joints in the wearing course shall coincide with either the lane edge or the lane marking, whichever is appropriate. Longitudinal joints shall not be situated in wheel track zones.

16.47.3.8 Opening to Traffic : The newly laid surface shall not be open to traffic for at least 24 hours after laying the completion of compaction, without the approval of the Engineer-in-Charge in writing.

16.47.3.9 Surface Finish and Quality Control of Work : The surface finish of the completed construction shall conform to the requirements of section 900 of MORTH Specifications. For control of the quality of materials supplied and the works carried out the relevant provisions of Section 900 of MORTH Specifications.

16.47.3.10 Arrangement for Traffic : During the period of construction, arrangements for traffic shall be made in accordance with the provisions of specification and as per direction of the Engineer- in-charge.

16.47.4 Measurement : Bituminous Macadam shall be measured as finished work in cubic meters correct to two places of decimal.

16.47.5 Rate : The rate includes the cost of all material, labour, machineries and equipments in all the operations described above.

16.48 DENSE BITUMINOUS CONCRETE

16.48.1 Scope

Dense Bituminous Concrete (DBC), is used in wearing and profile corrective courses. This work shall consist of construction in a single layer of bituminous concrete on a previously prepared bituminous bound surface. A single layer in a single layer shall be 30 mm / 40 mm / 50 mm thick.

16.48.2 Materials

16.48.2.1 Bitumen: The bitumen shall be viscosity grade paving bitumen complying with the Indian Standard Specification IS:73, or as otherwise specified in the item. The type and grade of bitumen to be used shall be specified in the item of Contract. Where modified bitumen is specified, it shall conform to the requirements of IRC:SP:53 and IS:15462.

Section criteria for viscosity grade bitumen, based on highest and lowest daily mean temperatures at a particular site are given in **Table 16.40A**.

Selection criteria for modified bitumen shall be in accordance with IRC:SP53.

16.48.2.2 Coarse Aggregates : Same as specified in para 16.46.2.2 excepting strength which shall be max 30% for Los Angeles Abrasion Value and Aggregate Impact Value of max 24%. Where crushed gravel is proposed for use as aggregate, not less than 95 percent by weight of the crushed material retained on the 4.75 mm sieve shall have at least two fractured faces.

16.48.2.3 Fine Aggregates : The fine aggregates shall be all as specified in para 16.46.2.3.

16.48.2.4 Filler : Filler shall be generally as specified in para 16.46.2.4.

16.48.2.5 Aggregate Grading and Binder Content : When tested in accordance with IS 2386 part 1 (wet grading method), the combined grading of the coarse and fine aggregates and added filler shall fall within the limits shown in Table No. 16.42 for grading 1 or 2 specified in the contract.

TABLE NO. 16.42
Composition of Bituminous Concrete Pavement Layers

<i>Grading</i>	<i>1</i>	<i>2</i>
Nominal aggregate size*	19 mm	13.2 mm
Layer Thickness	50 mm	30-40 mm
IS Sieve ¹ (mm)	Cumulative % by weight of total aggregate passing	
45	-	-
37.5	-	-
26.5	100	-
19	90-100	100
13.2	59-79	90-100
9.5	52-72	70-88
4.75	35-55	53-71
2.36	28-44	42-58
1.18	20-34	34-48
0.6	15-27	26-38
0.3	10-20	18-28
0.15	5-13	12-20
0.075	2-8	4-10
Bitumen content % by mass of total mix	Min. 5.2* or as specified in the item	Min. 5.4** or as specified in the item
Bitumen grade	Specified in item or directed otherwise	Specified in item or directed otherwise

* The nominal maximum particle size is the largest specified sieve size upon which any of the aggregate is retained.

** Corresponds to specific gravity of aggregates being 2.7. In case aggregate have specific gravity more than 2.7, the minimum bitumen content can be reduced proportionately. Further the region where highest daily mean air temperature is 30° C or lower and lowest daily air temperature is – 10 ° C or lower, the bitumen content may be increased by 0.5 percent.

16.48.3 Mix Design

The bitumen content required shall be determined following the Marshall mix design procedure contained in Asphalt Institute Manual MS-2.

The Fines to Bitumen (F/B) ratio by weight of total mix shall range from 0.6 to 1.2.

16.48.3.1 Requirements for the Mix : Same as specified in **Para 16.46.3.1** shall apply.

16.48.3.2 Binder Content : Same as specified in **para 16.46.3.2**.

16.48.3.3 Job Mix Formula : The procedure for formulating the job mix formula shall be generally as specified in **Para 16.46.3.3**.

16.48.3.4 Plant Trials – Permissible Variation In Job Mix Formula : The requirements for plant trials shall be as specified in **Para 16.46.3.4** and permissible limit for variation as given in **Table 16.43**.

TABLE 16.43
Permissible Variations in the Plant Mix from the Job Mix Formula

<i>Description</i>	<i>Permissible Variation</i>
Aggregate passing 19 mm sieve or larger	± 7%
Aggregate passing 13.2 mm, 9.5 mm	± 6%
Aggregate passing 4.75 mm	± 5%
Aggregate passing 2.36 mm, 1.18 mm, 0.6 mm	± 4%
Aggregate passing 0.3 mm, 0.15 mm	± 3%
Aggregate passing 0.075 mm	± 1.5%
Binder content	± 0.3%
Mixing temperature	± 10°C

16.48.3.5 Laying Trials : The requirements for laying trials be as specified in **Para 16.46.3.5**. The compacted layers of bituminous concrete (BC) shall have a minimum field density equal to or more than 92 percent of the average theoretical maximum specific gravity (Gmm) obtained on the day of compaction in accordance with ASTM D2041.

16.48.4 Construction Operations

16.48.4.1 Preparation of Base : The base on which DBC is to be laid shall be prepared, shaped and compacted to the required profile as appropriate or as directed by the Engineer-in-charge. The surface shall be thoroughly swept clean by a mechanical broom, and the dust removed by compressed air, in locations where mechanical broom cannot get access, other approved methods shall be used as directed by the Engineer-in-charge.

16.48.4.2 Tack Coat : Where the material on which the bituminous macadam is to be placed is bitumen bound surface, a tack coat shall be applied as specified, in accordance with **Para 16.29**, or as directed by the Engineer-in-Charge..

16.48.4.3 Mixing and Transportation of the Mixture : The provisions are same as specified in **Para 16.47.3.3** shall apply.

16.48.4.4 Spreading : The provisions are same as specified in **Para 16.47.3.5** shall apply.

16.48.4.5 Rolling/ Compaction : The provisions are same as specified in **Para 16.47.3.6** shall apply.

16.48.5 Opening to Traffic : The newly laid surface shall not be open to traffic for at least 24 hours after laying the completion of compaction, without the approval of the Engineer-in-Charge in writing.

16.48.6 Surface Finish and Quality Control of Work : The surface finish of the completed construction shall conform to the requirements of section 900 of MORTH Specifications. For control of the quality of materials supplied and the works carried out the relevant provisions of Section 900 of MORTH Specifications

16.48.7 Arrangement for Traffic : During the period of construction, arrangements for traffic shall be made in accordance with the provisions of specification and as per direction of the Engineer-in-charge.

16.48.8 Measurement

Dense Bituminous Concrete shall be measured as finished work in cubic meters, correct to two places of decimal.

16.48.9 Rate

The rate includes the cost of all material, labour, machineries and equipments in all the operations described above.

16.49 RETRO REFLECTIVE SIGNBOARD**16.49.0 General**

The colour, configuration, size and location of all the traffic signs for highways other than Express ways shall be in accordance with the code of practice for road signs, IRC:67 or as shown on the drawings. For expressways, the size of the signage, letters and their placement shall be as specified in the contract drawings and relevant specifications or as directed by the Engineer-in-Charge.

16.49.1 Materials**16.49.1.1 Concrete**

Concrete shall be of M-25 grade.

16.49.1.2 Reinforcing steel

Reinforcing steel shall confirm to the requirement of IS 1786 unless otherwise specified.

16.49.1.3 Bolts Nuts and Washers

High strength bolts shall confirm to IS 1367 whereas precision bolts, nuts etc. shall confirm to IS 1364.

16.49.1.4 Plates and Supports

Plates and support sections for the sign posts shall confirm to IS 226 and IS 2062 or any other stated IS specification.

16.49.1.5 Substrata

The substrate shall be either aluminium sheeting or aluminium composite material (ACM) confirming to following sub-sections.

16.49.1.5.1 Aluminium

Aluminium sheets used for sign boards shall be of smooth, hard and corrosion resistant aluminium alloy confirming to IS 736 material designation 24345 or 1900.

16.49.1.5.2 Aluminium composite materials

- (i) The Aluminum Composite Material (ACM), used as the substrate for signage application shall have a thickness of at least 4.0mm (excluding coating thickness).
- (ii) The ACM shall be composed of thermoplastic core of “Low Density Polyethylene’ (LDPE) of 3.0mm thickness sandwiched between two thick sheets of aluminium, of 3003 grade and H- 18 temper and minimum thickness of 0.5mm each. The retro reflection sheeting must be applied on the top surface with aluminium surface with recommended surface preparation from sheeting manufactures.
- (iii) A fluorocarbon coating may be applied over the exposed surface of aluminum to ensure corrosion resistance and weather proof and thus shall confirm to relevant ASTM.
- (iv) The ACM shall have a high-surface energy coating on the top surface, over which the retro reflective sheeting shall be applied.
- (v) When measured after 24 hrs after application, the 90 peel-adhesion strength of the top surface of ACM with the retro reflective sheeting applied on it using a 2kg roller as per ASTM D3330 shall be at least 1.5 kg-f.

- (vi) The front surface shall have no other coating other than the high-surface energy coating and shall be protected with a self-adhesive peel-off film. The retro reflective sheeting shall be applied only on the top surface with high-surface energy coating.
- (vii) On the back surface, it shall have a polyester based service coating preferably grey in color to protect against possible corrosion and to avoid undesired glare from the rear side of the sign.
- (viii) The mechanical properties of 4mm ACM and that of its aluminium skim shall confirm to the requirement given in table 16.44 below. When tested accordance with the test methods mentioned against each of them.

Table 16.44
Specification for Aluminium Composite Material (ACM)

S. No.	Description	Specification for 4mm	
		Standard Test	Acceptable Value/Results
A	Physical Tests for ACM		
1	Over all thickness of ACM	Measurement	4mm (Tolerance + 0.2mm)
2	Aluminium Skin thickness (each side)	Measurement	0.5mm (Tolerance +/- 0.03mm)
	Panel weight (ACM)	Measurement	5.5 Kg/m ² (+ 5%)
B	Mechanical Properties of ACM		
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm
2	Tensile strength	ASTM E638	Min. 40 N/mm ²
3	0.2% Proof Stress	ASTM E638	Min. 34 N/mm ²
4	Elongation	ASTM E638	Min. 6%
5	Flexural strength	ASTM C393	Min. 130 N/mm ²
5	Shear strength with punch shear test	ASSTM D732	Min. 18 N/mm ²
C	Properties of Aluminium skin		
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²
2	Modules of elasticity	ASTM E8	Min 70000 N/mm ²
3	Elongation	ASTM E8	Min. 2%
4	0.2% proof stress	ASTM E8	Min. 110 N/mm ²
D	Properties of High surface energy coating		
1	(90 deg) Peel adhesion strength of Retroreflective sheeting on ACM surface with high-surface energy coating	ASTM D330	Min. of 1.5 kgf i.e. Equal to or more than that with surface prepared aluminium

16.49.1.5.3 Performance Certificate

Requisite performance certificate from the manufacturer of the ACM stating compliance with ACM technical specification as per Table 16.44 above shall be submitted by the contractor to the Engineer- in-Charge.

16.49.1.6 Retro- Reflective Sheeting (Type-XI Prismatic Grade sheeting): (AS per IRC 67-2012 Clause 6.7)

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and

its having passed these tests shall be obtained from International / Government Laboratory / Institute by the manufacturer of the sheeting and in case the certificate is obtained from international agency, it should also be obtained from Indian agency within 3 years of launching of product by the manufacture in abroad. Alternatively, a certificate conforming to ASTM Specification (D 4956-09) on artificial accelerated weathering requirements from a reputed laboratory in India can be accepted provisionally. In such a situation, the Employer/ Client, if so desires, could seek for a performance guarantee which would be released after receipt of certificate meeting the requirement of three years outdoor weathering of the sheeting.

Retro-reflective sheeting is typically manufactured as a cube corner. The reflective sheeting shall be retro-reflective sheeting made of micro prismatic retro-reflective material. The retro-reflecting surface after cleaning with soap and water and in dry condition shall have minimum co-efficient of retro reflection (determined in accordance with ASTM D4956-09) confirming to IRC:67 Table 6.9.

When totally wet, the sheeting shall not show less than 90 per cent of the values of retro-reflection. At the end of 10 years the sheeting shall return at least 80 per cent of its original retro-reflectance.

16.49.1.7 Adhesives : The sheeting shall have a pressure-sensitive adhesive of the aggressive- tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer and approved by Engineer-in-Charge. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The Adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturers specifications.

16.49.2 Installation

16.49.2.1 Surface to be reflectorised shall be effectively prepared to receive the retro- reflective sheeting. The Aluminium / ACP sheeting shall be de-greased either by acid or hot alkaline etching and all scale/ dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. Complete sheet of the material shall be used on the signs except where it is unavoidable. Sheeting with heat-activated adhesives may be spliced with an overlap not less than 5 mm or butted with a gap not exceeding 0.75 mm. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds.

16.49.2.2 Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind load or displacement by vandalism. Normally, sign with an area upto 0.9 sq.m shall be mounted on a single post and for greater area two or more supports shall be provided. Sign supports shall be as specified in item or as per directions of Engineer-in-Charge. The work of foundation shall conform to relevant specification as specified.

16.49.2.3 Backside of aluminium sheet portion shall be painted with two coats of epoxy paint. Any part and support frame with two or more coats of synthetic enamel paint.

16.49.3 Performance Certificate

Requisite performance certificate from the manufacturer of the ACM stating compliance with ACM technical specification as per Table 16.44 above shall be submitted by the contractor to the Engineer- in-Charge.

16.49.4 Warranty and Durability

The Contractor shall obtain from the manufacturer a ten year warranty as per IRC:67 for satisfactory performance including stipulated retro-reflectance of the retro-reflective sheeting, the screen printed areas and cut out sheeting and cut out durable transparent overlay film and submit the same to the Engineer-in-Charge.

