

**PUNATSANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY
(PHPA-I), BHUTAN**



BIDDING DOCUMENT

FOR

**TEMPORARY RE-ALIGNMENT OF WANGDUE-TSIRANG NATIONAL
HIGHWAY(NH) FROM BJIMTHANGKHA BHU TO GASELO PNH JUNCTION –
PACKAGE IV (RD 5.43 – 7.125 KM)**

(NIT No. PHPA-I/CE(C&P)/146/2026/06)

SEPTEMBER, 2026

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CONTENTS OF BIDDING DOCUMENT

CONTENT	DESCRIPTION	PAGES
Section -I	Notice Inviting Tender (NIT)	2
Section -II	Instructions to Bidders (ITBs)	14
Section -III	Bid Data Sheet (BDS).....	3
Section -IV	General Conditions of Contract (GCC).....	45
Section -V	Special Conditions of Contract (SCC).....	1
Section -VI	General Technical Specifications (GTS).....	83
Section-VII	Forms	19
Section -VIII	Bill of Quantities (BoQ)	10
Section -IX	Drawings	22



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SECTION I
NOTICE INVITING TENDER



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PUNATSHANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY
OFFICE OF THE CHIEF ENGINEER (CONTRACTS & PROCUREMENT)

BJIMTHANGKHA :: BHUTAN
 E-mail: ce_candp@phpa1.gov.bt
 Ph# +975-2-471501

BHUTAN
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NIT No. PHPA-I/CE(C&P)/146/2026/06

Date: 15.09.2026

Punatsangchhu-I Hydroelectric Project Authority (PHPA-I) invites sealed item rate bids for the Work **“Temporary Re-Alignment of Wangdue-Tsirang National Highway (NH) from Bjimthangkha BHU to Gaselo PNH Junction”** from experienced & financially sound Bhutanese and Indian bidders, fulfilling the eligibility criteria specified in the Bidding Document for the below mentioned works:

Contract Package	Name of Work	Bid Security Amount(Nu./Rs.)	Completion Period (Months)
Package – I	Temporary Re-Alignment of Wangdue-Tsirang National Highway (NH) from Bjimthangkha BHU to Gaselo PNH Junction from RD 0.00 to 1.63 KM	849,000.00	7
Package – II	Temporary Re-Alignment of Wangdue-Tsirang National Highway (NH) from Bjimthangkha BHU to Gaselo PNH Junction from RD 1.63 KM to 3.43 KM	985,000.00	8
Package – III	Temporary Re-Alignment of Wangdue-Tsirang National Highway (NH) from Bjimthangkha BHU to Gaselo PNH Junction from RD 3.43 KM to 5.43 KM	1,083,000.00	8
Package – IV	Temporary Re-Alignment of Wangdue-Tsirang National Highway (NH) from Bjimthangkha BHU to Gaselo PNH Junction from RD 5.43 KM to 7.125 KM	942,000.00	7
Package – V	Temporary Re-Alignment of Wangdue-Tsirang National Highway (NH) from Bjimthangkha BHU to Gaselo PNH Junction from RD 7.125 KM to 9.49 KM	1,246,000.00	9



Eligibility Criteria

The participating Bidders shall fulfil the following criteria:

1. Have a valid trade license and BCTA's Registration Certificate as **Large Class (W1)** category for Bhutanese bidders and **Class II (Building & Road)** or **equivalent category** for Indian bidders issued by authority concerned.
2. Have an average turnover of value mentioned in Instructions to Bidders clause 3.1.1 of individual package of any 3 years of the last 7 years, preceding the last date of bid submission.
3. Have the latest income tax clearance Certificate. If such a Clearance Certificate is not being issued by the concerned Authority, a certified photocopy of the latest income tax return shall be submitted by the Bidders.
4. Bidders should have experience of having successfully completed road works during the last 7 years preceding the last date of bid submission, with the following value mentioned in Instructions to Bidders Clause 3.1.4 of individual package.

Bidders must submit the Completion Certificate issued by previous client(s) for the above similar works executed by them. Such a Certificate shall indicate the value, date, and the site of works, and shall specify whether they were satisfactorily completed.

5. Bidders shall submit from the Bank or Financial Institutions in Bhutan/India showing evidence of access to or availability of a credit line of at least value mentioned in Instructions to Bidders Clause 3.1.5 of individual package.

The prospective Bidders may purchase the Bidding Document from the office of the Chief Engineer (C&P), Bjimthangkha w.e.f **15.09.2026** to **6.10.2026** on payment of a non-refundable fee of Nu./Rs. **5,000** (five thousand) only in the form of a cash warrant or bank draft drawn in favor of PHPA-I, payable at the Bank of Bhutan (Bajo) or State Bank of India (Jaigoan). The bidder can also download the Bidding Document from the PHPA-I website: www.phpa1.gov.bt at free of cost. Any corrigendum/addendum/errata in respect of these tenders shall be made available only at the mentioned website.

Bidders may bid for all the packages. However, if a single bidder is successful in more than two packages, PHPA-I reserves the right to award maximum of two packages only.

The PHPA-I reserves the right to reject any or all the bids without assigning any reason thereof.

-Sd -

Chief Engineer (C&P)
Telephone No.: +975-2-471501



SECTION II
INSTRUCTION TO BIDDERS



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INSTRUCTION TO BIDDERS

GENERAL 1

1	Introduction	1
2	Scope of Work	1
3	Eligible Bidders	1
4	Number of Bids per Bidder	3
5	Signatory Authority for Submission of Bid	3
6	Cost of Bidding	3
7	Site Visit.....	4
8	Contents of Bidding Document	4
9	Clarification of Bidding Document	5
10	Amendment of Bidding Document	5

PREPARATION OF BID 5

11	Language of Bid.....	5
12	Documents Comprising the Bid	5
13	Bid Price	6
14	Currencies of Bid and Payment.....	6
15	Bid Validity Period.....	6
16	Bid Security	7
17	Bidding Condition	7
18	Format for Submittal.....	7
19	Signing of Bid.....	8

SUBMISSION OF BID 8

20	Sealing and Marking of Bid.	8
21	Deadline for Submission of Bids.	9
22	Late Submission of Bid.....	9
23	Modification and Withdrawal of Bid	9
24	Bidding Document.....	9

BID OPENING AND EVALUATION 9

25	Bid Opening	9
26	Confidentiality of Bid.....	10
27	Clarification of Bid	



28	Determination of Responsiveness	10
29	Corrections of Errors in Bid	11
30	Evaluation and Comparison of Bid	11
31	Qualification of the Bidder.....	12

AWARD OF CONTRACT 13

32	Award Criteria.....	13
33	PHPA-I's Right to accept any Bid and or to reject any or all Bids	13
34	Notification of Award.....	13
35	Performance Security.....	13
36	Signing of the Contract	14



GENERAL

1 Introduction

Sealed item rate bids are invited for and on behalf of the Punatsangchhu-I Hydroelectric Project Authority (PHPA-I) from experienced & financially sound Bidders from Bhutan and India for the Work as described in the Bid Data Sheet (BDS).

2 Scope of Work

The scope of work is specified in Section VI - General Technical Specifications.

3 Eligible Bidders

3.1 The participating Bidders shall fulfil the following criteria:

- 3.1.1 Have an average turnover of Nu./Rs. **38 million or more** of any 3 years of the last 7 years preceding the last date of submission of the Bid.
- 3.1.2 Have a valid trade license and BCTA's/CDB's registration certificate as **Large Class (W1)** category for Bhutanese bidders and **Class II** (Building & Road) or **equivalent category** for Indian bidders issued by the authority concerned.
- 3.1.3 Have the latest income tax clearance Certificate. If such a Clearance Certificate is not being issued by the concerned Authority, a certified photocopy of the latest income tax return shall be submitted by the Bidder.
- 3.1.4 Bidders should have experience of having successfully completed Road works during the last 7 years preceding the last date of bid submission, with the following value:

Three similar works, each of value not less than **Nu. 19 million**

OR

Two similar works, each of value not less than **Nu. 28 million**

OR

One similar work of value not less than **Nu. 38 million**

Bidders must submit the Completion Certificate issued by previous client(s) for the above similar works executed by them. Such a Certificate shall indicate the value, date and the site of works, and shall specify whether they were satisfactorily completed.

- 3.1.5 Bidders shall submit from the Bank or Financial Institutions in Bhutan/India showing evidence of access to or availability of a credit line of at least **Nu./Rs. 19 million**.
- 3.2 A bidder shall not have more than **7 works** in hand at the time of bids opening. Bidders shall declare about the '**work in hand**' along with the bid.



- 3.3 A Bidder shall not have a conflict of interest. Any Bidders found to have a conflict of interest shall be disqualified. Bidders may be considered to have a conflict of interest with one or more parties in this bidding process if:
- 3.3.1 they have at least one controlling partner in common; or
 - 3.3.2 they receive or have received any direct or indirect subsidy from either party; or
 - 3.3.3 they have the same authorized legal representative for purposes of this Bid; or
 - 3.3.4 they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the Bid of another Bidder, or influence the decisions of the Employer regarding this Bidding process; or
 - 3.3.5 A Bidder participating in more than one Bid in this Bidding process shall result in the disqualification of all Bids; or
 - 3.3.6 A Bidder or any of its affiliates has been hired (or is proposed to be hired) by the Employer as Project Manager for the Contract implementation; or
 - 3.3.7 A Bidder or any of its affiliates employs or otherwise engages a close relative of a civil servant who either is employed by the Employer or has authority over the Bidder or its affiliates or over the Bid. For the purposes of this Sub-Clause, a close relative is defined as immediate family, which includes father, mother, brother, sister, spouse, and own children.
- 3.4 Government-owned enterprises shall be eligible only if they can establish that they:
- 3.4.1 are legally and financially autonomous,
 - 3.4.2 operate under commercial law, and
 - 3.4.3 are not a dependent agency of the Employer.
- 3.5 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer as the Employer shall reasonably request.
- 3.6 A Bidder shall be excluded if:
- 3.6.1 as a matter of law or official regulation, Bhutan prohibits commercial relations with the country in which the firm is constituted, incorporated or registered; or by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, Bhutan prohibits any import of goods or contracting of Works or services from that country in which the firm is constituted, incorporated or registered or any payments to persons or entities in that country.
 - 3.6.2 he is insolvent or is in receivership or is a bankrupt or is in the process of being wound up, or has entered into an arrangement with his creditors; or



- 3.6.3 his affairs are being administered by a court, judicial officer, or appointed liquidator; or
- 3.6.4 he has suspended business or is in any analogous situation arising from similar procedures under the laws and regulations of his country of establishment; or
- 3.6.5 he has been found guilty of professional misconduct by a recognized tribunal or professional body; or
- 3.6.6 he has not fulfilled his obligations with regard to the payment of taxes, social security, or other payments due in accordance with the laws of the country in which he is established or of the Kingdom of Bhutan; or
- 3.6.7 he is or has been guilty of serious misrepresentation in supplying information required for any prior registration with the Employer or the Bhutan Construction and Transport Authority; or
- 3.6.8 he has been convicted of fraud and/or corruption by a Competent Authority; or
- 3.6.9 he has not fulfilled his Contractual obligations with the Employer in the past; or
- 3.6.10 he has been debarred from participation in public procurement by any Competent Authority as per law; or
- 3.6.11 Any successful bidder in the earlier tenders failed to sign the contract agreement with PHPA-I within the prescribed time period.

4 Number of Bids per Bidder

Each Bidder shall submit only one Bid per package. A Bidder who submits or participates in more than one Bid per package (other than as a Sub Contractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.

5 Signatory Authority for Submission of Bid

5.1 Signatory Authority of the submission of Bids shall be as follows:

- 5.1.1 In the case of a proprietary firm, the Bid shall be signed by the Proprietor or authorized signatory.
- 5.1.2 In the case of a Limited Company or Corporation, the Bid shall be signed by an authorized person holding the Power of Attorney for signing the Bid. A Power of Attorney (in original) shall accompany the Bid.
- 5.1.3 Bid documents are not transferable.

6 Cost of Bidding

Bidders shall bear all costs associated with the preparation and submission of their Bids, and the PHPA-I will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.



7 Site Visit

- 7.1 Bidders are advised to visit the site to verify, examine, and obtain all key information that may be necessary for preparing the Bid. The costs of visiting the Site shall be at the Bidder's own expense.
- 7.2 A Bidder or his representative will be granted permission to enter the site of work only upon the condition that the Employer or his personnel or agent will not be responsible for death or personal injury or loss or damage to property and other loss, damage, cost, or expenses incurred as a result of inspection/visit.

BIDDING DOCUMENT

8 Contents of Bidding Document

- 8.1 The Bidding document is as stated below and should be read in conjunction with any corrigendum/modification issued to this document:
 - 8.1.1 Notice Inviting Tender (NIT)
 - 8.1.2 Instructions to Bidders (ITBs)
 - 8.1.3 Bidding Data Sheet (BDS)
 - 8.1.4 General Conditions of Contract (GCC)
 - 8.1.5 Special Conditions to Contract (SCC)
 - 8.1.6 General Technical Specifications (GTS)
 - 8.1.7 Forms
 - 8.1.8 Bill of Quantities
 - 8.1.9 Drawings
 - 8.1.10 Any other document forming part of the Bid.

- 8.2 Bidders are expected to examine carefully the contents of all the above documents.

Failure to comply with the requirements of the Bid submission will be at the Bidder's own risk. Bids that are not substantially responsive to the requirements of the Bidding document will be rejected. Prior to the last date of submission of the Bid, the Employer may, for any reason whatsoever, modify the Bid by issuing a corrigendum/addendum, which will become a part of the Bidding document. No modification of the Bid shall be permissible after the last date of submission, whatsoever may be the reason.

PHPA-I may, at its discretion, extend the deadline for submission of Bid, if considered necessary.



9 Clarification of Bidding Document

- 9.1 Any prospective Bidder requiring any clarifications of the Bidding Document **may notify PHPA-I in writing to the address mentioned in the BDS, not later than 10 days prior to the date of bid submission.** If required, PHPA-I will issue a clarification in writing not later than **5 days** prior to the deadline for submission of the Bid. All such clarification shall form part of the Bidding Document and shall accompany the Bidder's Bid. Written copies of PHPA-I's response (including a description of the enquiry but without identifying its source) shall be uploaded on PHPA-I's website (www.phpa1.gov.bt).
- 9.2 Bidders or their official representatives may attend a pre-bid meeting, if any, which will take place at the time and place stated in the BDS.

10 Amendment of Bidding Document

- 10.1 At any time but not later than 5 days prior to the deadline for submission of Bids, the PHPA-I may, for any reason, whether at its own initiative or in response to a clarification requested by prospective Bidders, modify the Bidding Document by the issuance of a Corrigendum/Addendum through the PHPA-I's website.

PREPARATION OF BID

11 Language of Bid

Bid prepared by the Bidder and all correspondence and documents relating to the Bid exchanged by the Bidder and the PHPA-I shall be written in the English language only.

12 Documents Comprising the Bid

- 12.1 Bid to be prepared and submitted by the Bidder shall comprise the following: -
- 12.1.1 Complete Bidding document, forms, and schedules used thereto, duly filled in and signed wherever required without altering the formats;
 - 12.1.2 Bid Security in accordance with clause 16 of ITB. The Bids that do not contain the required Bid Security will be summarily rejected;
 - 12.1.3 Valid Trade license and latest Tax Clearance Certificate & Pre-Contract Integrity Pact Statement;
 - 12.1.4 Abstract of work program for completing various works in MS Excel or MS Project;
 - 12.1.5 List of Machinery, Equipment, tools, and Manpower proposed to be deployed;
 - 12.1.6 Site organization proposed for this work;
 - 12.1.7 Methodology proposed to be adopted for this work;
 - 12.1.8 Any other relevant material/information.



- 12.2 For Bid submissions, the bidders may refer to the eligibility criteria and other mandatory data prior to the submission of bids.

13 Bid Price

- 13.1 Unless stated otherwise in the Bidding Document, the Contract shall cover the entire scope of work as described in Clause 2 of ITB, based on the schedule of unit rates/prices submitted by the Bidder. For any item in the Bill of Quantities (BoQ) where the Bidder has not entered a rate or price, or has quoted zero, the Bidder shall nonetheless be required to execute the item. However, no separate payment shall be made by PHPA-I for such items, and the cost shall be deemed to be included in the rates/prices quoted for other items in the BoQ.
- 13.2 Bidders are advised to quote a rate for all the items in the BoQ.
- 13.3 In accordance with the SCC, the rates quoted by the Bidder may be subjected to adjustment during the performance of the Contract as per the provisions of GCC Clause 63.
- 13.4 The Bidder shall quote its final all-inclusive net price for execution of the Contract, including all incidental costs. All duties, taxes, and other levies payable by the Contractor under the Contract or for any other cause up to the deadline for submission of Bids shall be deemed to be included in the rates, prices, and the total Bid Price submitted by the Bidder, excluding Goods and Services Tax (GST).

The Bidder shall quote the applicable GST separately in the Bill of Quantities (BoQ) to facilitate its reimbursement through interim payments, as applicable.

However, if PHPA-I is exempted from the applicable GST in Bhutan at any time during the performance of the Contract, the GST amount quoted separately in the BoQ shall not be payable by PHPA-I.

14 Currencies of Bid and Payment

The unit rate shall be Ngultrum (Nu./Rs.), and the payment shall be made in the currency of the Bid.

15 Bid Validity Period

- 15.1 Bids shall remain valid for acceptance for a period specified in the BDS.
- 15.2 In exceptional circumstances, prior to expiry of the original Bid validity period, the PHPA-I may request the Bidder for a specified extension in the period of validity along with the validity of the Bid Security. The request and the responses thereto shall be made in writing. A Bidder may refuse the request without forfeiting his Bid Security. A Bidder agreeing to the request will not be required/ nor permitted to modify his Bid, but will be required to extend the validity of his Bid security correspondingly. The provision of ITB Clause 16.3,



regarding discharge and forfeiture of Bid security, shall continue to apply during the extended period of Bid validity.

16 Bid Security

16.1 Bidders shall furnish as part of their Bid, a Bid Security in original, denominated in the currency and amount specified in BDS, in a separate sealed envelope.

16.1.1 Any Bid not accompanied by Bid Security of specific value and validity shall be rejected by PHPA-I as *non-responsive*.

16.1.2 The Bid Securities of the unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder furnishing the Performance Security and signing the Contract Agreement, in any event, not later than 30 days after the expiry of the validity of the Bid.

16.2 Bid Security shall be in any of the following forms:

16.2.1 Demand Draft issued by any Financial Institution of Bhutan/India and drawn in favor of **Punatsangchhu-I Hydroelectric Project Authority** payable at Bank of Bhutan (Bajo)/ State Bank of India, Jaigaon. If the demand draft validity is less than the bid security validity, PHPA-I shall encash the said draft after opening of the bid prior to expiry of its validity.

16.2.2 Unconditional Bank Guarantee (BG) issued by any Financial Institutions or any other Scheduled Banks in Bhutan/India and pledged in favour of the **Punatsangchhu-I Hydroelectric Project Authority**. The Proforma for Bank Guarantee shall be in accordance with the Proforma for bid security (Form 2) enclosed at Section-VII of the Bidding Document.

16.3 Bid Security is liable to be forfeited if:

16.3.1 Bid is withdrawn during the period of its validity, after opening of Bids.

16.3.2 Correction of Bid price is not accepted by the Bidder pursuant to ITB Clause 29.

16.3.3 Successful Bidder fails to sign contract agreement and furnish Performance Security within the specified time limit.

17 Bidding Condition

Bidders shall submit their Bids complying with the requirement of the Bidding Document. Any deviation from the Bidding document shall be liable for rejection.

18 Format for Submittal

Format for submittal of related information for Bid shall be as per the Section VII - Forms, and shall be strictly adhered to.



19 Signing of Bid

- 19.1 Bidders shall prepare one original of the documents comprising the Bid as described in ITB Clause 12, bound with the volume containing the Forms of Bid. The Bid, typed or written in indelible ink and shall be signed by a person duly authorized. ***Proof of authorization shall be furnished in the form of a written Power of Attorney (in original) along with the Bid.***

All pages of the Bid and entries where amendments have been made shall be initialed by the person signing the Bid.

- 19.2 The complete Bid shall be without alternations or erasures, except those to accord with instructions issued by the PHPA-I, or as necessary to correct errors made by the Bidder, in which case such corrections shall be initialed by the person signing the Bid.

SUBMISSION OF BID

20 Sealing and Marking of Bid.

- 20.1 The bids shall be submitted in one original and one copy enclosed in an inner envelope, duly marking the envelopes as “original” and “copy” as appropriate.

- 20.2 The bids shall be submitted in a **Single-Stage: Two-Envelope system, Techno-Commercial Bid** along with valid Bid Security marked as **Envelope-I**, **Price Bid** marked as **Envelope-II** and enclosed Envelope I & II together in a larger outer envelope with marked as “Confidential”. The bids shall be addressed to:

20.2.1 Chief Engineer (Contracts & Procurement Circle), PHPA-I, Wangdue, Bhutan.

20.2.2 bear the following identification:

20.2.2.1 Bid for “.....”.

20.2.2.2 “**DO NOT OPEN BEFORE**” the date & time specified in Bidding Data Sheet.

20.2.3 The inner envelopes shall clearly identify the envelope number and the contents of the envelopes detailed as under:

a) Envelope- I

- i. Valid Bid Security
- ii. Duly filled Proforma forms
- iii. Complete Bidding document specified under Clause 12 along with all amendments as mentioned in ITB Clause 10 except Price Bid
- iv. Envelope shall be superscribed as “Techno-Commercial Bid”.

b) Envelope - II

- i. Duly filled price/rate of items in the BoQ



ii. Envelope shall be superscribed as "Price Bid".

20.2.4 If the outer envelope is not sealed and marked as above, PHPA-I shall assume no responsibility for the misplacement or premature opening of the Bid.

21 Deadline for Submission of Bids.

21.1 The Bids must be submitted within the time and date specified in BDS.

21.2 PHPA-I may, at its discretion, extend the deadline for submission of Bids by issuing an amendment, in which case all rights and obligations of the PHPA-I and the Bidders previously subject to the original deadline shall thereafter be subject to the new deadline, as extended.

22 Late Submission of Bid

Any Bid received by the PHPA-I after the deadline for submission of Bids prescribed by the PHPA-I in ITB Clause-21 shall be returned unopened (outer envelope shall be opened to know the Bidder's address).

23 Modification and Withdrawal of Bid

23.1 Bidders may modify or withdraw their Bid before the deadline for submission of Bid by giving modification or withdrawal notice in writing to PHPA-I.

23.2 Bidder's modifications or notice of withdrawal shall be prepared, sealed and clearly marked as "Modification" or "Withdrawal" as appropriate and delivered/submitted prior to deadline for submission of Bid in accordance with ITB Clause 21.

23.3 No Bid will be modified after the deadline for submission of the Bid. Withdrawal of the Bid between deadline for submission and expiry of Bid validity will result in forfeiture of Bid Security pursuant to ITB Clause 16.3.

24 Bidding Document

Entire set of Bidding Document shall be submitted after filling it wherever required & signing each page as a token of acceptance of all terms & conditions of the Bidding Document. No portion of the Bidding Document shall be retained by the Bidder.

BID OPENING AND EVALUATION

25 Bid Opening

25.1 PHPA-I shall open the Techno-Commercial Bids, including modifications made pursuant to ITB Clause 23, in the presence of the Bidders or their authorized representatives who may choose to attend at a time & place mentioned in the BDS.



- 25.2 Envelopes marked "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to ITB Clause 23, shall not be opened.
- 25.3 The Bidder's name, modifications, withdrawals, presence or absence of Bid Security and other such details as considered appropriate will be announced at the time of opening Techno-Commercial Bids. The record of the Bid opening including information disclosed will be preserved for office records.
- 25.4 The "Price Bid" (Envelope II) of only those bidders whose Techno-Commercial bids have been ascertained to be substantially responsive to the requirement of the Bidding Document shall be opened later. The date, time and venue for the opening of the price bids shall be notified separately to the eligible and technically qualified bidders, who wish to be present.

26 Confidentiality of Bid

- 26.1 After the public opening of Bids, information relating to the examination, clarification, evaluation and comparison of Bids and recommendations concerning the Award of Contract shall not be disclosed to Bidders or other persons not officially concerned with such process.
- 26.2 Any effort by a Bidder to influence the PHPA-I in the process of examination, clarification, evaluation, comparison of Bids, and in decisions concerning Award of Contract, may result in the rejection of his Bid.

27 Clarification of Bid

To assist in the examination, comparison and evaluation of Bid, the PHPA-I may ask Bidders for clarification of the Bids, including a breakdown of unit rate. But no change in price or substances of Bid will be sought, agreed or permitted except as required to confirm the correction of arithmetic errors discovered by PHPA-I in the evaluation of Bids. The request for clarification and its response shall invariably be in writing.

28 Determination of Responsiveness

- 28.1 Prior to the detailed evaluation of the Bid, it will be determined whether each Bid:
- 28.1.1 has been properly signed;
 - 28.1.2 is accompanied by required bid security;
 - 28.1.3 is substantially responsive to the requirements of the Bidding Document;
- 28.2 A substantially responsive document is one which conforms to all the terms, conditions & specifications without material deviation or reservation which:
- 28.2.1 affects in any substantial way the quality or scope of the Work;
 - 28.2.2 limits in any substantial way the scope of Work;



28.2.3 is inconsistent with the Bidding Document;

28.2.4 affects unfairly the competitive position of other Bidders.

28.3 Bids not found substantially responsive are liable to be rejected. Conditions if added by the Bidder, which have adverse bearing on the cost and scope of tendered work shall make the Bid liable to disqualification.

29 Corrections of Errors in Bid

29.1 The price bids shall be checked by the Employer for any arithmetic errors in computation and summation. Errors will be corrected by the Employer as follows:

29.1.1 where there is a discrepancy between the rate in figures and words, the rate in words will govern; and

29.1.2 where there is a discrepancy between the unit rate and the total amount derived from the multiplication of the unit rate and the quantity, the unit rate as quoted will govern and the total amount shall be corrected.

29.1.3 if there is an error in a total corresponding to the addition or subtraction of sub-totals, the sub-totals shall prevail and the total shall be corrected.

29.1.4 If the Bidder does not quote for any item in the BoQ, it is presumed that he will execute the quantity mentioned in the BoQ free of cost and he has covered the price of this item in rate of other items quoted by him.

29.2 If the Bidder does not accept the corrected amount of Bid, his Bid will be rejected and the Bid security will be forfeited.

30 Evaluation and Comparison of Bid

30.1 PHPA-I will only evaluate and compare the Bids determined to be substantially responsive.

30.2 In evaluating Bids, PHPA-I will determine, for each Bid, the Evaluated Bid Price by adjusting the Bid Price as follows:

30.2.1 making any correction for errors;

30.2.2 making an appropriate adjustment for any discount and;

30.2.3 making an appropriate adjustment for acceptable quantifiable variations or deviations.

30.3 If the bid price of the lowest evaluated Bid appears abnormally low (below 20% of the estimated value) and/or seriously unbalanced, PHPA-I may require the Bidder to produce written explanations or justifications and detailed price analyses for any or all items of the Bill of Quantities to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. Abnormally low Bid may or may not be accepted. If PHPA-I decides to accept the abnormally low Bid and/or the bid with serious



unbalanced rates after considering the above, the Bidder shall increase the performance security from ten percent (10%) up to maximum of 30% of the initial Contract price; or

Alternatively, the PHPA-I may require the successful bidder to deposit the difference between the departmental estimate and contract amount in the form of cash warrant in addition to 10% performance security.

- 30.4 If the prices of all bids are abnormally high (above 20% of the estimated value), PHPA-I may seek justification from the bidder for the high rates and if necessary, negotiate with the lowest evaluated bidder or may reject the bid if considered to be abnormally higher than the estimated cost.
- 30.5 PHPA-I reserves the right to accept or reject any variation, deviation or alternative offers. Variations, deviations, alternative offers and other factors which are in excess of the requirements of the Bidding Document or otherwise result in the accrual of unsolicited benefits to PHPA-I shall not be taken into account in Bid evaluation.
- 30.6 PHPA-I will carry out a detailed technical evaluation of the Bids in order to determine whether the technical aspects are in accordance with the requirements. In order to reach to such determination, PHPA-I will examine and compare the technical aspects of the Bids on the basis of the information provided by the Bidders.
- 30.7 Supplied overall completeness and compliance with the General Technical Specifications and Drawings; suitability of the Works/ Services offered in relation to the environmental and climatic conditions prevailing at the Site. The Bid that does not meet minimum acceptable standards of completeness, consistency and detail will be rejected as non-responsive.
- 30.8 All other considerations being equal, preference shall be given to the Bhutanese bidder to allocate the work.

31 Qualification of the Bidder

- 31.1 PHPA-I shall determine to its satisfaction whether the Bidder selected is having the lowest evaluated responsive Bid, meet the terms of the qualification requirements stipulated in the BDS and have the capacity and capability to perform the Contract.
- 31.2 The determination shall be based upon an examination of the documentary evidence, including the authenticity of the Bidder's qualifications and capacity & capability submitted by the Bidder.



AWARD OF CONTRACT

32 Award Criteria

PHPA-I will award the Contract to the Bidder whose Bid has been determined to be substantially responsive to the Bidding Document:

- 32.1 **A Bidder may submit bids for all five packages, however, an individual/single Bidder shall be awarded maximum of two packages only, even if they emerge as the lowest evaluated bidder (L₁) across all packages.**
- 32.2 If single bidder is L₁ for all the packages, the PHPA-I will award the packages preferably the highest contract value to the L₁ bidder, and shall set aside their bids for subsequent packages.
- 32.3 For the remaining package(s) where the L₁ bidder is precluded from award due to the two-package ceiling/restriction, the contract shall be awarded to the successful bidders in the sequence of ranking in order, starting from next lowest evaluated bidder (L₂), at the L₁ bidder's quoted rate (s)/price(s). Otherwise, at the sole discretion of the PHPA-I, the award may proceed at the original rates quoted by the L₂ bidder with negotiation.

33 PHPA-I's Right to accept any Bid and or to reject any or all Bids

PHPA-I reserves the right to accept or reject any Bid, and to annul the Bidding process and reject all Bids, at any time before award of the Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the PHPA-I's action.

34 Notification of Award

- 34.1 Prior to the expiry of the Bid validity period prescribed or any extension thereof, PHPA-I will notify the successful Bidder in writing that his Bid has been accepted.
- 34.2 This notification letter shall be issued to the successful Bidder by the PHPA-I in Form (hereinafter and in the Conditions of Contract called the "Letter of Award") in duplicate and will state the sum that PHPA-I will pay to the successful Bidder in consideration of the execution, and completion of the Works by the successful Bidder as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

35 Performance Security

- 35.1 Within **30 days** of the issue of the letter of award by PHPA-I, but not later than the date of the signing of the Agreement, the successful Bidder shall furnish to the PHPA-I, a Performance Security in the form of a Bank Guarantee or Demand Draft for an amount equal to **10%** of the Contract Price.
- 35.2 Performance Security provided by the successful Bidder in the form of a Bank Guarantee or Demand Draft shall be in favour of PHPA-I issued by any Financial Institution in



Bhutan/India. Bank Guarantee shall be on the Proforma (Form 3) attached at Section-VII of this bidding document.

36 Signing of the Contract

- 36.1 Upon submission of the Performance Security as per ITB Clause 35, and within **30 days** of issue of the Letter of Award, the successful Bidder or his authorized representative shall attend the office of the **Chief Engineer (C&P Circle), PHPA-I, Bjimthangkha, Bhutan** for the signing of the Contract Agreement on a date and time mutually agreed upon, or as specified in the Letter of Award.
- 36.2 In case the successful Bidder fails to sign the Contract Agreement within the deadline specified above, it shall lead to cancellation of the award and forfeiture of Bid Security.



(Chief Engineer)
Contracts & Procurement Circle



SECTION III
BID DATA SHEET



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BID DATA SHEET

The following Bid Data for the Work to be procured shall amend and/or supplement the Clauses in the Instruction to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in the ITB.

ITB Clause Reference	Data
General	
1. Name of work	Temporary Re-Alignment of Wangdue Phodrang-Tsirang National Highway (NH) from Bjimthangkha BHU to Gaselo PNH Junction – Package IV (RD 5.43 – 7.125 km).
3.5 A Bidder shall be excluded	If the Contract has been terminated by the PHPA-I due to fundamental breach of Contract by the Contractor in last 2 years prior to submission of the Bid.
Bidding Document	
9.1 Clarification on Bidding Document	Employer's address for clarification in writing: Chief Engineer (C&P), Punatsangchhu-I Hydroelectric Project Authority (PHPA-I), Bjimthangkha, Wangdue Phodrang Email: ce_candp@phpa1.gov.bt
9.2 Pre-bid Meeting	Not applicable
Preparation of Bids	
13 Bid Price	Price quoted by Bidder shall remain firm & not subject to adjustment during the performance of the Contract.
14 Currency of Bid and Payment	Currencies of Bid shall be in Ngultrum (Nu.)/ Rupee (Rs.)
15 Bid Validity Period	The bid shall remain valid up to 90 days from the deadline for submission of a bid.
16 Bid Security	Bid Security amount is Nu./Rs. 942,000.00 and shall remain valid for 30 days beyond the validity period of the Bids, as extended if applicable, in accordance with ITB Sub-Clause 15.2
Submission of Bids	
20 Sealing and Marking of Bids	The Employer's address for the purpose of Bid submission is: Chief Engineer (C&P), PHPA-I, Bjimthangkha, Wangdue Phodrang, Bhutan



21 Deadline for bid submission	The deadline for submission of bids shall be on 6.10.2026 at 1300 Hrs. (BST). Bids shall be received at the following offices: Chief Engineer (C&P), PHPA-I, Bjimthangkha, Wangdue Phodrang OR Liaison Office, PHPA-I, Phuntsholing, Chhukha
Bid opening and Evaluation	
25 Bid opening	The bid opening shall take place on 9.10.2026 at 1430 Hrs. (BST) in the O/o Chief Engineer (C&P), PHPA-I, Bjimthangkha, Wangdue Phodrang.
30 Evaluation and Comparison of Bids & 31 Qualification of the Bidder	The following qualification requirement has to be met by the Bidder: Financial 1. Average turnover for any 3 years of last 7 years preceding the last date of bid submission shall be equal to Nu./Rs. 38 million or more. 2. The Bidder must have credit line facilities in the relevant form issued by any Banks or Financial Institutions in Bhutan/India for at least Nu./Rs. 19 million. Technical 1. Experience in having completed Road works during the last 7 years as below: i. 1 road work of value not less than Nu./Rs. 38 million, OR ii. 2 road works each of value not less than Nu/Rs 28 million, OR iii. 3 road works each of value not less than Nu/Rs 19 million and submit at least one Completion Certificate of the above work issued by the previous client(s). Such a Certificate shall indicate the value, date, and site of works, and shall specify whether they were successfully completed. 2. The essential construction equipment/machineries to be furnished for each Package by the Bidder:



	a. Excavator/Payloader – 1 No b. Road roller- 1 No c. Truck – 1 No d. Air compressor – 1 No. e. Survey equipment – 1 No The bidder is required to furnish a document to prove ownership of the equipment. In case of hire, the agreement/consent letter along with proof of ownership with the lessor shall be submitted. 3. The skilled and experienced manpower required for the timely and quality execution of the work to be made available by the Bidder: a. One Graduate Engineer (Civil) with a minimum of 3 years of work experience in a similar field. b. One Site Supervisor with a minimum 3 years of experience in similar work. CV of the personnel shall be submitted.
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SECTION IV

GENERAL CONDITIONS OF CONTRACT



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DEFINITIONS AND INTERPRETATIONS 1

1	Definitions.....	1
	ENGINEER-IN-CHARGE AND ENGINEER-IN-CHARGE'S REPRESENTATIVE(S)	4
2	Duties and Powers of Engineer-in-Charge and Engineer-in-Charge's Representative(s).....	4
3	Assignment.....	5
4	Sub-letting.....	5

CONTRACT DOCUMENTS 5

5	Language and Law	5
6	Drawings	5
7	Further Drawings and Instructions	6

GENERAL OBLIGATIONS 6

8	Contractor's General Responsibilities	6
9	Contract Agreement	7
10	Performance Security.....	7
11	Inspection of Site	8
12	Sufficiency of Bid.....	8
13	Works to be to the Satisfaction of Engineer-in-Charge	8
14	Programme to be furnished	8
15	Contractor's Superintendence	9
16	Contractor's Employees.....	10
17	Setting out.....	11
18	Watching and Lighting.....	11
19	Care of Works	11
20	Damage to Persons and Property	13
21	Third Party Insurance	13
22	Accidents or Injury to Workmen	13
23	Giving of Notices, Payment of Fees and Compliance with Statutes and Regulations, etc.....	14
24	Fossils etc.....	15



25	Compliance with Tax laws	15
26	Interference with Traffic and Adjoining Properties	15
27	Extraordinary Traffic	16
28	Opportunities for other Contractors.....	16
29	Upkeep of Site	17
30	Clearance of Site on Completion.....	17
LABOUR		17
31	Labour	17
32	Returns of Labour etc.	18
MATERIALS AND WORKMANSHIP		18
33	Materials and Workmanship.....	18
34	Inspections of Operations	20
35	Examination of Work Before covering up	20
36	Removals of Improper Work and Materials	20
37	Suspension of Work	21
COMMENCEMENT AND DELAYS		22
38	Commencements of Works	22
39	Possession of Site.....	22
40	Time for Completion	22
41	Extension of Time for Completion	23
42	Shift Works	23
43	Rate of Progress.....	23
44	Liquidated Damages for Delay	24
45	Certification of Completion of Works	24
MAINTENANCE AND DEFECTS		25
46	Maintenance and Defects	25
ALTERNATIONS, ADDITIONS, OMISSIONS AND EXTRA ITEMS		26
47	Variations	26
48	Determination of Price Variation.....	26
PLANT, TEMPORARY WORKS AND MATERIALS		28
49	Plants, Temporary Works and Materials.....	28



50	Approval of Materials etc. not implied	29
	MEASUREMENT	29
51	Quantities.....	29
52	Works to be measured.....	29
53	Method of Measurement	30
54	Security Rules	30
55	Foreign Personnel	30
	CERTIFICATE AND PAYMENT	31
56	Certificate and Payment	31
57	Approval only by Maintenance Certificate	35
58	Maintenance Certificate.....	35
	REMEDIES AND POWERS	36
59	Remedies and Powers.....	36
	SPECIAL RISKS/TERMINATION	37
60	Special Risks/Termination of Contract	37
	NOTICES	38
61	Notices	38
	DEFAULT OF PHPA-I	39
62	Default of PHPA-I.....	39
	CHANGES IN COSTS AND LEGISLATION	39
63	Increases or Decrease of Costs.....	39
	ADDITIONAL CLAUSES	42
64	Bribery and Collusion	42
65	Termination of Contract for PHPA-I's Convenience.....	42
66	Environment, Pollution, and Noise.....	43
67	Occupational Health and Safety.....	43
	SETTLEMENT OF DISPUTES	44
68	Arbitration	44



DEFINITIONS AND INTERPRETATIONS

1 Definitions

- 1.1 In the Contract, as hereinafter defined, the following words and expressions shall have the meanings hereby assigned to them, except where the context otherwise requires:
- 1.1.1 'PHPA-I'/ 'Project Authority' means the Punatsangchhu-I Hydroelectric Project Authority and the legal successor in title to the PHPA-I who will employ the Contractor.
- 1.1.2 "RGoB" means the Royal Government of Bhutan.
- 1.1.3 "BDS" means Bid Data Sheet.
- 1.1.4 "Tender/Bid, tenderer/bidders" means synonymous throughout this Contract document.
- 1.1.5 'Contractor'/ 'Supplier' means the person or persons, firm or company, group of firms or Joint Venture, whose bid has been accepted by the PHPA-I and includes the Contractor's personal representatives, successors and permitted assigns.
- 1.1.6 Employer/Department/Authority shall mean Punatsangchhu-I Hydroelectric Project Authority and include a duly authorized representative or any other person empowered or any other person empowered on behalf of PHPA-I to discharge all or any of its functions.
- 1.1.7 Accepting Authority shall mean the Managing Director of Punatsangchhu-I Hydroelectric Project Authority or his authorized nominee.
- 1.1.8 "Engineer-in-Charge" (EIC) means the Engineer-in-Charge appointed from time to time by the PHPA-I and notified in writing to the Contractor to act as the Engineer-in-Charge for the purposes of the Contract.
- 1.1.9 "Engineer-in-Charge's Representative" means any Engineer or assistant of the Engineer-in-Charge appointed from time to time by the PHPA-I or the Engineer-in-Charge to perform the duties set forth in Clause-2, hereof, whose authority shall be notified in writing to the Contractor by the Engineer-in-Charge.
- 1.1.10 "Works" shall include both Permanent Works and Temporary Works.
- 1.1.11 "Temporary works" means all temporary works of every kind required in or about the execution or maintenance of Works.



- 1.1.12 "Permanent Works" means the permanent works to be executed and maintained in accordance with the Contract.
- 1.1.13 "Contract" means the Conditions Governing the Contract, Technical Specifications, Drawings, priced Bill of Quantities, Letter of Award, and the Contract Agreement.
- 1.1.14 "Contract Price" means the aggregate price payable to the Contractor as specified in the Contract at the time of award.
- 1.1.15 "Constructional Plant", "Plant and Equipment" or "Machinery" means and include plant, equipment, machinery, tools, appliances, other implements of all description or things of whatsoever nature required in or about the execution, or maintenance of the Works but does not include materials or other things intended to form or forming part of the Permanent Works.
- 1.1.16 "Specifications" means the Technical Specifications and other Specifications referred to in the Bidding Documents and any modification thereof or addition thereto or deletion therefrom as may, from time to time, be furnished/ decided by PHPA-I and/or submitted by the Contractor and approved in writing by the Engineer-in-Charge.
- 1.1.17 "SBRW" shall mean the latest 'Specifications for Building and Road Works' of the Ministry of Infrastructure and Transport, RGoB, Thimphu.
- 1.1.18 "Drawings" means the drawings referred to in the Specifications and any modification of such drawings approved in writing by the Engineer-in-Charge and such drawings, as may, from time to time, be furnished by PHPA-I and/or submitted by the Contractor and approved in writing by the Engineer-in-Charge.
- 1.1.19 Special Conditions to Contract referred to in these conditions shall mean relevant schedule(s) annexed to these tender documents or the standard schedule mentioned in Section V with amendments thereto, if any.
- 1.1.20 "Site" means the land and other places on, under, in or through which the Permanent Works or Temporary Works, designed by the Engineer-in-Charge are to be executed and any other lands and places provided by the PHPA-I for the purposes of working space or any other purpose as may be specifically designated in the Contract or subsequently approved as forming part of site.
- 1.1.21 "Approved" means approved in writing, including subsequent written confirmation of previous verbal approval, and "approval" means approval in writing, including as aforesaid.
- 1.1.22 "Director (Technical)" means the Chief of Engineering of the Works or his successor and to whom the Engineer-in-Charge reports.



- 1.1.23 “Managing Director” means the Technical and Administrative head of the Project.
- 1.1.24 “Gol” means Government of India.
- 1.1.25 “Sub-Contractor” means the party or parties having a direct Contract with the Contractor and to whom any part of the Contract has been sublet by the Contractor with the consent, in writing, of the Engineer-in-Charge.
- 1.1.26 “Manufacturer” means the party proposing to design and/or manufacture the equipment and materials as specified, complete or in part.
- 1.1.27 “Letter of Award” means the letter from the PHPA-I conveying acceptance of the bid subject to such reservations as may have been stated therein.
- 1.1.28 Metric system shall be followed in all interpretation and execution of Works under this Contract. Any conversion found necessary shall be in accordance with the figures given in ‘Indian Standard’, IS 786-1967 and subsequent revision(s) of this Standard.
- 1.1.29 “Day” means a day from midnight to midnight.
- 1.1.30 “Month” means from the beginning of a given date of a calendar month to the end of the preceding date of the next calendar month.
- 1.1.31 “Week” means seven consecutive days.
- 1.1.32 “Quarter” means a period of three consecutive months starting from January, April, July and October i.e., January to March, April to June, July to September, and October to December.
- 1.1.33 “Ngultrum” means Bhutanese Currency.
- 1.1.34 “Rupee” means Indian Currency
- 1.1.35 Words in the singular number shall include the plural number and vice-versa where the context so requires. “He” shall include “She” and vice-versa.
- 1.1.36 “Cost” means all expenditure properly incurred or to be incurred, whether on or off the site, including overhead and other charges allocable thereto, but does not include any allowance for profit.
- 1.1.37 The “Goods” means all the equipment/machinery’s accessories and/or other materials, etc., which the Contractor is required to supply to PHPA-I under the scope of the Contract for execution of all works in totality.



- 1.1.38 "Services" means services ancillary to the supply of Goods, such as transportation and insurance, and any other incidental services such as installation, performance of on-site erection, testing, painting, commissioning for the supplied goods, training, and other such obligations of the Contractor covered under the Contract.
- 1.1.39 Retention money & security deposit are synonymous.
- 1.1.40 Defects Liability Period means the period of validity of warranties given by the Contractor commencing at the completion of the Works or a part thereof, if separate completion of the Works for such part has been provided in the Contract, during which the Contractor is responsible for defects with respect to the Works

ENGINEER-IN-CHARGE AND ENGINEER-IN-CHARGE'S REPRESENTATIVE(S)

- 2 Duties and Powers of Engineer-in-Charge and Engineer-in-Charge's Representative(s)**
- 2.1 The Engineer-in-Charge shall carry out such duties in issuing decisions, Certificates and orders as are specified in the Contract.
- 2.2 The Engineer-in-Charge's representative(s) shall be responsible to the Engineer-in-Charge, and his duties are to watch and supervise the works and to test and examine any materials to be used or workmen employed in connection with the Works. He shall have no authority to relieve the Contractor of any of his duties or obligations under the Contract nor, except as expressly provided hereunder or elsewhere in the Contract, to order any Work involving delay or any extra payment by the Engineer-in-Charge, nor to make any variation of or in the Works.
- 2.3 The Engineer-in-Charge may, from time to time in writing, delegate to the Engineer-in-Charge's Representative(s) any of the powers and authorities vested in the Engineer-in-Charge and shall furnish to the Contractor a copy of all such written Delegation of Power and Authorities. Any written instructions or approval given by the Engineer-in-Charge's Representative(s) to the Contractor within the terms of such delegation, but not otherwise, shall bind the Contractor as though it had been given by the Engineer-in-Charge. Provided always as follows:
- Failure of the Engineer-in-Charge's Representative(s) to disapprove any Work or materials shall not prejudice the powers of the Engineer-in-Charge thereafter to disapprove such Work or materials and to order the pulling down, removal or breaking up thereof.
- 2.4 If the Contractor is dissatisfied by reason of any decision of the Engineer-in-Charge's Representative(s), he shall be entitled to refer the matter to the Engineer-in-Charge, who shall thereupon confirm, reverse or vary such decision.



3 Assignment

The Contractor shall not assign the Contract or any part thereof, or any benefit or interest therein or thereunder, otherwise than by a charge in favor of the Contractor's bankers of any money due or to become due under this Contract, without the prior written consent of the PHPA-I.

