SYAMA PRASAD MOOKERJE PORT, KOLKATA

श्यामा प्रसाद मुखर्जी पोर्ट, कोलकाता

(Erstwhile KOLKATA PORT TRUST)

(AN AUTONOMOUS BODY UNDER THE MINISTRY OF PORTS, SHIPING AND WATERWAYS,GOVERNMENT OF INDIA)

KOLKATA DOCK SYSTEM

TENDER FOR ".

"रैपिड ईआईए अध्ययन, गुवाहाटी, असम में ब्रह्मपुत्र रिवरसाइड और ताप्ती नदी, सूरत हब, गुजरात में समुद्री विमान संचालन के लिए जल एयरोड्रम के निर्माण के लिए ईआईए रिपोर्ट और पर्यावरण मंजूरी की तैयारी "

Limited TENDER FOR "Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat"

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Civil Engineering Department

सिविल इंजीनियरिंग विभाग

SYAMA PRASAD MOOKERJEE PORT, KOLKATA

श्यामा प्रसाद मुखर्जी पोर्ट, कोलकाता

TENDER NO.: SMPK/KDS/CIV /T/2746/18 DT. 16.03.2023

TENDER NO.: SMPK/KDS/CIV /T/2746/18 DT. 16.03.2023

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SYAMA PRASAD MOOKERJEE PORT, KOLKATA

श्यामा प्रसाद मुखर्जी पोर्ट, कोलकाता

(Formerly KOLKATA PORT TRUST)

Civil Engineering Department

1.0 NOTICE INVITING TENDER

NIT NO.: SMPK/KDS/CIV /T/2746/18 DT. 16.03.2023

Limited Single cover Tender is invited from **shortlisted reliable, bonafide** & experienced agency with required experience as per Prequalification criteria stipulated in Tender Document for **"Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat"**as per Billof Quantities the Bid Document may be seen from the **https://kopt.enivida.in.** Corrigenda or clarifications, if any, shall be hosted on the above- mentioned website only. The tender is also published on SMPK website (www.smportkolkata.shipping.gov.in).

Note:- Shortlisted bidders are also informed through e-mail.

SCHEDULE OF TENDER (SOT)

a.TENDER NO. निविदा संख्या	**SMPK/KDS/CIV /T/2746/18 DT. 16.03.2023**
b. MODE OF TENDER निविदा का तरीका	e-Procurement System (**Online Limited single** part Techno-Commercial Bid and Price Bid through **Enivida Portal https://kopt.enivida.in/**) The intending bidders are required to submit their offers electronically through e-tendering portal. **No physical tender is acceptable** by SYAMA PRASAD MOOKERJEE PORT, KOLKATA.
c. i) Estimated Cost 0f the Work अनुमानित लागत 0f कार्य ii) Earnest Money Deposit बयाना राशि	**NA** **Rs. 1,80,000/- (Rupees one lakh eighty thousand only)** payable through DD / RTGS / NEFT to be transferred on **A/C:** Syama Prasad Mookerjee Port, Kolkata **A/c No:** 067502000000491 **IFSC:** IOBA0000675 **Bank Name:** Indian Overseas Bank **Branch Name:** STRAND ROAD Branch

iii) Tender Document fee (**Non-refundable)** निविदा दस्तावेज शुल्क (अप्रतिदेय)	The intending bidders should submit the tender costof **Rs.1770/-(Rupees one thousand seven hundred and seventy only**) **including @18% GST)** to KoPT through DD/Banker's Cheque in favour of Syama Prasad Mookerjee Port, Kolkata on any scheduled/NationalisedBank payable at Kolkataotherwise their offer will be summarily rejected. Asper cl. 2, page no.12 payable through DD / RTGS / NEFT to be transferred on **A/C:** Syama Prasad Mookerjee Port, Kolkata **A/c No:** 067502000000491 **IFSC:** IOBA0000675 **Bank Name:** Indian Overseas Bank **Branch Name:** STRAND ROAD Branch
iv) Railtel Tender Processing Fee (Non-refundable) Mode ofPayment: - E-payment Only through Debit/Credit Card or Net Banking. रेलटेल टेंडर प्रोसेसिंग शुल्क(नॉन रिफंडेबल) भुगतान का प्रकार:- ई-पेमेंट केवल के माध्यम से डेबिट/क्रेडिट कार्ड या नेट बैंकिंग।	TPF- **0.1%** of estimate cost (Minimum 750/- Maximum7500/-+GST Registration ChargesRs.2000/- +Applicable GST Per Year
d. Date of NIT available to parties to download पार्टियों को डाउनलोड करने के लिए उपलब्ध एनआईटी की तिथि	**17.03.2023 to 30.03.202**3(up to **14:00 hrs**.)
e. Pre – Bid Meeting Date & Time प्री-बिड मीटिंग की तारीख और समय	**No Pre-Bid Meeting**.
f. Last date of submission of EMD & TenderDocument fee at Syama Prasad Mookerjee Port, Kolkata श्यामा प्रसाद मुखर्जी पोर्ट, कोलकाता में ईएमडी और निविदा दस्तावेज शुल्क जमा करने की अंतिम तिथि	**03.04.202**3(up to **12:00 hrs**.)
g. Date of Starting of e-Tender for submission of online Techno-Commercial Bid at Enivida Portal के लिए ई-निविदा शुरू होने की तिथि Enivida पोर्टल पर ऑनलाइन टेक्नो-कमर्शियल बिड और प्राइस बिड जमा करना	**17.03.2023(From 14:00 hrs**. **onwards)**

h.Date of closing of online e-tender for submissionof Techno-Commercial Bid & PriceBid. तकनीकी-वाणिज्यिक बोली और मूल्य बोली जमा करने के लिए ऑनलाइन ई-निविदा बंद करने की तिथि	**30.03.2023(Up to 15:00 hrs.)**
i.Date & time of opening of Techno-Commercial Bid and Price Bid. तकनीकी-वाणिज्यिक बोली और मूल्य बोली खोलने की तिथि और समय।	**31.03.2023 (After 14:00 hrs) (The Techno Commercial Part and Price Part will be opened on that date)**

Note: In the event of any unforeseen closure of work / holiday on any of the above days, the samewill be opened / held on the next working day without any further notice.

List of Annexures

Important Instructions for E- procurement : - Annexure - A
Commercial Terms & Conditions : - Annexure - B
Techno Commercial Bid : - Annexure - C
List of Scanned Documents required to be uploaded: - Annexure – D(Document consisting Annexure A to Annexure D To be treated as Techno Commercial Part)
Price Bid (Financial Part) : - Annexure – E(Both the Techno Commercial Part & Financial Part will be uploaded separately & will be available both in the SMPK website& Enivida Portal)
General Conditions of Contract : - Annexure – F

Chief Engineer
Civil Engineering Department
SYAMA PRASAD MOOKERJEE PORT, KOLKATA
Tender Inviting Authority

ANNEXURE-A

Important Instructions for e-Tender

Bids are invited from the shortlisted bidders for this work

Shortlisted Bidders are requested to use internet Browsers Firefox version below 50 / Internet Explorerversion 8 or above, and Java 8 Update 151 or 161.
Further, bidders are requested to go through the following information and instructions available on the Enivida Portal **https://kopt.enivida.in** before responding to this e-tender:

- Bidders Manual Kit
- Help for Contractors
- FAQ

Contact Persons (Syama Prasad Mookerjee Port, Kolkata):

1. P.P.Datta, Manager, Environment
2. Commander P.Maitra (HOC)
3. S.K.Halder, Superintending Engineer (Contract)

3. S.Das ,Engineer (c) M.-98306218

Phone no.: **9836298**92,**03371012486, 03371012398**

E-mail IDs : - partha@kolkataporttrust.gov.in
sk.halder@kolkataporttrust.gov.in &

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Contact persons (Enivida Portal):

Phone No.7278929467/8448288981

E-Mail IDs: - enividahelpdesk@gmail.com/ ewizardkumar@gmail.com

1	All entries in the tender should be entered in online Technical & Commercial Formats without any ambiguity.
2	E-tender cannot be accessed after the due date and time mentioned in NIT.
3	SMPK reserves the right to cancel or reject or accept or withdraw or extend the tender in full or part as the case may be without assigning any reason thereof.
4	Any order resulting from this tender shall be governed by the terms and conditions mentioned therein.
5	No deviation to the technical and commercial terms & conditions are allowed.
6	The bidders must upload all the documents required as per terms of tender. Any other document uploaded which is not required as per the terms of the tender shall not be considered.
7	The bid will be evaluated based on the filled-in technical & commercial formats.
8	Bidder has fully read and understood the entire Tender Document, GCC, Corrigendum and Addenda, if any downloaded from under the instant e-tender and no other source, and will comply to the said document, GCC, Corrigendum and Addendum. **A declaration in this regard is to be made by the bidder.**
9	(A) Tender will be opened electronically on specified date and time as mentioned in the NIT. Bidders can witness electronic opening of Bid. (B) Necessary addendum/corrigendum (if any) of the tender would only be hoisted in the **Enivida Portal**.

Annexure –B

SYAMA PRASAD MOOKERJEE PORT, KOLKATA
Civil Engineering Department
6, Fairlie Place, Fairlie WareHouse , 2 nd floor ,
Kolkata 700 001.
Tele – 033 2230-3451 Extension: 398,399,400
Fax - (033) 2230-0413
E-mail id: partha@kolkataporttrust.gov.in &
sk.halder@kolkataporttrust.gov.in

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3.0 Commercial Terms & Conditions

SL. NO.	TERMS
1	Mere participation in e-tender will not mean that a particular bidder will be automatically considered qualified and their bids will be entertained. Such qualification will be reviewed atthe time of techno-commercial evaluation of bids also.
2	Copy of valid NSIC Certificate or MSME Certificate under **MSME** has to be submitted alongwith the bid.
3	EARNEST MONEY:**.** As Per NIT
4	E-Tenderers submitted without requisite Earnest Money are liable to be rejected excepting in case of Micro & Small Enterprises (MSEs) registered with NSIC (under single point registration scheme) or MSME for items for which the tender is invited.
5	SCOPE OF WORK: **As per E-Tender Document**
6	The Terms and Conditions of E-Tender shall be read in conjunction with the General Conditions of Contract, Specifications, Bill of Quantities and other documents forming partof this Contract wherever the Contract so requires.
7	The several documents forming the Contract shall be taken, as mutually explanatory to one another and in case of any discrepancies; the Bill of Quantities shall prevail over the Specifications and the Terms and Conditions over the General Conditions of Contract of SMP, Kolkata. In case of any dispute, question or difference either during the execution of the Contract or any other time as to any matter or thing connected with or arising out of this Contract, the decision of the Chief Engineer, SYAMA PRASAD MOOKERJEE PORT, KOLKATA, thereon shall be final and binding upon all parties.
8	The Contract will include the Client's Bid Documents with the General Conditions of Contractand the Bidder's Offer as finally accepted by the Client, together with Addenda, if there be any. Trustees' General Conditions of contract is the integral part of the tender / contract. The above-mentioned General Conditions of Contract may be inspected at the office of the undersigned on any working day before quoting for the Tender.
9	The Trustees are not bound to accept the lowest or any Tender and reserve the right to accept a tender in full or in part and / or reject a tender in full or in part without assigning any reason thereof.

10 The contract shall be governed by all relevant Indian Acts applicable only within the jurisdiction of the High Court at Calcutta.

11 Intending bidders must take into account any cost or expense incurred by them in connection with the preparation and submission of their bids or for any other expenses incurred in connection with such bidding.

12 Bidders are advised to visit the site of work prior to submission of their bid. Bidder shall get himself thoroughly familiarized with the site conditions, existing road facilities for carrying materials etc. before submission of the e-tender. He may contact the Chief Hydraographer (I/C)/**M a n a g e r , E n v i r o n m e n t** or his authorized representative at his office at 15, Strand Road, Kolkata 700001 in this regard. Non-compliance of the same will in no way relieve the successful bidder of any of his obligations in performing the work in accordance with this Bid Document within the quoted price.

13 VALIDITY: -

The tender shall remain open for acceptance for a period of **4 months** from the date of opening of techno-commercial bid.

If before expiry of this validity period, the Bidder amends his quoted rates or tender, making them unacceptable to the Trustees and / or withdraws his tender, the Earnest Money depos**it**ed shall be liable to forfeiture at the option of the Trustees / sanctioning Authority.

14 NON- RESPONSIVE BIDDER: -

The offer/tender shall be treated as non-responsive, if it:

(i) is not accompanied by requisite Earnest Money /valid NSIC Registration Certificate /MSME Registration Certificate.

(ii) is not accompanied by requisite tender paper cost / or valid NSIC/MSME Registration Certificate.

(iii) validity of the offer is less than tender stipulation,

(iv) does not meet the Qualification Criteria as stipulated in the NIT.

(v) The bidder submits conditional offer / impose own terms and conditions / does not accept tender conditions completely/offer or tender if submitted with any deviation from the tender terms & conditions.

In addition to above, a bidder may be disqualified if –

a) The bidder provides misleading or false information in the statements and documents submitted.

b) Record of unsatisfactory performance during the last seven years, such as abandoning of work or rescinding of contract for which the reasons are attributable to the non-performance of the contractor or inordinate delays in completion or financial bankruptcy etc.

The decision of Syama Prasad Mookerjee Port, Kolkata in this regard shall be final and binding on the Bidder.

Offer / tender is submitted with any deviation from the tender terms & conditions.

15 EARNEST MONEY AND SECURITY DEPOSIT: - : As per tender Document

16. PERFORMANCE GUARANTEE:- Not Applicable

17 In the event of the successful bidder fails to execute the order within the stipulated delivery period without sufficient reasons acceptable to the Trustees, the Security Deposit may be forfeited and the order be cancelled at the option of the Trustees' **apart from other actions**.

18 PRICES: - As per BOQ given in the tender document.

19 The bidder shall quote his price as per the Bill of Quantities in the Price bid

20 Orders may be placed in full/part to the lowest bidder.

21 Price(s) to be quoted should remain firm over the contract period.

22 **The prices quoted shall be including all statutory levies excluding GST, which shall be paid extra.**

23 EVALUATION CRITERIA: As per relevant clause of Tender document.

24 PAYMENT: - As per Tender document.

25 LOCATION: As per Tender document.

26 TIME OF COMPLETION: As per Tender document.

27 Work is to be carried out as per terms & condition of the contract document.

28 JURISDICTION OF COURT: -
The contract shall be governed by all relevant Indian Acts applicable within the jurisdiction of Kolkata.

29 PERSONAL PROTECTIVE EQUIPMENT (PPE): -
Contractor and their workmen including driver & helper must use PPE i.e. safety helmet etc. at the time of work inside the dock premises. For safety measure Cl. No.25, page-23 may be referred to.

30 Compensation (Liquidated Damages) against failure to complete the work within the stipulated time as per tender condition.

31 PRICE ADJUSTMENT CLAUSE: As per Tender document.

32 TECHNICAL CAPACITY: As stipulated in Tender document.

33 FINANCIAL CAPACITY: As stipulated in Tender document.

34. DOCK PERMITS: As per tender document.

35. The bidder may offer a Bank Guarantee in the Trustees' specified proforma from any Scheduled/ Nationalized Bank of India having Branch at Kolkata in lieu of Earnest Money /Security Deposit beyond **Rupees 10 (Ten) lakhs**.

Besides the above conditions all other conditions as stated in the NIT, BOQ, Special Conditions of Contract, Instruction to the tenderers, G.C.C. shall have to be agreed by the Bidders.

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Annexure –C

Syama Prasad Mookerjee Port, Kolkata

CIVIL ENGINEERING DEPARTMENT

6, Farlie Place , Fairlie Warehouse,2nd Floor

Kolkata – 700001

NIT No.: **SMPK/KDS/CIV /T/2746/18** DT. 16**.03.2023**

NOTE: Last Date of **Download** of tender documents : **30.03.2023 (up to 14.00 hours)**

Tender is due for submission by **15.00 Hrs.** On **30.03.2023**
Tender is due to open after 14.00 Hrs. On **31.03.2023**

Techno Commercial Bid

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रैपिड ईआईए अध्ययन, गुवाहाटी, असम में ब्रह्मपुत्र रिवरसाइड और ताप्ती नदी, सूरत हब, गुजरात में समुद्री विमान संचालन के लिए जल एयरोड्रम के निर्माण के लिए ईआईए रिपोर्ट और पर्यावरण मंजूरी की तैयारी ”

Limited TENDER FOR “Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat”

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SHORT TENDER NOTICE

Limited E-Tender is invited from the Shortlisted reliable, bonafide & experienced agency with required experience as perPre-Qualification Criteria stipulated in Tender Document for the following work at Syama Prasad Mookerjee Port, Kolkata.

Name of work कार्य का नाम	:	**Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat"**
NIT No एनआईटी नंबर	:	**SMPK/KDS/CIV /T/2746/18 DT. 16.03.2023**
Estimated Cost अनुमानित लाग	:	**NA**
Period of Execution निष्पादन की अवधि	:	**6 (Six) Months**.
EMD (Earnest Money Deposit)/Bid Security ईएमडी (बयाना राशि जमा)/बोली सुरक्ष	:	**Rs. 1,80,000/- (Rupees one lakh eighty thousand only)** payable through DD / RTGS / NEFT to be transferred on **A/C:** Syama Prasad Mookerjee Port, Kolkata
Period of Download ofE-Tender (Both Days Inclusive) ई-निविदा के डाउनलोड की अवधि (दोनों दिन सम्मिलित)	:	**17.03.2023 to 30.03.2023 (UPTO 14:00 hrs.)** (Bid document will be available on website **https://kopt.enivida.in**). Bidders will have to participate in bidding process through website **https://kopt.enivida.in/**) only.
Date and Time for pre-bidmeeting & site visit प्री-बिड मीटिंग और साइट विज़िट के लिए दिनांक और समय	:	**No Pre-Bid Meeting**
Last date of submission of e-tender and opening of the tender ई-निविदा जमा करने और निविदा खोलने की अंतिम तिथि	:	**Submission on 30.03.2023 Up to 15:00 hrs.** **Opening on 31.03.2023 after 14:00 hrs. (Techno Commercial Part AND Price Part will be opened on the date)**

Cost of Tender Document (Non-refundable) निविदा दस्तावेज की लागत (अप्रतिदेय)	:	**Rs.1770/-(Rupees one thousand seven hundred and seventy only)including @18% GST)** payable through DD / RTGS / NEFT to be transferred on **A/C:** Syama Prasad Mookerjee Port, Kolkata

Contact Person. संपर्क व्यक्ति।	:	**P.P.Datta, Manager(Env)** **S.K.Halder, Superintending Engineer** **S.Das, Engineer, Contract** **9836298692, 96747 20075,03371012486, 03371012366**

4.0: INSTRUCTIONS TO BIDDER

Limited TENDER FOR "Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat"

NIT NO: SMPK/KDS/CIV /T/2746/18 DT. 16**.03.2023**

1.0 GENERAL

The work as described in the tender shall be executed in Kolkata and in accordance with the attached General Conditions of Contract, Special Conditions of Contract, Particular Specifications, and Drawings (if any) & detailed Bill of Quantities. Location Plan of the place of work might be inspected at the office of the **Manager, Environment** on any working day before quoting for the tender.

Cost of tender paper and EMD are to be physically deposited at the office of Chief Engineer at 15, Strand Road, Kolkata-700 001 by vendors/contractors through Bank Draft/Banker's Cheque/Demand Draft/Pay Order etc. On any scheduled/nationalised Bank, in favour of Syama Prasad Mookerjee Port, Kolkata, payable at Kolkata, within 3 working days after opening oftender.

Details of cost of e-tender paper remitted should be entered by the participating vendor/contractor in the space provided in the e-tender as indicated hereunder:

a) Name of remitting vendor/contractor :
b) Tender No. :
c) Amount remitted :
d) Date of remittance :
e) Bank Draft / Cheque No. :

Details of Earnest money remitted should be entered by the participating vendor/contractor in the space provided in the e-tender as indicated hereunder:

a) Name of remitting vendor/contractor :
b) Tender No. :
c) Amount remitted :
d) Date of remittance :
e) Bank Draft / Cheque No.

Tender submitted without requisite cost of tender paper will be liable for rejection.

MODE OF SUBMISSION OF BID:

All bidders must submit their offers through e- tendering in accordance with the terms and conditions set out in the bid documents and no deviation will be accepted.

A Bid shall contain the following scanned copies of which are to be uploaded (Refer AnnexureD):-

i) GST registration certificate.

ii) a) Valid Trade License (Valid for current period & also for type of work).

iii) Valid Professional Tax Clearance Certificate / Up to date tax payment challan If this is not applicable, the bidder must submit a declaration in this regard.

iv) Proof of possessing valid Employees' Provident Fund (EPF) Account. EPF Registration Certificate.

v) Proof of being registered with Employees' State Insurance Corporation (ESIC), ESI Registration Certificate.

vi) Details of the firm as per Schedule-O (in Part-I) of the tender document duly filled up.

vii) Credentials in the form of copies of Letters of Award of Works along with corresponding/successful Completion Certificates from owners to justify that the intending bidder satisfies the earlier mentioned pre-qualification criteria.

viii) Last three years balance sheet and profit & loss account in support of Annual Financial turnover **(i.e. 2019 –20, 2020-21 and 2021-2**2). **The same should be audited as per relevant norms wherever required along with UDIN of the Auditor.**

ix) PAN Card

x) Bank Draft/ Pay order / Bank Transfer Details etc. regarding Cost of EMD and cost of Tenderdocuments/valid NSIC certificate/MSME Certificate .

xi) A list of technically qualified and skilled persons would be engaged to supervise and execute the work.

xii) Self declaration of the bidder that the Bidding Firm has Not been debarred / de-listed by any Govt / Quasi Govt. / Public Sector undertaking in India (**to be mentioned in the letter head of the Firm**).

xiii) Self-declaration regarding the proprietor/partner(s)/authorized signatory of the bidding firm (in the case of proprietorship firm /partnership firm /limited company, as the case may be) is/are not associated with any other firm bidding for the same work (**to be mentioned in the letter head of the Firm**).

xiv) A list of works which are in hand at the time of submitting the offer as per the enclosed proforma titled 'Concurrent Commitments of The Bidder' vide 'Schedule –T' in Part-I of the tender document.

xv) Undertaking of the tenderer to be submitted as per enclosed Pro-forma (ANNEXURE –D-1) in lieu of submission of signed copies of the full Tender document, G.C.C, addenda & corrigendum **in the letter head of the Firm.**

xvi) Last page of "Bill of Quantities" & the "Form of Tender" duly filled up (without price quoted) shall be duly signed and stamped by the Bidder.

N. B.-1 The bidder will have to produce the original documents or any additional documents, if asked for, to satisfy the Authorities for clarification of his documents or credibility.

N.B.-2 Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have made misleading or false representations in the forms, statements

and attachments submitted in proof of the qualification requirements and their EMD will be Forfeited for such action.

All the bidders should submit the e-tender in accordance with the Mode of submissionof Bid as afore-said.

SECURITY DEPOSIT: -

For the successful Bidder, the Security Deposit will be recovered from the contractors each and every On-Account Bill [including the final bill, if necessary] at the percentage of each such bills as set forth in **Clause. 3.4, 3.5 & 3.6 of the General Conditionsof Contract.**

Refund of S.D. and forfeiture S.D. shall be guided by Cl. 3.5 (i) & (ii) of the G.C.C**.**

5.0 Delay/ Extension of time/ Liquidated Damage/ Termination of Contract.

Clause 8.0 of G.C.C. to be referred regarding Delay/ Extension of time/ Liquidated Damage/Termination of Contract.

6.0 REFUND OF EARNEST MONEY: - The Earnest Money received, will be refunded or released as the case may be to the unsuccessful Bidders without any interest after opening of Price bid (Part – II) of the manual tender document.

7.0 VALIDITY OF OFFER: -

The e-tender shall remain valid for a period of **4 (four) months** from the date of opening the same. If before expiry of this validity period, the Bidder amends his quoted rates or tender, making them unacceptable to the Trustees and / or withdraws his e-tender, the Earnest Money deposited shall be liable to forfeiture at the option of the Trustees/ Sanctioning Authority/Engineer.

DETAILED SCRUTINY OF E-TENDERERS:

During the course of examination of Part-I of the bid, the bidders, if asked for, shall furnish any or additional document(s) for the purpose of evaluation of his / their bids.

9.0

During Techno-Commercial Evaluation, i.e. evaluation of Part-I of tender, an offer shall beconsidered non-responsive in case it: -

(i) is not accompanied by requisite Earnest Money /valid NSIC Registration Certificate /MSME Registration Certificate.

(ii) is not accompanied by requisite tender paper cost / or valid NSIC/MSME RegistrationCertificate.

(iii) validity of the offer is less than tender stipulation,

(iv) does not meet the Qualification Criteria as stipulated in the NIT.

(v) The bidder submits conditional offer / impose own terms and conditions / does not accept tender conditions completely/offer or tender if submitted with any deviation from the tender terms & conditions.

a) The bidder provides misleading or false information in the statements and documentssubmitted.

b) Record of unsatisfactory performance during the last seven years, such as abandoning

of work or rescinding of contract for which the reasons are attributable to the non-performance of the contractor or inordinate delays in completion or financial bankruptcy etc.

The decision of Syama Prasad Mookerjee port, Kolkata in this regard shall be final and binding On the Bidder.

10. An amount of **Cess** calculated at the rate of **1% of the billed amount** shall be progressively recovered from each running bill as well as from the final bill of the contractor for onward transmission of the same by the appropriate authority statutory deductions will also be made as applicable at the time of payment.

11. For **Micro & Small Enterprises (MSEs) registered with NSIC & or MSME: -**

Micro & Small Enterprises (MSEs) registered with NSIC (under single point registration scheme) **or MSME** are exempted from depositing Cost of Tender Document.
If Micro & Small Enterprises (MSEs) registered with **NSIC or MSME** intends to participate inthe tender, for the items they are not registered with NSIC OR MSME , then they will have to deposit cost ofTender Document, as per NIT. **Otherwise their offer will not be considered**.
Copy of valid NSIC Certificate for MSEs has to be submitted along with bid.

EVALUATION CRITERIA: -

During evaluation of Part-II i.e. Price Part, provided that the bidder submits his offer following e-tender stipulations & specifications, the overall lowest offer received shall be considered for acceptance by the Trustees.

ACCEPTANCE OF TENDER: -

Syama Prasad Mookerjee Port, Kolkata reserves the right to accept / reject any / all offer(s) without assigning any reason thereof and also reserve the right to accept the tender in part or as a whole.
Any attempt to exercise undue influence in the matter of acceptance of Tender is strictly prohibited and any Tenderer who resorts to this will render his tender liable to rejection.

The successful Tenderer will be notified in writing of the acceptance of his tender. The "Tenderer" then becomes the "Contractor" and he shall forthwith take steps to execute the Contract Agreement within six weeks of issue of Letter Of acceptance and fulfil all his obligations as required by the Contract.

14.0 MISCELLANEOUS:

i) Bidder shall submit his offer for complete scope of work, strictly in accordance with the tender documents. Any deviation from the tender documents and / or any incomplete tender shall not be considered.

ii) The bidder shall not impose his own terms & conditions in his offer or quote his rates based on his own terms and conditions, such E-Tenderers are liable to rejection at the option of the Trustees without further reference to the bidder.

All materials shall have to be procured by the successful Bidder and shall be of the best and approved quality conforming to relevant specifications. The successful Bidder shall also arrange for the supply of all labour, tools and plants as stipulated in the Special Conditions of Contract,

iii) required for efficient execution of the work.

iv) All measuring units are in Metric System and rates and sums in the tender are in Indian currency. The language used throughout shall be in English.

v) The Tender Documents with all the enclosures, appendices, Abstract Form of Tender and Form of Tender shall be required to be complete, duly filled in and signed and uploaded.

vi)Enlisted/registered contractor of SMPK will get the benefit of exemption of deposition of Earnest Money **up to the prescribed limit**. They are to upload the scan copy of the original T.R. issued to them by SMPK during registration to SMPK relating to **Permanent Security Deposit**.

vii) The Bidder shall give a declaration about the names of their relations employed in Syama Prasad Mookerjee Port, Kolkata. It is not the intention to debar the Contractors from working if their relatives are working in SMPK, but such a declaration is necessary in the interest of Trustees against any possible lapses.

5.0: SPECIAL CONDITIONS OF CONTRACT

Limited E-TENDER FOR "Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat"

1. GENERAL:

Sealed offers are invited from bonafide, resourceful ,experienced as per following pre-qualification criteria in accordance with this notice inviting tender, General Condition of Contract, enclosed instruction to the bidders, Special Condition of Contract and Bill of Quantities for the above stated work.

These provisions though given in a separate section are part of the tender documents which must be read as a whole, the various sections being complementary to one another and are to be taken as mutually explanatory. These provisions shall be read in conjunction with the other parts of the tender documents viz. General Conditions of Contract, Notice Inviting E-Tenders, and Instructions to Bidder, Particular Specifications, Drawings, Bill of Quantities and other documents forming part of the Contract. In case of any discrepancy or ambiguity in the documents, the order of precedence of the documents as stated below will apply. In particular, these provisions will over ride those in the General Conditions provided there is discrepancy between them.

2. CORRELATION AND ORDER OF PRECEDENCE OF TENDER DOCUMENTS:

If the stipulations in the various tender documents be found to be at variance in any respect, one will override others (but only to the extent these are at variance) in the order of precedence as given in the list below, i.e. any particular item in the list will take precedence over all those placed lower down in the list.

(a) Order letter.
(b) Bill of Quantities.
(c) Drawings.
(d) Particular Specifications of work.
(e) Special Conditions of Contract.
(f) General Conditions of Contract.

In case of any dispute, question or difference either during the execution of the work or any other time as to any matter or thing connected with or arising out of this Contract, the decision of the Chief Engineer, Syama Prasad Mookerjee Port, Kolkata, thereon shall be final and binding upon all parties.

The execution of work shall conform minutely to the approved & assigned drawings & specification & any other details drawings which shall be provided /duly approved by the Engineer during the progress of the work as to such other drawings those have formed part of the contract documents.

3. PRE-QUALIFICATION CRITERIA FOR BIDDERS: -

The Bidder /Consultant must have accreditation as EIA Consultant for Port, Harbour and Dredging works under 7(e) category of EIA Notification 2006 and amendment thereof. The work experience should cover successful completion of Consultancy work for EIA study, preparation of EIA and EMP Report in connection with Environmental Clearance for different Projects

during last 7 (seven) years ending last day of month previous to the one in which applications are invited should be either of the following:

The Tenderer shall have to furnish documents (certified copy), viz. order letter and proofof execution(Completion) to establish his credentials.

(i) **Either 03 (Three)** completed works each costing not less than Rs. **36,00,000.00.**
Or (ii) 02 (Two) completed works each costing not less than Rs. **45,00,000.00**
Or (iii) 01 (One) completed work costing not less Rs. **72,00,000.00**

ii) The Average Annual Financial Turnover of the bidding firm during the **last three years**, ending on **31-03-2022,** should be at least Rs. **27,00,000.00. The same should be audited as per relevant norms wherever required along with UDIN of the Auditor**

4. SCOPE OF WORK:

TERMS OF REFERENCE FOR SEEKING QUOTATION FROM THE SHORTLISTED EIA CONSULTANTS.

A. Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam.