Processed and applied in accordance with recommended procedures, the reflective material shall be weather resistant and following cleaning, shall show no appreciable discoloration, cracking, blistering or dimensional change and shall not have less than 50 percent of the specified minimum reflective intensity values when subjected to accelerated weathering of 1000 hours, using type E or EH Weather meter (AASHTO Designation M 268).

16.49.5 Measurement

These shall be measured in square meters upto two place of decimal.

16.49.6 Rate

The rate includes the cost of materials labour and equipments involved in all the operations described above except **16.49.1.1 to 16.49.1.4**.

16.50 RETRO REFLECTIVE OVERHEADSIGNAGE

16.50.0 General

Overhead signs may be used in lieu of, or as an adjunct to, ground signs where the situation so warrants for proper information and guidance of the road user.

The support system should be properly designed based on sound engineering principles, to safely sustain the dead load, live load and wind load on the completed sign system. For this purpose, the overhead signs shall be designed to withstand a wind loading of 150 kg/m² normal to the face of the sign and 30 kg/m² transverse to the face of the sign. In addition to the dead load of the structure, walkway loading of 250kg concentrated live load shall also be considered for the design of the overhead sign structure.

16.50.1 Height

Overhead signs shall provide a vertical clearance of not less than 5.5 m over the entire width of the pavement and shoulders except where a lesser vertical clearance is used for the design of other structures. The vertical clearance to overhead sign structures or supports need not to be greater than 300 mm in excess of the minimum design clearance of other structures.

16.50.2 Lateral Clearance

16.50.2.1 The minimum clearance outside the usable roadway shoulder for expressway sign mounted at the road side or for overhead sign supports either to the right or left side of the roadways shall be 1.80 m. This minimum clearance of 1.80 m shall also apply outside of an unmountable kerb. Where practicable, a sign should not be less than 3 m from the edge of the nearest traffic lane.

16.50.2.2 Where a median is 3.6 m or less in width, consideration should be given to spanning over both roadways without a central support. Where overhead sign supports cannot be placed at a safe distance away from the line of traffic or in an otherwise protected site, they should either be so designed as to minimize the impact forces or protect motorists adequately by a physical barrier or guard rail of suitable design.

16.50.3 Number of Signs at an Overhead Installation

In no case should there be more than three signs displayed at any one location, including regulatory or warning signs, either on the overhead structure or on its support.

16.50.4 Materials for Overhead Sign and Support Structures

16.50.4.1 Aluminium alloy or galvanized steel to be used as truss design supports shall conform to relevant IS. These shall be of sections and type as per structural design requirements as shown on the plans.

16.50.4.2 Plates and support sections for sign posts shall conform to IS 226 and IS 2062.

16.50.4.3 The overhead signs shall be reflectorised with high intensity retro-reflective sheeting of encapsulated lens type.

16.50.5 Size, Locations, etc of Signs

16.50.5.1 The size of the signs, letter and their placement shall be as specified in the Contract drawings and specifications as per direction of Engineer-in-Charge.

16.50.6 Installation

16.50.6.1 The supporting structure and signs shall be fabricated and erected as per details given in the plans.

16.50.6.2 Sign posts, their foundations and sign mountings shall be so constructed as to hold sign in a proper and permanent position to adequately resist swaying in the wind or displacement by vandalism.

16.50.6.3 The work of construction of foundation for sign supports including excavation and backfill, forms, steel reinforcement, concrete and its placement shall conform to the relevant specifications given in this specification.

16.50.6.4 The structures shall be erected with the specified camber and in such a manner as to prevent excessive stresses, injury and defacement.

16.50.6.5 Brackets shall be provided for mounting signs of the type to be supported by the structure. For better visibility, they shall be adjustable to permit mounting the sign faces at any angle between a truly vertical position and three degree from vertical. This angle shall be obtained by rotating the front lower edge of the sign forward. All brackets shall be of a length equal to the heights of the signs being supported.

16.50.6.6 Before erecting support structures, the bottom of each base plate shall be protected with an approved material which will adequately prevent any harmful reaction between the plate and the concrete.

16.50.6.7 The end supports shall be plumbed by the use of levelling nuts and the space between the foundation and base plate shall be completely filled with an anti-shrink grout.

16.50.6.8 Anchor bolts for sign supports shall be set to proper locations and elevation with templates and carefully checked after construction of the sign foundation and before the concrete has set.

16.50.6.9 All nuts on aluminium trusses, except those used on the flanges, shall be tightened only until they are snug. This includes the nuts on the anchor bolts. A thread lubricant shall be used with each aluminium nut.

16.50.6.10 All nuts on galvanized steel trusses, with the exception of high strength bolt connections, shall be tightened only to a snug condition.

16.50.6.11 Field welding shall not be permitted.

16.50.6.12 After installation of signs is completed; the sign shall be inspected by the Engineer. If specular reflection is apparent on any sign, its positioning shall be adjusted by the Contractor to eliminate or minimize this condition.

16.50.7 Measurement

These shall be measured in sq.meter upto two place of decimal.

16.50.8 Rate

The rate includes the cost of materials, labour and equipments involved in all the operations described above.

16.51 ROAD MARKINGS STRIPS

The colour width and layout of road markings shall be in accordance with the Code of Practice for Road Markings with paints, IRC : 35, and as specified in the drawings or as directed by the Engineer- in-Charge.

16.51.1 Materials

Road markings shall be of ordinary road marking paint (retro-reflective), hot applied thermoplastic compound as specified in the item.

16.51.2 Hot Applied Thermoplastic Road Marking

General

- (i) The thermoplastic material shall be homogenously composed of aggregate, pigment, resins and glass reflectorizing beads.
- (ii) The thermoplastic compound shall be screeded/extruded on to the pavement surface in a molten state by suitable machine capable of controlled preparation and laying with surface application of glass beads at a specific rate. Upon cooling to ambient pavement temperature, it shall produce an adherent pavement marking of specified thickness and width and capable of resisting deformation by traffic.
- (iii) The thermoplastic material shall conform to ASTM D36/BS-3262-(Part I).
- (iv) The material shall meet the requirements of these specifications for a period of one year. The thermoplastic material must also melt uniformly with no evidence of skins or unmelted particles for the one year storage period. Any material not meeting the above requirements shall be replaced by the manufacturer/supplier/Contractor.
- (v) **Marking** : Each container of the thermoplastic material shall be clearly and indelibly marked with the following information:
 - 1. The name, trade mark or other means of identification of manufacturer.
 - 2. Batch number
 - 3. Date of manufacture
 - 4. Colour (White or yellow)
 - 5. Maximum application temperature and maximum safe heating temperature.
- (vi) **Sampling and Testing** : The thermoplastic material shall be sampled and tested in accordance with the appropriate ASTM/BS method. The Contractor shall furnish to the Engineer-in-Charge a copy of certified test reports from the manufacturers of the thermoplastic material showing results of all tests specified herein and shall certify that the material meets all requirements of this Specification.

16.51.3 Preparation

- (i) The material shall be melted in accordance with the manufacturer's instructions in a heater fitted with a mechanical stirrer to give a smooth consistency to the thermoplastic material to avoid local overheating. The temperature of the mass shall be within the range specified by the manufacturer, and shall on no account be allowed to exceed the maximum temperature stated by the manufacturer. The molten material should be used as expeditiously as possible and for thermoplastic material which has natural binders or is otherwise sensitive to prolonged heating, the material shall not be maintained in a molten condition for more than 4 hours.
- (ii) After transfer to the laying equipment, the material shall be maintained within the temperature range specified by the manufacturer for achieving the desired consistency for laying.

6.51.4 Properties of Finished Road Marking

- (a) The stripe shall not be slippery when wet.
- (b) The marking shall not lift from the pavement in freezing weather.
- (c) After application and proper drying, the stripe shall show no appreciable deformation or discolouration under traffic and under road temperatures upto 60°C.
- (e) The marking shall not deteriorate by contact with sodium chloride, calcium chloride or oil drippings from traffic. The stripe or marking shall maintain its original dimensions and position. Cold ductility of the material shall be such as to permit normal movement with the road surface without chopping or cracking.
- (f) The colour of yellow marking shall conform to IS Colour No. 356 as given in IS 164.

16.51.5 Application

Marking shall be done by fully /semi automatic paint applicator machine fitted with profile shoe, glass beads dispenser, propane tank heater and profile shoe heater, driven by experienced operator as specified in item. For locations where painting cannot be done by machine, approved manual methods shall be used with prior approval of the Engineer-in-charge. The Contractor shall maintain control over traffic while painting operations are in progress so as to cause minimum inconvenience to traffic compatible with protecting the workmen.

The thermoplastic material shall be applied hot either by screeding or extrusion process. After transfer to the laying apparatus, the material shall be laid at a temperature within the range specified by the manufacturer or otherwise directed by the Engineer-in-Charge for the particular method of laying being used. The paint shall be applied using a screed or extrusion machine.

The pavement temperature shall not be less than 10°C during application. All surfaces to be marked shall be thoroughly cleaned of all dust, dirt, grease, oil and all other foreign matter before application of the paint.

Thermoplastic paint shall be applied in intermittent or continuous lines of uniform thickness of at least 2.5 mm unless specified otherwise. Where arrows or letters are to be provided, thermoplastic compound may be hand-sprayed.

The minimum thickness specified is exclusive of surface applied glass beads.

The finished lines shall be free from ruggedness on sides and ends and be parallel to the general alignment of the carriageway. The upper surface of the lines shall be level, uniform and free from streaks.

16.51.6 Measurements for Payment

The painted markings shall be measured in sq. metres of actual area marked (excluding the gaps, if any) correct upto the two places of decimal.

16.51.7 The rate include the cost of all materials, labour and equipments required in all the above operations.

16.52 KERB CHANNEL OF CEMENT CONCRETE

Base : The base of the channel to be of the 75 mm compacted thick dry brick ballast 40 mm nominal size well rammed and consolidated and grouted with fine sand.

Kerb channel shall be provided in cement concrete of specified grade. These shall be cast in-situ of specified size as given in the item. Top surface of channel to be finished smooth.

Measurements : Cement concrete channel shall be measured in metre of length of the completed channel correct upto two places of decimal.

Rate : The rate includes the cost of all the materials, labours and tools required in all the operations described above.

16.53 75 MM THICK COMPACTED BED OF DRY BRICK BALLAST

16.53.1 Collection of Material

Before the start of work brick aggregate 40 mm nominal size unless specified otherwise, shall be stacked for the entire work and record measurements done as per para 16.4.

16.53.2 Preparation of Sub Grade

The formation for a width equal to that of the area shall be cut to the depth below the proposed finish level, equal to the thickness of the course of brick aggregate (due allowance being made for consolidation) and dress off in level to the finished profile. In case of made up soil, copious water shall be poured so that earth settles down as much as possible and the same rolled up with 3 tonnes or light power roller, as directed by the Engineer-in-Charge.

16.53.3 Laying and Packing Brick Aggregate

Brick aggregate shall be racked off the stack with the racks so as to leave behind mud and dust. It shall be spread evenly over the prepared surface to the required depth with a finishing material to avoid segregation. Brick aggregate shall be carefully laid and packed, bigger size being placed at the bottom to 7.5 cm. depth unless specified otherwise. After that the area shall be grouted with fine sand.

16.53.4 Consolidation

The bricks aggregate shall be consolidated by dry rolling with 3 tonne or light weight power roller as directed by the Engineer-in-Charge.

16.53.5 Measurement

The measurement of the finished work shall be taken in sqm. correct to two places of decimal. Length and breadth shall be measured in metre correct to a centimeter.

16.53.6 Rate

Rate includes the cost of all the materials, labour and equipment required in all the operations as described above.

POST DELINEATORS

16.53.7 The role of delineators is to provide visual assistance to drivers about alignment of the road ahead, especially at night. Delineators are particularly effective in the case of complex locations involving changes

in horizontal / vertical geometry and doing severe weather condition such as heavy rain, fog or snow. Normally reflectors are used on the delineators for better night time visibility. Road delineators may have a circular, rectangular or triangular cross-section, however the side facing the traffic should not be less than 10 cm wide.

In board sense, Delineators stands for any device or treatment whose aim is to outline the road way.

16.53.8 Material :

The design, materials to be used and the location of the road delineators shall conform to recommended practice for road delineators, IRC:79, and to relevant drawings and as directed by the Engineer-in-charge.

The delineators are to be made of Acrylonitrile Butadiene Styrene (ABS) body fitted with 2 No. 100 mm dia of highly reflective reflectors are mounted on M.S. pipe of 65 mm dia or of size specified otherwise, duly powder coated of minimum 40 microns thickness anti-rust and anti-theft, installed as per direction of Engineer-in-charge. Road delineators may have a circular, rectangular or triangular cross-section, however the side facing the traffic should not be less than 10 cm wide.

16.53.9 Dimensions :

Height of the delineator should be not less than 800 mm above ground. Width not less than 100 mm. Not more than 300 mm below the ground while being installed.

16.53.10 Placement and spacing:

As a general rule, delineators posts should be erected at the edge of the usable shoulders, and in the case of kerbed sections at a distance of 0.6 to 1.5 m from the kerb face. On hill roads they may be placed either on the parapet or at the edge of the shoulders.

The delineator should be so positioned that the reflectorised face is perpendicular to the direction of travel.

Warranty :

The contractor shall obtain a two years warranty for satisfactory performance including stipulated retro-reflectance of the retro-reflective sheeting and submit the same to the Engineer-in-charge.

16.53.11 Measurement

The measurement shall be made in numbers of delineators fixed at site.

16.53.12Rate

The rate include the cost of all the material, labour and equipments required in all the operations described above.

16.54 EXCAVATING HOLES UPTO 0.10 CUM

The specifications of sub head earth work of CPWD specifications 2019 Vol-I to be followed for this item.

16.55 FACTORY MADE RCC PAVEMENT SLAB

Precast RCC slab casted with the cement concrete of M-30 or specified otherwise grade of size specified in item made of approved brand and manufacturer to be used.

Specification of cement concrete base, bed cement mortar and RCC to be of the sub head cement concrete, mortar and RCC of the CPWD specification- 2019 Vol- I to be followed.

16.56 FACTORY MADE CEMENT CONCRETE INTERLOCKING PAVER BLOCK

16.56.1 Base

Interlocking paver block to be fixed on the bed 50 mm or specified otherwise thick of coarse sand of approved specification and filling the joints with the sand of approved type and quality or as specified and as directed by Engineer-in-charge.