4 Sub-letting

The Contractor shall not sub-let the whole of the Works. Except where otherwise provided by the Contract, the Contractor shall not sub-let any part of the Works without the prior written consent of the Engineer-in-Charge, which shall not be unreasonably withheld, and such consent, if given, shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of any sub-Contractor, his agents, Employees or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents, employee or workmen. Provided always that the provision of labour on a piece work basis shall not be deemed to be a sub-letting under this Clause.

CONTRACT DOCUMENTS

5 Language and Law

- 5.1 The Contract documents shall be drawn up in English. All correspondence and documents relating to the bid, exchanged by the bidder and the PHPA-I, shall be submitted in the prescribed form in English. All supporting documents and printed literature in connection with the bid shall be preferably in English.

The law to which the Contract is to be subject and according to which the Contract is to be construed shall be the law for the time being in force in Bhutan and within the jurisdiction of Thimphu courts.

5.2 Documents Mutually Explanatory

Several documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies, the documents shall take precedence in the order in which they are set out in the Proforma of Agreement (Forms).

6 Drawings

6.1 Custody of Drawings

The drawings shall remain in the sole custody of the Engineer-in-Charge, but 2 copies thereof shall be furnished to the Contractor free of charge. The Contractor shall make and provide at his own expense, any further copies required by him.



6.2 *One copy of drawings to be kept on site*

One copy of the drawings, furnished to the Contractor as aforesaid, shall be kept by the Contractor on the Site and the same shall, at all reasonable times, be available for inspection and use by the Engineer-in-Charge and the Engineer-in-Charge's Representative and by any other person authorized by the Engineer-in-Charge in writing.

7 **Further Drawings and Instructions**

The Engineer-in-Charge shall have full power and authority to supply to the Contractor from time to time, during the progress of the Works, such further drawings and instructions as shall be necessary for the purpose of the proper and adequate execution and maintenance of the Works. The Contractor shall carry out and be bound by the same.

GENERAL OBLIGATIONS

8 **Contractor's General Responsibilities**

- 8.1 The Contractor shall, subject to the provisions of the Contract, and with due care and diligence, execute and maintain the Works and provide all labour, including the supervision thereof, materials, constructional plant and all other things, whether of a temporary or permanent nature, required in and for such execution and maintenance, so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract.
- 8.2 The Contractor shall take full responsibility for the adequacy, stability and safety of all site operations and methods of construction, provided that the Contractor shall not be responsible, except as may be expressly provided in the Contract, for the design or specification of the Permanent Works, or for the design or specification of any Temporary Works prepared by the Engineer-in-Charge.
- 8.3 The Contractor shall promptly inform the Engineer-in-Charge of any error, omission, fault and other defects in the design of or specifications for the Works which are discovered when reviewing the Bidding Document or in the process of execution of the Works.
- 8.4 Where no specifications have been laid down, the materials used and the Work done shall conform to the relevant Specifications for Building and Road Works (latest) or I.S. Code or as directed by the Engineer-in-Charge.
- 8.5 All instructions and orders given by the Engineer-in-Charge at Site are to be maintained in the **Site Instruction Book** and shall be taken to have been conveyed to the Contractor for his compliance.



- 8.6 The Contractor must have a site office to receive normal correspondence between 9.00 AM and 5.30 PM on working days and urgent correspondence at any time on all days.

9 Contract Agreement

The Contractor shall, when called upon so to do, enter into and execute a Contract Agreement, to be prepared and completed at the cost of the PHPA-I in the Proforma annexed, with such modification as may be necessary.

10 Performance Security

- 10.1 For the due performance of the Contract, the Contractor shall furnish to the PHPA-I a Performance Security in the form of Bank Guarantee/Demand Draft. The amount of the Bank Guarantee/Demand Draft shall be **10% of the Contract Price**. The bank guarantee/demand draft shall be issued by any Financial Institutions in Bhutan/India. The cost of complying with the requirements of this Clause shall be borne by the Contractor unless the Contract otherwise provides.
- 10.2 The proceeds of the Performance Security shall be payable to PHPA-I as compensation for any loss, resulting from Contractor's failure to complete his obligation under the Contract.
- 10.3 The Performance Security shall be valid until **30 days** after the issue of Completion Certificate.
- 10.4 Should the Contract period, for whatever reasons be extended, the Contractor, on receipt of written request from the Engineer-in-Charge, shall at his own cost get the validity period of Bank Guarantee in respect of Performance Security furnished by him extended and shall furnish the extended/revised Bank Guarantee to the Engineer-in-Charge before the expiry date of the Bank Guarantee originally furnished.
- 10.5 Performance Security shall not be refunded till the Contractor produces NOC from all concerned including the Labour and Environmental officers. As soon as the work is virtually complete, the Contractor shall apply for the Clearance Certificate to the Labour/Environmental Officer under intimation to the Engineer-in-Charge. On receipt of the said communication, the Engineer-in-Charge shall write to the Labour/Environmental Office to intimate if any complaint is pending against the Contractor in respect of the work. If no complaint is pending on record after completion of the work and/or no communication received from the Labour/Environmental Officer to this effect till 6 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.



11 Inspection of Site

The Contractors are advised to inspect and examine the Site and its surroundings and information available in connection therewith and to have satisfied himself, so far as is practicable, before submitting his Bid, as to the form and nature thereof, including the subsurface conditions, the Hydrological and climatic conditions, the extent and nature of work, and materials necessary for the completion of the Works, means of access to the Site and the accommodation he may require and, in general, shall be deemed to have obtained all necessary information, subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Bid. The costs of visiting the site shall be at the bidder's own expense.

12 Sufficiency of Bid

The Contractor shall be deemed to have satisfied himself before bidding as to the correctness and sufficiency of his Bid for the Works and of the rates stated in the priced Bill of Quantities and the Schedule of Rates, if any, which Bid rates shall, except in-so-far as it is otherwise provided in the Contract, cover all his obligations under the Contract, and all matters and things necessary for the proper execution/completion and maintenance of all the permanent works.

13 Works to be to the Satisfaction of Engineer-in-Charge

Save in-so-far as it is legally or physically impossible the Contractor shall execute and maintain the Works in strict accordance with the Contract to the satisfaction of the Engineer-in-Charge and shall comply with and adhere strictly to the Engineer-in-Charge's instructions and directions on any matter whether mentioned in the Contract or not, touching or concerning the Works. The Contractor shall take instructions and directions only from the Engineer-in-Charge, or, subject to the limitations referred to in Clause-2 hereof, from the Engineer-in-Charge's Representative.

14 Programme to be furnished

- 14.1 Within a period of 15 days, the Contractor shall, after the acceptance of his Bid by PHPA-I, submit to the Engineer-in-Charge for his approval, 2 copies of the detailed **Construction Programme** in MS Excel or MS Project showing the order of sequence and procedure in which he proposes to carry out the Works. The Contractor's programme shall conform to the total time period and completion of the work specified in Clause-40 hereof.
- 14.2 The detailed construction programme submitted by the Contractor for orderly completion of the Works shall show the planned sequence of operations and the dates for commencement and completion of all salient features of the Works.



- 14.3 The programme shall cover activities on the Site and procurement and delivery activities.
- 14.4 The programme shall be orderly and realistic to meet this requirement and should include a chart of the principal quantities of Work forecast for monthly execution, and a schedule of payments expected to be made to the Contractor by the PHPA-I.
- 14.5 The Contractor shall promptly advise the Engineer-in-Charge of any occurrence requiring substantial revision of the programme, giving a detailed explanation of the cause of the revision, and shall furnish a revised programme within 15 days of such occurrence.
- 14.6 If at any time it should appear to the Engineer-in-Charge that the actual progress of the Works does not conform to the approved programme, the Contractor shall produce, at the request of the Engineer-in-Charge, a revised programme showing the modifications to the approved programme necessary to ensure completion of the Works within the time for completion as defined in Clause-40 hereof.
- 14.7 The submission to and approval by the Engineer-in-Charge or Engineer-in-Charge's Representative of such program or the furnishing of such particulars shall not relieve the Contractor of any of his duties or responsibilities under the Contract.
- 14.8 The Contractor shall, whenever required by the Engineer-in-Charge or Engineer-in-Charge's Representative, also provide in writing, for his information, a general description of the arrangements, such as deployment of modern and efficient machinery, skilled and unskilled labour and methods, which the Contractor proposes to adopt for the execution of Works.
- 14.9 The Contractor shall have to obtain prior approval of the Engineer-in-Charge for the sequence of construction which he proposes to adopt.

15 Contractor's Superintendence

- 15.1 The Contractor shall provide all necessary superintendence during execution of the work and as long thereafter as may be necessary for proper fulfilling of the obligations under the Contract.
- 15.2 The Contractor shall immediately after receiving letter of award, intimate in writing to the Engineer-in-Charge the name, qualification, experience, age, address and other particulars along with Certificates of the Site Engineer to be the In-Charge of the work.
- 15.3 The Engineer-in-Charge shall within 15 days of receipt of such communication intimate in writing his approval or otherwise of Site Engineer of the Contractor.



- 15.4 Any such approval may at any time be withdrawn, and in case of such withdrawal, the Contractor shall appoint another such Site Engineer according to the provisions of this Clause. The decision of the EIC shall be final and binding on the Contractor in this respect.
- 15.5 Such Site Engineer shall be appointed by the Contractor soon after receipt of the approval from the Engineer-in-Charge and shall be available at the site within 15 days of the start of work.
- 15.6 The Site Engineer shall, on receiving reasonable notice from the Engineer-in-Charge, present himself to the Engineer-in-Charge and/or at the site of work, as required, to take instructions. Instructions given to the Site Engineer shall be deemed to have the same force as if these have been given to the Contractor. The Site Engineer representative and/or the Contractor or his responsible authorized agent shall be available at site as well as during recording of measurement of works and whenever so required by the Engineer-in-Charge by a notice as aforesaid and shall also note down instructions conveyed by the Engineer-in-Charge or his designated representative in the site order book and shall affix his signature in token of noting down the instructions and in token of acceptance of measurement.
- 15.7 If the Engineer-in-Charge is convinced that no such Site Engineer or agent is effectively appointed or is effectively attending or fulfilling the provision of this Clause, then the decision of the Engineer-in-Charge as recorded in the site order book and measurement recorded in Measurement Books shall be final and binding on the Contractor.
- 15.8 In case the Site Engineer of the Contractor does not discharge his duties satisfactorily, the Engineer-in-Charge shall have full powers to suspend the work, and the Contractor shall be held responsible for the delay so caused to the work.

16 Contractor's Employees

- 16.1 The Contractor shall provide its employees on the Site in connection with the execution and maintenance of the Works:
- 16.1.1 only such technical assistants as are skilled and experienced in their respective trades and such sub-agents competent to give proper supervision to the work they are required to supervise, and
- 16.1.2 such skilled, semi-skilled and unskilled labour as is necessary for the proper and timely execution and maintenance of the Works.
- 16.1.3 Experienced Safety Officer to maintain and supervise safety requirements at the site of Works. Safety standards shall be followed as provided in these documents.



- 16.2 The Engineer-in-Charge shall be at liberty to object to and require the Contractor to remove forthwith from the Works any person employed by the Contractor in or about the execution or maintenance of the Works who, in the opinion of the Engineer-in-Charge, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose employment is otherwise considered by the Engineer-in-Charge to be undesirable and such persons shall not be again employed upon the Works without the written permission of the Engineer-in-Charge. Any person so removed from the Works shall be replaced as soon as possible by a competent substitute approved by the Engineer-in-Charge.

17 Setting out

- 17.1 The Contractor shall be responsible for true and proper setting out of the works in relation to original points, lines and levels of reference given by the Engineer-in-Charge in writing.
- 17.2 The Contractor shall ensure the correctness thereof and shall carefully protect and preserve all benchmarks, pegs and other things used in setting out the Works.

18 Watching and Lighting

- 18.1 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 required by the Engineer-in-Charge or the Engineer-in-Charge's Representative, or by any duly constituted authority, for the protection of the Works, or for the safety and convenience of the public or others.
- 18.2 The Contractor shall also be responsible for temporary roadways, footways, guards, fences, caution notices etc., as far as the same may be rendered necessary by reason of the Work for the pedestrians or other traffic and owners/occupiers of the adjacent property and of the public and shall remain responsible for any accidents that may occur on account of his failure to take proper and timely precautions.

19 Care of Works

- 19.1 The Contractor shall take full responsibility for the care of the Works from the date of Commencement of Works until the date of issue of the Completion Certificate for the whole of the Works.
- 19.2 In the event of any loss or damage to the Works or any part thereof, during the period for which the Contractor is responsible for the care thereof, from any cause whatsoever, other than the risks defined in Clauses 19.5 & 19.6 of this Clause, the Contractor, at his own cost, shall rectify such loss or damage so that the permanent works conform in every respect within provision of the Contract to the satisfaction of Engineer-in-charge.



The Contractor shall also be liable for any loss or damage to the Works occasioned by him in the course of any operation carried out by him for the purpose of complying with his obligations under Clause-46.

19.3 In the event of any loss or damage to the Permanent Works which may occur or arise out of any of the Risks defined in Clause 19.5, the same shall be made good/rectified by the Contractor, if and to the extent required by the Engineer-in-Charge, at the cost of the PHPA-I which sum shall be determined by the Engineer-in-Charge in accordance with Clause 47 and Clause 48.

19.4 In the event of any loss or damage which may occur or arise out of any of the risks defined in Clause 19.6, neither party to the Contract shall be liable to the other for any such loss or damage. However, in the event of any loss or damage to the Permanent Works arising as a consequence of the risk(s) defined in Clause 19.6 the same shall be made good/rectified by the Contractor at the cost of the PHPA-I which sum shall be determined by the Engineer-in-Charge under the provisions of the Contract.

19.5 The PHPA-I's risks are as under:

19.5.1 Loss or damage due to the use or occupation by the PHPA-I of any section or part of the Permanent Works except as may be provided for in the Contract.

19.5.2 loss or damage to the extent that it is due to the design of the Works other than any part of the design provided by the Contractor.

19.6 Force Majeure/Excepted risks are as under:

19.6.1 war, hostilities (whether war be declared or not), invasion, act of foreign enemies, act of public enemies.

19.6.2 riot, commotion, disorder, any epidemic/pandemic, strike or lockout by persons other than the Contractor's personnel.

19.6.3 Ionizing, radiations or contamination by radio activity from any nuclear fuel, radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly.

19.6.4 Pressure waves caused by aerial devices travelling at supersonic speeds.

19.6.5 any operation of the forces of nature against which an experienced Contractor could not reasonably have been expected to take precautions.



20 Damage to Persons and Property

The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the PHPA-I against all losses and claims in respect of injuries or damage to any persons or material or physical damage to any property whatsoever which may arise out of or in consequence of the execution and maintenance of the Works and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect of or in relation thereto except any compensation or damages for or with respect to injuries or damage to persons or property resulting from any act or neglect of the PHPA-I, his agent, Employees or other Contractors, not being employed by the Contractor, or for or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or where the injury or damage was contributed to by the Contractor, his Employees or agents, such part of the compensation as may be just and equitable having regard to the extent of the responsibility of the PHPA-I, its Employees or agents or other Contractors for the damage or injury.

21 Third Party Insurance

- 21.1 Before commencing the execution of the Works, the Contractor, but without limiting his obligations and responsibilities under Clause-20 hereof, shall insure against his liability for any material or physical damage, loss or injury which may occur to any property, including that of the PHPA-I, or to any person, including any employee of the PHPA-I, by or arising out of the execution of the Works or in the carrying out of the Contract, otherwise, than due to the matters referred to in the provision to Clause- 20 hereof.

22 Accidents or Injury to Workmen

- 22.1 The PHPA-I shall not be liable for or in respect of any damages or compensation payable according to law in respect or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or any sub -Contractor, save and except an accident or injury resulting from any act or default of the PHPA-I, its agents or Employees. The Contractor shall indemnify and keep indemnified the PHPA-I against all such damages and compensation, save and except as aforesaid, and against all claims, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.
- 22.2 On the occurrence of accident arising out of the Works which result in death, or which is so serious as to be likely to result in death, the Contractor shall, within 24 hours of such accident, report in writing to the Engineer-in-Charge and other statutory bodies of the Government the facts stating clearly and in sufficient details the circumstances of such accident and the subsequent action. All other accidents on the Works involving injuries to persons or damage to property other than that of the Contractor shall be



promptly reported to the Engineer-in-Charge and other statutory bodies of the Government, stating clearly and in sufficient details of the facts and circumstances of the accidents and the action taken. In all cases, the Contractor shall indemnify the PHPA-I against all loss or damage resulting directly or indirectly from the Contractor's failure to report in the manner aforesaid. This includes penalties or fines, if any, payable by the PHPA-I as a consequence of failure to give notice or failure to conform to the provisions of any Act in regard to such accidents.

22.3 Insurance against Accident, etc., to Workmen

The Contractor shall insure against such liability with an insurer approved by the PHPA-I, which approval shall not be unreasonably withheld, and shall continue such insurance during the whole of the time that any persons are employed by him on the Works and shall, when required, produce to the Engineer-in-Charge or the Engineer-in-Charge's Representative such policy of insurance and the receipt for payment of the current premium. Provided always that, in respect of any persons employed by any sub-Contractor, the Contractor's obligation to insure as aforesaid under this sub-Clause shall be satisfied if the sub-Contractor shall have insured against the liability in respect of such persons in such manner that the PHPA-I is indemnified under the policy, but the Contractor shall require such sub-Contractor to produce to the Engineer-in-Charge or the Engineer-in-Charge's Representative, when required, such policy of insurance and the receipt for the payment of the current premium.

23 Giving of Notices, Payment of Fees and Compliance with Statutes and Regulations, etc.

23.1 Giving of Notices and Payment of Fees

The Contractor shall give all notices and pay all fees required to be given or paid by any Statute, Ordinance, or other Law, or any regulation, or by-law of any local or other duly constituted authority in relation to the execution of Works and by the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works.

23.2 Compliance with Statutes, Regulations, etc.

The Contractor shall conform in all respects with the provisions of any such Statute, Ordinance or Law as aforesaid and the regulations or by-laws of any local or other duly constituted authority which may be applicable to the Works and with such rules and regulations of public bodies and companies as aforesaid and shall keep the PHPA-I indemnified against all penalties and liability of every kind for breach of any such Statute, Ordinance or Law, regulation or by-law.



- 23.3 The Contractor shall be fully responsible for compliance with any Notices, payment of any fees, etc. under this Clause.

24 Fossils etc.

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site of the Works shall, as between the PHPA-I and the Contractor, be deemed to be the absolute property of the PHPA-I/RGoB. The Contractor should protect such findings from any damage/theft & notify immediately to the Engineer-in-Charge &/or his authorized representative.

25 Compliance with Tax laws

- 25.1 The Royal Government of Bhutan shall exempt taxes, levies/duties for plant, construction materials & equipment, machineries and services imported for direct use in the construction of the Project. Any procurement made under tax exemption basis shall be liable for tax payment as per the Tax Act of the Kingdom of Bhutan if disposed off in Bhutan.

- 25.2 Any Contractor, sub-Contractor or consultants recruited in connection with the Project will be liable for tax in Bhutan as per the Income Tax Act of Bhutan 2025 and applicable 5% Goods and Services Tax (GST) rates in accordance with the GST Act of Bhutan 2020 and amendment thereof. Further, such recruiting agency shall be responsible for deducting and remitting Tax Deducted at Source (TDS) as per the provision of the said Income Tax Act. For Bhutanese and Indian bidder, a contractor tax of 2% and 5% respectively shall be deducted from the bill (s).

- 25.3 With effect from 1st July 2017, all exports (including ones to Bhutan) are 'zero rated items' under the GST regime in the GoI. Therefore, no reimbursement or costs on account of any tax implications will be admissible. However, in the situation, if the categorization is changed for exports from 'zero rated' to any other slab, the same will be applicable.

- 25.4 The Royal Government of Bhutan shall receive royalty from the Contractor for the timber, boulders, aggregates and other construction materials required from Bhutan for the work.

- 25.5 The Contractor shall obtain necessary permits and deposit royalty with local authorities for supply of such materials required for the work.

26 Interference with Traffic and Adjoining Properties

All operations necessary for the execution of the Works shall, in so far as compliance with the requirements of the Contract permits, be carried on so as not to interfere



unnecessarily or improperly with the convenience of the public, or the access to, use and occupation of public or private roads and footpaths to or of properties whether in the possession of the PHPA-I or of any other person. The Contractor shall save harmless and indemnify the PHPA-I in respect of all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of, or in relation to, any such matters in-so-far as the Contractor is responsible there for.

27 Extraordinary Traffic

27.1 Protection of Highways and Bridges

The Contractor shall use every reasonable means to prevent any of the highways or bridges communicating with or on the routes to the Site from being damaged or injured by any traffic of the Contractor or any of his sub-Contractors and, in particular, shall select routes, choose and use vehicles and restrict and distribute loads so that any increase in traffic frequency as will inevitably arise from the moving of plant and material from and to the Site, shall be limited, as far as reasonably possible to arise any unnecessary traffic congestion damage or injury which may be occasioned to such highways & bridges.

27.2 Settlement of Extraordinary Traffic Claims

If during the execution of the Works or at any time thereafter, the Contractor shall receive any claim arising out of the execution of the Works in respect of damage or injury to highways or bridges, he shall immediately report the same to the Engineer-in-Charge and thereafter the PHPA-I shall negotiate the settlement of and pay all sums due in respect of such claim and shall indemnify the Contractor in respect thereof and in respect of all claims, proceedings, damages, costs, charges and expenses in relation thereto. Provided always that if and so far as any such claims or part thereof shall, in the opinion of the Engineer-in-Charge, be due to any failure on the part of the Contractor to observe and perform his obligations under Clause 27.1, then the amount certified by the Engineer-in-Charge to be due to such failure shall be paid by the Contractor to the PHPA-I.

28 Opportunities for other Contractors

The Contractor shall, in accordance with the requirements of the Engineer-in-Charge, afford all reasonable opportunities for carrying out their works to any other Contractors employed by the PHPA-I and their workmen and to the workmen of the PHPA-I and of any other duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any Contract which the PHPA-I may enter into in connection with or ancillary to the Works.



29 Upkeep of Site

- 29.1 During the progress of the Works, the Contractor shall keep the site reasonably free from all unnecessary obstructions and shall store or dispose of any Constructional plant and surplus materials and clear away and remove from the site any wreckage, rubbish, or Temporary Works no longer required.
- 29.2 In case the Contractor does not keep the area clean and if it is necessary to get the area cleaned, the Engineer-in-Charge shall issue a notice of 48 hours, and in the event of non-compliance by the Contractor, get the area cleaned by some other agency at the cost of the Contractor. In case of rubbish accumulating due to deposition by more than one Contractor, the share of charges to be borne by the Contractors as indicated by the Engineer-in-Charge.

30 Clearance of Site on Completion

On the completion of the Works, the Contractor shall clear away and remove from the Site all Constructional Plant, surplus materials, rubbish, and Temporary Works of every kind, and leave the whole of the site and Works clean and, in a workman, like condition to the satisfaction of the Engineer-in-Charge.

LABOUR

31 Labour

31.1 Engagement of Labour

The Contractor shall make his own arrangements for the engagement of all labour, local or otherwise, and save in-so-far as the Contract otherwise provides, for the transport, housing, feeding, and payment thereof. The Contractor shall not employ in connection with the Works any person who has not completed 18 years of age. No female labour shall be employed on night shifts. The Contractor shall have to arrange permits for the labour/staff for their entry into Bhutan, at their own cost. The Contractor shall recruit local manpower (skilled and unskilled) and use local resources to the extent possible.

31.2 Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site, to the satisfaction of the Engineer-in-Charge or his Representative, an adequate supply of drinking and other water for the use of the Contractor's staff and workmen.

31.3 Alcoholic Liquor & Drugs

The Contractor shall not, otherwise than in accordance with the Statutes, Ordinances and Government Regulations or orders for the time being in force, import, sell, give,



barter or otherwise dispose of any alcoholic liquor, or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his Sub-Contractors, agents or employees.

31.4 *Disorderly Conduct, etc.*

The Contractor shall, at all times, take all reasonable precautions to prevent any unlawful, riotous, or disorderly conduct by or amongst his employees and for the preservation of peace and protection of persons and property in the neighborhood of the Works against the same.

31.5 *Contractor to Follow Labour and Employment Act 2007*

The Contractor shall, in respect of labour employed by him, comply with the provisions of the various labour laws, Minimum Wages as per the **Labour and Employment Act 2007** and its Rules and Regulations, RGoB, and shall indemnify the PHPA-I in respect of all claims that may be made against the PHPA-I for non-compliance thereof by the Contractor.

Notwithstanding anything contained herein, the Engineer-in-Charge may take such actions as may be necessary for compliance with the various labour laws and recover the costs thereof from the Contractor.

31.6 *Observance by Sub-Contractors*

The Contractor shall be responsible for the observance by his Sub-Contractors of the foregoing provisions.

32 *Returns of Labour etc.*

The Contractor shall deliver to the Engineer-in-Charge or his Representative, a return in detail in such form and at such intervals as the Engineer-in-Charge may prescribe, showing the supervisory staff and the number of the several classes of labour from time to time employed by the Contractor on the site.

MATERIALS AND WORKMANSHIP

33 *Materials and Workmanship*

33.1 *Materials and Workmanship*

- 33.1.1 The Contractor shall be responsible for arranging all the materials required for the construction of the Works from the source(s) acceptable to the PHPA-I, other than those materials to be issued by the PHPA-I, as listed under the materials inventory available with the PHPA-I. He shall also be responsible for the proper transportation



and storage of these materials to the satisfaction of the Engineer-in-Charge and shall bear all related costs.

- 33.1.2 The Engineer-in-Charge shall be entitled at any reasonable time to inspect or examine all such materials. The Contractor shall provide reasonable assistance for such inspection or examination as may be required.
- 33.1.3 The Contractor shall initiate timely action to procure the materials well in advance so as to ensure that the progress of Works does not suffer for want of the materials on the site at least 30 days before these are intended to be used on Works. Any setback to the progress of the Works and consequent delay in completion of the Works on account of non-availability of materials at the Site shall be the sole responsibility of the Contractor.
- 33.1.4 Any assistance that the Engineer-in-Charge can give to the Contractor for arranging the materials shall be provided on a "no responsibility" basis.

33.2 *Quality of materials, Workmanship, and Tests*

- 33.2.1 The Contractor shall provide the materials of the quality, kind, and specifications as provided in the Contract. The Contractor shall produce to the Engineer-in-Charge certified quality test reports in respect of the materials procured by him.
- 33.2.2 In case the materials procured by the Contractor are not to the satisfaction of the Engineer-in-Charge and do not conform to the specifications laid in the Contract, such materials shall be rejected by the Engineer-in-Charge, and the cost incurred on such procurement shall be the responsibility of the Contractor.
- 33.2.3 The workmanship shall be of the kind described in the Contract and in accordance with the Engineer-in-Charge's instructions.
- 33.2.4 All the materials and the workmanship shall be subjected, from time to time, to such tests as the Engineer-in-Charge may require. The Contractor shall provide such assistance, instruments, machines, labour and materials as are required for examining, measuring and testing any material and shall supply samples of materials, before incorporation in the Works, for testing, as may be selected and required by the Engineer-in-Charge.

33.3 *Cost of Samples*

All samples shall be supplied by the Contractor at his own cost.

33.4 *Cost of Tests*



Cost for any test intended by or provided for in the Contract shall be borne by the Contractor.

34 Inspections of Operations

The Engineer-in-Charge or any person authorized by him shall, at all times, have access to the Works and to all places where the materials, manufactured articles or machinery are being obtained for the Works and the Contractor shall afford every facility for and every assistance in or in obtaining the right to such access.

35 Examination of Work Before covering up

- 35.1 No Work shall be covered up or put out of view without the approval of the Engineer-in-Charge or his Representative and the Contractor shall afford full opportunity for the Engineer-in-Charge or the Engineer-in-Charge's Representative to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereof. The Contractor shall give due notice whenever any such work or foundations is or are ready or about to be ready for examination and the Engineer-in-Charge or the Engineer-in-Charge's Representative shall, without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such work or of examining such foundations.

35.2 Uncovering and making Openings

The Contractor shall uncover any part or parts of the Works or make openings in or through the same as the Engineer-in-Charge or Engineer-in-Charge's Representative may, from time to time, direct and shall reinstate and make good such part or parts to the satisfaction of the Engineer-in-Charge and all such costs shall be borne by the Contractor.

36 Removals of Improper Work and Materials

36.1 The Engineer-in-Charge shall have power to issue instructions from time to time for:

- 36.1.1 the removal from the Site, within such time as may be specified in the instructions, of any materials which, in the opinion of the Engineer-in-Charge, are not in accordance with the Contract,
- 36.1.2 the substitution of proper and suitable materials, and
- 36.1.3 the removal and proper re-execution, notwithstanding any previous test thereof or interim payment therefor, of any work which in respect of materials or workmanship is not, in the opinion of the Engineer-in-Charge, in accordance with the Contract.



36.2 **Default of Contractor in Compliance**

In case of default on the part of the Contractor in carrying out such instruction, as specified in Clause 36.1, the Engineer-in-Charge shall be entitled to employ and pay other persons to carry out the same and all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor by the Engineer-in-Charge or may be deducted from any money due or which may become due to the Contractor.

37 **Suspension of Work**

37.1 The Contractor shall on the order/instructions of the Engineer-in-Charge suspend the progress of the Works or any part thereof for such time or times and in such manner as the Engineer-in-Charge may consider necessary and the Contractor shall during such suspension properly protect and secure the Works as is necessary in the opinion of the Engineer-in-Charge. If such suspension is:

37.1.1 provided for in the Contract, or

37.1.2 necessary for the proper execution of the Works or by reason of weather conditions or on account of any default on the part of the Contractor, or

37.1.3 necessary for the safety of the Works or any part thereof,

then, the Contractor shall not be entitled to payment of extra costs (if any) incurred by him during the period of suspension of the Works. Provided however that in the event of any suspension being ordered by the Engineer-in-Charge for reasons other than aforementioned and if each such period of suspension exceeds a continuous period of 14 days, the Contractor shall be entitled to such extension of Time for Completion of the Works as the Engineer-in-Charge may deem proper having regard to the period or periods of such suspensions and shall also be entitled to such compensation as the Engineer-in-Charge may consider to be reasonable cost incurred by the Contractor during the periods of such suspension.

37.2 If the progress of Works or any part thereof is suspended on the order of the Engineer-in-Charge for a continuous period of not less than 90 days at a time for reasons other than those referred to in sub-Clause 37.1.1,37.1.2,37.1.3 of Clause 37.1 above, the Contractor may serve a written notice to the Engineer-in-Charge requiring permission within 15 days from the receipt thereof to proceed with the Works or that part thereof in regard to which progress is suspended and if such permission is not granted within the said 15 days period, the Contractor may by a further written notice served on the PHPA-I elect to treat the suspension where it affects part only of the Works as an omission of such part and where it affects the whole of the Works as an abandonment of the Contract by the Employer.



COMMENCEMENT AND DELAYS

38 Commencements of Works

The Contractor shall commence the Works on Site within a period of **30 days** from the date of issue of the Letter of Award.

39 Possession of Site

- 39.1 Save in so far as the Contract may prescribe, the extent of portions of the Site of which the Contractor is to be given possession from time to time, the Engineer-in-Charge in turn will issue written order to commence the Works, give to the Contractor possession of so much of the Site as may be required to enable the Contractor to commence and proceed with the execution of the Works in accordance with the programme referred to in Clause-14 hereof.

The Contractor shall not be allowed, without any prior consent of the Engineer-in-Charge, to occupy other Government and/or PHPA-I land for temporary use.

39.2 *Rights of Way and Facilities*

The Contractor shall bear all costs and charges for special or temporary rights of way required by him in connection with access to the Site. The Contractor shall also provide, at his own cost, any additional facilities outside the Site required by him for the purpose of the Works.

- 39.3 The Contractor shall not be entitled to any additional payment against any delay in handing over of site up to the extent of 30 days from the date of issuance of the Letter of Award.

40 Time for Completion

- 40.1 The period of completion of the whole of the Work shall be specified in SCC or such extended time as may be allowed under Clause-41 hereof. The period of completion shall be reckoned from 30 days of issue of the Letter of Award to the Contractor by the PHPA-I. The programme submitted by the Contractor in accordance with Clause-14 should match with the total time of completion as specified in this Clause.
- 40.2 The time for completion of the works shall be extended in the event of any deviations resulting in additional cost over the Contract Price. If requested by the Contractor, the same shall be worked out in proportion to the additional cost of the altered, additional, or substituted work against the original Contract Price.



41 Extension of Time for Completion

- 41.1 Should the amount of extra or additional work of any kind or any cause of delay referred to in these Conditions, or exceptional adverse climatic conditions which result in stoppage of work, and such stoppage of work is duly recorded in the hindrance register maintained by Contractor and verified by PHPA-I. The Contractor shall, within 28 days of such circumstances, or as soon thereafter as is practicable, submit to the Engineer-in-Charge, full and detailed particulars of any extension of time to which he may consider himself entitled. The Engineer-in-Charge shall determine the period of such hindrance and, accordingly, notify the Contractor of the time extension. The Contractor shall not be entitled to any payment for the time-related costs incurred by him, if any, except those provided under the Contract, during the extended period for completion of Works.
- 41.2 The Contractor shall maintain a record of hindrances in the **Hindrance Register** (Form No. 12), which shall be endorsed by the Engineer-in-Charge or the Engineer-in-Charge's representative on a monthly basis. Only such hindrances approved by the Engineer-in-Charge will be taken into consideration for granting of any time extension.
- 41.3 **Site Order Book** shall be maintained at the site systemically and securely by the Engineer-in-Charge or the Engineer-in-Charge's Representative.

42 Shift Works

- 42.1 To achieve the required progress, the Work may be carried out round the clock. The period of completion and the number of working days shall not be affected by the number of shifts. No extra amount on account of any shift work is payable to the Contractor.

43 Rate of Progress

- 43.1 To ensure proper progress during the execution of the Works, the Contractor shall complete $\frac{1}{8}$ th of the Works before $\frac{1}{4}$ th of the whole time allowed in the Contract has elapsed, $\frac{3}{8}$ th of the Works before one half of such time has elapsed, and $\frac{3}{4}$ th of the Works before $\frac{3}{4}$ th of such time has elapsed.
- 43.2 If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works of any section at any time is not commensurate with the rate of progress stipulated in this Clause and in the opinion of the Engineer-in-Charge does not ensure completion by the prescribed time or extended time for completion, the Engineer-in-Charge shall so notify the Contractor in writing and the Contractor shall thereupon take such steps as are necessary and the Engineer-in-Charge may approve to expedite progress so as to complete the Works or such section by the prescribed time



or extended time. The Contractor shall not be entitled to any additional payment for taking such steps.

44 Liquidated Damages for Delay

- 44.1 If the Contractor fails to achieve completion of the Works within the time prescribed by Clause-40 hereof, then the Contractor shall pay to the PHPA-I the sum stated in SCC as liquidated damages. The PHPA-I may, without prejudice to any other method of recovery, deduct the amount of such damages from any money in its hands, due or which may become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract.
- 44.2 The Liquidated Damages penalty will be charged for all delays due to the fault of the Contractor at 1% per week, subject to a maximum of 10% of the Initial Contract Price.
- 44.3 In the event of termination of the Contract in accordance with Clause-59 of GCC, referred hereof, PHPA-I shall be entitled to recover Liquidated Damages up to 10% of the Contract price. The Performance Security shall be adjusted towards Liquidated Damages. The balance work (if any) under the Contract shall be executed in any other manner by PHPA-I by recovering the value equivalent to **20% of the balance works up to a maximum of 10% of the Contract Price** from the Contractor.

45 Certification of Completion of Works

When the whole of the works have been substantially completed and have satisfactorily passed any final test that may be prescribed by the EIC, the Contractor may give a notice to that effect to the Engineer-in-Charge or to the Engineer-in-Charge's representatives, accompanied by an undertaking to finish any outstanding work within a mutually agreed period. Such notice and undertaking shall be in writing and shall be deemed to be a request by the Contractor for the Engineer-in-Charge to issue a Certificate of Completion in respect of the Works. The Engineer-in-Charge shall, within 21 days of the date of delivery of such notice either issue to the Contractor, a Certificate of Completion stating the date on which, in his opinion, the Works are substantially completed in accordance with the Contract or give instructions in writing to the Contractor specifying all the Works which, in the Engineer-in-Charge's opinion, are required to be done by the Contractor before the issue of such Certificate. The Engineer-in-Charge shall also notify the Contractor of any defects in the Works affecting substantial completion that may appear after such instructions and before completion of the Works specified therein. The Contractor shall be entitled to receive such Certificate of Completion within 21 days of completion to the satisfaction of the Engineer-in-Charge.



MAINTENANCE AND DEFECTS

46 Maintenance and Defects

46.1 Defects Liability Period

In these Conditions, the expression "Defects Liability Period" shall be as specified in SCC, calculated from the date of completion of the Works, certified by the Engineer-in-Charge in accordance with Clause -45 hereof.

46.2 Execution of Work of Repair, etc.

To the intent that the Works shall, at or as soon as practicable after the expiration of the Defects Liability Period be delivered to the PHPA-I in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer-in-Charge, the Contractor shall complete the work, if any, outstanding on the date of completion, as certified under Clause-45 hereof, as soon as practicable after such date and shall execute all such work of repair, amendment, reconstruction, rectification and making good defects, imperfections, shrinkages or other faults as may be required of the Contractor in writing by the Engineer-in-Charge during the Defects Liability Period or within 14 days after its expiration, as a result of an inspection made by or on behalf of the Engineer-in-Charge prior to its expiration.

46.3 Cost of Execution of Works of Repair, etc.

All repair works shall be carried out by the Contractor at his own expense if the necessity thereof shall, in the opinion of the Engineer-in-Charge, be due to the use of materials or workmanship not in accordance with the Contract, or due to neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the Contract. If, in the opinion of the Engineer-in-Charge, such necessity shall be due to any other cause, the value of such work shall be ascertained and paid for as if it were additional work.

46.4 Remedy on Contractor's Failure to carry out Work Required

If the Contractor fail to do any such work as aforesaid required by the Engineer-in-Charge, the PHPA-I shall be entitled to employ and pay other persons to carry out the same and if such work is the work which in the opinion of the Engineer-in-Charge, the Contractor was liable to do at his own expense under the Contract, then all expenses consequent there on or incidental thereto shall be recoverable from the Contractor by the Engineer-in-Charge from any money due or which may become due to the Contractor.



ALTERNATIONS, ADDITIONS, OMISSIONS AND EXTRA ITEMS

47 Variations

47.1 The Engineer-in-Charge shall make any variation in the form, quality or quantity of the Works or any part thereof or substitution for original specifications, design, drawings and instructions that may, in his opinion be necessary and for that purpose, or if for any other reason it shall, in his opinion be appropriate, he shall have power to order the Contractor to do and the Contractor shall do any or all of the following:

- 47.1.1 increase or decrease the quantity of any work included in the Contract;
- 47.1.2 omit or substitute any such work;
- 47.1.3 change the character or quality or kind of any such work;
- 47.1.4 change the levels, lines, positions, and dimensions of any part of the work;
- 47.1.5 execute, additional work of any kind necessary for the completion of the works, and
- 47.1.6 change any specified sequence or timing of construction of any part of the work.

No such variations shall in any way vitiate or invalidate the Contract, but the effect, if any, of all such variations shall be valued in accordance with Clause-48 hereof.

Provided that where the issue of an instruction to vary the Works is necessitated by some default of or breach of Contract by the Contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the Contractor. Any altered, additional, and substituted work which the Contractor may be directed to do in the manner above specified as part of the Works shall be carried out by the Contractor on the same conditions in all respects on which he agreed to do the main Works.

48 Determination of Price Variation

- 48.1 Upon certified completion of the whole Works, if a reduction or increase in the total value of the work is found to be within 20% of the initial Contract Price, then there shall be no change in the Contract rates for individual items of work specified in the bill of quantities, irrespective of the quantum of variation in individual items.
- 48.2 However, if a reduction or an increase is found to be more than 20% of initial Contract price, the increase in payment for minus variation or decrease in payment for plus variation shall be specified based on slabs of variation in the Contract value as specified below:

Variation in Value of Works	Increase in Payment for minus variation	Decrease in Payment for plus variation
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Up to 20%	Nil	Nil
Above 20% and up to 35 %	6.00%	3.00%
Above 35% and up to 60%	8.00%	4.00%
Above 60 % and up to 100%	10.00%	5.00%
Above 100%	-	5.00%

While working out the value of Works for the purpose of variation, the extra items for which new rates have been paid and payment towards price adjustment; and the adjustment towards statutory variations shall not be considered.

Illustration

- a) In case of variation in value of Works by (plus) + 60 percent, the payment for (60-20) percent i.e., 40 percent of Contract value of Works shall be decreased by 4 % (four percent.). The reduction in Contract rates shall commence as soon as the value of Works executed reaches 120% of Contract Price.
 - b) In case of variation in value of Works by (minus) – 55 percent, the payment for (55-20) percent i.e., 35 percent of Contract value of Works shall be increased by 8% (eight percent.).
- 48.3 No variation limit for any individual BOQ item has been specified in these GCC except for the payment due to the Contractor as detailed above. No claim for revision of rate(s) for any individual BOQ item shall be admissible irrespective of the extent to which the ordered quantity may get revised (+) or (-) during the actual execution of the Works.
- 48.4 Within 14 days of the date of instruction for executing varied Works and before the commencement of such Works, notice shall be given either:
- a) by the Contractor to the Employer of his intention to claim extra payment or a varied rate or price, or
 - b) by the Engineer-in-Charge to the Contractor of the intention to vary a rate or price.
- 48.5 The Contractor within 14 days from the receipt of an order to execute any extra item shall submit rate analysis to the Engineer-in-Charge supported by documentary evidence of basic rates adopted therein; having regard to the cost of materials, actual wages of labour, and other operational costs. The analysis so provided by the Contractor shall form the basis for determination of rates for such extra items. Extra items of work/supply which are not provided in the Bill of Quantities shall be paid on the basis of



Bhutan Schedule of Rates (BSR) after adjusting such rates for the place of Works and cost index prevailing at the time of award. If rates for such extra items are not available in BSR, the rates for such items shall be determined based on the actual expenditure relating to that item including cost of materials, fabrication/machinery handling and erection at Site plus twenty percent (20%) towards overheads including profits. The price of varied items determined by the Engineer-in-Charge shall be final and binding on the Contractor. No payment shall be made for the items of Works ordered to be omitted.

- 48.6 If there is delay in the agreement between Employer and the Contractor on the rate of varied Works, provisional rates @ 75% of the rates as determined by the Engineer-in-Charge shall be payable as a provisional payment till such time as the rates are finalized.
- 48.7 Under no circumstances, the Contractor shall at any stage suspend work on account of non-settlement of rates of such item(s).

PLANT, TEMPORARY WORKS AND MATERIALS

49 Plants, Temporary Works and Materials

49.1 Contractor to Provide Plant

The Contractor shall provide at his own expense all Constructional Plant, Temporary Work and materials including Equipment, Materials and Camps required for the execution of the Works. He shall furnish along with the bid a list of items of all Constructional Plant and machinery which he shall be deploying on the particular job. He shall also make necessary arrangements for supplementing them at his own expense, if required to do so by the Engineer-in-Charge at the time of award of the Contract, or later on as the Work progresses.

49.2 Plant etc., Exclusive Use for the Works.

All Constructional Plant, Temporary Works and materials provided by the Contractor shall, when brought on to the Site, be deemed to be exclusively intended for the execution of the Work and the Contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the Site to another, without the consent, in writing of the Engineer-in-Charge.

49.3 Removal of Plant etc.

Upon completion of the Works, the Contractor shall remove from the Site all the said Constructional Plant and Temporary works remaining thereon and any unused materials provided by the Contractor after obtaining written permission from the Engineer-in-Charge.

49.4 PHPA-I not Liable for Damage to Plant etc.



PHPA-I shall not at any time be liable for the loss of or damage to any of the said Constructional Plant, Temporary Works or materials save as mentioned in Clause-19 and Clause-60 hereof.

50 Approval of Materials etc. not implied

The operation of Clause-49 hereof shall not be deemed to imply any approval by the Engineer-in-Charge of the materials or other matters referred to therein nor shall it prevent the rejection of any such materials at any time by the Engineer-in-Charge.

MEASUREMENT

51 Quantities

The quantities set out in the Bill of Quantities are the approximate estimated quantities of the Work, and they are not to be taken as the actual quantities of the Works to be executed by the Contractor in fulfillment of his obligations under the Contract.

52 Works to be measured

- 52.1 Engineer-in-Charge shall, except as otherwise provided, ascertain and determine the measurement value in accordance with the Contract of work done.
- 52.2 All measurement of all items having financial value shall be entered in Measurement Book and/or level in the field book so that a complete record is obtained of all works performed under the Contract.
- 52.3 All 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 his representative as token of his acceptance. If the Contractor objects to any of the measurement recorded, a note shall be made to that effect with reasons and signed by both the parties.
- 52.4 If for any reason, the Contractor or his authorized representative is not available and the work of recording measurements is suspended by the Engineer-in-Charge or his representative, the Engineer-in-Charge shall not entertain any claim from Contractor for any loss or damages on this account. If the Contractor or 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 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.



- 52.5 The Contractor shall, without extra charge, provide all appliances, instruments, labour and other items necessary for survey, measurement and recording of levels etc.
- 52.6 In the case of items which are not covered by specifications, measurements issued by the **Ministry of Infrastructure and Transport, Department of Infrastructure Development, Thimphu, Bhutan, RGoB** and if for any item no such standard is available, then a mutually agreed method shall be followed.

53 Method of Measurement

The Works shall be measured net, notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the Contract. However, the guidelines given in relevant part of the **Specifications of Building & Road Works-2025** published by the Ministry of Infrastructure and Transport, Department of Infrastructure Development, Thimphu, Bhutan, RGoB, will prevail in case of any confusion that may arise during measurement.

54 Security Rules

The Work shall be a protected area. The Contractor, his employees and labourers shall have to follow the Security Rules as may be imposed from time to time by the Engineer-in-Charge or by the Royal Government of Bhutan. If the Contractor, his employees or labourers are found to be reluctant to follow the Rules, the Engineer-in-Charge will have the right to prohibit such persons from entering into the Work area. If required, the Engineer-in-Charge shall have the authority to take the help of local District Administration and or local police, if it is considered absolutely necessary.