Scope of Work:

1. Actions relating to online application including draft ToR for submission to the State EIA Authority, Govt. of Assam.
2. All services related to presentation before the Expert Appraisal Committee.(EAC).
3. EIA Study based on the approved ToR.
4. Collection of real time baseline date of one season data (except rainy season).
5. Testing of samples in CPCB/SPCB recognized laboratory.
6. All special studies as per the standard ToR for port and harbour are to be carried out by the consultant.
7. Any special study beyond the standard ToR for Port & Harbour as per requirement arising out of approved ToR by concerned EIA authority will be payable extra.
8. The EIA consultant will engage separate renowned institutions for conducting special studies, if required.
9. Assistance for conducting public hearing as per ToR condition. All necessary arrangements are to be made by the EIA consultant.
10. Preparation of power point presentation as per requirement.
11. Preparation of draft EIA report as per EIA notification 2006 and amendment thereof.
12. The total EIA & EMP report is to be carried out as per EIA Notification 2006 &amendment thereof.
13. Assistance to the SMP, Kolkata (Project Proponent) for presentation before the EAC for final environmental clearance (EC).
14. All equipments deployed at site are to be properly calibrated and certified by the issuing authority.
15. Cost towards public hearing is to be quoted separately as additional cost.
16. The selected EIA consultant will undertake visit to the site and will arrange for site meeting with the SMP, Kolkata officials immediately after receiving the work order.
17. All expenses towards travel and accommodation undertaken by the consultant relating to site visit, meeting with the SMP, Kolkata officials at their office at Kolkata, physical presentation to the EAC and other related requirement are to be taken into account in the quoted rate.
18. A copy of Obstacle Limitation Surface (OLS) survey as approved by Civil Aviation Authority will be provided. A copy of bathymetry study will also be provided. No further study in this regard is

envisaged.
19. The consultant will provide hard copy to SMP, Kolkata (Project Proponent) as per requirement. Quoted price should include all stationary charges.
20. Selected EIA Consultant will engage one expert having knowledge in EC for Airport projects.
21. Al the above conditions are based on the assumption that EC will be cleared by the Department of Environment, Govt. of Assam. If same is referred to MoEF&CC, the same terms and conditions will prevail. For this no extra claim will be entertained.
22. Quotation should contain separate cost for services related to (a)Environmental Clearance,(b)additional cost for Public Hearing.

B. Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations on River Tapti,Surat Hub,Gujrat.

1. Conditions are same from serial No. 1 to 20.
21. Al the above conditions are based on the assumption that EC will be cleared by the Department of Environment, Govt. of Gujrat. If same is referred to MoEF&CC, the same terms and conditions will prevail. For this no extra claim will be entertained.
22. For CRZ clearance, necessary work is to be carried out as per CRZ notification, 2011 or amendment thereof.
23. For CRZ clearance, necessary expenses for preparation of CRZ mapping and report through accredited agencies are to be taken into account. No separate payment will be paid in this regard.
24. Superimposition of the project layout in the CRZ map is to be carried out.
25. Preparation of power point presentation for obtaining recommendation from the Department of Environment, Govt. of Gujrat and for final presentation at MoEF&CC
26 . Participation & assistance during final presentation at MoEF&CC.
27. The consultant will provide hard copy to SMP, Kolkata (Project Proponent) as per requirement. Quoted price should include all stationary charges.
28. Quotation should contain separate cost for services related to **(a**) Preparation of EIA Report & clerarence ,(b)additional cost for Public Hearing, (c) additional cost for CRZ clearance.

C.TERMS OF PAYMENT:

1. 10% excluding GST on submission of online application on quoted price of (a).
2. 15% excluding GST after approved ToR is issued on quoted price of (a)
3. 45% excluding GST after submission of draft EIA report and CRZ report as applicable.
4. In case of public hearing, 35% will be paid on the quoted price of (b) before public hearing and 35% on quoted price of (b) will be paid after conducting the public hearing.
5. 20% excluding GST on quoted price of (a),(b),(c) after presentation to the EAC.
6. 10% excluding GST after obtaining EC plus CRZ clearance as applicable.
7. GST will be payable extra.

The work also includes all appurtenant works as described and set forth in **Bill of Quantities**, **Special Conditions of Contract, Technical Specification of works, Specification for materials & workmanship** with all additional or varied works which may thereafter be required in accordance with **Clause 7 of General Conditions of Contract** and as per direction and up to satisfaction of the Engineer.
The intending renderer shall inspect the site of work both at Kolkata Dock System (KDS. in consultation with the **CH(I/C)/Manager(Environment) /OSD (Environment)** and acquaint them self with the nature of work before preparing his bid. Their attention is drawn to **Clause No. 3.1** of the General Conditions of Contract in this regard. No excuse on ignorance as to the site conditions, availability of space for storing materials and approaches to site etc., will be entertained.
Unless otherwise specified, the work to be provided for by the consultant shall include but not be limited to the following:-

a) Provide all materials, supervision, services, tools and plants, transportation, necessary approaches, temporary fencing and temporary lighting as required for safety and work purposes etc.

b) Prepare and submit hard copy & soft copy of quarterly report for review and assessment.

c) The quoted price to include all necessary stationary charges, journey to site, collection of samples, testing & other ancillary charges except GST..

d) Prepare and submit for review and assessment to the Engineer how the work is actually going to be done.

e) The Contractor shall at all time carry out work in a manner creating least interference to existing services while consistent with the satisfactory execution of the same. The Contractor shall execute the work in accordance with the direction of the Engineer-In-Charge and maintain during the execution of the work, a passage for traffic along a part of the existing carriage way.

5.0 Location of the Project : The coverage area of Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat..

6.0 ACCESS TO THE SITE:

A) By Road: Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat..

6) Work Site:

The work site is located within Kolkata Dock System consisting of Kidderpore Dock,Netaji Subhas Dock & surrounding area **under** Syama Prasad Mookerjee Port, Kolkata**.** Tenderer must visit the work site and its surrounding before submission of the tender, so that due consideration is given to the local conditions at site. The intending tenderer should contact **CH(I/C),Manager(Environment) /OSD (Environment) at 15, Strand Road OR AT 6, Fairlie Place , Kolkata -700001 t**o make the site inspection along with his representative.

7. INSPECTION OF SITE:

The Bidder shall inspect the site of work and thoroughly familiarise himself with the nature of work, site conditions, and access to the site and location before submission of the tender. He should contact **CH(I/C),Manager(Environment) /OSD (Environment) at 15, Strand Road OR AT 6, Fairlie Place , Kolkata -700001 for** collecting information about the site before submission of the tender. No excuse will be entertained afterwards on the above ground. In case any part of the site cannot be handed over to the successful Bidder in time, no compensation for loss of labour or any other cause nor any claim will be entertained by the Trustees. Suitable extension of time shall, however, be granted to the successful Bidder on that ground if applied for.

8. SITE CONDITIONS & METHOD OF WORK:

The work shall have to be executed within Kolkata Dock system consisting of Kidderpore Dock, Netaji Subhas Dock & surrounding area **under Syama Prasad Mookerjee Port, Kolkata** as detailed in the Scope of Work & B.O.Q.

The contractor shall take adequate measures so as to execute the work with due regard to the above. The cost of which shall have to be included in the quoted rates.
Further, if so required by the Engineer in the interests of normal working of the Port, if it is found necessary to shift / suspend some construction activity for some duration, this shall be done in compliance with the instructions of the Engineer and as per relevant clause of the G.C.C. The bidder shall consider all the above points while quoting as no separate claim for idle charges towards labour, material will be considered for payment.

Proper care should be taken to provide adequate protection to the existing structures and cables (telephone, computer, etc) all such installations against any damage at the Contractor's risk and expense. Any damage / defect to existing structures arising due to the faulty execution of the work shall have to be rectified forthwith as directed to the satisfaction of the Engineer, without charging extra.

9.TIME OF COMPLETION

The work is urgent in nature and must be commenced immediately on receipt of the work order and to be completed in all respects within **6 (Six) Months,** including preliminary time from the date of placement of work order.

10.SUFFICIENCY OF TENDER:

i) The tender drawings and all data / information as furnished herein or inspected and / or collected by the tenderer for the purpose of the work should be properly assessed, interpolated or utilised in his offer at his own responsibility and SMPK does not guarantee sufficiency or adequacy of the data / information so supplied to him or collected or understood by the tenderer.

ii) The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates stated in the pricedBill of Quantities and the rates shall cover all his obligations under the contract and all matters and things necessary for the proper construction, completion, commissioning and maintenance of the work.

iii) In case rate of particular item is printed erroneously in B.O.Q., the rate stated in the schedule of rates will prevail over the rate misprinted in B.O.Q.

11. ACCESSIBILITY FOR CHECKING AND SUPERVISION.

The engaged Contractor is to provide necessary arrangement for free access to the SMPK officer's and personnel for supervision and checking of the subject work at his own cost.

12. PROGRAMME AND PROGRESS:

The contractor shall submit a detailed **programme of work** within **7 [seven] days** from the date of Work Order / L.O.I. showing the commencement, duration and completion time of all major items of work including procurement of all materials etc. The sequence of work shown in the programme must be practicable and compatible with technical specifications and conditions prevailing at site.

The contractor shall maintain the progress of work as per the approved programme. In case of any slippage of programme the engineer may require the contractor to augment the input of plant, equipment, labour of any item as he may deem fit. The contractor shall comply with the engineer's directive in this regard, without any extra charge whatsoever.

In case of delays caused due to conditions or circumstances beyond the control of the contractor, the delays must individually be informed to the Engineer forthwith in writing and his acceptance in writing obtained.

13. RESPONSIBILITY OF THE CONTRACTOR FOR METHODOLOGY OF WORKS:

i) The Contractor shall be solely responsible for the methodology and detailed working for the whole of the works, keeping in mind the site conditions and shall supply to the Engineer such particulars thereof as he may require from time to time.

ii) The Contractor shall submit within the time stipulated by the Engineer in writing, the details of actual methods/Scheme that would be adopted by the Contractor for the execution of each item of the work supported by necessary details.

iii) Approval, for the Drawings and sketches, if necessary including those of the plant and machinery that would be used, their locations, arrangements for conveying and handling materials etc., should be obtained from the Engineer well in advance for starting each item of work. The Engineer reserves the right to suggest modifications or make concrete changes in the methods proposed by the Contractor whether accepted previously or not at any stage of the work, to obtain the desired accuracy, quality and progress of the work, which will be final and binding on the Contractor.

14. MATERIALS:

It will be the responsibility of the contractor to make timely procurement of all materials for both temporary and permanent works required in accordance with the Bill of Quantities or for any extra/additional work required as per the directions of the Engineer. The contractor shall procure cement, reinforcement steel and other materials from manufacturers approved by the Engineer-In-Charge.

The contractor will be allowed to take away surplus materials on completion of the work, subject to Engineer's verification of contractor's records of entry and consumption of materials in the works.

15. QUALITY CONTROL:

Quality control is an essential part in the construction of and must be based on proper objective and qualitative measurement. The Contractor will have the full responsibility for quality control and delivering the acceptable quality in the field. Regular appraisal of the quality control to the Engineer should be made for effecting improvements in the construction techniques to ensure satisfactory quality of work. The quality control function shall include but not be limited to the following items.

16.SAMPLING AND TESTING OF CONSTRUCTION MATERIALS:

Essentially to be carried out on the materials brought to site for construction work unless permitted otherwise by the Engineer. The Contractor shall undertake all field tests and laboratory tests for all such materials and workmanships as directed by the Engineer or his representative at his own cost. The samples shall be taken for test jointly by the representatives of the Engineer and the contractor at the worksite and tested /sent to a Govt. registered laboratory or Institutional laboratory as may be decided by the Engineer for testing. In case of field test, the contractor shall undertake the test by his own testing equipments or by any approved agency in presence of the representatives of the Engineer and the contractor at the worksite. All the testing charges and all incidental charges like packaging and transporting the test samples, equipments etc. shall be borne by the Contractor.

17.SPECIFICATIONS/ CODES AND STANDARDS:

All works under this contract will be executed according to the Trustees' Specification for works. Whenever the details are not specifically covered in the specifications, relevant provisions in the latest revision and/ or replacements of the Indian Standard Specifications (IS) or any other International Code of Practice/ CPWD specifications will be followed. The Contractor shall have to procure copies of such codes/ standards for ready reference of his own personnel as well as the Engineer or his representative at site at his own cost and without any additional reimbursement.

19.TEMPORARY WORKS:

The successful tenderer shall allow for providing labour and materials for the construction and removal of all temporary works, e.g. site office, site store, scaffolding, fencing lighting; watching, tube well and pipe lines etc. required for constructional purpose as well as for drinking water purpose of contractor's men, water supply, vats, platform, etc. as may be necessary for the successful execution, completion and maintenance of works without any extra cost to the Trustees and the rates should be quoted accordingly. No rent shall, however, be charged to the contractor for construction/erection of such temporary sheds and structures.

20. PLANT & CONSTRUCTIONAL EQUIPMENT

The contractor shall supply his tools, plants and constructional equipments within his quoted rates. A list of plant as intended to be employed by the tenderers in this construction must be furnished with full details along with the tender.

21. CONTRACT PRICE:

The **"Contract Price"** for this contract means the sum named in the tender subject to such additions thereto, deductions there from or reductions due to supply of any materials by the Trustees' as provided for in the Contract.

22. SETTING OUT OF WORK AND INITIAL MEASUREMENTS:

The Engineer shall provide the initial reference and Bench Mark for the setting out of work. It will be the contractor's responsibility to set out the work accurately and get them checked by the Engineer. The Contractor shall provide at his own expense all necessary instruments, staff and labour for the checking of the survey.

The Contractor shall be responsible for the true setting out of the work and for the correctness of all dimensions, levels, lines, positions and alignment. Any error in any part of the works shall be rectified by the Contractor at his own cost. The Contractor would set up inspection facilities at Site at his own cost.

23. FORWARDING OF MATERIALS:

The contractor shall have to arrange transport for forwarding any useable/ saleable materials that may be found during the process of execution of the work to the Trustees' Sales yard or any other site/ godown including labourers, transportation, loading, unloading all complete as per the direction ofthe Engineer or his representative at site. No separate payment will be made to the contractor on thisaccount unless specifically mentioned in the B.O.Q.

24. PARTICULARS OF EXISTING WORKS:

Such information as maybe given in the specification as to the existing features and works other than those now under construction as part of "Syama Prasad Mookerjee Port, Kolkata" given without warranty of accuracy and neither the Trustees nor the Engineer will be liable for any discrepancies therein.

25. SAFETY MEASURES:

The contractor shall adhere to safe construction practice, guard against hazardous and unsafe working conditions and follow all safety precautions for prevention of injury or accidents and safeguarding life and property. The contractor shall comply with relevant provisions of Dock Workers (Safety, Health and Welfare) Act – 1986 and Dock Workers (Safety, Health and Welfare) Regulation – 1990 and Safety Officer of the Trustees or Safety Inspectors shall be afforded all facilities for inspection of the works, tools, plant, machineries, equipments etc. wherever so required. The contractor shall further comply with any instruction issued by the Engineer, Trustees' Safety Officer, Safety Inspector in regards to safety which may relate to temporary, enabling or permanent works, working of tools, plants, machineries, equipments, means of access or any other aspect.

The contractor shall provide all necessary first aid measures, rescue and life-saving equipment to be available in proper condition.

The contractor shall provide PPE's (Personal Protective Equipments) such as, helmet, safety shoe etc. to all workers and shall also provide job specific PPE's e.g. safety belts for working at heights; protective face and eye shield, goggles, han2d7 gloves for welding / gas cutting works; protective Foot wear and gloves for hot works; facemasks, gloves and overalls for painting works, mixing and handling materials etc. as directed by the Engineer-In-Charge.

All safety rules shall be strictly followed while working on live electrical systems or installations as stipulated in the relevant safety codes.

Use of hoisting machines and tackles including their attachments, construction tools, machineries and equipments shall comply to the relevant safety codes.

Before allowing workers in sewers, manholes, any duct or covered channel etc, the manhole covers shall have to be kept open and ventilated at least one hour in advance and necessary safety torches / lamps should be inserted first before allowing entry to the worker. Suitable hand gloves and other safety gear will be provided to the worker during handling / removing of slushes / sludge etc. without any extra cost. The contractor shall adopt all the above safety measures at his own cost.

The successful bidder shall also ensure that –

(i) No damage is caused to plants and vegetations unless the same is required for execution of the project proper.

(ii) The work shall not pollute any source of water / land / air surrounding the work site so as to affect adversely the quality or appearance thereof or cause injury or death to animal and plant life.

(iii) His office & labour hutment etc. shall be maintained in a clean and hygienic condition throughout the period of their use and different effluents of the labour hutment shall have to be

disposed off suitably.

26. HOLIDAY OR SUNDAY WORK:

Subject to provisions in local Acts and any statutes of the State, the Contractor shall arrange for working on Holidays and Sundays whenever so desired by the Engineer to expedite progress and complete the works in time.

The Contractor shall not be entitled to any additional payment for taking up works on Holidays and Sundays. The Contractor should be prepared to resort to round-the-clock working by following shift timings for labour.

27. POWER SUPPLY:

If available and if required, suitable power supply may be arranged by the Trustees at the nearest existing supply point of the site of work on receipt of request letter from the Contractor to that effect. All necessary arrangements for the distribution at site will have to be made by the Contractor at his own cost as approved by the Trustees' Engineer or his representative.

Charges for consumption of power shall be periodically recovered from the Contractor's Bill at the rates of SMPK as prevalent amended from time to time including installation and hire charges for meters. The Trustees do not guarantee uninterrupted power supply from the above sources and Contractor shall not be compensated for any delay in providing / irregularity of power supply. The Contractor shall have to arrange for the supply of power at his own cost during such periods.

28. WATER:

The Contractor will arrange for supply of water both for drinking and for construction purposes. However, on written request from the Contractor, water for drinking purposes may be made available free of cost from the exiting water line of the Trustees at a point near the site of work. The contractor will have to arrange for laying pipelines, as necessary, as per approval of the Engineer or his representative, for storing and distributing the same to the work point at his own cost.

i) Under no circumstances, the contractor would be allowed to use such drinking water for constructional works.

ii) In any case Dock water will not be allowed to be used for any work including curing.

29. KEEPING THE SITE AND WORKING AREA CLEAR:

The Contractor shall at all times keep the site and working areas free from all surplus materials, rubbish and offensive matter all of which shall be disposed off in a manner to be approved by the Engineer's Representative.

30. PROTECTION OF EXISTING SERVICES:

The contractor must pay full attention to the fact that the existing service facilities for users are not distributed at any time due to storing of materials and rubbish and take every precaution to keep the entrance passage clear if the same are being used by the laborers.

The contractor shall be held liable for all damage and interference to the existing service, caused by him in execution of works. Should any damage be done to the existing services, in general, the contractor shall make good the same and any further work considered necessary by the Engineer's representative without any delay otherwise the cost of such repairing shall be recovered for his running bill for which Engineer's decision shall be final and binding.

31. CLEANING DURING EXECUTION AND AFTER COMPLETION:

On completion of the works the contractor shall reinstate and make good at his own expense any property or land which might have been disturbed and/or damaged by his works. He should also clean the site as required during execution and fully clear the site after completion of all the works.

The contractor shall forward any usable materials found during the course of construction at the work site or its vicinity to SMPK stores/yards, dispose off the debris beyond the port area all at his own expenses by his own transport and labour and clean out all part of the work and leave everything clean and tidy to the entire satisfaction of the Engineer, failing which suitable deduction will be made from final bill as per discretion of the Engineer/Engineer's representative.

32. METHOD OF MEASUREMENT:

Unless otherwise specified in the Particular Specifications and Bill of Quantities, the work shall be measured according to the current P.W.D.'s (Building, S&P & Road) Schedule of Rates (2014), Govt. of West Bengal and analysed rate. For details of measurement not covered by the above S.P.-27 1987 of B.I.S. shall be referred to.

33. ON ACCOUNT PAYMENT:

On account payment to the Contractor shall be arranged as and when required at the discretion of the Engineer on the basis of measurements of completed works at the quoted rates in the Bill of Quantities. The terms of payment shall be in accordance with Clause-6 of the General Conditions of Contract. The Bills should be submitted by the contractor in quadruplicate to the Office of the respective **Superintending Engineer (Netaji Subhash Dock)** with necessary documents in original. Subject to the availability and feasibility of system, SMPK may make payment directly to the contractor's designated bank account. For this purpose, the contractor will have to indicate (i) name of bank (ii) branch name
(iii) branch code and (iv) designated account number in the "Abstract Form Of Tender". In case payment is made directly through bank, the contractor may be required to submit a pre-receipt as per instruction of SMPK.

34. LABOUR, TOOLS & PLANTS:

The Contractor shall supply all necessary labour, tools and plants required for satisfactory execution of the work.

35. Escalation / Variation : No Escalation / Variation on the prices on any account will beconsidered for adjustment of payment.

36. CONTRACT LABOUR LAWS:

The contractor shall be required to comply with the Minimum wages Acts 1948, Employees Liability Act, 1938, Industrial Disputes Act, 1947, and The Contract Labour (Regulation and Abolition) Act, 1970, or statuary amendments and the modifications thereof, any other laws relating thereto and the rules made there under from time to time. **Payment to the labourers to be made as per the minimum wage rates fixed by Chief Labour Commissioner (Central) and as per M.W.A. Govt. of W.B. whichever is higher and revision from time to time.**

It will be the duty of the contractor to abide by the provisions of the Act. Ordinances, Rules, Regulations, Byelaws and Procedures as are lawfully necessary in the execution of the works. The contractor will be fully responsible for any delay/damage etc. and keep the Engineer indemnified against all penalties and liabilities of any kind for noncompliance or infringement of such Acts, Ordinances, Rules, Regulations By-laws and Procedures. **The Contractor shall comply to the Employees' Bonus rules & to pay Bonus once a year to his workmen accordingly, for which no extra payment shall be made to the Contractor.**

The contractor shall indemnify the SMPK against payment to be made under or for the observance of the laws aforesaid without prejudice to his right to claim indemnity from his subcontractor.

The aforesaid regulations shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a Breach of Contract. It will be obligatory on the part of Contractor to

obtain necessary Labour Licence from the Competent Authority for deploying requisite Nos. of labours in the work and submit to the Engineer-In-Charge prior to commencement of the work.

The contractor shall also be required to comply regarding 'Workmen Compensation Act, 1923 as amended by Amendment Act No.65 of 1976'
In addition to the above, the Personal Injuries (Compensation Insurance) Act, 1963 and any modifications thereof and rules made there under from time to time. The contractor shall take into account all the above said financial liabilities in his quoted rates and nothing extra, whatsoever, shall be payable to him on this account.
The Contractor shall indicate maximum number of workmen to be engaged on any day for execution of the work in the appropriate place in the ABSTRACT FORM OF TENDER & he shall have to obtain a regular /permanent license as per sec12(1) of the Contract Labour Act.

Further, whenever a contract work has commenced or completed, the contractor has to intimate the same to the Assistant Labour Commissioner (Central) /labour Enforcement Officer (Central) in Form IV-A within 15 days of such commencement or completion.
The contractor has to arrange for displaying the name of the Regional Labour Commissioner (Central), Asst. Labour Commissioner (Central) & Labour Enforcement Officer (Central) at his worksite(s). The contractor shall inform the Principal Employer the date, time & venue of disbursement to be made by him to his workers.
The successful bidder shall also be required to put up a notice at the site of work mentioning the date, time & venue of disbursement to be made by him to his workers and he or his authorized representative shall have to be present during period of disbursement.

37. COMPLIANCE WITH E.P.F & M. P. ACT & ESI Act 1948:

The successful contractor will have to comply with provision of EPF & MP Act 1952 and also for Employees State Insurance Act 1948 (along with amendments, if any), issued from time to time as applicable.

If asked for by the Employer, the contractor will be required to submit photocopy of all payment challans and produce the original for verification to the representative of the principal employer, i.e. **Superintending Engineer (South).**

38. INDEMNIFICATION:

The successful bidder shall be deemed to indemnify and keep indemnified the Trustees from and against all actions, claims, demands and liabilities whatsoever under and in respect of the breach of any of the provisions of any law, rules or regulations having the force of law, including but not limited to –

a) The Minimum Wages Act, 1948.

b) The Dock Workers (Regulation of Employment) Act, 1948

c) The Building and Other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996.

d) The Dock Workers' Safety, Health & Welfare Act, 1986

e) The Payment of Wages Act, 1936.

f) The Workmen's Compensation Act, 1923.

g) The Employees Provident Fund Act, 1952.

h) The Contract Labour (Regulation and Abolition) Act, 1970; Rules 1971.

i) The Equal Remuneration Act, 1976.

j) The Employees State Insurance Act, 1948 & Employees State Insurance (Amendment) Act

, 1989

k) Child Labour (Prohibition and Regulation) Act, 1986.

l) The Maternity Benefits Act 1961

m) Interstate Migrant Workmen (Regulation of Employment & Conditions Of Service) Act, 1979.

n) Motor Vehicle Act, latest revision.

o) The payment of Bonus Act,1965.

39. TAXES & DUTIES:

The prices quoted shall be including all statutory levies excluding GST, which shall be paid extra. Supplier/service provider to confirm that the GST amount charged in invoice is declared in its returns and payment of taxes is also made.

- The Supplier/ Service Provider agrees to comply with all applicable GST laws, including GST acts, rules, regulations, procedures, circulars & instructions thereunder applicable in India from time to time and to ensure that such compliance is done within the time prescribed under such laws. Supplier/Service Provider should ensure accurate transaction details, as required by GST laws, are timely uploaded in GSTN. In case there is any mismatch between the details so uploaded in GSTN by Supplier/ Service Provider and details available with Syama Prasad Mookerjee Port, Kolkata, then payments to Supplier/Service Provider to the extent of GST relating to the invoices/s under mismatch may be retained from due payments till such time Syama Prasad Mookerjee Port, Kolkata is not sure that accurate tax amount is finally reflected in the GSTN to SMPK's Account and is finally available to Syama Prasad Mookerjee Port, Kolkata in terms of GST laws and that the
- credit of GST so taken by Syama Prasad Mookerjee Port, Kolkata is not required to be reversed ata later date along with applicable interest.Syama Prasad Mookerjee Port, Kolkat3a1has the right to recover monetary loss including interest and penalty suffered by it due to any non-compliance of tax laws by the supplier/service provider. Any loss of input tax credit to Syama Prasad Mookerjee Port, Kolkata for the fault of supplier shall be recovered by Syama Prasad Mookerjee Port, Kolkata by way of adjustment in the consideration payable.
- Supplementary invoices/Debit note/credit note for price revisions to enable Syama Prasad Mookerjee Port, Kolkata to claim tax benefit on the same shall be issued by bidder for a particular year before September of the succeeding Financial Year.

The purchase order/ work order shall be void, if at any point of time bidder is found be to a black listed dealer as per GSTN rating system and further no payment shall be entertained.

40. SETTLEMENT OF DISPUTES:

If a dispute of any kind whatsoever arises between the Employer and the Contractor in connection with or arising out of the contract or the execution of the works, the same shall be dealt as per relevant provisions of the General Conditions of Contract.

41. CONTRACTOR TO EXECUTE CONTRACT AGREEMENT:

The contractor after acceptance of his tender shall be required to enter into and execute a Contract Agreement to be prepared in the form annexed to the General Conditions of Contract together with such modifications as may be necessary within one month from the date of placement of the order. The contractor shall have to submit copies in sextuplets of all documents; correspondence, connected papers etc. as detailed in the above from of Contract Agreement together with the instrument of Contract Agreement prepared on Non-Judicial stamped paper of requisite denomination having five more copies made on plain paper all at his own cost. The successful tenderer shall have to submit three sets of such Contract Agreement duly executed, sealed, signed and witnessed for execution by the

Trustees. The other three sets shall be completed in all respects but not signed. If the successful tenderer or tenderers are a partnership concern, they will have to get Agreement signed by all the partners or by the partner who is authorized to sign for and on behalf of the other partners.

The contractor shall also comply with the requirements of Security Deposit for the due fulfillment of the contract. The blank proforma of tender documents shall be supplied in sextuplets to the successful tenderer free of charge for preparing the documents of the aforesaid Contract Agreement.

The successful tenderer shall have to copy out and prepare the documents of the Contract Agreement neatly and correctly. The necessary amendments, corrections etc. (if any) have to be done at his own cost. The successful contractor shall be required to keep close co-ordination and liaison with the Marine Department while executing the works. The **Superintending Engineer** in charge of the construction will direct the representatives of the contractor to maintain liaison with different sections of the other departments and the contractor must keep the concerned **Superintending Engineer** of the Civil Engineering Department informed and/or posted with the programme contemplated with other departments. The **Superintending Engineer** of the Civil Engineering Department shall be nodal authority in all these co-ordinations and / or liaison and all programmes must be vetted by him. In cases of exigencies, the contractor or his representatives may establish direct liaison/co-ordination but in all such case the **Superintending Engineer,South** should be informed promptly.

42. EMPLOYMENT OF LOCAL RESOURCES:

The contractor shall pay special attention to engage the maximum possible number of local Engineer, other technical personnel, office workers; labourers (skilled, semiskilled, unskilled) periodically or as and when called for.

43. KOLKATA PORT TRUST:

The expression **"KOLKATA PORT TRUST'** appearing anywhere in the tender documents, shall be construed to read as **"SYAMA PRASAD MOOKERJEE PORT, KOLKATA"**.

44. CLARIFICATION OF BIDS:

To assist in the examination and comparison of Tenders, the Employer may, at his discretion, ask any Tenderer for clarification of his Tender, including breakup/analysis of unit rates. The request for clarification and the response shall be in writing, but no change in the price or substance of the Tender shall be sought, offered, or permitted except as required to conform the correction of arithmetic errors discovered by the Employer in the evaluation of the Tenders.

No Tenderer shall contact the Employer on any matter relating to his Tender from the time of the Tender opening to the time the contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Employer, he should do so in writing.

Any effort by the Tenderer to influence the Employer's Tender evaluation, Tender comparison or contract award decisions, may result in the rejection of his Tender.

45. WORKMEN AND WAGES:

The Contractor shall deliver, if ordered, a weekly return for all labour employed in writing in the requisite form as instructed by the Engineer or his representative.

The contractor shall have to engage sufficient number of technically qualified and skilled persons to supervise and execute the work **and this should be mentioned in the letter head of the Firm.**

46. RATE FOR PAYMENT AGAINST EXTRA ITEMS:

For any unforeseen work not covered under the Bill of Quantities and Condition of Contract,depending on contingent situation at site, if required for successful completion of the work, extra items have to be carried out by the Contractor. If those items are already available in Trustees' Schedule of rate, payment will be made on the basis of Trustees' Schedule of rate;including surcharge in force at the time of acceptance of the tender, if any adopted by the Trustees with due regard to the accepted contractual percentage, if any, thereon, otherwise, if the rates are not available in the SMPK Schedule of Rates, then the Special Rates will be prepared as follows: -

(i) The rate of payment of work involving labour & material shall be fixed on the following basis.

a) Cost of materials consumed including transport and wastage, plus

b) Cost of labour actually engaged in the works, plus

c) Taxes and Duties as applicable, plus

d) 16 % on the aggregate of (a) and (b) towards overhead, profit and cess.

(ii) For any work involving only labour, rate of payment shall be fixed on cost of labour actually engaged in the work plus 11 % towards profit and cess.

(iii) For only supply of any material at site, rate of payment shall be fixed on actual cost of material plus transport, loading & unloading (if any) plus 11 % towards profit and cess.

47. DISPARITY IN QUOTED RATE/AMOUNT.

If there is any disparity between the quoted rate in percentage and the Tender Amount, the rate quoted in percentage shall prevail as the rate quoted by the tenderer and the Tender Amount shall be derived by adding/subtracting (as the case may be) this percentage quoted in figures and in words, the rate quoted in words shall prevail.

48. DOCK PERMIT:

For works inside the Docks, Dock permit required for men, materials, vehicles and equipments etc. are to be procured by the successful tenderer **at free of cost** as per recommendation of the executing departments/divisions indicating the specific number of free permits to be issued. But for creation of individual IDs in permit system a charge as applicable, will be levied per person (one time) even for companies/ Individuals who have been granted permission to obtain free permits by SMPK. In case the work has to be carried out in an operational zone, the tenderer should keep in mind that the work is to be executed without hampering the operational activities and should complete the work within the stipulated time specified in the tender.

49. WORKING PERIOD:

Normally the work will be carried out between **8 A.M**. to **5 P.M**. on the Trustees' working days only. However, the tenderer should note that he might be required to carry out the job on Sundays, holidays and after normal working hours and at night in addition to the normal working hours to expedite the progress of the work if permitted by **Competent Authority**. The tenderer should include in his rates the cost, if any, involved on those accounts.

50. BANK GUARANTEE IN LIEU OF CASH SECURITY DEPOSIT:

Security deposit shall be recovered from the On A/C. Bill as per **Clause – 3.4 and 3.5** of **General Conditions of Contract**. However, Bank Guarantee may be considered in lieu of Cash Security Deposit. In that case, the Contractor shall have to submit to the Engineer a performance Bond in the form of an irrevocable guarantee from any Nationalized Bank at Kolkata in the proforma as given in the G.C.C. In this context **Clause 3.6 of G.C.C.** may be referred to.

51. MEASURES AGAINST POLLUTION:

The contractor shall have to take proper measures against environmental pollution during execution of work as directed by the Engineer.