16.56.2 Interlocking Paver Block

Factory made precast paver block of M-30 or otherwise specified grade to be used. Paver blocks to be of approved brand and manufacturer and of approved quality. Minimum strength as prescribed by manufacturer and as per direction of Engineer-in-Charge for the grade specified to be tested as per method mentioned in specification of subhead cement concrete of CPWD Specification 2019 Vol. I.

16.56.3 Measurement & Rates

Area provided with paver block to be measured in sqm. correct upto two places of decimal. The rate include the cost of the material, labour, tools etc. required in all the operations described above.

16.57 KERB STONE (PRECAST)

16.57.1 Laying

16.58.1.1 Trenches shall first be made along the edge of the wearing course of the road to receive the kerb stones of cement concrete of specified grade. The bed of the trenches shall be compacted manually with steel rammers to a firm and even surface and then the stones shall be set in cement mortar of specified proportion.

16.58.1.2 The kerb stones with top 20 cm. wide shall be laid with their length running parallel to the road edge, true in line and gradient at a distance of 30 cm. from the road edge to allow for the channel and shall project about 12.5 cm. above the latter. The channel stones with top 30 cm. wide shall be laid in position in chamber with finished road surface and with sufficient slope towards the road gully chamber. The joints of kerb and channel stones shall be staggered and shall be not more than 10 mm. Wherever specified all joints shall be filled with mortar 1:3 (1 cement : 3 coarse sand) and pointed with mortar 1:2 (1 cement: 2 fine sand) which shall be cured for 7 days.

16.58.1.3 The necessary drainage openings of specified sizes shall be made through the kerb as per drawings or as directed by the Engineer-in-Charge for connecting to storm water drains.

16.57.2 Finishing

Berms and road edges shall be restored and all surplus earth including rubbish etc. disposed off as directed by the Engineer-in-charge. Nothing extra shall be paid for this.

16.57.3 Measurements

It shall be measured in cubic meters with Length of the finished work (for specified width and height of stone) shall be measured in running metre along the edge of the road correct to a cm.

16.57.4 Rate

The rate shall include the cost of all the materials and labour involved in all the operations described above.

16.58 G.I. CHAIN LINK FABRIC FENCING

16.58.1 Material

G.I. Chain link fabric fencing of required width in mesh size 50 x 50 or 25 x 25 mm or specified otherwise of approved brand and made of specified dia GI wire PVC coated of specified thickness / or not as specified in item of required colour or shade to be used.

16.59.1.1 Fixing : GI chain link shall be stretched and fixed in specified width, strengthening with 2 mm dia wire or nuts bolts & washers as required to be done complete as per the direction of Engineer- in-Charge.

16.59.1.2 Measurements : The length and width shall be measured correct to a cm. The area shall be calculated in square metre, correct to two places of decimal.

16.58.2 The rate shall include the cost of material and labour involved in all the operations described as above.

16.59 SUPPLYING AND STACKING OF HARD STONE (FOR STONE PITCHING)

Hard stone hammer dressed having no side less than 15 cm. with minimum depth of 20 cm. of the specification as mentioned in subhead - stone work of CPWD Specification- 2019 Vol. I to be used.

Specification for supplying, stacking and measurement to be same as for item no. 16.3.

16.60 VACUUM DEWATERED CEMENT CONCRETEPAVEMENT

16.60.1 Cement concrete to be compacted by screed board vibrator of the type approved by Engineer- in-Charge and by vacuum dewatering process complete as per directions of Engineer-in-charge.

16.60.2 Measurements

It shall be measured in cubic metres correct to two place of decimal.

16.60.3 Rate

The rate shall include the cost of material, labour and machinery involved in all the operations described above.

16.62. GRANULAR SUB-BASE

16.62.1. Scope

This work shall consist of laying and compacting well-graded material on prepared subgrade in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as sub-base or lower sub-base and upper sub-base (termed as sub-base hereinafter) as necessary according to lines, grades and cross-sections shown on the drawings or as directed by the Engineer-in-charge.

16.62.2 Materials

16.62.2.1. The material to be used for the work shall be natural sand, crushed gravel, crushed stone, crushed slag or combination thereof depending upon the grading required. Use of materials like brick metal, Kankar and crushed concrete shall be permitted in the lower sub-base. The material shall be free from organic or other deleterious constituents and shall conform to the grading given in Table 16.44 and physical requirement given in Table 16.45 Gratings III and IV shall preferably be used in lower sub-base. Grading V and VI shall be used as a sub-base-cum-drainage layer. The grading to be adopted for a project shall be as specified in the Contract. Where the sub-base is laid in two layers as upper sub-base and lower sub-base, the thickness of each layer shall not be less than 150 mm.

16.62.2.2 If the water absorption of the aggregate determined as per IS : 2386 (Part 3); if this value is greater than 2 per cent, the aggregate shall be tested for Wet Aggregate Impact Value (AIV) (IS: 5640). Soft aggregates like Kankar, Brick ballast and laterite shall also be tested for Wet AIV (IS: 5640).

TABLE No. 16.44
GRADING FOR GRANULAR SUB-BASE MATERIALS

IS Sieve Designation	Percent by Weight Passing the IS Sieve					
	Grading I	Grading II	Grading III	Grading IV	Grading V	Grading VI
75.0 mm	100	--	--	--	100	--
53.0 mm	80-100	100	100	100	80-100	100
26.5 mm	55-90	70-100	55-75	50-80	55-90	75-100
9.50 mm	35-65	50-80	--	--	35-65	55-75
4.75 mm	25-55	40-65	10-30	15-35	25-50	30-55
2.36 mm	20-40	30-50	--	--	10-20	10-25
0.85 mm	--	--	--	--	2-10	--
0.425 mm	10-15	10-15	--	--	0-5	0-8
0.075 mm	<5	<5	<5	<5	--	0-3

TABLE No. 16.45
PHYSICAL REQUIREMENTS FOR MATERIALS FOR GRANULAR SUB-BASE

Aggregate Impact Value (AIV)	IS:2386 (Part 4) or IS:5640	40 Maximum
Liquid Limit	IS:2720 (Part 5)	Maximum 25
Plasticity Index	IS:2720 (Part 5)	Maximum 6
CBR at 98% dry density (at IS:2720-Part 8)	IS:2720 (Part 5)	Minimum 30 unless otherwise specified in the Contract

16.62.3 Construction Operations

16.623.1. Preparation of Sub-Grade:

The surface of the sub grade to receive the Granular Sub-base shall be prepared to the specified lines and crossfall (Camber) as necessary and made free of dust and other extraneous materials. Any ruts or soft yielding places shall be corrected in an approved manner and rolled with 80 – 100 kN smooth wheeled roller until firm surface is obtained if necessary by sprinkling water. Weak places shall be strengthened, corrugations removed and depressions and pot holes made good with suitable materials, before spreading the aggregate for GSB.

Where the existing surface over which the sub base of GSB is to be laid is black topped, to ensure effective internal drainage, furrows 50 mm x 50 mm (depth of furrows increased to reach bottom of bituminous layer where necessary) at one metre intervals shall be cut in the existing bituminous surface at 45 degrees to the central line of the carriageway at one metre intervals in the existing road before the GSB is laid.

16.62.3.2 Spreading and compacting:

The sub-base material of grading specified in the Contract and water shall be mixed mechanically by a suitable mixer equipped with provision for controlled addition of water and mechanical mixing. So as to ensure homogenous and uniform mix. The required water content shall be determined in accordance with IS:2720 (Part 8). The mix shall be spread on the prepared sub-grade with the help of a motor grader of adequate capacity, its blade having hydraulic controls suitable for initial adjustment and for maintaining the required slope and grade during the operation, or other means as approved by the Engineer-in-charge.

Moisture content of the mix shall be checked in accordance with IS:2720 (Part 2) and suitably adjusted so that, at the time of compaction, it is from 1 to 2 per cent below the optimum moisture content (OMC).

Immediately after spreading the mix, rolling shall be done by an approved roller. If the thickness of the compacted layer does not exceed 100 mm, a smooth wheeled roller of 80 to 100 kN weight may be used. For a compacted single layer upto 200 mm the compaction shall be done with the help of a vibratory roller of minimum 80 to 100 kN static weight capable of achieving the required compaction. Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional crossfall or on super elevation. For carriageway having crossfall on both sides, rolling shall commence at the edges and progress towards the crown.

Each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. During rolling, the grade and crossfall (camber) shall be checked and any high spots or depressions, which become apparent, corrected by removing or adding fresh material. The speed of the roller shall not exceed 5 km per hour.

Rolling shall be continued till the density achieved is at least 98 percent of the maximum dry density for the material determined as per IS : 2720 (Part 8). The surface of any layer of material on completion of compaction shall be well closed, free from movement under compaction equipment and from compaction planes, ridges, cracks or loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of layer and re-compacted.

16.62.4 Measurements

Granular sub-base shall be measured as finished work in position in cubic metres. The length and breadth shall be measured to the nearest centimetre. The depth of consolidated layer shall be computed to nearest half centimetre by taking average of depths at the centre and at 30 cm from the left and right edges at a cross section taken at 100 metre interval or less as decided by the Engineer-in-Charge by making small pits. The consolidated cubical contents shall be calculated in cubic metres correct to two places of decimal. The protection of edges of granular sub-base extended over the full formation as shown in the drawing shall be considered incidental to the work of providing granular sub-base and as such no extra payment shall be made for the same.

16.62.5. Rate

The Contract unit rate for granular sub-base shall be payment in full for carrying out the required operations including all labour, tools, equipments, machinery and incidentals to complete the work to the specifications as described above.

16.63. WET MIX MACADAM (WMM) SUB-BASE/BASE

16.63.1 Scope

This work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared subgrade/sub-base/base or existing pavement as the case may be in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as necessary to lines, grades and cross-sections shown on the approved drawings or as directed by the Engineer-in-charge.

The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75 mm. When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub-base course may be increased to 200 mm upon approval of the Engineer-in-charge.

16.63.2. Materials

16.63.2.1 Aggregates

16.63.2.1.1 Physical requirements

Coarse aggregates shall be crushed stone. If crushed gravel/shingle is used, not less than 90 per cent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table

16.46 below.

If the water absorption value of the coarse aggregate is greater than 2 per cent, the soundness test shall be carried out on the material delivered to site as per IS:2386(Part-5).

TABLE 16.46
PHYSICAL REQUIRMENTS OF COARSE AGGREGATES FOR SUB-BASE/BASE COURSES

	Test	Test Method	Requirement
1.	Los Angeles Abrasion value	IS:2386 (Part-4)	40 per cent (Max.)
2.	or Aggregate impact value Combined Flakiness and Elongation indices (Total)	IS:2386 (Part-4) or IS:5640 IS:2386 (Part-1)	30 per cent (Max.) 35 per cent (Max.)*

* To determine this combined proportion, the flaky stone from a representative sample should first be separated out. Flakiness index is weight of flaky stone metal divided by weight of stone sample. Only the elongated particles be separated out from the remaining (non-flaky) stone metal. Elongation index is weight of elongated particles divided by total non-flaky particles. The value of flakiness index and elongation index so found are added up.

16.63.2.12 Grading requirements :

The aggregates shall conform to the grading given in Table 16.47 below.

TABLE 16.47
GRADING REQUIREMENTS OF AGGREGATES FOR WET MIX MACADAM

IS Sieve Designation	Per cent by weight passing the IS sieve
53.00 mm	100
45.00 mm	95-100
26.50 mm	---
22.40 mm	60-80
11.20 mm	40-60
4.75 mm	25-40
2.36 mm	15-30
600.00 micron	8-22
75.00 micron	0-5

Materials finer than 425 micron shall have Plasticity Index (PI) not exceeding 6.

The final gradation approved within these limits shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa.

16.63.3. Construction Operations

16.63.3.1 Preparation of base :

The surface of the sub grade / sub base / base to receive the Wet Mix Macadam shall be prepared to the specified lines and crossfall (Camber) as necessary and made free of dust and other extraneous materials. Any ruts or soft yielding places shall be corrected in an approved manner and rolled with 80-100 kN smooth wheeled roller until firm surface is obtained if necessary by sprinkling water. Weak places shall be strengthened, corrugations removed and depressions and pot holes made good with suitable materials, before spreading the aggregate for WMM.

Where the existing surface over which the sub base of WMM is to be laid is black topped, to ensure effective internal drainage, furrows 50 mm x 50 mm (depth of furrows increased to reach bottom of bituminous layer where necessary) at one metre intervals shall be cut in the existing bituminous surface at 45 degrees to the central line of the carriageway at one metre intervals in the existing road before the WMM is laid.

166332 Provision of lateral confinement of aggregates:

While constructing wet mix macadam, arrangement shall be made for the lateral confinement of wet mix. This shall be done by laying materials in adjoining shoulders along with that of wet mix macadam layer.

166333 Preparation of mix:

Wet Mix Macadam shall be prepared in an approved mixing plant of suitable capacity having provision for controlled, addition of water and forced/positive mixing arrangement like pugmill or pan type mixer of concrete batching plant. For small quantity of wet mix work, the Engineer may permit the mixing to be done in concrete mixers.

Optimum moisture for mixing shall be determined in accordance with IS:2720 (Part-8) after replacing the aggregate fraction retained on 22.4 mm sieve with material of 4.75 mm to 22.4 mm size. While adding water, due allowance should be made for evaporation losses. However, at the time of compaction, water in the wet mix should not vary from the optimum value by more than agreed limits. The mixed material should be uniformly wet and no segregation should be permitted.

166334 Spreading of mix :

Immediately after mixing, the aggregates shall be spread uniformly and evenly upon the prepared subgrade/sub-base/base in required quantities. In no case should these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed stretch be permitted.

The mix may be spread either by a paver finisher.

The paver finisher shall be self-propelled of adequate capacity with the following features:

- (i) Loading hoppers and suitable distribution system. So as to provide a smooth uninterrupted material flow for different layer thickness from the tipper to the screed.
- (ii) Hydraulically operated telescopic screed for paving width upto 8.5 metre and fixed screed beyond this. The screed shall have tamping and vibrating arrangement for initial compaction of the layer.
- (iii) Automatic leveling control system with electronic sensing device to maintain mat thickness and cross slope of mat during laying procedure. In exceptional cases where it is not possible for the paver to be utilized mechanical means like motor grader may be used with the prior approval of the Engineer-in-charge. The motor grader shall be capable of spreading the material uniformly all over the surface.