55 Foreign Personnel

- 55.1 The Contractor shall submit to the PHPA-I, the details and bio-data of all personnel he proposes to bring into Bhutan for the performance of the Works under the Contract. Such data for each person shall, besides the proof of his citizenship (either passport or voter identity card only will be acceptable), contain the name, his present address, his assignment and responsibility in connection with the Works, and a short resume of his qualifications, experience etc. in relation to the Works to be performed by him.
- 55.2 Any person unsuitable and unacceptable to the PHPA-I shall not be brought to Bhutan. Any person, if found unsuitable or unacceptable to the PHPA-I on a later date, shall within a reasonable time, be repatriated by the Contractor, who shall make alternative arrangements for providing a suitable replacement.
- 55.3 No person brought to Bhutan for the purposes of the Works shall be repatriated without the consent of the PHPA-I in writing, which shall be based on a written request from the Contractor for such repatriation giving reasons for such an action to the Engineer-in-



Charge. The PHPA-I may give permission for such repatriation provided it is satisfied that the progress of Works shall not suffer due to such repatriation/replacement.

- 55.4 The Contractor and his expatriate personnel shall observe/respect all Bhutanese Acts, Laws, Rules and Regulations and shall not in any way interfere with Bhutanese political and religious affairs and shall meticulously follow any other Rules and Regulations which the RGoB, the PHPA-I and the Engineer-in-Charge may impose on them from time to time. The Contractor's expatriate personnel shall work and live-in close co-operation with their co-workers and the community and shall not engage themselves in any other employment either part time nor shall they take part in any local politics.
- 55.5 PHPA-I will assist the Contractor, to the extent possible, in obtaining necessary permits to travel to Bhutan and back by issuing necessary Certificates and other information required by the RGoB and other agencies.

CERTIFICATE AND PAYMENT

56 Certificate and Payment

56.1 Interim Payment Certificate

The Contractor shall submit an application for interim payment, in duplicate to the Engineer-in-Charge at the end of each month in a Proforma approved by the Engineer-in-Charge. The application shall include the following items, as applicable, which shall be taken into account in the sequence listed.

- 56.1.1 the estimated Contract Price of the Permanent Works executed up to the end of the month in question, obtained by applying the base unit rates and prices in the Bill of Quantities to the quantities measured by the Engineer-in-Charge pursuant to Clause-52,
- 56.1.2 the estimated Contract value of the Permanent Works obtained as in 56.1.1, executed up to the end of the previous month.
- 56.1.3 the estimated Contract value at base unit rates and prices, of the Permanent Works for the month in question obtained by deducting 56.1.2 from 57.1.1.
- 56.1.4 an amount reflecting any changes pursuant to Clause-63 hereof.
- 56.1.5 any amount to be deducted on account of the repayment of Advances under the provisions set forth in Clause 56.2 and
- 56.1.6 any other sum to which the Contractor may be entitled under the Contract.

It may be noted that all interim payments would be treated as provisional payments.



Within 28 days of receipt of the said applications for interim payment, it shall be approved or amended such that, in the Engineer-in-Charge's opinion, the Certificate reflects the amount due to the Contractor in accordance with the Contract. In case of differences in opinion as to the value of any item, the Engineer-in-charge's view shall prevail. When the Engineer-in-Charge has determined the amount due to the Contractor, he shall issue to the Contractor a Certificate hereinafter called "Interim Payment Certificate" certifying the amount due to the Contractor, and

The Engineer In-Charge may make any correction or modification in any previous interim Payment Certificate which was issued by him. The Engineer In-Charge shall have authority to omit or reduce the value of such work in any Interim Payment Certificate if any work is not carried out to his satisfaction.

56.2 Retention Money

- 56.2.1 Deduction of Retention Money amounting to 10% (ten percent) of the amount included in any monthly Interim Payment Certificate pursuant to Clause 56.1 due to the Contractor on account of Permanent Works executed shall be made by the Engineer-in-Charge.
- 56.2.2 The Retention Money shall be certified due for payment after the expiration of the Defects Liability Period, notwithstanding that at such time there may be outstanding claims by the Contractor against the PHPA-I. Provided always that, if at such time there shall remain to be executed by the Contractor any Works ordered during such period pursuant to Clause-46 hereof, the PHPA-I shall be entitled to withhold payment until the completion of such Works or so much of the Retention Money as shall, in the opinion of the Engineer-in-Charge represent the cost of the Works so remaining to be executed, and
- 56.2.3 On completion of the whole of the works, the Retention Money may be substituted by a Bank Guarantee issued by any Financial Institution in Bhutan/India acceptable to PHPA-I. The Bank Guarantee on the proforma of the PHPA-I form shall be valid until the issue of the Defects Liability Certificate by PHPA-I.
- 56.2.4 Retention Money shall not be refunded till the contractor produces a NOC from all concerned, including the labour officers. 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. On receipt of the said communication, the Engineer-in-Charge shall write to the Labour Office to intimate if any complaint is pending against the Contractor in respect of the work. If no complaint is pending on record till after three months after completion of the work and/or no communication 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.

56.3 **Advances**

Advances for execution of the Works, if required by the Contractor, will be granted in the following cases, provided that the advances are spent only for the Work under the Contract.

56.3.1 *Mobilization Advance*

- i. Advance to the extent of **10%** of the Contract Price can be granted for mobilization of labour, stores, and workshops, including camps, labour sheds, and Construction Plant, etc., for preliminary and enabling Works. The Contractor is to use the advance payment only to pay for equipment, Plant, Materials, and Mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance has been used in this way by supplying copies of invoices or other documents to the project manager.
- ii. The release of this advance shall be regulated and governed by the following conditions:
 - a. The advance shall be interest-free.
 - b. The advance will be released if requested by the Contractor in writing within one month of the order to commence the work.
 - c. The advance will be disbursed on the production of the irrevocable Bank Guarantee (on the Proforma in Forms) from any Financial Institution of Bhutan/India for an amount equal to the required advance payment, and the BG shall be valid till the advance is fully recovered.

The advance is recoverable, and the deduction of the advance shall be made on pro-rata percentage basis from the interim payments certified by the Engineer-in-Charge under the Contract. The deduction shall commence in the next Interim Payment Certificate following that in which the total of all such payments to the Contractor has reached 10% of the Contract Price until such time as the advance has been fully repaid, provided always that the entire amount of advance shall be completely deducted by the time the total of all payments to the Contractor has reached 80% of the Contract Price.

56.3.2 *Secured Advance*



- i. The Contractor shall be entitled to Secured Advance during the execution of the work up to 75% of the assessed value of any materials which in the opinion of the Engineer-in-Charge are non-perishable, non-fragile and non-combustible and are in accordance with the Contract and which have been brought to 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.
- ii. When materials on account of which an advance have been made under this sub-Clause are incorporated in the work, such advance shall be recovered/deducted from the next payment of the Contractor.
- iii. Secured Advance shall also be payable on other items of perishable nature, fragile, and combustible, with the approval of the Engineer-in-Charge and provided that the Contractor takes 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.
- iv. No Secured Advance shall, however, be paid on high-risk materials such as glass, petrol, diesel, etc.

56.3.3 Corrections

Since all the interim payment Certificates are issued provisionally, the Engineer-in-Charge may, by any Interim Payment Certificate, make any correction or modification in any previous Certificate (other than one purporting to be Final Payment Certificate) which shall have been issued by him and shall have power to modify or withhold any Interim Certificate if the Works or any part thereof, are not being carried out to his satisfaction.

56.4 Final Account

- 56.4.1 Not later than 2 months after the date of issue of the Certificate of Completion of Works in pursuance of Clause-45 hereof, the Contractor shall submit a draft statement of Final Account and supporting documentation to the Engineer-in-Charge showing in detail the value of the work done in accordance with Contract, together with all further sums which the Contractor considers to be due to him under the Contract up to the date of Defects Liability Certificate (Hereinafter called the "Contractor's Draft Final Account").
- 56.4.2 Within 4 months after receipt of the Contractor's Draft Final Account and of all information reasonably required for its verification, the Engineer-in-Charge shall determine the value of all matters to which the Contractor is entitled under the



Contract. The Engineer-in-Charge shall then issue to the Contractor a statement (hereinafter called the "Engineer-in-Charge's Draft Final Account") showing the final amount to which the Contractor is entitled under the Contract. The Contractor shall sign the Engineer-in-Charge's Draft Final Account as an acknowledgement of the full and final value of the work performed under the Contract and shall promptly submit a signed copy (hereinafter called the "Final Account") to the Engineer-in-Charge within 30 days, failing which the Engineer-in-Charge shall consider it as accepted by the Contractor.

56.5 Final Certificate

On receipt of the Final Account, the Engineer-in-Charge shall promptly prepare and issue to the Contractor a Final Payment Certificate certifying any further money due to the Contractor in respect of the Contract. Payment to the Contractor of the amount due under the Final Payment Certificate shall be made by the PHPA-I within 60 days of such Certificate being issued. In the event of non-payment/ failing to collect by the Contractor within the said period, no interest shall accrue to the Contractor.

57 Approval only by Maintenance Certificate

No Certificate other than the Maintenance/Defects Liability Certificate referred to in Clause-58 hereof shall be deemed to constitute approval of the Works.

58 Maintenance Certificate

58.1 The Contract shall not be considered as completed until a Maintenance/Defects Liability Certificate shall have been signed by the Engineer-in-Charge stating that the Works in all respect have been completed and maintained to his satisfaction. This Certificate shall be issued by the Engineer-in-Charge within 28 days after the expiry of the Defects Liability Period or if different periods become applicable to different sections or parts of the Works, the expiry of the latest such period, or as soon thereafter as any work ordered during such period, pursuant to Clause-46 hereof, shall have been completed to the satisfaction of the Engineer-in-Charge and full effect shall be given to this Clause, notwithstanding any previous entry on the Works or the taking possession, using thereof or any part thereof by the PHPA-I.

58.2 Cessation of PHPA-I's Liability

The PHPA-I shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or execution of the Works unless the Contractor shall have made a claim in writing in respect thereof before the issuing the Maintenance/Defects Liability Certificate.



REMEDIES AND POWERS

59 Remedies and Powers

59.1 *Default of Contractor*

If the Contractor shall become bankrupt, or have a receiving order made against him, or shall present his petition in bankruptcy, or shall make an arrangement with or assignment in favors of his creditors, or shall agree to carry out the Contract under a committee of inspection of his creditors or, being a corporation, shall go into liquidation (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), or if the Contractor shall assign the Contract, without the consent in writing of the PHPA-I first obtained, or shall have an execution levied on his goods, or if the Engineer-in-Charge shall certify in writing that, in his opinion, the Contractor:

- 59.1.1 has abandoned the Contract, or
- 59.1.2 without reasonable excuse has failed to commence the Works or has suspended the progress of the Works for 28 days after receiving written notice from the Engineer-in-Charge to proceed, or
- 59.1.3 has failed to remove materials from the site or to pull down and replace work for 28 days after receiving from the Engineer-in-Charge's written notice that the said materials or work had been condemned and rejected by the Engineer-in-Charge under these conditions, or
- 59.1.4 despite previous warnings by the Engineer-in-Charge in writing, is not executing the Works in accordance with the Contract, or is persistently or flagrantly neglecting to carry out his obligations under the Contract, or
- 59.1.5 has, to the detriment of good workmanship, or defiance of the Engineer-in-Charge's instruction to the contrary, sub let any part of the Contract;

then the Engineer-in-Charge may, after giving 14 days' notice in writing to the Contractor, enter upon the Site and expel the Contractor, from the entire Works or part thereof, without thereby voiding the Contract, or releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and powers conferred on the PHPA-I or the Engineer-in-Charge by the Contract, and may itself complete the entire Work or part thereof as the case may be or may employ any other Contractor to complete the Works at the risk and cost of the Contractor in accordance with Clause 44.3.

- 59.1.6 PHPA-I or such other Contractor may use for such completion so much of the Constructional Plant, Temporary works and materials, which have been deemed to



be reserved exclusively for the execution of the works, under the provisions of the Contract, as he or they may think proper, and the PHPA-I may, at any time, sell any of the said Constructional Plant, Temporary works and unused materials and apply the proceeds of sales in or towards the satisfaction of any sums due or which may become due to the Contractor under the Contract.

59.2 Valuation at Date of Forfeiture

The Engineer-in-Charge shall, as soon as may be practicable after any such entry and expulsion by the PHPA-I, fix and determine ex-parte, or by or after reference to the parties, or after such investigation or enquiries as he may think fit to make or institute, and shall certify what amount, if any, had at the time of such entry and expulsion been reasonably earned by or would reasonably accrue to the Contractor in respect of work actually done by him under the Contract and the value of any of the said unused or partially used materials, any Constructional Plant and any Temporary Works.

59.3 Payment after Forfeiture

- 59.3.1 If the PHPA-I shall enter and expel the Contractor under this Clause, it shall not be liable to pay to the Contractor any money on account of the Contract until the expiration of the Defects Liability Period and thereafter until the costs of execution and maintenance, damages for delay in completion, if any, and the percentage to apply to the value of work not completed, as indicated in the SCC, have been ascertained and the amount thereof certified by the Engineer-in-Charge. The Contractor shall then be entitled to receive only such sum or sums, if any, as the Engineer-in-Charge may certify would have been payable to him upon due completion by him after deducting the said amount. If such amount shall exceed the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the PHPA-I the amount of such excess and it shall be deemed a debt due by the Contractor to the PHPA-I and shall be recoverable accordingly.
- 59.3.2 In the event of the above course being adopted by the Engineer-in-Charge, the Contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any Constructional Plant, material or entered into any agreements or made any advances on account or with a view to the execution of the Works or the performance of the Contract.

SPECIAL RISKS/TERMINATION

60 Special Risks/Termination of Contract

60.1 Special Risks



The special risks are war, hostilities (whether war be declared or not), invasion, act of foreign enemies, and all other risks described in Clause-19.6 hereof.

60.2 Termination of the Contract

If, during the currency of the Contract, any of the Special Risks mentioned hereinabove which, whether financially or otherwise, materially affects the execution of the Works, the Contractor shall, unless and until the Contract is terminated under the provisions of this Clause, continue to use his best endeavors to complete the execution of the Works. Provided always that the PHPA-I shall be entitled at any time after occurrence of such Special Risks to terminate the Contract by giving written notice to the Contractor and upon such notice being given, this Contract shall, except as to the right of the parties under this Clause and to the operation of Clause-68 hereof, terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof.

60.3 Removal of Plant on Termination

If the Contract shall be terminated under the provisions of the last preceding sub-clause, the Contractor shall, with all reasonable dispatch, remove from the Site all Constructional Plant and shall give similar facilities to his sub-Contractors to do so.

60.4 Payment if Contract is Terminated

If the Contract is terminated as aforesaid, the Engineer-in-Charge shall issue a Certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting & securing the Works less advance payments received in respect of Constructional Plant and materials and any other sums which at the date of termination were recoverable by the PHPA-I from the Contractor under the terms of the Contract.

NOTICES

61 Notices

61.1 Service of Notices to Contractor

All Certificates, notices, or written orders to be given by the Engineer-in-Charge to the Contractor under the terms of the Contract shall be served either through post or hand delivery to the Contractor's office on Site or his principal place of business, or such other address as the Contractor shall nominate for this purpose.

61.2 Service of Notice to PHPA-I or its Engineer-in-Charge



All notices to be given to the PHPA-I or to its Engineer-in-Charge under the terms of the Contract shall be served to the Engineer-in-Charge, PHPA-I, Bjimthangkha, Wangdue.

61.3 Change of Address

Either party may change these addresses through prior written notice.

DEFAULT OF PHPA-I

62 Default of PHPA-I

62.1 In the event of the PHPA-I failing to pay to the Contractor the amount due under any Certificate of the Engineer-in-Charge within 90 days after the same shall have become due under the terms of the Contract, subject to any deduction that the PHPA-I is entitled to make under the Contract, the Contractor shall be entitled to issue a notice to the Engineer-in-Charge stating that he shall be terminating his Works after 30 days from the issue of such notice, for the reasons stated therein. However, if within the said period of 30 days, the Engineer-in-Charge notifies the Contractor that the reasons stated in the notice of the Contractor are not valid or that the alleged event of default of the PHPA-I has been remedied or no longer exists, then the Contractor shall not be entitled to terminate the Contract.

62.2 If the Contractor becomes entitled to terminate the Contract in terms of Clause 62.1, after expiry of the notice of 30 days, he may, notwithstanding the provisions of Clause 49.2 hereof, remove from the Site all Constructional Plant brought by him.

62.3 In the event of such termination, the PHPA-I shall be under the same obligations to the Contractor in regard to payment as if the Contract had been terminated under the provisions in Clause-60 hereof.

CHANGES IN COSTS AND LEGISLATION

63 Increases or Decrease of Costs

63.1 If the prices of materials and/or wages of labour required for execution of the work increase/decrease, the Contractor's payment shall be adjusted for such variation as per provisions detailed below and the amount of the Contract shall accordingly be varied, subject to the condition that such variation in prices shall be available only for the work done during the stipulated period of the Contract as per Clause 40 including such period for which the Contract validity is extended under the provisions of Clause 41 of the Contract without any action under the Clause 44. Such variation in the prices of materials and labour, when due, shall be worked out based on the following provisions:

63.1.1 No price adjustment shall be allowed for the work within the first 12 months of the Contract. The base date for working out such variation for the Contract period



exceeding 12 months shall be the last stipulated date of Bid submission, including extension, if any.

- 63.1.2 The cost of work on which variation will be payable shall be reckoned as 80% of the cost of work as per the bills, running or final, excluding any work for which payment is made at prevailing market rates. From this amount, the value of materials supplied under Clause 56.3 of this Contract and proposed to be recovered in the particular bill shall be deducted before the amount of compensation for price variation is worked out. In the case of materials brought to the site for which any secured advance is included in the bill, the full value of such materials as assessed by the Engineer-in-Charge (and not the reduced amount for which secured advance has been paid) shall be added to the cost of work shown in the bill for operation of this Clause.

Similarly, when such materials are incorporated in the work and the Secured Advance is deducted from the bill, the full assessed value of the materials originally considered for operation of this Clause should be deducted from the cost of the work shown in the bill, running or final.

- 63.1.3 The compensation for escalation for material shall be worked out as per the formula given below:

$$V_m = 0.80 W \times 0.75 \times (MI - M_{Io}) / M_{Io}$$

Where,

V_m : Variation in material cost, i.e., increase or decrease in the amount in BTN to be paid or recovered.

W : Cost of work as indicated in Clause 63.1.2.

MI & M_{Io} : Material Index [Index Number published by National Statistical Bureau (NSB)] for the period under consideration and that valid on the last stipulated date of Bid submission, including extension, if any (Clause 63.1.6). Until NSB comes up with the Material Index for the Royal Government of Bhutan, the Wholesale Price- Index (All commodities) published by Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Government of India shall be used for Material Index for the purpose of this clause.

- 63.1.4 The following principles shall be followed while working out the indices mentioned in Clause 63.1.2.
- The compensation for price variation shall be worked out at quarterly intervals and shall be with respect to the cost of work done as per bills paid during the 3 calendar months of the said quarter. The first such payment shall be made after



the first 12 months of the Contract, excluding the month in which the tender was accepted and thereafter at three-month intervals. At the time of completion of the work, the last period for payment might become less than 3 months, depending on the actual date of completion.

- ii. The index (MI) relevant to any quarter/period for which such compensation is paid shall be the arithmetical average of the indices relevant to the 3-calendar-month period. If the period up to date of completion after the quarter covered by the last such installment of payment is less than 3 months, the index MI shall be the average of the indices for the months falling within that period.

63.1.5 The compensation for escalation for labour shall be worked out as per the formula given below:

$$VI = 0.80 W \times 0.25 \times (LI - LIO) / LIO$$

Where:

VI: Variation in labour cost i.e., amount of increase or decrease in BTN to be paid or recovered.

W: Cost of work as indicated in Clause 63.1.2.

LIO: Minimum daily wage in BTN. of an unskilled adult male mazdoor, fixed by the Royal Govt. of Bhutan on the last stipulated date of Bid submission, including extension, if any.

LI: Minimum wage in BTN of an unskilled adult male mazdoor, fixed by the Royal Govt. of Bhutan on the last date of the quarter previous to the one under consideration.

63.1.6 The following principles will be followed while working out the compensation as per Clause 63.1.4.

- i. The price variation for labour shall also be paid at the same quarterly intervals as applicable to materials under this Clause. If such a revision of minimum wages takes place during any such quarterly intervals, the compensation shall be applicable at revised rates only for work done in subsequent quarters.
- ii. Irrespective of variation in minimum wages of any category of labour, for the purpose of this Clause, the variation in the rates for an unskilled adult male mazdoor alone shall form the basis for working out the compensation payable on the labour component.
- iii. Subsequent Legislation



If, after the date 30 days prior to the latest date of submission of Bid for the Works, there occur in Bhutan changes to any Statute, Ordinance, Decree or other Law or any regulation or by-law of any local or other duly constituted authority, or the introduction of any such Statute, Ordinance, Decree, Law, Regulation or bye-law which causes additional or reduced amount to the Contractor, other than above Clause (63.1.3 & 63.1.5) in the execution of the Works, such additional or reduced amount shall be certified by the Engineer-in-Charge after examining the record provided by the Contractor and shall be paid by or credited to the PHPA-I. Notwithstanding the foregoing, such additional or reduced amount shall not be separately paid or credited if the same shall already have been taken into account in the indexing of any input to the price adjustment formulae in accordance with sub-Clause 63.1.3 & 63.1.5 of this Clause.

ADDITIONAL CLAUSES

64 Bribery and Collusion

64.1 The PHPA-I shall be entitled to terminate the Contract and recover from the Contractor the amount of any loss resulting from such termination if the Contractor shall have offered or given to any person any consideration of any kind as an inducement or reward for doing, forbearing to do, any action in relation to obtaining, or in the execution of the Contract or any other Contract with the PHPA-I, or for showing favour to any person in relation to the Contract or any other Contract with the PHPA-I, or if any of the like acts shall have been done by any person employed by the Contractor or acting on his behalf (whether with or without the knowledge of the Contractor), or if the Contractor shall have come to any agreement with another Contractor or number of Contractors whereby an agreed quotation or estimate shall be offered as a bid to the PHPA-I by one or more Contractor(s).

64.2 *In the event of such termination, the Contractor shall:*

64.2.1 proceed as provided in Clause-60.3 hereof;

64.2.2 be paid by the PHPA-I as provided in Clause-60.4 hereof, provided that any loss referred to in Clause-65.1 shall first be deducted.

65 Termination of Contract for PHPA-I's Convenience

65.1 The PHPA-I shall be entitled to terminate this Contract at any time for the PHPA-I's convenience after giving 60 days' prior notice to the Contractor.

65.2 In the event of such termination, the Contractor shall:

65.2.1 Proceed as provided in the sub-Clause-60.3 hereof, and;



65.2.2 be paid by the PHPA-I as provided in sub-Clause-60.4 hereof.

66 Environment, Pollution, and Noise

66.1 Subject to and without prejudice to any other provision of the Contract and the law of the land and its obligations as applicable, the Contractor shall take all reasonable precautions in connection with streams, watering, drains, water courses, underground water resources, including percolating water, and will prevent:

66.1.1 Silting

66.1.2 Erosion of the beds or banks

66.1.3 Pollution of the water so as to adversely affect the quality or appearance thereof or cause injury or death to animals and plants.

66.1.4 Any interference with the supply to or obstruction from such sources

66.1.5 Pollution of the water so as to adversely affect the quality thereof.

66.2 All works shall be carried out without unreasonable noise and disturbance. The Contractor shall indemnify and keep the PHPA-I indemnified from & against any responsibility for damages or in carrying out the work and against all claims, demands, proceedings, damages, costs, charges, and expenses whatsoever in regard to or in relation to such liability. All RGoB environment protection laws will be duly implemented. The vegetation and land shall be protected from damage during the course of execution except to the barest minimum essentially required not to cause or permit any one to cause any nuisance, disturbance, or pollution or inconvenience to the public, employer, or neighborhood of the site.

67 Occupational Health and Safety

The Contractor shall comply with the Labour and Employment Act of Bhutan-2007, Regulations on Occupational Health and Safety (OHS) and Welfare-2012, or any revisions thereof. Payment towards Personal Protective Equipment (PPE) and Common Protection Measures (CPMs) as listed in the latest BSR for worker's OHS measures at construction sites shall be released upon certification by the Engineer-in-Charge.

67.1 Non-compliance

If during the performance of works under the Contract, the PHPA-I informs the Contractor that it is the opinion of the Engineer-in-Charge that the Contractor is:



- 67.1.1 Not conducting the work in compliance with the Contractor's Health and Safety Coordination Plan, relevant Safe Working Method Statements, relevant legislation, or Health and Safety procedures provided by the RGoB from time to time, or
- 67.1.2 Conducting the work in such a way as to endanger the Health and Safety of Contractors' employees or its Contractors' and sub-Contractors' employees, and the public.
- 67.1.3 Conducting the work in such a way as to risk property, plant, equipment, or materials.

The Contractor shall remedy that breach of Health and safety promptly.

67.2 Consequences of its non-compliance

- 67.2.1 The Engineer-in-Charge shall reject the Contractor's claim on the worker's Occupational Health and Safety measures.
- 67.2.2 The Engineer-in-Charge may direct the Contractor to suspend the work until such time as the Contractor satisfies the Engineer-in-Charge that the work will be resumed in conformity with applicable health and safety provisions.
- 67.2.3 During periods of suspension referred to above, the PHPA-I shall not be required to make any payment whatsoever to the Contractor.
- 67.2.4 If the Contractor fails to rectify any breach of health and safety for which the work has been suspended, or if the Contractor's performance has involved recurring breaches of health and safety, the PHPA-I may as its option terminate the work forthwith, without further obligation to the Contractor. In this event, the PHPA-I's liability shall be limited to payment for the work performed and costs incurred by the Contractor up to the time of termination or an earlier suspension of works.

SETTLEMENT OF DISPUTES

68 Arbitration

- 68.1 Except where otherwise provided in the Contract, all questions and disputes relating to the meaning of the specifications, design, drawings and instructions herein 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, 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.



68.2 If the Contractor considered 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 on any matter in connection with or arising out of the Contract or carrying out of the work, to be unacceptable, he shall promptly within 15 days request the Engineer-in-Charge in writing for written instruction or decision. There upon, the Engineer-in-Charge shall give his written instructions or decision within a period of 30 days from the receipt of the Contractor's letter.

If the Engineer-in-Charge fails to give his instructions or decision in writing within the aforesaid period or if the Contractor is dissatisfied with the instructions or decision of the Engineer-in-charge, the Contractor may, within 15 days of the receipt of Engineer-in-charge's decision, appeal to the Director (Technical), PHPA-I, who shall afford an opportunity to the Contractor to be heard, if the latter so desires, and to offer evidence in support of his appeal. The Director (Technical), PHPA-I shall give his decision within 30 days of receipt of Contractor's appeal. If the Contractor is dissatisfied with his decision, the Contractor shall within a period of 30 days from receipt of his decision, give notice to Director (Technical), PHPA-I for resolution of disputes or differences through arbitration in accordance with the rules and procedures prescribed in the SCC, failing which the said decision shall be final, binding and conclusive and not referable to adjudication by the Contractor.



SECTION V
SPECIAL CONDITIONS OF CONTRACT



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SPECIAL CONDITIONS OF CONTRACT

The following Special Conditions of Contract (SCC) shall supplement and/or amend the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

SL	Clause Reference to GCC	Data
1	10. Performance Security	The Performance Security shall be 10% of the Contract Price in the form of a Bank Guarantee (on the proforma form of PHPA-I) or Demand Draft issued by any Financial Institutions in Bhutan/India, and valid until 30 days after the date of issue of the Completion Certificate .
2	21. Minimum amount of third-party insurance	As permissible under the policy.
3	40. Time for Completion	The work shall be completed within 7 months . The period of completion shall be reckoned from the 30 th day of issue of the Letter of Award.
4	44.2. Liquidated Damage	1% per week of delays, subject to a maximum of 10% of the Contract Price .
5	46.1. Defects Liability Period	Defects Liability Period shall be for 12 months from the date of issuance of Completion Certificate
6	59.3. Payment after forfeiture	The percentage to apply to the value of the work not completed, representing the PHPA-I's additional cost for completing the balance work is 20% up to a maximum of 10 % of the Contract Price .
6	63. Increase or decrease of cost	Not Applicable
7	68. Arbitration	Except where a decision has become final and conclusive, all disputes arising in connection with this Contract shall be referred to arbitration at the Bhutan Alternative Dispute Resolution Centre (BADRC), Thimphu. The parties shall follow the procedures as contained in the Alternative Dispute Resolution Act of Bhutan 2013, as amended from time to time.



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SECTION VI

GENERAL TECHNICAL SPECIFICATIONS



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Table of Contents

Contents

1. General	3
2. Quality of Materials and Workmanship	3
3. Scope of Works	4
1. Earthworks	5
A. General Requirements.....	5
B. Definitions for Earthwork.....	7
C. Classification of Excavated Materials	8
D. General Excavation for Road Work& Drainage Work	9
E. Disposal of Materials	15
F. Forming of Embankment and Filling or Bedding	16
G. Compaction of Embankments and other Areas of Fill/Backfill.....	20
2. Pavement Work	21
A. Subgrade	21
B. Sub-Base/ Base	24
C. Wet Mix Macadam.....	27
D. Prime Coat.....	31
E. Tack Coat.....	34
F. Dense Bituminous Macadam (DBM)	35
G. Asphalt/ Bituminous Concrete	43
H. Cement Concrete Interlocking Paver Block	46
3. Scarifying	48
A. Preliminary Work:	48
B. Scarifying:.....	48
C. Finishing:	48
D. Measurement:	48
E. Rate:	48
4. Road Markings.....	49
A. Materials	49
B. Weather Limitations	49
C. Tools and Equipment for Painting:	49
D. Surface Preparation.....	49
E. Setting out of Road Markings.....	50
F. Application of Paint	50
G. Tolerances Requirements	50
H. Faulty Workmanship or Materials.....	51



I.	Protection	51
J.	Tests and Standards of Acceptance	51
K.	Application of Reflective Glass Beads	51
L.	Measurement	52
5.	Traffic Safety Associated Works	53
A.	Metal Crash Barriers	53
6.	Concrete Works	55
A.	General	55
B.	Plain Concrete	58
7.	Masonry Works	59
A.	General Requirements	59
B.	Execution	60
C.	Random Rubble Masonry	61
D.	Sampling, Testing and Quality Control	63
E.	Measurements and Payments	63
8.	Gabion Walls	65
A.	Double Twisted Woven Gabion	65
B.	Welded Wire Gabion	70
C.	Precautions	75
9.	Construction of Pipe Culverts	76
A.	Excavation	76
B.	Jointing of Concrete Pipes	78
C.	Refilling Trenches	78
D.	Measurement	79
E.	Rate	79
10.	Drainage Work	80
A.	Construction of V-shaped drain:	80
B.	QA/QC	80
C.	Measurement:	80
D.	Rates:	80
11.	Causeways	81
A.	Vented Causeways	81
B.	Submersible Causeway	82
12.	Occupational Health and Safety	83



TECHNICAL SPECIFICATIONS

1. General

The Technical Specifications shall give general information about execution of various items of works under the Contract and cover the specified stipulations for measurements and payment therefor included in the Bill of Quantities.

These specifications shall be the part of the requirements for various items of works, which shall be executed according to the stipulations of the Contract. Hence, the instructions given herein form an integral part of and are applicable to the bidding documents issued for the works. Addenda to these specifications may be issued, as required during bidding and construction phases.

These specifications shall be read in conjunction with Bill of Quantities (BoQ), drawings and the Conditions of Contract. While quoting the price, the Contractor shall comply with all provisions contained within the bidding documents with an objective to complete each items of work without any addition of cost thereof. In case Specifications, BoQ and Condition of Contract do not corroborate each other for completion of any particular item of work, the same as well as the assumptions made in quoting of price for such item(s) of Works shall be brought out clearly in the bid.

It is the intent of these specifications to establish acceptable standards of quality as specified in the technical specifications. These specifications cover the execution of the Works, as shown in the Bill of Quantities, Drawings and in the General Conditions of Contract, and shall be read in conjunction with all other contract and bidding documents including the Environmental Codes of Practice.

2. Quality of Materials and Workmanship

All works shall be executed in conformity to the approved drawings and instructions issued by the Engineer-In-Charge for construction. Execution of works contemplated under these specifications shall include, in complete, all the procurement and supply of all required Man power (skilled and un-skilled) and Materials (inclusive of octroi and all other taxes and charges as levied, if any), Equipment, Plant and Machineries, office, stores and workshop etc., transportation, handling and placement of Materials and Equipment to site in a professional and diligent manner.

All works shall comply with the quality requirements defined in the relevant sections of these specifications and other section of the bidding documents. Where no specifications have been laid down, the materials used and the Work done shall conform to the latest edition of Specifications for Building and Road Works: Royal Govt. of Bhutan, Indian Standards(IS), or International Standards Organization (ISO) Specification and the Environmental Codes of Practice (ECP), Highways and Roads or as directed by the Engineer-In-Charge. The Contractor



shall endeavour to provide all such necessary efforts in order to comply with the intent of these specifications to the satisfaction of the Engineer-In-Charge.

The materials and workmanship shall be of the best of their respective kinds and shall be to the approval of the Employer or his representative on Site, the Engineer. In reading these Specifications, the words to the approval of the Engineer shall be deemed to be included in the description of all materials incorporated in the works, whether manufactured or natural and in the description of all operations for the due execution of the works.

The contractor shall carry out modifications in the procedure of work, if found necessary, as directed by the Engineer during inspection. Substandard quality of work shall be rectified/redone by the contractor at his own cost, and defective work/material shall also be removed from the site of works by the contractor at his own cost.

The Engineer may ask to carry out the field/Laboratory tests mentioned in the specification and the cost of carrying out such tests which include equipment charges, tools, materials, labour and incidentals to perform tests and other operations of quality control according to the specification requirements shall be deemed to be incidental to the work and no extra payment shall be made for the same. Sampling and testing procedure to be used shall be as approved by the Engineer and his decision shall be final and binding on the contractor.

3. Scope of Works

The work to be carried out under the Contract is as specified in the contract data and drawings and shall include the following:

1. Earthwork for road work and drainage work etc
2. Pavement Work
 - Subgrade
 - Sub-Base/Base
 - DBM
 - Asphalt Concrete/Bituminous Concrete
 - Prime coating
 - Tack Coating
 - Road marking
3. Scarifying
4. Drainage Work
5. Steel & Metal Work and Other works
6. Protection Works



1. Earthworks

This Section covers the works related to the roadway excavation, roadway filling, backfilling, excavation/filling for drains, channels etc. The works shall consist of hauling and disposing of all unsuitable and excess materials and excavating, hauling, placing and compacting suitable materials, from areas of excavation or borrow, all as required to construct the graded areas, embankments, roads, drainage, building construction sites and parking, or otherfill area. The work shall be done in accordance with these specifications and in conformity with the lines, grades, dimensions and typical cross- sections shown on the Drawings.

Suitable materials taken from excavation shall be used in the formation of embankment, subgrade, or for backfilling on the Drawings or as directed by the Engineer-in-charge. When the volume of suitable excavated material exceeds that required to construct the works to the grades indicated, the excess shall be hauled, disposed with proper soil management at safe tipping sites as directed. When the volume of excavation is not sufficient for constructing the works to the grades indicated, the deficiency shall be supplied from the borrow areas.

The Contractor shall also provide all safety measures for the workmen and others as per standard practices and requirements and / or direction of the Engineer-In-Charge during all types of excavation / filling at his own cost and responsibility. However, approval given by the Engineer-In-Charge to the Contractor's methods and equipment shall not relieve the Contractor of his full responsibility for a proper and safe execution of excavations, or of liability for injuries to, or death of persons, or any obligations under this Contract.

A. General Requirements

Earthwork includes two types of operations i.e. (i) earth excavation and disposal of the excavated materials (ii) earth excavation and use of excavated materials. The use of excavated materials may be in the form of filling embankment, backfilling (including grading and obtaining graded and structural backfill material) and filling other areas as required.

Earth excavation and disposal implies excavation of all types of materials including part of the structures below ground level within and outside of the limit of the right of way except for otherwise specified, shaping the exposed surface of excavation as specified or directed by the Engineer-In-Charge, removal, hauling and disposal of the excavated material at the locations and in the manner as specified or directed by the Engineer-In-Charge.

Any damage to the Works due to the Contractor's operations, including shattering of material and existing structures beyond the required excavation lines, shall be repaired at the expense of and by the Contractor. Any and all excess excavation for the convenience of the Contractor for any purpose or reason, except as may be ordered in writing by the Engineer-In-Charge, and whether or not due to the fault of the Contractor, shall be at the expense of the Contractor. Where required to complete the work, all such excess excavation and over-excavation shall be



filled and compacted with suitable material supplied and placed at the expense of and by the Contractor.

Cutting work shall be executed true to levels, slope, shape and pattern as per the drawing or as indicated by the Engineer-In-Charge. The sides of excavation shall be dressed or trimmed and bottom shall be levelled or graded and rammed as directed by the Engineer-In-Charge. Under no circumstances shall undermining or under cutting be allowed during excavation, the contractor shall maintain the natural/man-made drainage of the area.

When the cutting has reached to the formation width the contractor shall immediately construct and maintain drain of as per the drawing. Excavation and filling implies excavation of materials and shaping the exposed surface of excavation as stated above, removal, hauling and use of the excavated material at the location and in the manner as specified or directed by the Engineer-In-Charge.

Prior to the commencement of any excavation, the Contractor shall satisfy himself as to the circumstances at the site and of all and the various materials, obstructions, strata, water streams including the possibility of floods, etc., and of all other items and things liable to affect or be encountered in the excavation necessary for the proper construction of the works. The rates priced in the Bill of Quantities shall provide for these circumstances.

The Contractor shall ensure that earthwork operation do not cause interference to the public. If excavations are carried out within 5 m of buildings, the Contractor shall execute the work in a way that will minimize damage and disturbances. In general, vertically sided excavation will be required in such places and all necessary timbering or other support shall be provided. Under-excavation of excavation sides will not be permitted.

No excavated suitable material other than surplus to requirements of the contract shall be removed from the site except on the direction of the Engineer-In-Charge. Should the Contractor be permitted to remove suitable material from Site to suit his operational procedure, then he shall make good at this own expense any consequent deficit of filling arising therefrom.

Material in surplus to the total requirements of works, and all unsuitable materials shall, unless the Engineer-In-Charge permits otherwise, be run to spoil dumps.

Where the excavation reveals a combination of suitable and unsuitable materials the Contractor shall carry out the excavation in such a manner that the suitable materials are excavated separately for use in the works without contamination by the unsuitable materials.

The Contractor shall make his own arrangements for the stockpiling of top-soil and/or suitable material.

At all times the Contractor shall ensure that earthworks are not damaged by weather or traffic.



In the event of such damage occurred, the Engineer-In-Charge may withdraw approval from the affected works until the Contractor has carried out repairs to restore the works to their original condition. The cost of all such repairs and any additional testing shall be borne by the Contractor without extra cost to the Employer.

Work on embankments and/or cuttings in areas required for the construction of structures shall not be carried out until the EIC agrees that construction of such structures is sufficiently advanced that there is no interference or damage to them.

The Contractor shall get approval of the Engineer-In-Charge in respect of method of earthwork, type of equipment to be used, disposal and other details before commencement of the earthwork.

Excavation and disposal shall include:

- Excavation and disposal of any type of material indicated on the Drawing.
- Excavation and removal or partial removal of existing pavement.
- Excavation and disposal for channel, trenches and drains etc.
- Excavation required in cuts or under embankments below the lowest normal limit of excavation as indicated on the Drawing or below ground line.
- Excavation and disposal of unsuitable materials.
- Removal or partial removal of existing embankments and disposal of the materials as shown on the Drawing or as directed by the Engineer-In-Charge.
- Excavation for foundation and disposal of materials.

Excavation and filling shall include:

- Filling for embankment
- Backfilling in trenches, foundation pits etc.
- Any type of other filling or backfilling whereby the ground level is raised or a hole is filled up.

B. Definitions for Earthwork

The following definitions of earthwork materials shall apply to this and other Clauses of these specifications, if otherwise not specified.

- i. **"Topsoil"** shall mean the top layer of soil that can support vegetation. It shall include turf acceptable for turfing.
- ii. **"Suitable Material"** It shall comprise all that which is acceptable such as moorum, sandy gravels, hard stones etc., in accordance with the technical specification for use in the



Works and which is capable of being compacted to form a stable fill having side slopes as indicated in the Drawings.

- iii. **"Unsuitable Material"** shall mean other than suitable material and shall include:
- a) Material from swamps, marshes or bogs;
 - b) Peat, logs, stumps, perishable material, organic clays;
 - c) Material susceptible to spontaneous combustion;
 - d) Soft or loose boulders which does not meet the technical specification
 - e) Material in a frozen condition; materials classified as such, if otherwise suitable, shall be classified as suitable when unfrozen.
 - f) Clay of liquid limit exceeding 70 and/or plasticity index exceeding 45;
 - g) Any such materials unless otherwise permitted in the contract
- iv. **Rock:** It shall mean masses of hard material, which necessitate the use, or partly use, of blasting for their removal
- v. **Rock Fill:** It shall consist of hard material of suitable size for deposition and compaction and may comprise rock as defined above, broken stone, hard brick, concrete or other comparable hard inert material.
- vi. **Soft Material:** It shall mean suitable material with the exception of rock fill.
- vii. **Cohesive Soil:** It includes clays and marls with up to 20% of gravel and having a moisture content not less than the value of the plastic limit (determined in accordance with IS 2720, Part V); also chalk having a saturation moisture content of 20% or greater.
- viii. **Well Graded Granular and Cohesive Soils:** They include clays and marls containing more than 20% of gravel and/or having moisture content less than the value of the plastic limit (determined in accordance with IS 2720, Part V); Well graded sands and gravels with a uniformity coefficient exceeding 10; chalk having a saturation moisture content within the range 15-20% and all shale, clinker ash, and approved spent domestic refuse.
- ix. **Uniformly Graded Material:** It includes sands and gravels with a uniformity coefficient of 10 or less, and all silts and pulverized fuel shed. Any soil containing 80% or more material in the particle size range 0.060.002 mm will be regarded as silt for this purpose.

C. Classification of Excavated Materials

The Definition and Classification of materials for purpose of excavation shall be as follows:



- i. **All Kinds of Soil:** Generally, any strata, such as sand, gravel, loam, clay, mud, black cotton moorum, shingle, river or nallah bed boulders, soiling of roads, paths etc. and hard core macadam surface of any description (water bound, grouted tarmac etc.), lime concrete, mud concrete and their mixtures which for excavation yields to the application of picks, shovels, jumpers, scarifiers, ripper and other manual digging implements.
- ii. **Ordinary Rock:** Generally, any rock which can be excavated by splitting with crow bars or picks and does not require blasting, wedging or similar means of excavation such as limestone, sand stone, hard laterite, hard conglomerate and un-reinforced cement concrete below ground level. If required light blasting may be resorted to, for loosening the materials but this will not in any way entitle the material to be classified as "Hard Rock"
- iii. **Hard Rock:** Generally, any rock or boulder for the excavation of which blasting is required such as quartzite, granite, basalt, reinforced cement concrete (reinforcement to be cut through but not separated from concrete) below ground level and the like.
- iv. **Hard Rock (blasting prohibited):** Hard rock requiring blasting as described under (c) but where the blasting is prohibited for any reason and excavation has to be carried out by chiseling, wedging or any other agreed method.
- v. **Marshy Soil:** This shall include soils like soft clays and peat excavated below the original ground level of marshes and swamps and soils excavated from other areas requiring continuous pumping or bailing out of water.

D. General Excavation for Road Work& Drainage Work

All excavations shall be carried out to such lengths, depths and inclinations as are shown on the Drawings or as may be ordered by the Engineer-in-charge. The Contractor shall open up excavation sites in stages as ordered by the Engineer. No further excavation works shall commence until the Engineer has inspected and approved the completed excavation site.

All excavations shall be carried out by excavator, unless otherwise indicated by the Engineer. The Contractor shall take all precautions necessary to preserve the material or existing structures below and beyond any line of excavation in the soundest possible condition.

Any damage to the Works due to the Contractor's operations, including shattering of material and existing structures beyond the required excavation lines, shall be repaired at the expense of and by the Contractor. Any and all excess excavation for the convenience of the Contractor for any purpose or reason, except as may be ordered in writing by the Engineer, and whether or



not due to the fault of the Contractor, shall be at the expense of the Contractor. Where required to complete the work, all such excess excavation and over-excavation shall be filled and compacted with suitable material supplied and placed at the expense of and by the Contractor.

All excavation shall be carried out during dry weather. The Contractor shall supply and operate all necessary pumping plant to remove all water from any source whatsoever which may enter the excavation whether these are in progress. If excavations are carried out within 5 m of buildings, the Contractor shall execute the work in a way that will minimize damage and disturbances. In general, vertically sided excavation will be required in such places and all necessary timbering or other support shall be provided. Under-excavation of excavation sides will not be permitted. Excavations shall be finished to the lines and dimensions shown on the Drawings or directed by the Engineer.

The Engineer reserves his right to direct the Contractor as to the lengths of trenches or parts of bulk excavations, which may be opened at any one time. In the case of excavations likely to cause interference to the public, the Contractor shall organise his operations in such a way as to reduce to a minimum the interval between opening up and back-filling the excavations. Prior to the commencement of any excavation, the Contractor shall satisfy himself as to the circumstances at the site and of all the various materials, obstructions, strata, water streams including the possibility of floods, etc., and of all other items and things liable to affect or be encountered in the excavations necessary for the proper construction of the works. The rates entered in the Bill of Quantities shall provide for these circumstances. Cutting work shall be executed true to levels, slope, shape and pattern as per the drawing or as indicated by the Engineer.

The sides of excavation shall be dressed or trimmed and bottom shall be levelled or graded and rammed as directed by the Engineer. Under no circumstances shall undermining or under cutting be allowed during excavation, the contractor shall maintain the natural/man-made drainage of the area.

When the cutting has reached to the formation width the contractor shall immediately construct and maintain V-shaped temporary earth drain of size 600mm wide and 500mm deep as per the drawing. No extra payment shall be made for the construction and maintenance of the drain, the rate shall be deemed to be covered by excavation of road formation/trace/box cutting.

- **Manually Excavation:**
- **Mechanically Excavation**
- **Blasting**

i. Use of Explosives and Blasting



Training: All blasting works shall have to be carried out exclusively in a controlled manner. It has been experienced that the blasters do not have adequate knowledge on control blasting. Therefore, the contractor shall make arrangements to organise control blasting training for a period of one week before starting the blasting operation.

The contractor shall prepare the site for practical demonstrations and training, make arrangement of all equipment's and explosives well in advance and inform the Engineer-In-Charge at least two weeks in advance after finalizing the date. The Department of Roads will provide the resource person and the contractor shall make arrangements for accommodation and logistics for the resource person. The contractor shall have provision included in the contract to meet the above expenses and nothing extra shall be paid. On any work requiring the use of explosives, the Contractor shall employ blasters experienced in controlled blasting and these blasters must be in possession of a current blasting certificate or should recently have participated in a training for Controlled Blasting organised by Department of Roads. The purchase, transport, storage and use of explosives shall be carried out in accordance with DoR "Blasting Manual" [Reini Schrämlí, Switzerland, 1999], which is available at DoR Head Office and the by-laws issued by the Ministry of Home and Cultural Affairs and the Contractor shall allow in his rates for excavation and quarrying for all expenses incurred in meeting these requirements, including the provision of suitable stores.