The contractor shall, abide by all the regulations and rules of Syama Prasad Mookerjee Port, Kolkata and those that may be issued from time to time without any extra cost to the SMPK.

52. PORT AREA OBLIGATIONS:

The Dock area is a custom bounded area and as such the contractor shall comply with all Regulations of the Port and Custom authorities and those that may be imposed from time to time in respect of the transit of all of contractor's plants, vehicles, materials, and staff in the area.

Whenever regulations so require, permits shall have to be obtained for such transit of Contractor's plants, vehicles, staff and workmen. The contractor shall instruct his staff and Workmen to comply with all requirements in this "Restricted Area".

The contractor shall suitably fence the area that may be allotted to him inside the "Bonded Area" of the port for stores and other requirements to the full satisfaction of the Port and SecurityAgencies.The contractor shall, abide by all the regulations and rules of Syama Prasad Mookerjee Port, Kolkataand those that may be issued from time to time without any extra cost to the SMP

53. ERRORS IN THE B.O.Q:

In case rate of particular item is printed erroneously in BOQ, the rate stated in the Schedule ofrates will prevail over the rate misprinted in BOQ.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

SCHEDULE T

ANNEXURE-C (Contd.)

SYAMA PRASAD MOOKERJEE PORT, KOLKATA

CONCURRENT COMMITMENT(S) OF THE BIDDER (i.e. Works in The Hand Of The Bidder At The Time Of Submission Of Tender Offer)

(To be submitted with Part-I of Offer)

Bidders must fill in the under noted columns.

Sl. No.	Full particulars of works to be executed concurrently by the bidder. (i) Name of work. (ii) Client. (iii) W.O. No. & Date.	Sanctioned Tender Value. (in Rs.)	Completion time as stated in tender.	Name and address to whom reference can be made.
1	(i)			
	(ii)			
	(iii)			
2	(i)			
	(ii)			
	(iii)			
3	(i)			
	(ii)			
	(iii)			
4	(i)			
	(ii)			
	(iii)			

(To be submitted with Part-I of Offer) **ANNEXURE-C (Contd.)**

SCHEDULE 'O' SHEET – 1

The Bidders are also requested to furnish the following particulars: -

A) In case of Limited Company -

1) Name of Company :

2) Address of its present registered office. :

3) Date of its incorporation :

4) Full name and address of each of its Directors – any special particulars as to Directors if desire to be stated. :

5) Name, address and other necessary particulars of Managing Agents, if any appointed by the Company. :

6) Copies of Memorandum, Articles of Association (with the latest amendments, if any). :

7) Copies of audited balance sheets of the Company for the last **three years**. :

B) In case of a firm -

1) Name and address of the firm. :

2) When business started :

3) If registered a certified copy of certificate of registration. :

4) A certified copy of the Deed of Partnership :

5) Full name and address of each of the partners and the interest of each partner in the partnership – any special particulars as to partners if desired to be stated. :

6) Whether the firm pays income tax over Rs.10, 000/- per year :

(To be submitted with Part-I of Offer)

SCHEDULE 'O' SHEET – 2.

C) In case of an Individual:

1) Full name and address of the Bidder any special particulars of the Bidder if desired to be stated.

2) Name of the father of the Bidder.

3) Whether the Bidder carries on business in his own name or any other name.

4) When business was started and by whom.

5) Whether any other person is interested in the business directly or indirectly, if so, name and address etc. of such persons and the nature of such interest.

6) Whether the Bidder pays Income Tax over Rs.10, 000/- per year.

Dated:

(Full Signature of Bidder)

(Proforma of Performance certificate/credential of works)

[To be issued on issuing authority's letterhead duly signed with office seal]

1.	Name of the Certifying Authority:	
2.	Name of the work:	
3.	Name of the Contractor:	
4.	Schedule date of commencement and completion of the work as per Work Order:	
5.	Date of actual commencement of work & date of actual completion:	
6.	i) If there is time overrun, whether delay is due to the contractor (Yes/No.): ii) If yes, what is the extent of delay attributable to the contractor:	
7.	Sanctioned Tender value & Actual value executed:	
8.	Quality of work (Excellent/satisfactory/poor):	
9.	Remarks (If any):	

ANNEXURE – D

DOCUMENTS TO BE UPLOADED ALONG WITH PART –I

Scanned copy of the following documents to be uploaded: -

i) GST registration certificate.

ii) Valid Trade Licence (Valid for current period & also for type of work).

ii) Valid Professional Tax Clearance Certificate / Up to date tax payment challan. If this is not applicable, the bidder must submit a declaration in this regard.

iii) Proof of possessing valid Employees' Provident Fund (EPF) Account. EPF Registration Certificate.

iv) Proof of being registered with Employees' State Insurance Corporation (ESIC), ESI Registration Certificate

v) Details of the firm as per Schedule-O (in Part-I) of the tender document duly filled up.

vi) Credentials in the form of copies of Letters of Award of Works along with corresponding Completion Certificates from owners to justify that the intending bidder satisfies the earlier mentioned pre-qualification criteria.

vii) Balance sheet and Profit and Loss account / Trading account for the last 3 (three) financial years **(i.e. 2019–2020, 2020-2021 and 2021-2022). The same shouldbe audited as per relevant norms wherever required along with UDIN of the Auditor**

viii) Bank Draft/ Pay Order etc. regarding **Cost of EMD and Tender documents / validNSIC certificate.**

ix) PAN Card

x) A list of technically qualified and skilled persons would be engaged to supervise andexecute the work **(to be mentioned in the letter head of the Firm).**

xi) Self- declaration of the bidder that the Bidding Firm has Not been debarred / de-listed by any Govt / Quasi Govt. / Public Sector undertaking in India **(to be mentioned in the letter head of the Firm).**

xii) Self declaration regarding the proprietor/partner(s)/authorized signatory of the bidding firm (in the case of proprietorship firm /partnership firm /limited company, as the case may be) is/are not associated with any other firm bidding for the same work **(to be mentioned in the letter head of the Firm).**

xiii) A list of works which are in hand at the time of submitting the offer as per the enclosed proforma titled 'Concurrent Commitments of The Bidder' vide 'Annexure-C' (Schedule –T) in Part-I of the tender document.

xiv) Undertaking of the tenderer to be submitted as per enclosed Pro-forma (Annexure –D-1) in lieu of submission of signed copies of the full Tender document, G.C.C, addenda & corrigendum **in the letter head of the Firm.**

xv) Last page of **"Bill of Quantities"** & the **"Form of Tender"** duly filled up (without price quoted) shall be duly signed and stamped by the Bidder.

N.B.-1 The bidder will have to produce the original documents or any additional documents, if asked for, to satisfy the Authorities.

N.B.-2 Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements and their EMD will be forfeited for such action.

ANNEXURE –D-1

NIT NO. SMPK/KDS/CIV /T/2746/18 DT. 16.03.2023

[DOCUMENT TO BE DOWNLOADED, FILLED IN UNDER BIDDER'S LETTERHEAD, SIGNED, SCANNED AND UPLOADED]

Undertaking to be submitted in lieu of uploading/submitting signed copy of full tender document

Ref. No…… Dated:

The Chief Engineer,
Syama Prasad Mookerjee Port, Kolkata,
Civil Engineering Department,
15, Strand Road,
Kolkata – 700 001

Dear Sir,

1. We,.....(Name of Tenderer) have fully read and understood the entire Tender Document, GCC, Corrigendum and Addenda, if any, downloaded from under the instant e-tender and no other source, and will comply to the said document, GCC, Corrigendum and Addenda.

We are submitting this undertaking in lieu of submission of signed copy of the full tender documents GCC, Corrigendum and Addenda.

Yours faithfully,

Signature of Tenderer……

Name: ……..

Designation: ……

Date: ……..

Seal of the tenderer:…….

ANNEXURE –E

SYAMA PRASAD MOOKERJEE PORT, KOLKATA
Civil Engineering DepartmentHead6, Fairlie
Place, Fairlie Warehouse,
2nd Floor ,Kolkata 700 001.
Tele – 033 2230-3451 Extension: 398,399,400
Fax - (033) 2230-0413
E-mail ID: partha@kolkataporttrust.gov.in &
sk.halder@kolkataporttrust.gov.in

NIT No.: **SMPK/KDS/CIV /T/2746/18** DT. 16**.03.2023**

NOTE: Last Date of Download of tender documents : 30.03.2023(up to 14-00 hours)

Tender is due for submission (by 15-00 hours) On 30.03.2023
Tender is due to open after 14-00 hours On 31.03.2023

PRICE BID

रैपिड ईआईए अध्ययन, गुवाहाटी, असम में ब्रह्मपुत्र रिवरसाइड और ताप्ती नदी, सूरत हब, गुजरात में समुद्री विमान संचालन के लिए जल एयरोड्रम के निर्माण के लिए ईआईए रिपोर्ट और पर्यावरण मंजूरी की तैयारी "

Limited TENDER FOR "Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat"

****

ANNEXURE-E (CONTD.)

Limited E-TENDER FOR **" Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat"**

NIT NO: SMPK/KDS/CIV /T/2746/18 DT. 16.03.2023

PRICE BID

TENDER PARTICULARS

ESTIMATED COST अनुमानित लागत		**NA**
EMD (Earnest Money Deposit)/ Bid Security ईएमडी (बयाना राशि जमा)/बोली सुरक्षा		**Rs.1,80,000/- (Rupees one lakh eighty thousand only)** payable through DD / RTGS / NEFT to be transferred on **A/C:** Syama Prasad Mookerjee Port, Kolkata
Cost of Tender document(Non-refundable) निविदा दस्तावेज की लागत (अप्रतिदेय)		**Rs.1770/-(Rupees one thousand seven hundred and seventy only) including @18% GST)**payable through DD / RTGS / NEFT to be transferred on **A/C:** Syama Prasad Mookerjee Port, Kolkata
TIME OF COMPLETION पूरा होने का समय		**6(Six) Months**
PERIOD OF DOWNLOAD OF E-TENDER (Both Days Inclusive) ई-निविदा के डाउनलोड की अवधि (दोनों दिन सम्मिलित)		**17.03.202**3 to **30.03.202**3(UPTO 14:00 HRS.) (Bid document will be available on website **https://kopt.enivida.in**). Bidders will have to participate in bidding process through website **https://kopt.enivida.in/**only.
DATE AND TIME FOR PRE-BID MEETING & SITEVISIT प्री-बिड मीटिंग और साइट विज़िट के लिए दिनांक और समय		**No Pre-Bid Meeting**
LAST DATE OF SUBMISSION OF E-TENDER ANDOPENING OF THE TENDER ई-निविदा प्रस्तुत करने और निविदा खोलने की अंतिम तिथि		**Submission on 30.03.2023up to 15:00 hrs. Opening on 31.03.2023 after 14-00 hrs. (Techno Commercial Part and price Part will be opened on date)**

SYAMA PRASAD MOOKERJEE PORT, KOLKATA

Office of the Civil Engineering Department

Limited E-TENDER FOR **Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat**."

NIT NO: SMPK/KDS/CIV /T/2746/18 DT. 16.03.2023

The Bill of Quantities must be read with the General Conditions of Contract, the Special Conditions of Contract and the Particular Specifications of Work and the Bidder is deemed to haveexamined the above documents and to have thoroughly familiarise himself with the total scope ofwork and its mode of execution.

The quantities given in the Bill of Quantities are approximate only and are given to provide a common basis for tendering. Payment will be made according to the quantities of each item of work actually carried out at the accepted rates as per Order Letter. The measurements of each item of work shall be measured jointly by the Engineer-in-Charge or his representative.

General direction and description of work or materials given elsewhere in the contract documents are not necessarily repeated in the description of items in the "Bill of Quantities".

The prices and rates entered by the Contractor in the "Bill of Quantities" shall be deemed to cover the complete and finished work, inter-alia, all costs and expenses which may be required for successful completion of the works together with all risks, liabilities, contingencies, insurance, octroi, royalties, taxes and obligations imposed or implied by the Contractor.

Where separate items such mobilisation, demobilisation, temporary works etc., have not been provided in the "Bill of Quantities" for works required under the Contract, then the cost ofsuch works shall be deemed to have been included in the prices and rates of other items.

Without affecting the generality of the foregoing provisions, the prices and rates entered in the Bill of Quantities by the Contractor shall include inter-alia, all costs and expenses involved in orarising out the followings: -

The provision, storage, transport, handling, use distribution and maintenance of all materials, plans, equipment machineries and tools including all costs, charges dues demurrages or other outlays involved in the transportation.

The provision and maintenance of all his staff and labours and their payments, accommodation, transport, taxes and other requirements.

Setting out including the location and preservation of survey markers, measurement andsupervision.

The provision, storage, transport, use handling, distribution and maintenance of consumable stores, fuel, water and electricity.

All First Aid, Welfare and safety requirements.

Damage caused to the works, plants, materials and consumables stores caused by weather.

Licence, fees and other charges for compliance of Government Acts and Rules that are in-force and applicable.

The Contractor should be held responsible for the safe custody of materials, machineries etc. at site procured by him or issued to him by the Trustees.

This being a ITEM RATE tender, the Bidder shall quote his item wise rate in the tender on line, based on his own analysis. The total Tender Price thus established would be taken for comparative evaluation of E-Tenderers

a. The Contractor shall at all times keep the site and working areas free from all surplus materials, rubbish, other excavated/offensive matter etc. all of which shall be disposed off in a manner to be approved by the Engineer's Representative.

b. On completion of the works the contractor shall reinstate and make good at his own expense any property or land which might have been disturbed and/or damaged by his works. He should also clean the site as required during execution and fully clear the site after completion of all the works.

The contractor shall forward any usable materials found during the course of construction atthe work site or its vicinity to SMPK stores/yards, dispose off the debris beyond the port area all at his own expenses by his own transport and labour and clean out all part of the work and leave everything clean and tidy to the entire satisfaction of the Engineer, failing which suitable deduction will be made from final bill as per discretion of the Engineer/Engineer's representative.

****

SYAMA PRASAD MOOKERJEE PORT, KOLKATA

Civil Engineering Department

BILL OF QUANTITIES

Limited E-TENDER " Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam and in River Tapti,Surat Hub,Gujrat

NIT No: SMPK/KDS/CIV /T/2746/18 DT. 16.03.2023

BILL OF QUANTITIES

Part-A" Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam

Item No.	Description Of Item	Quantity	Rate Rs. P.	Unit	Amount Rs. P.
1	**Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations at Brahmaputra Riverside in Guwahati,Assam.**	1 Unit			
2	Additioal cost for Misc. works as per EIA Notofication 2006 Ammendmend thereof for successful arrangement for Public Hearing.	1 Unit			
Part- B **Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations in River Tapti,Surat Hub,Gujrat**					
4	**Rapid EIA study, preparation of EIA Report & Environmental Clearence for Construction of Water Aerodrome for Sea Plane operations in River Tapti,Surat Hub,Gujrat**	1 Unit			
5	Additioal cost for Misc. works as per EIA Notofication 2006 Ammendmend thereof for successful arrangement for Public Hearing	1 Unit			
6.	Additioal cost for preparation of CRZ Report and maps including presentation to the Expert Apprisal Committee and obtaining clearance for the same.	1 Unit			
Total = Rs					

Tenderer to fill up the following [score out which is not applicable]

price not to be quoted here

(a)… ..... %
(in figures) Below par (-) Rs.

……Percent
(in words)

(b)…… At par NIL

(c)%
(in figures) Above par (+) Rs.

……
……
Percent(in
words)

Total Tendered Amount: Rs. _____

Total tendered amount (in words……

……..

[The prices quoted shall be including all statutory levies excluding GST, which shall be paid extra]

Maximum number of workmen likely to be engaged in days work ..... numbersPermanent

Income Tax A/C. No… ……..

Date:

_____
(Signature of Tenderer)

[Total amount of tender, completion time and preliminary time as quoted /stated above are to be carried over to Form of Tender attached]

Witness: -
(Name in block letters)Address:
Occupation:

THE BOARD OF TRUSTEES FOR THE PORT OF KOLKATA
FORM OF TENDER

To
The Chief Engineer,
Syama Prasad Mookerjee Port, Kolkata.

I/We_____
___having examined the site of work, inspected the Drawings and read the specifications, General & Special Conditions of Contract and Conditions of the Tender, hereby tender and undertake to execute and complete all the works required to be performed in accordance with the Specification, Bill of Quantities, General & Special Conditions of Contract and Drawings prepared by or on behalf of the Trustees and at the rates & prices set out in the annexed Bill of Quantities within **6(Six) Months** from the date of order to commence the work and in the event of our tender being accepted in full or in part. I / We also undertake to enter into a Contract Agreement in the form hereto annexed with such alterations or additions thereto which may be necessary to give effect to the acceptance of the Tender and incorporating such Specification, Bill of Quantities, Drawing and Special & General Conditions of Contract and I / We hereby agree that until such Contract Agreement is executed the said Specification, Bill of Quantities, Conditions of Contract and the Tender, together with the acceptance thereof in writing by or on behalf of the Trustees shall be the Contract.
THE TOTAL AMOUNT OF TENDER Rs. **Not to mention here**

(Repeat in words)_____**Not to mention here**

_____

I / We require_____days / months preliminary time to arrange and procure the materials required by the work from the date of acceptance of tender before I We could commence the work.

I / We have deposited with the Trustees' Manager (Finance), SMPK, vide Receipt No. _____of_____as Earnest Money.
I / We agree that the period for which the tender shall remain open for acceptance shall not be less than four months.

Dated:

(Signature of Bidder with Seal)

Name of the Bidder: -

Address: -

ANNEXURE – F

KOLKATA PORT TRUST

KOLKATA DOCK SYSTEM

CIVIL ENGINEERING DEPARTMENT

15, STRAND ROAD, KOLKATA -700001

GENERAL CONDITIONS OF CONTRACT

FORMS AND AGREEMENTS

SANCTIONED BY TRUSTEES UNDER RESOLUTION NO. 92 OF THE 6TH MEETING HELD ON 27TH MAY, 1993.

(Copy of Booklet Published on May, 1993)

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GENERAL CONDITIONS OF CONTRACT

INDEX

C L A U S E

1. DEFINITIONS

In the contract, as her-in-after defined, the following words and expressions shallhave the meaning here-in assigned to them, except where the context otherwiserequired.
"**Employer**" or "Board" or "Trustees" means the Board of Trustees for the Port of Kolkata, a body c9orporate under Section 3 of the Major Port Trust Act, 1963, including their successors, representatives and assigns.

"Chairman" means the Chairman of the Board and includes the person appointed to act in his place under Sections 14 and 14A of the Major Port TrustsAct, 1963.
"Contractor" means the person or persons; Firm or Company whose tender /offer has been accepted by the Trustees and includes the Contractor's representative's heirs, successor and assigns, if any permitted by the Board / Chairman.
"Engineer" means the Board's official who has invited the tender on its behalf and includes the Chief Engineer, the Chief Mechanical Engineer, the Senior Executive Engineer the Chief Hydraulic Engineer, the Deputy Chief Engineer, the Deputy Chief Mechanical Engineer, the Senior Resident Engineer, The Manager (Infrastructure & Civic Facilities), the Manager (Plant & Equipment) the Deputy Manager (Infrastructure & Civic Facilities) and the Deputy Manager (Plant & Equipment), or other official as may be appointed from time to time by the employer, with written notification to the Contractor, to act as Engineer for the purpose of the contract, in place of the "Engineer' so designated.

"Engineer's Representative" means any subordinate Engineer or Assistant to the Engineer or any other official appointed from time to time by the Engineer toperform the duties set forth in Clauses 2.4 to 2.6 hereof.

"Work" means the Work to be executed in accordance with the Contract and includes authorized "Extra Works" and "Excess Works" and Temporary Works.

"Temporary Works" means all temporary works of every kind required in or about the execution, completion or maintenance of the works and includes (without thereby limiting the foregoing definitions) all temporary erections, scaffolding, ladders, timbering, soaking vats, site offices, cement and other god owns, platforms and bins for stacking building materials, gantries, temporary tracks and roads, temporary culverts and mixing platforms.

"Extra Works" means those works required by the Engineer for completion of the Contract which were not specifically and separately included in the scheduleof items of works (i.e., Bills of Quantities) of the tender. "Excess Works" means the required quantities of work in excess of the provision made against any item of the Bill of Quantities.

"Specifications" means the relevant and appropriate Bureau of Indian Standard's Specifications (latest revisions) for materials and workmanship unlessstated otherwise in the Tender.

"Drawings" means the drawings referred to in the Tender and specification and any modification of such drawings approved in writing by the Engineer and such other drawings as may from time to time be furnished or approved in writing by the Engineer.

"Contract" means and includes the General and Special Conditions of Contract, Specifications, Drawings, priced Bill of Quantities, the Tender/ Offer, the letter of acceptance of the Tender/Offer, the Contract Agreement if separately entered into and the Schedule of Rates and Price, if any, adopted by the Trustees at their discretion.

"Constructional Plant" means all appliances or things of whatsoever nature required in or about the execution, completion or maintenance of the works or temporary works and includes (without thereby limiting the foregoing definition) all machinery and tools but does not include materials or other things intended to form or forming part of the permanent work.

"Site" means the land and other places, on, under, in or through which the worksare to be executed or carried out and any other lands or places provided by the Trustees for the purpose of the Contract.

"Contract Price" means the sum named in the letter of acceptance of the Tender/ Offer of the Contractor, subject to such additions thereto and deduction there from as may be made by the Engineer under the provisions here-in-after contained.

"Month" means English Calendar Month.

"Excepted risks" are riot in so far as it is uninsurable, war, invasion, act of foreign enemies, hostilities (whether war be declared or not) Civil War, rebellion, revolution, insurrection or military or usurped power or use or occupation by the Trustees of any portion of the works in respect of which a certificate of completion has been issued (all of which are herein collectively referred to as the excepted risks).

Word importing the **singular** only, also includes the **plural** and vice-versawhere the context so required.

The **headings and marginal notes** in these General Conditions of Contract shall not be deemed to be part thereof or be taken into consideration in the interpretation or construction thereof or of the contract.

Unless otherwise stipulated the word "Cost" shall be deemed to include overhead costs of the contractor, whether on or off the site.

2. DUTIES & POWERS OF ENGINEER & ENGINEER'S REPRESENTATIVE

The Contractor shall execute, complete and maintain the works in terms of the contract to the entire satisfaction of the Engineer and shall comply with the Engineer's direction on any matter whatsoever.

The Contractor shall take instructions from the Engineer and subject to limitationof Clause 2.5 herein, from the Engineer's Representative.

The Engineer shall have full power and authority

(a) 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 proper and adequate execution and maintenance of the works and the contractor shall carry out and be bound by the same.

(b) to alter or modify the specification of any material and workmanship and toinspect the work at any time.

(c) to order for any variation, alternation and modification of the work and for extra works.

(d) to issue certificates as per contract.

(e) to settle the claims & disputes of the Contractor and Trustees, as the first referee.

(f) to grant extension of completion time.

The Engineer's representative shall:

(a) watch and supervise the works.

(b) test and examine any material to be used or workmanship employed in connection with the work.

(c) have power to disapprove and material and workmanship not in accordancewith the contract and the contractor shall comply with his direction in this regard.

(d) take measurements of work done by the contractor for the purpose of payment or otherwise.

(e) order demolition of defectively done work for its reconstruction all by the Contactor at his own expense.

(f) have powers to issue alteration order not implying modification design and extension of completion time of the work and

(g) have such other powers and authorities vested in the Engineer, which have been delegated to him in writing by the Engineer under intimation to the Contractor.

Provided always that the Engineer's Representative shall have no power:

(a) to order any work involving delay or any extra payment by the Trustees,

(b) to make variation of or in the works and

(c) to relieve the Contractor of any of his duties or obligations under the Contract.

Provided also as follows:

(a) Failure of Engineer's Representative to disapprove any work or materials shall not prejudice the power of the Engineer thereafter to disapprove such work or materials and to order the pulling down, removal, breaking-up thereof and re-construction at the contractor's cost and the contractor shall have no claim to compensation for the loss sustained by him.

(b) If the contractor shall be dissatisfied by reason of any decision of the Engineer's Representative, he shall be entitled to refer the matter to the Engineer who shall there upon confirm, reverse or vary such decision.

(c) Any written instructions or written approval given by the Engineer's Representative to the contractor, within the terms of delegation of power and authority vested in Engineer to his Representative in writing shall bind the contractor and the Trustees as though it had been given by theEngineer, who may from time to time make such delegation. Contractor and the Trustees as though it had been given by the Engineer, who may from time to time, make such delegation.

3. THE TENDER / OFFER AND ITS PRE-REQUISITES

The Contractor shall, before making out and submitting his tender / offer be deemed to have inspected and examined the site, fully consider all factors, risksand contingencies, which will have direct and in direct impact on his expenses and profit from the work and shall be specifically deemed to have taken the following aspects into consideration:

(a) The form and nature of the site and its surroundings including their sub-surface, hydrological, tidal and climate conditions, the means of access to the site and all other local conditions including the likely charges and costs for temporary way-leave, if any, required for the work.

(b) The drawings, specifications, the nature and extent of work to be executed and the quality, quantity and availability of the required materials and labour for the work and the need to execute the work to the entire satisfaction of the Engineer, and also by complying with the General and Special Conditions of Contract.

(c) The accommodation required for the workmen and site office, mobilization / demobilization and storage of all plant, equipment and Constructionmaterials.

(d) The sources and means of procurement of water for drinking, washing and execution of work, and source and availability of electrical power, all of Contractor's cost.

(e) Payment of taxes and duties and compliance of all applicable statues, ordinances and law together with the rules made there under, the rules, regulations and bye-laws of public bodies or any local or other authority by the Contractor, keeping the Trustees indemnified against penalties and liabilities of every kind arising from the Contractor's failure in such compliance.

(f) Payment of all kinds of stamp-duty for exacting the agreement or for anylegal instrument including Bank Guarantees and Indemnity Bonds.

The Contractor's tender shall be in ink on the Tender Forms supplied by the Trustees, unless stipulated otherwise in the Notice-Inviting the Tender and shall be faultless in figures and free from erasing. Corrections, if any, shall only be made by scoring out and initialing of the revised figure.

If required by the Engineer or the Trustees, the Contractors in their tender or subsequently, shall disclose the names of their owners/partners/Share Holders at the required points of time. The failure in this regard shall be treated as a breach and a contract, if entered into, shall be liable to be cancelled.

(a) Unless otherwise stipulated in the Notice Inviting the Tender/Offer, every tender must be submitted with Earnest Money of the amount calculated as perthe following scale.

Estimated Value	Amount of Earnest Money	
	For works contract.	For contract of supplying materials of equipment only
Up to Rs.1,00,000/-	5% of the estimated valueof work	1% of the estimated valueof work.
Over Rs. 1,00,000/-	2% of the estimated value of work subject to a maximum of Rs.20,000/- and minimum of Rs. 5,000/-	1/2% of the estimated value of work subject to a maximum of Ts. 10,000/- and minimum of Rs. 1,000/-

(b) Earnest Money shall be deposited with Trustees' treasurer in cash or by Banker's Cheque of any Kolkata Branch of a Nationalized Bank of India drawn in favour of Kolkata Port Trust or in the form of an "Kolkata Port Trust" and payable at Kolkata / Haldia Holding as the case may be and the receipt granted there for be kept attached to the Tender / offer in the Sealed Cover.

(c) Earnest Money of un-accepted tender shall be refunded without any interest through A/c. Payee Cheque drawn on a Nationalized Bank of Kolkata / Haldia.

(d) The enlisted (registered) Contractors of the Trustees, who have deposited fixed Security with the Trustees FA & CAO / Manager (Finance) according to his Class of Registration, shall be exempt from depositing the Earnest Money,as per the following scale:

Class of Registration	Amount of Fixed Security	Financial limit of each tender
A	Rs. 10,000/-	Any tender priced up to Rs. 2,00,000/-
B	Rs. 5,000/-	Any tender priced up to Rs.1,00,000/-
C	Rs. 2.500/-	Any tender priced up to Rs.50,000/-

(e) (i) Tender submitted without requisite Earnest Money may be liable to rejection.

(ii) If before expiry of the validity period of his Tender / offer, the tender amends his quoted rates or tender/ offer making them unacceptable to the Trustees and / or withdraws his tender / offer, the Earnest Money deposited shall be liable to forfeiture of the option of the Trustees.

(f) The Earnest Money of accepted Tender / offer shall be retained by the Trustees as part of the Security Deposit, for which a separate Treasury Receipt shall be issued to the Contractor after cancellation of the previous Receipt of Earnest Money.

(g) Balance security for works contract shall be recovered by deduction from all progressive Bill (including final Bill, if necessary) @ 10% of the gross value ofwork in each such bill, so that the total recovery may not exceed the quantumcomputed as per the under noted percentages of the total value of work actually done up to the stage of completion.

Value of Work	% of Security Depositfor works contract	% of Security Deposit for Contract of supplying materials and equipments only
For works up to Rs. 10,00,000/-	10% (Ten percent)	1% (One percent)
For works costing more than Rs.10,00,000/- and up to Rs.20,00,000/-	10% on first Rs. 10,00,000/- + 7½ % on the balance	1% on first Rs.10,0,000/- +1/2% on the balance
For works costing more than Rs.20,00,000/-	10% on first Rs. 10,00,000/- + 7½ % on next Rs.10,00,000/- + 5% on the balance	1% on first Rs.10,0,000/- +1/2% on next Rs.10,00,000/-+ 1/4% on the balance

(h) Balance Security for Contract of supplying materials and equipment computed in terms of the percentages given above, shall have to be deposited with the trustees' Treasurer in advance and within 30 days from the date of placementof supply order, either in cash or by A/c. Payee Draft of a Nationalized Bank ofIndia drawn in favour of Kolkata Port Trust and payable at Kolkata / Haldia, asthe case may be.

(i) No interest shall be paid by the trustees to the Tenderer / Contractor on the amount of Earnest Money / Security Deposit held by the Trustees, at any stage.

(i) The Security Deposit shall be refunded to the Contractor in terms of Clause 9.3 hereinafter and subject to deduction, if any, under the provision of Sub- Clause 3.5(ii) herein below. If, however, the contract provides for any maintenance period, 50% of the Security Deposit may be refunded against any of the Treasury Receipt for that amount on expiry of half of the

maintenance period and the balance deposit on the said maintenance period and after the Engineer has certified the final completion of work in form G.C.2 and the Contractor has submitted his "No Claim" Certificate in form G.C.3.

(ii) The Security Deposit/Earnest Money may be liable to forfeiture at the option of the Trustees, if the Contractor fails to carry out the work or to perform/observe any of the conditions of the contract. The Trustees shall alsobe at liberty to deduct any of their dues from the Security Deposit, fixed Security, Earnest Money or from any sum due or to become due to the Contractor under any other contract.

If stipulated in the contract as a Special Condition, the Contractor shall have to submit to the Engineer a performance Bond in the form of an irrevocable guarantee from Kolkata / Haldia Branch, as the case may be, of any Nationalized Bank of India in the proforma annexed hereto and for the sum and period as mentioned in the letter of acceptance of the Tender/Offer, within 15 days from the date of such letter, failing which the contract shall be liable to be terminated and the Earnest Money are liable to forfeiture; all at discretion of the Engineer. The cost of obtaining this or any other Bank Guarantee and/or the revalidation thereof, wherever required, has to be borne by the Contractor and it shall be his sole responsibility to arrange for timely revalidation of such bank guarantee, failing which and for non-fulfillment of any contractual obligation by the Contractor, the Engineer and/or the Trustees shall be at liberty to raise claim against the Guarantee and/or enforce the same unilaterally.

Every Tenderer / bidder shall submit in respect of a tender value of more than Rs. 5 crores, along with their tender comprising Special Conditions of Contract, General Conditions of Contract, BOQ, Earnest Money, etc., a document called **Integrity Pact Agreement** duly signed by their authorized representative. Theproforma of the Integrity Pact Agreement shall as specified in the G.C.C. In caseof tender value more than Rs. 5 crores, the Integrity Pact Agreement is an essential part and parcel of the bid document to be submitted by each tenderer,without which the tender shall not be considered.

4. THE CONTRACT & GENERAL OBLIGATIONS OF CONTRACTOR

4.1.

(a) The contract documents shall be drawn-up in English language.