The surface of the aggregate shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregate may be required. The layer may be tested by depth blocks during construction. No segregation of larger and fine panicles should be allowed. The aggregates as spread should be of uniform gradation with no pockets of fine materials.

The Engineer-in-charge may permit manual mixing and / or laying of Wet Mix Macadam, where small quantity of WMM is to be executed. Manual mixing / laying in inaccessible / remote locations and in situations where use of machinery is not feasible can also be permitted. Were manual mixing / laying is intended to be used, the same shall be done with the approval of the Engineer-in-charge.

166335 Compaction:

After the mix has been laid to the required thickness, grade and crossfall/camber the same shall be uniformly compacted, to the full depth with suitable roller. If the thickness of single compacted layer does not exceed 100 mm, a smooth wheel roller of 80 to 100 kN weight may be used. For a compacted single layer upto 200 mm, the compaction shall be done with the help of vibratory roller

of minimum static weight of 80 to 100 kN with an arrangement for adjusting the frequency and amplitude. An appropriate frequency and amplitude may be selected. The speed of the roller shall not exceed 5 km/h.

In portions having unidirectional cross fall/superelevation, rolling shall commence from the lower edge and progress gradually towards the upper edge. Thereafter, roller should progress parallel to the centre line of the road, uniformly over-lapping each preceding track by at least one-third width until the entire surface has been rolled. Alternate trips of the roller shall be terminated in stops at least 1 m away from any preceding stop.

In portions in camber, rolling should begin at the edge with the roller running forward and backward until the edges have been firmly compacted. The roller shall then progress gradually towards the centre parallel to the centre line of the road uniformly overlapping each of the preceding track by at least one-third width until the entire surface has been rolled.

Any displacement occurring as a result of reversing of the direction of a roller or from any other cause shall be corrected at once as specified and/or removed and made good.

Along forms, kerbs, walls or other places not accessible to the roller, the mixture shall be thoroughly compacted with mechanical tampers or a plate compactor. Skin patching of an area without scarifying the surface to permit proper bonding of the added material shall not be permitted.

Rolling should not be done when the subgrade is soft or yielding or when it causes a wave-like motion in the sub-base/base course or subgrade. If irregularities develop during rolling which exceed 12 mm when tested with a 3 metre straight edge, the surface should be loosened and premixed material added or removed as required before rolling again so as to achieve a uniform surface conforming to the desired grade and crossfall. In no case should the use of unmixed material be permitted to make up the depressions.

Rolling shall be continued till the density achieved is at least 98 per cent of the maximum dry density for the material as determined by the method outlined in IS: 2720 (Part-8)

After completion, the surface of any finished layer shall be well-closed, free from movement under compaction equipment or any compaction planes, ridges, cracks and loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of the layer and recompacted.

16.63.3.6 Setting and drying: After final compaction of wet mix macadam course, the road shall be allowed to dry for 24 hours.

16.63.4. Opening to Traffic

No vehicular traffic of any kind should be allowed on the finished wet mix macadam surface till it has dried and the wearing course laid.

16.63.5. Surface Evenness

All work perform shall confirm to the lines, grades, cross sections and dimensions shown on the drawings or as directed by the Engineer-in-charge, subject to the permitted tolerances described herein after.

16.63.5.1 Horizontal Alignment

Horizontal alignments shall be reckoned with respect to the centre line of the carriageway as shown on the drawings. The edges of the carriage way as constructed shall be correct within a tolerance of ± 10 mm there from. The corresponding tolerance for edges of the roadway and lower layers of pavement shall be ± 25 mm.

16.63.5.2 Surface Levels

The levels of the Sub-base / base course as constructed, shall not vary from those calculated with reference to the longitudinal and cross-profile of the road shown on the drawings or as directed by the Engineer-in-charge beyond the tolerances mentioned as below:

TOLERANCES IN SURFACE LEVELS OF WMM

Sub-base

- | | |
|-----------------------|---------|
| (a) Flexible pavement | ± 10 mm |
| (b) Concrete pavement | ± 06 mm |

Base course flexible pavement

- | | |
|-------------------------------------|---------|
| (a) Bituminous Base / Binder Course | ± 06 mm |
| (b) Granular | |
| (i) Machine laid | ± 10 mm |
| (ii) Manually laid | ± 15 mm |

For checking compliance with the above requirement for sub-base / base courses, measurements of the surface levels shall be taken on a grid of points placed at 6.25 m longitudinally and 3.5 m transversely.

The longitudinal profile shall be checked with a 3 metre long straight edge / moving straight-edge as desired by the Engineer-in-charge at the middle of each traffic lane along a line parallel to the centre line of the road.

16.63.6. Measurements

Wet Mix Macadam shall be measured as finished work in position in cubic metres. The length and breadth shall be measured to the nearest centimetre. The depth of consolidated layer shall be computed to nearest half centimetre by taking average of depths at the centre and at 30 cm from the left and right edges at a cross section taken at 100 metre interval or less as decided by the Engineer-in-Charge by making small pits. The consolidated cubical contents shall be calculated in cubic metres correct to two places of decimal.

16.63.7. Rates

The contract unit rate for Wet Mix Macadam shall be payment in full for carrying out the required operations including all labour, tools, equipments machinery and incidentals to complete the work to the specification as described above.

16.64 REFLECTIVE PAVEMENT MARKERS (RPM) OR ROAD STUDS

16.64.1 Scope

The work shall cover the providing and fixing of reflective pavement marker (RPM) or road stud, a device which is bonded to or anchored within the road surface, for lane marking and delineation for night-time visibility, as specified in the Contract.

16.64.2 Material

16.64.2.1 Plastic body of RPM/road stud shall be moulded from ASA (Acrylic Styrene Acrylonitrile) or HIPS (Hi-impact Polystyrene) or Acrylonitrile Butadiene Styrene (ABS) or any other suitable material approved by the Engineer. The markers shall support a load of 13.635 kg tested in accordance with ASTM D 4280.

16.64.2.2 Reflective panels shall consist of number of lenses containing single or dual prismatic cubes capable of providing total internal reflection of the light entering the lens face. Lenses shall be moulded of methyl methacrylate conforming to ASTM D 786 or equivalent.

16.64.3 Design

The slope or retro-reflecting surface shall preferably be $35 \pm 5^\circ$ to base and the area of each retro-reflecting surface shall not be less than 13.0 sq.cm.

16.64.4 Optical Performance

16.64.4.1 Unidirectional and Bi-directional Studs.

Each reflector or combination of reflectors on each face of the stud shall have a Coefficient of Luminous Intensity (C.I.L.), as specified in **Table 16.48**

TABLE NO 16.48
Minimum C.I.L. values for Road Studs

Entrance Angle	Observation Angle	C.I.L. in mcd/lx		
		White	Amber	Red
0° U 5° L&R	0.3°	220	110	44
0° U 5° L&R	0.5°	120	60	24

16.64.5 Tests

16.64.5.1 Co-efficient of luminance intensity can be measured by procedure described in ASTM E 809 “Practice for Measuring Photometric Characteristics” or as recommended in BS:873-Part 4 : 1973.

16.64.6 Fixing of Reflective Markers or Road Studs or Cats Eyes.

16.64.6.1 Requirements

The enveloping profile of the head of the stud shall be smooth and the studs shall not present any sharp edges to traffic. The reflecting portions of the studs shall be free from crevices or ledges where dirt might accumulate. Marker height shall not be less than 10 mm and shall not exceed 20 mm, and its width shall not exceed 130 mm. The base of the marker shall be flat within 1.3 mm. If the bottom of the marker is configured, the outermost faces of the configurations shall not deviate more than 1.3 mm from a flat surface. All road studs shall be legibly marked with the name, trade mark or other means of identification of the manufacturer.

16.64.6.2 Placement

The reflective marker shall be fixed to the road surface using the adhesives and the procedure recommended by the manufacturer. No nails shall be used to affix the marker so that they do not pose safety hazard on the roads. Regardless of the type of adhesive used, the markers shall not be fixed if the pavement is not surface dry and on new asphalt concrete surfacing until the surfacing has been opened to traffic for a period of not less than 14 hours. The portions of the highway surface, to which the marker is to be bonded by the adhesive, shall be free of dirt, curing compound, grease, oils, moisture, loose or unsound layers, paint and any other material which would adversely affect the bond of the adhesive.

The adhesive shall be placed uniformly on the cleaned pavement surface or on the bottom of the of the marker in a quantity sufficient to result in complete coverage of the area of contract of the marker with no voids present and with a slight excess after the marker has been lightly pressed in place. For epoxy installations, excess adhesive around the edge of the marker, excess adhesive on the pavement and adhesive on the exposed surfaces of the markers shall be immediately removed.

16.64.6.3 Warranty and Durability

The contractor shall submit a two year warranty for satisfactory field performance including stipulated retro-reflectance of the reflecting panel, to the Engineer-in-charge. In addition, a two year warranty for satisfactory infield performance of the finished road marker shall also be given by the contractor who carries out the work of fixing of reflective road markers. In case the markers are displaced, damaged, get worn out or lose their reflectivity compared to stipulated standards, the contractor would be required to replace all such markers within 15 days of the intimation from the Engineer-in-charge, at his own cost.

16.64.7 Measurement

The measurement of reflective road markers or road studs shall be made in numbers supplied and fixed at site.

16.64.8 Rates

The rates include the cost of all the material, labour, tools and equipments required in all the operation described above.

16.65 PRIME COAT OVER GRANULAR BASE

16.65.1 Scope

This work shall consist of the application of a single coat of low viscosity liquid bituminous material to a porous granular surface preparatory to the superimposition of bituminous treatment or mix.

16.65.2 Materials

16.65.2.1 Primer:- The primer shall be cationic bitumen emulsion SS1 grade conforming to IS:8887 or medium curing cutback bitumen conforming to IS:217 or as specified in the contract.

16.65.2.2 Quantity of SS1 grade bitumen emulsion for various types of granular surface shall be as given in Table 16.49 or as specified in the item of contract.

Table 16.49
Quantity of Bitumen Emulsion for various types of Granular Surfaces

Type of Surface	Rate of Spray (kg/sqm)
WMM/WBM	0.7-1.0
Stabilized soil bases/Crusher Run Macadam	0.9-1.2

16.65.2.3 Cutback for primer shall not be prepared at the site. Type and quantity of cutback bitumen for various types of granular surface shall be as given in Table 16.50.

Table 16.50
Type and Quantity of Cutback Bitumen for various types of Granular Surface

Type of Surface	Type of Cutback	Rate of Spray (kg/sq.m)
WMM/WBM	MC 30	0.6-0.9
Stabilized soil bases/Crusher Run Macadam	MC 70	0.9-1.2

16.65.2.4 The correct quantity of primer shall be decided by the Engineer-in-Charge and shall be such that it can be absorbed by the surface without causing run-off of excessive primer and to achieve desired penetration of about 8-10mm.

16.65.3 Construction

16.65.3.1 Equipment

The primer shall be applied by a self propelled or towed bitumen pressure sprayer equipped for spraying the material uniformly at specified rates and temperatures. Hand spraying shall not be allowed except in small areas, inaccessible to the distributor, or in narrow strips where primer shall be sprayed with a pressure hand sprayer, or as directed by the Engineer-in-Charge.

16.65.3.2 Preparation of Road Surface

The granular surface to be primed shall be swept clean by power brooms or mechanical sweepers and made free from dust. All loose material and other foreign material shall be removed completely. If soil/moorum binder has been used in the WBM surface, part of this should be brushed and removed to a depth of about 2 mm so as to achieve good penetration.

16.65.3.3 Application of Bituminous Primer

After preparation of the road surface the primer shall be sprayed uniformly at the specified rate as per item of contract. The method for application of the primer will depend on the type of equipment to be used, size of nozzles, pressure at the spray bar and speed of forward movement. The contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray, within the tolerances specified.

No heating or dilution of SS1 bitumen emulsion and shall be permitted at site. Temperature of cutback bitumen shall be high enough to permit the primer to be sprayed effectively through the jets of the spray and to cover the surface uniformly.

16.65.3.4 Curing of Primer and Opening to Traffic

A primed surface shall be allowed to cure for at least 24 hours or such other higher period as is found to be necessary to allow all the moisture/volatiles to evaporate before any subsequent surface treatment or mix is laid. Any unabsorbed primer shall first be blotted with a light application of sand, using the minimum quantity possible. A primed surface shall not be opened to traffic other than that necessary to lay the next course.

16.65.4 Measurement for Payment

Prime coat shall be measured in terms of surface area of application in square metres.

16.65.5 Rate

The contract unit rate for prime coat shall be payment in full for carrying out the required operations i/c all equipments, labour and machinery as described above.

APPENDIX A

BITUMEN REGISTER (Clause 16.24 to 16.31, 16.32, 16.33)

Name of Work:

Name of Contractor:

<i>Receipts</i>			<i>Issues</i>					
<i>Date of receipt</i>	<i>Quantity received</i>	<i>Progressive total</i>	<i>Date of issue</i>	<i>Quantity of Bitumen issued</i>	<i>Total issue</i>	<i>Daily Balance in hand</i>	<i>Contractor's initial</i>	<i>Junior Engineer's initial</i>
1	2	3	4	5	6	7	8	9

Daily Comparison of Issues with Requirements

<i>Item of work for which issued</i>	<i>Approx. quantity of work done on each day</i>	<i>Theoretical requirement of bitumen for work done on each day</i>	<i>Assistant Executive Engineer/Assistant Engineer</i>	<i>Executive Engineer</i>
10	11	12	13	14

DETERMINATION OF IN-SITU DENSITY OF ASPHALTIC CARPET OR BITUMINOUS MACADAM BY SAND POURING DEVICE

The metallic tray of the field density unit is kept on a level spot of the surface and a hole 10 cm in dia, is cut to the entire thickness of the carpet. All materials removed from the hole are carefully collected and weighed.

A known weight of dry standard sand, passing 710 micron I.S. Sieve and retained on 355 micron I.S. sieve, is taken in the sand pouring cylinder. The cylinder is kept directly over the hole and the shutter of the cylinder is released without any jerk and closed when the hole is filled with the sand. The quantity of the residual sand in the cylinder as well as the quantity filling the cone of the cylinder are weighed.

The in-situ density of the carpet is calculated as follows:-

$$\text{Density: } \frac{A, d}{U - (U_1 + U_2)} \text{ gm per cc}$$

- Where A = Weight of the materials removed from the carpet hole.
W = Initial weight of the sand taken in the cylinder.
W₁ = Weight of the sand filling the cone of cylinder.
d = Bulk density, gm per cc of the sand.
W₂ = Weight of sand remaining in the cylinder.