Blasting operations shall be carried out in a controlled manner, as bench blasting using detonating cords of 5, 10 and 40gm/m depending upon the site requirements without overcharging the holes and in advance by the Engineer-In-Charge approved drilling pattern. Delay detonators of delay time of 20 milliseconds shall be used to increase the interval of blasting between two rows of holes. No blasting shall be carried out without using delay detonators.

To attain the maximum output, the size of the hole shall be drilled appropriately with different rod size, for 3 feet 34mm dia, 5 feet 32mm dia and for 8 feet 30mm dia. The minimum capacity of the compressors shall be 7.50 cum of air/min. for two jack hammers. Blasting shall take place with as little interference as possible to traffic or persons. Shot hole blasting is not allowed except when explicitly approved as an exception by the Engineer-In-Charge. The rates shall include for all flagging, watching, barricades and clearance of debris, and the Contractor shall take all precautions for the protection of persons, properties and the Works.

For horizontal drilling the contractor shall have minimum of two pusher legs. Slopes shattered or loosened by blasting shall be taken down at the expense of and by the Contractor. The Contractor's controlled blasting and other operations in excavation shall be such that they will yield as much material as possible suitable for use in the Works. The Contractor shall limit falling



down of blasted material along the valley slope to the maximum. The Contractor shall in this respect take all measures reasonably possible and shall mitigate any damages caused by blasted material to the extent possible.

The contractor shall immediately request the Engineer-In-Charge to inspect upon arrival of new consignment of explosives. Only the approved explosives after inspection shall be permitted to use. Any explosives which are more than one year from the date of manufacture shall not be not be used.

(i) Finishing:

All excavations shall be carried out in conformity with the lines, grades, side slopes and levels shown on the drawings or as directed by the Engineer-in-charge. The contractor shall not excavate outside the limits of excavation subject to the permitted tolerances, any excess depth/width excavated beyond the specified levels/dimensions on the drawings shall be made good at the cost of the contractor. All debris and loose materials on the slopes of cutting and the formation width shall be removed. After excavation the sides of excavated areas shall be trimmed and the required slopes/gradient shall be maintained uniformly to minimise erosion and ponding. The excavated area shall be neatly dressed and all overhanging soil shall be removed. The formation width shall be finished to the final level with the given cross fall, neatly dressed surface free from depressions and projections and at gradients given in the drawing.

(ii) Measurements:

The length, breadth and depth shall be measured correct to 10 mm. In case the measurements are taken with staff and level, the level shall be recorded correct to 5 mm and depth of cutting and heights of filling calculated correct to 5 mm.

In the formation cutting the measurement shall be done by taking cross sections at suitable intervals, where it is not feasible to compute volumes by this method because of erratic surfaces, the volumes shall be computed by other accepted methods. For rock excavation, the over burden shall be removed first so that necessary cross sections could be taken for measurement. Where cross sectional measurements could not be taken due to irregular configuration or where the rock is admixed with other classes of materials, the volumes shall be computed on the basis of stacks of excavated rubble after making 35% deduction there from. When volumes are calculated in this manner for excavated material other than rock, deduction made will be to the extent of 16% of stacked volumes. The cubical contents shall be worked out to the nearest two places of decimal in cubic meters.

(iii) Rates:

The rates shall cover the cost for carrying out all the required excavation and banking operations within 50m lead including cost of labour, materials, equipment hired/owned, tools and plants,



blasting materials and incidentals necessary to complete the work. In case of rock, the rate shall include the cost of all operations of blasting with explosives, machineries and other accessories or other means as mentioned above. The filling & embankment within the formation width on the valley side shall be measured and paid as per specification under filling and embankment.

ii. Rough excavation:

Rough Excavation shall mean bringing earth from hillside cutting, borrow pits, etc. where dressing of sides and bottom and reduction to exact level is not required. Hillside cutting shall be done from top to bottom. Under no circumstances shall under-mining or under cutting be allowed. During excavation the contractor shall maintain the natural/man-made drainage of the area.

Cutting work, other than rough excavation, shall be executed true to levels, slope, shape and pattern indicated by the Engineer. The sides of excavation shall be dressed or trimmed, and bottoms shall be levelled or graded and rammed as directed by the Engineer. All cutting shall be done to the required levels. In case it is taken deeper by the contractor, it shall be brought to the required levels by filling in with earth duly consolidated at the contractors cost. However, in case of hard rock, where blasting operations have been resorted to, cutting shall be measured to the actual level provided the Engineer is satisfied that the contractor has not gone deeper than what was unavoidable.

(i) Filling:

The earth from cutting shall be directly used for filling and no claim for double handling of earth shall be entertained. Filling shall be done in regular horizontal layers, each not exceeding 200mm in depth. The earth shall be free from all roots, grass and rubbish. All lumps and clods exceeding 80mm in any direction shall be broken and each layer shall be consolidated by ramming and rolling, etc. Watering shall be done, if so stipulated. The top surface of the finally finished area shall be neatly dressed.

The finished formation levels in case of filling shall be kept higher than the required level by making an allowance of 10% of depth of filling for future settlement in case of ordinary consolidated fills, and 5% in case where consolidation is done by heavy mechanical machinery under optimum moisture conditions.

(ii) Measurements:

The length, breadth and depth shall be measured correct to 10mm. In case the measurements are taken with staff and level, the level shall be recorded correct to 5mm and depth of cutting and heights of filling calculated correct to 5mm. The cubical contents shall be worked out to the nearest two places of decimal in cubic metres.



Where excavation is in trench or in borrow pits, the measurements of cutting in trenches or borrow pits shall be made. In case of borrow pits, diagonal ridges, cross ridges or deadmen shall be left by the contractor to permit accurate measurements being taken on the completion of work. The position of deadmen etc. shall be fixed by the Engineer.

Deduction of such ridges and deadmen shall be made from the measurements, unless the same are required to be removed later on and the earth so removed is utilised in the work. In the later case nothing extra will be paid for their subsequent removal.

Where the ground is not fairly uniform or where the site is required to be levelled, levels shall be taken before the start and after the completion of work and the quantity of excavation in cutting computed from these levels.

Where it is not possible or convenient to take measurements from borrow pits or cutting, excavation shall be worked out from filling. The levels of the original ground before start of the work after site clearance, and after compaction of the fill shall be taken at suitable intervals. The quantity of fill shall be computed from these levels. The quantity of earthwork so computed shall be reduced by 10% in case of consolidated fills and by 5% in case the consolidation is done by heavy mechanical machinery, to arrive at net cubical contents. No such deduction shall be made where:

- Consolidation is done by heavy mechanical machinery at the optimum moisture content or
- Consolidated filling is done in confined situations, such as under floors.

(iii) Rates:

The rates shall cover the cost for carrying out all the required excavation and banking operations, including the cost of labour, materials, equipment hired/owned, tools and plants, and incidentals necessary to complete the work. In case of rock, the rate shall also include the cost of all operations of blasting with explosive and accessories or other means as mentioned above.

Protection and supporting of existing services i.e. pipes, water mains, cables met within the course of excavation should be provided. Care shall be taken not to disturb electric and communication cables, and, if necessary for removal it shall be arranged by the Engineer.

iii. Trenches Excavation

All excavation operation shall include excavation and getting out the excavated matter. Getting out shall include throwing the excavated earth at least one metre or half the depth of excavation whichever is more, clear off the edge of excavation. The subsequent disposal of the excavated material shall either be as directed by the Engineer under a separate item or as



included in this item disposal up to 50 metres lead. Excavation shall be dug out to the exact dimensions as shown in the drawing or as directed by the Engineer.

Care shall be taken to cut the sides and bottom exactly to the required shape, slope and gradient, while carrying out excavation for drains work. The surface shall be dressed properly. If the excavation is done to a depth greater than that shown in the drawings or greater than that required by the Engineer, the excess depth shall be made good at the cost of the contractor with stiff clay puddle at places where the drains are required to be pitched and with ordinary earth, properly watered and rammed, where the drains are not required to be pitched. In case the drain is required to be pitched, the back filling with clay puddle shall be done side by side as the pitching work proceeds. The brick pitched storm water drains shall be avoided as far as possible in filled up areas.

Excavation in ordinary rock shall be carried out by crowbars, pickaxes or pneumatic drills. Blasting operations are generally not required in this case. If the contractor wishes to resort to blasting, he can do so with the permission of Engineer, but nothing extra will be paid to him on this account.

Excavation in hard rock shall be done by chiselling where blasting operation is prohibited or is not applicable. In trenches or drains where blasting is not otherwise prohibited, the excavation in hard rock shall be carried out by blasting in the first instance and finally by chiselling so as to obtain the correct section of the trench as per drawing. The blasting operation shall be strictly as per latest RGOB blasting manuals.

(i) Measurements:

The length, breadth and depth shall be measured correct to 10mm. The cubical contents shall be worked out to the nearest two places of decimal in cubic metres.

(ii) Rates:

The rates shall cover the cost for carrying out all the required excavation and banking operations including cost of labour, materials, equipment hired/owned, tools and plants, and incidentals necessary to complete the work. In case of rock, the rate shall also include the cost of all operations of blasting with explosive and accessories as mentioned above.

Protection and supporting of existing services i.e. pipes, water mains, cables met within the course of excavation. Care shall be taken not to disturb electric and communication cables, and, if necessary for removal it shall be arranged by the Engineer.

E. Disposal of Materials

Transport of loose spoil materials in designated locations including loading/unloading, dressing of dump sites and plantation of vegetation after completion of dumping. The free and



indiscriminate disposal of any surplus materials is strictly prohibited. Spoil materials shall only be disposed off to sites approved by the Engineer-In-Charge. It is the Contractor's responsibility to select suitable spoil disposal sites (ranging from 50 metres to 1000 metres lead) such as suitable gullies, natural depressions, abandoned quarries, degraded land. Enough care shall be taken not to trigger instability on such disposal sites to avoid the destruction of property, vegetation, irrigation and drinking water supply systems. The deposited materials shall be properly stacked by benching using excavator and compacting with boom to accommodate more materials. After the completion of the disposal the surface shall be neatly dressed and plantation shall be done after applying top soil. The plantations shall be fast growing plants or turfing as directed by the Engineer-In-Charge.

The contractor shall identify small disposal sites along the road on the valley side where slope is gentler and risk of destruction is minimum. These disposal sites shall be improved by construction log and boulder barriers. The dumping shall be done by benching with the excavator releasing the material from the bucket at a very low height to prevent the material from rolling down. For dumping the boulders or rocks the space shall be created first to place them firmly. The contractor shall notify these identified areas for Engineer-In-Charge's inspection and approval. These dumping areas shall be optimally used to reduce time and long-distance transport. Wetland shall not be used as spoil disposal site unless drained properly on forehand, to the discretion of the Engineer-In-Charge.

Measurement:

The length, breadth and depth of the loose volume (excavated material) shall be measured correct to 10 mm. In case of rocks/boulders 10% deduction for voids for the measured quantity shall be done. The cubical contents shall be worked out to the nearest two places of decimal in cubic meters.

Rates:

The rates shall cover the cost for carrying out all the operations described above including labour charges, loading, unloading, engaging of excavator for levelling and compacting the spoil deposits, spreading of top soil, plantations and other incidentals involved in the operation.

F. Forming of Embankment and Filling or Bedding

i. Forming of Embankment for Road

Filling and embankment construction includes the preparation of areas for embankments, to be constructed. All materials used by the Contractor for the construction of fillings and embankments shall be approved by the Engineer. Approved materials shall normally be rock and slightly weathered rock passing a 150 mm ring and other excavated material, defined as suitable material, free from vegetable matter or top-soil and having a liquid limit of not more than 65.



Preparation of Surface for Filling:

Areas to receive fillings and embankments shall be cleared and grubbed, and all existing structures and other obstruction shall be demolished and cleared away, in accordance with Section C of this Technical Specification. Where groundwater or seepage is encountered, the Contractor shall notify the Engineer-in-charge and any action to be taken shall, unless otherwise specified, be submitted to the Engineer for review.

Where the existing ground has an inclination steeper than 4 (horizontally) to 1 (vertically), benches shall be cut progressively over the full area to be covered by the fill. The width of each bench shall be such as to permit safe and effective operation of plant but shall be not less than 1 m. Prior to the placing of fill, the sub grade shall be compacted to 95% of the maximum dry density. The Contractor shall not commence placing any fill on the prepared areas until the Engineer has inspected these areas and has given consent to proceed.

Construction of Road Embankment:

Embankments shall be built up evenly over the full width in layers of not more than 200 mm compacted thickness and shall be maintained at all times with a sufficient cross-fall to valley side and a surface sufficiently even to enable surface water to drain readily from them. All materials used in embankments shall be compacted as soon as practicable after deposition. Each layer shall be compacted to a density of not less than 98% of the maximum dry density as determined by the Modified Standard Proctor Test. Earthmoving plant shall not be accepted as compaction equipment.

During the construction of embankments, the Contractor shall control and direct constructional traffic uniformly over their full width. Damage to compacted layers by constructional traffic shall be made good by the Contractor. If the condition of the material deposited as fill is such that it cannot be compacted in accordance with the requirements of the Contract the Contractor shall either:

Embankments shall be built up evenly over the entire width and shall be maintained at all times with a sufficient camber to enable surface water to drain rapidly from them. Damage to compacted layers by constructional or other traffic shall be made good by the Contractor.

Make good by removing the material off the embankment either to top or elsewhere until it is in a suitable physical condition for re-use and replacing it with suitable material; or

Make good the material by mechanical or chemical means to improve its stability; or



Cease work on the material until its physical conditions are again such that it can be compacted as described in the Contract.

The finishing of the road embankment shall be in accordance with the levels and dimensions provided in the design, including the provision of the temporary side drain. The finishing, including road shoulders, shall be smooth with a cross fall to the mountain side of 4%, allowing controlled surface water run-off in to the temporary side drain.

Slopes:

The finishing of mountain and valley side slopes shall be in accordance with the levels and dimensions provided in the design. The finishing shall be smooth to the extent that bio engineering works can be taken up if needed slopes shall be trimmed where necessary.

QA/QC

- **Material:** Materials from swamps, marshes, bogs, peat, log, stump and perishable materials are considered unsuitable for filling/embankment.
- The materials for embankment/filling shall be obtained from approved sources with preference given to materials becoming available from nearby excavation or any other excavation under the same contract.
- **Sub grade compaction:** Check whether the sub grade is compacted as per specification (CBR not less than 5).
- **Sub grade:** If the sub grade is weak, conduct field density test by DCP apparatus.
- **Moisture content:** Moisture content of the material shall be checked at the site of placement prior to commencement of compaction; if found to be beyond the tolerance of optimum moisture content, the same shall be made good.
- If the materials are brought from borrow pits following tests may be conducted: Grid the borrow area at 25m c/c (or closer if the variability is high) to full depth of proposed working. These pits shall be logged and plotted for proper identification of suitable sources of material.
 - Sand content as per IS 2720 part 4, 2 tests per 3000 cum of soil
 - Plasticity test as per IS 2720, part 5, 2 tests per 3000 cum of soil
 - Density test as per IS 2720, part 8, 2 tests per 3000 cum of soil
 - Deleterious content as per IS 2720, part 27, as and when required.
 - Moisture content test as per IS 2720, part 2, one test per 250 cum of soil.
- Control shall be exercised on each layer by taking at least one measurement of density for each 1000 sqm of compacted area or closer. The determination of density shall be in accordance with IS: 2720 (part-28) & (CBR not less than 5).



- **Finishing:** All finishing works like shaping and dressing the shoulders/roadbed and side slopes conform to the alignment, levels, cross sections and dimensions shown on the drawings or as directed by the Engineer.

Measurement:

The length, breadth and depth of the compacted layer shall be measured correct to 10 mm. The cubical contents shall be worked out to the nearest two places of decimal in cubic meters.

Rates:

The rates shall cover the cost of transporting of earth, labour involved for screening, laying of the useful material and disposing the spoil material, preparation of site, watering, power rolling and dressing and any other incidentals involved in the operation.

ii. Filling or Bedding

Earth used for filling shall be free from stone, shingle or boulder larger than 75 mm in any direction and salts, organic or other foreign matter. Normally excavated earth from the same area shall be used for filling. However, if such earth contains deleterious material, it shall not be used. All clods of earth shall be broken or removed.

The spaces around the foundations pipes and drains in trenches shall be cleared of all debris, brick bats etc. The filling shall be done in layers, not exceeding 200mm in each layer. Each layer shall be watered, rammed and consolidated before the succeeding one is laid. Earth shall be rammed with iron rammers where feasible and with the butt-ends of crowbars where rammer cannot be used. Special care shall be taken that no damage is caused to the pipes, drains and masonry or concrete in the trenches, under floor, etc.

Measurements:

The cubical contents of foundation concrete and masonry in foundation up to ground level shall be worked out and the same deducted from the cubical contents of earthwork in excavation for foundations to arrive at the quantity for filling sides of foundation. For filling in plinths and under floors, depth shall be the consolidated depth.

Rates:

The rates shall cover the cost for carrying out all the required filling operations including cost of labour, materials, equipment hired/owned, tools and plants, and incidentals necessary to complete the work.



G. Compaction of Embankments and other Areas of Fill/Backfill

All fill shall be compacted to the depth and degree of compaction as specified in Table below or as shown on the Drawing. This requirement applies whether the specified zone is in fill or in existing ground, except for any part which may fall within rock or rock fill. Formation level in this context shall mean top of sub grade.

Table 1: Depth and Degree of Compaction

Location	Depth below Formation Level (mm)	Minimum Compaction (%MDD) Heavy Compaction
Roadway Embankment including roadway embankment over rock fill	0-300	95
Roadway Cut	0-300	95
All other roadway fill and backfill not separately specified	-	90

Layers of material other than rockfill shall not exceed 150 mm compacted depth unless and until the Contractor can demonstrate to the satisfaction of the Engineer-In-Charge that he can successfully compact layers of a greater thickness.

Each layer shall be constructed in lengths suitable to the compaction and working methods used. Materials of each layer shall be thoroughly mixed with water as necessary to facilitate its compaction to the specified density.

In cut areas, the subgrade shall be processed as necessary and compacted to the depth and compaction requirements as given in table above. In the event that the Contractor is unable to achieve the minimum compaction requirements below formation level he shall excavate and recompact in layers as necessary.

Where it may be impracticable to use conventional rollers, the compaction shall be carried out by appropriate mechanical means such as small vibratory rollers, power rammers or plate compactor. Track rolling can be used where specified in the drawing with the approval of the Engineer-In-Charge. Care shall be taken to ensure that the compaction equipment does not hit or come too close to any structural member so as to cause any damage to it.



2. Pavement Work

A. Subgrade

i. Preparation

- **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.

If sub-grade composed of clay, fine sand or other soils that may be forced up into the coarse aggregate during rolling operations, an insulation layer of granular materials or over size brick aggregate not less than 10 cm thick of suitable thickness shall be provided for blanketing the sub-grade.

In slushy soil 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.

- **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 elastic mass (the roller shall pass a minimum of 5 runs on the sub-grade). All the undulations in the surface that developed due to rolling shall be made good with material or quarry spoils as the case may be and the sub-grade is re-rolled.

- **Surface Regularity:**

The finished surface shall be uniform and conform to the lines, grades and typical cross-sections shown in the drawings. When tested with the template and straight edge, the variation shall be within the tolerances specified in the table below:

Table2: Permissible Tolerances of Surface Regularity

Longitudinal profile	Cross profile
Maximum permissible undulation when measured with a 3 m	Maximum permissible variation from specified profile when measured with a



straight edge 24 mm	camber template 15 mm
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When the surface irregularity of the sub-grade falls outside the specified tolerances, the contractor shall rectify these with fresh material or quarry spoils as the case may be, and the sub-grade re-rolled to the satisfaction of the Engineer-In-Charge-in-charge.

- **Measurement:**

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.

- **Rate:**

The rate shall include the cost of materials and labour required for all the operations mentioned above, unless specified otherwise

ii. Extra for compaction of earth in embankments

Extra for compaction of earth in embankments under suitable moisture conditions to give at least 95% of the proctor density. In the case of earthwork 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 content (OMC). Each layer of uniform thickness not exceeding 200mm 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 shall not be less than 95% of the density obtained in the laboratory.

Each compacted layer shall be tested in the field for density and accepted before the operations for next layer are begun. 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.

iii. Density Measurement and Acceptance Criteria:

One measurement of density shall be made for each 500 sq.m of compacted area or for a smaller area as directed by the Engineer-In-Charge. Each measurement shall consist of at least 5 density determinations and the average of these 5 determinations shall be treated as the field density achieved. In general the control at the top 40 cm thickness of the formation shall be stricter with density measurements being done at the rate of one measurement for 250 sq.m 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. When density measurements reveal any soft areas in the embankment, the Engineer-In-Charge-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. Should circumstances arise, owing to wet weather the moisture content cannot be reduced to the required amount by above procedure, compaction work shall be suspended.

iv. Control Tests on Borrow Material:

Soil suitable for consolidation under O.M.C. conditions should preferably have the following characteristics:

- Minimum percentage of clay - 10%
- Liquid Limit -14
- Plasticity index - 4
- Percentage of silt should not exceed -50%
- Peat, muck and organic soils are unsuitable.

The Engineer-In-Charge, may, however, relax these requirements taking into account availability of materials, cost of transportation and other relevant factors. Various tests required to be conducted on the borrow material with their recommended frequency are indicated below. All the tests need not be stipulated on every project. Depending upon site conditions 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.

- Gradation: At least one test for each kind of soil. Usual rate of testing shall be 1 to 2 tests per 8000 cu.m of soil.
- Plasticity: At least one test for each kind of soil. Usual rate of testing shall be 1 to 2 tests per 8000 cu.m of soil.
- Proctor Tests: At the rate of 1 to 2 per 8000 cu.m of soil. (d)
Deleterious Contents: As required.
- Moisture Contents: One test for every 250 cu.m of soil.

v. Measurement:

The filling shall be measured and quantity of earthwork computed from cross sections of filling or the embankment. No deduction shall be made for voids.



vi. Rate:

The rate shall include the testing, additional rolling to obtain required density in addition to the cost of materials and labour required for all the operations mentioned above.

B. Sub-Base/ Base

i. Granular Su-base:

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 subbase hereinafter) as necessary according to lines, grades and cross-sections shown on the drawings or as directed by the Engineer-In-Charge-in-charge.

ii. Materials:

The material to be used for the work shall be natural sand, moorum, gravel, crushed stone, or combination thereof depending upon the grading required. Materials like crushed slag crushed concrete, brick metal and kankar may be allowed only with the specific approval of the Engineer-In-Charge. The material shall be free from organic or other deleterious constituents and conform to one of the three grading given in table below:

Table3: Grading for Close Graded GSB Materials

IS sieve Designation	% by weight passing the IS sieve		
	Grading I	Grading II	Grading III
75	100	-	-
53	80-100	100	-
26.5	55-90	0-100	100
9.5	35-65	0-80	65-95
4.75	25-55	0-65	50-80
2.36	20-40	0-50	40-65
0.425	10-25	5-25	20-35
0.075	3-10	3-10	3-10
In CBR value	30	25	20

Table4: Grading for Coarse Graded GSB Materials

IS sieve Designation	% by weight passing the IS sieve		
	Grading I	Grading II	Grading III
75	100	-	-
53		100	
26.5	55-75	50-80	100



9.5			
4.75	10-30	15-35	25-45
2.36			
0.425			
0.075	<10	<10	<10
In CBR value	30	25	20

Note: The material passing 425-micron sieve shall for all the three gradings when tested shall have liquid limit and plasticity index not more than 25 and 6 % respectively

While the grading is respect of close-graded granular sub-base materials, one each for maximum particle size of 75 mm, 53 mm and 26.5 mm. The corresponding grading for the coarse graded materials for each of the three maximum particle sizes are given at table. The grading to be adopted for the project shall be as specified in the contract.

iii. Physical Requirements:

The materials shall have a 10 percent fines value of 50 KN or more (for sample in soaked condition) when tested in compliance with BS: 812(Part 111). The water absorption value of the coarse aggregate shall be determined as per IS: 2386 (Part 3); if this value is greater than 2 percent, the soundness test shall be carried out on the material delivered to the site as per IS: 383. For grading II and III materials, the CBR shall be determined at the density and moisture content likely to be developed in equilibrium conditions which shall be taken as being the density relating to a uniform air voids content of 5 percent.

iv. Strength of sub-base:

It shall be ensured prior to actual execution that the material to be used in the sub-base satisfies the requirements of CBR and other physical requirements when compacted and finished. When directed by the Engineer-In-Charge, this shall be verified by performing CBR tests as required on specimens remolded at field dry density and moisture content and any other tests for the "quality" of the materials, as may be necessary

v. Construction operations:

Preparation of subgrade: Immediately prior to the laying of the sub-base, the subgrade already finished to Clause 301 or 305 as applicable shall be prepared by removing all vegetation and



other extraneous matter, lightly sprinkled with water if necessary and rolled with two passes of 80- 100 KN smooth wheeled roller.

Spreading and Compacting: The sub-base material of grading specified in the contract shall be spread on the prepared subgrade 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 the grade during the operation or other means as approved by the Engineer-In-Charge.

When the sub-base materials consist of combination of materials mentioned above, mixing shall be mechanically done by the mix-in place method.

Manual mixing shall be permitted only where the width of laying is not adequate for mechanical operations, as in small sized jobs. The equipment used for mix-in-place construction shall be a rotavator or similar approved equipment capable of mixing the material to the desired degree. If so desired by the Engineer-In-Charge, Trial runs with the equipment shall be carried out to establish its suitability for the work.

Moisture content of the loose material shall be checked in accordance with IS: 2720(Part 2) and suitably adjusted by sprinkling additional water from a truck mounted or trailer mounted water tank and suitable for applying water for uniformly and at controlled quantities to variable widths of surface or other means approved by the Engineer-In-Charge so that, at the time of compaction, it is from 1 percent above to 2 percent below the optimum moisture content corresponding to IS: 2720 (Part 8). While adding water, due allowance shall be made for evaporation losses. After water has been added, the material shall be processed mechanical or other approval means like disc harrows, rotavators until the layer is uniformly wet.

Immediately thereafter, rolling shall start. 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 up to 225 mm the compaction shall be done with the help of a vibratory roller of a minimum 80 to 100 KN static weight with plain drum or pad foot drum or heavy pneumatic tyred roller of minimum 200 to 300 KN weight having a minimum tyre pressure of 0.7 MN/m² or equivalent capacity roller capable of achieving the required compaction. Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional cross fall and super-elevation and shall commence at the edges and progress towards the centre for portions having cross fall on both sides.

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 cross fall (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 density is at least 98% 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 recompact.

vi. Measurements for payment:

GSB shall be measured as finished work in position in cubic meters. 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 subbase and as such no extra payment shall be made for the same.

vii. Rate:

The contract unit rate for granular sub-base shall be payment in full for carrying out the required operations.

C. Wet Mix Macadam

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/subbase/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 200mm upon approval of the Engineer-In-Charge.

i. Materials:

➤ Aggregates:

Physical Requirements: Coarse aggregates shall be crushed stone. If Gravel/shingle is used, not less than 90% by weight of the gravel/shingle pieces retained on 4.75mm sieve shall have at least two fractured faces.

Table 5: Physical Requirements of Coarse Aggregate for WMM for the Subbase Base Course



Test	Requirement
*Los Angeles abrasion value test or Aggregate impact value test	40 percent maximum 30 percent maximum
Combined flakiness and elongation indices(combined)	30 percent maximum**
*Aggregates may satisfy the requirements of either of the two tests **To determine this combined proportion, the flaky stone from a representative sample should first be separated out. Flakiness index is weight of flaky stone divided by weight of stone sample. Only the elongated particles be separated out from the remaining non-flaky stone metal. Elongation index is the weight of elongated particles divided by total non-flaky particles. The value of flakiness index and elongation index so found are added up.	

If the water absorption value of the coarse aggregates is greater than 2 percent, the soundness test shall be carried out on the material delivered in the site as per IS: 2386 (part 5) Grading Requirements:

Table6: Grading Requirements of Aggregates for WMM

IS sieve Designation	% 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 micron	8 – 22
75 micron	0 – 8

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 and viceversa. The aggregates can also conform to the grading given in the table below:

Table7: Grading Requirements of Aggregates



Percentage by mass of total aggregate passing test sieve Nominal maximum particle size		
37.5 mm	28 mm	20 mm
100	-	-
95-100	100	-
-	-	-
60-80	70 -85	90-100
40-60	50 – 65	60-75
25 – 40	35 – 55	40 – 60
15 – 30	25 – 40	30 – 45
7-19	12 – 24	13 – 27
5 – 12	5 – 12	5- 12

Note: For paver laid materials lower fines content may be accepted

ii. Construction Operations:

Preparation of Base:

The base of the sub-grade/sub-base/base shall be prepared to the specified lines and cross fall (camber) and made free of dust and other extraneous material. Any ruts or soft yielding places shall be corrected in an approved manner and rolled until firm surface is obtained, if necessary, by sprinkling water. Preparation of lateral confinement of aggregates: While constructing WMM, arrangement shall be made for the lateral confinement of wet mix. This shall be done laying materials in adjoining shoulders along with that of WMM layer.

Preparation of Mix:

WMM 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-In-Charge 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 22.4mm sieve with material of 4.75mm to 22.4mm 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.

Spreading of mix:



Immediately after mixing, the aggregates shall be spread uniformly and evenly upon the prepared sub-grade/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 by motor grader. For portions where mechanical means cannot be used, manual means as approved by the Engineer-In-Charge shall be used. The motor grader shall be capable of spreading the material uniformly all over the surface. Its blade shall have hydraulic control suitable for initial adjustments and maintaining the same so as to achieve the specified slope and grade.

The surface of the aggregate shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregate as may be required. The layer may be tested by depth blocks during construction. No segregation of larger and fine particles should be allowed. The aggregates as spread should be of uniform gradation with no pockets of fine materials.

Compaction:

After the mix has been laid to the required thickness, grade and cross fall/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 up to 200 mm, the compaction shall be done with the help of vibratory roller of minimum static weight of 80 to 100 KN or equivalent capacity roller. The speed of roller shall not exceed 5km/h.

In portions having a unidirectional cross fall/super-elevation, rolling shall commence from the lower edge and progress gradually towards the upper edge. Thereafter, roller should progress parallel to the center line of the road, uniformly overlapping each preceding track by at least one-third width until the entire surface had 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 toward s the center parallel to the centerline 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 on an area without scarifying the surface to permit proper bonding of the added material shall not be permitted.

Rolling shall not be done when the subgrade is soft yielding or when it causes a wave like motion in the sub-base/base course or subgrade. If irregularities develop during rolling which exceeds 123 mm when tested with a 3 m straight edge, the surface should be loosened and premixed material added or removed as required before rolling again as to achieve a uniform surface conforming to the desired grade and cross fall. In no case should the use of unmixed materials be permitted to make up the depressions.

Rolling shall be continued till the density achieved is at least 98% of the maximum dry density for the material. 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 re-compacted.

Setting and Drying:

After final compaction of wet mix macadam course, the road shall be allowed to dry for 24 hrs.

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.

iii. Measurement for payment:

WMM shall be measured as finished work in position in cubic meters.

iv. Rates:

The unit rate for WMM shall be payment in full for carrying out all the required operations.

D. Prime Coat

Providing and applying prime coat using bitumen emulsion conforming to IS: 8887, using asphalt/bitumen sprayer including preparing the surface and cleaning with roadbroom.

- On W.M.M @ 0.75 kg/m²



- On W.B.M @0.4 kg/m²

A prime coat means a thin layer of low viscosity bituminous binder applied to an absorbent non bituminous surface. If the prime coat is to be trafficked, it shall be covered with blinding material.

i. Materials:

The primer shall be cationic bitumen emulsion SS1 grade conforming to IS:8887

ii. Weather and seasonal limitations:

Primer shall not be applied during a dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10°C. Surfaces which are to receive emulsion primer should be damp, but no free or standing water shall be present. Surface can be just wet by very light sprinkling of water.

iii. 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.

iv. 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.

v. Application of Bituminous Primer

After preparation of the road surface, the primer shall be sprayed uniformly at the specified rate. 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 shall be permitted at site. Temperature of bitumen shall be high enough to permit the primer to be sprayed effectively though the jets of the spray and to cover the surface uniformly.

vi. 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

vii. Testing:

The minimum testing frequency for the purpose of process control shall be as given in table below

Table 8: Minimum Testing Frequencies

Type of Construction	Test	Frequency (min.)
Prime Coat/Tack Coat/Fog Spray	i) Quality of binder ii) Binder temperature for application iii) Rate of spread of Binder	Number of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable at regular close intervals

viii. Tolerances

The actual rate of application of bituminous binder across the width of each spray run shall not vary by more than $\pm 5\%$ of the rate ordered and the actual rate of application of binder for each single run of the spray shall not vary from this specified rate by more than 0.03 litre per square metre. If, after the application of the prime coat, the bituminous material fails to penetrate within the time specified or if the road must be used by traffic, blinding material shall be spread in the amount required to absorb any excess bituminous material and to protect the primed surface.

Blinding material shall be spread from trucks in such a manner that no wheel shall travel on uncovered bituminous material.

Unless the Engineer-In-Charge permits otherwise, all loose material on the sprayed surface, including any blinding material shall be removed before any further layer of the pavement is laid.

ix. Measurement:

Prime coat shall be measured in terms of surface area of application in square metres.

x. Rate:

The rate shall include the cost of materials and labour required to carry out all the operations.



E. Tack Coat

Providing and applying tack coat using bitumen emulsion conforming to IS: 8887, using asphalt/bitumen sprayer including preparing the surface and cleaning with road broom.

- On DBM/Prime coat @ 0.3 kg/m²
- On old bituminous surface (resurfacing work) @ 0.75 kg/m²
- Providing and applying tack coat using bitumen emulsion conforming to IS: 8887, including preparing the surface and cleaning with broom. On old bituminous surface (resurfacing work) @ 1.00 kg/m² (Manually)

The section shall consist of the application of a 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, when specified in the Contract or as instructed by the Engineer-In-Charge.

i. Materials

The binder used for tack coat shall be either Cationic bitumen emulsion (RS 1) complying with IS:8887 or suitable low viscosity paving bitumen of VG 10 grade conforming to IS:73. The type and grade of binder for tack coat shall be as specified in the Contract or as directed by the Engineer-In-Charge.

ii. Weather and seasonal limitations

Bituminous material shall not be applied during a dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10°C. Where the tack coat consists of emulsion, the surface shall be slightly damp, but not wet.

iii. Equipment

The tack coat shall be applied by a self-propelled or towed bitumen pressure sprayer, equipped for spraying the material uniformly at a 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.

iv. 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. The granular or stabilized surfaces shall be primed. 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.



v. Application of Tack Coat

The tack coat shall be applied uniformly. No dilution or heating at site of RS1 bitumen emulsion shall be permitted. Paving bitumen if used 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. 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.

vi. 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.

vii. Measurement:

Tack coat shall be measured in terms of surface area of application in square metres.

viii. Rate:

The rate shall include the cost of materials and labour required to carry out all the operations.

F. Dense Bituminous Macadam (DBM)

This clause specifies the construction of dense graded bituminous macadam, (DBM), for use mainly, but not exclusively, in base/binder and profile corrective courses. DBM is also intended for use as a 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 50mm to 100 mm.

i. Materials

- **Bitumen:**The bitumen shall be paving bitumen of Penetration Grade complying with IS: 73.
- **Coarse Aggregates:**The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on the 2.36 mm sieve. They shall be clean, hard, and durable, of cubicle shape, free from dust and soft or friable matter, organic or other deleterious substances.



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 sieve shall have at least two fractured faces

Table 9: Physical Requirements for Coarse Aggregate for DBM

Property	Test	Specifications
Cleanliness(dust)	Grain size analysis	Max 5% passing 0.075 mm sieve
Particle Shape	Flakiness and Elongation index (combined)	Max 30%
Strength	Los Angeles Abrasion Value	Max 35%
	Aggregate Impact Value	Max 27%
Durability(Soundness)	Sodium Sulphate	Max 12%
	Magnesium Sulphate	Max 18%
Water Absorption	Water absorption	Max 2%
Stripping	Coating and Stripping of bitumen aggregate mixtures	Minimum retained coating 95%
Water Sensitivity	Retained tensile strength	Min 80%

* The tests shall be carried out in accordance with the respective IS Specifications

- **Fine Aggregates:** Fine aggregates shall consist of crushed or naturally occurring mineral material or a combination of the two, passing the 2.36 mm sieve and retained on the 75-micron sieve. They shall be clean, hard, durable, dry and free from dust, and soft or friable matter, organic or other deleterious matter. The fine aggregate shall have a sand equivalent value of not less than 50 when tested in accordance with the requirement of IS: 2720 (part 37). The plasticity index of the fraction passing the 0.425mm sieve shall not exceed 4 when tested in accordance with IS: 2720 (part 5). The plasticity index of the fraction passing the 0.425 mm sieve shall not exceed 4 when tested in accordance with IS: 2720 (part 5).
- **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 specified below:



Table 10: Grading of Filler Material

IS Sieve (mm)	Cumulative % by weight of total aggregate
0.60	100
0.30	95 – 100
0.75	85 - 100

The filler shall be free from organic impurities and have a plasticity index not greater than 4. The plasticity requirement shall not apply if the filler is cement or lime. When the coarse aggregate is gravel, 2% by weight of the total aggregate, shall be Portland cement or hydrated lime and the % of fine aggregate reduced accordingly. Cement or hydrated lime is not required when the limestone aggregate is used. Where the aggregates fail to meet the requirements of the water sensitivity test, then 2% by total weight of aggregate, of hydrated lime shall be added without additional cost.

ii. 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 the Table below, for DBM grading 1 or 2 as specified. The type and quantity of bitumen, and appropriate thickness, are also indicated for each mixture type.

Table 11: Composition of DBM Pavement Layer

Grading		
Nominal Aggregate Size	40 mm	25 mm
Layer Thickness	80 – 100 mm	50 – 75 mm
IS Sieve (mm)	Cumulative % by weight of total aggregate	
45		-
37.5		100
26.5		90-100
19		71-95
13.2		56 – 80
9.5		-



4.75		38 – 54
2.36		28- 42
1.18		-
0.6	-	-
0.3	7 – 21	7 – 21
0.15	-	-
0.075	2- 8	2 – 8
Bitumen content % by mass of total mix ²	Min 4.0	Min 4.5
Bitumen grade	65 or 90	65 or 90

Notes:

- The combined aggregate grading shall not vary from the low limit on one sieve to the high limit on the adjacent sieve.
- Determined by the marshall method

iii. Mixture Design

Requirement for the mixture: Apart from conformity with the grading and quality requirements for individual ingredients, the mixture shall meet the requirements set out in Table below.

Table 12: Requirements for Dense Graded Bituminous Macadam

Minimum stability (KN at 60° C)	9.0
Minimum flow (mm)	2
Maximum flow (mm)	4
Compaction level (Number of blows)	75 blows on each of the two faces of the specimen
Percent air voids	3-6
Percent voids in mineral aggregate	See Table 10 above.
Percent voids filled with bitumen (VFB)	65-75

Table 13: Minimum Percent Voids in Mineral Aggregate (VMA)



Nominal Maximum Particle Size	Minimum VMA, percent related to Design Air Voids, percent		
	3.0	4.0	5.0
9.5	14.0	15.0	16.0
12.5	13.0	14.0	15.0
19.0	12.0	13.0	14.0
25.0	11.0	12.0	13.0
37.5	10.0	11.0	12.0

Notes:

- a. The nominal maximum particle size is one size larger than the first sieve to retain more than 10 percent
- b. Interpolate minimum voids in the mineral aggregate (VMA) for design air voids values between those listed.

iv. Binder Content:

The Marshall method for determining the optimum binder content shall be adopted as described in the Asphalt Institute Manual MS-2, replacing the aggregates retained on the 26.5 mm sieve by the aggregates passing the 26.5 mm sieve and retained on the 22.4 mm sieve, where approved by the Engineer-In-Charge.

Where the 40mm DBM mixture is specified, the modified Marshall method described in MS- 2 shall be used. This method requires modified equipment and procedures; particularly the minimum stability values shall be multiplied by 2.25 and the minimum flow shall be 3 mm.

v. Job mix formula:

The contractor shall inform the Engineer-In-Charge in writing, at least 20 days before the start of the work, of the job mix formula proposed for use in the works. 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 mixture and its different ingredients satisfy the physical and strength requirements of these specifications.

Approval of the job mix formula shall be based on the 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.



The approved job-mix formula shall remain effective unless and until a revised job mix formula is approved. Should a change in the source of materials be proposed, a new job mix formula shall be forwarded to the Engineer-In-Charge for approval before placing of the material.

vi. 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 the Table below. These variations are intended to apply to individual specimens taken for quality control tests.

Table14:Permissible Variations from the Job Mix Formula

Description	Permissible variation	
	Base/Binder course	Wearing course
Aggregate passing 19 mm sieve or larger	± 8%	± 7%
Aggregates 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

Once the plant trials have demonstrated the capacity of the plant, and the trials are approved, the laying operation may commence. Over the period of the first month of production for laying on the works, the Engineer-In-Charge shall require additional testing of the product to establish the reliability and consistency of the plant.

Table15: Manufacturing and Rolling Temperatures

Bitumen penetration	Bitumen mixing (°C)	Aggregate mixing (°C)	Mixed Material (°C)	Rolling (°C)	Laying (°C)
35	160 – 170	160 – 175	170 Max.	100 Min.	130 Min.
65	150 – 165	150 – 170	165 Max.	90 Min.	125 Min.
90	140 – 160	140 – 165	155 Max.	80 Min.	115 Min.



vii. 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 all. The laying trial shall be carried out on a suitable area which is not to form part of the works, unless specifically approved in writing, by the Engineer-In-Charge. The area of the laying trials shall be a minimum of 100 sq.m. of construction similar to that of the project road, and shall be in all respects, particularly compaction, the same as the project construction, on which the bituminous material is to be laid.

The contractor shall previously inform the Engineer-In-Charge of the proposed method for laying and compacting the material. The plant trials shall then establish if the proposed laying plant, compaction plant, and methodology is capable of producing satisfactory results. The density of the finished paving layer shall be determined by taking cores, no sooner than 24 hours after laying, or by other approved method.

Once the laying trials have been approved, the same plant and methodology shall be applied to the laying of the material on the project, and no variation of either shall be acceptable, unless approved in writing by the Engineer-In-Charge, who may at his discretion require further laying trials.

viii. Constructions Operations

The methodology and plant to be used for the whole project should be based arrived after plant and laying trials for the job mix ratio, which should be based on a correct and truly representative sample of the materials that will actually be used in the work, and that its different ingredients satisfy the physical and strength requirements of these specifications.

- **Weather and Seasonal Limitations:**Laying shall be suspended while free standing water is present on the surface to be covered, or during rain, fog and dust storms. After rain, the bituminous surface, prime or tack coat shall be blown off with high pressure 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 laid is below 10degC, or when the wind speed at any temperature exceeds 40 km/h at 2m height unless specifically approved by the Engineer-In-Charge.
- **Mixing and Transportation of the mixture:**The premixed bituminous material for DBM shall be prepared in a hot-mix plant of adequate capacity and capability of yielding a mix of proper and uniform quality with thoroughly coated aggregates at appropriate mixing temperatures; the difference in temperature between the binder and the aggregate at



no time should exceed 14 deg C. The hot mix plant should be calibrated from time to time in order to ensure the uniform quality of the mix and better coating of aggregates.

The bituminous material should be transported in clean insulated vehicles, and unless otherwise agreed by the Engineer-In-Charge, shall be covered while in transit or waiting tipping. Subject to the approval of the Engineer-In-Charge, a thin coating of diesel or lubricating oil may be applied to the interior of the vehicle to prevent sticking and to facilitate the discharge of the material.

- **Spreading:** Except in areas where a mechanical paver cannot access, bituminous materials shall be spread, leveled and tamped by an approved self-propelled paving machine. As soon as possible after arrival at site, the material 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 maximum thickness of material laid in each paver pass shall be 150 mm. When laying binder course or wearing course approaching an expansion joint of a structure, machine laying shall stop short 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 the joint cavity shall be kept clear of surfacing material. Bituminous material shall be kept clean and uncontaminated. The only traffic permitted to run on bituminous material to be overlaid shall be that engaged in laying and compacting the next course or, where a binder course is to be sealed or surface dressed, that engaged on such surface treatment. Should any bituminous material become contaminated the contractor shall make it good to the satisfaction of the Engineer-In-Charge. Binder course shall not remain uncovered by either the wearing course or surface treatment, whichever is specified in the contract, for more than three consecutive days after being laid. The Engineer-In-Charge may extend the period by minimum amount of time necessary, because of weather conditions or for any other reason.
- **Rolling:** Bituminous materials shall be laid and compacted in layers which enable the specified thickness, surface level, regularity requirements and compaction to be achieved. Compaction 6 to 8 tonnes smooth wheeled tandem rollers. 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. Rollers shall move at a speed of not more than 5km/h. 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 material on the pavement either when the rollers are operating or standing. The wheels of the 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 the rollers and the mixture should be used. Surplus water shall not be allowed to stand on the partially compacted pavement.

Where longitudinal joints are made, the materials shall be fully compacted and the joint made flush. All joints shall be offset by 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.

- **Opening to traffic:** The newly laid surface shall not be open to traffic for at least 24 hrs after laying and completion of compaction, without the express approval of the Engineer-In-Charge.

ix. Measurement:

The finished work shall be measured in sq.m at a specified thickness correct to two places of decimal.

x. Rate:

The rate shall include the cost of materials and labour required to carry out all the operations.

G. Asphalt/ Bituminous Concrete

This clause specifies the construction of Bituminous Concrete, for use in wearing and profile corrective courses. This work shall consist of construction in a single or multiple layers of bituminous concrete on a previously prepared bituminous bound surface. A single layer shall be 25 mm to 100 mm in thickness.

i. Materials

- **Bitumen:** The bitumen shall be paving bitumen of penetration grade complying with IS Specification for paving Bitumen, IS:730 or otherwise



as specified in item. Where modified bitumen is specified, it shall conform to the requirements of IRC: SP:53 and IS:15462.

- **Coarse aggregates:** The coarse aggregates shall be generally as specified for DBM, except that the aggregates shall satisfy the physical requirements specified in table below.

Table 16: Physical Requirements for Coarse Aggregate for Asphalt/Bituminous Concrete Pavement Layers

Property	Test	Specification
Cleanliness (dust)	Grain size analysis	Max. 5% passing 0.075 mm sieve
Particle shape	Flakiness and Elongation Index	Max. 30% (Combined)
Strength	Los Angeles Abrasion Value	Max. 30%
	Aggregate Impact Value	Max. 24%
Polishing	Polished Stone Value	Min. 55
Durability (Soundness)	Sodium Sulphate	Max. 12%
	Magnesium Sulphate	Max. 18%
Water Absorption	Water Absorption	Max. 2%
Stripping	Coating and Stripping of Bitumen Aggregate Mixtures	Minimum retained coating 95%
Water Sensitivity	Retained Tensile Strength	Min. 80%

- **Fine Aggregates:** The fine aggregates shall be as for DBM.
- **Filler:** Filler shall be generally as specified for DBM. Where the aggregates fail to meet the requirements of the water sensitivity test, then 2 percent by total weight of aggregate, of hydrated lime shall be added without additional cost.

ii. Aggregate grading and binder content:

When tested in accordance with IS:2386 Part I (wet grading method), the combined grading of the coarse and fine aggregates and added fillers shall fall within the limits shown in table: 17 below for grading 1 to 2 as specified.