(b) The contract shall be governed by all relevant Indian Acts as applicable only within the jurisdiction of the High Court at Kolkata, India, including thefollowing Act:

1. The Indian Contract Act, 1872.
2. The Major Port Trust, Act, 1963.
3. The Workmen's Compensation Act, 1923.
4. The Minimum Wages Act, 1948.
5. The Contract Labour (Regulation & Abolition) Act, 1970.
6. The Dock Workers' Act, 1948.
7. The Indian Arbitration Act (1940) (in the case of a definite arbitration Agreement only).

After acceptance of his Tender / Offer and when called upon to do so by the Engineer or his representative, the Contractor shall, at his own expense, enter

into and execute a Contract Agreement to be prepared by him in the form annexed hereto. Until such Contract Agreement is executed the other documents referred to in the definition of the term "Contract" here-in-before shall collectivelybe the Contract.

Several documents forming the contract are to be taken as mutually explanatory of one another. Should there be any discrepancy, ambiguity, omission or error in the various contract documents, the Engineer shall have the power to correct the same and his decision shall be final and binding on the parties to the Contract.

Two copies of the Drawing referred to in the General and Special Conditions of Contract and in the Bill of Quantities, shall be furnished by the Engineer to the Contractors free of cost for his use on the work, but these shall remain the properly of the Trustees and hence, the Contractor shall return them to the Engineer or his Representative on completion of the work. if not torn or mutilated on being regularly used at site.

The Contractor shall prove and make at his own expense any working or progress drawings required by him or necessary for the proper execution of the works and shall, when required, furnish copies of the same free of cost to the Engineer for his information and/ or approval, without meaning thereby the shifting of Contractor's responsibility on the engineer in any way whatsoever.

The Contractor shall not directly or indirectly transfer, assign or sublet the Contract or any part thereof without the written permission of the engineer. Evenif such permission be granted, the Contractor shall remain responsible (a) for theacts, defaults and neglect of any sub-contractor, his agents servants or workmen as fully as if these were the acts, defaults or neglects of the Contractor himself orhis agents, servants or workmen, and (b) for his full and entire responsibility of the contract and for active superintendence of the works by him despite being sublet, provided always that the provision of labourers on a "piece rate" basis shall not be deemed to be subletting under this clause.

Unless otherwise specified, the Contractor shall be deemed to have included in his Tender / Offer all his cost for supplying and providing all constructional plant,temporary work, materials both for temporary and permanent works, labour including supervision thereof transporting to and from the site and in and about the work, including loading, unloading, fencing, watching, lighting, payment of fees, taxes and duties to the appropriate authorities and other things of every kind required for the construction, erection, completion and maintenance of the work.

The Contractor shall be solely responsible for the adequacy, stability and safety of all site operations and methods of construction, even if any prior approval thereto has been taken from the Engineer or his Representative. The Contractor shall not be responsible for the correctness of the design or specification of the Temporary and Permanent works formulated by the Engineer; but the contractor shall be fully responsible for the correct implementation thereof as also for any design and specification prepared / proposed / used by the Contractor.

Whenever required by the Engineer or his Representative, the Contractor shall submit to him the details of his (a) programme for execution of the work, (b)

proposed procedure and methods of work, (c) proposed deployment of plant, equipment labour, materials and temporary works. The submission to and/ or any approval by the Engineer or his Representative to any such programme or particulars, shall not relieve the Contractor of any of his obligations under the contract. If for any reason the contractor be unable to adhere to his earlier programme, he shall submit his revised programme for completion of work withinthe stipulated time whenever asked to do so.

Necessary and adequate supervision shall be provided by the Contractor during execution of the works and as long thereafter as the Engineer or his Representative shall consider necessary during the maintenance period. The Contractor or his competent and authorised agent or representative shall be constantly at site and instructions given to him by the Engineer or his Representative in writing shall be binding upon the Contractor subject to limitation in clause 2.5 hereof. The Contractor shall inform the Engineer or his Representative in writing about such representative / agent of his at site.

The Contractor shall employ in execution of the Contract only qualified, careful and experienced persons and the Engineer shall be at liberty to direct the Contractor to stop deployment of any of his staff, workmen or official at site and the Contractor shall within 48 hours comply with such instruction without any demur, whenever the Engineer shall feel that the deployment of the person concerned will not be conducive tothe proper and timely completion of the work.

The Contractor shall be responsible for the true and proper setting-out of the works in relation to reference points/lines/levels given by the Engineer in writing. The checking of any setting-out or of any alignment or level by the Engineer or his Representative shall not in any way relieve the contractor of his responsibility for the correctness thereof and he shall fully provide, protect and preserve all stakes, templates, bench marks, sight rails, pegs, level marks, profilemarks and other things used in setting-out the works.

From the commencement of the works till issue of the completion certificate in Form G.C.1, vide Clause 5.12 hereof, the contractor shall take full responsibility for the care thereof. Save for the excepted risks, any damage, loss or injury to the work or anypart there of shall be made good by the Contractor at his down cost as per instruction and to the satisfaction of the Engineer, failingwhich the Engineer or his Representative may cause the same to be made goodby any other agency and the expenses incurred and certified by the Engineer, shall be recoverable from the Contractor in whatever manner the Engineer shall deem proper. This Clause will not apply to that part of the work, which might have been taken over by the Trustees on partial completion of the work and in such case the Contractor's obligation will be limited to repairs and replacement for manufacturing or construction defects during the Maintenance period (Guarantee Period) as per the directions of the Engineer as also for defects/ damages if any caused to the work by the Contractor during such repairs and replacement in the maintenance period.

The Contractor shall at his own cost protect, support and take all precautions in regard to the personnel or structure or services or properties belonging to the Trustees or not, which may be interfered with or affected or disturbed or endangered and shall indemnify and keep indemnified the Trustees

against claim for injury, loss or damage caused by the Contractor in connection with the execution and maintenance of the work to the aforesaid properties, structures and services and/ or to any person including the Contractor's workmen. Cost of Insurance Cover, if any, taken by the Contractor shall not be reimbursed by the Trustees, unless otherwise stipulated in the Contract.

The Contractor shall immediately inform the Engineer's Representative if any fossil, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological importance be discovered at site which shall remain the property of the Trustees and protect them from being damaged by his workmen and arrange for disposal of them at the Trustees expense as per the instruction of the Engineer's Representative.

The Contractor shall be deemed to have indemnified the Trustees against all claims, demands, actions and proceedings and all costs arising there from onaccount of:

(a) Infringement of any patent right, design, trade-mark, or name or other protected right, in connection with the works or temporary work.

(b) Payment of all royalties, rent, toll charges, local taxes, other payments or compensation, if any, for getting all materials and equipment required for the work.

(c) Unauthorized obstruction or nuisance caused by the Contractor in respect of Public or Private road, railway tracks, footpaths, crane tracks, waterways, quays and other properties belonging to the Trustees or any other person.

(d) Damage / injury caused to any highway and bridge on account of the movement of Contractor's plants and materials in connection with the work

(e) Pollution of waterway and damage caused to river, lock, sea-wall or other structure related to waterway, in transporting contractor's plants and materials.

(f) The Contractor's default in affording all reasonable facilities and accommodation as per the direction of the Engineer or his Representative to the workmen of the Trustees and other agencies employed by or with the permission and / or knowledge of the Trustees on or near the site of work.

Debris and materials, if obtained by demolishing any properly, building or structure in terms of the Contract shall remain the property of the Trustees.

The Contractor’s quoted rates shall be deemed to have been inclusive of the following:

(a) Keeping the site free of unnecessary obstruction and removal from site of constructional plant wreckage, rubbish, surplus earth or temporary works nolonger required.

(b) Cleaning and removal from site the entire surplus materials of every kind to leave the site clean and tidy after completion of the work, without which payment against final bill may be liable to be withheld.

(c) Precautionary measures to secure efficient protection of Docks, the River Hooghly and other waterways against pollution of whatever nature during execution and maintenance of the works, and to prevent rubbish, refuse and

other materials from being thrown intothe water by the Contractor's menor those of his agency.

(d) Making arrangements for deployment of all labourers and workers, local or otherwise including payment for their wages, transport, accommodation, medical and all other statutory benefits and entry permits, wherever necessary.

(e) Making arrangements in or around the site, as per the requirements of Kolkata Municipal Corporation or other local authority or the Engineer or his Representative, for preventing (i) spread of any infectious disease like smallpox, cholera, plague or malaria by taking effective actions for destruction of rats, mice, vermin, mosquitoes etc. and by maintaining healthy and sanitary condition, (ii) illegal storage and distribution of Drugs, Narcotics, Alcoholic liquor, Arms and Ammunitions, (iii) unlawful, riotous or disorderly conduct of the Contractor's or his Sub-Contractor's workmen,
(iv) deployment of workmen of age less than 16 years.

Every direction or notice to be given to the Contractor shall be deemed to have been duly served on or received by the Contractor, if the same is posted orsent by hand to the address given in the tender or to the Contractor's Site Officeor in case of Trustee's enlisted Contractor to the address as appearing in the trustee's Register or to the Registered Office of the Contractor. The time mentioned in these conditions for doing any act after direction or notice shall be reckoned from the time of such posting or dispatch.

The Contractor and his sub-contractor or their agents and men and any firm supplying plant, materials, and equipment shall not publish or caused to be published any photographs or description of the works without the prior authorityof the Engineer in writing.

The Contractor shall, at the Trustees' cost to be decided by the Engineer, render all reasonable facilities and Co-operation as per direction of the Engineer or his representative to any other Contractor engaged by the Trustees and their workmen, to the Trustees' own staff and to the men of other Public Body on or near the site of work and in default, the contractor shall be liable to the trustees for any delay or expense incurred by reason of such default.

The work has to be carried out by the Contractor causing the minimum of hindrance for any maritime traffic or surface traffic.

All constructional plants, temporary works and materials when brought tothe site by the contractor, shall be deemed to be the property of the Trustees who will have a lien on the same until the satisfactory completion of the work and shall only be removed from the site in part or in full with the written permission of the Engineer or his Representative.

5. COMMENCEMENT, EXECUTION AND COMPLETION OF WORK

The contractor shall commence the work within 7 days of the receipt ofEngineer's letter informing acceptance of the Contractor's tender / offer by the Trustees o within such preliminary time as mentioned by the contractor in the

Form of Tender or the time accepted by the Trustees. The contractor shall then proceed with the work with due expedition and without delay, except as may beexpressly sanctioned or ordered by the Engineer or his Representatives, time being deemed the essence of the contract on the part of the Contractor.

The Contractor shall provide and maintain a suitable office at or near the site, to which the Engineer's Representative may send communications and instructionsfor use of the Contractor.

Unless specified otherwise in the contract or prior permission of the Engineer has been taken, the contractor shall not execute the work beyond the working hours observed by the Engineer's Representative and on Sundays and Holidays observed in the trustees system, except in so far as it becomes essential on account of tidal work or for safety of the work. If the progress of the work lags behind schedule or the work has been endangered by any act or neglect on the part of the contractor, then the Engineer or his Representative shall order and the contractor at his own expense shall work by day and by night and on Sundays and Public Holidays. Any failure of the Engineer or his Representative to pass such an order shall not relieve the contractor from any of his obligations. The Engineer's decision in this regard shall be final, binding and conclusive.

Unless stipulated otherwise in the contract, all materials required for the work shall be procured and supplied by the contractor with the approval of the Engineer or his Representative and subject to subsequent testing as may be required by the Engineer or his Representative. The engineer shall exercise his sole discretion to accept any such materials.

Unless stipulated otherwise, in the contract, all materials, workmanship method of measurement shall be in accordance with the relevant Codes (Latest Revision) of the Bureau of Indian Standards and the written instructions of the Engineer or his Representative. Where no specific reference is available in the contract, the materials and workmanship shall be of the best of their respective kinds to the satisfaction of the Engineer.

Samples shall be prepared and submitted for approval of the Engineer or his Representative, whenever required to do so, all at the contractor's cost.

Unless stipulated otherwise in the contract, the cost of any test required by the Engineer or his representative in respect of materials and workmanship deployedon the work shall be borne by the contractor.

Regarding the supply of any materials by the Trustees to the contractor in accordance with the contract, the following conditions shall apply:

(a) The contractor shall, at his own expense, arrange for transporting the materials from the Trustees' Stores, watching, storing and keeping them in his safe custody, furnishing of statement of consumption thereof in the manner required by the Engineer or his representative, return of surplus and empty container to the Trustees' Stores as per the direction of the Engineeror his Representative.

(b) Being the custodian of the Trustees' materials, the contractor shall remain solely responsible for any such materials issued to him and for any loss or damage thereof for any reason other than "Excepted Risks", the contractor

shall compensate the Trustees' in the manner decided by the Engineer and shall at no stage remove or cause to be removed any such material from thesite without his permission.

(c) The Trustees' materials will generally be supplied in stages and in accordance with the rate of progress of work, but, except for grant of suitable extension of completion time of work as decided by the Engineer, the contractor shall not be entitled to any other compensation, monetary or otherwise, for any delay in the supply of Trustees' materials to him. The Contractor shall, however communicate his requirement of such materialsto the Engineer from time to time.

(d) Unless stipulated otherwise in the contract, the value of the Trustees' materials issued to the contactor shall be recovered from the Contractor'sbills and / any of his other dues. Progressively according to the consumption thereof on the work and / or in the manner decided by the Engineer or his Representative and at the rate / stipulated in the contract.These rates shall only be considered by the contractor in the preparation of his tender / offer and these will form the basis of escalation / variation, if infuture the contractor is required to procure and provide any such material onthe written order of the Engineer consequent on the Trustees' failure to affect timely supply thereof.

(e) If the Engineer decides that due to the contractor's negligence, and of the Trustees' materials issued to the contractor has been – (i) last or damaged, (ii) consumed in excess of requirement, and (iii) wasted by the contractor inexcess of normal wastage, then the value thereof shall be recovered from the contractor's bills or from any of his other dues, after adding 19.25% extra over the higher one of the following:

1. The issue rate of the materials at the Trustees' Stores, and
2. The market price of the material on the date of issue as would be determined by the Engineer.

The Engineer or his Representative shall have the power to inspect any material and work at any time and to order at any time – (i) for removal from the site of any material which in his opinion is not in accordance with the contract or the instruction of the Engineer or his Representative, (ii) for the substitution of the proper and suitable materials, or (iii) the removal and proper re-execution of anywork, which in respect of material and workmanship is not in accordance with the contract or the instructions of the Engineer. The contractor shall comply withsuch order at his own expense- and within the time specified in the order. If thecontractor falls to comply, the Engineer shall be at liberty to dispose and such materials and re-do any work in the manner convenient to the Trustees by engaging any outside agency at the risk and expense of the contractor and aftergiving him a written prior notice of 7 days.

No work shall be covered up and put out of view by the contractor without approval of the Engineer or his Representative and whenever required by him the contractor shall uncover any part or parts of the work or make openings in or through thesame as may be directed by the Engineer or his Representative from time to time and shall reinstate or make good those part of works thus affected to the satisfaction of the Engineer, all at the cost of the contractor. The Trustees shall reimburse such cost as determined by the Engineer, if the initial covering upwas with prior written order of the Engineer or his Representative.

On a written order of the Engineer or his Representative the contractor shall delay or suspend the progress of the work till such time the written order toresume the execution is received by him. During such suspension the contractor shall protect and secure the work to the satisfaction of the Engineer or his Representative. All extra expenses in giving effect to such order shall beconsidered by the Trustees, unless such suspension is

Otherwise provide for in the contract, or

1. Necessary by reason of some default on the part of the Contractor, or
2. Necessary by reason of climatic conditions on the site, or
3. Necessary for proper execution of the works or for the safety of the works or any part thereof. The Engineer shall settle and determine such extra payment and / or Extension of completion time to be allowed to the contractor, as shall, in the opinion of the Engineer, be fair and reasonable.

If at any time before or after commencement of the work the Trustees do not require the whole of the work tendered for, the Engineer shall notify the same tothe contractor in writing and the contractor shall stop further works in compliance of the same. The Contractor shall not be entitled to any claim for compensation for underived profit or for such premature stoppage of work or onaccount of curtailment of the originally intended work by reason of alteration made by the Engineer in the original specifications, drawings, designs and instruction.

When the whole of the work has been completed to the satisfaction of the Engineer and has passed any final test prescribed in the contract, the contractor shall, within 21 days of submission of his application to the Engineer be entitled to receive from him a certificate for completion of work in Form G.C.1 annexed hereto. If any part of the total work having been completed to the satisfaction ofthe Engineer, be takeover and / or used by the Trustees the Contractor shall on application be entitled to partial completion certificate in the Form of G.C.1 indicating the portion of the work covered by it, so that the Contractor's liability during maintenance period of the contract, if any, shall commence from the date mentioned in such certificate so far as the completed portion of the work is concerned.

6. TERMS OF PAYMENT:

No Sum shall be considered as earned by or due to the Contractor in respect of the work till final and satisfactory completion thereof and until a certificate of final completion in Form G.C.2 has been given by the Engineer. On account payments, if any, made prior to issue of the certificate in Form G.C.2, shall all betreated as mere advances, which shall stand recoverable in full or in part, if the Engineer so decides in the context of Contractor's unfulfilled contract condition, ifany.

All payments shall be made to the Contractor on the basis of measurement of actual work done, as recorded in the Trustees' measurement books and at accepted tendered or at agreed rates, as the case may be except as otherwise provided in the contract and when the Engineer decided any other rate for change in the scope of work or omission, if any, on the part of the Contractor.

For work of sanctioned tender value more than Rs. 50,000/- or having an initially stipulated completion period of 4 months or more, on account payments may bemade at the discretion of the Engineer or his Representative at intervals deemed suitable and justified by him. Provided always that, subject to execution of workof substantial value in the context of the contract price, the interval of such on account payments shall be decided by the Engineer or his Representative, whichshall ordinarily not be less than 1 month in between two payments for on account bill and / or advance.

Measurement for works done shall be progressively taken by the Engineer's Representative and entered in the Trustees' Measurement Book, at intervals deemed suitable and proper by him and / or the Engineer. The Contractor or his duly accredited Representative or Agent shall remain present at the time of suchmeasurement and assist the Engineer's Representative in every manner requiredby him. After the measurements taken have been entered in the Measurement Book, the Contractor or his Agent shall sign the Measurement Book at the end of such Measurements over the Contractor's Rubber Stamp as a taken of acceptance of all such measurements, recorded above and prior to such signature. If the Contractor or his Agent fails to participate even other 3 days written notice from the Engineer's Representative the measurement shall be taken ex-part by the Engineer's representative and those shall be accepted by the Contractor.

Based on the quantum of work and the value thereof computed in the Measurement Book, the Contractor shall type out his bill in the proformaapproved by the Engineer and submit the same to the Engineer's Representativein quadruplicate, duly signed by him or his accredited Agent over his Rubber Stamp. The Engineer or his Representative may, in his absolute discretion, allow advance payment against such bill to the extent of an amount not exceeding 75% of the "net payable' sum of the said bill, subject to adjustment thereof against the bill at the time of checking and auditing the bill at the Trustees end.,The measurement Book will not be handed over to the Contractor; but he will obtain the abstracts of quantities, amount and recoveries to type out the bill.

At the discretion of the Engineer or his Representative and only in respect of accepted offers/ where estimated amount put to tender would be Rs. 2,00,000/-or more, advance payment may be made to the extent of 75% of the value of any material purchased and brought to the site by the Contractor. Provided always that:

i.

The materials shall, in the opinion of the Engineer or his Representative, be ofimperishable nature.

ii. The value of such materials shall be assessed by the Engineer or his Representative, at their own discretion.

iii. A formal agreement has been drawn up with the contractor, under whichthe Trustees secure a lien on the contractor's materials.

iv. The materials are safe-guarded by the contractor against losses, shortage and misuse due to the contractor postponing the execution of the work orotherwise.

v. In the event of shortage of such materials within the Trustees' protected areas in the Docks, the contractor shall submit an indemnity Bond in the proforma and manner acceptable to Trustee' whereby the contractor shall indemnify the Trustees' against all financial loss/ damage, on account of loss/ damage to such materials for whatever reasons.

vi. In the event of storage of such materials outside the Trustees' protected areas the Contractor shall submit to the Engineer an irrevocable Bank Guarantee favoring the Trustees and for the same sum as is being advance, in the proforma and manner acceptable to the Trustees. The Guarantee shall be of a Kolkata / Haldia Branch of any Nationalized Bank or a Scheduled Commercial bank, as the case may be, acceptable to the Trustees and shall remain valid till the anticipated period of consumption of such materials in the work. The Bank Guarantee must bear an undertaking by the issuing Bank guaranteeing automatic payment of the guaranteed sum to the Trustees by the Bank on the date of expiry of the validity of the Guarantee, unless with the prior written approval of the Engineer on behalf of the Trustees, the Bank has extended the validity of the Guarantee.

vii. The amount of advance shall be recoverable from the contractor's bills or any other dues, progressively with the consumption of the materials on the basis of quantity consumed. Consequent on full recovery of the advance the Indemnity Bond / Bank Guarantee, vide sub-clause (v) & (vi)above, shall be returned to the Contractor duly discharged by the Engineeron behalf of the Trustees.

No Certificate of the Engineer or his Representative shall protect the Contractor against or prevent the Trustees from obtaining repayment from the Contractor, in case the Engineer or his Representative should over certify for payment or the Trustees should over-pay the Contractor on any account.

No claim for interest shall be admissible to the Contractor at any stage and in respect of any money or balance or Bank Guarantee, which may be due to the Contractor from the Trustees, owing to dispute or otherwise or for any delay on the part of the Trustees in making interim or final payment or otherwise.

7. VARIATION AND ITS VALUATION:

The Quantities set out in the Bill of Quantities of the tender shall be treated as estimated quantities of the work and shall never be deemed as actual or correct quantities of the works to be executed by the contractor in fulfillment of his obligation under the contract.

The Engineer shall have the power to order the Contractor in writing to make anyvariation of the Quantity, quantity or form of the works or any part thereof that may, in his opinion, be necessary and the Contractor upon receipt of such an order shall act as follows:

a) Increase or decrease the quantity of any work included in the contract.

b) Omit any work included in the contract.

c) Change the Character or quality or kind of any work included in the contract.

d) Change the levels, lines, position and dimensions of any part of the work, and

e) Execute extra and additional work of any kind necessary for completion of theworks.

No such variation shall in any way vitiate or invalidate the contract or be treated as revocation of the contract, but the value (if any) of all such variations evaluated in accordance with the Engineer's sole decision shall be taken into account and the contract price shall be varied accordingly.

Provided always that written order of the Engineer shall not be required for increase or decrease in the quantity of any work up to 15% where such increaseor decrease is not the result of any variation order given under this clause but is the result of the quantities exceeding or being less than those stated in the bill ofquantities. Provided also that verbal order of variation from the Engineer shall be complied with by the Contractor and the Engineer's subsequent written confirmation of such verbal order shall be deemed to be an order in writing within the meaning of this clause.

a) The Contractor shall not be entitled to any claim of extra or additional work unless they have been carried out under the written orders of the Engineer.

b) The Engineer shall solely determine the amount (if any) to be added to or deducted from the sum named in the tender in respect of any extra work done or work omitted by his order.

c) All extra, additional or substituted work done or work omitted by order of the Engineer shall be valued on the basis of the rates and prices set out in the contract, if in the opinion of the Engineer, the same shall be applicable. If the contract does not contain any rates or prices directly applicable to the extra additional or substituted work, then the Engineer may decided the suitable rates on the basis of Schedule of Rates (including surcharge in force at the time of acceptance of tender), if any, adopted by the Trustees with due regard to the accepted contractual percentage, if any thereon. In all other cases the Engineer shall solely determine suitable rates in the manner deemedby him as fair and reasonable, and his decision shall be final, binding and conclusive.

d) If the nature or amount of any omission or addition relative to the nature or amount of the whole of the contract work or to any part thereof shall be such that, in the opinion of the Engineer, the rate of prices contained in the contract for any item of the works or the rate as evaluated under sub-clauses (b) and (c) of this clause, is by reason of such omission or addition rendered unreasonable or in-applicable the Engineer shall fix such other rate or price ashe deems proper and the Engineer's decision shall be final, binding and conclusive.

8. DELAY / EXTENSION OF COMPLETION TIME / LIQUIDATED DAMAGE /TERMINATION OF CONTRACT

Should the quantum of extra or additional work of any kind or delayed availabilityof the Trustees' materials to be supplied as per contract or exceptionally adverse climatic conditions and natural phenomenon or strikes, lock-outs, civil commotions or other special circumstances of any kind beyond the control of the Contractor cause delay in completing the work, the contractor shall apply to the Engineer in writing for suitable extension of completion time within 7 days from the date of occurrence of the reason and the Engineer shall thereupon consider the stated reasons in the manner deemed necessary and shall either reject the application or determine and allow in writing the extension period as he would deem proper for completion of the work, with or without the imposition of "Liquidated Damaged" Clause (No. 8.3 hereof) on the Contractor and his decision shall be binding on the contractor. If an extension of completion time is grantedby the Engineer, the clause No. 8.3 of the Liquidated damage shall apply from its date of expiry, if the work be not completed within the extended time, unless stated otherwise in the decision communication by the Engineer, as aforesaid.

a) If the Contractor fails to complete the work within the stipulated dates or such extension thereof as communicated by the Engineer in writing, the contractor shall pay as compensation (Liquidated Damage) to the Trustees and not as a penalty, ½ % (half percent) of the total value of work (contract price) as mentioned in the latter of acceptance of the tender/offer, for every week or part thereof the work remains unfinished. Provided always that the amount of such compensation shall not exceed 10% the said value of work.

b) Without prejudice to any of their legal rights, the Trustees shall have the power to recover the said amount of compensation / damage in Sub-Clause (a) ofthis clause, from any money due or likely to become due to the contractor. The payment or deduction of such compensation / damage shall not relieve the Contractor from his obligation to complete the work or from any of his other obligations / liabilities under the contract and in case of the Contractor's failure and at the absolute discreti9on of the Engineer, the work may be ordered to be completed by some other agency at the risk and expense of the Contractor, after a minimum three days notice in writing has been given to the contractor by the Engineer or his Representative.

Without being liable for any compensation to the Contractor , the Trustees may ,in their absolute discretion , terminate the contract due to occurrence of any of the following reasons and decision of the Trustees in this respect, as communicated by the Engineer shall be final and conclusive:

(i) The Contractor has abandoned the contract.

(ii) In the opinion of the Engineer, either the performance of the Contractor is not satisfactory or the work is not getting completed within the agreed period on account of Contractor's lapses.

(iii) The Contractor has failed to commence the work or has without any lawfulexcuse under these conditions , has kept the work suspended despite receiving the Engineer's or his Representative's written notice to proceed with the work.

(iv) The Contractor has failed to remove materials from site after receiving from the Engineer or his Representative the written notice stating that thesaid materials or work are rejected by him .

(v) The Contractor is not executing the work in accordance with the contract or is persistently or flagrantly neglecting to carry out his obligations underthe contract.

(vi) Any bribe, commission, gift or advantage is given, promised or offered by or on behalf of the contractor to any officer, servant or representative of the Trustees or to any person on his or their behalf in relation to the obtaining or to the execution of the contract.

(vii) The Contractor is adjudged insolvent or enters in to composition with his creditors or being a company goes in to liquidation either compulsorily or voluntarily.

Upon receipt of the letter of termination of work, which may be issuedby the Engineer on behalf of the Trustees, the Contractor shall hand overall the Trustees' tools, plant and materials issued tohim at the place to be ascertained from the Engineer, within 7 daysof receipt of such letter.

In all such cases of Termination of work, the Trustees shall have the power to complete the Work through any other agency of the Contractor's risk and expense and the Contractor shall be debited any sum or sums that may be expended in completing the work beyond the amount that would have been due to the contractor, had he duly completed the whole of the work in accordance with the contract.

Upon termination of contract, the contractor shall be entitled to receive payment of only 90 % of the value of the work actually done or materials actually supplied by him and subject to recoveries as per contracts, provided the work done and materials conform to specifications at the time of taking over by the Trustees. The payment for work shall be based on measurements of actual work done and priced at approved contract rates or other rates, as decided by the Engineer. The payment for materials supplied shall be at the rates as decided by the Engineer, which shall in no case be more than market rates prevailing at the time oftalking over by the Trustees. The Engineer's decision in all such case shall befinal, binding and conclusive.

The Trustees shall have the power to retain all moneys due to the Contractor until the work is completed by other agency and the Contractor's Liabilities to the Trustees and known in all respect.

9. MAINTENANCE AND REFUND OF SECURITY DEPOSIT

On completion of execution of the work the contractor shall maintain t6he same for a period, as may be specified in the form of a Special Condition of the Contract, from the date mentioned in the initial Completion Certificate in the Form G.C.1. Any defect / fault, which may appear in the work during aforesaid maintenance period, arising, in the sole opinion of the Engineer or his Representative, from materials or workmanship not in accordance with the contract or the instruction of the Engineer or his Representative, shall, upon thewritten notice of the Engineer or his Representative, be amended and made goodby the Contractor at his own cost within seven days of the date of such notice, tothe satisfaction of the Engineer or his Representative, failing which the Engineer or his Representative shall have the defects amended and made good through other agency at the Contractor's risk and cost and all expenses, consequent thereon or incidental thereto, shall be recoverable from the Contractor in mannerdeemed suitable by the Engineer.

The Contract shall not be considered completed and the work shall not be treated as finally accepted by the Trustees, until a final Completion Certificate in from G.C. 2 annexed hereto shall have been signed and issued by the Engineer to the contractor after all obligations under the Contract including that in the maintenance period, if any, have been fulfilled by the Contractor. Previous entry on the works or taking possession, working or using thereof by the trustees shallnot relive the Contractor of his obligations under the contract for full and final completion of the work.

On completion of the contract in the manner aforesaid, the Contractor may applyfor the refund of his Security Deposit by submitting to the Engineer (i)The Treasury Receipts granted for the amount of Security held by the Trustees, and
(ii) his "No further claim" Certificate in from G.C.3 annexed hereto (in original), where upon the Engineer shall issue Certificate in from G.C.2 and within two months of the Engineer's recommendation, the Trustees shall refund the balancedue against the Security Deposit to the Contractor, after making deduction there from in respect of any sum due to the Trustees from the Contractor.

10. INTERPRETATION OF CONTRACT DOCUMENTS , DISPUTES &ARBITRATION

In all disputes, matters, claims, demands or questions arising out of or connected with the interpretation of the Contract including the meaning of Specifications and Instructions or as to the quality of workmanship or as to the materials used in the work or the execution of the work whether during the progress of the work or after the completion and whether before or after the determination , abandonment or breach of the contract the decision of the Engineer shall be final and binding on all parties to the contract and shall forthwith be given effect to by the Contractor.

If, the Contractor be dissatisfied with any such decision of the Engineer, he shall within 15 days after receiving notice of such decision require that the matter shall be referred to Chairman, who shall thereupon consider and give a decision.

If , however , the contractor be still dissatisfied with the decision of the Chairman , he shall, within 15 days after receiving notice of such decision required that within 60 days from his written notice , the Chairman shall refer the matter to an Arbitrator of the panel of Arbitrators to be maintained by the Trustees for the purpose and any such reference shall be deemed to be a submission to arbitration within the meaning of Indian Arbitration Act , l940 or any statutory modification thereof.

If the Arbitrator so appointed is unable or unwilling to act or resigns his appointment or vacates his office due to any reason whatsoever, another person from panel shall be appointed as Sole Arbitrator and he shall proceed from the stage at which it was left by his predecessor.

The Arbitrator shall be deemed to have entered on reference on the datehe issuesnotice to both the parties fixing the date of first hearing.

The time limit within which the Arbitrator shall submit his award shall normally be 4 months as provided in Indian Arbitration Act, 1940 or any amendment thereof. The Arbitrator may, if found necessary, enlarge the time for making and publishing the award, with the consent of theparties.

The Venue of the arbitration shall be Kolkata or as may be fixed by the Arbitrator in his sole discretion. Upon every or any such reference to costof any incidental to the reference and award respectively shall be in discretion of the Arbitrator who may determine, the amount thereof or bywhom and to whom and in what manner the same shall be borne and paid.

The Award of the Arbitrator shall be final and binding on all parties subject to the provisions of the Indian Arbitration Act, 1940 or any amendment thereof. The Arbitrator shall give a separate award in respectof each item of disputes and respective claim referred to him by each party and give reason for the award.

The Arbitrator shall consider the claims of all the parties to the contract within only the parameters of scope and conditions of the contract in question.

Save as otherwise provided in the contract the provisions of the Arbitration Act, 1940 and rules made there under, for the time being in force, shall apply to the arbitration proceedings under this Clause.