**LIST OF MINIMUM EQUIPMENT TO BE PROVIDED IN THE FIELD TESTING
LABORATORY BY THE CONTRACTOR AT HIS OWN COST.**

Concrete Section

1. Sieve Analysis of stone ballast
 - (a) Sets of I.S. Sieves of sizes 63 mm, 45 mm, 22.4 mm, 11.2 mm, 5.60 mm. etc.
2. Sieve analysis of sand
 - (a) Sets of I.S. sieves of sizes 2.36 mm, 1.18 mm, 600 micron, 355 micron and 180 micron.
3. Silt content of sand
 - (a) Graduated glass cylinders 500 C.C. capacity.
4. Bulkage of sand
 - (a) Graduated glass cylinders 500 C.C. capacity.
5. Slump test.
 - (a) Slump cones.
 - (b) Slump rods 3/8" dia. 24" long bullet pointed.
 - (c) Steel plates 24" x 24"
 - (d) Steel scales.
6. For making beam specimens for flexural strength.
 - (a) Beammoulds.
 - (b) Tamping rods.
7. Testing flexural strength of concrete:-
 - (a) 100 ton capacity compressive strength testing i/c hand operated in two numbers with flexure test attachment.
8. Other miscellaneous items.
 - (a) Physical balance with set of weights.
 - (b) Pan balances.
 - (c) Spring balances.
 - (d) Glass measuring jar.
 - (e) Beakers.
 - (f) Towels, glass plates etc.

GENERAL GUIDELINES ISSUED BY NDMC

I. Roads/Foot Paths/and Storm Water Drains.

A. RESIENTIAL

S.No	Specifications applicable prior to 26.9.79	Specifications applicable after 27.9.79 (Modified)	Remarks
(1)	(2)	(3)	(4)
1.	15 ft wide right of way service lanes: Metal width not less than 8'-0" 4-1/2" soling 4-1/2" metal two coats of bitumen painting	4.577tres (15ft) right of way service lane: (i) Metalled width not less than 2.44 metres (8 ft.) (ii) 0.1143 metres (4-1/2") thick stone aggregate sub-base course of W.B.M. as per IRC specifications. (iii) 0.1143 metre (4-1/2") thick stone aggregate base-course W.B.M. as per IRC specifications. (iv) 2 cm (3/4") thick pre-mix carpet with seal coat of premixed stone dust. (v) 0.2286 metre (9") wide brick-on- edge edging on either side. (vi) CC (M-150) channel 8 cm thick and 30 cm wide with gola of 8 cm radius laid over a bed layer of 8 cm thick 1:5:10 c.c. top surface finished with a floating coat of neat cement. (vii)The space between brick edging and c.c. channel on both sides shall have brick on-edge flooring.	
2.	20 ft. wide right of way service lanes: Metalled width 10 ft. plus 9" brick-on-edge on either side. 4-1/2" soling 4-1/2" metal 3/4" bitumen carpet.	6.098 metres (20 ft.) right of way service lane: (i) Metalled width 3.48 metres (10 ft.) (ii) 0.1143 metre (4-1/2") thick stone aggregate sub-base course of W.B.M. as per IRC specifications. (iii) 0.1143 metre (4-1/2") thick stone aggregate base-course of W.B.M. as per IRC specifications. (iv) 2 cm (3/4") thick pre-mix carpet with seal coat of premixed stone. (v) 0.2286 metre (9") wide brick on edge edging on either side.C (vi) C (M-150) channel 8cm thick and 30 cm wide with gola of 8 cm radius laid over a bed layer of 8 cm thick 1:5:10 cement concrete top surface finished with a floating coat of neat cement. (vii) The space between brick edging & CC channel on both side brick on edge flooring.	
3.	Roads with right of way 30 feet: 12 ft. Metalled width plus 9" thick edging on either side. 6" soling 6" metal (water	9.14 metre (30 ft.) right way roads: (i) metres (12 ft.) mettalled width with 0.2286 metre (9") wide brickon- edge-edging on either side	

	bound 3" thick each layer) 3/4" carpet	(ii) 0.1016 metre (4") thick stone aggregate base-course of W.B.M. as per IRC specifications. (iii) 0.2032 metre (8") thick stone aggregate base-course of W.B.M. as per IRC specifications (to be laid in two layers).2 (iv) cm (3/4") thick pre mix carpet with seal coat of premixed stone dust.	
4.	Service roads with right of way 40 ft. 18 ft. metalled width plus 9" thick edging on either side. 6" soling 7-1/2" metal (water bound 4-1/2" & 3" thick separately) 1" carpet.	12.19 mtrs. (40 ft.) and less than 13.71 mtrs. (45 ft.) right of way roads: (i) 7.32 m. (24 ft.) metalled width with 0.2286 m (9") wide brick-on-edge edging on either side. (ii) 0.1524 m (6") stone aggregate sub- base course of W.B.M. as per IRC specifications. (iii) 0.2032 m (7-1/2") stone aggregate base-course of W.B.M. as per IRC specifications (to be laid in two layers) (iv) 2.5 cm (1") thick pre-mix carpet with seal coat of premixed stone dust.	The change in metalled width is to adopt two lane width since 18 ft. width is not standard width.
5.	Service roads with right of way 60 ft. 22 ft. metalled width plus 9" brickon-edge on both sides. 6" soling. 7-1/2" metal. 1-1/2" thick asphaltic concrete.	13.71 mtrs. (45 ft.) and less than 18.29 mtrs.(60 ft.) right of way road: (i) 7.32 mtrs. (24 ft.) metalled with 0.2284 m (9") wide brick-on-edge on either side. (ii) 0.1524 m (6") thick stone aggregate sub-base course of W.B.M. as per IRC specifications. (iii) 0.2032 m (71/2") thick stone aggregate base-course of W.B.M. as per IRC specifications (to be laid in two layers). (iv) 5 cm (2") thick Bituminous Macadam (B.M.) with seal coat of premixed stone dust.	The change in metalled width from 22 ft. to 24 ft. is to adopt standard two lane width.
6.	Roads with right of way above 60 ft. and upto 79 ft. 22 ft. metalled width 9" brick-on-edge on either side. 9" soling 7-1/2" metal (W.B.M. 4-1/2" & 3" thick separately). 1-1/2" thick asphaltic concrete	18.29 mtrs. (60 ft.) and less than 24.38 mtrs. (80 ft.) right of way road (i) 7.32 mtrs. (24 ft.) metalled with 0.2286 mtrs. (9") wide brick-on-edge edging. (ii) 0.1524 m (6") thick stone aggregate sub-base of W.B.M. as per IRC specifications. (iii) 0.2667 m (10-1/2") thick stone aggregate base-course of W.B.M. as per IRC specifications (to be laid in three layers). (iv) 5 cm (2") thick Bituminous Macadam (BM) with seal coat of premixed stone dust.	The change in metalled width from 22 ft. to 24 ft. is to adopt standard two lane width.
7.	Roads with right of way 80 ft. and above 9" soling. Metalled width 24 ft. soling 9" 7- 1/2" metal. 1" carpet.	24.38 mtrs. (80 ft.) and above right of way road. (i) 14.64 mtrs. (48 ft.) metalled width.	The change in metal width is to adopt standard X section for 80 ft.

		(ii) 0.1524 m (6") thick stone aggregate sub-base course of W.B.M. as per IRC specifications. (iii) 0.2667 m (10-1/2") thick stone aggregate base-course of W.B.M. as per IRC specifications (to be laid in three layers). (iv) 5 cms. (2") thick Bituminous Macadam (BM) with seal coat of premixed stone dust. (v) 3.048 mtrs. (10 ft.) wide raised foot path on both sides of the carriageway as per specifications given hereinafter.	wide roads. Such roads normally carry heavy amount of traffic which needs a metalled width of 48 ft. for easy flow of traffic.
8.	Service lanes/ walkways having right of way less than 15 ft. Nil	Service lanes/walkways having right of way less than 4.57 mtrs.(15 ft.) 0.1143 mtrs. (4-1/2") thick cement concrete (M-150) over 0.1143 (4-1/2") dry brick ballast in complete width with c.c. (M-150) channel 8 cms. thick and 30 cm wide with gola of 8 cm radius laid over a bed layer of 8 cms. Thick 1:5:10 cement concrete top surface finished with floating coat of neat cement.	

Notes :

- (a) Roads with right of way 80 ft. and above passing through residential colony should have raised foot paths on either sides.
- (b) Where it is necessary for practical requirements to do the road work in two stages then it is advisable to do a coat of bitumen painting after leaving the first layer of water bound macadam.
- (c) Brick-edging 9" wide shall be provided beyond the metalled width of roads in item (2) to (5) above.
- (d) Brick pitched drains with adequate discharging capacity shall be provided on both sides of the road.
- (e) Where raised footpaths are not provided, berms shall be properly dressed to slope towards the side drains.

**Foot-Paths and Storm Water Drains for Roads in
Residential and Industrial Areas**

1	2	3	4
1.	10 ft. wide foot-path	<p>3.048 mtrs. (10 ft.) wide foot-path</p> <p>(i) 0.076 m (3") thick dry brick ballast.</p> <p>(ii) 0.076 m (3") thick cement concrete M-150 pavement with or without chequered tiles embedded in cement concrete.</p> <p>(iii) Cement concrete (M-150) kerbstones of size 0.3048 m x 0.203 m (12" x 8")</p> <p>(iv) 0.2286 m x 0.3048 m brick toe wall on the other end of foot-path.</p> <p>(v) 0.3048 m (1 foot) wide channel with C.C. (M-150) 75 mm thick over 75 mm bed concrete 1:5:10 finished with a floating coat of neat cement.</p> <p>(vi) NP class R.C.C. pipes 150 mm dia with collars jointed with cement mortar 1:2 (1 cement: 2 fine sand) for cross drainage with gully chambers of size 50 x 45 x 65 cms. with M.S. grating of size 500 x 450 mm</p>	

Notes:

1. Brick pitched drains with adequate designed discharge capacity shall be provided on both sides of the roads above 20 ft. right of way (For cross section of different R.O. roads, showing the carriage width, arrangement of footpaths, storm water drains, water supply mains, sewer lines and also of trees.
2. Where raised foot-paths are not provided, berms shall be properly dressed to slope toward the side drains.
3. The work shall be carried out as per prevailing CPWD/IRC specifications.
4. Crust thicknesses mentioned in the above specifications mean compact thicknesses.
5. Brick edging wherever mentioned in the above specifications shall be 0.1143 m (4-1/2") deep.
6. For any road having right of way other than mentioned in the specifications, the standard of the next higher R.O.W. will be applicable.

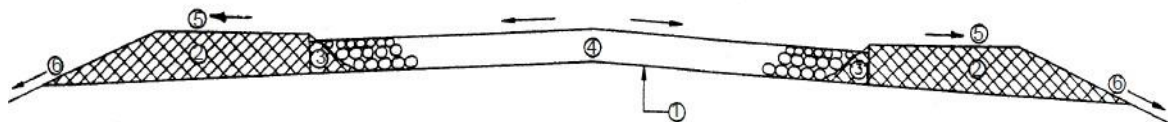
S.No	Specifications applicable prior to 26.9.79	Specification applicable after 27.9.79 (Modified)
1	2	3
1	NIL	(1) Roads/Service lanes having R/W less than 6.10 metres (20 ft.). (i) Minimum length of the culvert shall be the entire width of R/W.
2	NIL	(2) Roads having R/W 6.10 metres (20 ft.). (i) Minimum length of the culvert shall be 4.57 metres (15 ft.).
3	NIL	(3) Roads having R/W 9.14 metres (30 ft.). (i) Minimum length of the culvert shall be 6.10 metres (20 ft.).
4	NIL	(4) Roads having R/W 12.19 m (40 ft.). (i) Minimum length of the culvert shall be 9.14 metres (30 ft.).
5	NIL	(5) Roads having R/W 13.72 m (45 ft.). (i) Minimum length of the culvert shall be 10.91 metres (36 ft.).
6	NIL	(6) Roads having R/W 18.29 m (60 ft.) and less than 24.38 m (80 ft.). (i) Minimum length of the culvert shall be 14.64 metres (48 ft.).
7	NIL	(7) Roads having R/W 24.38 m (80 ft.) and above. (i) Minimum length of the culvert shall be metalled width + width of foot-paths.

Notes :

- (i) Slab of the culvert shall be of R.C. C. M-150 with suitable reinforcement.
- (ii) Minimum thickness of R.C.C. slab shall be 0.1524 m (6") for culverts in residential areas and 0.2286 m (9") for culverts in industrial areas.
- (iii) Maximum span of the culverts slab shall be 1.165 m (4 ft.) C/C.
- (iv) 0.9144 m high parapet of brick masonry and plastered with cement mortar 1:4 (1 cement: 4 coarse sand) finished with a floating coat of neat cement will be constructed on both sides of culvert.