Table 17: Composition of Bituminous Concrete Pavement Layers

Grading	1	2
Nominal aggregate size	19 mm	13 mm
Layer thickness	50-65 mm	19-45 mm



IS Sieve (mm)	Cumulative % by weight of total aggregate passing	
45	-	-
37.5	-	-
26.5	100	-
19	79 - 100	100
13.2	59 - 79	79 - 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	5.0-6.0	5.0-7.0
Bitumen Grade (pen)	65	65

iii. **Mixture Design:**

- **Requirements for the mixture:** Apart from the conformity with the grading and quality requirements for individual ingredients, the mixture shall meet the requirements set out in Table 18.
- **Binder Content:** The binder content shall be optimized to achieve the requirements of the mixture set out in the following table 18, and the traffic volume as specified in the contract.

Table 18: Requirements for Bituminous Pavement Layers

• Minimum stability (KN at 60°C) • Minimum flow (mm) • Maximum flow (mm) • Compaction level (Number of blows)	• 9.0 • 2 • 4 • 75 blows on each of the two faces of the specimen.
• Percent air voids • Percent air voids in mineral aggregate (VMA) • Percent air voids filled with bitumen (VFB) • Loss of stability on immersion in water at 60°C (ASTMD 1075)	• 3-6 • see table 13 • 65 - 75 • Minimum 75 percent retained strength



The Marshall method for determining the optimum binder content shall be adopted as described in the Asphalt Institute Manual MS-2, replacing the aggregates retained on the 26.5mm sieve and retained on the 22.4 mm sieve, where approved by the Engineer-In-Charge.

iv. Job mix formula:

The procedure for formulating the job mix formula shall be generally as specified in DBM and the results of tests enumerated.

v. Plant trials – permissible variations in job mix formula:

The requirements for the plant trials shall be all as specified for DBM works.

vi. Laying trials:

The requirements for laying trials shall be all as specified for DBM.

vii. Construction operations:

The methodology and plant to be used for the whole project should be based arrived after plant and laying trials for the job mix ratio, which should be based on a correct and truly representative sample of the materials that will actually be used in the work, and that its different ingredients satisfy the physical and strength requirements of these specifications.

- **Weather and seasonal limitations:** The provisions as in DBM shall apply.
- **Mixing and transportation of the mixture:** The provisions as specified in DBM shall be applied.
- **Spreading:** The general provisions as in DBM shall apply, as modified by the approved laying trials.

viii. Measurement:

The measurement shall be as specified in DBM.

ix. Rate:

The contract unit rate shall be all as specified in DBM, except that the rate shall include the provision of bitumen at 5.0 percent, by weight of total mixture. The variance in actual percentage of bitumen used will be assessed and the payment adjusted up or down, accordingly.

H. Cement Concrete Interlocking Paver Block

Interlocking paver block to be fixed on the bed 50 mm or specified otherwise thick of coarsesand 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. Factory made precast paver block should conform to IS 15658: 2006.

i. Measurement

Area provided with paver block to be measured in sq.m, correct up to two places of decimal.

ii. Rates

The rate includes the cost of the material, labour, tools etc. required in all the operations described above.



3. Scarifying

A. Preliminary Work:

All dirt, dust, cracked up mud, slush, animal droppings, vegetation and all other rubbish shall be removed from the water bound macadam surface.

B. Scarifying:

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.

C. 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 aggregate received from scarifying although this aggregate will be consolidated along with aggregate of new wearing course to be paid separately.

D. Measurement:

The measurement of the finished work shall be taken in sq.m. Length and breadth shall be measured correct to 10mm between the kerb or channel stones or brick edging etc. as the case may be.

E. 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. stone soling, aggregate, blinding materials, if specified, shall be paid for separately



4. Road Markings

This Clause covers the permanent marking of the road surface with white or yellow paint as indicated on the Drawing or instructed by the Engineer-In-Charge. The colour, width and layout of road marking shall be in accordance with the standards prescribed by the Department of Roads. This also covers the reflective glass beads installed on the pavement surface along the road centerline to identify the course of the carriageway in darkness or bad weather.

A. Materials

Paint shall comply with the requirements of BS 6044 (1987) or equivalent or as specified by the Engineer-In-Charge. If specified in the contract, the paint may also be reflectorised paint, in which case the paint shall be reflectorised by the addition of reflecting beads. The beads shall comply with BS 6088: 1981 (1993). The paint shall be delivered to the site in sealed containers bearing the name of the manufacturer and the type of paint. The viscosity of the paint shall be such that it can be applied without thinning. Under no circumstances thinning shall be allowed. The colour to be used shall be bright white or yellow as shown on the Drawing or indicated in the Pavement Markings Manual, DOR.

B. Weather Limitations

Road marking paint shall not be applied to damp surfaces or when the relative humidity exceeds 80%, or at temperatures lower than 10°C, or when, in the opinion of the Engineer-In-Charge, wind strength is such that it may adversely affect the painting operations.

C. Tools and Equipment for Painting:

The paint shall be applied by brush or machine. However, before ordering paint, the Contractor shall inform the manufacturer the proposed method of application of paint to ensure that correct type of paint is ordered.

D. Surface Preparation

Road markings shall be applied to bituminous surfacing only after sufficient time has elapsed to ensure that damage shall not be caused to the painted surface by volatile substances evaporating from the bituminous surfacing. In no case shall road markings be applied until at least 48 hours after the completion of the surfacing or any longer period required by the Engineer-In-Charge. Before the paint is applied, the surface shall be clean and dry and completely free from any soil, grease, oil, acid or any other material which shall be detrimental to the bond between the paint and the surface. The portions of the surface where the paint is to be applied shall be properly cleaned by means of watering, brooming or compressed air.



E. Setting out of Road Markings

The lines or marks shall be set out by means of paint spots of the same colour as the proposed final lines and marks. These spot marks shall be at such intervals as needed to ensure that the road markings can be accurately applied, and in no case they shall be more than 1.5 m from each other. After spotting, the positions of the proposed road markings such as dotted lines, starting and finishing points shall be indicated on the road. Pre-marking shall be approved by the Engineer-In-Charge prior to the commencement of any painting operations. The positions and outlines of special markings shall be produced on the finished road in chalk and shall be approved by the Engineer-In-Charge before they are painted. The use of approved templates shall be permitted on the condition that the positioning of the marking is approved by the Engineer-In-Charge before painting is commenced.

F. Application of Paint

Where the paint is applied by means of a machine, it shall be applied in one layer. Before the road marking machine is used on the pavement, the satisfactory working of the machine shall be demonstrated on a suitable site which is not part of the pavement. Adjustment to the machine operation shall be followed by further testing. Only when the machine has been correctly adjusted, and the use thereof is approved by the Engineer-In-Charge after testing, the machine may be used on the pavement. The operator shall be experienced in the use of the machine. After the machine itself has been satisfactorily adjusted, the rate of application shall be checked and adjusted, if necessary, before application on a large scale is commenced. Where two or three lines are required next to each other, the lines shall be applied simultaneously by the same machine. The paint shall be stirred before application in accordance with the manufacturer's instructions. Where painting is done by hand, it shall be applied in two layers, and the second layer shall not be applied before the first layer has dried out completely. As most road marking paint reacts with the bitumen surface of the road, the paint shall be applied with only one stroke of the brush or roller at any one point on the road to prevent reaction with bitumen surface. Ordinary road marking paint shall be applied at a nominal rate of 0.42 litre/sq.m. for painted old surface, and 0.75litre/sq.m. for new surface, or as specified in the contract.

G. Tolerances Requirements

Road markings shall be constructed to accuracy within the tolerances given below:

- **Width:** The width of the lines and other markings shall not deviate from the specified width by more than 5%.



- **Position:** The position of lines, letters, figures, arrows, and other markings shall not deviate from the true position specified by more than 20 mm.
- **Alignment of Markings:** The alignment of any edge or a longitudinal line shall not deviate from the true alignment by more than 10 mm in 15 m
- **Broken Lines:** The length of segments of broken longitudinal lines shall not deviate from the specified length by more than 150 mm.

H. Faulty Workmanship or Materials

If any material not complying with the requirements is delivered on the site or used in the works, or if any substandard work is carried out, such material or work shall be removed, replaced or repaired as required by the Engineer-In-Charge at the Contractor's own cost. Rejected road markings and paint which has been splashed or dripped on the surfacing, kerbs, structures or other such surfaces, shall be removed by the Contractor at his own cost, in such a way that the markings or split paint shall not show up again later.

I. Protection

After the application of paint, the road markings shall be protected against damage by traffic or other causes. The Contractor is responsible at his own cost for the erection, placing and removal of all warning boards, flags, cones, barricades and other protective measures which may be necessary.

J. Tests and Standards of Acceptance

The materials shall be tested in accordance with the relevant standards specified and shall meet the prescribed criteria. The Contractor shall furnish necessary test certificates as required by the Engineer-In-Charge. The work shall conform to these Specifications and shall be true to the lines, levels and dimensions as indicated on the Drawing or as directed by the Engineer-In-Charge, subject to the tolerances as indicated in these Specifications.

K. Application of Reflective Glass Beads

The reflective glass beads shall consist of plastic road studs 100x100x17.9 mm in dimension with 29 glass elements per side (2 rows) with two way reflective and 19 degree tilt for maximum reflection. It shall have two finger grips for easy handling on installation and flat base. The beads shall be installed on the road surface along the centerline of the carriageway.



L. Measurement

The measurement of road marking shall be in linear meter for each type of marking. The measurement of reflective glass beads shall be in number.



5. Traffic Safety Associated Works

A. Metal Crash Barriers

Providing and erecting "W" metal beam crash barrier (3mm thick w-metal beam of 4m length, width 310mm, wave height- 81-85mm, 1.8m long Channel post 150x75x5mm @ 2m c/c & 330mm long spacer 150x75x5mm) including excavation and PCC 1:1.5:3 for channel post, complete as per drawing.

i. Scope

This section covers the materials required and construction of metal crash barrier. The barriers shall be single side single W-beam metal crash barrier with related accessories like beam, spacer, channel, post, end unit (fish tail, bull dog) and fastener. The W-metal beam crash barrier shall comprise of 3mm thick corrugated sheet metal beam rail, 312 mm minimum width, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150x 75 x 5mm spaced at 2 m center to center, 1.8 meter high, 1.1 m below the ground/road level. The W-beam rails should be fixed on the vertical post with a spacer of channel section 150x75x5mm, 330mm long.

ii. Materials

Unless otherwise specified the materials for the metal crash barrier shall meet the following specifications:

W-Beam: It should be cold rolled formed section, minimum 3 mm thick, hot dip galvanized, 550g/m² and raw materials conforming to IS:5986 Gr. Fe 360(ST-37)/Fe.

Post and Spacer: It should be cold rolled formed section, minimum 5 mm thick, hot dip galvanized, 550g/m² and raw materials conforming to IS:5986 Gr. Fe 360(ST-37)/Fe.

iii. Construction

The crash barrier shall be constructed at the locations shown on the Drawings or as instructed by the Engineer. The W-Beam spacer post shall be cast in M20 concrete block (400x400 mm), 700 mm deep.

After the concrete has fully set, the crash barrier shall be erected by assembling beam, spacer channel and other accessories.

iv. Tests and Standards of Acceptance

The materials shall be tested in accordance with the relevant standards specified and shall meet the prescribed criteria. The Contractor shall furnish necessary test certificates as required by the Engineer. The work shall conform to these Specifications and shall be true to the lines, levels and dimensions as indicated on the Drawing or as directed by the Engineer, subject to the tolerances as indicated in these Specifications.



v. Measurement

The measurement of metal crash barrier shall be in linear meter.

vi. Rate

The rate shall include the cost of labour, materials, equipment hired/owned, tools and plant, and incidentals necessary to complete the work specified above.



6. Concrete Works

A. General

Water, Cement, fine aggregate and coarse aggregate shall conform to material specifications. Concrete can be specified by proportions or by nominating the required strength.

Concrete shall be prepared by mixing graded stone aggregate or gravel of normal size as specified with fine aggregate and cement in specified proportions with required quantity of water.

Proportioning: It shall be done by volume. Boxes of suitable size shall be used for measuring sand and aggregate. The internal dimensions of the boxes shall be generally 35 x 25 x 40 cm deep or as otherwise approved by the Engineer. The unit of measurement for cement shall be a bag of 50 kg and this shall be taken as 0.035 cum. While measuring the aggregate, shaking, ramming or heaping shall not be done. The proportioning of sand shall be on the basis of its dry volume and in case of damp sand allowance for bulking shall be made by adopting the method prescribed under IS 2386 (part III).

Mixing: It shall be done in mechanical mixer. Mixing by hand shall be employed only in special cases with the specific prior permission of the Engineer-in-Charge. Stone aggregate shall be washed with water to remove dirt, dust or any other foreign materials, where necessary.

Machine Mixing: The mixer drum shall be flushed clean with water. Measured quantity of dry coarse aggregate shall be followed with measured quantity of fine aggregate and then cement. In case damp sand is used, add half of the quantity of coarse aggregate followed by cement and sand. Finally add balance quantity of the coarse aggregate. The skip shall be raised and dry materials slipped into the drum. The dry materials shall be mixed for at least four turns of the drum, after which the correct quantity of water shall be added gradually while the drum is in motion, to ensure even distribution with the dry material. The total quantity of water for mixing shall be introduced before 25% of mixing time has elapsed and shall be regulated to achieve the specified water cement ratio. The complete contents of the mixed concrete shall be emptied before recharging. When the mixer is closed down for the day or at any time exceeding 20 minutes, the drum shall be flushed clean.

Mixing time: The materials shall be mixed for a period of not less than 2 minutes and until a uniform colour and consistency is obtained. The time shall be counted from the moment all the materials have been put into the drum.

Hand Mixing: Hand mixing shall be done on a smooth, clean and water-tight platform of suitable size in the following manner.

- Measured quantity of sand shall be spread evenly
- The cement shall be dumped on the sand and distributed evenly



- The sand and cement shall be mixed intimately with spade, turning the mixture over and over again, until it is of even colour throughout and free from streaks
- The sand cement mixture shall be spread out and measured quantity of coarse aggregate shall be spread on its top. Alternatively, the measured quantity of coarse aggregate shall be spread out and the sand cement mixture shall be spread on its top.
- The above materials shall be mixed at least three times by shovelling and turning over by twist from centre to side, then back to the centre and again to the sides.
- A hollow shall be made in the middle of the mixed pile
- Three quarters of the total quantity of water required shall be added while the material is turned in towards the centre with spades. The remaining water shall be added by a water-can fitted with rose head, slowly turning the whole mixture over and over again until a uniform colour and consistency is obtained throughout the pile.
- The mixing platform shall be washed at the end of the day.

Consistency: The quantity of water to be used for each mix of 50kg cement, to give the required consistency shall not be more than 34 litres for 1:3:6 mix, 30 litres for 1:2:4 mix, 27 litres for 1:1 1/2:3 mix and 25 litres for 1:1:2 mix. In the case of vibrated concrete, the limits specified may be suitably reduced to avoid segregation. The quantity of water shall be regulated by carrying out regular slump tests.

Slumps for different kinds of work

Work	Slump in mm	
	Vibrator Used	Vibrator not used
Mass concrete in foundation footings, retaining walls and pavement	10-25	50-75
Thin sections of flooring less than 75 mm thickness	25-40	75-100

The entire concrete used in the work shall be laid gently (not thrown) in layers not exceeding 150mm and shall be thoroughly vibrated by means of mechanical vibrators till a dense concrete is obtained. The Engineer may however relax the condition specifying use of mechanical vibrators at his discretion for certain items depending upon the thickness of the members and feasibility of vibrating the same and permit hand compaction. Hand compaction shall be done with the help of tamping rods so that concrete is thoroughly compacted and completely worked into the corners of the formwork. The layers of concrete shall be so placed that the bottom layer does not finally set before the top layer is placed.



Compaction shall be completed before the initial setting starts i.e. within 30 minutes of addition of water to the dry mixture. For items where the vibrators are not to be used, it shall be the duty of the contractor to take the permission of the Engineer before the start of work.

During cold weather, concreting shall not be done when the temperature falls below 4.5°C. The concrete placed shall be protected against frost by suitable covering. Concrete damaged by frost shall be removed and work redone. Please see specifications relating to cold weather concreting Reinforced Cement Concrete. During hot weather, precautions shall be taken to see that the temperature of wet concrete does not exceed 38°C.

When the placing of concrete is suspended, necessary removal of laitance and roughening the surface for jointing future work shall be done before the concrete sets. When the work is resumed the previous work must be thoroughly cleaned, roughened, watered and a grout of neat cement slurry of the proportion, 1 Kg of cement per 2 litres of water applied uniformly.

Curing: Green work shall be protected from rain by suitable covering. The work should also be protected from damage and rain during construction. After the concrete has begun to harden i.e. about 1 to 2 hours after its laying, it shall be protected with moist gunny bags, sand or any other material approved by the Engineer against quick drying. After 24 hours of laying of concrete, the surface shall be cured by flooding with water of minimum 25mm depth, or by covering with wet absorbent materials. The curing shall be done for a minimum period of 14 days. In special cases, curing may have to be done for more number of days as required by the Engineer.

Over the foundation concrete, the masonry work may be started after 48 hours of its laying, but the curing of cement concrete shall be continued along with the masonry work for minimum period of 14 days.

Where cement concrete is used as sub-grade for flooring, the flooring may be commenced before the curing period of sub-grade is over but the curing of sub-grade shall be continued along with the top layer of flooring for a minimum period of 14 days.

The water used for curing shall not produce any objectionable stains or unsightly deposit on concrete surface. In special circumstances and locations curing by other means such as sealing material insulating blankets etc. may be adopted with the specific prior approval of the Engineer.

The minimum compressive strength of mix 1:1.5:3 and 1:2:4 shall be as follows:

Mix	Compressive strength in kg/sq.cm at 28 days	
	At 7 days	At 28 days
1:1.5:3	175	265
1:2:4	140	210



B. Plain Concrete

Providing and laying in position plain cement concrete in 1:3:6 (1 cement : 3 sand : 6 graded crushed rock 40 mm nominal size) excluding the cost of centering and shuttering - All work upto plinth level.

Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level: 1:2:4 (1 cement : 2 sand : 4 graded crushed rock 20 mm nominal size)

Measurement

It shall be measured in cubic meter.

Rate

As per awarded rate and tender conditions.



7. Masonry Works

The Scope of Works covered under this section shall comprise of stone masonry works including supply of all construction materials, equipment, tools and plants, labour (skilled or un-skilled), etc. as would be required for construction of all types of masonry as shown in the Drawings and as specified herein and / or as directed by the Engineer-in-Charge.

The Scope of Works shall also include to provide all structural parts, scaffolding, transportation, loading, unloading, inspection, test and quality control, preparation of foundation surfaces, adjustment of surfaces adjacent to the walls, linings, pavements, including curing and protection, etc. and all other incidentals and operations required to complete the masonry works in all respects.

A. General Requirements

All materials and structural parts incorporated in the permanent work shall be new and unused. Quality and dimensions of materials as well as works shall comply with these Specifications and approved Standards.

All masonry work shall be carried out in a workman like manner at the highest standards and all works shall be coordinated with the other works carried out at the site to allow the performance of all works simultaneously without causing any hindrance to other works.

i. Classification of Masonry

The masonry works shall be classified as mentioned in Table-14.1. The required works shall be executed as per drawing, specifications and / or as directed by the Engineer-in-Charge

Table-14.1 Classification of Masonry

Type of masonry	Classification	Cement-mortar Mix
Random Rubble Masonry	RRM	1 (Cement) :6 (Sand)
Coursed Rubble masonry	CRM	1 (Cement) : 4 (Sand)

ii. 2.3 Materials

Stones for masonry shall be hard, sound, durable and free from weathering decay and defects like cavities, cracks, flaws, sand holes, injurious veins, patches of loose or soft materials and other similar defects that may adversely affect its strength and appearance. As far as possible, stones shall be of uniform color, quality and texture. Generally, stones shall not contain crystalline silica or chart, mica and other deleterious materials like iron-oxide organic



etc. Stones with round face shall not be used. The stones shall be obtained from quarries, approved by the Engineer-in-Charge.

The percentage of water absorption, according to tests conforming to IS-1124 shall not exceed 1% to 2% of its own dry weight, after 24 hours submersion in water. The crushing strength in unconfined compression test shall not be less than 150 kg/cm³ when tested on any plane. Samples of stone from quarries shall be tested for compressive strength in accordance with IS: 1121. The compressive strength testing shall be conducted with the load parallel to the bedding plane and also perpendicular to the bedding plane. The stone samples shall also be tested for water absorption and also for soundness to ensure suitability of stones for use.

iii. Stones for RR Masonry

Normally, stones for RR masonry shall be so sized to be lifted and placed by hand. Unless otherwise indicated, length of the stones shall not exceed three times the height and the breadth or base shall be greater than three-fourth the thickness of wall, but not less than 15cm. The height of the stones may be upto 30cm. Each stone shall be hammer dressed on the face, the sides and the bed conforming to IS: 11129. The bushing on the face shall not be more than 3cm on an exposed face, and 1cm on a face to be plastered.

B. Execution

i. Preparation of Cement Mortar

The mortar for all masonry works shall consist of cement, sand and water with or without admixtures as approved by the Engineer-in-Charge, each complying with its specifications. The quantity of water shall be as necessary to obtain a satisfactory workability regarding the use of the mortar. Quality of mortar shall in general, meet the requirements specified in IS: 2250 (Code of Practice and Use of Masonry mortar).

ii. Mixing, Transporting and Placing

The unit of measurement for cement shall be a bag of cement weighing 50kg and this shall be taken as 0.035 cubic metre. Sand in specified proportion shall be measured in boxes of size: 35 x 25 x 40 cm. It shall be measured on the basis of its dry volume. In case of damp sand, its quantity shall be increased suitably to allow for bulking.

Mortar for masonry shall invariably be produced in a mechanical mixture by volume batching. The mortar shall be mixed in small batches such that the quantity of mortar so prepared at a time could be completely used up in masonry within 30 minutes of mixing. Mortar that has remained longer than this period or that has become stiff or set on account of delay in consumption or otherwise shall be rejected at the Contractor's cost.



Cement and sand in the specified proportions shall be mixed dry thoroughly in a mixer. Water shall then be added gradually and wet mixing continued for at least two minutes. Care shall be taken not to add more water than that which shall bring the mortar to the consistency of a stiff paste. Only the quantity of mortar, which can be used within 30 minutes of its mixing shall be prepared at a time. The drum shall be totally emptied before a new batching cycle is started. The drum shall be kept free from hardened mortar and shall be thoroughly cleaned prior to change of mix or on cessation of mixing.

Hand-mixing for small batches may be approved by the Engineer-in-Charge. However, the mortar shall be mixed up to the degree obtained with a mechanically operated mixer. Prior to adding water to the mix, sand, cement and admixture (if required) shall be mixed dry thoroughly in a leveled platform until the mixture has a uniform colour. The quantity of dry mix, which can be used within 30 minutes, shall then be mixed in masonry trough with just sufficient quantity of water to bring the mortar to the consistency of a stiff paste.

The equipment and tools used for transporting and for placing of mortar shall ensure that contamination or loss of ingredients do not take place. Mortar shall be stirred or worked at frequent intervals to prevent separation. In case, the mortar has stiffened because of evaporation of water from the mortar, it may be re-tampered by adding water frequently as needed to restore the requirements of consistency but this re-tampering shall be permitted only upto 2 hours from the time of original addition of water. Mortar unused for more than two hours shall be rejected and removed from the site of work.

C. Random Rubble Masonry

All stones shall be wetted before use. The wall construction shall be carried up truly plumb or to the specified batter. Every stone shall be carefully fitted to the adjacent stones, so as to form neat and close joints. The bond shall be obtained by fitting in closely, the adjacent stones and by using bond stones. Face stones shall extend and bond well into the backing. These shall be arranged to break joints as much as possible, and to avoid long vertical lines of joints.

The hearting or interior filling of the wall shall consist of rubble stones which may be of any shape but shall not pass through a circular ring of 16 cm inner diameter. Thickness of these stones in any direction shall not be less than 10 cm. These shall be carefully laid, hammered down with a wooden mallet into the position and solidly bedded in mortar.

Chips and spells of stone shall be used where necessary to avoid thick mortar beds or joints and at the same time ensuring that no bellow spaces are left any where in the masonry. The hearting shall be laid nearly level with facing and backing except that at about one metre intervals, vertical 'plumb' projecting about 16 cm to 6cm shall be firmly embedded to form a bond between successive courses. The chips shall not be used below the hearting stone.



these upto the level of face stones. The use of chips shall be restricted to the fillings of interstices between the adjacent stones in hearting, and these shall not exceed 6% of the quantity of stone masonry.

The masonry in a structure shall be carried regularly. Where the masonry of one part has to be delayed, the work shall be raked back at an angle not steeper than 46 deg. Toothing in masonry shall not be permitted.

Bond or through stones running right through the thickness of walls shall be provided in walls upto 60 cm thick and in case of walls above 60 cm thickness, a set of two or more bond stones over tapping each other by at least 15 cm shall be provided in a line from face to back. In case of highly absorbent type of stones (porous lime stone and sand stone etc.) the bond stone shall extend about two-third into the wall. Through stone in such cases may give rise to damp penetration and therefore, for all thickness of such walls, a set of two or more bond stones overlapping each other by at least 15 cm shall be provided. Where bond stones of suitable length are not available, cement concrete block of mix. 1:3:6 (with 6mm nominal size graded stone aggregate) shall be used. At least one bond stone or a set of bond stones shall be provided for every 0.5 sqm of the wall surface. All bond stones in stone masonry shall be marked suitably as directed by the Engineer-in-Charge.

The quoins shall be selected stones, neatly dressed with the hammer or chisel to form the required angle, and laid header and stretcher in the alternate layers volume of these stones shall not be less than 0.03 cum. Stones shall be so laid that all joints are fully packed with mortar and chips Face joint shall not be more than 6mm thick. When plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying. Otherwise the joints shall be raked to a minimum depth of 5 mm by raking and during the progress of work when the mortar is still green.

i. Weep Holes

Weep holes shall be provided with 75 mm dia PVC pipe. Weep holes shall extend through the full width of concrete/masonry with slope of about 1 vertical: 20 horizontal towards the draining face. The spacing of weep holes shall generally be 1m in either direction or as shown in the drawing with the lowest at about 150mm above the low water level or ground level whichever is higher or as directed by the Engineer-in-Charge.

ii. Curing and Protection

All types of masonry shall be protected from rain by suitable covering when the mortar is green and shall be kept continuously moist on all faces for a minimum period seven days. New built work shall be covered with gunny bags or tarpaulin so as to prevent the mortar from being



washed away. Damage, any, shall be made good to the satisfaction of the Engineer-in-Charge. The work shall also be protected from damage, mortar droppings. Masonry carried out during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period.

iii. Scaffolding

Single scaffolding having one set of vertical supports shall be allowed. The supports shall be sound and strong, tied together by horizontal pieces, over which the scaffolding planks shall be fixed. The inner end of horizontal scaffolding members may rest in a hole provided only in the header course. The holes left in masonry work for supporting the scaffolding shall be filled and made good with cement plaster 1:3:6.

D. Sampling, Testing and Quality Control

The Contractor shall carry out all sampling and testing in accordance with the Specifications for Building and Road Works, 2025: Royal Govt. of Bhutan and / or the relevant Indian Standards and shall conduct such tests as are called for by the Engineer-in-Charge. Where no specific testing procedure is mentioned, the tests shall be carried out as per the relevant accepted practice or as directed by the Engineer-in-Charge. Tests shall be done in the field and at the laboratory approved by the Engineer-in-Charge. The Contractor shall submit to the Engineer-in-Charge, the test results in triplicate within three days after completion of tests. The Engineer-in-Charge may, at his discretion, wave off some of the stipulations for small and unimportant operations.

Material / work found unsuitable for acceptance shall be removed and replaced by the Contractor. The works shall be redone as per specification requirements and to the satisfaction of the Engineer-in-Charge without any additional cost to PHPA.

E. Measurements and Payments

Measurement and Payment for Stone Masonry

i. Measurement for Stone Masonry

- a. Unless otherwise specified, all stone masonry works shall be measured net as fixed in its proper position. Any extra work done by the Contractor over the specified dimensions shall not be measured. Thickness of wall shall be measured at the joints, excluding the bushings. Only specified dimensions shall be measured correct to 10mm and cubic contents shall be worked out in cubic meter correct to two places of decimal.
- b. No deduction made nor any extra payment shall be made for the following:



Opening each upto to 0.1 sq.m in area. In calculating the area of the opening, any separate lintels or sills shall be included along with the size of the openings but the end portions of the lintels shall be excluded and the extra width of the rebated levels, if any, shall also be excluded.

- c. Wall plates and bed plates, bearing of slabs, chajjas and the like, where the thickness does not exceed 10 cm and the bearing does not extend over the full thickness of the walls. (The bearing of floor and roof slabs shall be deducted from wall masonry).
- d. Drain holes and recesses for cement concrete blocks to embed holdfasts for doors windows etc.
- e. Tapered Walls shall be measured net as per actual dimensions. The width as well length and height shall be measured correct to 10 mm.

ii. Payment for Stone Masonry

Payment for Stone masonry will be made as per Unit rate in the Schedule of Quantities. The Unit rate shall include the cost of materials and labour required for all the operations to complete the stone masonry. The Unit rate shall include the following:

- a. Raking out joints for plastering or pointing done as a separate item or finishing flush as the work proceeds,
- b. Preparing tops and sides of existing walls , for raising and extending
- c. Rough cutting and waste for forming gables, cores, skewbacks, and spandrels of arches, splays and eaves and all rough cutting unless or otherwise specified
- d. Bond stones or cement bond blocks
- e. Providing weep holes for drainage.
- f. Bedding and pointing wall plates, lintels, etc, in or on walls, bedding roof tiles and corrugated sheets in or on walls.



8. Gabion Walls

A. Double Twisted Woven Gabion

Construction of gabion wall as per drawings with dry stone masonry (hammer dressed facing) including excavation of foundation in all types of soils, sides and backfilling, delivery of machine woven gabion mesh (Hexagonal mesh of size 100mm x 120mm with a minimum of doubly twisted) with GI wire 2.70 mm dia including diaphragm, fixing of selvedge wire 3.4 mm dia, binding/lacing wire 2.40 mm dia complete.

Height up to 1.0m
Height up to 2.0m
Height up to 3.0m
Height up to 4.0m
Height up to 5.0m

Height up to 6.0m
Height up to 7.0m
Height up to 8.0m
Height up to 9.0m

Construction of gabion wall as per drawings with dry stone masonry (hammer dressed facing) including excavation of foundation in all types of soils, sides and backfilling, delivery of machine woven gabion mesh (Hexagonal mesh of size 100mm x 120mm with a minimum of doubly twisted) with GI wire 3mm dia including diaphragm, fixing of selvedge wire 4.06mm (8 swg) dia, binding/lacing wire 2.64mm (12 swg) dia complete.

Height up to 1.0m
Height up to 2.0m
Height up to 3.0m
Height up to 4.0m
Height up to 5.0m

Height up to 6.0m
Height up to 7.0m
Height up to 8.0m
Height up to 9.0m

The space (excavated for construction purposes) between the side of the finished walls and the road embankment needs to be filled with dry masonry in order to create a smooth finishing from the wall to the road embankment/slope as per site condition and the site engineer's instruction.

i. Materials

Stone

Stones used for filling for gabion boxes shall be clean, hard, sound, unweathered and angular rock fragments or boulders. The smallest dimension of any stone shall be at least twice that of the longer dimension of the mesh of the crate.

Before filling any gabion boxes, the Contractor shall submit representative samples of the rock he proposes to use in the gabions for approval by the Engineer. Further representative samples shall be submitted for approval each time whenever there is a change in the type or strength of the rock that the Contractor proposes to use in gabion work.



Gabion Crates (woven wire mesh)

Gabions shall consist of steel wire mesh crates. The steel wire shall be mild steel wire complying with IS 280. All wire used in the manufacture of the crates and for use as diaphragms, binding and connecting wire shall be galvanised with an extra heavy coating of zinc by an electrolytic galvanising process. The weight of deposition of zinc shall be in accordance with IS 4826. Zinc coating shall be uniform and shall be able to withstand a minimum number of dips and adhesion test specified as per IS 4826. Tolerance on diameter of wire shall be 2.5 percent. The tensile strength shall be between 300 to 550 N/mm².

The wire shall be mechanical woven into a hexagonal mesh of standard size with tolerance of +16 and -4. The tightness of the twisted joints shall be such that a force of 7 KN is required to pull on one wire to separate it from the other wire provided that each wire is prevented from turning and the whole process is done in one plane. All edges of the crates shall be finished with a selvedge wire. Gabions shall be manufactured in the standard sizes shown in the following table.

Standard sizes of Gabions

Dimensions (m)	Diaphragms (No.)	Dimensions of Diaphragms (m)	Volume of Crate (m ³)
1x1x1	1	1x1	1
1.5x1x1	1	1x1	1.5
2x1x1	1	1x1	2
3x1x1	2	1x1	3
2x1x0.5	1	1x0.5	1

Diaphragms shall be manufactured of the same materials as the parent gabion and shall have selvedge wire throughout their perimeter. The number and size of diaphragms to be provided with each crate shall be as in the table 5.21.2. All crates shall be supplied with binding and connecting wire.

ii. Installation Methodology of Gabions

General Requirements

Before filling any gabion boxes, the Contractor shall also submit samples of gabion boxes assembled for approval and shall be retained for reference and comparison with the gabions built. The size, type and location of the samples shall be as directed by the Engineer.



Gabion boxes shall be assembled and erected including filling in the dry on prepared surfaces except as may be otherwise approved. Approval for assembling and erecting gabions in water will be given only if in the Engineer's opinion such a method will produce work, which is otherwise in accordance with the Specification.

Preparation of Foundation and Surface for Bedding

1. Excavate the foundation to the required level as shown in the drawings. If good bearing stratum is not observed after the excavation up to mentioned levels, then, the same should be brought to the notice of Engineer-in-charge for further advice. The surface of foundation should be free from any deleterious material and unwanted foreign objects. Loose pockets if any, should be excavated and filled with suitable granular or backfill material.
2. If there is standing water, the place should be cleared of to ensure proper placement of gabions. In case, dewatering is not possible then gabions shall be installed underwater. The installation of the gabion underwater is not covered by this specification. The method of installation shall be referred IRC: SP 116.
3. Compact the foundation. Density of compacted foundation should be greater than or equal to 95% of the modified Proctor value.

Assembly

Gabions are delivered at the work site in bundles along with the lacing wire. Bundles must be unloaded using any available machine and stored close to the site where they are to be installed. While unloading, care shall be taken that Gabion bundles are not damaged. Maximum 4 bundles shall be stacked over each other. Gabion bundles shall be stacked on a levelled ground with wooden rafters/sleepers in between them for easy in handling and preventing any damage to the mesh and other components like the selvedge wire. Storage can be outdoors as long as the bundles are not laid over abrasive or chemically aggressive surfaces (corrugated asphalt, oils, grease, chemicals, etc.).

The following are the steps in the basic procedure for erection and installation of structures. At the work site bundles should be opened and gabions assembled according to the following instructions:

1. The outer alignment of the gabion facia should be marked as per the requirements in the drawings.
2. The gabions are unfolded and laid over an even, level and hard surface (compact ground). One or two persons may be deployed for the straightening of mesh panel activity depending on the size of gabions. The gabions should be properly assembled and wired



together, so that all four corners match and form an exact rectangular shape and size as designed.

3. The side panels are opened up to form a box by tying the upper corner of each pair of side panels using the thick selvedge wires.
4. The edges are laced together, starting from top corner, in a continuous operation using alternate single and double loop at the spacing of one mesh length i.e., 100 mm to 125 mm. The ends of the lacing wire are secured at each corner and turned into the gabions. Alternatively, steel rings mentioned IS16014 can be used which are attached using mechanical tool.
5. Similarly, all the other sides are tied up and the box structure made, with the top end open to fill the boxes.

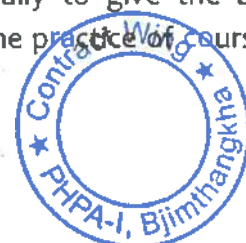
Filling

1. The crates shall be placed in their final position before filling commences. The selvages of the crate will be bound to the selvages of adjacent crates with lacing wire. They shall be stretched to their full dimension and securely pegged to the ground or wired to adjacent gabions and stretched from the opposite end or side by inserting temporary bars and levering them forward before filling. The top and bottom shall be kept stretched by tensioning with tie wires attached to an anchorage or equivalent approved method until the gabion has been filled. The gabions shall be inspected at this stage but before filling with stone to ensure that the tie wiring has been properly carried out and the gabion boxes are not pulling apart. Gabion boxes may be tensioned either singly or in the case of a long straight structure by straining a number of units together using an approved tensioning system.

The vertical corners shall be kept square and to full dimension by inserting a steel bar of at least 20 mm diameter at each vertical corner maintaining it in the correct final position throughout the filling process. The steel bars will have to be removed when the crate is full.

2. Mild Steel pipe/frame formwork shall be provided at the gabion facia for achieving a good aesthetic appearance and keeping the bulges within the specified tolerances. The formwork enables to achieve uniformity in the gabion box dimensions during the filling and placement of stones.

The filling will be carried out by placing individual stones into the gabion by hand in courses in such a manner that the stones are bedded on each other and bonded as in dry stone masonry to achieve proper bonding and minimize void. For better finish, the stone fill to the external faces is hammer dressed and placed carefully to give the best appearance. No loose stones shall be tipped into the crate. And the practice of coursing



and bonding the outer layer and filling the interior with un-laid stones will not be permitted. As far as possible a fair face of large flat stone should be placed at the exposed faces. The Gabion is over-filled by approximately 25 mm to 50 mm, to allow for settlement of the infill (due to self-weight).

All 1 m deep gabions shall be filled in three equal layers and 0.5 m depth gabions in two equal layers. Horizontal bracing wires made with the same lacing wires as used for lacing shall be fixed directly above each layer of the stone in the compartments. The bracing wires are looped round two adjoining meshes in each side of the compartment and joined together to form a double tie which shall be tensioned by winding the bracing wires together with a flat stone in order to keep the face of the gabions even and free from bulges. Bracing wires shall be spaced horizontally along and across the gabions at distances not greater than 0.33 m.

3. The filled layer of gabion box should never be more than 300 mm higher than any adjoining cell.
4. The gabion box compartments shall be filled slightly over-full to allow for subsequent settlement. The lids shall then be laced down with binding wire to the tops of all partition panels. The lids shall be stretched to fit the sides exactly by means of a suitable tool but due care shall be taken to ensure that the gabions are not so full that the lids are over stretched. The corners shall be laid so that the hinge of the lid is on the lower side on slopes and on the outer side in walls. Where laid horizontally, hinges for retaining walls shall be placed on the valley side and for breast walls on the mountain side. On completion the crates shall be completely and tightly filled, square, true to dimensions and the line and level shown on the Drawings.
5. The Gabions should be covered on the inner face with a non-woven geotextile before placing and compacting the backfill.
6. The backfill shall be placed and compacted to 95% of modified Proctor density in the area behind the gabion units.
7. In walls, gabion boxes shall be placed such that vertical joints are not continuous but staggered. Aprons shall be formed of headers. If more than one unit is required to obtain the necessary width, units of unequal length shall be used and the joints between them should be staggered. The adjoining boxes shall be joined together with the selvedge wire.

iii. Testing

Testing of the shall be done in accordance with IS 16014.



iv. Measurement

In case of gabion retaining and breast walls, the length of the wall shall be measured in running metre correct to 10 mm and the quantity shall be calculated nearest to two places of decimal.

v. Rates

In case of gabion retaining walls and breast walls, the rate shall include the cost of excavation to foundation level, back and side filling and providing and delivering stones from quarry and their preparation to use for gabion walls, as well as the providing, delivery and filling and closing of the gabion boxes, materials, including all testing, labour, equipment, tools, and incidentals necessary to complete the works as specified.

B. Welded Wire Gabion

Construction of gabion wall, as per drawing with dry stone masonry (hammer dressed facing) including excavation of foundation in all types of soils, sides and backfilling, delivery of welded wire gabion mesh conforming IS 16013 (50mm x 100 mm) with GI wire 4 mm dia including diaphragm, fixing of Spiral binder 3 mm (minimum) dia, stiffener wire 4 mm (minimum) dia, lacing wire 3 mm (minimum) dia complete

Height up to 1.0m
Height up to 2.0m
Height up to 3.0m
Height up to 4.0m
Height up to 5.0m

Height up to 6.0m
Height up to 7.0m
Height up to 8.0m
Height up to 9.0m

Welded gabions are mostly used in architectural applications, free standing retaining walls, cladding or low height structures. It should not be used where there is risk of differential settlement.

i. Materials

Stone

Stones used for filling for gabion boxes shall be clean, hard, sound, unweathered and angular rock fragments or boulders. The smallest dimension of any stone shall be at least twice that of the longer dimension of the mesh of the crate.

Before filling any gabion boxes, the Contractor shall submit representative samples of the rock he proposes to use in the gabions for approval by the Engineer. Further representative samples



shall be submitted for approval each time whenever there is a change in the type or strength of the rock that the Contractor proposes to use in gabion work.

Welded Gabion Crates

The wire used in the manufacture of welded wire fabric shall be manufactured from zinc-coated steel wire conforming to IS 4826 (heavy coated) or IS 12753 (heavy coated). Gabions and gabion mattresses shall be manufactured with all components mechanically connected at the production facility with the exception of the mattress lid which may be supplied separately. Specification of welded gabions such as classifications, manufacture and materials, mechanical properties, physical properties and dimensions should be as per IS 16013.

Standard Sizes of Gabions_Typical Gabion Size

S. No.	Length (m)	Height (m)	Width (m)	Number of Cells	Capacity (m ³)
I)	1.8	0.9	0.9	2	1.46
II)	2.7	0.9	0.9	3	2.19
III)	3.6	0.9	0.9	4	2.92
IV)	1.2	1.2	1.2	1	1.73
V)	2.7	0.9	0.3	3	0.73
VI)	2.7	0.9	0.45	3	1.09

Wire Diameters

S. No.	Mesh Opening (mm)	Minimum Nominal Diameter metallic coated wire (mm)	Minimum Diameter, PVC coated (Including Coating) Wire (mm)
I)	5 x 75 / 38 x 75	3.0	3.80
II)	100 x 100 / 50 x 100	4.0	4.80
III)	150 x 150 / 75 x 150	4.0	4.80
IV)	Lacing Wire	3.0	3.80



V)	Preformed wire spiral binders	3.0	3.80
VI)	Stiffeners	4.0	4.80

The metallic-coated wire shall have the size tolerances in accordance with IS 4826 (heavy coated) or IS 12753 (heavy coated) or IS 432 (part 2) for class B.

The minimum thickness of the PVC overcoats which covers the wire shall be 0.40 mm measured radially at any cross-section transverse to the wire length

Tensile Strength

The tensile strength of the welded fabric, spiral binders, lacing wire, and stiffeners shall be in accordance with the requirements of IS 4826 (heavy coated) or IS 12753 (heavy coated).

Welded Shear Strength

The minimum shear value, in Newton, shall be 70 percent of the tensile strength of the wire or as indicated in Table below, whichever is greater:

S. No.	Minimum Wire Diameter (mm)	Minimum Strength (N)	Breaking Shear Strength (N)
I)	3.0	2520	1760
II)	4.0	4480	3140
III)	5.0	7000	4900

The material shall be deemed to conform with the requirements for weld shear strength, if the average of the test results of the first four specimens tested complies with the value above or if the average of the test results for all welds tested complies with the value.

Panel to Panel Joint Strength

The minimum strength of the joined panels, when tested shall be as specified in the Table below:

S. No.	Mesh Size (mm)	Exterior Panels (kN/m)	Diaphragm Panels (kN/m)
I)	75x75 Mesh/ 38 x75 Mesh	20.4	8.7
II)	100 x 100 Mesh/ 50 x 100 Mesh	27.2	11.6



III)	150 x 150 Mesh/ 75 x 150Mesh	18.1	7.7
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ii. Installation Methodology of Welded Wire Gabions

General Requirements

Before filling any gabion boxes, the Contractor shall also submit samples of gabion boxes assembled for approval and shall be retained for reference and comparison with the gabions built. The size, type and location of the samples shall be as directed by the Engineer.

Gabion boxes shall be assembled and erected including filling in the dry on prepared surfaces except as may be otherwise approved. Approval for assembling and erecting gabions in water will be given only if in the Engineer's opinion such a method will produce work, which is otherwise in accordance with the Specification.

Preparation of Foundation and Surface for Bedding

The foundation on which the gabions are to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. Surface irregularities, loose material, vegetation, and all foreign matter shall be removed from foundation surface area. The foundation should then be compacted to prevent settlement. When fill is required, it shall consist of materials conforming to the specified requirements. Gabions and bedding or specified geotextiles shall not be placed until the foundation preparation is completed, and subgrade surfaces have been inspected and approved by the site engineer. The surface of the finished material shall be to grade and free of mounds, dips or windrows. Extra care should be taken with foundation preparations in order to ensure a level and smooth surface. Geotextile shall be installed in accordance with the requirements of the plans and specifications.

Assembly and Placement

The assembly and placement of gabions shall be in accordance with the following procedures:

1. The outer alignment of the gabion facia should be marked as per the requirements in the drawings.
2. Rotate the gabion panels into position and join the vertical edges with fasteners for gabion assembly. Lacing wire, spiral binder or ring type fasteners are used for gabion assembly. Where lacing wire is used, first double loop and/or twist the lacing wire to the wire mesh. Then wrap the wire with alternating single and double loops at intervals between 100 to 130 mm similar to double twisted woven gabion. Pull each loop tightly and finally secure the end of lacing wire to the wire mesh with double loop and twist. Where spiral fasteners are used, crimp the ends to secure the spirals in place. Where contract type



- alternate fasteners are used for basket assembly, install the fasteners at a maximum spacing of 150 mm.
3. Use the same fastening procedures to install interior diaphragms where they are required. Interior diaphragms will be required where any inside dimension exceeds 91 cm for gabion baskets thicker than 300 mm. Diaphragms will be installed to assure that no open intervals are present that exceed 91 cm. For baskets 300 mm or less, rectangular cells are allowed with dimensions 91 cm in one direction and not to exceed 183 cm in the perpendicular direction.
 4. Place the empty gabions on the foundation. To interconnect the adjacent gabions boxes along the top, bottom, and vertical edges, use spiral binder if the joints of the individual boxes are connected with either lacing wire or ring type fasteners. And use lacing wires when individual gabion box joints are connected using spiral binders. The process of joining shall be same as described in step 2 above.
 5. To lay the subsequent layers, interconnect each layer of gabions to the underlying layer of gabions along the front, back, and sides using lacing wire. Stagger the vertical joints between the gabions of adjacent rows and layers by at least one half of a cell length.