The Contractor shall not suspend or delay the work and proceed with the work with due diligence in accordance with Engineer’s decisions. The Engineer also shall not withhold any payment, which, according to him, is due or payable

to the Contractor, on the ground that certain disputes have cropped up and arelikely to be referred to arbitration.

Provided always as follows:

(a) Nothing of the provisions in paragraphs 8.3 to 8.3.7 hereinabove would apply in the case of contracts, where tendered amount appearing in the letter ofacceptance of the tender / offer is less than Rs. 40,00,000/-.

(b) The Contractor shall have to raise disputes or differences of any kind whatsoever in relation to the execution of the work to the Engineer within 30 days from the date of occurrence of the cause of dispute and before the preparation of the final bill, giving detailed justifications, in the context of contract conditions.

(c) Contractor's dispute, if any, arising only during the maintenance period stipulated in the contract, must be submitted to the Engineer, with detailed justifications in the context of contract Conditions, before the final completion ofthe work. No dispute or difference on any matter whatsoever, pertaining to the contract can be raised by the contractor after the completion of the work.

(d) Contractor's claim / dispute raised beyond the time limits prescribed in sub-clauses 8.5 (b) and 8.5 (c) hereinabove, shall not be entertained by the Engineer and / or by any Arbitrator, subsequently.

(e) The Chairman / Trustees shall have the right to alter the panel of Arbitrators on their sole discretion, by adding the names of new Arbitrators and / or by deleting the names of existing Arbitrators, without any reference to the Contractor.

THE BOARD OF TRUSTEES FOR THE PORT OF KOLKATA

FORM OF TENDER

CONTRACT NO…….

To,

……..

I/We

……

……. of

……

…….

having examined the site of works, inspected the Drawings and read the Specifications, General and Special Conditions of Contract and Conditions of Tender, hereby tender and undertake to execute and complete all the works required to be performed in accordance with the Specification, Bill of Quantities, General & Special Conditions of Contract and Drawings prepared by or on behalf of the Trustees and at the rates and prices set out in the annexed Bill of Quantities with …….. month/week from the date of the order to commence the work and in the event of our Tender being accepted in full or in part, I/We also undertake to enter into a Contract Agreement in the Form hereto annexed with such alterations or additions thereto which may be necessary to give effect the acceptance of the Tender and incorporating such Specification, Bill of Quantities, Drawings and Special & General Conditions of Contract and I / We hereby agree that until such Contract Agreement is executed the said Specifications, Bill of Quantities, Conditions of Contract and the Tender, together with the acceptance thereof in writing by or on behalf of the Trustees shall be the Contract.

THE TOTAL AMOUNT OF TENDER Rs (Not To be filled up)

(Repeat in words) **(Not to be filled up)**

****

*

**********……
……..

*I/We require ……..... days/months preliminary time to arrange and procure the materials required by the work from date of acceptance of the Tender before I/We could commence the Work.

(* This should be scored out in the case of labour contracts)

I/We have deposited with the Trustees' Financial Advisor & Chief Accounts Officer / Manager (Finance), Haldia Dock Complex vide Receipt No ……. of.....as Earnest Money.

I/We agree that period for which the Tender shall remain open for acceptance shall not be less than four months.

Signature of the Tenderer
(Seal of the Tenderer)
Name of the Tenderer

Witness:
Signature …….
……..
Name ……... (In Block Letters)
(In Block Letters)

Address …… Dated

……

…….. Address

……

Occupation …….

……..

THE BOARD OF TRUSTEES FOR THE PORT OF

KOLKATAFORM OF AGREEMENT

THIS AGREEMENT made this.....day of…….200..... between the Board of Trustees for the Port of Kolkata, a body corporate constituted by the Major Port Trusts Act, 1963 (thereinafter called "Trustees" which expression shall unless excluded by or repugnant to the context be deemed to include their successors in office) of the one part and ……
……(hereinafter called " the Contractor ", which expression shall unless excluded by or repugnant to the context be deemed to include its heirs, executors, administrators, representatives and assignees or successors in office) of the other part.

WHEREAS the Trustees are desirous that certain works should be executed / constructed , viz.
……
……...and have accepted a Tender / Offer by the Contractor for the execution and maintenance of such work NOW THIS AGREEMENT WITNESSETH as follows :

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in General Conditions of Contract hereinafter referred to.
2. The following documents shall be deemed to from and be read and construed as part of this Agreement, viz.
   (a) The said Tender / Offer & the acceptance of the Tender / Offer
   (b) The General Conditions of Contract
   (c) The Special Conditions of Contract
   (d) The Conditions of Tender
   (e) The Technical Specifications
   (f) The Schedule of Rates
   (g) The Terms of Payment
   (h) All correspondence by which, the contract is added, amended, varied or modified in any way by mutual consent.

3. In consideration of the payments to be made by the Trustees to the Contractor as hereinafter mentioned , the Contractor hereby covenant with the Trustees to execute and maintain the work in conformity in all respects with the provisions of the contract.

4. The Trustees hereby covenants to pay to the Contractor, in consideration of such execution and maintenance of the Work, the Contract Prices at the times and in the manner prescribed by the Contract.

IN WITNESS whereof of 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.

The Seal of……
…
……

……..

Was hereunto affixed in the presence of:

Name.....

Address .....

……

…..……

…….

Or

SIGNED, SEALED AND DELIVERED

by the said ……
.

In the presence of:

Name.....
Address: .....
……
….

The Common Seal of the Trustees was hereunto affixed in the presence of:

Name……

Address: ……...

Contractor .....

Address .....

……

Date of Completion

……....

Dear Sir/s,

This is to certify that the following works viz.

Name of the Work .....
……
Estimate Number E.E.O ……dt
C.E.O……dt ---------- --.
Work Order Number .....
Allocation.....
Contract Number .....

Which was carried out by you is in the opinion of the undersigned completing in every respect on the ---------- Day of----------.20….....in accordance with clause 62 of the General Conditions of Contract and under the provisions of the Contract for a period of---------- --. Days /weeks / months / years.

From the……...day of ……..…….. 20 ……

To the ……day of ……..….. 20 ……

Signature (.....)
(Engineer / Engineer's Representative)

Name……...……

Designation…….

Office Seal

c.c. to The Deputy Chief Engineer ( )
The Deputy Manager ( )
Financial Adviser & Chief Accounts Officer/
Manager (Finance), Haldia Dock Complex.

KOLKATA PORT TRUST

FORM G.C.2

The Financial Adviser & Chief Accounts Officer.

The Manager (finance), Haldia Dock Complex.

CERTIFICATE OF FINAL COMPLETION

This is to certify that the following works viz.

Name of Work .....

Estimate No. E.E.O. No. …… dt ……

C.E.O. No …….dt ……

Work Order No.……..….dt ……

Contract No. .....

Resoln. No & Meeting No.....

Allocation .....

Which was carried out by Shri / Messrs ..... is now complete in every respect in accordance with the terms of the Contract and that all the obligations under Contract have been fulfilled by the Contractor.

Signature (.....)

(Engineer / Engineer's Representative)

Name……

Designation…….

Office Seal

KOLKATA PORT TRUST

FORM G.C.3

('No Claim' Certificate From Contractor)

The Engineer
Kolkata Port Trust
Kolkata / Haldia

(Attn:.....)

(Address, the Trustees' Official, mentioned in the work Order and under whom the Contract was executed)

Dear Sir,

I / We do hereby declare that I / We have received full and final payment from Kolkata Port Trust for the execution of the following work, viz.

Name of Work .....

Work Order No …….. dt ……

Contract No …… dt……
Agreement No ……...…….dt……..…..……
and I / We have no further claim against Kolkata Port Trust in respect of the above mentioned job.

Yours faithfully,

(Signature of Contractor)

Date ……..……

Name of Contractor ……..……

Address ……..……

…….

(Official Seal of the Contractor)

Draft Proforma of Bank Guarantee (Performance Bond) in lieu of cash Security Deposit, to be issued by the Kolkata/Haldia Branch, as the case may be, of any nationalized Bank of India on Non-Judicial Stamp Paper worth Rs.50/- or as decided by the Engineer / Legal Adviser of the Trustees.

To

The Board of Trustees

for the Port of Kolkata.

BANK GUARANTEE

NO……DATE……

Name of issuing Bank
……..……...
Name of Branch……...
…….
Address……
..

In consideration of the Board of Trustees of the Port Kolkata, a body corporate - duly constituted under the Major port Trust Act, 1963 (Act 38 of 1963), having agreed to exempt Shri / Messrs ..... ……. a proprietary / Partnership / Limited / Registered Company, having its Registered Office at .... (hereinafter referred to as "The Contractor") from cash payment of Security Deposit / Payment of Security Deposit through deduction from the Contractors' bills under the terms and conditions of a contract made between the Trustees and the Contractor for …… …… …… … …… (write the name of the work as per Work Order) in terms of the Work order No ……. ……. ated ..... (hereinafter referred to as "the said contract"), for the due fulfillment by the contractor of all the terms and conditions contained in the said contract, on submission of a bank Guarantee for Rs …… …… …… … (Rupees …… …… …… …… …… ……) we,…….Branch, Kolkata ...../ Haldia, do on the advise of the contractor, hereby undertake to indemnify and keep indemnified the Trustees to the extent of the said sum of Rs …… (Rupees ....) We..... Branch,Kolkata ……/Haldia, further agree that if a written demand is made by the Trustees through any of its officials for honoring the Bank Guarantee constituted by these presents, We,……. Branch, Kolkata …… …….. /Haldia shall have no right to decline to cash the same for any reason whatsoever and shall cash the same and pay the sum so demanded to the Trustees within a

week from the date of such demand by an A/c. Payee Banker's Cheque drawn in favour of "Kolkata Port Trust", without any demur. Even if there be any dispute between the contractor and the Trustees, this would be no ground for us,…… ……(Name of Bank), …… …… ……. Branch, Kolkata...../Haldia to decline to honour the Bank Guarantee in the manner aforesaid. The very fact that We, …… …… …… …… ……Branch,Kolkata ...../Haldia, decline or fail or neglect to honour the Bank Guaranteed in the manner aforesaid shall constitute sufficient reason for the Trustees to enforce the Bank Guarantee unconditionally without any reference, whatsoever, to the contractor.

2. We,..... Br anch,Kolkata ...../Haldia, further agree that a mere demand by the Trustees at any time and in the manner aforesaid, is sufficient for us, ……... …… Branch, Kolkata …….. / Haldia, to pay the amount covered by this Bank Guarantee in full and in the manner aforesaid and within the time aforesaid without reference to the contractor and no protest by the contractor, made either directly or indirectly or through Court , can be valid ground for us, …… …… …… …… …Branch,Kolkata ...../Haldia, to decline or fail or neglect to make payment to the Trustees in, the manner and within the time aforesaid.
3. We, ……. Branch, Kolkata …… / Haldia, further agree that the Bank Guaranteed herein contained shall remain in full force and effect, during the period that is taken for the due performance of the said contract by the contractor and that is shall continue to be enforceable till all the dues of the Trustees under and/or by virtue of the terms and conditions of the said contract have been fully paid and its claim satisfied and/or discharged in full and/or till the Trustees certify that the terms and conditions of the said contract have been fully and properly observed/fulfilled by the contractor and accordingly, the Trustees have discharged the Bank Guarantee, subject however, that this guarantee shall remain valid up to and inclusive of ……day of ……..19……and subject all so that the provision that the Trustees shall have no right to demand payment against this guarantee after the expiry of 6(six) calendar months from the expiry of the aforesaid validity period up to ……. Or any extension thereof made by us, ……..Branch, Kolkata...../ Haldia, in further extending the said validity period of this Bank Guarantee on Non-Judicial Stamp Paper of appropriate value, as required / determined by the Trustees, only on a written request by the Trustees to the contractor for such extension of validity of this Bank Guarantee.
4. We, …… …… …… …… …… ……. Branch, Kolkata ..... / Haldia, further agree that, without our consent and without affecting in any manner our obligations hereunder, the Trustees shall have the fullest liberty to vary from time to time any of the terms and conditions of the said contract or to extend the time for full performance of the said contract including fulfilling all obligations under the said contract by the contractor or to postpone for any time or from time to time any of the powers exercisable by the Trustees against the contractor and to forebear or enforce any of terms and conditions relating to the said contract and We, ...Branch, Kolkata ……../Haldia, shall not be relieved from our liability by reason of

any such variation or extension being granted to the contractor or for any fore-bearance, act or commission on the part of the Trustees or any indulgence by the Trustees to the contractor or by any such matter or thing of whatsoever nature, which under the law relating to sureties would, but for this provision, have effect of so relieving us,..... Branch, Kolkata..... /Haldia.

5. We …… Branch, Kolkata ...……/Haldia, lastly undertake not to revoke this Bank Guarantee during its currency except with the previous consent of the Trustees in writing.

SIGNATURE……
NAME……
DESIGNATION……

(Duly constituted attorney for and on behalf of)

BANK……
BRANCH……
Kolkata…..... / HALDIA.

(OFFICIAL SEAL OF THE BANK)

Integrity Pact

Between

Syama Prasad Mookerjee Port,Kolkata (SMPK) hereinafter referred to as "The Principal/ Employer".

And

..... hereinafter referred to as "The Bidder/Contractor"

Preamble

The Principal intends to award, under laid down organizational procedures, contract/s for ..... The Principal values full compliances with all relevant laws of the land, rules, regulations, economic use of resources and of fairness/transparency in its relations with its Bidder(s) and/or Contractor(s).

In order to achieve these goals, an Independent External Monitor (IEM) appointed by the principal, will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:-

Enabling the PRINCIPAL/EMPLOYER to get the contractual work executed and/or to obtain/dispose the desired said stores/ equipment at a competitive price in conformity with the defined specifications/ scope of work by avoiding the high cost and the distortionary impact of corruption on such work /procurement/ disposal and Enabling BIDDERs/ CONTRACTORs to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the PRINCIPAL/EMPLOYER will commit to prevent corruption, in any form, by its officials by following transparent procedures.

Section 1 – Commitments of the Principal/ Employer.

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

1. No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

2. The Principal will, during the tender process treat all Bidder(s) with equity and reason.

The Principal will, in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

3. The Principal will exclude from the process all known prejudiced persons.

(2). If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the Indian Penal Code (IPC)/Prevention of Corruption (PC) Act, or if there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer and in addition can initiate disciplinary actions.

Section-2 –Commitments of the Bidder(s) / Contractor(s)

(1) The Bidder(s)/Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

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

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

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

d. The Bidder(s)/Contractor(s) of foreign origin shall disclose the name and address of the Agents/representatives in India, if any. Similarly the Bidder(s)/Contractor(s) of Indian Nationality shall furnish the name and address of the foreign principles, if any. Further details as mentioned in the "Guidelines on Indian Agents of Foreign Suppliers" shall be disclosed by the Bidder(s)/Contractor(s). Further, as mentioned in the Guidelines, all the payments made to the Indian agent/representative have to be in Indian Rupees only. Copy of the "Guidelines on Indian Agents of Foreign Suppliers" is annexed and marked as Annex-A.

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

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

Section-3-Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/Contractor(s) before award or during execution has committed a transgression through a violation of Section 2 above, or in any other form such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/Contractor(s) from the tender process or take action as considered appropriate.

Section 4-Compensation for damages

(1) If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/Bid Security.

(2) If the Principal has terminated the contract according to Section 3 or if the Principal is entitled to terminate the contract according to Section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages of the contract value or the amount equivalent to Performance Bank Guarantee.

Section 5-Previous transgression

(1) The Bidder declares that no previous transgressions occurred in the last 3 years from the date of signing the Integrity pact with any other Company in any country conforming to the anti corruption approach or with any other Public Sector Undertaking / Enterprise in India, Major Ports/ Govt. Departments of India that could justify his exclusion from the tender process.

(2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or action can be taken as considered appropriate.

Section 6- Equal treatment of all Bidders/Contractors/Sub-Contractors

(1) The Bidder(s)/Contractor(s) undertake(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact, and to submit it to the Principal before contract signing.

(2) The Principal, will enter into agreements with identical conditions as this one with all Bidders, Contractors and Sub-contractors.

(3) The Principal will disqualify from the tender process all bidders who do not sign this Pact or violate its provisions.

Section 7- Other Legal actions against violating Bidder(s)/ Contractor(s)/ Sub Contractor(s)

The actions stipulated in this Integrity pact are without prejudice to any other legal action that may follow in accordance with provisions of the extant law in force relating to any civil or criminal proceedings. .

Section 8 – Role of Independent External Monitor(IEM):

(a) The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this pact.

(b) The Monitors shall not be subject to instructions by the representatives of the parties and shall perform their functions neutrally and independently.

(c) Both the parties accept that the Monitors have the right to access all the documents relating to the contract.

(d) As soon as the Monitor notices, or has reason to believe, a violation of this pact, he will so inform the authority designated by the Principal and the Chief Vigilance Officer of Kolkata Prot Trust.

(e) The BIDDER/ CONTRACTOR(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the PRINCIPAL including that provided by the BIDDER/ CONTRACTOR. The BIDDER/ CONTRACTOR will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation, if any. The same is applicable to sub-contractors. The Monitor shall be under contractual obligation to treat the information and documents of the Bidder/Contractor/ Sub-contractor(s) with confidentiality.

(f) The Principal/ Employer will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor, the option to participate in such meetings.

(g) The Monitor will submit a written report to the designated Authority of Principal/ Employer/ Chief Vigilance Officer of Syama Prasad Mookerjee Port,Kolkata within 8 to 10 weeks from the date of reference or intimation to him by the Principal/ Employer/ Bidder/ Contractor and should the occasion arise, submit proposals for correcting problematic situation. BIDDER/ CONTRACTOR can approach the Independent External Monitor (s) appointed for the purposes of this Pact.

(h) As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or to take corrective action, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

(i) If the Monitor has reported to the Principal substantiated suspicion of an offence under the relevant

IPC/PCA, and the Principal/ Employer has not, within reasonable time, taken visible action to proceed

against such offence or reported to the Chief Vigilance Officer, the Monitor may also transmit this

information directly to the Central Vigilance Commissioner, Government of India.

(j) The word 'Monitor' would include both singular and plural.

8.a) The Name and Correspondence Particulars of Independent External Monitors:

a) Shri Subhashish Sarkar,

Flat No. 406, Block-III,

Kirti Apartments,

Mayur Vihar Phase-I Extension,

Delhi-110 091,

Mob No. 98117 07230,

E-mail : subhashishsarkar53@yahoo(dot)com

b) Ms. Bulbul Sen, IRS (Retd.),

B-104 Nayantara Aptts.

Block 8B, Sec - 7

Dwarka

New Delhi-110075

E-mail ID – bsensarkar@gmail(dot)com

Section 9 – Facilitation of Investigation:

In case of any allegation of violation of any provisions of this Pact or payment of commission, the PRINCIPAL/EMPLOYER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER/CONTRACTORS and the BIDDER/CONTRACTOR shall provide necessary information and documents in English and shall extend all possible help for the purpose of such examination.

Section 10 – Pact Duration:

The pact beings with when both parties have legally signed it and will extend upto 2 years or the complete execution of the contract including warranty period whichever is later. In case bidder/contractor is unsuccessful this Integrity Pact shall expire after 6 months from the date of signing of the contract.

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

Section 11 – Other Provisions:

(1) This agreement is subject to Indian Law. Place of performance and jurisdiction is the Registered Office of the Principal in Kolkata.

(2) Changes and supplements as well as termination notices need to be made in writing in English.

(3) If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

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

_____ _____

(For & on behalf of the Principal) (For & on behalf of Bidder/Contractor).

(Office Seal) (Office Seal)

Place :

Date :

Witness 1:

(Name & Address) .....

.....

.....

Witness 2:

(Name & Address) .....

.....

.....

ANNEXURE-A

GUIDELINES FOR INDIAN AGENTS OF FOREIGN SUPPLIERS

There shall be compulsory registration of Indian agents of Foreign suppliers for all Tenders. An agent who is not registered with SMPK shall apply for registration in the prescribed Application-Form.

Registered agents will file an authenticated Photostat copy (duly attested by a Notary Public)/Original certificate of the principal confirming the agency agreement and giving the status being enjoyed by the agent and the commission/ remuneration/salary/retainer ship being paid by the principal to the agent before the placement of order by SMPK.

Wherever the Indian representatives have communicated on behalf of their principals and the foreign parties have stated that they are not paying any commission to the Indian agents, and the Indian representative is working on the basis of salary or as retainer, a written declaration to this effect should be submitted by the party (i.e. Principal) before finalizing the order.

DISCLOSURE OF PARTICULARS OF AGENTS/REPRESENTATIVES IN INDIA. IFANY.

Tenderers of Foreign nationality shall furnish the following details in their offer:

The name and address of the agents/representatives in India, if any and the extent of authorization and authority given to commit the Principals. In case the agent/representative be a foreign Company, it is to be conformed whether it is real substantial Company and details ofthe same shall be furnished.

The amount of commission/ remuneration included in the quoted price(s) for such agents/representatives in India.

Confirmation of the Tenderer that the commission/remuneration if any, payable to his agents/ representatives in India, is to be paid by SMPK in Indian Rupees only.

Tenderers of Indian Nationality shall furnish the following details in their offers:

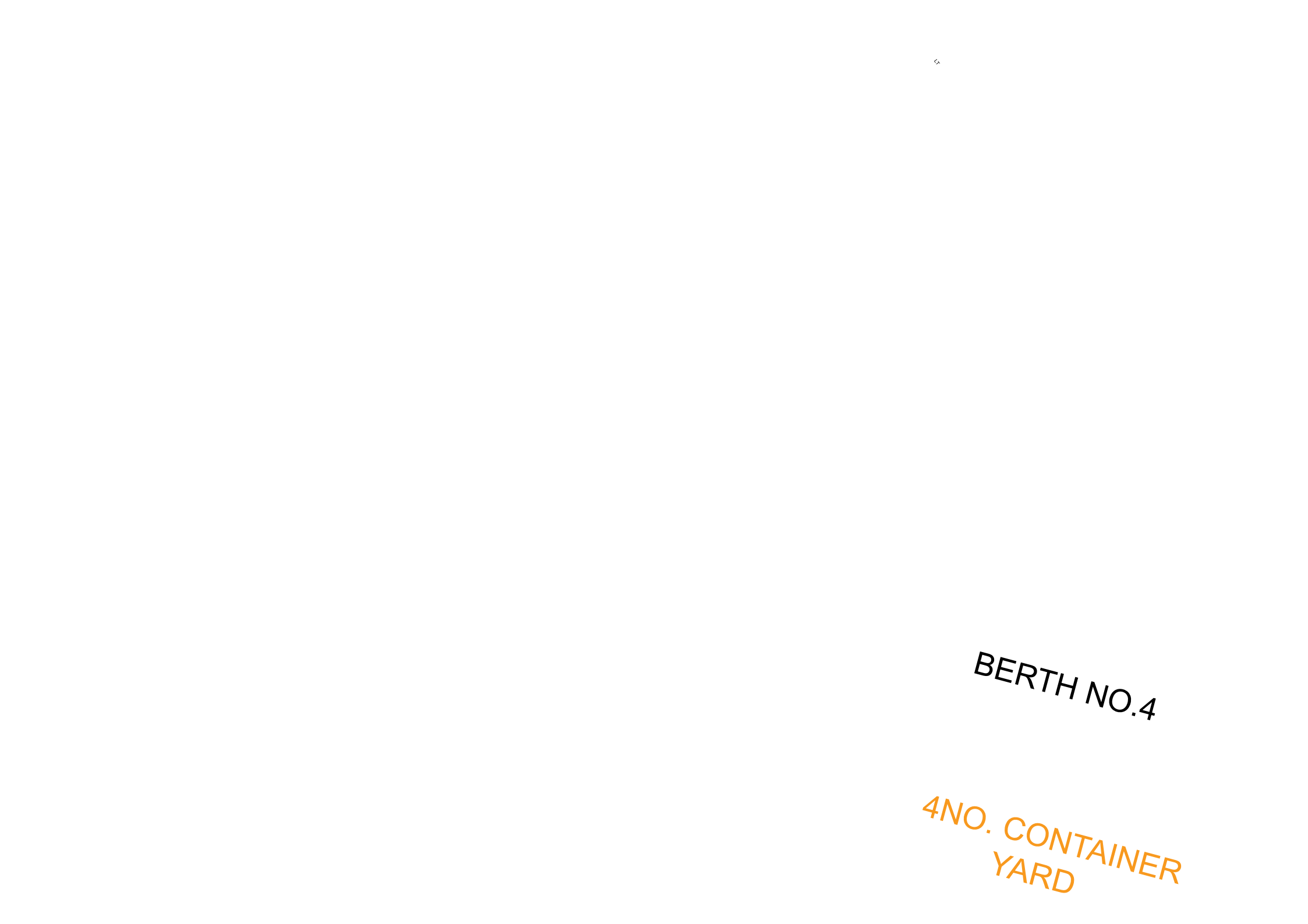
The name and address of the foreign principals indicating their nationality as well as their status, i.e. whether manufacturer or agents of manufacturer holding the Letter of Authority of the Principal specifically authorizing the agent to make an offer in India in response to tender either directly or through the agents /representatives.

The amount of commission/remuneration included in the price(s) quoted by the Tenderer for himself.

Confirmation of the foreign principals of the Tenderer that the commission/remunerations, if any, reserved for the Tenderer in the quoted price(s), is to be paid by SMPK in India in equivalent Indian Rupees.

In either case, in the event of contract materializing, the terms of payment will provide for payment of the commission/remuneration, if any payable to the agents/representatives in India in Indian Rupees on expiry of 90 days after the discharge of the obligations under the contract.

Failure to furnish correct and detailed information as called for in paragraph-2.0 above will render the concerned tender liable for rejection or in the event of a contract materializing, the same liable to termination by SMPK. Besides this there would be a penalty of banning business dealings with SMPK or damage or payment of a named sum.


BERTH NO.4
4NO. CONTAINER YARD

“Carrying Out Bathymetric Survey, OLS Survey and Preparation of DPR for Construction of Water Aerodrome for Seaplane Operations at Surat Hub, Gujarat.”

SYAMA PRASAD MOOKERJEE PORT, KOLKATA

NEPC
NEKTOR ENGINEERS & PROJECT CONSULTANTS

TRANSMITTAL

This document and its contents have been prepared and are intended solely for Shyama Prasad Mookerjee Port, Kolkata, information and use concerning Detail Project Report.

NEPC assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

Document History:

Sr No	Description	Date Of Submission	Revision
1)	Detailed Project Report – Surat Water Aerodrome	25-Feb-22	R0
2)	Detailed Project Report – Surat Water Aerodrome	29-Mar-22	R1

Client Signoff:

Client	SYAMA PRASAD MOOKERJEE PORT, KOLKATA
Project	Carrying out bathymetric survey, OLS Survey and preparation of DPR for construction of water aerodrome for seaplane operations at Surat Hub, Gujarat under the directions of Marine Department of SMP, Kolkata
Document Title	Detailed Project Report

This report contains the followings:

- Detailed Project Report
- Geotechnical Investigation Report
- Bathymetry Report
- OLS Report
- Drawings
- Bill of Quantity and Cost Estimates

DISCLAIMER

This document has been prepared for the benefit of Shyama Prasad Mookerjee Port, Kolkata and other authorized entities and does not carry any right of publication or disclosure to any other party. NEPC has prepared the document for Shyama Prasad Mookerjee Port, Kolkata.

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DEFINITIONS / GLOSSARY

AERODROME: A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

AERODROME BEACON: Aeronautical beacon is used to indicate the location of an Aerodrome from the air.

AERODROME LICENSE: A license issued by the Director General of Civil Aviation under applicable regulations for aerodrome operation.

AERODROME MAPPING DATA (AMD): Data collected to compile Aerodrome mapping information for aeronautical uses.

AERODROME MAPPING DATABASE (AMDB): A collection of Aerodrome mapping data organised and arranged as a structured data set.

AERODROME ELEVATION: The elevation of the highest point of the landing area.

AERODROME IDENTIFICATION SIGN: A sign placed on an Aerodrome to aid in identifying the Aerodrome from the air.

AERODROME REFERENCE POINT: The designated geographical location of an Aerodrome. Amphibian

PLANE: an aircraft that can take off and land on land and water.

ANCHORAGE AREA: A dedicated area along the shoreline within the protected waters to secure a Seaplane.

DOCK/DOCKING AREA: A floating platform extending from the shore, on water and supported by pillars or pontoons to hold in position, intended alongside seaplanes for loading or unloading passengers, cargo, fueling or parking.

FLOATING JETTY: An anchored, defined platform inside protected waters licensed for embarkation and disembarkation of passengers or cargo by aircraft.

GANGWAY: A movable walkway where people embark or disembark decks, piers, and barges.

LICENSEE: The license holder of the Water Aerodrome.

LANDING AREA (WA): Part of a movement area (WA) on Water Aerodromes intended for the landing or take-off of aircraft.

MOVEMENT AREA (WA): part of a Water Aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the maneuvering area (WA) and the apron(s).

MANOEUVRING AREA (WA) that part of a Water Aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons.

MOORING BUOY: A floating marker held in place by chain or cable to a permanent, unmovable anchor sunk deeply into the bottom within the Water Aerodrome. These buoys are mainly used to secure a Seaplane.

PROTECTED AREA: An area usually located on the atoll-ward side near islands, protected from large waves by the surrounding reef or lagoon.

RESPONSE TIME: The time between the initial call to the Rescue and Fire Fighting Services (RFFS) and the first effective intervention by a rescue and firefighting vessel at the accident site.

WATER AERODROME: A defined area on water (including any buildings installations and equipment) intended to be used either wholly or in part for aircraft arrival, departure, and movement.

WATER RUNWAY/SEA LANE: A defined rectangular area on a Water Aerodrome intended for aircraft landing and take-off run along its length.

ABBREVIATIONS

AAI	:	Airports Authority of India
AIMS	:	Airport Information Management System
AMIS	:	Interface of Airport Management Information System
AMSS	:	Aeronautical Mobile Satellite Service
ATC	:	Air Traffic Control
ATF	:	Air Turbine Fuel
ATM	:	Aircraft Movement
BCAS	:	Bureau of Civil Aviation Security
BOQ	:	Bill of Quantity
CAG	:	Comptroller and Auditor General of India
CAR	:	Civil Aviation Regulations
CCEA	:	Cabinet Committee on Economic Affairs
CPI-IW	:	Consumer Price Index for Industrial Workers
CPP	:	Central Public Procurement
CPSU	:	Central Public Sector Undertaking
DF	:	Development Fee
DGCA	:	Directorate General of Civil Aviation
DoNER	:	Department of Development of Northeastern Region
ER	:	Eastern Region (FIR)
GST	:	Goods and Services Tax
IA	:	Implementing Agency
IACS	:	International Air Connectivity Scheme

IAF	:	Indian Air Force
ICAO	:	International Civil Aviation Organization
ICMR	:	Indian Council of Medical Research
IT	:	Information Technology
LOIA	:	Letter of Intent to Award
LOA	:	Letter of Award
MHA	:	Ministry of Home Affairs
MoCA	:	Ministry of Civil Aviation
MoHFW:		Ministry of Health and Family Welfare
MoU	:	Memorandum of Understanding
NCAP	:	National Civil Aviation Policy
NEC	:	Northeastern Council
NER	:	Northeastern Region (FIR)
NR	:	Northern Region (FIR)
NSOP	:	Non-Scheduled Operator's Permit
PG	:	Performance Guarantee
PPE	:	Personal Protective Equipment
RCS	:	Regional Connectivity Scheme
RCF	:	Regional Connectivity Fund
RTM	:	Right To Match
SAO	:	Selected Airline Operator
SAOA	:	Selected Airline Operator Agreement
SCO	:	Scheduled Commuter Operator

SR	:	Southern Region (FIR)
TNCL	:	Terminal Navigation Landing Charge
UDAN	:	Ude Desh ka Aam Naagrik
UDF	:	User Development Fee
UT	:	Union Territory
VGF	:	Viability Gap Funding

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1. INTRODUCTION

1.1 PREAMBLE

The Tourism industry in Gujarat has evolved, over the years, into a significant one, thanks to the varied natural and historical attractions and the effort made by the state and the private sector in marketing these attractions and providing the necessary infrastructure required by the industry. Even now, the industry is taking innovative and novel measuring promoting tourism. Such actions add greate value to Gujarat tourism.