PROVISION FOR LATERAL CONFINEMENT OF AGGREGATES

Sub Head: Road Work
Clause: 16.7.5



STAGES OF CONSTRUCTION

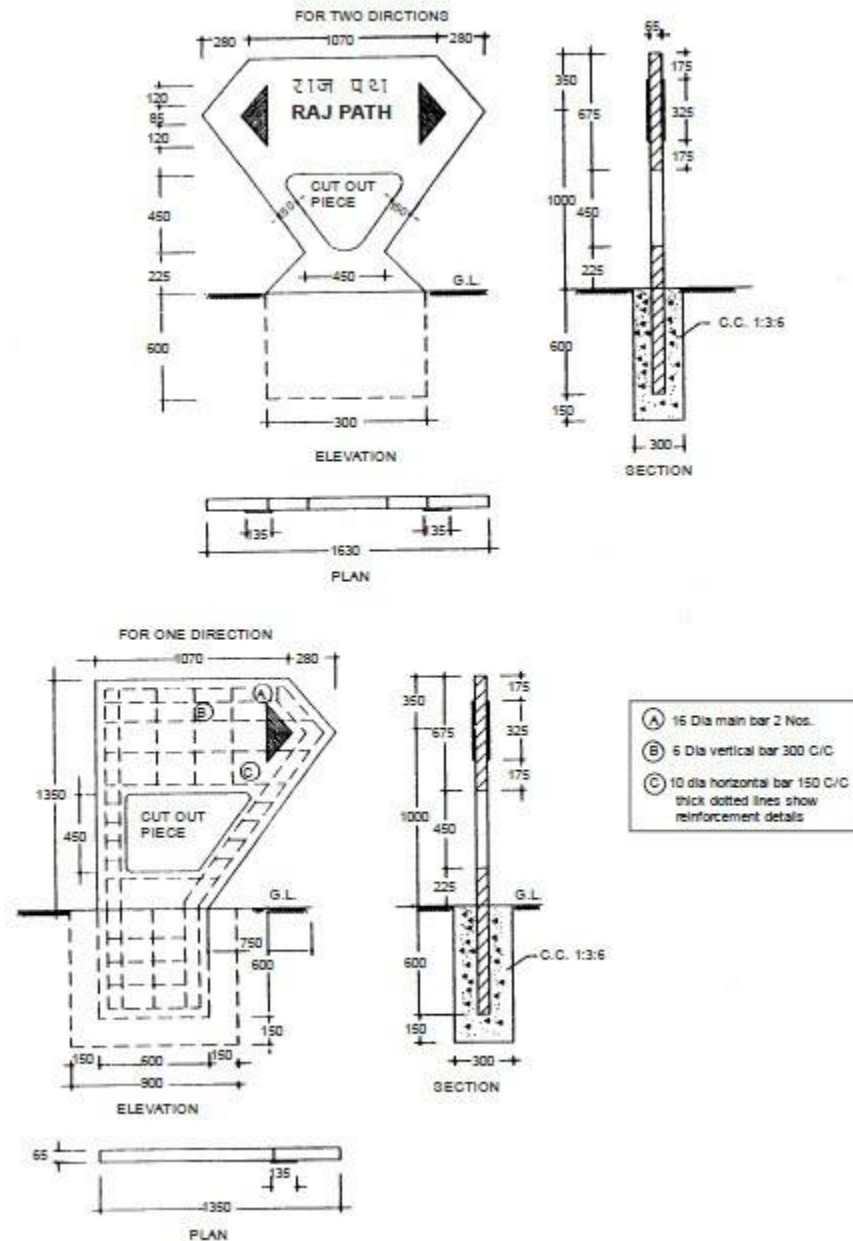
- ① Completion of Subgrade Level
- ② Completion of Shoulder
- ③ Trimming of Shoulder
- ④ WBM in Layers
- ⑤ Finishing Shoulder Top to Lines & Levels
- ⑥ Finishing Side Slopes to Lines & Levels

Drawing not to Scale
All dimensions are in mm

Fig. 16.1 : Provision for Lateral Confinement of Aggregates

R.C.C. NAME BOARD WITHOUT POST

Sub Head : Road Work

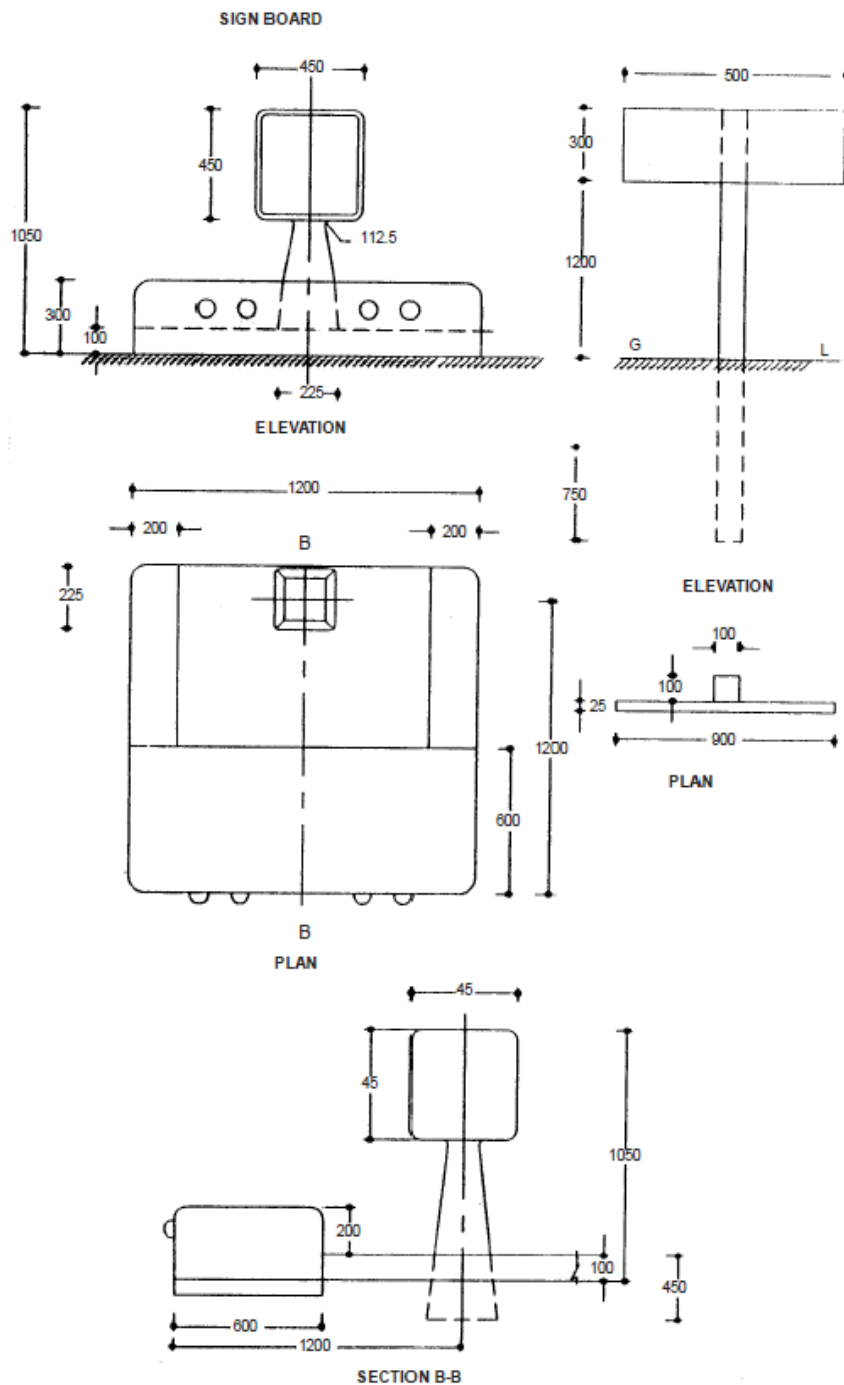


Drawing not to Scale
All dimensions are in mm

Fig. 16.2 : R.C.C. Name Board without Post

SIGN/NAME BOARD

Sub Head : Road Work

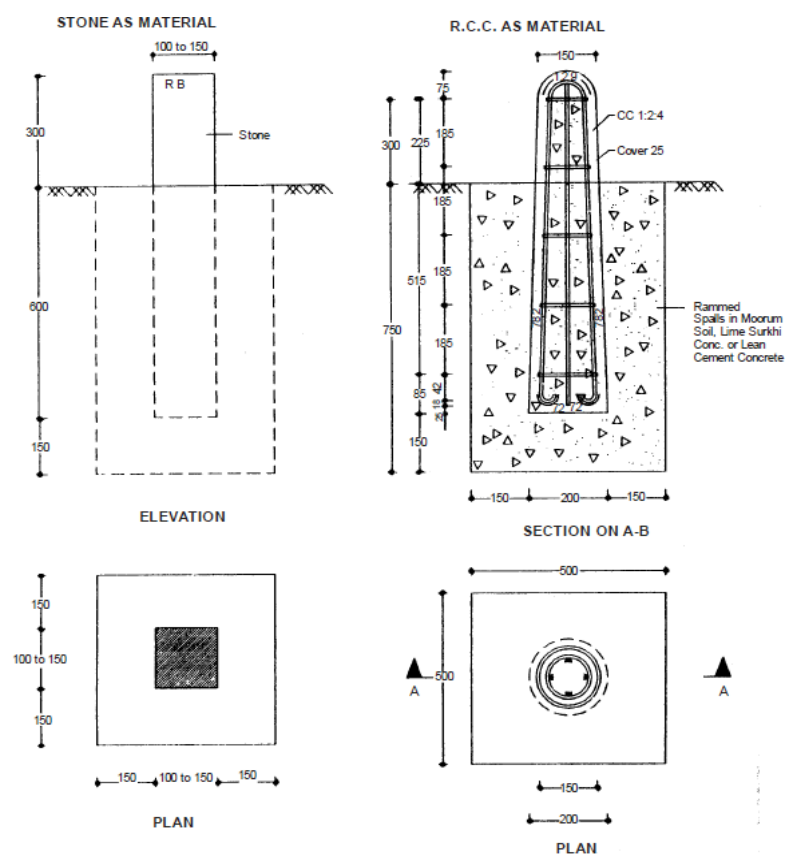


Drawing not to Scale
All dimensions are in mm
Red Reflectors()

Fig. 16.3 : Sign/Name Board

BOUNDARY STONE

Sub Head : Road Work
Clause : 16.20 & 16.21



BAR BENDING SCHEDULE					
S. No.	Type of M.S. Bar	No. of Bars	Shape of Bars	Dia in mm	Length of Bars I/S Hook
1.	Main Bars	2		6	1840
2.	Top Most Stirup	1		6	370
3.	Stirup 1st from Top	1		6	405
4.	Stirup Sec. from Top	1		6	440
5.	Stirup Third from Top	1		6	475
6.	Bottom Most Stirup	1		6	510

Drawing not to Scale
All Dimensions are in mm

Fig. 16.4 : Boundary Stone

STANDARD NUMERALS

Sub Head : Road Work

Clause : 16.19

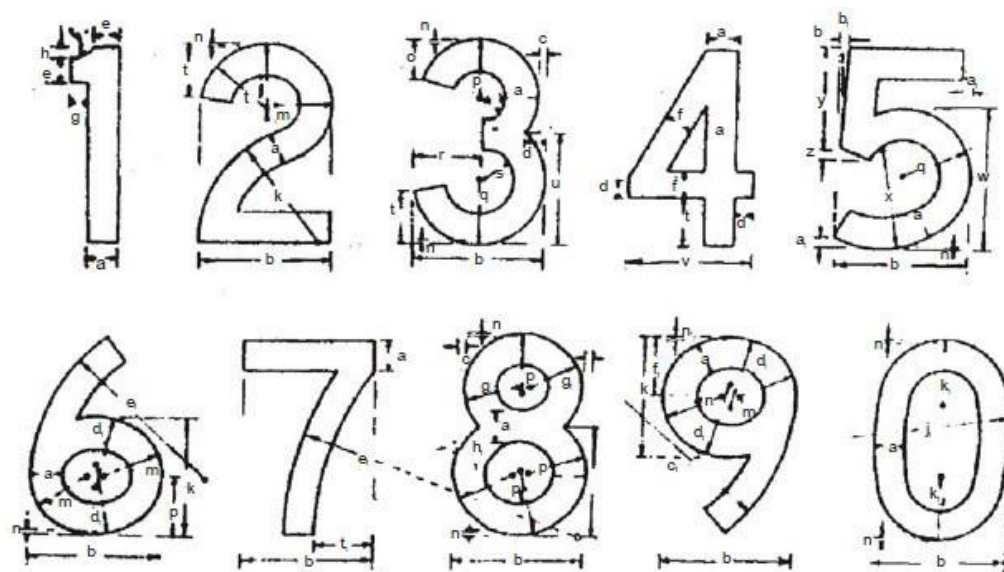


TABLE - I

Height of Numeral	DIMENSIONS																																				
	a	a ₁	b	b ₁	c	c ₁	d	d ₁	e	e ₁	f	f ₁	g	g ₁	h	h ₁	i	i ₁	j	j ₁	k	k ₁	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
80	13	4	54	2	3	71	8	29	10	120	11	24	7	21	5	9	26	56	31	80	46	26	21	23	1	16	24	27	28	12	20	45	51	58	41	41	4
100	16	5	67	2	4	89	9	36	13	150	14	30	9	26	6	12	33	70	39	100	61	32	27	29	2	20	30	34	34	15	25	56	64	72	51	52	5
130	20	7	87	3	5	116	12	47	16	195	18	39	11	34	8	15	43	91	51	130	79	42	35	38	2	26	40	44	45	19	33	73	83	93	66	67	6

TABLE - II
SPACING BETWEEN NUMERAL

Code Number	Numeral Height		
	80	100	130
1	19	24	31
2	15	19	24
3	10	13	16
4	5	6	8

TABLE - III
NUMERAL CODE NUMBER

Preceding Numeral	Following Numeral		
	1, 5	2, 3, 6, 8, 9, 0	4, 7
1	1	1	2
2	1	2	2
3	1	2	2
4	2	2	4
5	1	2	2
6	1	2	2
7	2	2	4
8	1	2	2
9	1	2	2
0	1	2	2

Note : To determine the proper spacing between numerals obtain the code number from Table III and enter Table II for that Code Number to Desired Numeral Height. Spacing is measured horizontally from the extreme right edge of the preceding numeral to the extreme left of the following numeral. For Dimensions of numerals of different heights see Table I.

Drawing not to scale

All dimensions are in mm

Fig. 16.5 : Standard Numerals

22 STANDARD LETTERS

Sub Head : Road Work
Clause : 16.19



TABLE - II

Height of Letter	DIMENSIONS																																																			
	a	a	b	b	c	c	d	d	e	e	f	f	g	g	h	h	i	i	j	j	k	k	l	l	m	m	n	n	o	o	p	p	q	q	r	r	s	s	t	u	v	w	x	y	z							
80	13	31	67	56	23	62	56	46	35	27	2	11	42	6	20	4	22	14	13	26	3	25	26	3	26	60	16	10	18	70	63	51	1	58	29	11	56	8	23	49	80	12	14	50	28							
100	16	39	84	69	28	77	67	58	44	34	2	14	52	8	25	5	27	17	16	30	3	31	33	4	32	79	20	13	22	88	73	64	2	84	36	13	70	9	29	61	100	15	18	5	34							
130	20	51	109	89	37	101	87	75	57	44	3	18	68	10	33	6	36	22	21	40	4	31	43	4	42	98	28	16	28	116	100	83	2	110	47	17	91	12	36	79	130	19	23	81	45							

TABLE - II
SPACING BETWEEN LETTERS

Code Number	Height of Letter		
	80	100	130
5			
12	19	24	31
9	15	19	24
6	10	13	16
3	5	6	8

TABLE - III
LETTER CODE NUMBER

Preceding Letter	Following Letter		
	B, D, E, F, H, I, K, L, M, N, P, R, U	C, G, O, Q, S, X, Z	A, J, T, U, W, Y
A	2	2	4
B	1	2	2
C	2	1	2
D	1	2	2
E	2	2	2
F	1	2	2
G	1	1	1
H	1	1	1
I	1	1	1
J	2	2	2
K	2	2	2
L	2	2	2
M	1	1	1
N	1	1	1
O	1	1	1
P	1	1	1
Q	1	1	1
R	1	1	1
S	1	1	1
T	2	2	2
U	1	1	1
V	2	2	2
W	2	2	2
X	2	2	2
Y	2	2	2
Z	2	2	2

Note : To determine the proper spacing between letters obtain the code number from Table III and enter Table II for that Code Number to Desired Height. Spacing is measured horizontally from the extreme right edge of the preceding Letter to the extreme left edge of the following letter. For Dimensions of letters of different heights, see Table I.