Filling

The filling of the gabion units shall be done described in 1.1.2 (IV) under Double Twisted Woven Gabion with the following additions:

1. Internal connecting cross-tie wires shall be placed in cell greater than 500 mm in height. Two internal connecting wires shall be placed concurrently with rock placement, at each 330 mm interval of depth for 1 meter height as shown for welded wire gabions. In addition to these crossties or stiffeners, in welded mesh gabions, corner stiffeners will be placed across all the corners of exterior sides of the structure of the gabions providing diagonal bracing as shown in. Alternatively, lacing wire or preformed wire stiffeners may be used.
2. The last layer of rock shall be uniformly levelled to the top edges of the gabions. Lids shall be placed over the rock filling using only approved lid closing tools as necessary. The use of crowbars or other single point leverage bars for lid closing is prohibited due to the potential for damage to the baskets.
3. The gabion lid shall then be secured to the sides, ends, and diaphragms with spiral binders, approved alternate fasteners, or lacing wire wrapped with alternating single and double loop in the mesh openings. Lacing may be used as needed to supplement the interconnection of welded mesh gabions, and the closing of lids.
4. Place the next course of empty gabions on top of the filled ones. Interconnect each layer of gabions to the underlying layer of gabions along the front, back, and sides using lacing



wire. Courses are staggered along the vertical and horizontal joints. The stone filling is done as in the previous layers.

5. Any damage to the wire or coatings during assembly, placement and filling shall be repaired promptly in accordance with the manufacturer's recommendations or replaced with undamaged gabion baskets.

iii. Testing

The testing of the welded wire gabions shall be done in accordance with IS 16013.

iv. Measurement

As described under Double Twisted Woven Gabions.

v. Rates

As described under Double Twisted Woven Gabions.

C. Precautions

1. Welded gabions are mostly used in architectural applications, free standing retaining walls, cladding or low height structures. It should not be used where there is risk of differential settlement.
2. Improper foundation and placing of gabion layers without the required preparation can lead to excessive settlements and thereby deformation of the structure.
3. Use of improper graded aggregate or rock and improper filling may lead to post construction deformations of the boxes and settlements.
4. While these structures can be constructed with local labours including skilled and unskilled labour, minimum machinery and equipment, construction of Gabion wall is highly quality conscious. It needs to be constructed as monolithic structure with simultaneous backfilling and compaction which is often not followed at site due to poor workmanship.
5. Improper galvanisation of the wires (mesh, fastening, lacing, stiffening etc.). Improper galvanising leads to the premature degradation of wires/gabions, causing the failure of the structure.



9. Construction of Pipe Culverts

The Scope of Works covered under this section shall comprise of Providing and laying NP2 class RC pipes, including Collars, jointing in cement mortar 1:2 including visual inspection of joints etc. including excavation, supply and placing of gravel bedding and suitable trench backfill as per shown in the Drawings and as specified herein and / or as directed by the Engineer-in-Charge.

A. Excavation

The ground shall be excavated to the lines and depths shown on the Drawings or to such other lines and depths as the Engineer may direct. Trenches shall be of sufficient width to enable the pipes to be properly laid, jointed and hunched. Should the Contractor desire to use mechanical plant for excavating trenches or for laying pipes he shall submit his proposals for approval by the Engineer, but such approval will not relieve the Contractor from responsibility for damage to pipes.

i. Water in Pipe Excavations

Trenches shall be kept free from water, until, in the opinion of the Engineer, the works will not suffer any deleterious effect from water. The Contractor shall, at his own expense, construct any sumps or temporary drains that the Engineer may consider necessary. The Contractor shall make good at his own expense, any damage caused by prolonged and excessive pumping, and shall take all precautions necessary for the safety of adjoining structures and buildings by shoring or otherwise, during the time the trenches are open.

Laying of Concrete Pipes

Concrete pipes shall comply with the requirements of I.S. 458-1971. The pipes shall be laid true to line and level, commencing at the outfall, each pipe being separately boned between sight rails. Laying of pipes shall proceed upgrade of a slope. Before placing the pipe culverts, the bottom width of the excavation shall be covered with a drainage layer of stones of specification and depth as noted on the contract drawings.

Where the required pipe length (as determined by the carriageway width, shoulder width etc.) is not a multiple of the standard pipe size, then the contractor shall not be paid for any additional length of pipe that he installs.

In the event that the pipe is installed over the design length which results in the need for scour or other water protection measures deemed necessary by the Engineer, then these shall be provided at the contractor's own cost.



Loading, transporting and unloading of concrete pipes shall be done with care. Handling shall be such as to avoid impact. Gradual unloading by inclined plane or by chain block is recommended. All pipe sections and connections shall be inspected carefully before being laid. Broken or defective pipes or connections shall not be used. Pipes shall be lowered into the trenches carefully. Mechanical appliances may be used.

In case where the foundation conditions are unusual such as in the proximity of trees or holes, under existing or proposed tracks, manholes etc. the pipe shall be encased all round in compacted sand or gravel for its full length.

In case where the natural foundation is inadequate the pipes shall be laid either in concrete cradle supported on proper foundations or on any other suitable designed structure. If concrete cradle bedding is used, the depth of concrete below the bottom of the pipe shall be at least $\frac{1}{4}$ th of the internal diameter of pipe subject to the minimum of 10 cm and a maximum 30 cm. The concrete shall extend up the side of the pipe at least to a distance of $\frac{1}{4}$ th of the outside diameter of the pipe. The pipe shall be laid in this concrete bedding before the concrete has set. Pipes laid in trenches in earth shall be bedded evenly and firmly in compacted sand or gravel at least to a distance of $\frac{1}{3}$ rd of the outside diameter of the pipe.

Necessary provision shall be made for joints wherever required.

When the pipe is laid in a trench in rock hard clay, shale or other hard materials the space below the pipe shall be excavated and replaced with an equalising bed of concrete, sand, gravel or compacted earth. In no place shall pipe be laid directly on such hard materials.

When the pipes are laid completely above the ground, the foundations shall be made even and sufficiently compacted to support the pipeline without any materials settlement.

Alternatively the pipe line shall be supported on rigid foundations at intervals. Suitable arrangements shall be made to retain the pipe line in the proper alignment, such as by shaping the top of the supports to fit the lower part of the pipe. The distance between the supports shall be a max of 2.5m centres, and not more than 300mm either side of any joints. In no case shall the joint come in the centre of the span. Care shall be taken to see that superimposed loads greater than the total load equivalent to the weight of the pipe when running full shall not be permitted.

Where joints are to be made with loose collars, the collars shall be slipped on before the next pipe is laid. Adequate and proper expansion joints shall be provided where directed.

Special care shall be taken to see that any excess of cement mortar is neatly cleaned off while each joint is being made and any earth, cement or other material thoroughly cleansed out of the pipes. A properly fitted plug shall be well secured at the ends of each pipe already laid and shall



be removed only when the next pipe is being laid or on completion of the culvert or pipe line. The excavations shall be kept free from water until the joints are thoroughly set.

B. Jointing of Concrete Pipes

Joints are generally of rigid type. Where specified flexible type joints may also be provided. Cement mortar for jointing pipes shall consist of 1 (cement):2 (sand) by volume. The materials shall be accurately gauged and mixed in an approved manner. Cement mortar shall be made in suitable small quantities only as and when required, and any mortar, which has begun to set, or which has been mixed for a period of more than one hour shall be rejected.

i. Pipe to be Left Clean on Completion

On completion, all pipe lines shall be flushed from end to end with water and left clean and free from obstructions.

ii. Pipes Bedded and Haunched With Concrete

Where shown on the Drawings or directed by the Engineer, pipes shall be bedded, surrounded and/or haunched with PCC M5:40. In carrying out this work the Contractor shall take care to pack the concrete under the around the pipes to ensure even bedding and solidity in the concrete in no instance shall the concrete be thrown directly on the pipes. The upper surface of the concrete shall be struck off with a wooden screed and neatly finished off

C. Refilling Trenches

Backfill to depth of $D/3$ mm of the pipe from its base shall be with filter material as Section G14 of SBRW 2025. All remaining backfill shall comply with Section D9 of SBRW 2025 to at least 600mm or $D/2$ above the pipe. (where D is the nominal internal diameter of the pipe). Backfill for concrete pipes and minor drainage structures shall be obtained from the material excavated in forming the

excavation and in the event of there being insufficient excavated material or the culvert is laid close to or above existing ground level then selected backfill shall be obtained from borrow pits. The remainder of the trench shall then be backfilled with best selected material available, placed in layers not exceeding 150 mm loose thickness, mixed, watered or dried as necessary and compacted.

All backfilling material shall be compacted to a minimum dry density of 95% of MDD (Heavy Compaction).

For pipe culverts which have been constructed close to, above or where the culverts protrudes above the existing ground the backfilling under the flanks and alongside and over the culverts



shall be placed and compacted in layers not exceeding 150 mm after compaction to 95% MDD. The width of backfilling along the flanks of the Culvert shall be at least $(2 + 1.5h)$ metres from each side of the culvert (Where 'h' is the height from the underside of the layer being compacted to the crown of the pipe in metres). All existing ground under this backfill shall be compacted to 95% MDD (Heavy Compaction) to a depth of 150 mm.

The material used for filling alongside the culvert above existing ground shall be the same material as will be used for the adjacent fill and no additional payment will be made than that provided for the fill in Section D10 of this Specification.

Backfilling shall be carried out simultaneously and equally on both sides of the culvert to avoid unequal lateral forces.

In all cases there shall be cover of at least 600mm or $D/2$ mm over the crown of the culvert before construction equipment is driven over it unless other protective measures approved by the Project Manager have been provided.

D. Measurement

All measurement will be done in accordance with the specific item coverage for the works as noted elsewhere.

E. Rate

The rate shall include the cost of all the materials and labour involved in the complete completion of pipe culvert including delivery of materials, laying of RC pipes & other incidentals involved in the above operation to complete the work



10. Drainage Work

A. Construction of V-shaped drain:

Trenches shall be made along the edge of the road where the drain is to be constructed. The excavation shall be done exactly to the required profile giving specified slope. The surface shall be levelled to uniform grade/level and rammed. The drain shall be maintained through out the construction and defect liability period therefore the contractor shall keep provision in his rates for such maintenance and nothing extra shall be paid. For the lined drain the relevant specification for concreting, soling and plastering shall be followed. The surface of the concrete shall be finished smooth. Any rough surface shall be made smooth by adding dry mix of cement and sand 1:3 (1 cement: 3 sand) on the surface immediately after concreting when the concrete is still green. No extra shall be paid for such finishes. All work shall be carried out as per the drawing and specification or as directed by the Engineer.

B. QA/QC

- a. Check the slope of the drain; it should be uniform to avoid ponding.
- b. The size of the drain shall not be more than the specified size.
- c. In case of earth drain, it shall be made by excavation and compaction of sides and bottoms, neatly finished. If the drain is made by filling, the filled earth shall be compacted as per the specification for embankment and filling.
- d. In case of lined drain sufficient time should be given to set and hardened the concrete before allowing the water to flow.
- e. All concrete and masonry work shall be thoroughly cured not less than 28 days.

C. Measurement:

The length shall be measured in running meter correct to 10mm.

D. Rates:

The rates shall include the cost of all material and labour involved in the above operation.



11. Causeways

A. Vented Causeways

i. Excavation

The ground shall be excavated to the lines and depths shown on the Drawings with a gradient of 5% in the flow direction or to such other lines and depths as the Engineer may direct. Trenches shall be kept free from water, until, in the opinion of the Engineer, the works will not suffer any deleterious effect from water. The Contractor shall, at his own expense, construct any sumps or temporary drains that the Engineer may consider necessary.

ii. Laying & Jointing of Concrete Pipes

As described in section 8

iii. Refilling of Trenches

As described in section 8

iv. Preparation of Surface for Bedding

The bed on which the stone pitching are to be laid as a basis for the concrete causeway slab shall be with an even surface. If necessary cavities between rock protrusions shall be filled with material similar to that specified for gabion filling.

v. Temperature Reinforcement

The temperature reinforcement shall conform to Indian Standards IS: 1786 – 1985. The reinforcement shall be laid on top allowing a minimum cover of 40 mm.

vi. QA/QC

- The slope of the causeway shall be not more than 1 in 20 (5% in flow direction) and cross slope of 10:1 (Span: Depth).
- The causeway shall not contract the stream and shall be built at right angles to prevent scouring.
- Protection work shall be done in the upstream and the down stream as per the specification.
- The temperature reinforcement of specified diameter shall be laid at spacing mentioned in the drawing.

vii. Measurement

The length and breadth of completed causeway shall be measured correct to 10 mm and the area calculated nearest to two places decimal.

viii. Rates:

The rate shall include the cost of all the materials and labour involved in the complete completion of causeway including delivery of materials, laying of RC pipes & other incidentals



involved in the above operation to complete the work.

B. Submersible Causeway

i. Excavation

The slope of the causeway shall be not more than 7% in flow direction and cross slope of 10:1. The actual length of the causeway will be determined by the natural FRL-IL depth. The ground shall be excavated to the lines and depths shown on the Drawings with a gradient of 7% in the flow direction or to such other lines and depths as the Project Manager may direct. Trenches shall be kept free from water, until, in the opinion of the Project Manager, the works will not suffer any deleterious effect from water. The Contractor shall, at his own expense, construct any sumps or temporary drains that the Project Manager may consider necessary.

The approach to the causeway shall be at 5% for not less than 10m.

ii. Preparation of Surface for Bedding

The bed on which the stone pitching are to be laid as a basis for the concrete causeway slab shall be with an even surface. If necessary cavities between rock protrusions shall be filled with material similar to that specified for gabion filling.

iii. Reinforcement

The reinforcement shall conform to Indian Standards IS :1786 – 1985. The reinforcement shall be laid allowing a minimum cover of 40 mm, 10mm dia at 200mm spacing top and bottom.

iv. Measurement:

All measurement will be done in accordance with the specific item coverage for the works as noted elsewhere.



12. Occupational Health and Safety

Occupational Health and Safety (OHS) shall be followed as per requirements stipulated in clause 5.22, Chapter 22 of SPECIFICATIONS FOR BUILDING AND ROAD WORKS 2025.

Incorporation of Occupational Health and Safety measures at construction sites, including Insurance, Personal Protective Equipment (PPE), First Aid kits, Boundary Fencing, Scaffolding, Safety nets, Traffic management, signage, etc, as listed in the specifications. The standards and specifications for the Insurance, OHS materials and (or) equipment shall comply with the Labour and Employment Act - 2007, Regulation on Occupational Health, Safety and Welfare - 2012, and other relevant national documents. All OHS items will remain the property of the bidder upon completion of the project.



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SECTION VII

FORMS

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CONTENT OF FORMS

Form 1: Proforma for Agreement	1
Form 2: Proforma for Bank Guarantee for Bid Security	3
Form 3: Proforma for Bank Guarantee for Performance Security	5
Form 4: Proforma for Bank Guarantee for Mobilization Advance.....	7
Form 5: Proforma for Bank Guarantee for Retention Money.....	9
Form 6: Pre-Contract Integrity Pact.....	11
Form 7: Bidder's Information Form	14
Form 8: Past Performance Data.....	15
Form 9: Present Order Book Position.....	16
Form 10: Data regarding Key Construction Personnel	17
Form 11: Data regarding available Equipment/ Machinery	18
Form 12: Performa for hindrance register	19



Form 1: Proforma for Agreement

[Note; This Proforma is included in the Bidding Documents only for the information of Bidders. Only the successful Bidder shall, in due course, be required to fill this Proforma].

THIS AGREEMENT MADE the _____ day of _____ BETWEEN Punatsangchhu-I Hydroelectric Project Authority (PHPA-I) _____ of (Mailing address of PHPA-I) _____ (hereinafter called "the PHPA-I") of the one part and (Name of Contractor) _____ of (Mailing address of Contractor) _____ (hereinafter called "the Contractor") of the other part.

WHEREAS the PHPA-I is desirous that " _____ " (herein after referred to as "the Work") should be executed by the Contractor AND WHEREAS by a Letter of Award No. _____ dated _____ the PHPA-I has accepted a Bid by the Contractor for the execution and completion of such Works AND WHEREAS the Contractor has agreed to undertake such work and furnish a performance security/bond.

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the conditions of Contract hereinafter referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz;
 - 2.1 The Agreement
 - 2.2 The Letter of Award
 - 2.3 Corrigendum/Amendments if any
 - 2.4 Documents furnished by bidder
 - 2.5 General Conditions of the Contract
 - 2.6 General Technical Specifications
 - 2.7 Special Conditions to Contract
 - 2.8 Appendix
 - 2.9 Bill of Quantities
 - 2.10 Drawings
 - 2.11 Any other documents as forming part of the Contract
3. The aforesaid documents shall be taken as complementary and mutually explanatory of one another, but in case of ambiguities or discrepancies, shall take precedence in the order set out under para 2 above.



4. In consideration of the payment to be made by the PHPA-I to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the PHPA-I to execute and complete the Works in conformity, in all respects, with the provisions of the Contract.
5. The PHPA-I hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein the Contract Price or such other sum as may become payable under the provisions of the Contract at the time and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused their respective common Seals to be hereunto affixed (or have hereunto set their respective hands and Seals) the day and year first above written.

SIGNED, SEALED AND DELIVERED

NAME _____
on behalf of the Contractor

NAME _____
on behalf of the PHPA-I

in the presence of:

in the presence of;

NAME _____
Address _____

NAME _____
Address _____



Form 2: Proforma for Bank Guarantee for Bid Security

To

The Punatsangchhu-I Hydroelectric Project Authority (PHPA-I)

(Address of PHPA-I)

WHEREAS, (Name of Bidder) _____ (hereinafter called "the BIDDER") has submitted his bid dated (_____ for the construction of (Name of Contract) _____ (hereinafter called "the Bid").

KNOW ALL MEN by these presents that we (Name of Bank) _____ of (Name of Country) _____ having our registered office at _____ (hereinafter called "the Bank") are bound unto the Punatsangchhu-I Hydroelectric Project Authority (PHPA-I) in the sum of _____ for which payment well and truly to be made to the PHPA-I the Bank binds himself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this _____ day of _____.

THE CONDITIONS of this obligation are;

1. If the Bidder withdraws his Bid during the period of bid validity specified in the Proforma of Bid; or
2. If the Bidder having been notified of the acceptance of his Bid by the PHPA-I during the period of bid validity;
 - 2.1 fails or refuses to execute the Proforma of Agreement in accordance with the Instructions to Bidders, if required; or
 - 2.2 fails or refuses to furnish the Performance Security, in accordance with the Instructions to Bidders,

We undertake to pay to the PHPA-I up to the above amount upon receipt of its first written demand, provided that in its demand the PHPA-I will note that amount claimed by it is due to it owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date **120 days** after the closing date for submission of bids as stated in the Invitation to Bid or as extended by you at any



time prior to this date, notice of which extension to the Bank being hereby waived, and any demand in respect thereof should reach the Bank not later than the above date.

DATE

SIGNATURE OF THE BANK

WITNESS

SEAL

(Signature, Name and Address)



Form 3: Proforma for Bank Guarantee for Performance Security

To

The Punatsangchhu-I Hydroelectric Project Authority,

(Address of PHPA-I)

WHEREAS (Name and Address of Contractor) _____ (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute (Name of Contract and Brief Description of Works) _____ (hereinafter called "the Contract").

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Nu. _____ (Amount of Guarantee in words to be inserted by the Guarantor), representing the percentage of the Contract Price, specified in the Contract, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of Nu. _____ (Amount of Guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.



This guarantee is valid until the date of **30 days** after issuing of the Completion Certificate.

SIGNATURE AND SEAL OF THE GUARANTOR

Name of Bank

Address

Date

Note: The Bidders are not required to fill this Proforma.



Form 4: Proforma for Bank Guarantee for Mobilization Advance

In consideration of the Punatsangchhu-I Hydroelectric Project Authority (PHPA-I) (which expression shall unless repugnant to the subject or context include its administrators, successors and assigns), (hereinafter called the "Principal") having agreed to make advance payment to (Name and full address of the Contractor) _____ (hereinafter called "the Contractor(s)", (which expression shall unless repugnant to the subject or context or meaning thereof include its successors, administrator, executors and permitted assigns), whose bid for (Name of the Contract) _____ has been accepted and to whom the acceptance of the bid has been communicated by a Letter of Award and who is required to execute a formal agreement on conditions of production of a Bank Guarantee for Rs..... (Both in figures and words) _____ we, the _____ Bank (any financial institutions in Bhutan) hereinafter referred to as "the Bank") do hereby undertake promise and guarantee payment to the Principal on demand all the amounts advanced by the Principal to the said Contractor.

1. The Bank further agrees that;
 - 1.1. The Principal shall have the fullest liberty without affecting in any way the liability of the Bank under the Guarantee or Indemnity, from time to time, to vary any of the terms and conditions of the said Contract or to extend time for performance by the said Contractor or to postpone for any time and from time to time any of the powers exercisable by it against the said Contractor and either to enforce or forbear from enforcing any of the terms and conditions governing the said Contract or the securities available to the Principal and the Bank shall not be released from its liability under these presents by any exercise by the Principal of the Liberty with reference to the matters aforesaid or by reason of time being given to the said Contractor or any other forbearance, act or omission on the part of the Principal or any indulgence by the Principal to the said Contractor or of any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect of a releasing the Bank from its such liability.
 - 1.2. These presents shall be governed by and constructed in accordance with Bhutanese laws.
 - 1.3. The Bank hereby declares that it has the power to issue this Guarantee and the undersigned has full power to do so.
 - 1.4. It shall not be necessary for the Principal to proceed against the Contractor before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank, notwithstanding any other security which



the Principal may have obtained or obtain from the Contractor, shall at the time when proceedings are taken against the Bank hereunder, be outstanding or unrealized.

- 1.5. The Guarantee herein contained shall remain in full force and effect, during the period that would be taken for the performance of the terms and conditions of the said Contract, Letter of Award and the Agreement which is to be executed as aforesaid and that it shall continue to be enforceable until all the dues of the Principal have been duly paid and its claims satisfied and discharged and till the Principal discharges the Guarantee in writing or until _____ whichever is earlier.
2. The Bank lastly undertakes not to revoke this Guarantee until all the dues of the Principal have been duly paid except with the previous consent of the Principal in writing.

Dated the _____ Day of _____ 2021

Here affix the Common Seal of the

Bank for _____ Bank Ltd.

Note: The Bidders are not required to fill this Proforma.



Form 5: Proforma for Bank Guarantee for Retention Money.

To

The Punatsangchhu-I Hydroelectric Project Authority,

(Address of PHPA-I)

WHEREAS (Name and Address of Contractor) _____ (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute (Name of Contract and Brief Description of Works) _____ (hereinafter called "the Contract").

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Nu. _____ (Amount of Guarantee in words to be inserted by the Guarantor), representing the amount of retention money, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of Nu. _____ (Amount of Guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.



This guarantee is valid until the date of **30 days** after completion of Defects Liability Period.

SIGNATURE AND SEAL OF THE GUARANTOR

Name of Bank

Address

Date

Note: The Bidders are not required to fill this Proforma.



Form 6: Pre-Contract Integrity Pact.

Note: This Proforma is included in the Bidding Documents for information of Bidders and shall be signed by successful Bidder when the work(s) is awarded. Signing authorities will be the head of the client (agency) or the authorized representative of the bidder.

1. General:

Whereas the Punatsangchhu-I Hydroelectric Project Authority (PHPA-I) hereinafter referred to as the "Employer" on one part, and(Name of bidder or his/her authorized representative, with power of attorney) representing M/s., (Name of firm), hereinafter referred to as the "Bidder" on the other part hereby execute this agreement as follows:

This agreement shall be a part of the standard bidding document, which shall be signed by both the parties at the time of purchase of bidding documents and submitted along with the tender document. This IP is applicable only to "large" scale works, goods and services, the threshold of which will be announced by the government from time to time. The signing of the IP shall not apply to framework Contracting such as annual office supplies etc.

2. Objectives:

Whereas, the Employer and the Bidder agree to enter into this agreement, hereinafter referred to as IP, to avoid all forms of corruption or deceptive practice by following a system that is fair, transparent and free from any influence/unprejudiced dealings in the Bidding process and Contract Administration, with a view to:

- 2.1 Enabling the Employer to obtain the desired Contract at a reasonable and competitive price in conformity to the defined specifications of the works or goods or services; and
- 2.2 Enabling bidders to abstain from bribing or any corrupt practice in order to secure the Contract by providing assurance to them that their competitors will also refrain from bribing and other corrupt practices.

3. Scope:

The validity of this IP shall cover the bidding process and Contract Administration period.

4. Commitments of the Employer:



The Employer Commits itself to the following: -

- 4.1 The Employer hereby undertakes that no officials of the Employer, connected directly or indirectly with the Contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favor or any material or immaterial benefit or any other advantage from the Bidder, either for themselves or for any person, organization or third party related to the Contract in exchange for an advantage in the bidding process and Contract Administration.
- 4.2 The Employer further confirms that its officials shall not favor any prospective bidder in any form that could afford an undue advantage to that particular bidder in the bidding process and Contract Administration and will treat all Bidders alike.
- 4.3 Officials of the Employer, who may have observed or noticed or have reasonable suspicion shall report to the head of the employing agency or an appropriate government office any violation or attempted violation of clauses 4.1 and 4.2.
- 4.4 Following report on violation of clauses 4.1 and 4.2 by official(s), through any source, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings shall be initiated by the Employer and such a person shall be debarred from further dealings related to the bidding process and Contract Administration.

5. Commitments of Bidders

The Bidder commits himself/herself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of the bidding process and Contract administration in order to secure the Contract or in furtherance to secure it and in particular commits himself/herself to the followings:-

- 5.1 The Bidder shall not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favor, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the Employer, connected directly or indirectly with the bidding process and Contract Administration, or to any person, organization or third party related to the Contract in exchange for any advantage in the bidding process and Contract Administration.
- 5.2 The Bidder shall not collude with other parties interested in the Contract to manipulate in whatsoever form or manner, the bidding process and Contract Administration.
- 5.3 If the bidder(s) have observed or noticed or have reasonable suspicion that the provisions of the IP have been violated by the procuring agency or other



bidders, the bidder shall report such violations to the head of the procuring agency.

6. Sanctions for Violation:

The breach of any of the aforesaid provisions shall result in administrative charges or penal actions as per the relevant rules and laws.

6.1 The breach of the IP or commission of any offence (forgery, providing false information, mis-representation, providing false/fake documents, bid rigging, bid steering or coercion) by the Bidder, or any one employed by him, or acting on his/her behalf (whether with or without the knowledge of the Bidder), shall be dealt with as per the terms and conditions of the Contract and other provisions of the relevant laws, including De-barment Rules.

6.2 The breach of the IP or commission of any offence by the officials of the procuring agency shall be dealt with as per the rules and laws of the land in vogue.

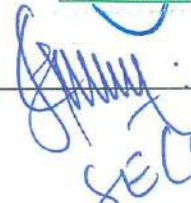
7. Monitoring and Administration:

7.1 The respective procuring agency shall be responsible for administration and monitoring of the IP as per the relevant laws.

7.2 The bidder shall have the right to appeal as per the arbitration mechanism contained in the relevant rules.

We, hereby declare that we have read and understood the clauses of this agreement and shall abide by it.

The parties hereby sign this Integrity Pact at (place) _____ on (date) _____

EMPLOYER		BIDDER
Witness:		Witness.
 _____		_____



Form 7: Bidder's Information Form

[The Bidder shall fill in this Form in accordance with the instructions indicated below. No alterations to its format shall be permitted and no substitutions shall be accepted.]

Date:[insert date of Bid submission]

NIT No.:

1.	Bidder's Legal Name:
2.	Bidder's or each member of JV's Country of Registration:
3.	Bidder's Year of Registration:
4.	Bidder's Legal Address in Country of Registration:
5.	Bidder's Local Address in Bhutan (if any):
6.	Bidder's Website Address:
7.	Bidder's Business Activities:
8.	Bidder's Authorized Representative 1. Name: 2. Designation: 3. Address: 4. Telephone/Fax numbers: 5. E-mail Address:
9.	Attached are copies of the following original documents: [check the box(es) of the attached original documents] Tax Clearance Certificate of Bidder named in 1 or 2 above Trade License of Bidder named in 1 or 2 above

Signature.....

Date :

Place :

Name.....

Designation.....



Form 8: Past Performance Data

Bidder's Name & Address: NIT No:

To

[PHPA-I's Name & Address]

Details of similar Works in last five (5) years

Sl. No.	Owner/ Client	Scope of Work	Order Value	Date of Order	Schedule Completion Date	Actual/ Completion Date	Reason for Delay (if any)

Date :

Signature.....

Place :

Name.....

Designation.....

Seal.....

Note:

1. Continuation sheets of like size and format may be used and annexed to this Form if required.
2. Relevant documents/LOA/Orders to be furnished to justify the data above.



Form 9: Present Order Book Position.

Bidder's Name & Address: NIT No:

To

[PHPA-I's Name & Address]

List of works under execution and their present status

S. No.	Owner/ Client	Scope of Work	Order Value	Date of Order	Schedule Time of Completion	Value of Outstanding Work	Actual/ Expected Time of Completion	Reason for Delay (if any)

Date :

Signature.....

Place :

Name.....

Designation.....

Seal.....

Note:

1. Continuation sheets of like size and format may be used and annexed to this Form if required.
2. Relevant documents/LOA/Orders to be furnished to justify the data above.



Form 10: Data regarding Key Construction Personnel

Bidder's Name & Address: NIT No:

To

[PHPA-I's Name & Address]

The qualification and experience of key construction personnel proposed for administration and execution of the Contract at the Site are as follows:

Position	Quantity	Name	Qualification	Years of experience

Date :

Signature.....

Place :

Name.....

Designation.....

Seal.....

Note:

1. Please furnish the complete Site organization chart proposed to be set up for execution of the Contract.
2. Continuation sheets of like size and format, may be used and annexed to this Form if required.



Form 11: Data regarding available Equipment/ Machinery

Bidder's Name & Address: NIT No:

To

[PHPA-I's Name & Address]

Items of equipment	Quantity	Description, make, Capacity and age (years)	Condition (new, good, poor) and number available	Owned, leased (from whome?), or to be purchased (from Whom?)

Date :

Signature.....

Place :

Name.....

Designation.....

Seal.....

Note: The above list of Equipment & Machineries indicates minimum requirements. However, we shall deploy any additional Equipment and Machineries, which may be required as per the directive of the Engineer-in-Charge to execute the work satisfactorily and as per the time schedule stipulated.



Form 12: Performa for hindrance register

Sl.no	Nature of hindrance	Items of works which could not be executed on account of this hindrance	Date of start of hindrance	Date of removal of hindrance	Overlapping period if any	Net hindrance in days	Weightage of this hindrance	Net effective days of hindrance	Signature of PHPA-I' s representatives	Signature of Contractor



SECTION VIII
BILL OF QUANTITIES



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BILL OF QUANTITIES (BoQ)

Name of work : Temporary Re-alignment of Wangdue-Tsirang National Highway from Gaselo junction to Bjimthangkha BHU - Package IV (RD 5.43 - 7.125 km)

Item No.	Item	Qty.	Unit	Unit Rate (Nu./Rs.)		Amount (Nu./Rs.)
				In Figure	In Words	
1	Dismantling and Demolition work					
1.1	Demolishing stone rubble masonry including stacking useful materials & disposal of rubbish within 50m lead- In Cement mortar	75.00	cum			
2	Site Preparation					
2.1	Clearing jungle including uprooting of vegetation & trees of girth <300mm, disposal with all leads and lifts	10,170.00	Sq. m			
2.2	Felling trees including cutting of trunks and branches, removal of roots, stacking of serviceable material and disposal of rubbish within all leads and lifts, all complete.					
2.2.1	Girth 300 to 600mm	45.00	each			
2.2.2	Girth 600 to 1200 mm	20.00	each			
2.2.3	Girth 1200 to 2400 mm	2.00	each			
3	Excavation/Filling					



3.1	Earthwork in excavation over areas, exceeding 300mm in depth, 1.5 m in width as well as 10 sq.m on plan including disposal of excavated earth (disposed earth to be levelled and neatly dressed)		cum			
3.1.1	All types of Soil	1,955.92	cum			
3.1.2	All types of rock (without blasting)	838.25	cum			
3.2	Earthwork in Excavation in foundation trenches or drains including dressing of sides and ramming of bottom, disposal of surplus excavated soil within 50m lead					
3.2.1	All types of soil	558.84	cum			
3.2.1	All types of rock (without blasting)	372.56	cum			
3.3	Excavation of road formation/trace/box cutting, with excavator including separate deposition of soil, rocks and stones with all lead and lift					
3.3.1	All types of soil	6,085.10	cum			
3.3.2	All types of rock (Without blasting)	2,607.90	cum			
3.4	Providing and laying filter material (600mm wide) in trenches, sides of foundations, walls etc. with 100 to 200 mm stones wherever applicable.	750.38	cum			



3.5	Construction of embankment by laying dry earth in horizontal layers not exceeding 200mm in depth(compact), including watering, power rolling, dressing and preparation of site with selected excavated earth within 50mm lead	1,125.50	cum			
3.6	Extra for compaction of earth in embankments under suitable moisture conditions to give at least 95% of the proctor density	1,125.50	cum			
4	Pavement works					
4.1	Subgrade Preparation					
4.1.1	Preparation of sub grade with proper camber by excavating earth to depth equal to pavement thickness, consolidation with roller, disposal of surplus earth up to 50m	5,127.38	cum			
4.1.2	Preparation of sub grade with proper camber by excavating earth to depth equal to pavement thickness, consolidation with roller, disposal of surplus earth including all leads and lifts- Consolidation of subgrade with roller and making good the undulation with earth and re rolling the sub grade	9,322.50	sqm			



4.2	Granular Sub-base					
4.2.1	Providing and laying Granular sub-base course (GSB) to required degree of compaction with proper formation of cross fall using motor grader for laying and compacted to required density as per material gradation and aggregate quality specified	1,864.50	cum			
4.3	Wet Mix Macadam					
4.3.1	Providing and laying wet mix macadam graded aggregate base course to required degree of compaction with proper formation of cross fall by using well graded crushed aggregates premixed with OMC using suitable mixer, motor grader as per material gradation and a aggregates quality specified	2,330.63	cum			
4.4	Dense Bituminous Macadam (DBM)					
4.4.1	Providing and Laying Dense Bituminous Macadam (DBM) to required degree of compaction based on mixture design (job mix formula) approved by the supervising engineer by mechanized method using asphalt plant, paver, steel roller, tyre roller etc. complete	9,322.50	Sqm			
4.5	Asphalt/Bituminous Concrete					
4.5.1	Providing and Laying Asphalt/Bituminous Concrete to required degree of compaction based on the job mixture design approved by the supervising engineer using asphalt plant, paver, steel roller, tyre roller etc. as per material gradation and aggregate quality specified	9,322.50	Sqm			



4.6	Prime coat						
4.6.1	Providing and applying prime coat using bitumen emulsion conforming to IS: 8887, using asphalt/bitumen sprayer including repairing the surface and cleaning with road broom. On W.M.M @ 0.75kg/sqm	9,322.50	Sqm				
4.7	Tack coat						
4.7.1	Providing and applying tack coat using bitumen emulsion conforming to IS: 8887, using asphalt/bitumen sprayer including preparing the surface and cleaning with road broom. On DBM/Prime coat @0.3 kg/sq.m	9,322.50	Sqm				
4.8	Road marking						
4.8.1	Providing and apply Road marking with hot applied thermoplastic compound with reflectorising glass beads on Bituminous surface as per IRC:35 and technical specifications. The finished surface to be level and free from streaks and holes	508.50	Sqm				
4.9	Scarifying						
4.9.1	Scarifying metalled (water bound) road surface disposal of rubbish with all leads and lifts and consolidation of the aggregate received from scarifying	9,322.50	Sqm				



5	Crash Barrier					
5.1	Providing and erecting "W" metal beam crash barrier (3mm thick w metal beam of 4m length, width 310mm, wave height- 81-85mm, 1.8m long Channel post 150x75x5mm @ 2m c/c & 330mm long spacer 150x75x5mm) including excavation and PCC 1:1.5:3 for channel post, complete as per drawing.	180.00	m			
6	Stone Soling					
6.1	Providing and laying Hand packed stone filling or soling with stones	390.38	cum			
7	Form Work					
7.1	Providing and fixing centering and shuttering (form work) including strutting and propping etc. and removal of form work etc. complete	712.17	sqm			
8	Plain Cement Concrete					
8.1	Providing and laying in position plain cement concrete in 1:3:6 (1 cement : 3 sand : 6 graded crushed rock 40 mm nominal size) excluding the cost of centering and shuttering - All work upto plinth level	124.05	cum			
8.2	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level. 1:2:4 (1 cement : 2 sand : 4 graded crushed rock 20 mm nominal size)	152.53	cum			



8.3	Providing & laying in position reinforced cement concrete excluding the cost of centering, shuttering and reinforcement - all work upto plinth level-1:1.5:3 (1 cement : 1.5 sand : 3 graded crushed rock 20 mm nominal size)	63.72	cum			
8.4	Providing & Fixing Thermomechanical Treated reinforcement bar(Yield Strength 500 Mpa) for R.C.C work including cutting, bending, binding and placing in position complete	5,002.02	kg			
9	Random Rubble Masonry					
9.1	Random Rubble Masonry in cement Mortar 1:6 with hard stone/boulder hammer-dressed in retaining/breast walls	1,636.25	cum			
10	Weep Holes					
10.1	Providing weep holes in stone masonry wall with 75 mm dia PVC pipe, existing through the full width of the structure with slope of 1V:8H towards draining face, Complete as per drawing.	1,296.00	m			
11	Gabion Wall					
11.1	Providing & filling hand-packed stone in G.I mesh 4mm (8swg)including supplying and weaving of mesh complete-Double-knotted mesh-100mm	257.91	cum			
12	Pipes					
12.1	Providing and laying NP2 class R.C pipes, including collars , jointly in cement mortar 1:2 including testing of joints etc.-complete 1050 mm dia.	72.00	m			



12.2	Providing & laying H.D.P.E pipes, 12.5 PN, including H.D.P.E fittings (excluding trenching, refilling & thrust block) -250mm	100.00	m			
13	Providing and Fixing Barbed Wire (Min. 10kg/100m) fencing					
13.1	1.8 m high fencing with 1.8 m angle posts (50mm x 50 mm x 6mm) placed every 3 m apart, embedded in cement concrete blocks, every 15th post, last but one end post and corner post shall be strutted on both sides and end post one side only, provided with nine horizontal lines and two diagonals of barbed wire between two post fitted and fixed with GI staples, turn buckles complete (cost of posts, struts, earthwork and concrete to be paid for separately)	50.00	m			
13.2	Steel work welded, in built up sections, trusses, frame-works including cutting, hoisting, fixing and appl. priming coat of red lead paint in Tees, angles, flats and channels	1,084.78	kg			
14	Providing & laying cement plaster, finished with floating coat of neat cement-20mm plaster in C.M 1:4 for cow Catcher.	90.00	Sqm			
15	Synthetic enamel, for steel & wood work, two coats on new work	100.00	sqm			
16	Occupational Health and Safety (OHS) & Temporary Living Accommodation					



16.1	Providing temporary living accommodation which includes bed room, kitchen, and toilet cum bathroom including proper water supply and electricity as per the drawing and temporary living accommodation standards. The accommodation facilities must be dismantled and cleaned upon the completion of project. All reusable materials of the accommodation facilities will remain as the property of the bidder upon completion of the project.	1.00	L/S			
16.2	Incorporation of Occupational Health and Safety measures at construction sites, including Insurance, Personal Protective Equipment (PPE), First Aid kits, Boundary Fencing, Scaffolding, Safety nets, Traffic management, signage etc as listed in the specifications. The standards and specifications for the Insurance, OHS materials and (or) equipment shall comply with the Labour and Employment Act - 2007, Regulation on Occupational Health, Safety and Welfare - 2012, and other relevant national documents. All OHS items will remain the property of the bidder upon completion of the project.	1.00	L/S			



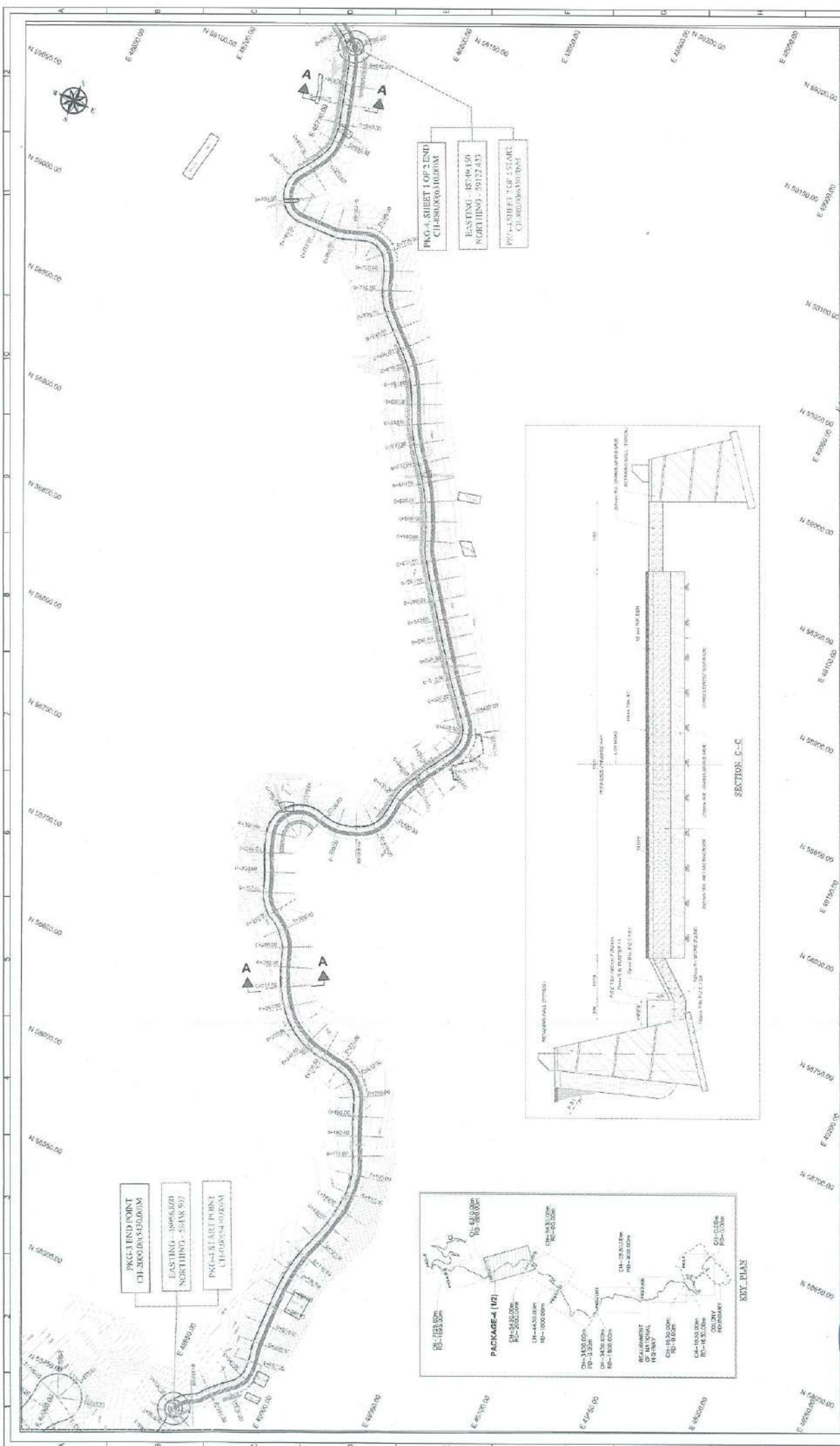
Sub-Total	A				
Rebate, if any	B				
Total Amount	$C = A - B$				
5% GST	$D = 5\% \text{ on } C$				
Final Total Amount (Nu./Rs.)	$C + D$				
Final Total Amount(in Words):					



SECTION IX
DRAWINGS



BLANK



SHEET 1 OF 2

PUNATSANGCHU HYDROELECTRIC PROJECT AUTHORITY (BHUTAN)
CIVIL ENGINEER
WAPCOS
(A UNIT OF PCL UNDERWRITING)

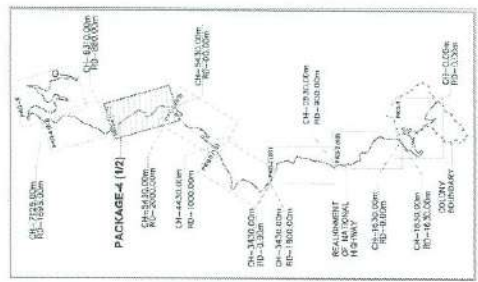
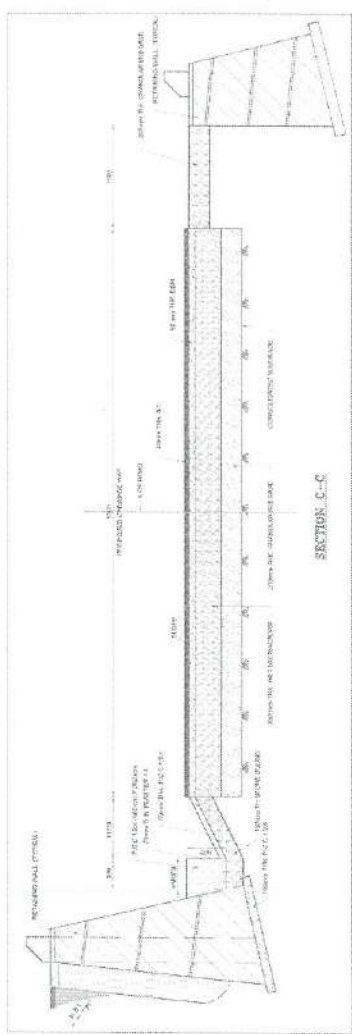
PUNATSANGCHU-1 H.E. PROJECT (BHUTAN)
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY
FROM BHU TO GASEO JN.
PACKAGE-4 LAYOUT PLAN
DRAWN: [] CHECKED: [] APPROVED: []
DATE: []

WAPCOS PROJECT OFFICE, BENTHINZHA BHUTAN
DIR. NO. WAP/PH/ENG/INT/PLAN/0003
MAR. 2023
REV-1

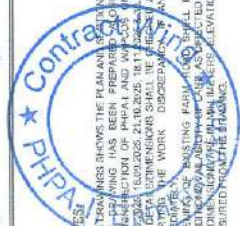
SCALE: 1:12.5
0 12.5 25 37.5 50 62.5 75 87.5 100
FOR STUDY PURPOSE ONLY

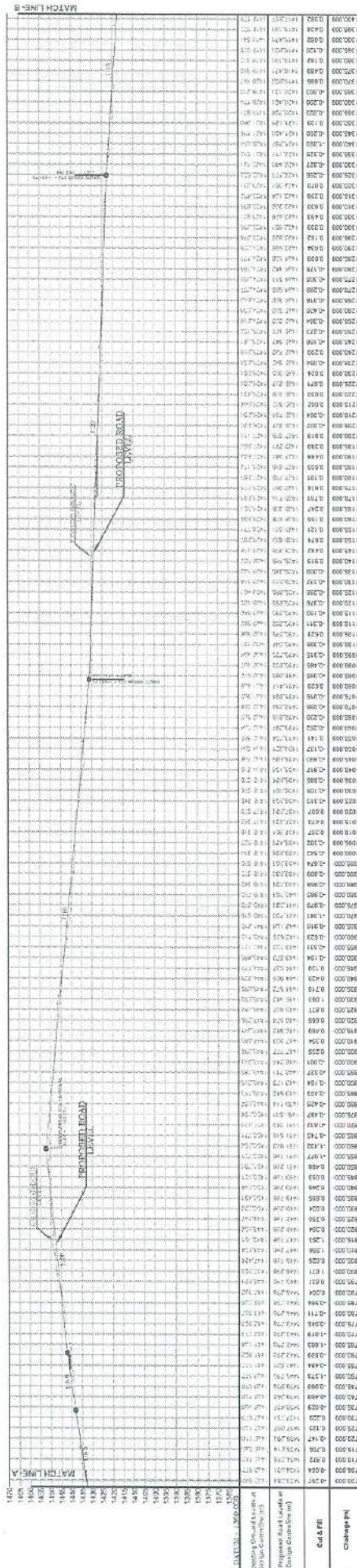
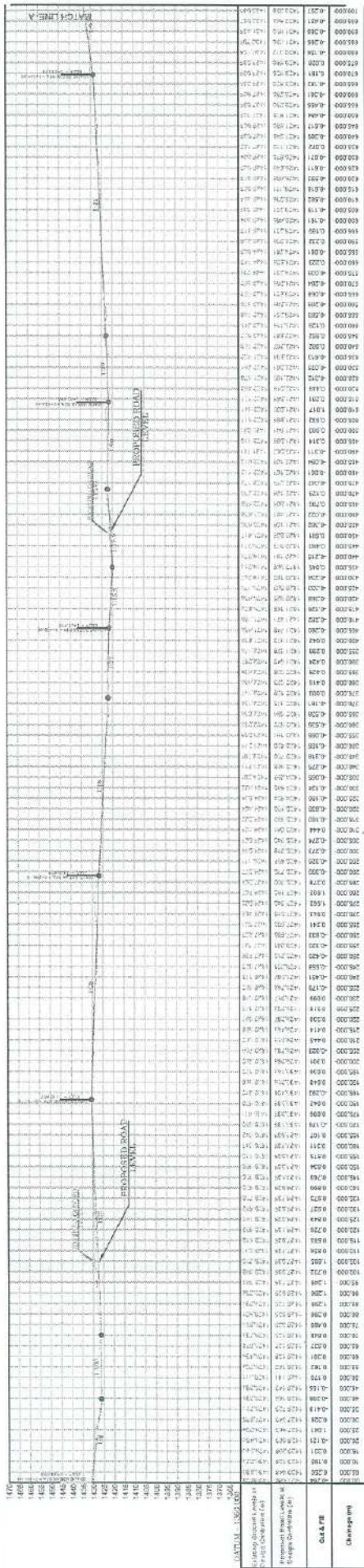
LEGEND:

	GROSS SECTION LINE		RETAINING WALL
	CONTOUR		PROPOSED DRAIN
	PROPOSED ROAD		PIPE CULVERT
	CAUSEWAY		EXISTING CULVERT
	NATURAL NALA		EXISTING PIPE LINE
			CRASH BARRIER



- NOTES:**
1. THIS DRAWING SHOWS THE PLANNING OF THE EXISTING ROAD.
 2. THE DRAWING HAS BEEN PREPARED USING THE ALIGNED FINALIZED BASED ON THE INFORMATION OF PHAI AND WAPCOS IN 2023.2023. 06.04.2023, 06.04.2023, 06.04.2023.
 3. ALL DATA AND DIMENSIONS SHALL BE IN METERS UNLESS OTHERWISE SPECIFIED.
 4. THE WORK SHALL BE TAKEN UP AS PER THE DRAWING, AS PER THE SITE CONDITIONS AND THE PROJECT REQUIREMENTS.
 5. ALL DIMENSIONS AND ELEVATIONS SHALL BE IN METERS, NO DIMENSION SHALL BE MEASURED FROM THE DRAWING.