Surat city is an important location from a tourism point of view. Surat tops the list in terms of development, but Surat still has its name at the top of the list when it comes to history, culture, and traditions. Awarded with many epithets like “The Textile City of India,” “Embroidery Capital of India,” and “The Sun City,” Surat has a lot to give to its tourists.

The city is a treat to architectural lovers, and it has retained its medieval charm despite being a land of several battles. Surat even has its mention in mythology; it is said that Lord Krishna had a little stopover here when he was travelling from Mathura to Dwarka. The city has witnessed many battles and revolutions, and all make it a city of immense importance. And adding to this, there are many places to visit in Surat, which reflects the city's rich history and culture.

1.2 BRIEF ABOUT RCS UDAN

UDAN (Hindi: Ude Desh ka Aam Naagrik, literally "An aviation country for the common citizen") is a regional airport development programme of the Government of India and part of the Regional Connectivity Scheme (RCS) for upgrading underserviced air routes. The UDAN Scheme is a critical component of the National Civil Aviation Policy (NCAP) which the Ministry of Civil Aviation released on June 15, 2016. UDAN is a first-of-its-kind scheme globally to stimulate regional connectivity through a market-based mechanism in which airlines bid for seat subsidies. It has created affordable yet economically viable and profitable flights on regional routes to make flying affordable to the commoner, even in small towns.

To continuously improve the scheme, RCS-UDAN has evolved over the years, considering the dynamic market conditions, changing priorities and objectives of the government, inputs from stakeholders, market response and participation patterns observed during the previous bidding

rounds and implementation issues and limitations faced during such round. Consequently, RCS has evolved into a robust platform to help shape India's aviation sector over the years.

Inclusion of seaplane routes: Considering the opportunity to drive air connectivity through seaplanes due to the presence of lakes and dams in many remote areas, the scope of the scheme was expanded to include the operations through seaplanes in UDAN 3. This was further supported by the development of multiple water aerodromes across the country.

FIGURE 1 EVOLUTION OF UDAN OVER YEARS

1.3 PROJECT BACKGROUND

With the growth of the aviation industry, India is also witnessing tremendous growth in aircraft operations. Seaplane operations in India are yet an untapped market despite immense potential, being a vast country with magnificent waterfronts all across.

With the current growth scenario in civil aviation, particularly in India, the Central Government has launched Regional Connectivity Scheme (RCS) to reach out to remote areas. Seaplane operation from coastal/ river/ canal and terrestrial water bodies will extend the connectivity to those areas where there is no land-based airport. Secondly, high capital investment for infrastructure development is required in the land-based airport, which can be avoided. Thus, there is a necessity to establish water aerodromes for seaplane operations.

Under the directions of the Marine Department of Shyama Prasad Mookerjee Port, Kolkata (SMPK) on behalf of Sagarmala Development Company Limited (SDCL) under the Ministry of

Ports, Shipping and Waterways (MoPSW) and Airport Authority of India (AAI) under Ministry of Civil Aviation (MoCA), M/s Nektor Engineers and Project Consultants (NEPC) has conducted Bathymetric survey, Obstacle Limitation Surface (OLS) survey and prepared a details project report of water aerodrome for the seaplane operation on Tapti River at Surat Hub, Gujarat.

1.4 IMPORTANCE AND REGIONAL ASPECTS

Located in the western part of India in the Gujarat State, Surat is one of the country's largest and most dynamic cities. Surat is well known as "The Diamond City", "The Green City", and The Silk City". Surat is one of the cleanest cities in India. Now, it is the commercial and economic centre in South Gujarat, which is famous for its diamonds and textile industries. Thus, it is called the diamond city and "The Textile City". It is the second-largest city in Gujarat after Ahmedabad, the eighth largest city by population, and the ninth-largest urban agglomeration in India. Surat to Ahmedabad distance is approx. 265km, and it is located 284 km south of the state capital, Gandhinagar, Surat to Mumbai distance is approx. 289 km.

1.5 SCOPE OF WORK

I. Bathymetry survey of the area (approx. area 5 - 6 sq. km) conforming to Special Order surveys under IHO's S-44 standards. Hydrological observation includes current velocity observation, tidal data collection, bed sampling and analysis, etc. The work is to be carried out under the guidance and observation of SMPK representative.
II. OLS survey to be performed, including establishing the Primary Ground control Points and Secondary Ground Control points in accordance with AAI aeronautical survey Manual-Part II and meeting ICAO and DGCA norms. SMP, Kolkata will forward the report to AAI/ MoCA for acceptance.
III. Preparation of BIM models with DPR for each site. SMPK will forward the report to AAI/ MoCA for acceptance.
IV. Finalised format of Location survey and submission of the report as per deliverables lists, both in hard copies and soft copies, along with raw data.
V. Project Management Consultancy (PMC) and technical support for two years.

2. WATER AERODROME

The Seaplane offers the unique feature, speed of the aeroplane with the utility of the boat – A valuable means of air transportation. The seaplane operation site, which deals explicitly with landing and take-off, are referred to as the Seaplane Base. Seaplane Base, also called Water Aerodrome, is operational with basic facilities and arrangements for aviation operations.

2.1 KEY BENEFITS-A BOON FOR WATER TRANSPORTATION NETWORK

Aviation, as a whole, plays a significant role in the nation's economy and its transportation network. Water Aerodrome serves the flying community like a marina serves boating enthusiasts. A water aerodrome provides the aviation, business, and tourism community an operational base and supports the community with economic, employment, and recreational opportunities. Seaplanes can be used to access remote areas that may not have runways for regular planes to land but may have suitable water bodies on which seaplanes can land. Seaplanes can help the field of aviation expand to an area that is not ready for expensive ground runway operations, which will emerge the utilisation of the suitable shorelines, lakes, rivers, and harbours which offer natural landing sites for seaplane operations. Seaplane routes have proven desirable where land or water vessel surface transportation may not exist or is tedious and time-consuming.

2.2 REGULATORY REQUIREMENTS

2.2.1 DGCA REQUIREMENTS

The regulations for these operations have been laid down by the Director General of Civil Aviation (DGCA) in Civil Aviation Requirements (CAR). A list of the CARs applicable to seaplane operations is given below:

1) CAR Section 3 Series 'C' Part III for obtaining the grant of Permit to operate Non-Scheduled Air Transport Services to undertake charter operations.
2) CAR Section 3 – Air Transport Series 'C' Part IX for operational and airworthiness requirements for seaplane operation. This CAR deals with airworthiness requirements of aircraft, pilot qualification & experience requirements, functional requirements including pre-flight, passenger briefings, use of seatbelts and shoulder harnesses, safety requirements for take-off and landing areas, requirements for floating platforms, site selection, size of water runway, approach and departure paths requirements, transfer of passengers, other aids, right-of-way rules, permit for seaplane operations, etc.

3) CAR Section 7 – Flight Crew Standards Training and Licensing Series 'B' Part XVI regarding seaplane rating for pilots.

Other detailed Section Ids for CAR shall be referred

SECTION 1 - GENERAL
SECTION 2 - AIRWORTHINESS
SECTION 3 - AIR TRANSPORT
SECTION 4 - AERODROME STANDARDS AND LICENSING
SECTION 5 - AIR SAFETY
SECTION 6 - DESIGN STANDARDS AND TYPE CERTIFICATION
SECTION 7 - FLIGHT CREW STANDARDS, TRAINING AND LICENSING
SECTION 8 - AIRCRAFT OPERATIONS
SECTION 9 - AIR SPACE AND AIR NAVIGATION STANDARDS
SECTION 10 - AVIATION ENVIRONMENT PROTECTION
SECTION 11 - SAFE TRANSPORT OF DANGEROUS GOODS BY AIR

2.2.2 Other Authorities

Following mandatory clearances are required to be obtained from the following authorities before introducing Seaplane services:

1. Ministry of Defence
2. Ministry of Environment and State Department of Environment as applicable
3. Local Body (under whom the Site/ area belongs)
4. Department of Forest if water aerodromes are located in forest areas

Beside the above clearances, an agency is also required to liaise and obtain no objection certificate to import and operate Seaplane in specified location(s). Inspection of all locations is mandatory by DGCA and BCAS officials as required will also be applicable.

2.3 SITE SELECTION FOR WATER AERODROME

Water Aerodrome site selection criteria recommend larger dimensional clearances and separations based on the physical characteristics of seaplanes, their unique operating characteristics and the interplay of winds and water current and water depth.

2.3.1 SEAPLANE CHARACTERISTICS

There are mainly two types of seaplanes: Floatplanes & Flying Boats. Reference to amphibious aircraft can be either type of seaplane that has a retractable wheel gear to allow operation on land or ingress and egress from the water via a ramp. The characteristics described below from FAA-H-8083-23, Seaplane, Ski plane, and Float/Ski Equipment Helicopter Operations Handbook, are the more pertinent characteristics used in this report.

FLOATPLANES

Floatplanes typically are conventional land aeroplanes that have been fitted with separate floats (sometimes called pontoons) in place of their wheels. The fuselage of a floatplane is supported well above the water's surface. Here, the term "seaplane" will be used in place of the term "floatplane."

FIGURE 2 FLOATPLANES

FLYING BOATS

The bottom of a flying boat's fuselage is its main landing gear. This is usually supplemented with smaller floats near the wingtips, called wing or tip floats. Some flying boats have sponsons, which are short, wing like projections from the sides of the hull near the waterline. Their purpose is to stabilize the hull from rolling motion when the flying boat is on the water, and they may also provide some aerodynamic lift in flight. Tip floats are sometimes known as sponsons. The hull of a flying boat holds the crew, passengers, and cargo; it has many features in common with the hull of a ship or boat.

FIGURE 3 FLYING BOATS

AMPHIBIANS

Some flying boats and floatplanes are equipped with retractable wheels for landing on dry land. These aircraft are called amphibians. On amphibious flying boats, the main wheels generally retract into the sides of the hull above the waterline. The main wheels for amphibious floats retract upward into the floats themselves, just behind the step.

FIGURE 4 AMPHIBIANS

2.3.2 SEAPLANE OPERATING CHARACTERISTICS

The following points highlight several operational difficulties that seaplane pilots face as compared to pilots operating land aircraft and to mitigate such difficulties, the water aerodrome must be provided with larger sea lanes than paved runways and greater water operating areas to manoeuvre seaplanes near objects. **(Reference: FAA-H-8083-23)**

NO BRAKES

Many of the operational differences between land aeroplanes and seaplanes relate to the fact that seaplanes have no brakes. From the time a seaplane casts off or is untied, the seaplane floats freely along the water's surface. That is, it is virtually always in motion due to the wind and current effects, propeller thrust, and inertia. To control such movements from the pilot end and safer water operations, it is recommended to provide extra dimensional space design criteria for taxi channels, turning basins, and for manoeuvring seaplanes towards and within seaplane bases located in the water operating area and the shoreline.

WEATHERVANING

Another major operational difference is the effect of the wind to cause an aeroplane to weathervane while on the water, i.e., yaw the nose into the wind. This tendency very evident in seaplanes can possibly impact the pilot's ability to manoeuvre seaplanes. To deal with this condition, water aerodrome design criteria should be included with extra dimensional space for anchoring and mooring seaplanes in the anchorage area (anchors and mooring buoys), tie downs at piers/docks, and water taxiing along with shoreline facilities.

LANDING

For water operations, the pilot must evaluate the characteristics of the water surface, determine wind direction, and speed, and choose a landing direction. Also once landed, water taxiing is more complicated given that seaplanes are in constant motion without the benefits of braking actions.

TAKE-OFF

For most seaplanes, the water take-off distance is usually much longer than the distance required for taking off from land. This is due to the drag of the water on the floats or hull. As seaplane

weight increases, the floats or hull will sink deeper into the water, creating more drag during initial acceleration and significantly increasing the required take-off distance.

2.3.3 Site Selection Criteria

This section provides proponents site selection criteria for determining a safer and more efficient seaplane base. The following figure shows one potentially safe, efficient, and compatible siting of a seaplane base to a typical community in general terms and more particularly to the other waterfront activities. Two seaplane base locations are illustrated in this “close” relationship with town businesses, the industrial waterfront area, and the convenience of access routes to the residential areas. In addition, the approach/departure paths and the traffic pattern do not pass over the existing community. Recreational boating can operate along the west shoreline safely and without interference or disturbance from seaplane operations. If the community can attract itinerant aviation, it would be possible to provide additional shoreline facilities, such as a floating dock with tiedowns, for enplaning and deplaning passengers.

Seaplane servicing is provided at the main north hangar facility. In general, river shipping is along the east shoreline with ample seaplane turning and docking area north of the railroad and bridge. This site location further offers protection to both seaplane base sites from down-river currents and prevailing north winds. All take-off climbs and approaches are over water, thereby providing a higher degree of safety as compared to over land paths.

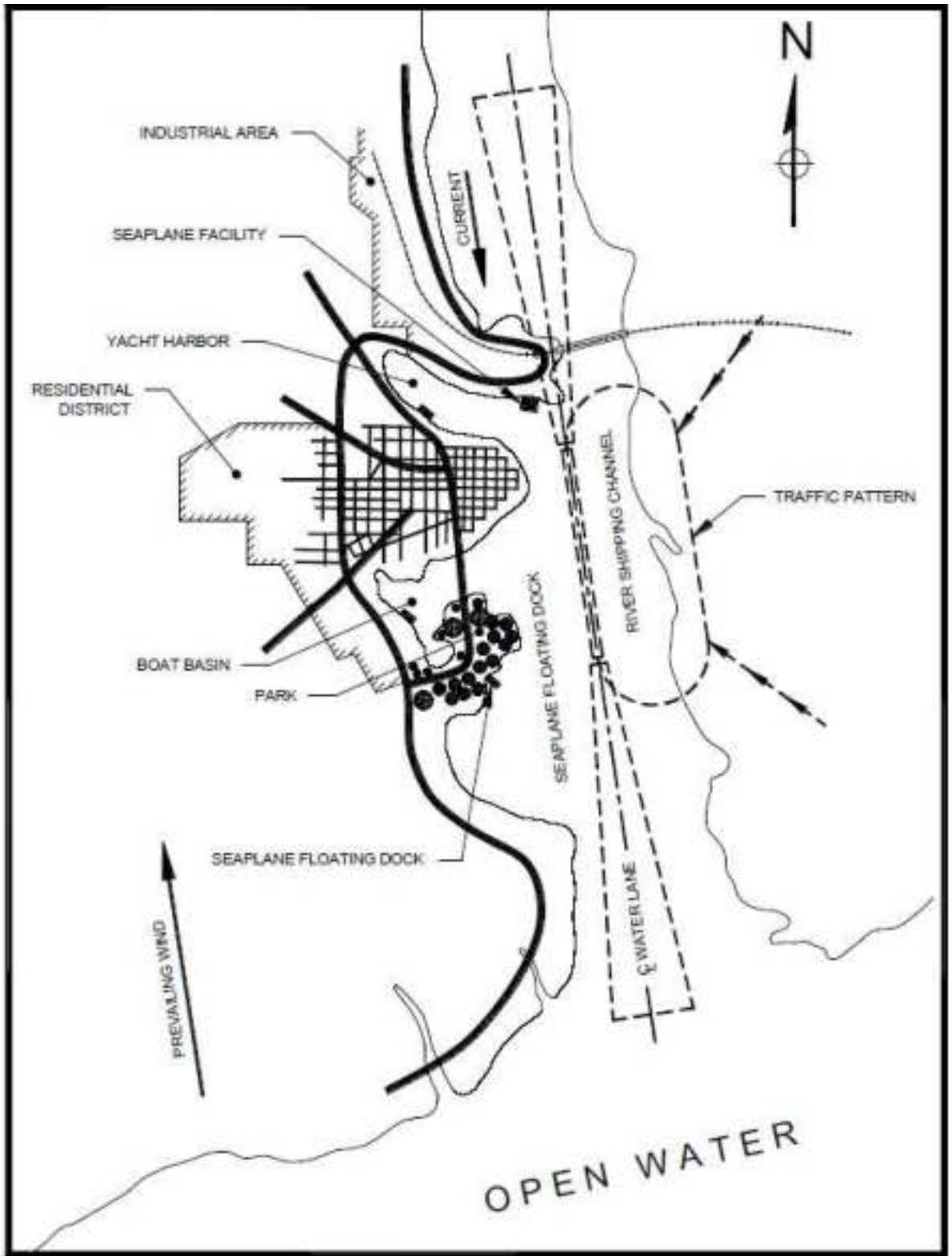


FIGURE 5 SEAPLANE WATER LANDING AREA IN RELATION TO A WATERFRONT COMMUNITY

WATER OPERATING AREA AND SHORE FACILITIES

The necessary size and location of the water operating area and shore facilities will depend upon at a minimum the following factors:

1) the performance characteristics and number of seaplanes expected to use the water operating area,
2) presence or absence in the surrounding area of existing or potential obstructions,
3) presence in the surrounding area of wildlife attractants such as bird sanctuaries or areas that attract flocks of birds due to terrain, vegetation, presence of food sources (landfills, seafood processing facilities, fish hatcheries, etc.). A local university cooperative extension may be able to assist in identifying these areas.
4) strength of water currents, water depth, wave action,
5) shoreline, river, or channel geography,
6) local regulations,
7) noise considerations,
8) prevailing wind direction,
9) presence of other seaplane bases and airports in the general area,
10) public accessibility,
11) character of development within the surrounding area, and
12) commercial ship operating routes, pleasure boating activities, and common recreational boating paths of travel.

APPROACH AND DEPARTURE PATHS

The recommended location for seaplane approach/departure paths is over water, preferably not occupied by large vessels, wherever possible. This site selection criterion permits reasonably safer landings during the approach and during the initial take-off climb in the event of power failure. Where a suitable sea lane (within the water operating area) exists but the shore and surrounding development prohibits straight-in approach and departure paths, an over-water climbing turn or let-down procedure may be possible.

To avoid operational limitations, the approach/departure paths should be clear of obstructions to air navigation. If an obstruction to air navigation is determined to be a hazard to air navigation and cannot be altered or removed, the AAI will impose seaplane operational limitations, e.g., limit

the type of seaplane operations to mitigate the hazard determination. Another mitigating alternative is the practice of lighting or/and marking of evaluated obstructions to air navigation which in turn may preclude such an object as being a determined as a hazard.

2.3.4 Wind Data

Recorded wind observations taken in the immediate vicinity of the site over an extended period are the most desirable. When local observations are not available, data from a nearby locality or airport can be used. Keep in mind that wind data of this source may not be directly applicable to the site considered, as many on-site factors can change wind conditions considerably.

2.3.5 Water Currents and Water-Level Variations

WATER CURRENTS

It is recommended that the landing and take-off areas be located where the currents are less than 3 knots (5 mph). Landing and take-off operations can be conducted in water currents more than 6 knots but any taxiing operation between the sea lane (or water operating area) and the shoreline facilities will usually require the assistance of a surface craft. Currents more than 3 knots usually cause some difficulty in handling seaplanes, particularly in slow taxiing mode. Locations of the following types should be avoided:

1) Where the currents exceed 6 knots (7.0 mph);
2) Where unusual water turbulence is caused by a sharp bend in a river, the confluence of two currents, or where tide rips are prevalent.

WATER LEVELS

As a general rule if the change in water levels exceeds 18 inches, it will be necessary to utilize floating structures or moderately inclined beaching accommodations to facilitate handling of seaplanes at the shoreline or waterfront. Where water-level variations are more than 6 feet, special or extended developments to accommodate seaplanes must be made.

2.3.6 Water Surface Conditions

All evaluations of the water surface conditions should include height of wave action and existence of floating debris. Open or unprotected water operating areas may become so rough under certain conditions of winds and currents as to prohibit operations; hence, the varying water

conditions at the proposed site must be investigated. The most desirable conditions exist where the surface of the water is moderately disturbed, having ripples or waves approximately 3 to 6 inches in height. At the other extreme, smooth or dead calm water is undesirable because of the difficulty experienced in lifting the floats or pull off the water during take-off. Lastly, the presence of floating debris must be determined. Areas in which there is an objectionable amount of debris for considerable periods of time should be avoided or debris should be removed.

2.3.7 Sheltered Anchorage Areas

A sheltered area that is protected from winds and currents is recommended, particularly if overnight or unattended seaplane tie-ups are to be made at locations where sudden and sometimes unexpected storms or squalls develop.

2.3.8 Bottom Conditions

The type and condition of the bottom at the site of a proposed seaplane base can influence the arrangement of the various components thereof, the means of construction of the fixed structures, and the water operation areas to and from the shoreline.

2.3.9 Environmental Factors

In seeking approval for establishment of a seaplane base, the permitting authority may require an environmental analysis. This evaluation should include an analysis of the proposals impact on water quality, wildlife, existing and proposed land use, noise, and historical/archaeological factors.

2.4 STANDARD SPECIFICATIONS FOR SUITABLE AREA FOR SEAPLANE OPERATIONS

1) Location of water aerodrome- By and large the location of the proposed water aerodrome should be in protected water where security and operation of seaplanes can easily be monitored and there should not be any obstructions in the flying funnels.
2) Dimensions of Floating Jetty – At least 7mX7m or as per the size of the aircraft.
3) Length of water runway - Approximately 2000-2500ft is required which should be free of marine areas, fishing nets, corals and boulders.
4) Depth of waters- Not less than 1.5 Meters at any place of operation which also includes a taxiway.
5) Height of waves - Not greater than 0.25 Meters.
6) Water Currents- Not greater than 3 Kts.
7) Winds - Not greater than 20 Kts, upwind operations.
8) Distance of water aerodrome from servicing location/island - The distance of the water aerodrome from the servicing location/jetty should not be less than the width of 2 Wingspans of the seaplane.
9) Maritime movement in vicinity- The maritime movement in the vicinity of the water aerodrome should be bare minimum so as not to cause any obstruction/disorientation of the operation of seaplane.
10) Bird Hazard - The bird activity at any given place cannot be controlled, however, all precautions are to be observed to keep the same to bare minimum and a strict watch is to be maintained in order to ensure safe operations.
11) Mooring - The dimensions of jetties should normally be 7mX7m, with protective breakwater, clear entrance and egress with no obstructions over 1M on the dock or within 8M of the docking side of the aircraft to enable wing clearance. In addition, a pontoon 4MX3MX1M height with rubberized edges, fenders, bollards, rope rails and a boarding ramp needs to be provided with the jetty. The mooring site shall be equipped with the following equipment in the interest of passenger safety which is fastened to the floating platform. The life buoys shall be easily accessible for use in case of any eventuality:

- 01 Axe
- 30M Life line rope
- 01 Crow bar
- 01Fire Extinguisher
- 01 Bucket
- 01 Bolt cutter
- 01 Tin sniper
- 01 Harness Cutting tool
- 01 Pair of gloves (fire resistant)
- 01 First Aid kit
- Life buoy

12) Beacon Flashing Beacon (white/yellow flashes of 22-30 fpm) should be installed on all locations to indicate the prohibited area so as to enable other marine movements to be outside this zone. The height of the beacon shall be 1M from the level of the platform and made of frangible material. Besides this facility a hotter/siren should also be installed to inform the marine movement in respect of seaplane operation. The local fisheries and other agencies should be educated regarding this facility to eliminate any ambiguity during operation. The above needs to be fine-tuned as per the local requirements.

13) Provision to be made for a Hooter/ Siren for cautioning fishing boats and people around jetty about taking-off and landing of Aircraft.

2.5 INFRASTRUCTURE REQUIREMENT

The basic public-use seaplane base will include:

1) A designated Water Lane (referred to as a sea lane)
2) A suitable water operating area, including identified approach and departure paths
3) Shore/Land access

Considering the purpose of the Water Aerodrome, facilities for public use as well as cargo requirements and facilities for seaplane operation to be fulfilled.

Water Aerodrome facilities are classified by

1) Off-Shore Facilities
   - Marked/Unmarked Water Lane
   - Taxi Channels
   - Turning Basins
   - Buoys
   - Anchorage Area
   - Fire and Rescue Boat
2) Shoreline Facilities
   - Docks
   - Pontoon
   - Gangways
   - Ramps
   - Floats
   - Barges (Floating or Fixed), etc.,
3) On-Shore Facilities

   On Shore facilities are further classified as follows:

   - Facilities for Aviation Operations
     - Ramp Connecting Terminal Building to Jetty
     - Fuelling Bowser
     - Service Apron
     - Aviation Catch area
     - Hanger

- Administrative Building

- Public Facilities
  - Parking Area (Staffs and Visitors')
  - Terminal Building
  - Entry Point
  - Public Concourse
  - Manager Office
  - Security Office
  - Check-In Gates
  - Baggage Screening and Handling Facility
  - Departure Lounge
  - Toilet facility (separate for Ladies and Gents) at all different sections
  - Sitting Arrangements
  - Surveillance Facility
  - Security Cabins & Gates
  - Security Aids
  - Assembly Area
- Amenities
  - Recreational Landscapes
  - Signages
  - Eateries
  - Shops
  - Taxi Booking Desk

3. SERVICES REQUIRED AT WATER AERODROME

Considering the purpose of the Water Aerodrome, facilities for public use as well as cargo requirements and facilities for seaplane operation to be fulfilled.

Water Aerodrome facilities are classified by

1) Off-Shore Facilities
2) Shoreline Facilities
3) On-Shore Facilities

3.1 OFF-SHORE FACILITIES

The basic offshore facilities include a sea lane, taxi channel, and an anchorage area. The anchorage area is a site where pilots can use single line anchors to secure their seaplanes to the bottom or mooring buoy anchoring sites that use permanently anchored mooring buoys.

In unconstrained open water, it may be tempting to establish facilities that are much larger than needed. Reasons to do so may include accounting for varying winds/water conditions, uncertainty on aircraft types and performance, or accommodating potential future demand. It is important to right size the offshore facilities, considering aviation needs, and the needs of other users.

3.1.1 MARKED/UNMARKED WATER LANE

Many of the runway design standards are applicable to a water-based runway in concept, but because aircraft are operating on a water surface, distinguishing between the operational surfaces and the safety/clearance areas can be problematic.

1) Determining Length

The aircraft using the seaplane base are the driving factor in identifying take-off and landing length requirements. To determine the water lane length, identify the most demanding aircraft and size the water lane to accommodate their requirements plus a safety buffer.

- If the seaplane base only serves visual approaches, the distance to the 50 feet obstacle will be 1,000 feet, based on a 20:1 visual approach and departure slope.

- If the seaplane base supports instrument approach procedures, the obstacle is assumed at 2,000 feet from the departure threshold based on a 40:1 instrument departure surface.

Typically, the take-off distance requirement is greater than the landing distance for seaplanes. Adjust the length for mean high monthly temperature and airport elevation. Refer to the Runway Length Requirement in AC 150/5300-13 for how to account for temperature and elevation.

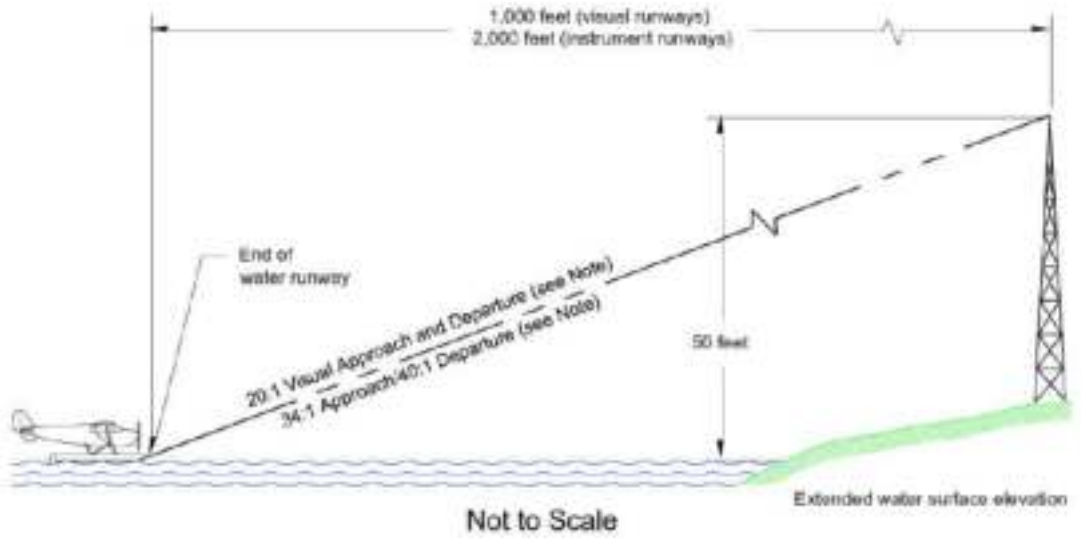


FIGURE 6 WATER-BASED RUNWAY OBSTACLE CLEARANCE

2) Determining the Width

When there are no constraints on the width of the water lane, 200 feet wide is considered a reasonable minimum width for most seaplane bases. This width accommodates the water runway and runway safety area (RSA) for most seaplanes; accommodates variation in water and wind conditions to minimize effects on aircraft; and provides a safety buffer.

However, the 200-foot width does not include the runway Object Free Area (OFA).

(AC150/5300-13)

A wider water lane is necessary in areas where the prevailing wind or water currents vary, and 95% wind coverage cannot be achieved across a 200-foot water lane width. When necessary, increase the water lane width in a method similar to that for a land-based runway.

3) Determining Depth

The water operating areas should provide a minimum of four feet of depth; six feet is recommended.

In open water, the operating areas should be clear of underwater obstructions that are less than four feet below the low tide line. If not possible to avoid or remove the obstruction, it should be identified with a marker or buoy.

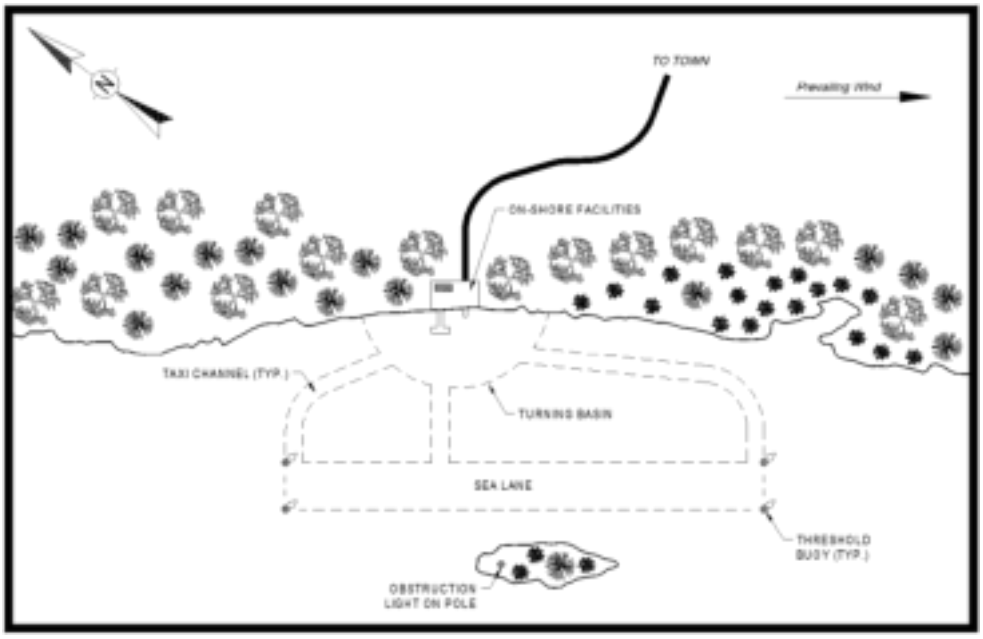


FIGURE 7 EXAMPLE OF A MARKED WATER LANE AND TAXI CHANNEL

3.1.2 TAXI CHANNELS

A taxi channel is a basic, minimum facility of a seaplane base that allows adequate separation for water taxing as shown in Figures ~~3-3~~ 7. The taxi channel provides direct access from the sea lane to the anchorage area and onshore facilities. The taxi channel should be oriented so that the approach to the shoreline and onshore facilities, such as the anchorage area and ramp, pier, will be into the prevailing wind or current. Dimensions are as follows:

- Minimum Width: 125 feet (recommend 150 feet)
- Minimum Depth: 4 feet
- Wingtip to Wingtip Clearance for passing seaplanes (dual-directional taxi channels): 50 feet

3.1.3 TURNING BASINS

Turning basins as shown in Figure are extra wide water maneuvering areas to facilitate water taxiing, turn manoeuvres, and to accommodate periods of changing wind and current conditions.