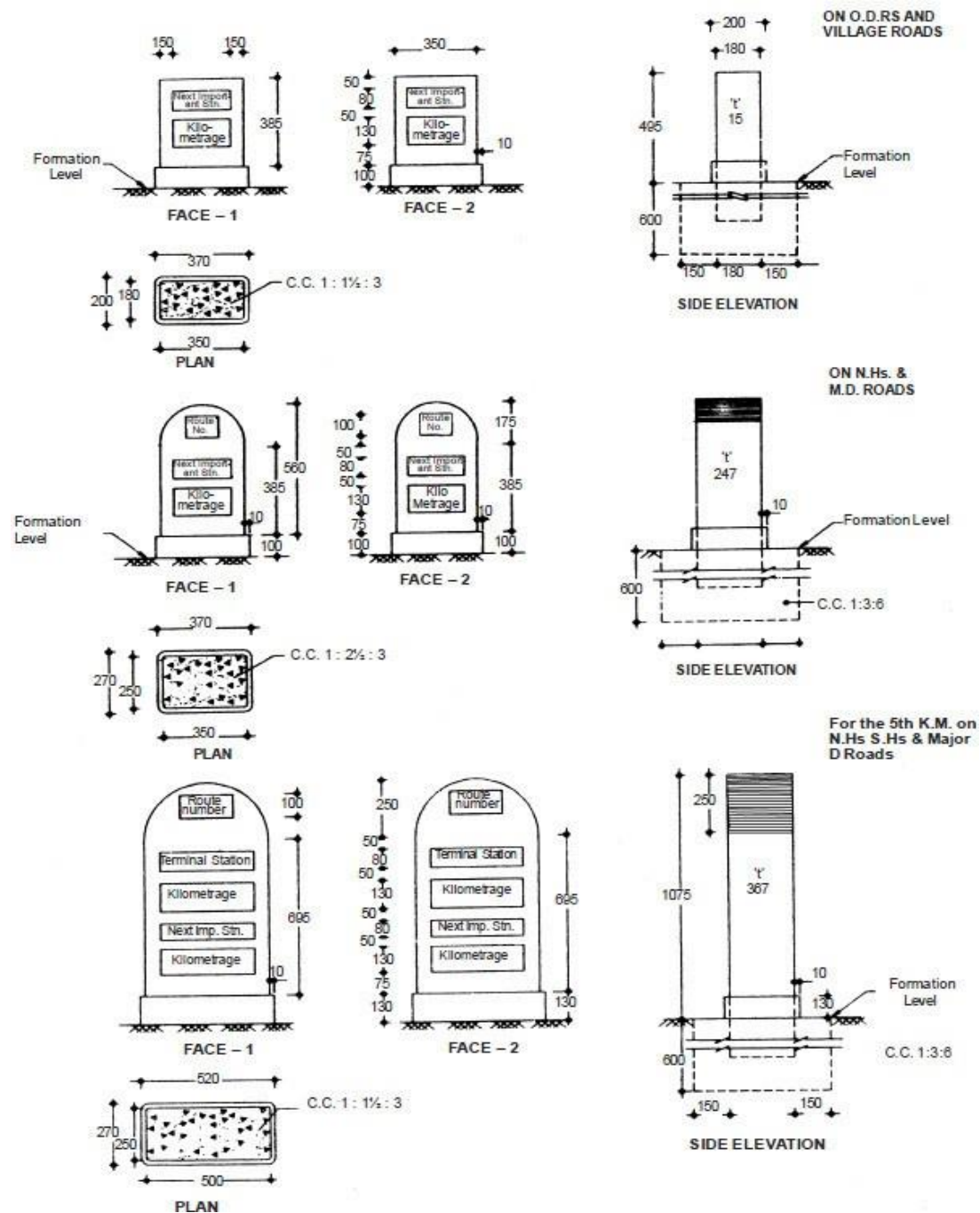
Drawing not to scale

All dimensions are in mm

Fig. 16.6 : Standard Letters

KILOMETRE STONES TYPE DESIGN

Sub Head : Road Work
Clause : 16.22



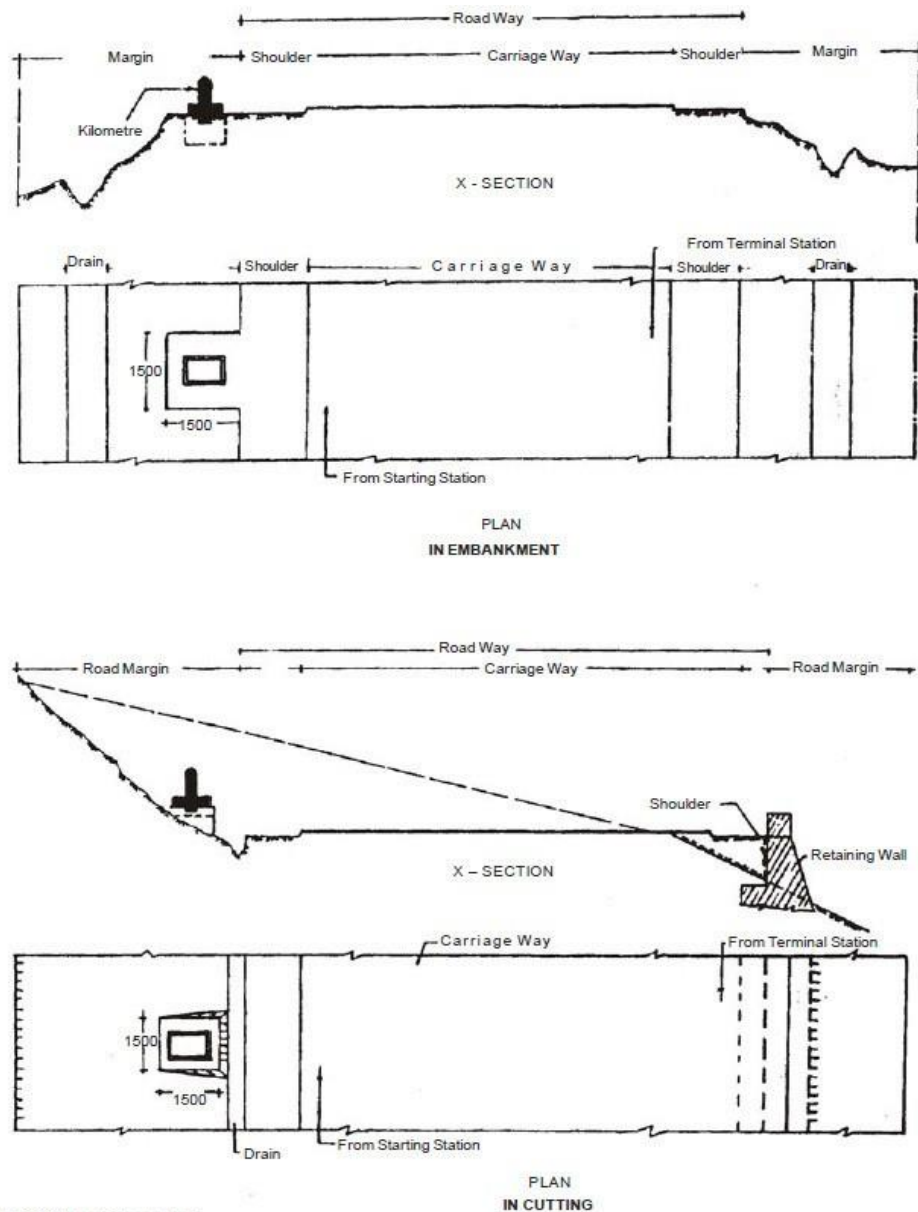
DRAWING NOT
TO SCALE ALL
DIMENSIONS
ARE IN MM.
RCC THICKNESS 'T'
SHALL BE 250 OTHER
MATERIAL

THICKNESS
MAY VARY.

Fig. 16.7 : Kilometre Stones Type Design

23 KILOMETRE STONE LOCATION (FOR HIGHWAYS)

Sub Head : Road Work
Clause : 16.22

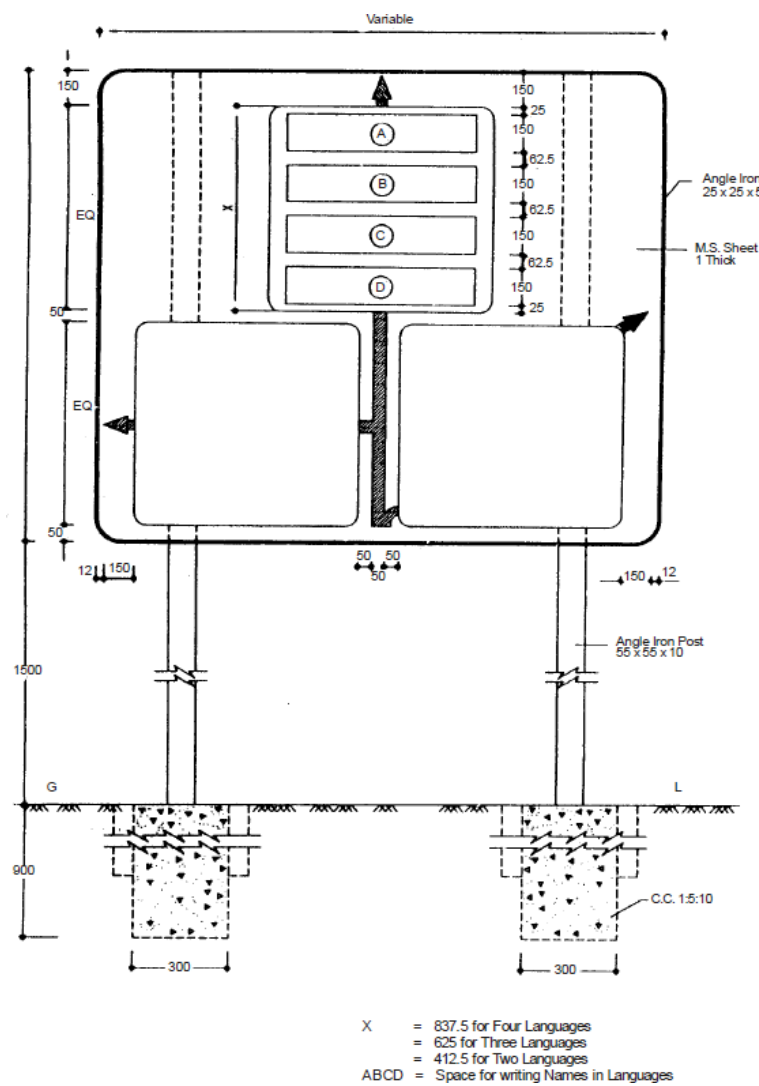


DRAWING NOT TO
SCALE ALL
DIMENSIONS ARE
IN MM

Fig. 16.7A : Kilometre Stones Location (For Highways)

INFORMATORY SIGN BOARD

Sub Head : Road Work
Clause : 16.49



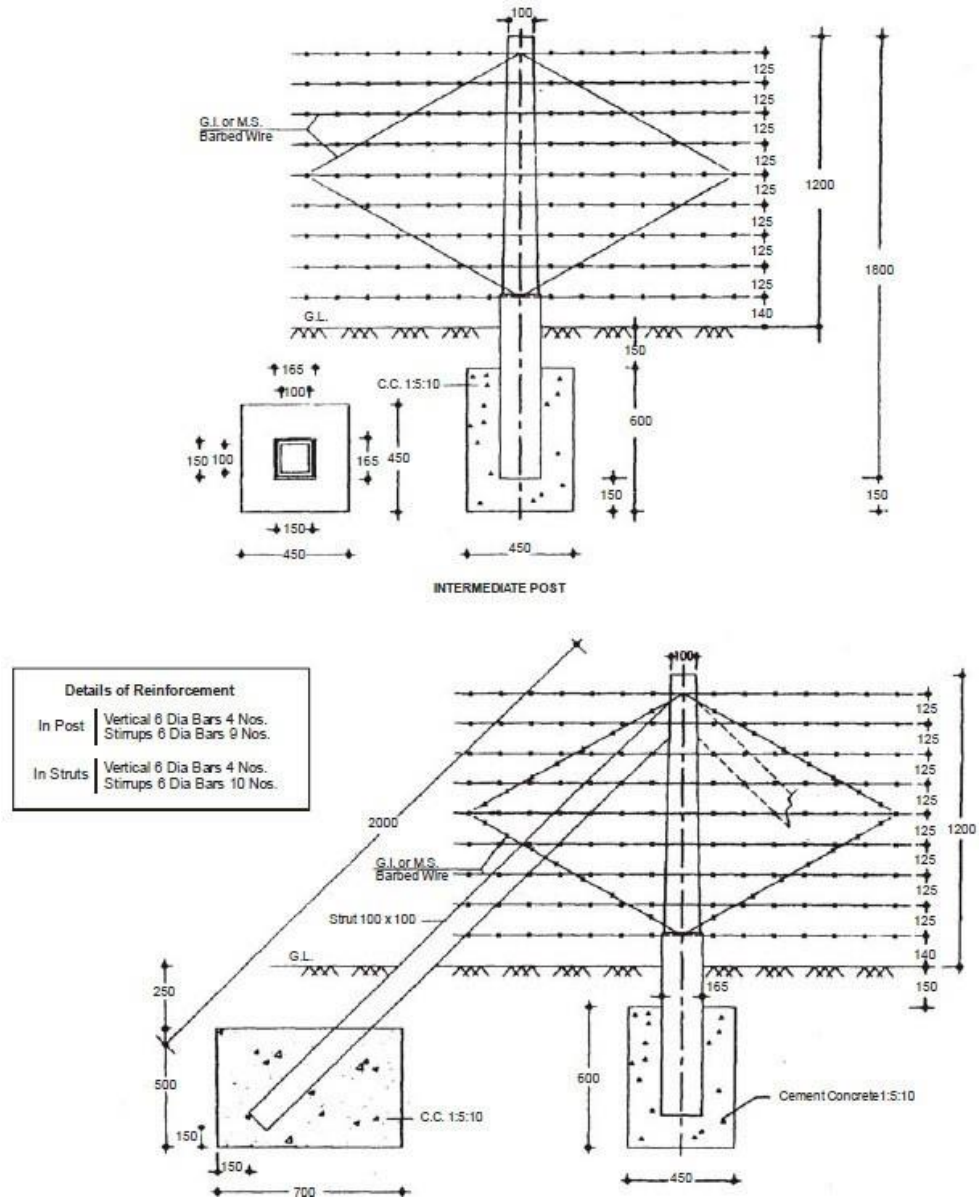
Drawing not to Scale
All dimensions are in mm