NOTE:

1. THIS DRAWING SHOWS "LONGITUDINAL SECTIONS" FROM CH 0+064.34(3.90) TO 106+067.15(2.00M). CH 0+00 INDICATE THE END OF THE PROJECT.
2. THIS DRAWING HAS BEEN PREPARED ALONG THE ALIGNMENT FINALIZED DATA ON JOINT SITE VISIT INSPECTION OF PH-PA AND MAPOCS ON 02.07.2025, 10.07.2025, 08.08.2025, 29.08.2025, 01.03.2026, 16.03.2026, 21.10.2026, 18.11.2026 & 29.08.2026
3. ALL DETAIL/DIMENSIONS SHALL BE CHECKED AGAINST THE WORK REFERRED/RELATED DRAWINGS BEFORE STARTING THE WORK. DISCREPANCY IF ANY, SHALL BE BROUGHT TO THE NOTICE OF MAPOCS IMMEDIATELY.
4. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SPECIFIED. ELEVATIONS & CHANGE ARE IN METERS, NO DIMENSION SHALL BE MEASURED FROM THE DRAINAGE.

FOR STUDY PURPOSE ONLY

PUNATSANGCHHUUJ HYDROELECTRIC PROJECT AUTHORITY (BHUTAN)

CONSULTANTS
WAPCOS
WAPCOS ENGINEERING & TECHNOLOGIES

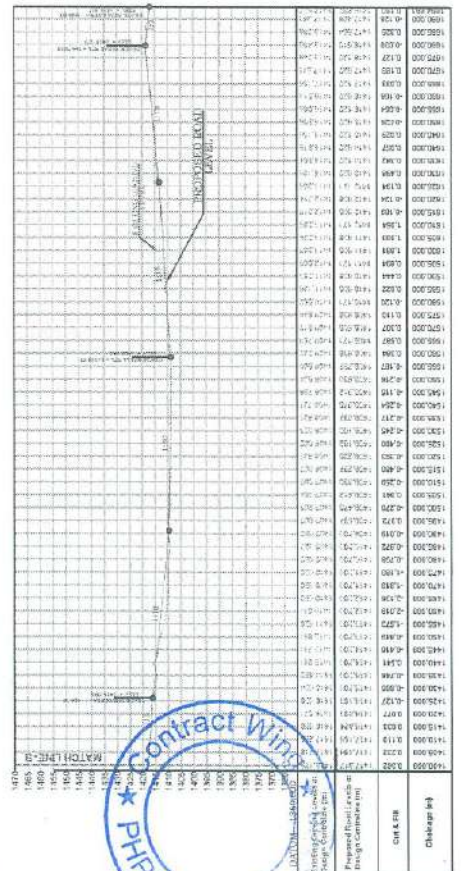
PUNATSANGCHHU-I H.E. PROJECT (BHUTAN)
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY
FROM BHU TO GASELO JN.

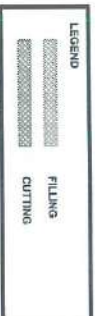
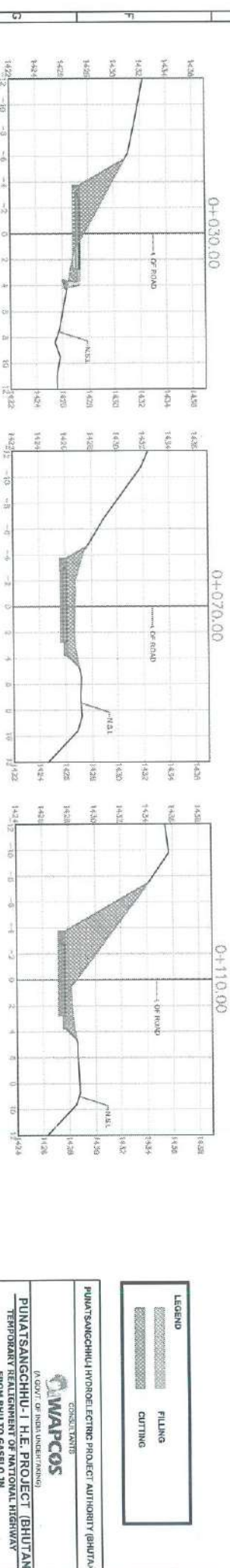
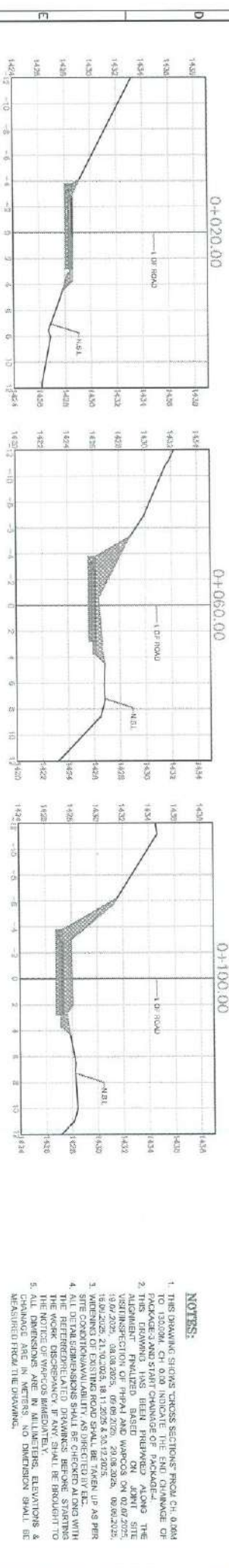
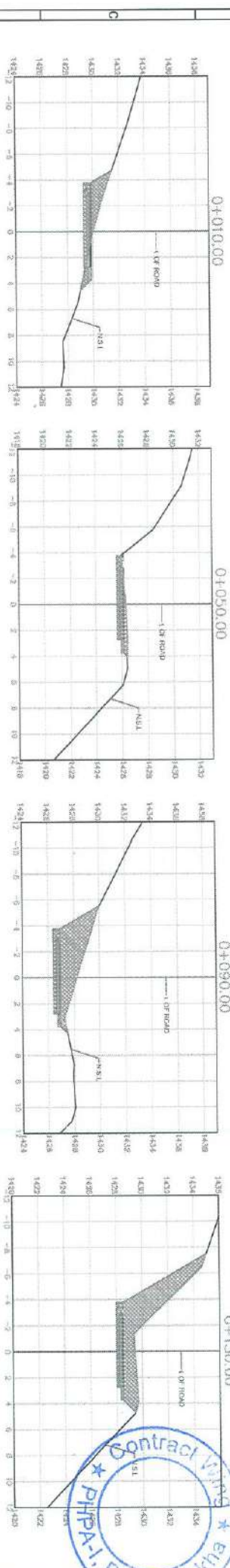
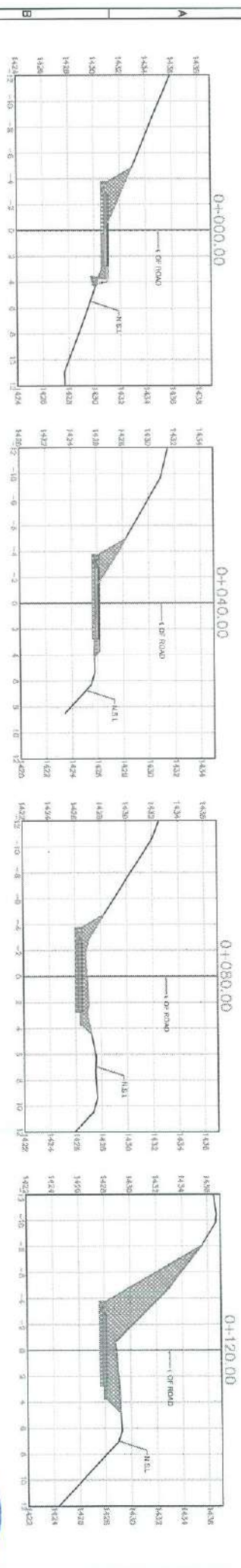
PACKAGE -4 - LONGITUDINAL SECTION

DRAWN	DESIGNED	CHECKED	APPROVED
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WAPCOS PROJECT OFFICE, BJIMTHANGKHA, BHUTAN	MAR., 2026
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NOTES:

- THIS DRAWING SHOWS CROSS SECTIONS FROM CH. 0.000 TO 130.000. CH. 0.000 INDICATE THE END CHANGE OF PACKAGE 3 AND START CHANGE OF PACKAGE 4.
- THIS DRAWING HAS BEEN PREPARED ALONG THE ALIGNMENT OF THE PIPRA-I AND WAPCOS ON 02.07.2025. THE DATE OF PREPARATION IS 02.07.2025.
- WIDENING OF EXISTING ROAD SHALL BE TAKEN UP AS PER SITE CONVENIENCY AND AS PER THE REQUIREMENT OF THE WORK DISCREPANCY IF ANY SHALL BE BROUGHT TO THE NOTICE OF WAPCOS IMMEDIATELY.
- ALL DIMENSIONS ARE IN MILLIMETERS. ELEVATIONS & CHANGES ARE IN METERS. DIMENSIONS SHALL BE MEASURED FROM THE DRAWING.

PUNATSANGCHU HYDRO-ELECTRIC PROJECT AUTHORITY (BHUTAN)

CONSULTANT

WAPCOS

PUNATSANGCHU-I H.E. PROJECT (BHUTAN)

TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY

FROM BHU TO CROSS SECTION

FROM CH.0.000 TO CH.130.000

DRAWN	DESIGNED	CHECKED	APPROVED

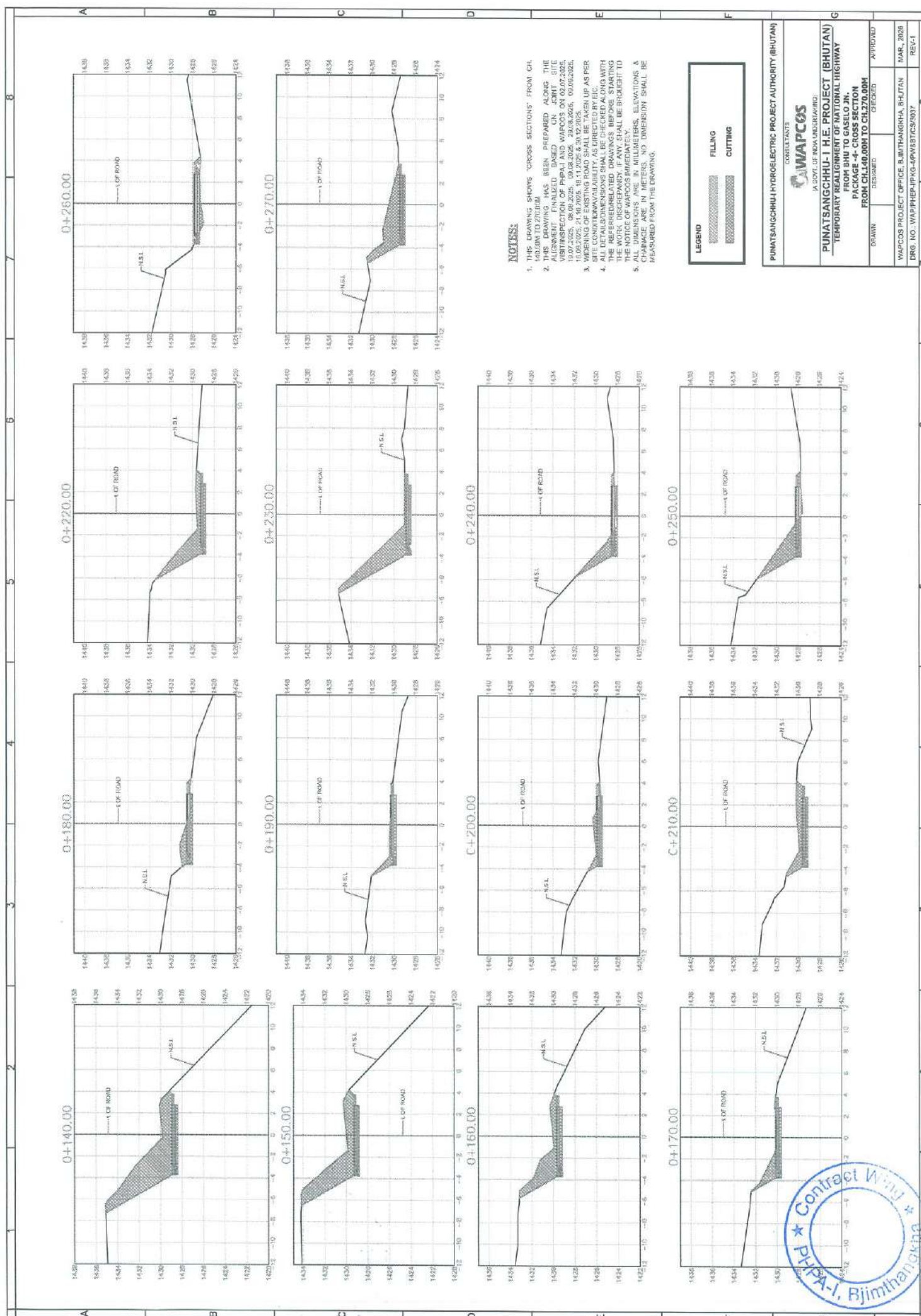
WAPCOS PROJECT OFFICE, BANGKOK, THAILAND

DWG. NO. WAP/PI-P/PHPA-I/2025/0005

REV.1

MAR., 2025





NOTES:

1. THIS DRAWING SHOWS "CROSS SECTIONS" FROM CH. 140.00M TO 270.00M.
2. THIS DRAWING HAS BEEN PREPARED ALONG THE ALIGNMENT FINALIZED BASED ON JOINT SITE VISITATION OF PHAP AND WAPCOS ON 02.07.2025, 03.07.2025, 04.07.2025, 05.07.2025, 06.07.2025, 07.07.2025, 08.07.2025, 09.07.2025, 10.07.2025, 11.07.2025 & 30.12.2025.
3. WIDENING OF EXISTING ROAD SHALL BE TAKEN UP AS PER SITE CONDITIONS/AVAILABILITY, AS DIRECTED BY E.C.
4. ALL DIMENSIONS SHALL BE CHECKED ALONG WITH THE EXISTING ROAD AND THE NEW ROAD. ANY DISCREPANCY, IF ANY, SHALL BE BROUGHT TO THE NOTICE OF WAPCOS IMMEDIATELY.
5. ALL DIMENSIONS ARE IN METERS. ELEVATIONS & CHARGES ARE IN MILLIMETERS. NO DIMENSION SHALL BE MEASURED FROM THE DRAWING.

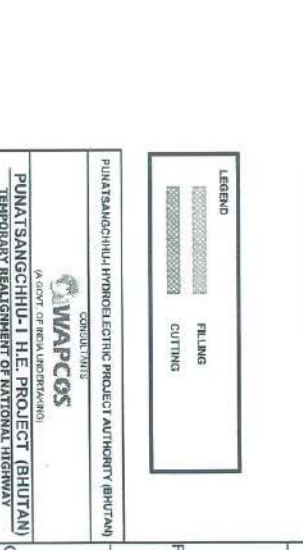
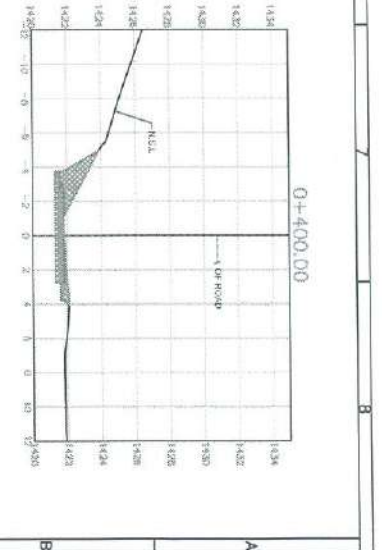
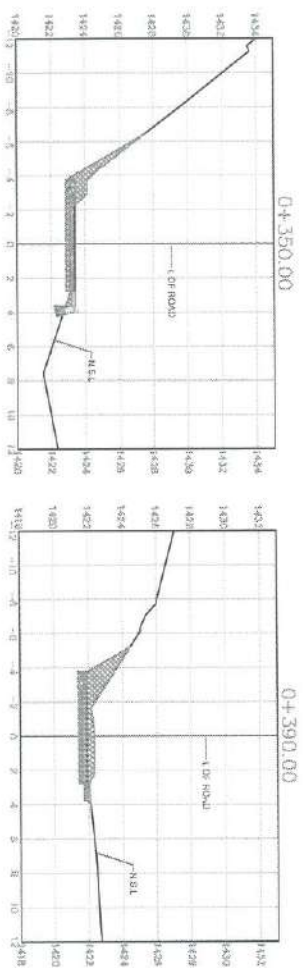
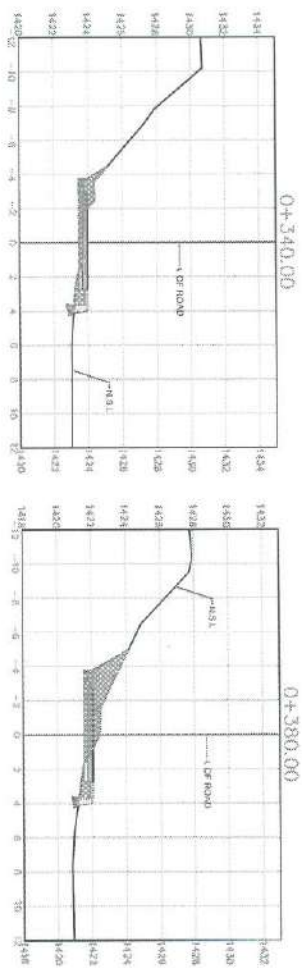
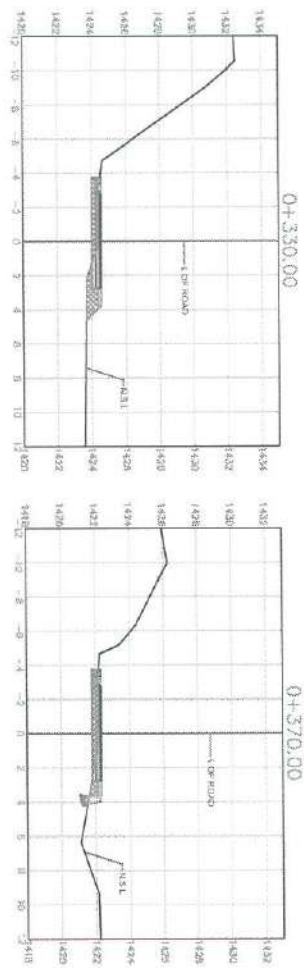
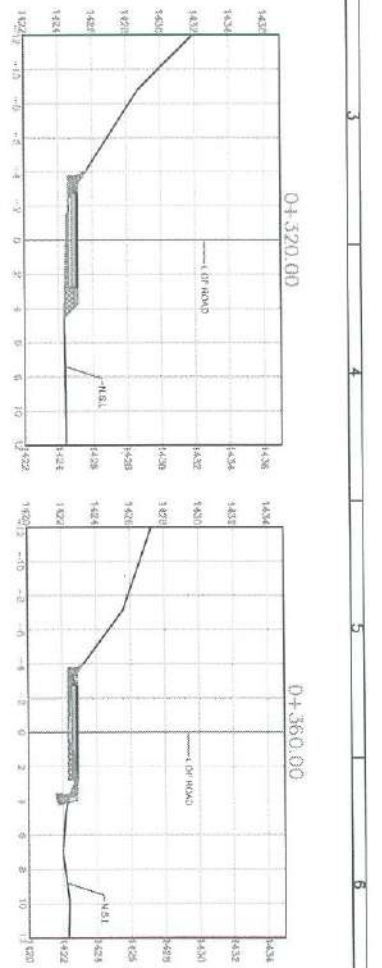
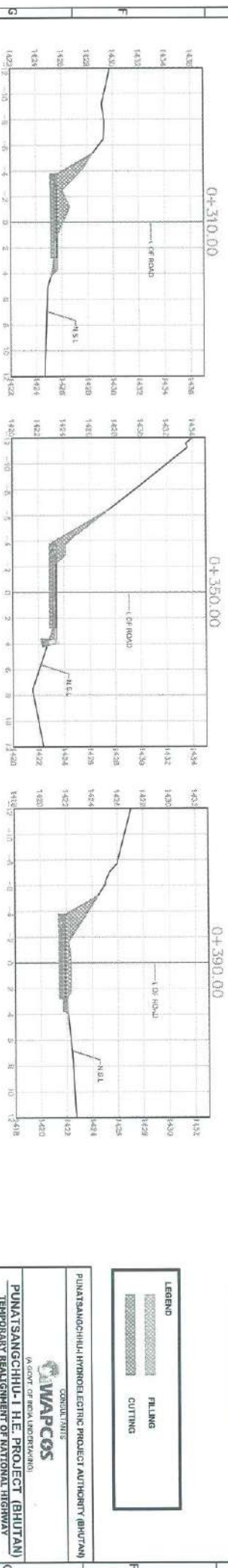
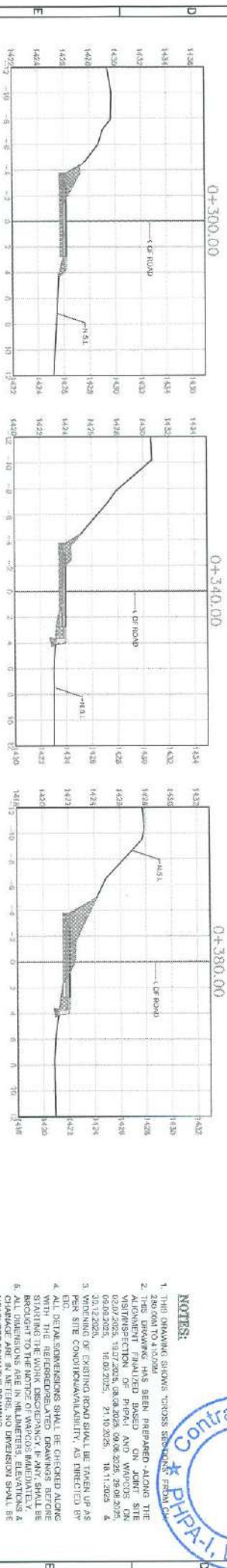
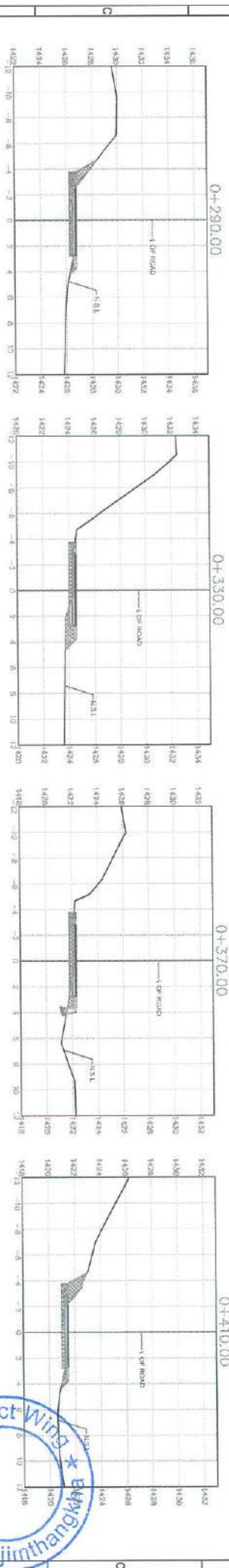
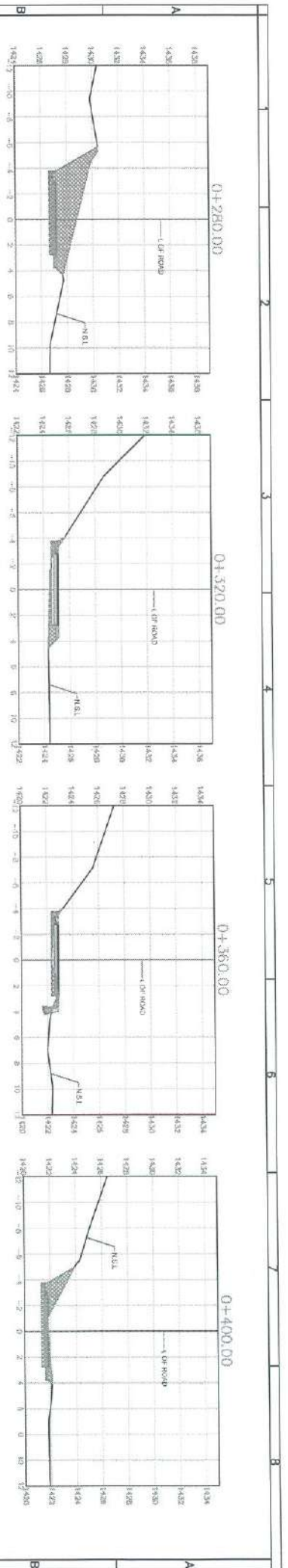
LEGEND

FILLING

CUTTING

PUNATSANGCHHU HYDROELECTRIC PROJECT AUTHORITY (BHUTAN)	
CONSULTANTS	
WAPCOS	
A DIV. OF MOA UNDER DRAYO	
PUNATSANGCHHU-1 H.E. PROJECT (BHUTAN)	
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY	
FROM BHU TO GASELO JN.	
PACKAGE -4- CROSS SECTION	
FROM CH.140.00M TO CH.270.00M	
DRAWN	DESIGNED
APPROVED	
WAPCOS PROJECT OFFICE, BJT/MTHANOKHA, BHUTAN	MAR., 2025
DRG. NO. WAP/PHAP/4PG-4PW/87CS/9037	REV.1





NOTES:

1. THIS DRAWING SHOWS CROSS SECTIONS FROM CH 280.00 TO CH 410.00.
2. THIS DRAWING HAS BEEN PREPARED ALONG THE ALIGNMENT FINISHED BASED ON JOINT SITE VISITATION AND PHOTOGRAPHY.
3. THE PROPOSED ROAD SHALL BE TAKEN UP AS PER SITE CONDITIONS/AVAILABILITY, AS DIRECTED BY THE ENGINEER.
4. ALL DETAIL SPECIFICATIONS SHALL BE CHECKED ALONG WITH THE REFERENCED RELATED DRAWINGS BEFORE STARTING THE WORK DISCREPANCY IF ANY SHALL BE BROUGHT TO THE NOTICE OF WAPCOS IMMEDIATELY.
5. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED.
6. ALL DIMENSIONS SHALL BE MEASURED FROM THE DRAWING.

LEGEND	
	FILLING
	CUTTING

PUNJATSANGCHU HYDRO ELECTRIC PROJECT AUTHORITY (BHUTAN)

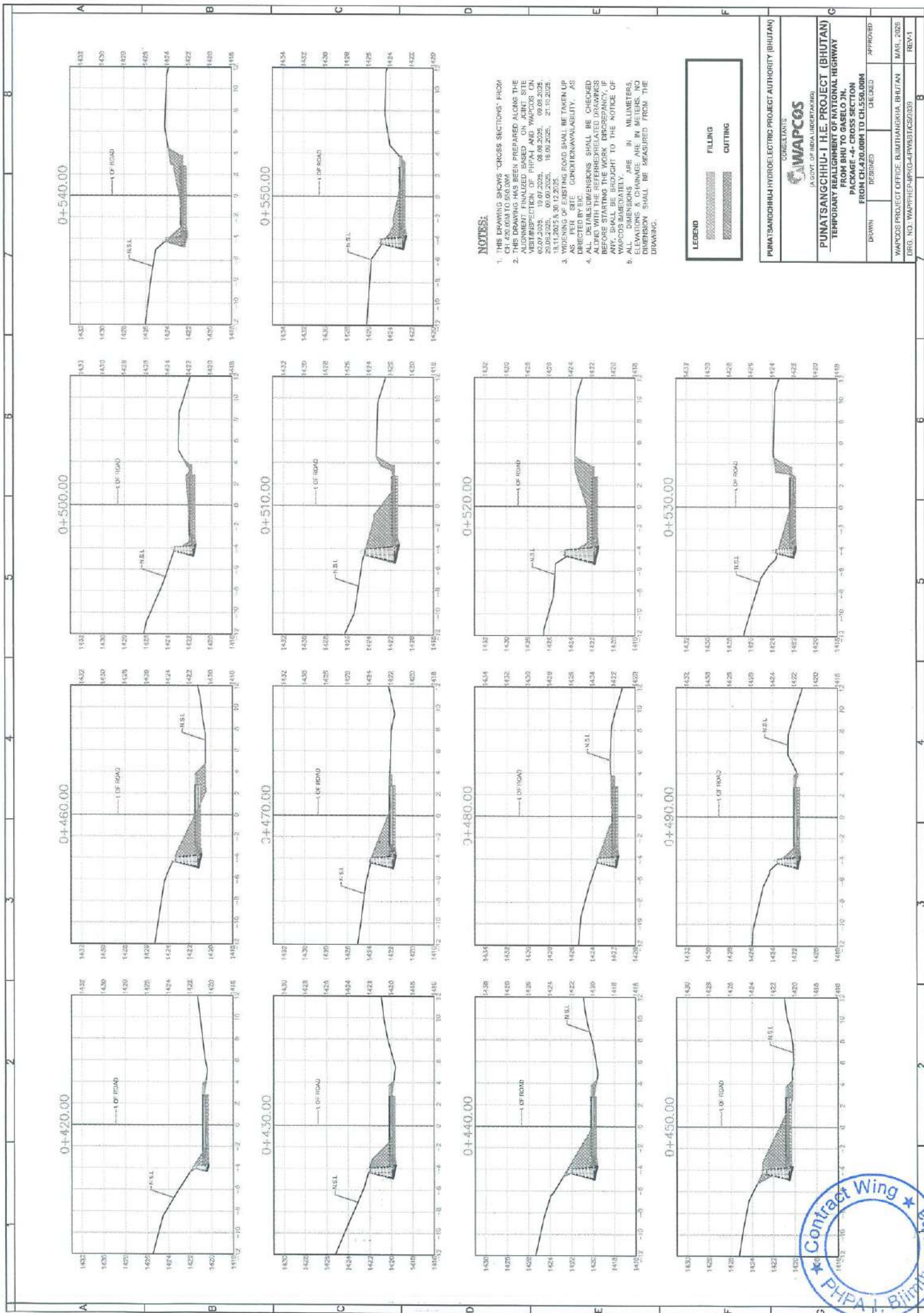


PUNJATSANGCHU-I H.E. PROJECT (BHUTAN)
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY
FROM BHU TO GASELO NK

PACKAGE -A- CROSS SECTION
FROM CH 280.00M TO CH 410.00M

DESIGN	DESIGNED	CHECKED	APPROVED
WAPCOS PROJECT OFFICE, BHUTHANG, BHUTAN			MAR, 2025
DWG NO. WAP/REP/ANG/PM/01/CSA/006			REV1





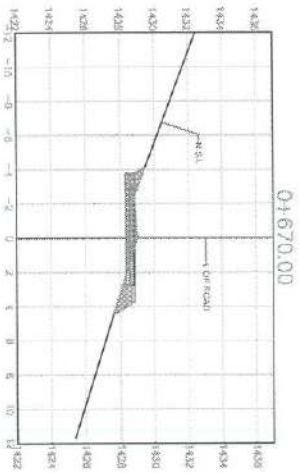
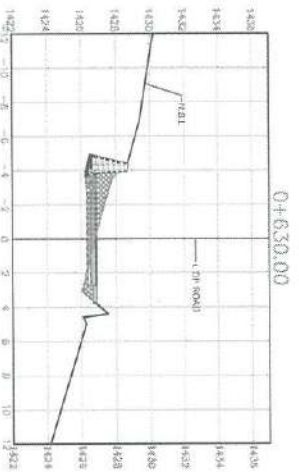
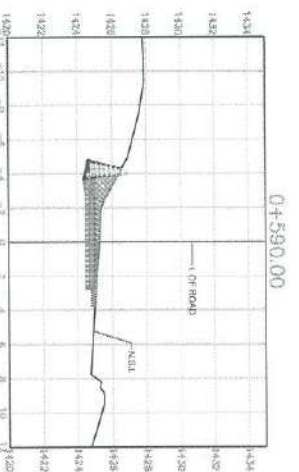
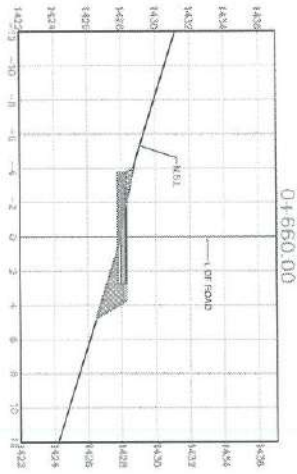
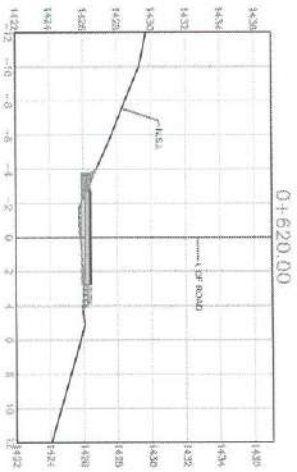
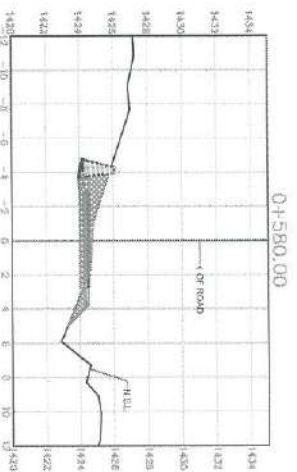
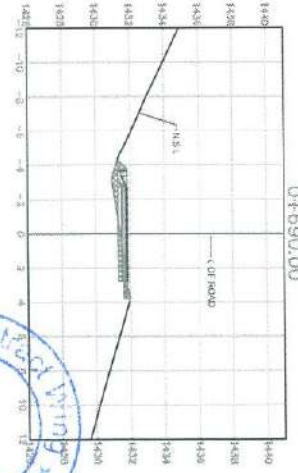
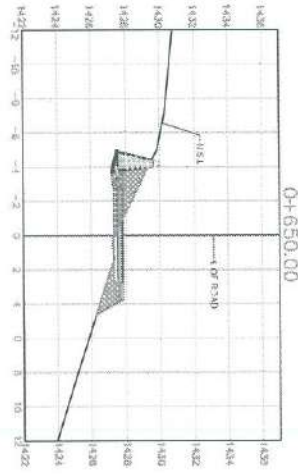
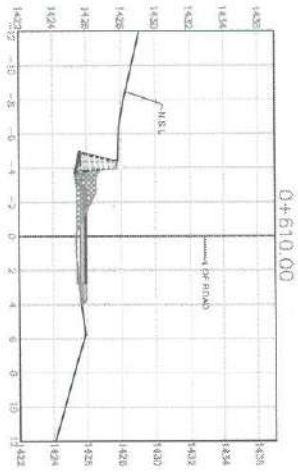
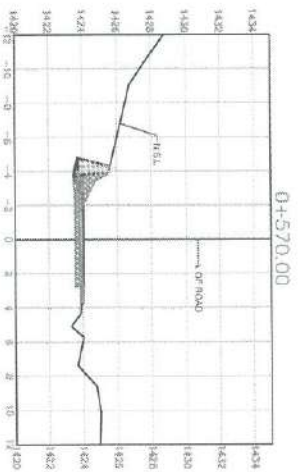
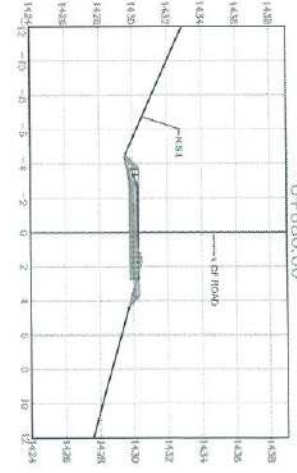
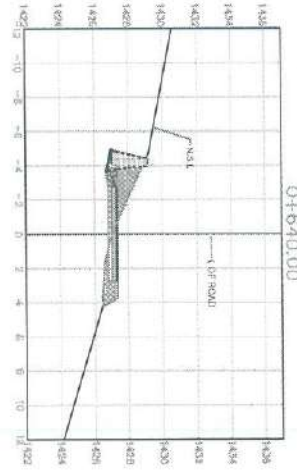
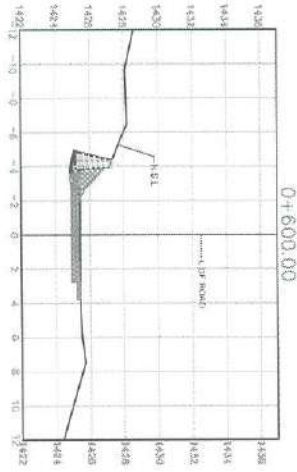
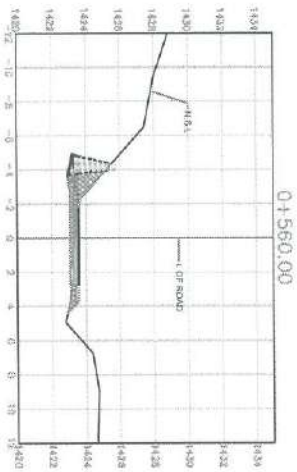
NOTES:

1. THIS DRAWING SHOWS "CROSS SECTIONS" FROM THE EXISTING GROUND TO THE PROPOSED ROAD ALIGNMENT. THE PROPOSED ROAD ALIGNMENT HAS BEEN PREPARED ALONG THE ALIGNMENT FINALIZED BASED ON JOINT SITE VISITATION OF PHPA AND WAPCOS ON 02.07.2025, 10.07.2025, 08.08.2025, 09.08.2025, 15.08.2025, 16.08.2025, 18.08.2025, 21.08.2025, 19.11.2025, 13.12.2025.
2. WIDENING OF EXISTING ROAD SHALL BE TAKEN UP AS PER SITE CONVENIENCY/AVAILABILITY, AS DIRECTED BY EIC.
3. ALL DIMENSIONS SHALL BE CHECKED BEFORE STARTING THE WORK. DISCREPANCY, IF ANY, SHALL BE BROUGHT TO THE NOTICE OF WAPCOS IMMEDIATELY.
4. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED. DIMENSIONS SHALL BE MEASURED FROM THE DRAWING.

LEGEND	
	FILLING
	CUTTING

PUNATSANGCHU HYDROELECTRIC PROJECT AUTHORITY (BHUTAN)	
CONSULTANTS	
WAPCOS	
(A GOVT OF INDIA UNDERTAKING)	
PUNATSANGCHU-I H.E. PROJECT (BHUTAN)	
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY	
PACKAGE -4- CROSS SECTION	
FROM CH.420.00M TO CH.550.00M	
DRAWN	DESIGNED
CHECKED	APPROVED
WAPCOS PROJECT OFFICE: BUTHANGKHU, BHUTAN	MAR. 2025
DRG. NO.: WAPHER/PHK/4-PRW/ST/CS/030	REV.1





NOTES:

1. THIS DRAWING SHOWS CROSS SECTION OF THE PROPOSED ROAD.
2. THIS DRAWING HAS BEEN PREPARED BASED ON THE DATA PROVIDED BY THE CLIENT.
3. THE ALIGNMENT OF THE ROAD SHALL BE AS DIRECTED BY THE CLIENT.
4. ALL DIMENSIONS SHALL BE IN METERS. ELEVATIONS & CHANGES ARE IN METERS. NO DIMENSION SHALL BE MEASURED FROM THE DRAWING.

LEGEND

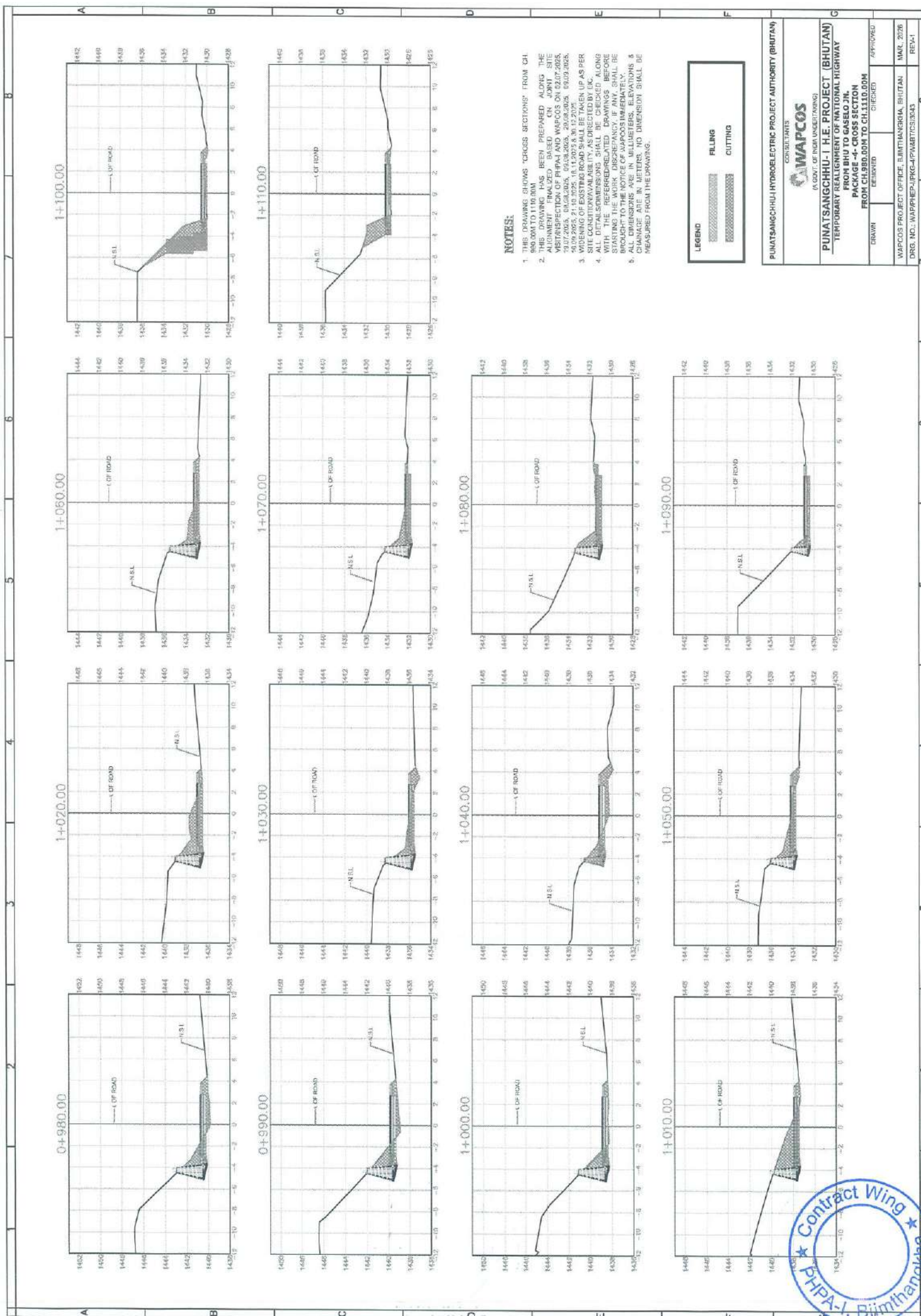
PUNATSANGCHULI HYDRO-ELECTRIC PROJECT AUTHORITY (BHUTAN)



PUNATSANGCHULI-1 H.E. PROJECT (BHUTAN)
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY
FROM BHU TO GASELO IN
PACKAGE -A- CROSS SECTION
FROM CH.560.00M TO CH.690.00M

DESIGNED	CHECKED	APPROVED
WARCOS PROJECT OFFICE, BHUTAN	WARCOS PROJECT OFFICE, BHUTAN	WARCOS PROJECT OFFICE, BHUTAN
DWG. NO. WAPNEP/ALING-4/PW/RT/CS/040		
		REV.1





NOTES:

1. THIS DRAWING SHOWS 'CROSS SECTIONS' FROM CH 980.00 TO 110.00.
2. THE DRAWING HAS BEEN PREPARED ALONG THE ALIGNMENT FINALIZED BASED ON JOINT SITE VISIT INSPECTION OF PHAJ AND WAPCOS ON 02.07.2025, 13.07.2025, 04.08.2025, 05.08.2025, 20.08.2025, 09.09.2025, 10.09.2025, 21.10.2025, 18.11.2025 & 30.12.2025.
3. THE ROAD CROSS SECTION SHALL BE DESIGNED UP AS PER THE DESIGN AND STANDARD AS DIRECTED BY I.C. SUT.
4. ALL DETAIL DIMENSIONS SHALL BE CHECKED ALONG WITH THE REFERRED RELATED DRAWINGS BEFORE STARTING THE WORK. DISCREPANCY, IF ANY, SHALL BE BROUGHT TO THE NOTICE OF WAPCOS IMMEDIATELY.
5. ALL DIMENSIONS SHALL BE IN METERS. NO DIMENSION SHALL BE MEASURED FROM THE DRAWING.