A turning basin should be provided to offer seaplane pilots an extra-wide water taxi maneuvering area to enter/exit an anchorage area and facilities located on the shoreline, for example, ramps, piers, hoisting equipment. For narrower, restricted sea lanes under 200 feet (60 m) in width, both ends of such restricted sea lanes should have turning basins of a minimum diameter of 200 feet (60 m).

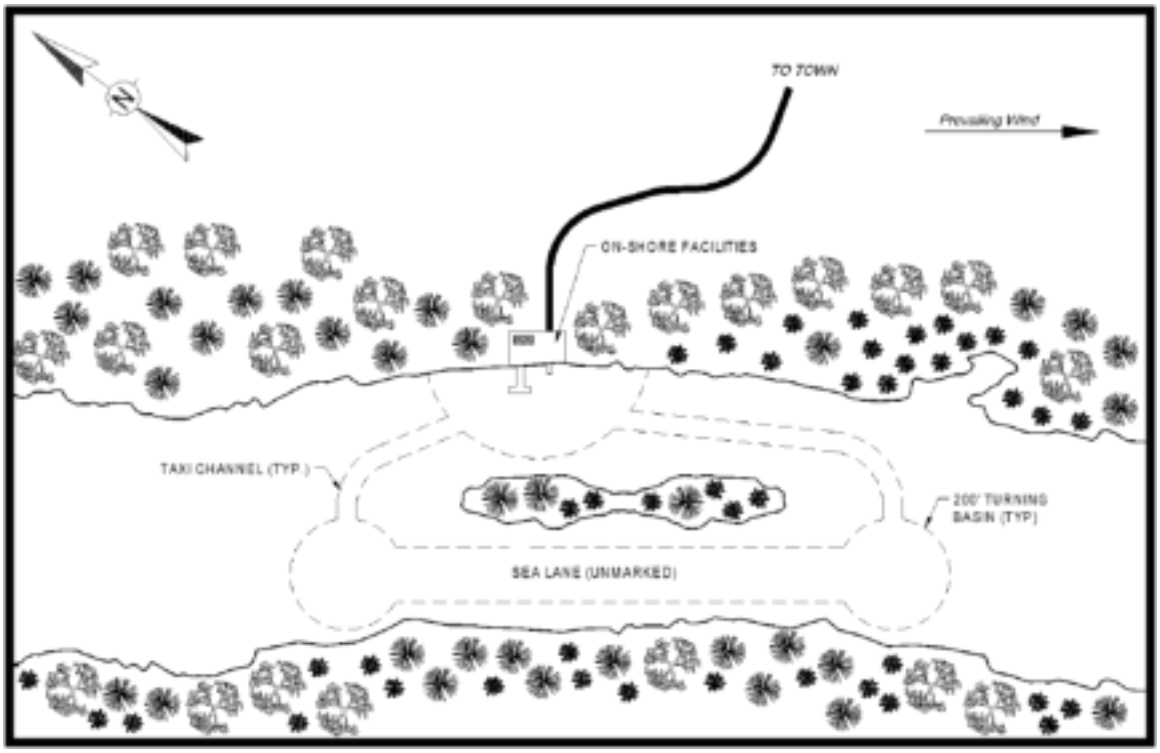


FIGURE 8 EXAMPLE OF A CONSTRICTED SEA LANE AND TAXI CHANNEL

3.1.4 BUOYS

The installation of buoys may require coordination with multiple resources and government agencies and tribal groups (if concerned). It is the responsibility of the seaplane base owner/operator to identify and coordinate with all applicable authorities, Central, State, or Local. A partial list of agencies with jurisdiction is provided.

3.1.5 ANCHORAGE AREAS

The basic seaplane base has a dedicated anchorage area along the shoreline for securing seaplanes. Anchoring, as shown in Figure 9, is an easy, inexpensive way to secure a seaplane near the shoreline.

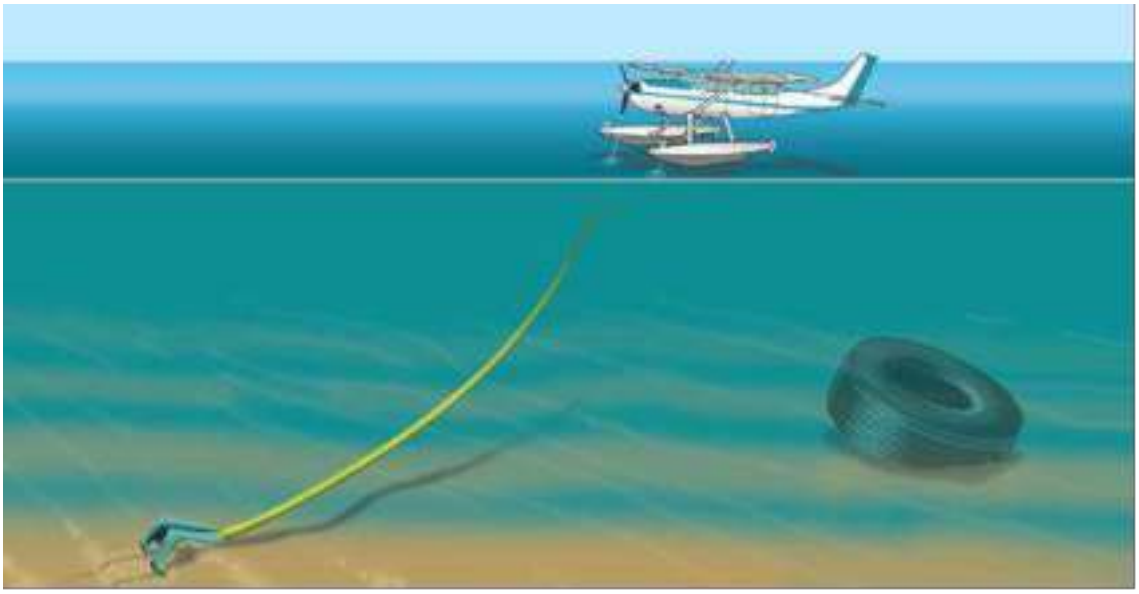


FIGURE 9 ANCHORING (SINGLE ANCHOR LINE)

FIGURE 10EXAMPLE OF A MOORING BUOY ANCHORAGE AREA (DUAL ANCHOR LINE PLUS BRIDLE)

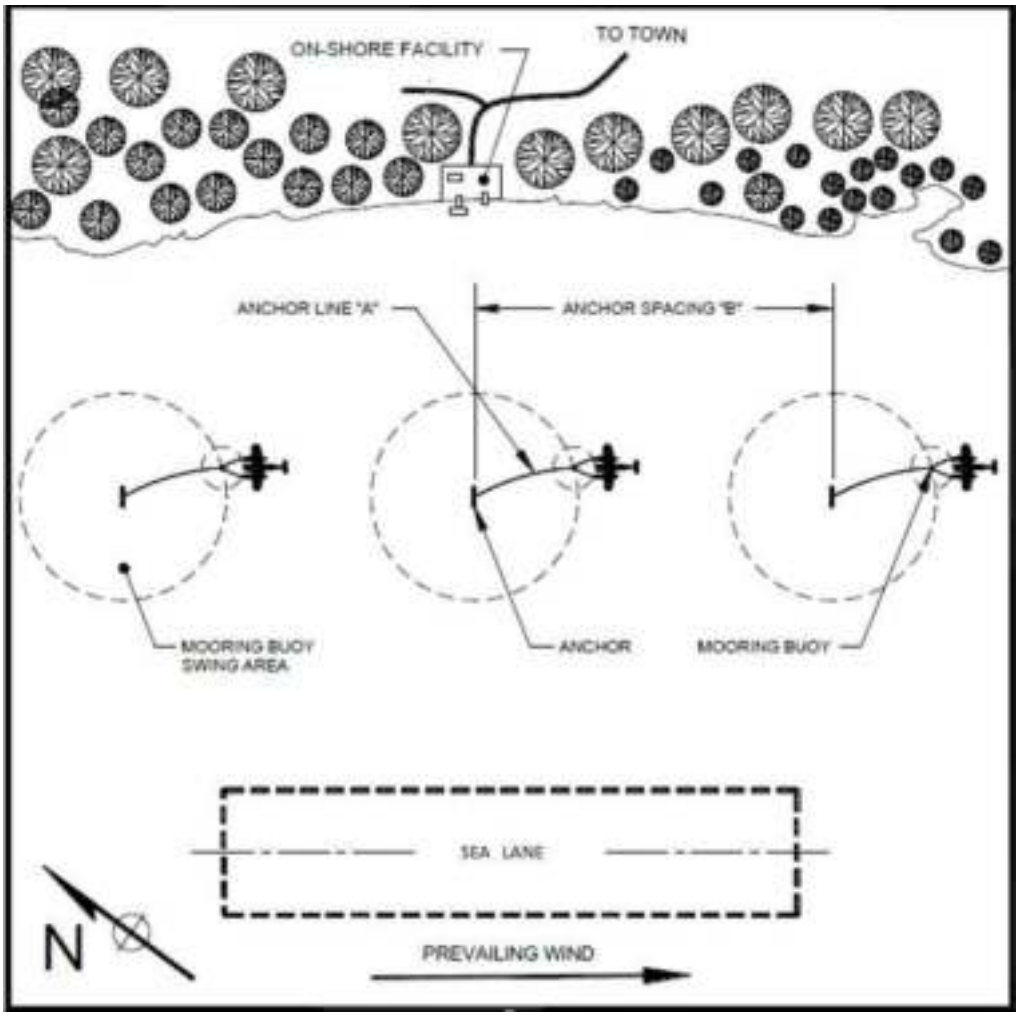


FIGURE 11EXAMPLE OF AN ANCHORAGE AREA WITH PERMANENT MOORING BUOYS SWING AREAS

The anchorage area selected should be out of the way of moving vessels and in water deep enough that the seaplane will not be left aground during low tide.

3.1.6 FOREIGN OBJECT DEBRIS REMOVAL BOAT

Generally, all the water bodies carry debris such as waste created by humans, wooden logs, garbage, silt by erosion in the direction of flow. Where velocity gets minimized all this debris material will be settled on the bed of the water body.

For Sea Plane operations, it is necessary to have clear water in & around the landing-take off areas, taxi channels. These water body areas should be free from any kind of debris or floating material etc. The floating material or debris settled on the bed will reduce the minimum depth of water required for safe Sea Plane operations. Even such materials can damage the floats of Sea Planes or engines if the debris enters the engine.

Hence, from the Sea Plane operational area before every take-off & landing of a Sea Plane, it is necessary to remove any debris or floating material. For the removal of this material, it is necessary to have a debris removal boat at every Water Aerodrome. The size & capacity of this boat will depend upon the type & quantity of debris to be removed.

Figure 12 Typical Debris Removal Boat

3.1.7 Fire and Rescue Boat

I. RESCUE & FIREFIGHTING VESSEL EQUIPPED WITH LIST OF EQUIPMENT

The following equipment shall be available in rescue and firefighting vessels:

1) Area Maps
2) Navigational Charts
3) Bailing Buckets
4) Water Pumps
5) Woolen Blankets (for passengers and crew)
6) Bullhorn(s)
7) Communication Equipment
8) Emergency Lights

9) Flares
10) Forcible Entry Tools
11) Marine Night Vision Binoculars
12) Life rafts (with paddles or oars)
13) Medical Kit
14) Navigational Equipment
15) Portable Resuscitation Equipment
16) Flood Lights (500 watts or greater)
17) Rescue Nets
18) Stretchers and Litters

FIGURE 13 FIRE FIGHTING BOAT

II. RESCUE THROWING BAGS AND ANCHORS DETAILS OF FIREFIGHTING BOAT

TABLE 1 DETAILS OF FIREFIGHTING BOAT

DESCRIPTION	NEW BUILD - 15m Firefighting Boat
LENGTH	17.3m (56ft 9in)
BEAM	4.92m (16ft)
DRAFT	0.83m (2ft 8in)

III. HIGHLIGHTED DESIGN FEATURES:

1) High speed in rough seas with superior acceleration and maneuverability;
2) Excellent sea keeping ability with very low slamming in all defined sea conditions for best crew comfort and safest operations;
3) Truly dry deck at all speeds with extremely excellent stability for coastal firefighting, patrol and SAR operations;

4) The boat is heavily designed with two firefighting monitors, among which 1 x 840m3/hr Fifi Monitor to be installed on the forward deck and 1 x115m3/hr firefighting monitor on roof of the pilothouse, providing 360 deg. of extremely high efficient firefighting service;

5) The bow is mounted with one 5" vertical and horizontal heavy-duty D section rubber on the push knee to provide safe boarding for survivor transfer from large vessel and marine facilities that is on fire.

IV. GENERAL DESCRIPTION

This specification describes the design and construction of the proven reliable, rough sea-going 15M aluminum vessel which will be arranged as a fast coastal craft (hereafter referred to as "vessel") to use in coastal waters with equipment capacities to focus on below Operating missions:

1) Harbor and coastal patrol and interception.
2) Search and rescue operations in high sea waves. c. Rapid deployment for firefighting.
3) Offshore facilities protection and crew transfer.
4) Oil field security.

The vessel will be constructed to a high commercial standard with particular attention to minimizing noise transference and vibration while enhancing structural rigidity and offering best crew comfort.

3.2 SHORELINE FACILITIES

Shoreline facilities are partly on land and in the water. These installations perform two general functions:

1) enable servicing, loading and unloading, handling and tying-up facilities for seaplanes without removing them from the water, and

2) provide hauling out facilities for removing seaplanes from the water.

Facilities along the shoreline, which vary according to need and topography, range from a simple wood-plank ramps and floating deck to the more elaborate piers, fixed docks, and barges, and possibly marine rail. The types, size, and arrangement of these various facilities will be determined by the water and wind conditions, the topography of the land adjacent to the shoreline, the configuration and conditions of the bottom of the water operating area, and

the number and type of seaplanes and amphibian airplanes to be moored, docked, or removed from the water.

3.2.1 DOCKS

The term “dock” is often used as a catch-all term for any structure that can be used to secure watercraft (including floatplanes) to a fixed facility, either the shoreline or a structure affixed to the seabed/lakebed. These structures could be a dock, pier, wharf, or float.

A dock is a floating surface connected to land by some means, typically a ramp. It rises and falls with the water level. It remains in a relatively fixed position either tied to a shoreline or to the waterbed.

3.2.2 WATER JETTY / FIXED PLATFORM

The dimensions proposed for single plane operation is **7m x 7m** size and has to be made on floating material. The size of the jetty has to be extended three times if two seaplanes are in operation to keep safe distance between the planes.

3.2.3 GANGWAYS

Floating docks are commonly connected to the shore by a gangway offering flexibility in providing docking facilities shown in Figure. This type of facility rises and falls with wave actions, tides and seasonal variations in water-level.

FIGURE 14 EXAMPLE OF A GANGWAY

3.2.4 RAMPS

A ramp as shown in Figures are a sloping platform extending well under the surface of the water that vary widely in size, shape, and construction materials, e.g., from rough logs to heavy-duty wood decks to concrete structures.

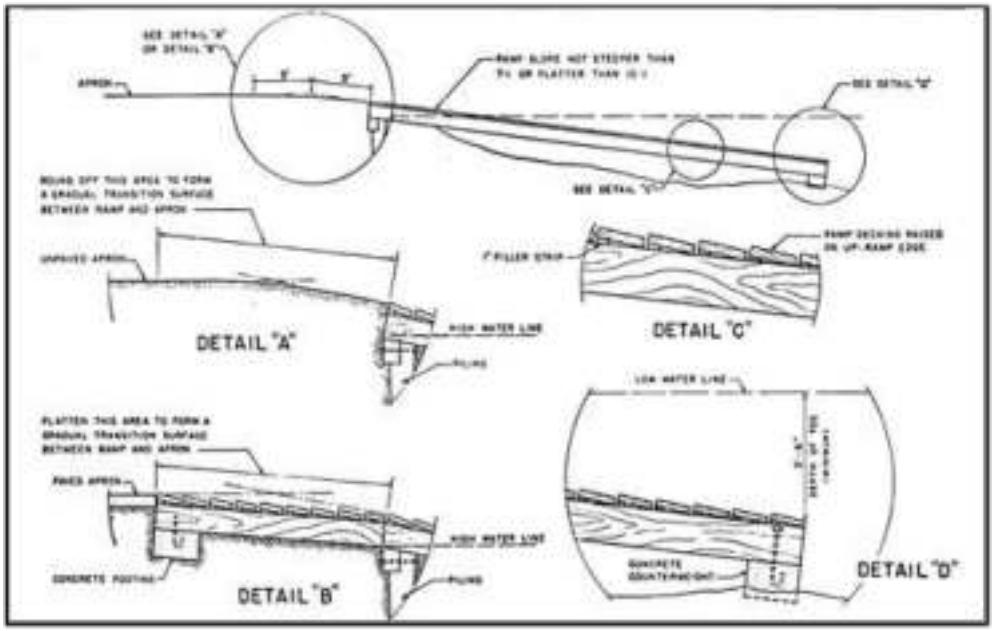


FIGURE 15 RAMP WITH SUBMERGED RAMP TOE

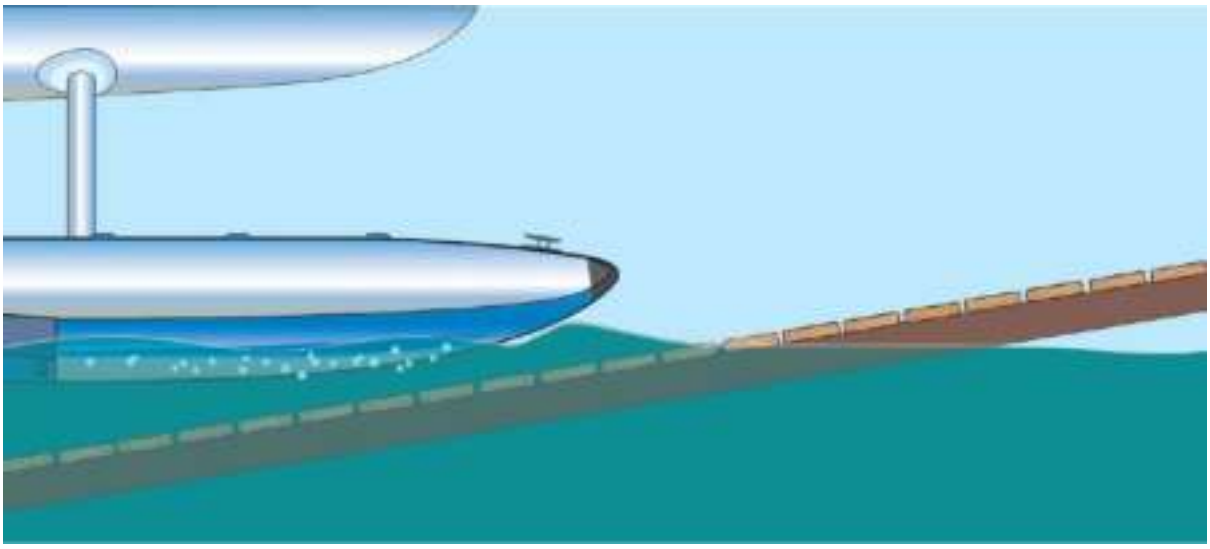


FIGURE 16 ILLUSTRATION OF A SUBMERGED RAMP TOE

A typical ramp designed to accommodate seaplane floats is approximately 15 by 20 feet (5 m by 6 m) wide and extends into the water to allow seaplanes to be launched and retrieved easily. The ramp needs to be sized appropriately to accommodate the aircraft that will be using it.

3.2.5 FLOAT

A float is a floating surface not permanently affixed to the land by any means. A seaplane docked at a float requires passengers and goods to be ferried to and from land by some means. A float may be permanent or used seasonally and affixed to another structure such as a barge, pier or wharf. A float may be called a floating dock.

A float is a buoyant material or contrivance used to keep a floating dock or a float (definition a) buoyant remaining above the surface of the water. Examples include: Styrofoam blocks, empty barrel, logs, or inflated bladders.

FIGURE 17 EXAMPLE OF FIXED DOCK WITH PARKING RAMPS

3.2.6 OPERATING SPACE BETWEEN SHORELINE FACILITIES

The desired clearances between the various docking and pier units, barges, and ramps has a decided influence on their arrangement and location. Each of these units should be so located such that a seaplane may approach and tie up in anyone of the available berths when adjacent units are occupied.

3.2.7 NAVIGATIONAL CLEARANCE

The stronger the wind and current, the more room it takes to make a water turn. Hence under these conditions, a minimum clearance of 50 feet (15 m) should be provided between the side of the turning basin and the nearest object.

3.3 ON-SHORE FACILITIES

A public-use seaplane base is recommended to conduct the following assessments before considering the installations of on-shore facilities. The addition of shoreline facilities ranges from simple aprons with tie-downs and public parking to moderate facilities that may include fueling, hangar, service repair shop, and a public building.

- Facilities for Aviation Operations
  - Ramp Connecting Terminal Building to Jetty
  - Fuelling Bowser
  - Service Apron
  - Aviation Catch area
  - Hanger
  - Hoisting Equipment
  - Administrative Building
- Public Facilities
  - Parking Area (Staffs and Visitors')
  - Road Access & Roadway Planning
  - Restrooms
  - Terminal Building
  - Entry Point
  - Public Concourse
  - Manager Office
  - Security Office
  - Check-In Gates
  - Baggage Screening and Handling Facility
  - Departure Lounge
  - Toilet facility (separate for Ladies and Gents) at all different sections
  - Sitting Arrangements
  - Administrative Building
  - Security Cabins & Gateways
  - Security Aids
  - Assembly Area

- Amenities
  - Recreational Landscapes
  - Signages
  - Eateries
  - Shops
  - Taxi Booking Desk

The needs of the seaplane users will determine if and what types of onshore facilities are necessary at a public seaplane base. Public onshore facilities commonly range from a service apron with storage/tiedown areas, marine fueling, basic public facilities (restrooms/chemical toilets, public parking), and possibly a marine store, hangar, building serving the public common area and/or an administrative building.

3.3.1 Pathway / Waterway

The pathway leading to Water Jetty keeping low tide & high tide levels in mind is to be provided for reaching up to the seaplane. The said pathway can be on fixed cc pillars or on floating type. Railings are to be provided on both side of the pathway for safety purpose.

3.3.2 Fueling Bowser

Where aviation fuel is provided at a public seaplane base, care must be taken to ensure that the storage and delivery systems are safe and that precautions are taken to minimize the possibility of spills and the resulting adverse environmental effects of a fuel spillage.

3.3.3 Service Apron & Aviation Catch Area

These features will occupy more space than any other onshore installations.

The desirable location is near ramps or where hoisted seaplanes onto the land have a short, direct route to the service apron and tiedown areas with minimum taxing conflicts with other seaplane movements.

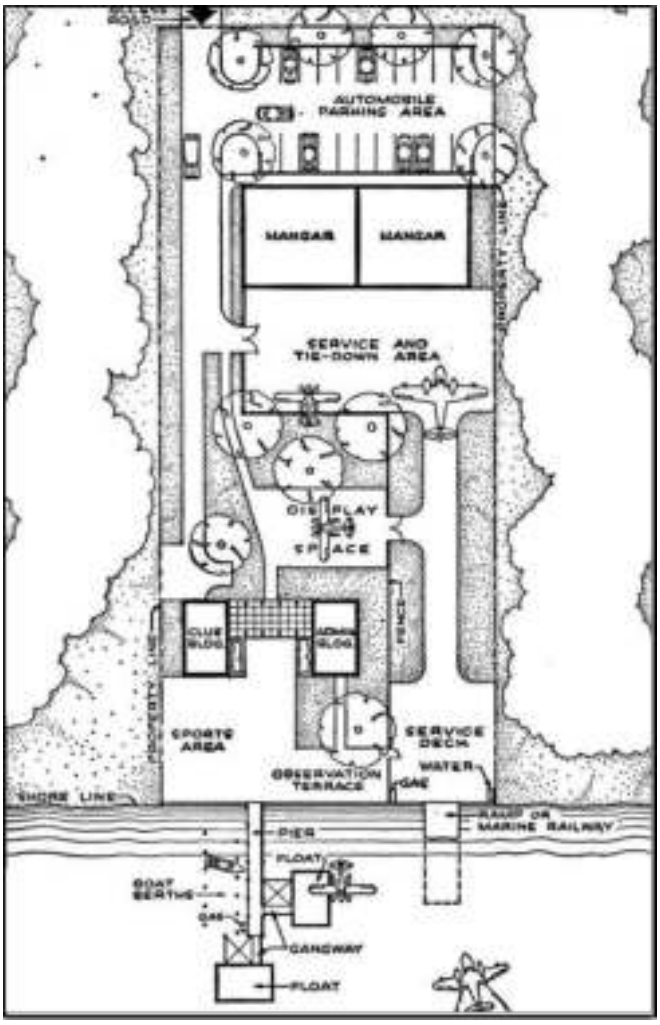


FIGURE 18 ILLUSTRATION OF A SEAPLANE BASE WITH VARIOUS CAPITAL IMPROVEMENTS

3.3.4 HANGARS

Many standard types of hangars used for land-based aircraft are adaptable for use by waterborne aircraft Hangars should be in a functional and orderly manner. That is, determine how seaplanes using ramps or being hoisted onto the land can have a direct route to the hangar without interfering with tiedown areas, any common public areas, and eliminate as much as possible taxing conflicts with other seaplane movements. The objective is to avoid the relocation of parked seaplanes. Both storage and repair hangars should likewise be located so that delivery of materials and access by service personnel will not conflict with seaplane movements.

The space required for service hangars will depend upon the number and the type of aircraft that are to be accommodated. Sufficient additional space needs to be provided for taxiing, turning, and temporarily parking seaplanes.

3.3.5 Hoisting Equipment

Types of hoisting equipment and their use vary with the operating needs of the individual site. They are frequently needed where a public use seaplane base is developed along a high seawall, bulkhead, or steep shoreline.

3.3.6 Administration Building and Common Public Area

At small, simply seaplane bases, a hangar can be used for both seaplane services and for an office. At larger seaplane bases a separate administration building may be required to provide adequate space for the manager's office, passenger and pilot's lounge, display space, restaurant, snack bar, and observation deck. It is desirable to employ an uncomplicated, functional design that can adequately respond to the administrative needs of the facility. The location should be in a prominent position on the site, readily accessible to seaplane arrivals as well as to customers and visitors arriving from the surrounding community. Visibility of the water area from the administration building is another desirable feature. This condition is especially true when visibility of the water operating area from the administration building may be required for the control of seaplanes at locations where traffic in and out requires two-way radio communications.

3.3.7 Parking Areas

Functionally, the parking area should be located for safe, convenient access to the various onshore and shoreline facilities. Hence, a parking area for cars, including handicapped spaces, and other transport must be made.

3.3.8 Road Access & Roadway Planning

Vehicular circulation must be provided for the public, service personnel, deliveries of gasoline, oil, fuel, and refuse removal. These routes will influence walks and interior road access. It is desirable that the interior road access to the seaplane base (administration building and public areas) be by an all-weather road. It is recommended that the seaplane base layout plan reflect the access road connection to a main highway or street.

The access or entrance road should have adequate width, serve the anticipated traffic, and permit safe and easy circulation throughout the landside of the facility.

- SERVICE ROADWAYS

A public highway should never be part of the interior road system of a seaplane base. Vehicular through vehicles, deliveries of gasoline, oil, fuel, and refuse removal, a limited-use access service roadway is needed. These limited use access roadways should be marked and controlled by devices such as removable posts or chains located at the entrance to the areas of aeronautical activity. Also, they serve to permit authorized access and provide circulation routes for emergencies.

3.3.9 TERMINAL BUILDING

The terminal station/ building is to be designed keeping the passenger load in mind. At present, it is proposed a building with minimum 20 passenger capacity is to be taken into consideration which can cater passenger load of two seaplanes of 09-seater capacity or a single plane of 19 seater capacity at a time. This building shall be constructed out of steel structure also with a glass facade and aluminium sheets.

A terminal station/ building can be divided into four parts in order of sequence:

ENTRY POINT

In this area, the Security Check of passengers shall be dealt with by Security with an X-Ray machine for baggage screening. Office of Terminal Manager and Security In charge. Toilets for Ladies and Gents. Chairs for minimum of 20 passengers. Provision for a small shop can also be made.

DEPARTURE LOUNGE

Departure Lounge with seating capacity for minimum 20 passengers. Provision for small shops and toilets is proposed.

ARRIVAL LOUNGE

Arrival Lounge is also proposed with toilets. The baggage area is earmarked separately with seating chairs for 8 to 10 passengers.

ARRIVAL LOUNGE AMENITIES

This section shall be utilized for Shops/Offices of Sea-Plane operators, Tourism Department Offices, Resort Owners Booking Counter, Transporter, etc. This can be allocated for revenue generation.

3.3.10 SECURITY AIDS

Procedures for security check of passengers and their hand baggage inside the terminal building and the procedure for checking the entry of passengers, visitors and other pre boarding anti hijacking check should be formulated in accordance with the standards and recommended practices of Annex 17 of ICAO and the instructions of the BCAS and Home Ministry Circulars.

Arrangements for guarding or protecting the vital installations at the Water Aerodrome serving the ATC Services and other Navigation and Landing Aids. Security coverage shall be in accordance with ICAO requirements as well as that of Ministry of Home Affairs.

Key facilities:

i. System of checking the entry of passenger and visitors inside the terminal building.

ii. Provision of anti-hijacking control room and facilities provided therein.

iii. Availability of.

a) Handheld metal detectors

b) Door frame metal detector

c) X-Ray machine/ manual for screening hand baggage and the Checked in baggage

d) Dog squad

e) Bomb disposal unit

f) Isolation bay

g) Cooling Pit

3.3.11 Outdoor Space/Landscapes

It is desirable to reserve an outdoor space immediately adjacent to the administration building for public use and for recreational type purposes. This outdoor space may consist of a small lawn or paved terrace, preferably overlooking the shoreline and suitable for informal gatherings, outdoor picking tables. Any common public use area should be physically separated from the aeronautical activity area and/or areas used for fueling or storage of flammable materials.

3.3.12 Amenities

It is also most desirable to provide general amenities across the premises, such as

- Signages
- VIP Lounge
- Eateries
- Shops
- Taxi Booking Desk

4. PHYSICAL CHARACTERISTICS OF AN AERODROME

4.1 UNITS OF MEASUREMENT

Except as specified, units of measurement shall be

as follows and the same shall be included in the Water aerodrome Operations

MANUAL:

a) Elevations to the nearest meter.

b) Linear dimensions to the nearest one-half meter.

c) Geographic coordinates in latitude and longitude to the nearest second.

d) Geographic co-ordinates measured in accordance with WGS 84

reference datum.

e) Bearings given to the nearest degree.

f) Water depth to the nearest meter to the nearest decimal; and

g) Range of tides or water levels to the nearest meter to the nearest decimal.

4.2 REFERENCE POINT

The water aerodrome reference point (WRP) should be located at the planned geometric center of the maneuvering area, or of the main one if more than one is provided.

4.3 REFERENCE ELEVATIONS

A Water aerodrome Reference Elevation (WRE) should be determined at the WRP. This elevation should be determined from the Chart Height, or the lowest recorded water level, converted to an elevation in meters above Means Sea Level.

4.4 MOVEMENT AREA FOR WATER AERODROME

a) License holder shall determine the area of any land and water on which seaplane operations may take place. This area will be designated as movement area (WA).

b) Water runway and runway strip

The movement/landing area (WA) should be rectangular in shape and should encompass all parts of the water surface intended for the taking off and landing operations.

The following Water Aerodrome dimensions shall be available for the landing area (WA).

I. The dimension of the landing area (WA) (Runway) shall be a minimum 800m X 60m.

II. The dimension of the landing area (WA) including the strip shall not be less than 920m X 120m; and

III. The water depth in the take-off and landing area (WA) shall not be less than 1.8m unless the airport is restricted to aircraft requiring less than 1.8m, in which case the depth of the water shall be based on the requirements of the aircraft type.

c) Taxiways

I. To permit safe and expeditious surface movement of aircraft, taxiways should be provided where required.

II. The width of taxiways shall not be less than 45 meters.

III. The depth of taxiways shall not be less than 1.2 m (4 ft).

d) Apron

Facilities to emplane and deplane passengers, Baggage and Cargo shall be provided in the form of a dock, ramp or beach, and a floating platform shall be based on the requirements of the seaplanes using the Water Aerodrome.