Fig. 16.8 : Informatory Sign Board

BARBED WIRE FENCING (WITH R.C.C. POST)

Sub Head : Road Work

Clause : 16.16



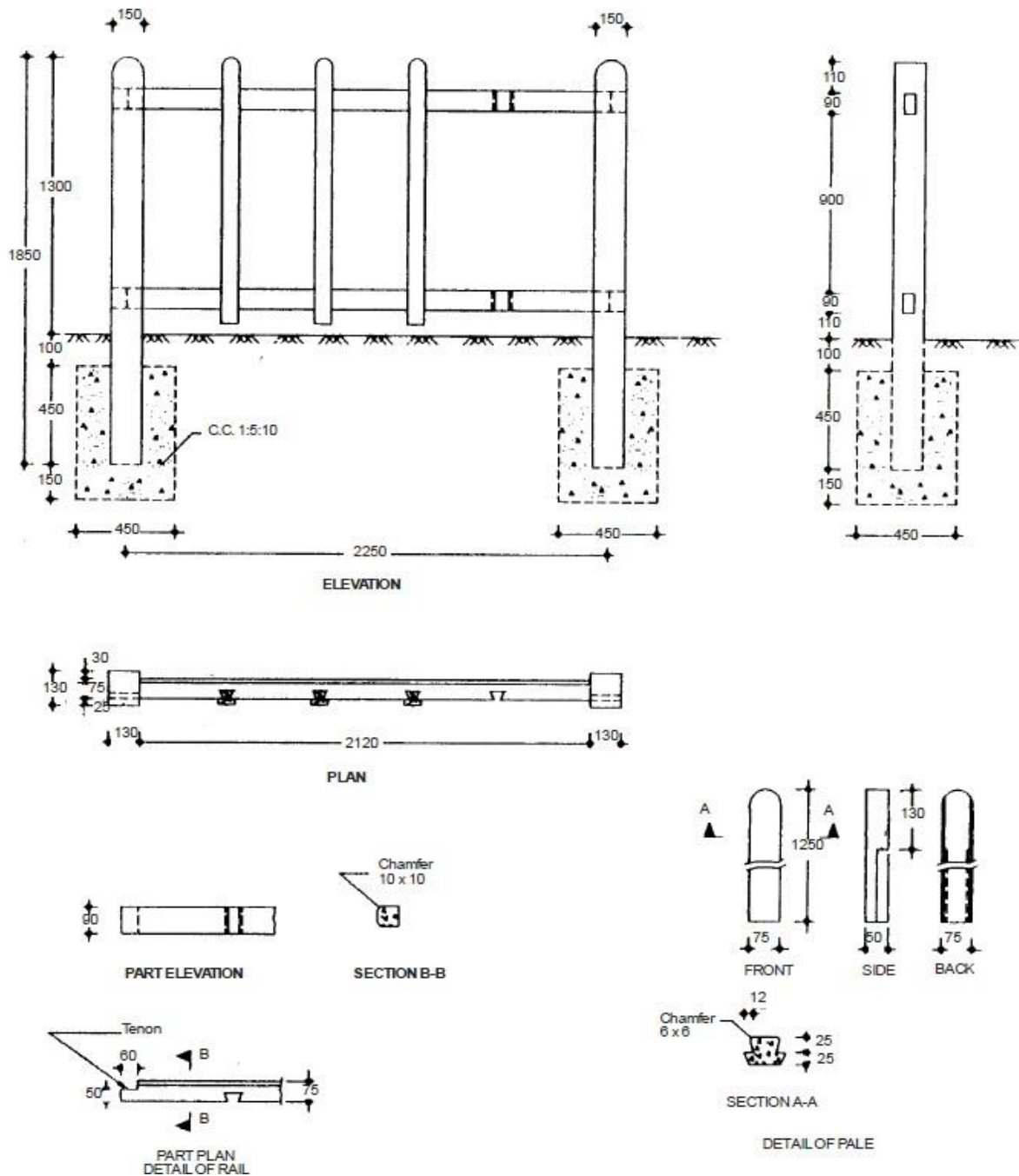
1. In case of end post one strut shall be omitted.
2. Drawing not to Scale
3. All dimensions are in mm.

Fig. 16.9 : Barbed Wire Fencing

FENCING WITH R.C.C. POST RAILS, PALES

Sub Head : Road Work

Clause : 16.18.6



Drawing not to Scale

All dimensions are in mm

Fig. 16.10 : Fencing with R.C.C. Post Rails, Pales

LOCATION OF INFORMATORY SIGN BOARDS

Sub Head : Road Work
Clause : 16.49

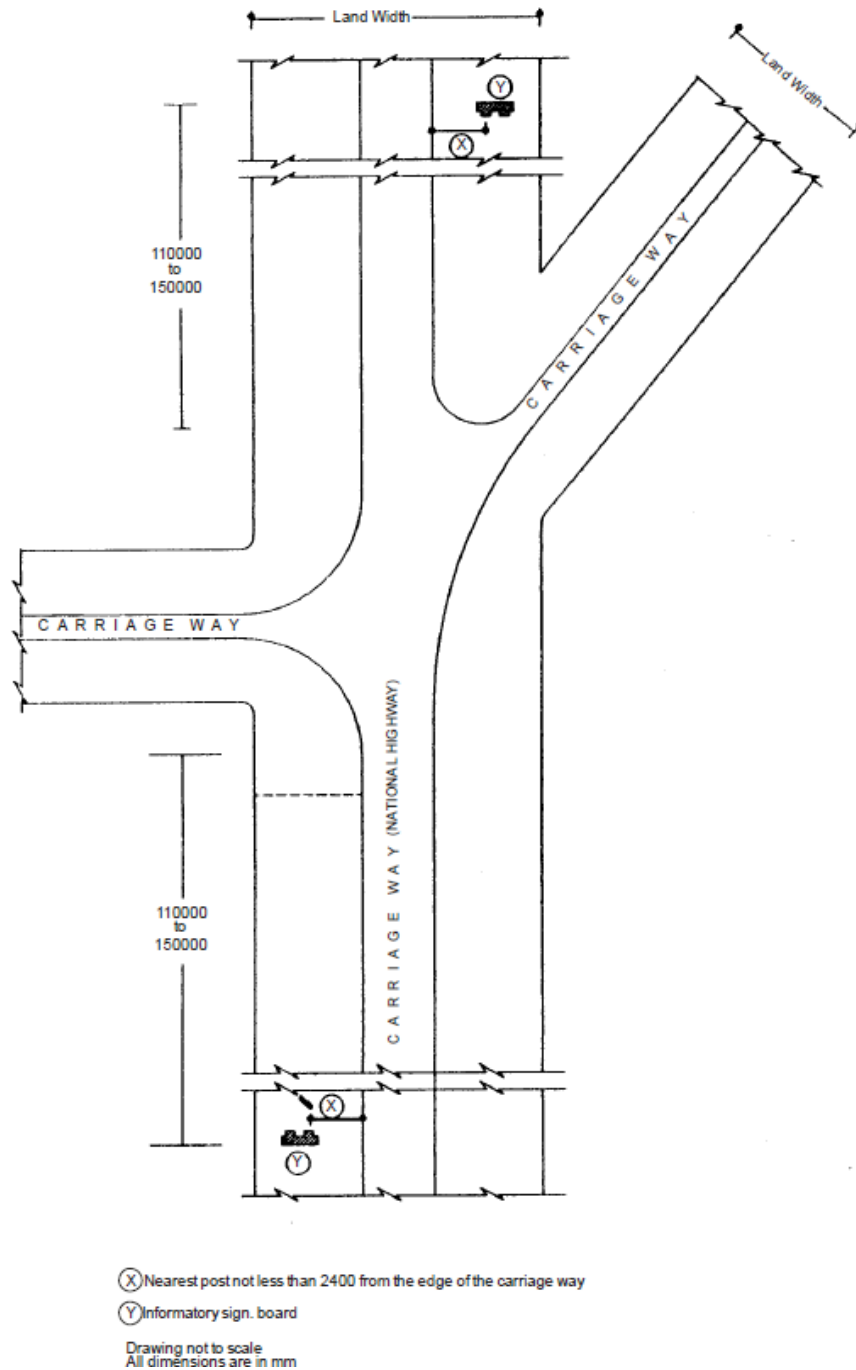
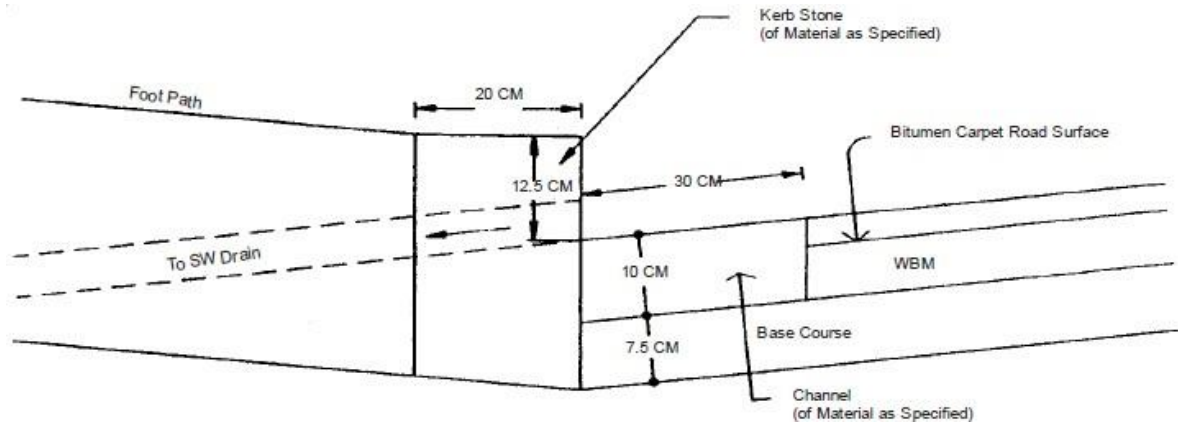


Fig. 16.11 : Location of Informatory Sign Boards

KERB & CHANNEL STONES

Sub Head : Road Work

Clause : 16.1.20



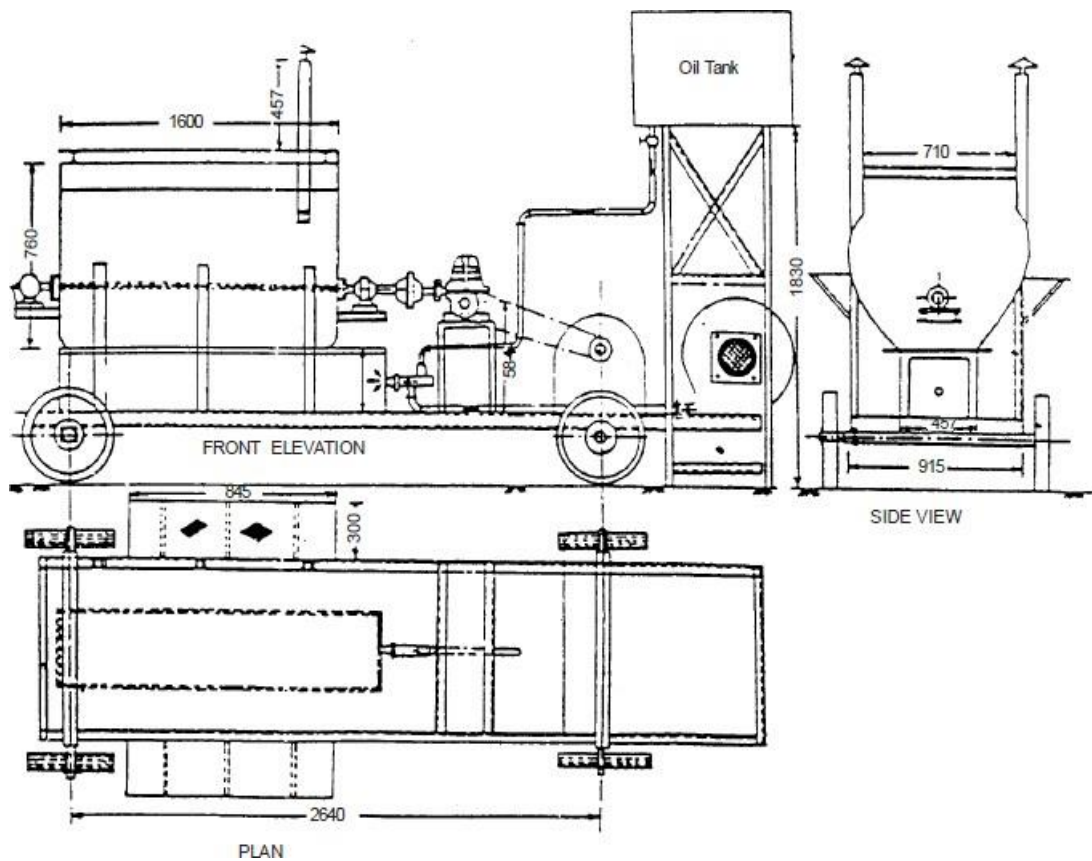
Drawing not to Scale
All dimensions are in mm

Fig. 16.12 : Kerb & Channel Stones

BROADDETAILSOFCOOKERFORBITUMENMASTICINWEARING COURSES

Sub Head: Road Work

Clause : 16.33.3



Drawing not to Scale.

All dimensions are in mm.

Fig. 16.13 : Broad Details of Cooker for Bitumen Mastic in Wearing courses

SECTION- 7 -(i) CAMPUS LAYOUT