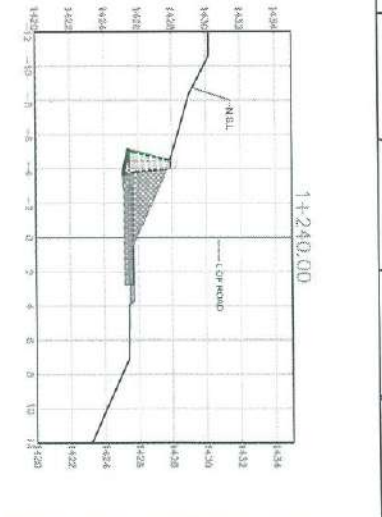
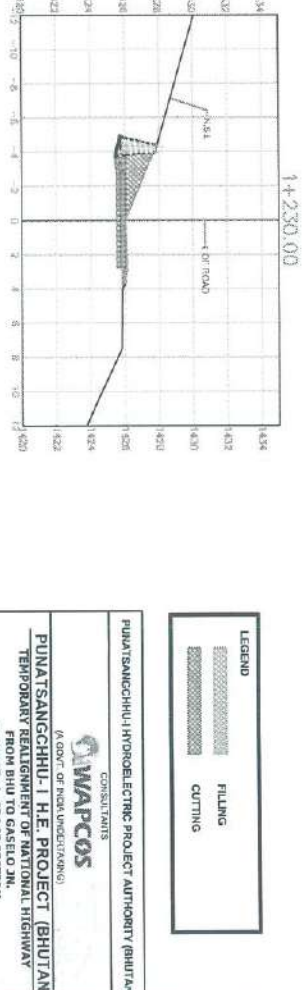
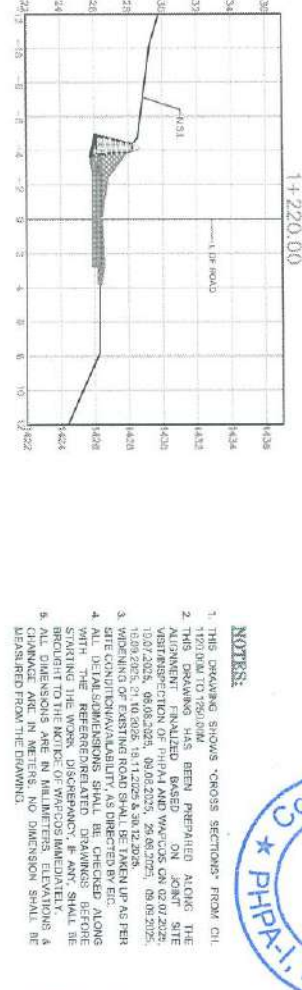
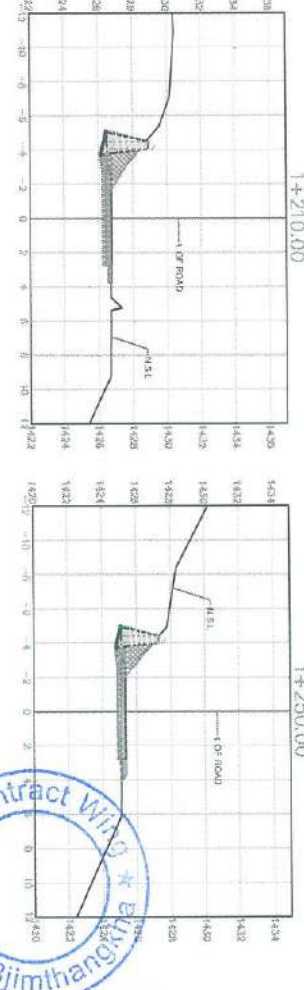
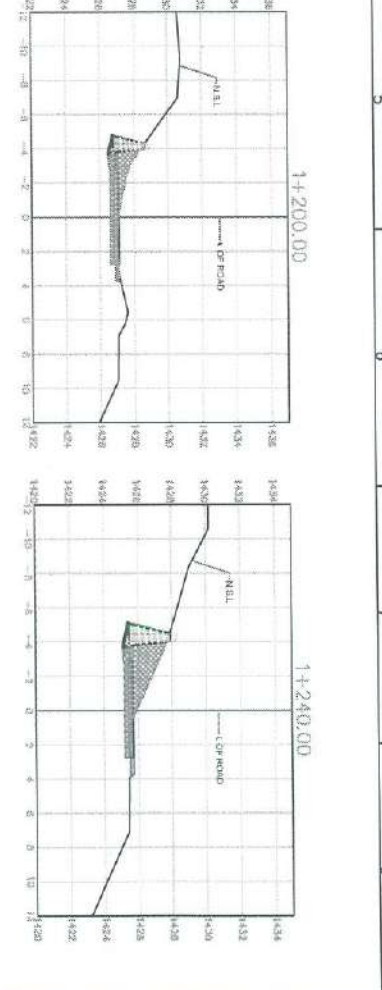
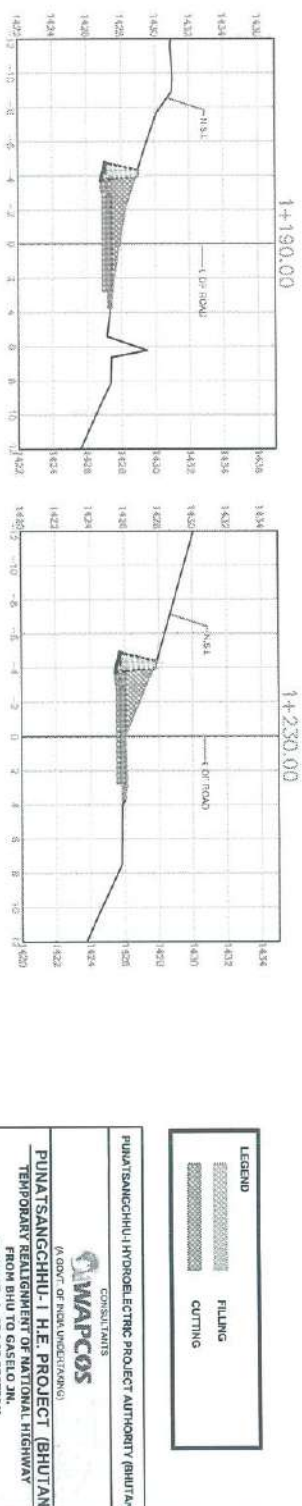
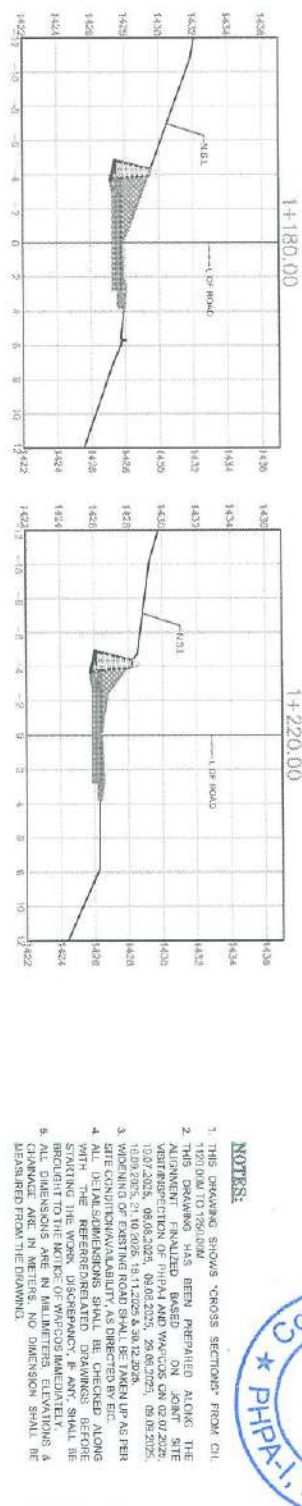
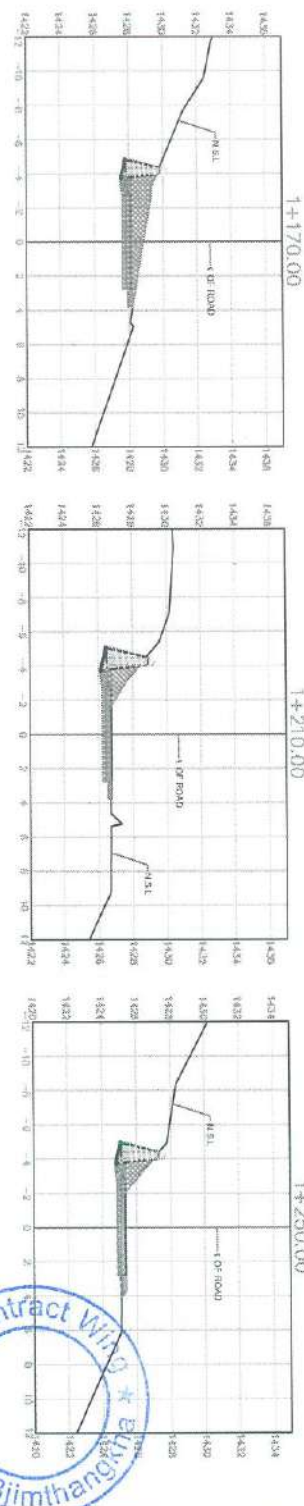
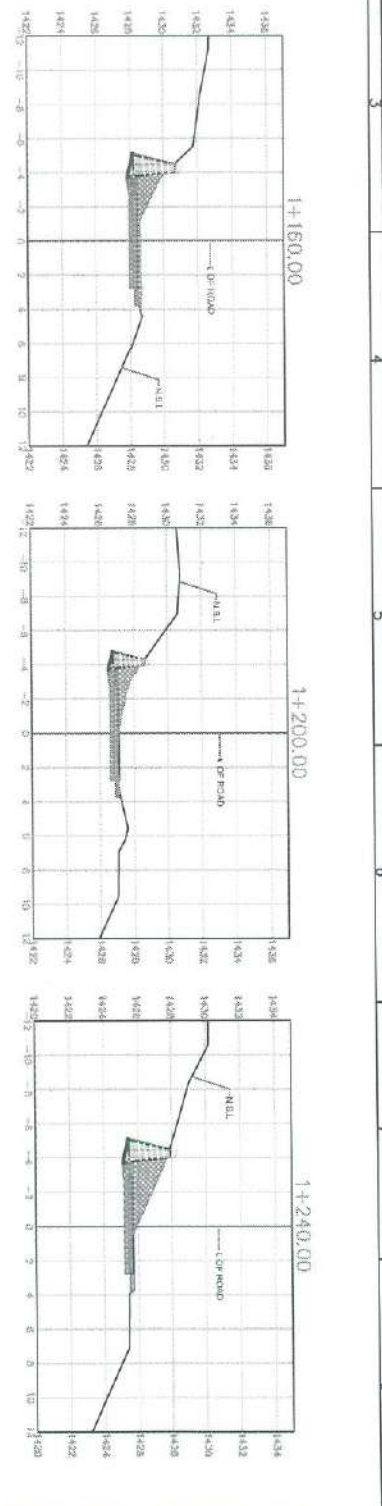
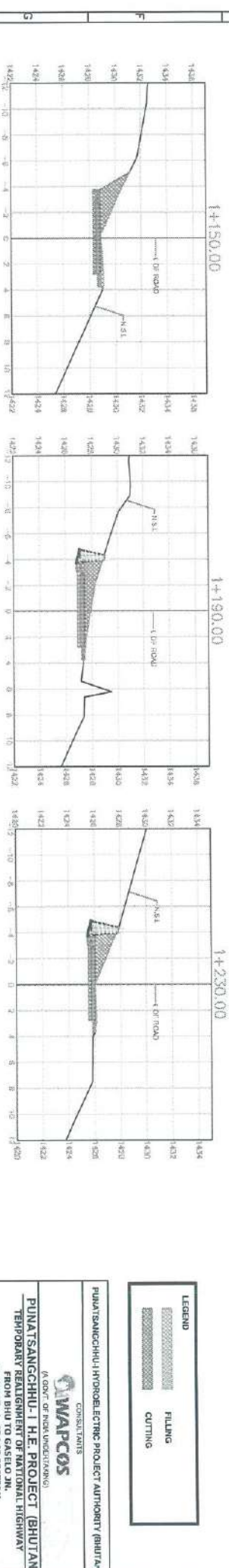
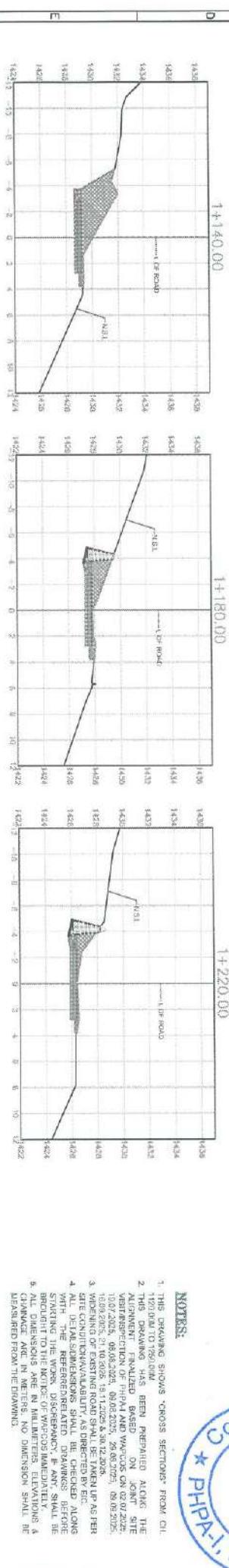
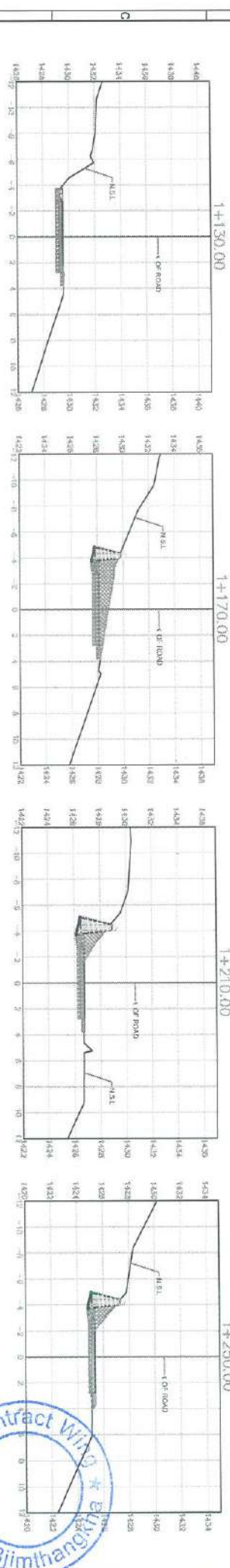
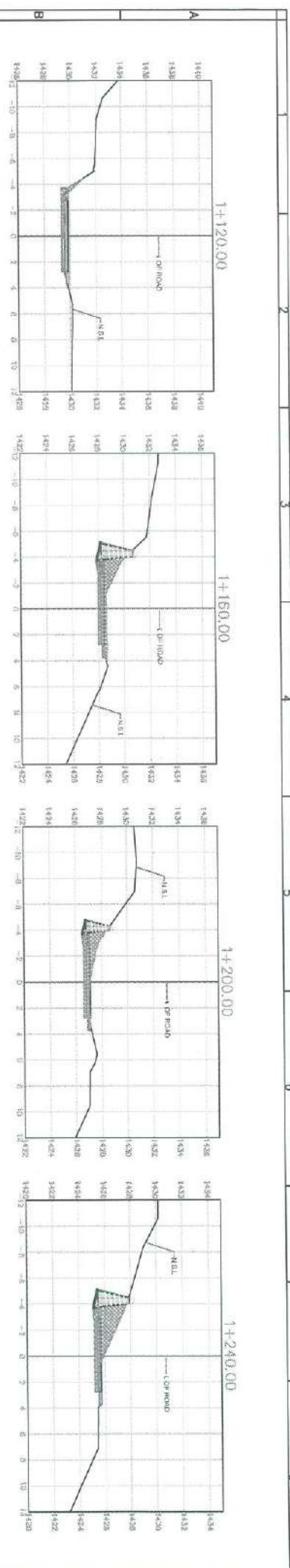
LEGEND

FILLING

CUTTING

PUNATSANGCHHU HYDROELECTRIC PROJECT AUTHORITY (BHUTAN)			
CONSULTANTS			
WAPCOS			
(A GOVT. OF INDIA UNDERTAKING)			
PUNATSANGCHHU - I H.E. PROJECT (BHUTAN)			
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY			
FROM BHU TO GASELO JN.			
PACKAGE -4- CROSS SECTION			
FROM CH.980.00M TO CH.1110.00M			
DRAWN	DESIGNED	CHECKED	APPROVED
WAPCOS PROJECT OFFICE, LUNTHANGCHU, BHUTAN		MAY, 2026	
DIBS. NO.: WAPPHED-IPR/4P/WT/CS/3643		REV.1	



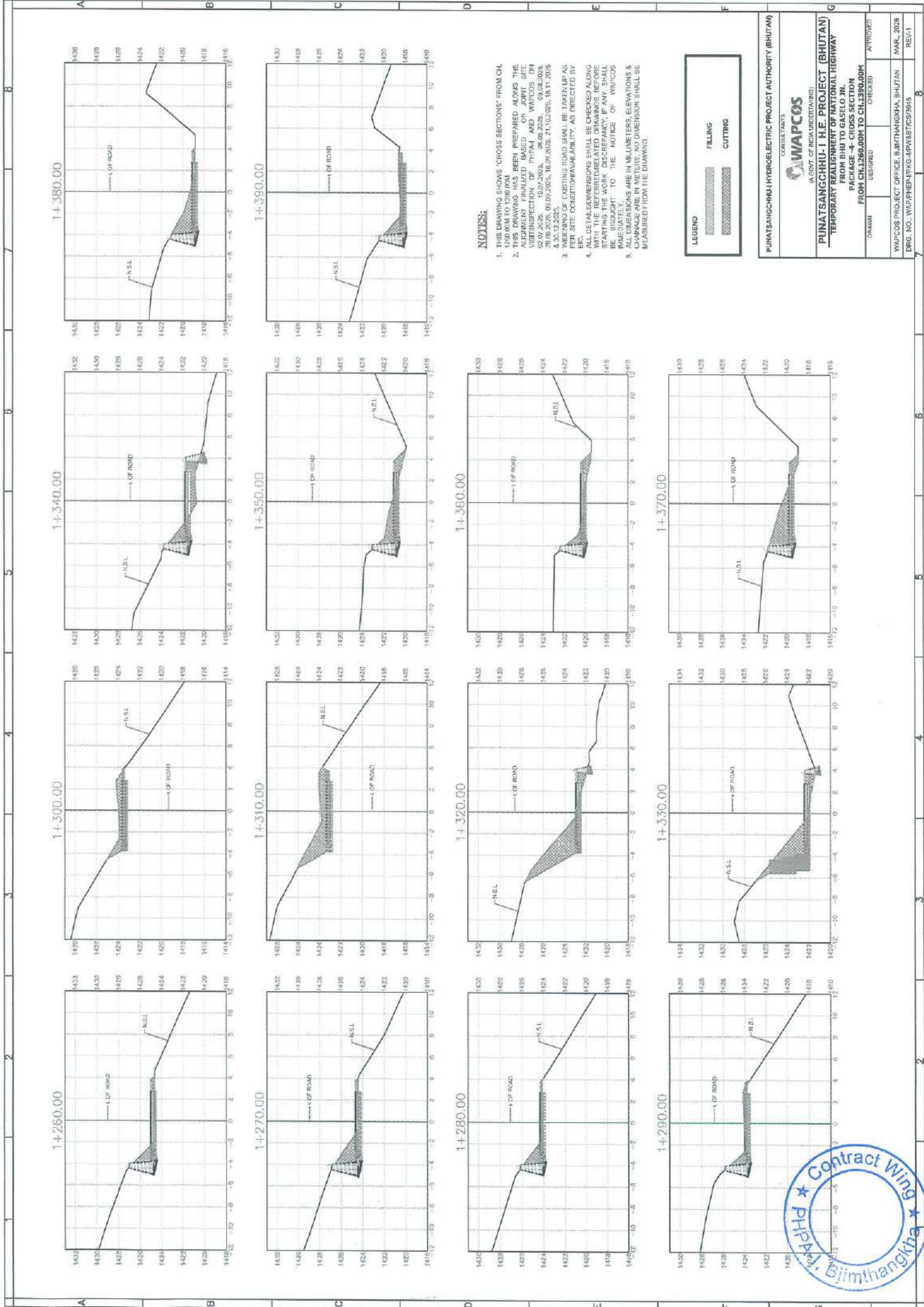


NOTES:

1. THIS DRAWING SHOWS 'CROSS SECTIONS' FROM CIL.
2. THIS DRAWING HAS BEEN PREPARED ALONG THE
3. ALIGNMENT OF THE ROAD AND THE ROAD WIDTH IS 10M.
4. THE ROAD WIDTH IS 10M AND THE ROAD HEIGHT IS 1.5M.
5. THE ROAD HEIGHT IS 1.5M AND THE ROAD WIDTH IS 10M.
6. THE ROAD WIDTH IS 10M AND THE ROAD HEIGHT IS 1.5M.
7. THE ROAD HEIGHT IS 1.5M AND THE ROAD WIDTH IS 10M.
8. THE ROAD WIDTH IS 10M AND THE ROAD HEIGHT IS 1.5M.
9. THE ROAD HEIGHT IS 1.5M AND THE ROAD WIDTH IS 10M.
10. THE ROAD WIDTH IS 10M AND THE ROAD HEIGHT IS 1.5M.

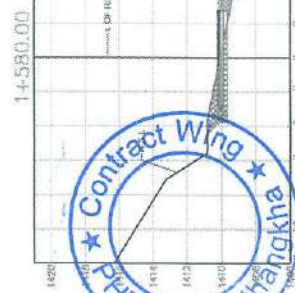
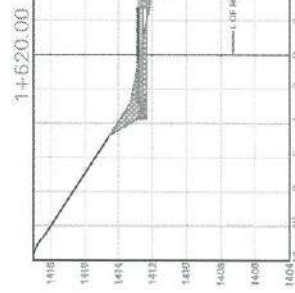
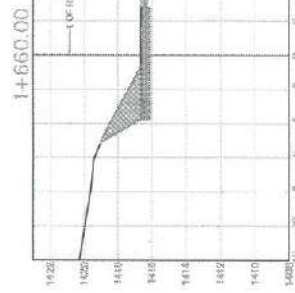
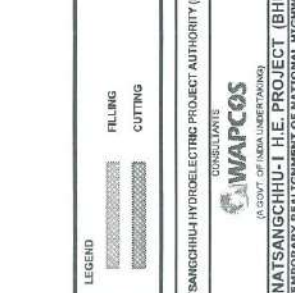
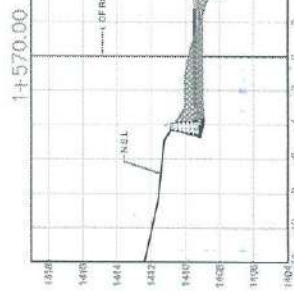
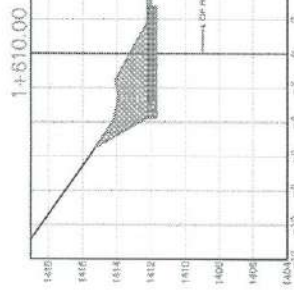
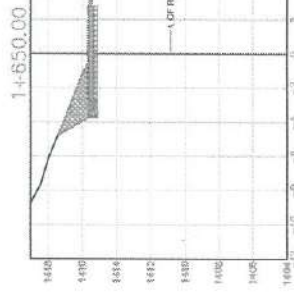
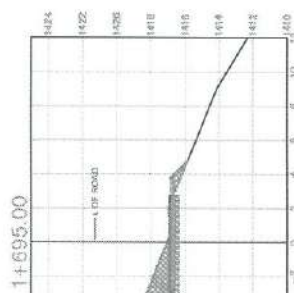
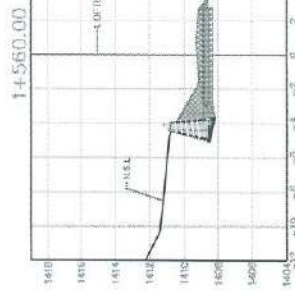
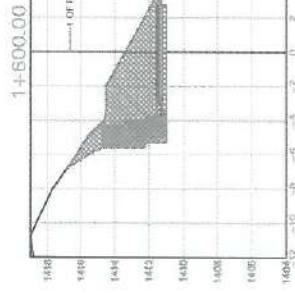
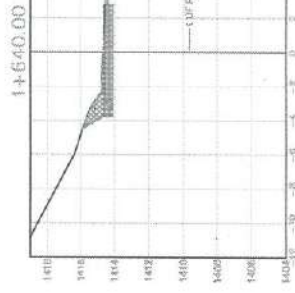
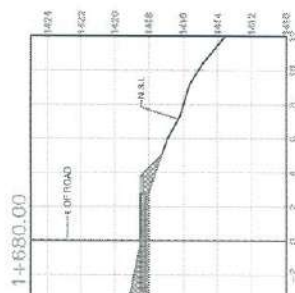
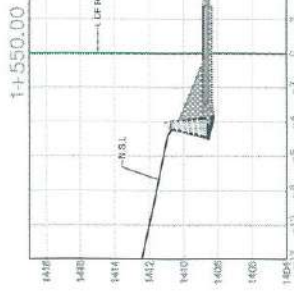
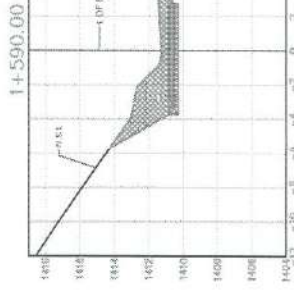
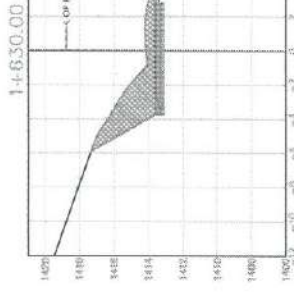
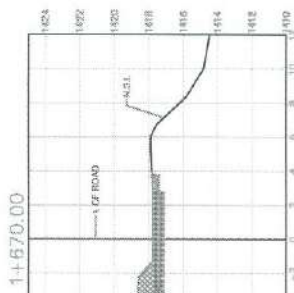
LEGEND	
	FILLING
	CUTTING

PUNATSANGCHU HYDRO-ELECTRIC PROJECT AUTHORITY (BHUTAN)			
CONSULTANTS			
PUNATSANGCHU-I H.E. PROJECT (BHUTAN)			
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY			
PACKAGE - 4- CROSS SECTION			
FROM CH.1120.00M TO CH.1250.00M			
DRAWN	DESIGNED	CHECKED	APPROVED
WAPCOS PROJECT OFFICE, BHIMTHANG, BHUTAN			MAR. 2006
DWG. NO. WAP/HEP/PHPA-I/PUNATSANGCHU-I			REV.1



PUNATSANGCHHU HYDROELECTRIC PROJECT AUTHORITY (BHUTAN)			
CONSULTANTS			
WAPCOS			
(A BODY OF REVENUE UNDERWARD)			
PUNATSANGCHHU-I H.E. PROJECT (BHUTAN)			
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY			
FROM BIHU TO GASELO IN			
PACKAGE -4- CROSS SECTION			
FROM CH.1260.00M TO CH.1390.00M			
DRAWN	DESIGNED	CHECKED	APPROVED
WAPCOS PROJECT OFFICE, BUTHANGMA, BHUTAN		MAR, 2025	
DRG. NO. WHP/REP/HPKG-HPV/EST/CS/2025		REV.1	





LEGEND
FILLING
CUTTING

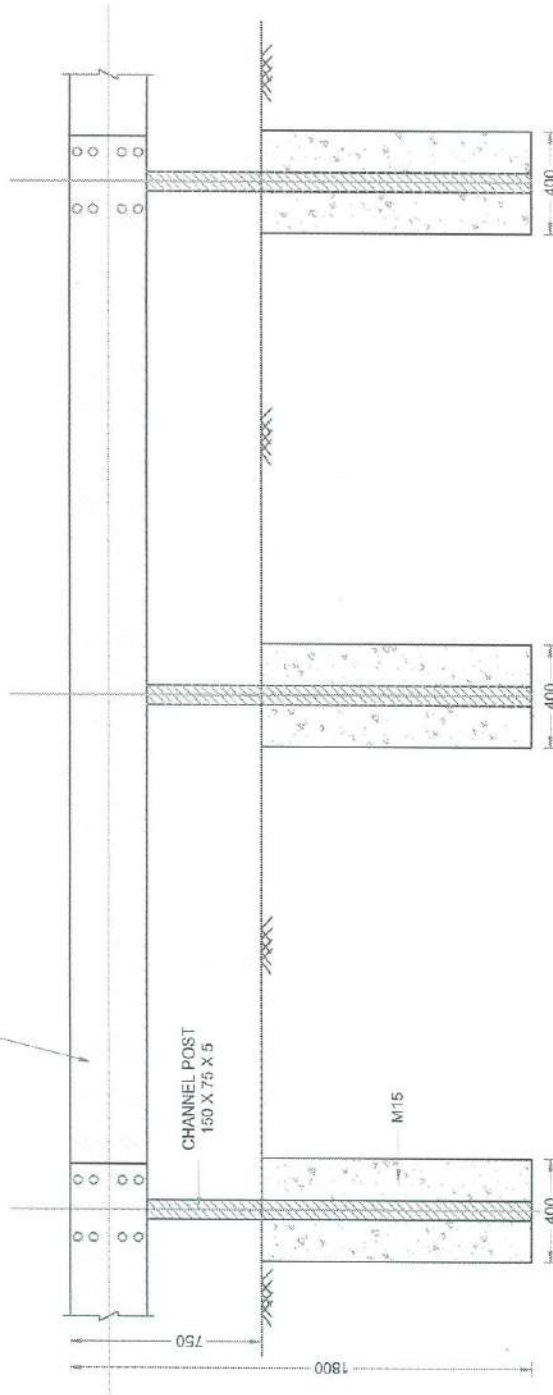
PUNATSANGCHU HYDROELECTRIC PROJECT AUTHORITY (BHUTAN)
CONSULTANT
WAPCOS
(A GOVT. OF INDIA UNDERTAKING)
PUNATSANGCHU-I H.E. PROJECT (BHUTAN)
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY
FROM BHU TO GASELO JN.
PACKAGE -4- CROSS SECTION
FROM CH.1540.00M TO CH.1695.00M

DESIGN	DECISION	CHECKED	APPROVED
WAPCOS PROJECT OFFICE, KUNTHANGKHA, BHUTAN			
DRG. NO. WAPPEP-PPKG-IPW&BTCS0047			REV-1

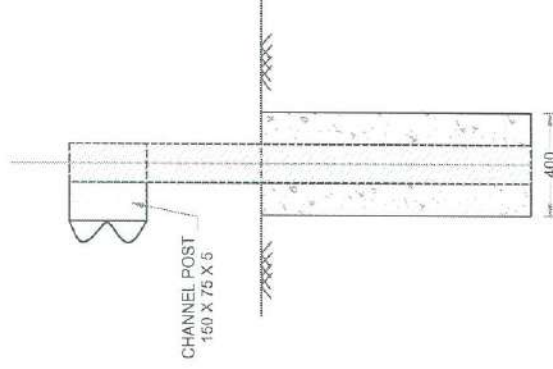
NOTES:
1. THIS DRAWING SHOWS CROSS SECTION FROM CH. 1540.00M TO 1695.00M.
2. THIS DRAWING HAS BEEN PREPARED ALONG THE ALIGNMENT FINALIZED BASED ON JNT SITE VISIT INSPECTION OF PHIPA-I AND WAPCOS ON 02.07.2023, 16.07.2023, 03.08.2023, 09.08.2023, 25.08.2023, 01.09.2023, 16.09.2023, 21.10.2023, 16.11.2023 & 30.12.2023.
3. MODIFICATION OF EXISTING ROAD SHALL BE TAKEN UP AS PER SITE CONDITION/AVAILABILITY, AS DIRECTED BY EIC.
4. ALL DIMENSIONS SHALL BE CHECKED ALONG WITH THE REFERRED RELATED DRAWINGS BEFORE STARTING THE WORK. DISCREPANCY, IF ANY, SHALL BE BROUGHT TO THE NOTICE OF WAPCOS IMMEDIATELY.
5. ALL DIMENSIONS ARE IN METERS. ELEVATIONS & CHANGING ARE IN METERS. NO DIMENSIONS SHALL BE MEASURED FROM THE DRAWING.



W-BEAM (CORRUGATED METAL CRASH BARRIER)



ELEVATION



SIDE VIEW



FOR STUDY PURPOSE

PUNATSANGCHU HYDROELECTRIC PROJECT AUTHORITY (BHUTAN)

CONSULTANTS



PUNATSANGCHU-I H.E. PROJECT (BHUTAN)

TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY

FROM BHU TO GASELO JN.

PACKAGE - 4 - DETAILS OF CRASH BARRIER

DRAWN DESIGNED CHECKED APPROVED

WAPCOS PROJECT OFFICE BHIMTHANGKHA, BHUTAN

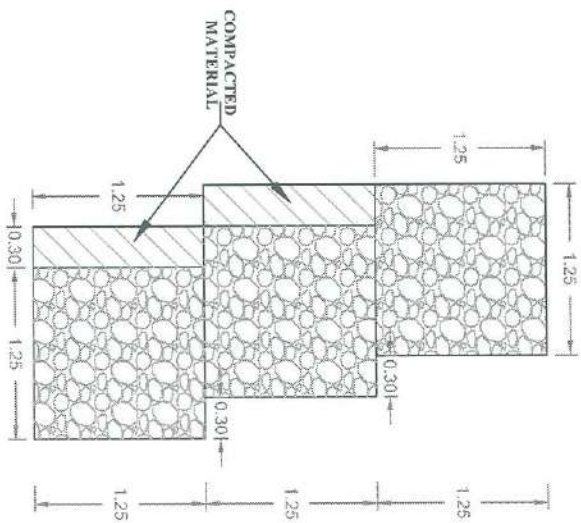
DRG. NO. WAPHEP-PPKG-4RWSTCBB049

MAR. 2020

REV.1

NOTES:

1. THE DRAWING SHOWS THE TYPICAL SECTION OF CRASH BARRIER.
2. ALL DIMENSIONS ARE IN MILLIMETERS. NO DIMENSION SHALL BE MEASURED FROM THE DRAWING.
3. IF ANY DISCREPANCY FOUND IN THIS DRAWING MUST BE BROUGHT TO THE NOTICE OF WAPCOS.
4. LOCATIONS SHALL BE DECIDED AS PER THE SITE REQUIREMENT AS DIRECTED BY E.C.

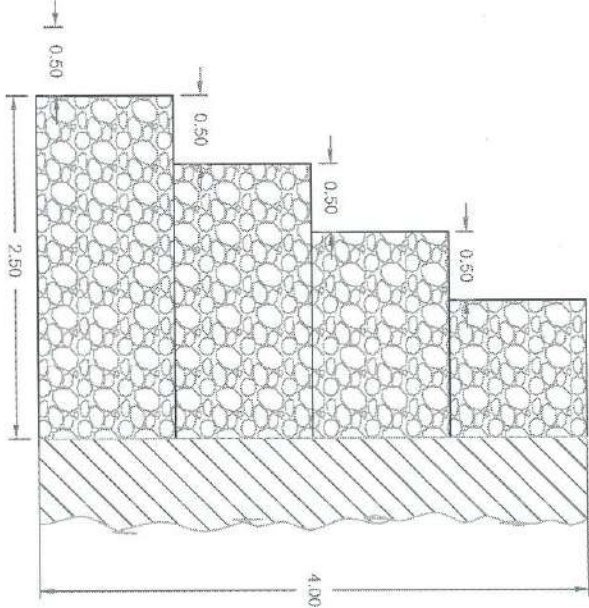
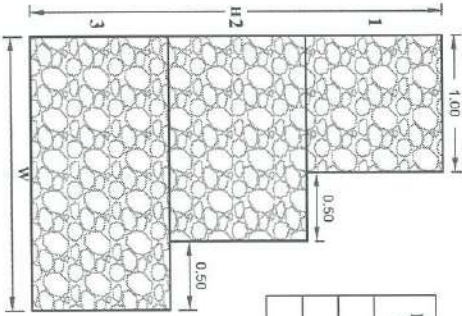


HEIGHT (H) IN METER	WIDTH (W) IN METER
1.25	1.25
2.0	1.5
3.0	2.0

TYPICAL DETAILS OF GABION WALL
(TYPE 1)

HEIGHT (H) IN METER	WIDTH (W) IN METER
1.0	1.0
2.0	1.5
3.0	2.0

TYPE-3



TOTAL HEIGHT H (M)	1.00	2.00	3.00	4.00
TOTAL WIDTH B (M)	1.00	1.50	2.00	2.50

TYPICAL DETAILS OF GABION WALL
(TYPE 2)

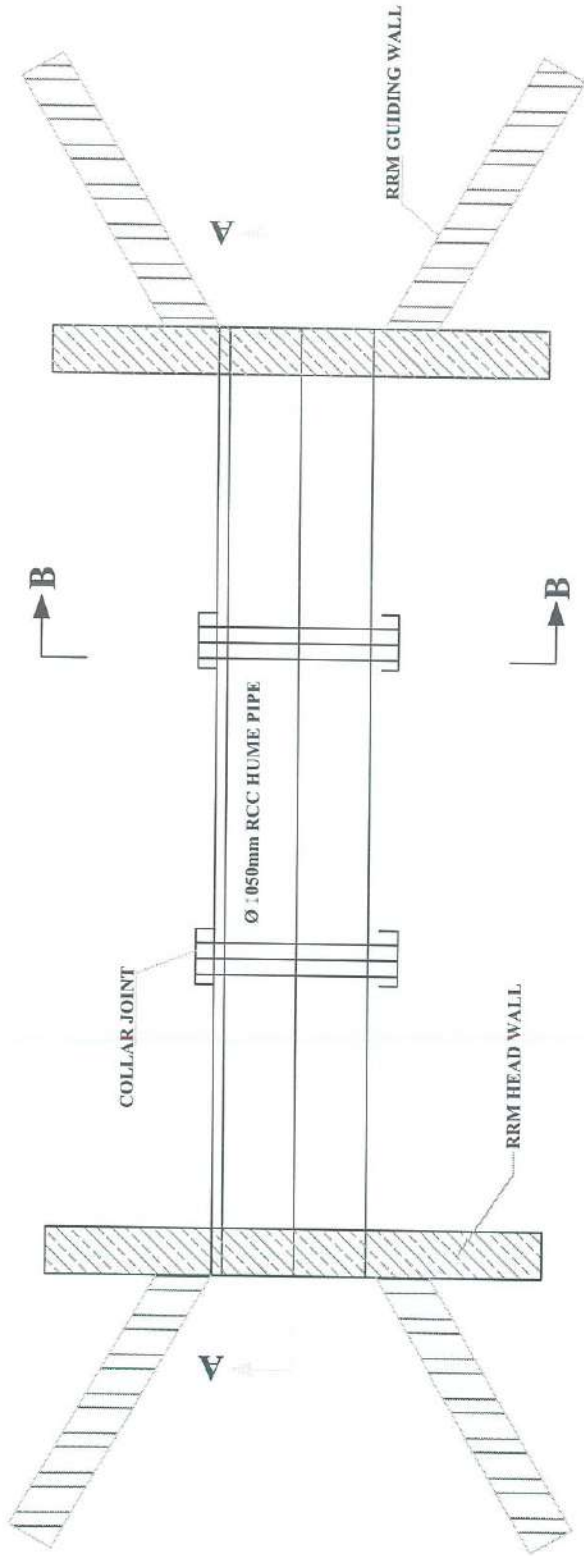
TYPICAL DETAILS OF GABION WALL
(TYPE 3)



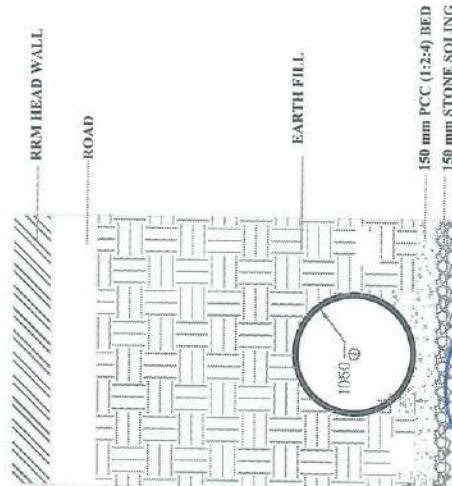
NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED.
2. LOCATION AND HEIGHT OF GABION WALL SHALL BE PROVIDED AS PER SITE CONDITION, AS DIRECTED BY ETC.

FOR STUDY PURPOSE ONLY

PUNATSANGCHHULI HYDROELECTRIC PROJECT AUTHORITY (BHUTAN)			
CONSULTANTS			
PUNATSANGCHHULI H.E. PROJECT (BHUTAN)			
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY			
FROM BHU TO GASELO JN.			
PACKAGE -4 - DETAILS OF GABION WALL (TYPE 1,2&3)			
DRAWN	DESIGNED	CHECKED	APPROVED
WAPCOS PROJECT OFFICE, LUNTHANGDOLA, BHUTAN	WAPCOS PROJECT OFFICE, LUNTHANGDOLA, BHUTAN	WAPCOS PROJECT OFFICE, LUNTHANGDOLA, BHUTAN	WAPCOS PROJECT OFFICE, LUNTHANGDOLA, BHUTAN
DATE: 01.04.2023	DATE: 01.04.2023	DATE: 01.04.2023	DATE: 01.04.2023
REV-1	REV-1	REV-1	REV-1



PLAN OF RCC HUME PIPE CULVERT



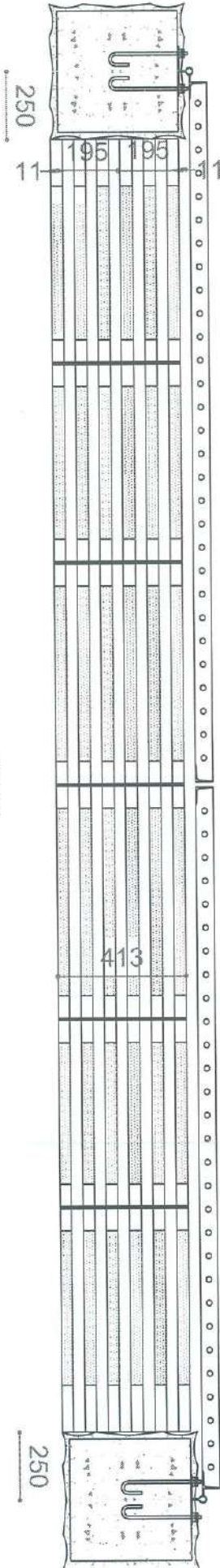
- NOTES:
1. THE DRAWING SHOWS THE TYPICAL LAYOUT PLAN AND SECTIONS.
 2. ALL DIMENSIONS ARE IN MILLIMETERS. NO DIMENSION SHALL BE METERS MEASURED FROM THE DRAWING.
 3. IF ANY DISCREPANCY FOUND IN THIS DRAWING, MUST BE BROUGHT TO THE NOTICE OF WAPCOS.
 4. LOCATION AND NUMBER OF PIPES IN PIPE CULVERT SHALL BE DECIDED AS PER THE SITE REQUIREMENT, AS DIRECTED BY E.C.

FOR STUDY PURPOSE ONLY

PUNATSANGCHU-1 HYDROELECTRIC PROJECT AUTHORITY (BHUTAN)			
CONSULTANTS			
WAPCOS			
(A JOINT OF INDA UNDETFAMING)			
PUNATSANGCHU-1 H.E. PROJECT (BHUTAN)			
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY			
FROM BHU TO GASELO JN.			
PACKAGE-4 - TYPICAL DETAILS OF HUME PIPE CULVERT			
DRAWN	DESIGNED	CHECKED	APPROVED
WAPCOS PROJECT OFFICE, BJIMTHANGKHA, BHUTAN			
DRG. NO. WAPHEP/MPKG-4/PW43/THP/0301			
MAR. 2020			
REV-1			



E



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- NOTE:-
1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED.
 2. LOCATION SHALL BE PROVIDED AS PER SITE CONDITION, AS DIRECTED BY E.C.
 3. SPECIFICATIONS SHALL BE REFERRED FOR ALL NECESSARY DETAILS.

[FOR STUDY PURPOSE ONLY]



PUNATSANGCHU HYDROELECTRIC PROJECT AUTHORITY (BHUTAN)



IN CHARGE OF PUNATSANGCHU
PUNATSANGCHU-I H.E. PROJECT (BHUTAN)
TEMPORARY REALIGNMENT OF NATIONAL HIGHWAY
FROM BHU TO GASELO JN.
PACKAGE - 4 - CATTLE GUARD

DESIGN	DESIGNED	CHECKED	APPROVED
WAPCOS PROJECT OFFICE, SAMPANGA, BHUTAN			MAN, 2008
DRG. NO.: WAP/PHPA-I/PH/ART/CD/0053A			REV-1