I. Where a dock is provided, It shall.

- It should be designed in such a way as to provide a safe clearance between an aircraft wing and any object the dock which could come in contact with.
- It should permit constant use without injury to persons or damage to aircraft.
- Where applicable, be attached or anchored in a manner that prevents it from shifting position or becoming detached.
- It should have access from the shore that provides the safe movement of persons using the facility.
- Should have enough tie-down points at each aircraft parking position to secure aircraft in Position; and

- When an aircraft is usually secured in a position where any aircraft propeller overhangs the dock and constitutes a hazard to the movement of persons using the facilities, the hazard shall be clearly indicated.

II. Where a ramp or beach is provided, it shall.

- Should be at least 1.5 times the width of floats or landing gear of the largest seaplane intended to use the facility.
- be designed in such a manner as to provide a safe clearance between an aircraft and any object it could come in contact with, and
- be designed for the seaplane using the facility.

III. Where a Floating Platform is provided, it shall

- provide adequate support and buoyancy for the loads imposed by embarking/disembarking passengers and their luggage.
- Be properly anchored so as to prevent it from shifting from its position or becoming detached.

4.5 OBSTACLE LIMITATION SURFACES (OLS)

Obstacle limitation Surfaces of the Water Aerodrome shall correspond to the dimensions for land-based runway code numbers 1, 2 and 3, respectively, as given in ICAO, Annex 14 Volume I Table 4-1/ GSR 751.

4.6 VISUAL AIDS

4.6.1 WIND INDICATORS

- A wind direction indicator shall be installed of a conspicuous colour and in the form of a truncated cone.
- The wind direction indicator shall be visible from any portion of the movement area & from a height of 1000 feet above the indicator.

4.6.2 MARKER BUOYS

Marker buoys shall be visible to landing aircraft from a height of 300m and maneuver aircraft in any part of the movement area (WA).

4.6.3 Take-off and Landing Area (WA) Markers

I. Where there is no conflict with marine traffic or marine regulations.

a) With the help of floating markers, both ends of the take-off and landing area (WA) shall be marked.

b) The markers shall be visible from a distance not less than 5 nautical miles.

c) Each marker shall be

I. Colored International orange and white; or

II. Alternating international orange and white

III. Where it is impracticable to mark the take-off/ landing area (WA) as specified in

1. Guidance such as geographical points and other visual references shall be provided to designate the take-off and landing area (WA); and

2. These visual references shall be identified and published.

4.6.4 Strobe Lights / Beacon Lights

For floating platforms located outside the house reef and in open waters, strobe lights/beacon lights shall be installed; it shall be:

I. White or coloured flashes shall be yellow and white.

II. Total flashes shall be between 20 to 30 flashes per minute.

III. It should be in an area that is quickly and constantly visible by both marine and air traffic; And

IV. Radio activated or activated by the Water Aerodrome operator or designated agency.

V. Beacon lights shall be installed on the floating platforms on the outer reef, and its height shall not be one (1) meter from the level of the forum. The beacon and its fixing strut shall be made from a frangible material. The beacon shall be 'ON' from dusk to dawn or as approved in Water Aerodrome Operation Manual.

4.6.5 HAZARDOUS AREAS

when the aircraft is docked to the floating platform Danger zone on the platform underneath the Aircraft wing shall be marked with a "DANGER" sign and painted alternating international orange and white.

I. Marker buoys shall indicate the hazardous area where shoals or other hazards could endanger a seaplane.

II. Marker buoys for delineating hazardous areas shall be coloured international orange.

III. Diagonal stripes restrict passengers from the docking area until aircraft propellers have completely stopped.

4.7 PASSENGER TRANSFER VESSEL (PTV)

a) Suppose floating platforms are provided for emplaning and deplaning passengers. In that case, the water aerodrome operator shall give a mechanized transfer vessel available for transferring passengers to and from the floating platforms to the shore.

b) The water aerodrome operator shall ensure that instructions are given to the PTV drivers about the direction of the water runway, the aircraft's movements for taxi, and the specific time of its arrival.

4.8 RESCUE AND FIRE FIGHTING SERVICES (RFFS)

a) The RFFS should be available from a minimum of 15 minutes before till 15 minutes after the times published at a water Aerodrome where the hours of operation are notified. Where the hours of operation are not reported, the RFFS should be available before the engine start of the first departing seaplane or to the first arriving seaplane commencing its final approach; and until the last arrival is moored, or 15 minutes after take-off of the final seaplane whichever is later.

b) Initial and recurrent competence-based training relevant to their role and task shall be given to the RFFS personnel. It shall at all-time be physically capable of performing the functions expected.

c) Procedures for the enhancement of passenger and crew post-accident survival should be developed. Facilities should be provided in terms of staff and equipment appropriate to the

type of seaplane operations anticipated at the Water Aerodrome. Within the provision of these procedures and facilities, account should be taken of the effect that variable environmental conditions might have on the ability of the rescue staff to respond rapidly to accidents and incidents.

d) A rescue vessel should be of a design and size that would allow survivors to be brought aboard & it should be equipped with an adequate number of floatation devices of a design that would enable survivors to remove themselves from the water.

e) All vessels shall be at least 200 m away from the floating platform when the seaplane is about to land or ready for take-off.

f) The level of protection provided at a Water Aerodrome for rescue and firefighting shall be appropriate to the Water Aerodrome using principles in paragraphs 9.2.4 and 9.2.5 of CAR Section 4 Series B Part I.

g) Types of extinguishing agents and the amount of water for foam production and complimentary agents shall be provided on the rescue and firefighting vessel/(s) by the Water Aerodrome category determined under Table 9-1 and Table 9-2 of CAR Section 4 Series B Part I.

h) A proper communication system shall be provided linking the Water Aerodrome fire station, control tower, fire and rescue vessel/(s), fire and rescue vehicles and any other fire station.

i) An alternate system for rescue and fire-fighting personnel, capable of being operated by that station, shall be provided at a fire station.

4.9 RESPONSE TIME

Response Time' is the time between the initial contact with the Rescue and Fire Fighting Services (RFFS) and the first practical action at the accident site by a rescue and firefighting vessel.

For water aerodromes within the house reef, the operational objective of the RFFS shall be to achieve a response time not exceeding three (03) minutes to any point of each operational water runway in optimum visibility and surface conditions.

As per ICAO, response time is **2 min** for runway and taxiway area and **3 min** for an operational area, including an apron.

The following equipment shall be available in rescue and firefighting vessels:

1) Area Maps
2) Navigational Charts
3) Bailing Buckets
4) Bullhorn(s)
5) Forcible Entry Tools
6) Marine Night Vision Binoculars
7) Water Pumps
8) Wool Blankets (for passengers and crew)
9) Life rafts (with paddles or oars)
10) Medical Kit
11) Communication Equipment
12) Emergency Lights
13) Flares
14) Navigational Equipment
15) Portable Resuscitation Equipment
16) Rescue Nets
17) Flood Lights (500 watts or greater)
18) Stretchers and Litters
19) Rescue Throwing Bags and Anchors

4.10ARRANGEMENT WITH AIR TRAFFIC SERVICES

The Water Aerodrome will fall within the jurisdiction of an ATS unit. An applicant for the Water Aerodrome to be licensed shall, in coordination with AAI, establish a procedure for the provision of Advisory or Flight Information services. Where the Water Aerodrome is situated within the control zone of an Aerodrome, the procedure of the controlling ATS shall be followed.

4.11GENERAL ADOPTIONS

a) In the design of the Water Aerodrome, Architectural and Infrastructure related requirements for the optimal implementation of security requirements shall be integrated as per the Bureau of Civil Aviation Security (BCAS) guidelines issued in this regard from time to time.

b) GCA may do inspections of the water aerodromes during the construction period if required to assess the progress, quality assurance system and security adopted by the applicant. A final inspection will be done after the applicant gives the completion report and makes a request for licensing of the water aerodrome.

c) The Water Aerodrome operator shall carry out inspections regularly to check the underwater and above water structural conditions of platforms, docks and ramps, including the safety equipment provided. Records of such inspections shall be maintained and made available for review by Regulatory Authority.

d) The following safety equipment shall be readily available on the floating platforms, dock and ramps:

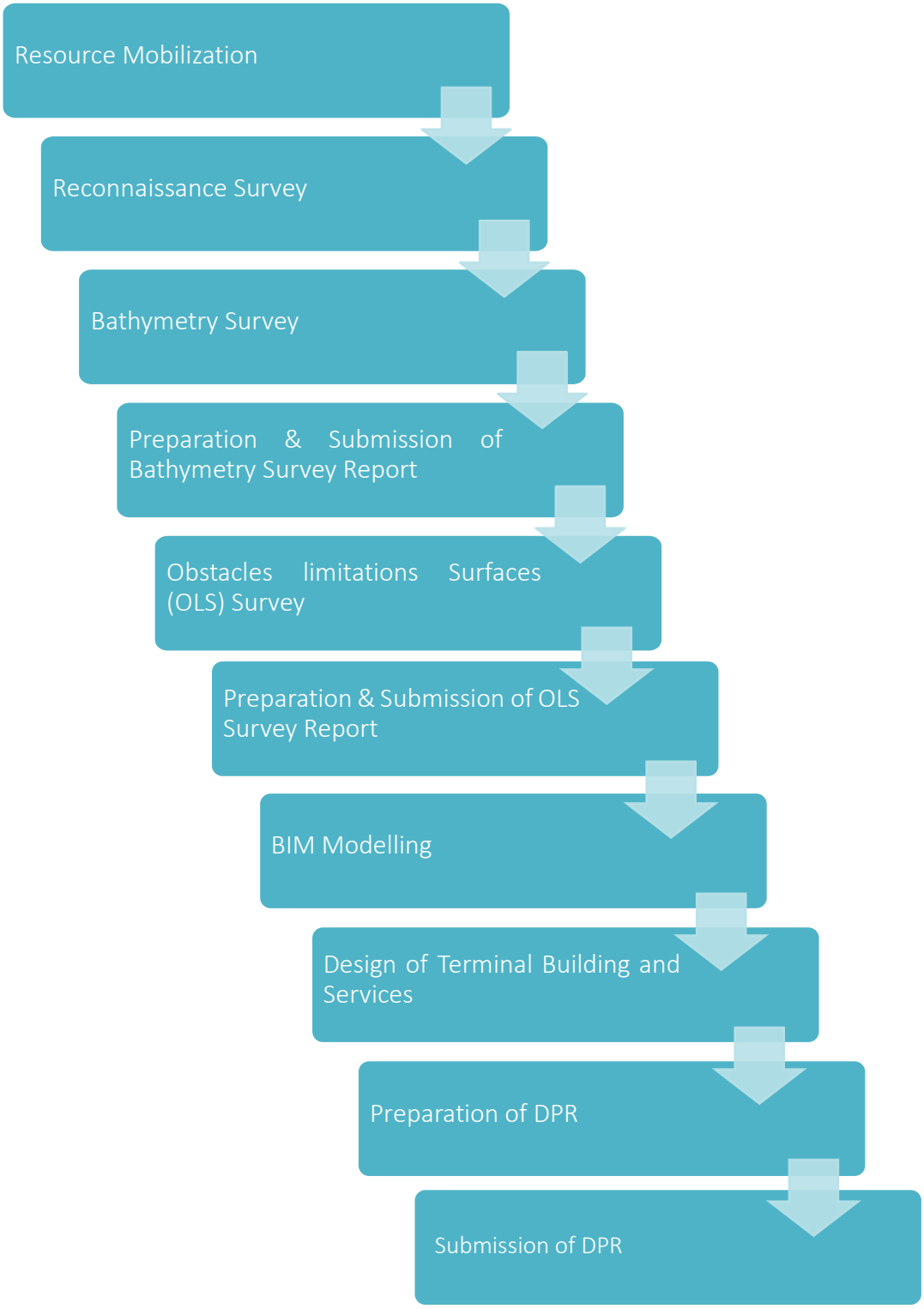
a) 30 m lifeline ropes – adequate to cater for the number of seaplane docking positions

b) Life Rings - adequate to cater for the number of seaplane docking positions

c) Fire extinguishers – 1 for each seaplane docking.

Note: The objectives of emergency planning outlined in CAR SEC4 Series B Part I Chapter 9, Additional guidance on seaplane ICAO Airport Services Manual (Doc 9137) Part.7

5. APPROACH AND METHODOLOGY



6. SITE APPRIATION

6.1 ABOUT SURAT

Surat is one of the most dynamic cities in India, with one of the fastest growth rates due to immigration from various parts of Gujarat and other states of India. Surat is one of the cleanest cities in India and is also known by several different names like "THE SILK CITY", "THE DIAMOND CITY", "THE GREEN CITY", etc. The State Government suggested the Tapti River running through the city for the pre-feasibility of a water aerodrome.

Surat is a city in the western Indian state of Gujarat. Located at the mouth of the Tapti River, it used to be a large seaport. It is now the commercial and economic center in South Gujarat and one of the largest urban areas of western India. It has well-established diamond and textile industries. About 90% of the world's diamonds supply are cut and polished in the city. It is the second largest city in Gujarat after Ahmedabad, the eighth largest city by population, and the ninth-largest urban agglomeration in India. The city is located 284 kilometres (176 mi) south of the state capital, Gandhinagar; 265 kilometres (165 mi) south of Ahmedabad; and 289 kilometres (180 mi) north of Mumbai. The city center is located on the Tapti River, close to the Arabian Sea. According to a study conducted by Economic Times, Surat will be the world's fastest-growing city from 2019 to 2035.

6.2 REGIONAL GEOGRAPHY

The city is located at 21°10′N 72°50′E. It has an average elevation of 13 meters. The Bharuch, Narmada, Navsari surround the Surat district; to the west is the Gulf of Cambay and the surrounding communities. The climate is tropical, and monsoon rainfall is abundant-about 2,500 mm a year. According to the Bureau of Indian Standards, the town falls under seismic zone-III, on a scale of I to V (in order of increasing vulnerability to earthquakes)

Surat has a tropical savanna climate, moderated strongly by the Sea to the Gulf of Camby. The summer begins in early March and lasts until June. April and May are the hottest months, with the average maximum temperature being 37 °C (99 °F). Monsoon begins in late June, and the city receives about 1,200 millimetres of rain by the end of September, with the average maximum being 32 °C (90 °F) during those months. October and November see the monsoon retreat and a return of high temperatures until late November. Winter starts in December and

ends in late February, with average mean temperatures around 23 °C (73 °F) and negligible rain.

6.3 CONNECTIVITY TO SITE

Surat airport is easily accessible from major cities of the country and is well connected. Construction of an International airport is already proposed for Surat. The nearest international airport is located at Ahmedabad, around 284 kilometres from Surat and the other is 289 kilometres in Mumbai.

Two ports are currently operational in Surat; one is Hazira Port, a deep-water liquefied natural gas (LNG) terminal and multi-cargo deep-water port about 20 miles southwest of Surat. The other magdala Port.

Surat city also known as the city of bridges is well connected with roads. Surat is connected with Mumbai in Maharashtra and Ahmedabad in Gujarat through Nation highway NH8 and is also connected with NH6 Running from Mumbai to Kolkata. Express way proposed from Delhi to Mumbai will also pass-through Surat.

6.4 TOURIST ATTRACTION

Surat is a principal business hub of the Indian state Gujarat, the eighth largest city and ninth largest urban agglomeration. Surat is the 2nd cleanest city of India and fastest growing city of the world. Surat is also famous for its food, besides being the hub of diamonds and textiles in India, and one of the country's oldest cities. Surat city is also surrounded by Historical Monuments, Forts, Museum, Beaches, dams, lakes, amusements & Zoos, which attracts huge crowd among the Globe. Following are the well-known attractions at/around Surat.

- Surat Castle
- Mughal Sarai
- Dutch Garden
- Dumas Beach
- Ubharat Beach
- Ukai Dam

Tapi Riverfront is a waterfront being developed along the banks of the Tapti River in Surat, India. State Government had cleared 54 hectares of land on riverbanks for the development of the riverfront project.

6.5 POPULATION OF SURAT, GUJARAT

Surat is the western city of the state of Gujarat, India, known for the popularity of diamonds and the Textile industry. Surat's population in 2022 is 7.2 million, It eighth largest city in India, popularly called the Silk city of India. Surat is a port city situated on the banks of the Tapi river and one of the fastest-growing cities in India. Surat is also a major hub of diamond cutting and polishing since the British East India era. Surat city covers around 326 sq km, and the population density is 14,000 people per sq km which is highly densely populated.

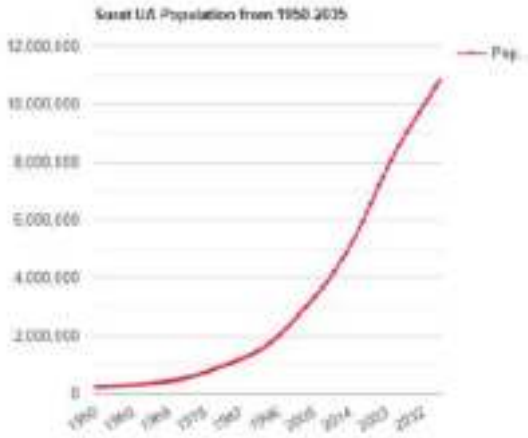


FIGURE 19 POPULATION OF SURAT

7. SELECTION OF SITE

Tapti River, Tapti also spelled Tapi, river in central India, rising in the Gawilgarh Hills of the central Deccan plateau in south-central Madhya Pradesh state. It flows westward between two spurs of the Satpura, across the Jalgaon plateau in Maharashtra, and through the plain of Surat in Gujarat state to the Gulf of Khambhat (an inlet of the Arabian Sea). It has a total length of about 435 miles (700 km) and drains an area of 25,200 square miles (65,300 square km). For the last 32 miles (51 km) it is tidal but is navigable by small vessels.

For Construction of Water Aerodrome following Site is suggested by client as per NIT. Where The state government proposed seven locations on Tapti River at Surat. Among the locations, only the 4th (21°14'18.21"N 72°48'9.63"E) location visited, near Verna Bridge, appeared to be feasible. Other locations were not feasible, due to various reasons like, lack of straight water stretch of sufficient length & breadth, very low water level, bridges and high-tension lines crossing the river, etc.

FIGURE 20 SITES FOR WATER AERODROME AT TAPTI RIVER, SURAT

Once after mobilization of resources and adopting reconnaissance survey for the site area, we have made observations regarding obstructions across the location, as following:

- Floating vegetation in river
- HT lines crossing the river on downstream side
- Maintaining sufficient water depth in dry season
- Air funnel interference with Surat Airport

And once after completion of topography survey, Bathymetry Survey and Obstacle Limitation Surface (OLS) survey for water aerodrome on Tapti River at Surat we have conclude the following location 21°14'49.53" N & 72°49'52.38" E (The Runway center of Water Aerodrome) which would cater domestic flight operations. And other compilation of proposed water lane, approach chart, objects of vertical significance chart and obstacle free zone chart worked out for operational safety perspective.

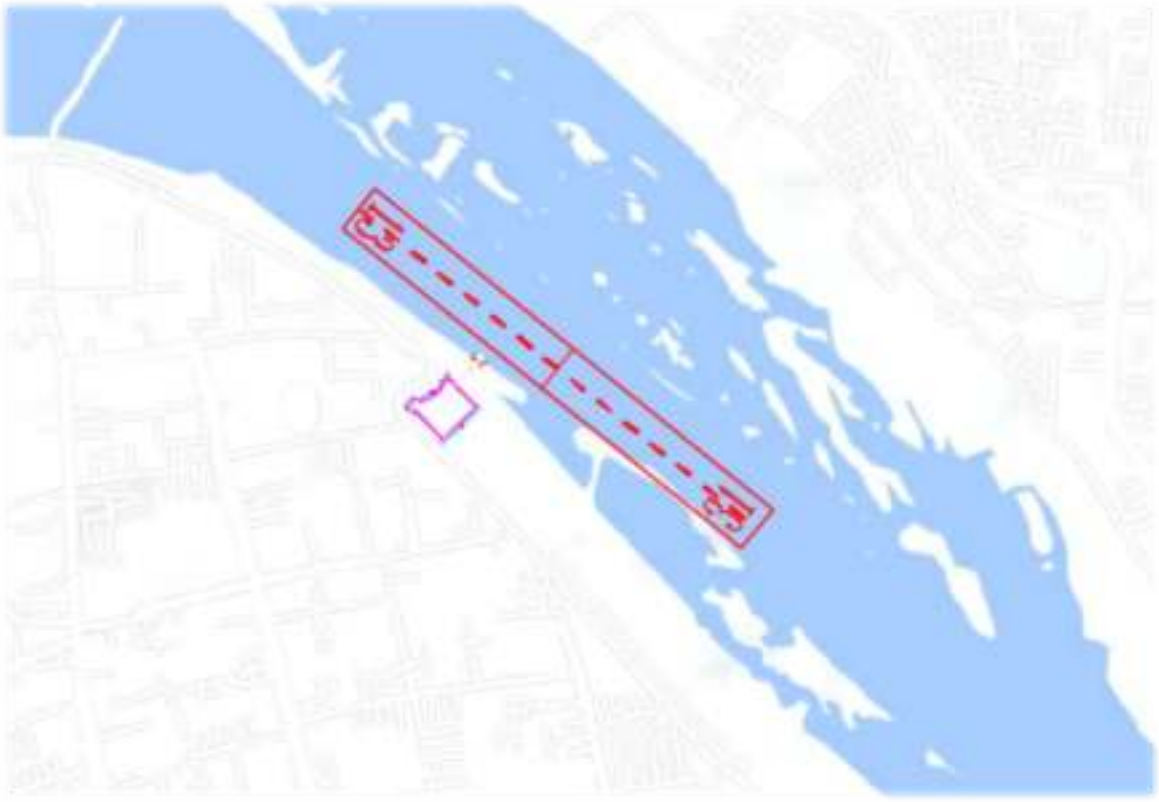


FIGURE 21 SURAT WATER AERODROME

7.1 SITE INFORMATION

As per the reconnaissance conducted during our site visit following are the points and our proposal for this site

- Name of River: Tapti (Surat, Gujarat)
- Location: *21°14'18.21"N, 72°48'9.63"E, Tapti River front, near Verna Bridge*
- Width of River: approx. 1100 to 620 meters

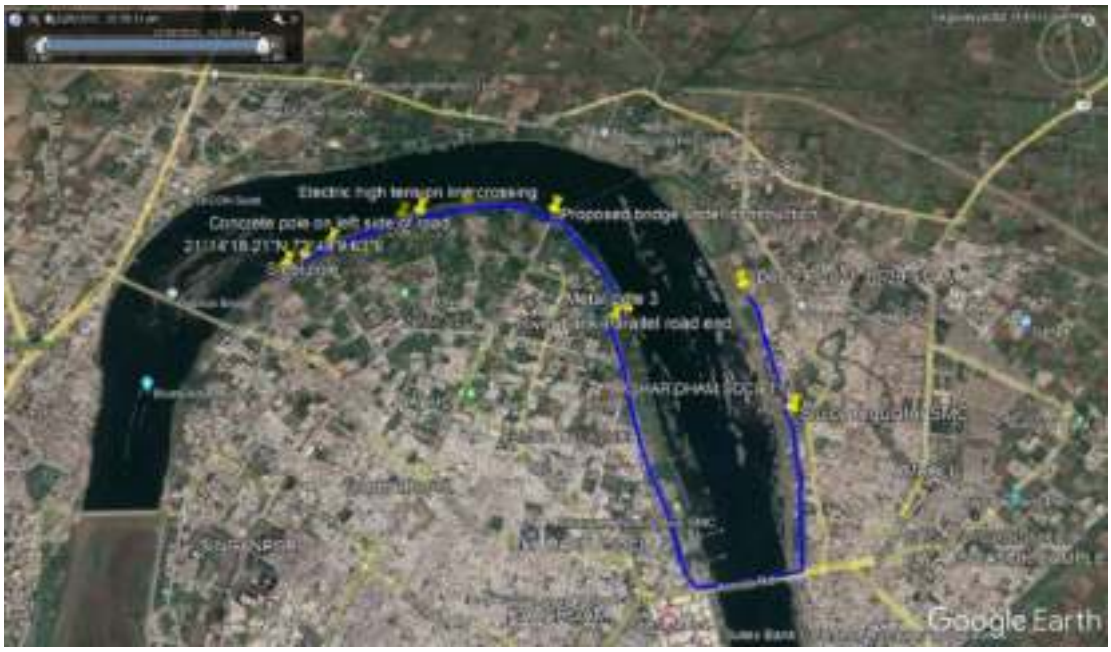


FIGURE 22 SITE VISIT PRIOR STARTING OF BATHYMETRIC SURVEY

Floating vegetation in scattered locations was observed in the proposed area of interest.

FIGURE 23 FLOATING VEGETATION IN AOI

- Electrical high-tension line on the road has been observed on (21.247680°, 72.809298°), which is approx. 1175 meters away from the proposed area of interest.

FIGURE 24 ELECTRICAL HIGH-TENSION LINE IN AOI

- Second Electrical high-tension line on the road have been seen on (21.249870°, 72.811849°), which is approx. 1580 meters away from the proposed area of interest.

FIGURE 25 ELECTRICAL HIGH-TENSION LINE IN AOI

- Under construction bridge has been seen on (21.251811°, 72.818879°) the way and its distance approx. 2338 meters away from proposed area of interest.

FIGURE 26 UNDER CONSTRUCTION BRIDGE NEAR AOI

- Vegetation and island have been seen in the middle of river Tapti, that can be accessible by public and animal.

FIGURE 27 : ISLAND FORMATION NEAR AOI

7.2 TOPOGRAPHICAL SURVEY

Multiple survey instruments were deployed as listed below to collect the necessary data which was integrated over a single platform for post analysis in order to generate the various OLS charts.

- DGPS
- Auto Level
- UAVs

7.2.1 DGPS GROUND CONTROL POINTS

DGPS uses a network of fixed ground-based reference stations to broadcast the difference between the positions indicated by the GPS satellite system and known fixed positions. These stations broadcast the difference between the measured satellite pseudo ranges and actual (internally computed) pseudo ranges, and receiver stations may correct their pseudo ranges by the same amount. The digital correction signal is typically broadcast locally over ground-based transmitters of shorter range.

Ground control points (GCP's) are locations on the surface of our planet with a known X, Y (e.g., latitude and longitude) and Z (e.g., height above mean sea level in meters). In order to use GCPs in the ortho-rectification process, or for any Survey application, they need to be extremely accurate. These units work by locking on to multiple GPS satellites in space that then triangulate your position on the ground. The position of each GPS satellite is then verified and corrected by a series of ground stations that monitor their orbit, velocity, and direction of movement, usually called as post processing of the DGPS observations using a suitable software.

Post-processing is used in Differential GPS to obtain precise positions of unknown points by relating them to known points such as survey markers. The software computes baselines using simultaneous measurement data from two or more GPS receivers. Initially, we have started to fix the Preliminary Ground control point (PGCP) with the help of DGPS. Then one by one we have started to establish the secondary Ground Control Points (SGCPS) with reference to the PGCP.

FIGURE 28 ESTABLISHMENT OF PRIMARY GROUND CONTROL POINT

FIGURE 29 ESTABLISHMENT OF SECONDARY GROUND CONTROL POINT

FIGURE 30 ALL GROUND CONTROL POINTS SURROUNDING AOI

7.3 GEOTECHNICAL INVESTIGATION

FIGURE 31 BORE LOG AT SITE

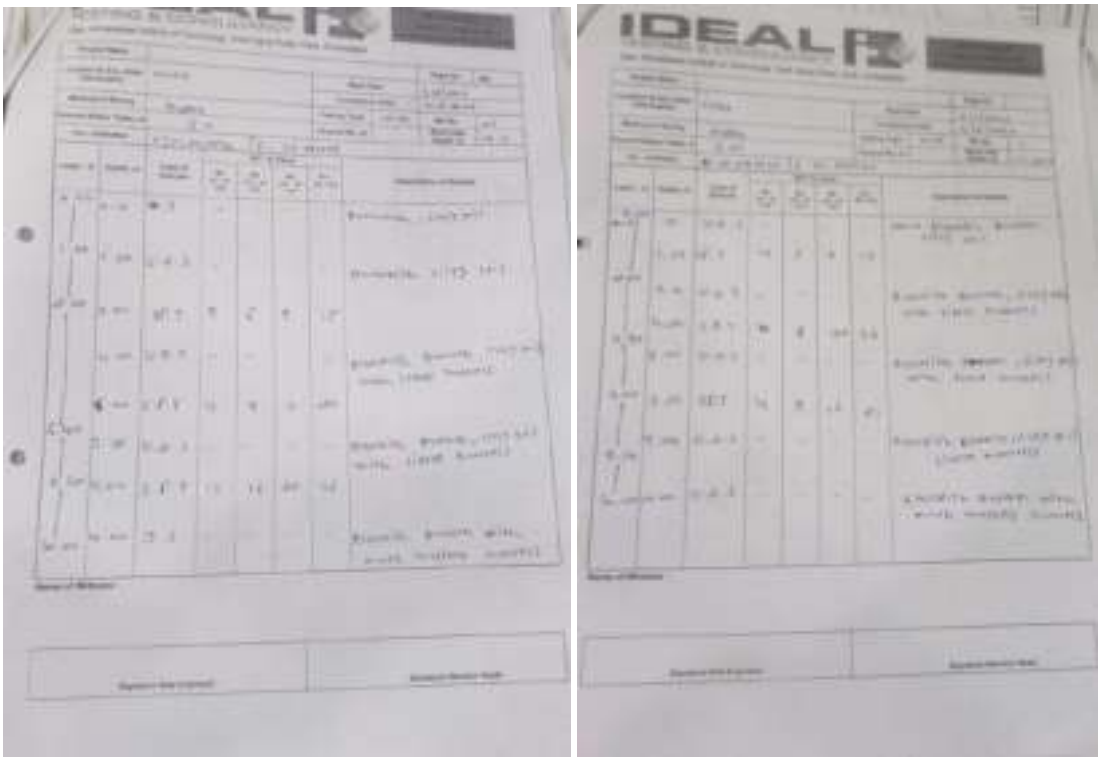


FIGURE 32 FIELD OBSERVATION REPORT

The above images were taken while conducting the Geotechnical Investigation.

7.4 BATHYMETRY SURVEY

The scope of work covers the bathymetric survey and hydrological observations at par with IHO Standards S-44, 5th edition, Special Order Surveys, including the specifications set out hereinafter for development of infrastructure on behalf of client. The detailed bathymetric survey carried out by using Automated Hydrographic Survey System (using digital Echo measurement, DGPS Receivers for position fixing and sounder for depth Hypack or equivalent software for data logging& processing), to achieve the desired S-44 accuracies.

7.4.1 SURVEY VESSEL

A rugged wooden country boat (diesel engine powered) was deployed for undertaking the survey activities, subjective to the safety of the manpower as well as the equipment. The boat with shallow draft and enough space for a team of around 6 persons who can easily operate and undertake the survey activities

FIGURE 33 SURVEY VESSEL DEPLOYED ON SITE

7.4.2 HORIZONTAL POSITIONING SYSTEM

Positions from GTS Benchmarks or positions established at bridges, barrages, Railway Stations, etc., if available in the vicinity, will be cross-checked with the established horizontal control.

GCPs are fixed using RTK DGPS in fix mode using UHF Radio Modem with IHO accuracy standards.

Positioning during survey works shall be provided using Trimble SPS356 or equivalent Differential Global Positioning Systems (DGPS). Satellite-Based Augmentation System (SBAS) correct the coded raw pseudo ranges received from selected GPS satellites not less than 12, to mobile receiver(s). The mobile receiver(s) apply these corrections to their own observed satellite pseudo ranges and so obtain the corrected pseudo ranges to be used for the position computations. The positions derived by the DGPS receiver are calculated in WGS84 spheroid and since the entire project work is based on WGS-84 spheroid, can be directly converted to UTM coordinates using map projections described in para 4.1 (Geodetic parameters and reference levels), with sub-meter accuracies.

The position of soundings, dangers, other significant submerged features, nav- aids (fixed and floating), features significant to navigation, the coastline and topographical features will be determined as per the requirements specified in S-44.

7.4.3 VERTICAL POSITIONING SYSTEM

The site was be equipped with an Auto Level instrument, Sokkia B40, or Similar. The Level instrument is required to control measurements and for accurate transfer of benchmark heights.

FIGURE 34 VERTICAL POSITIONING SYSTEM

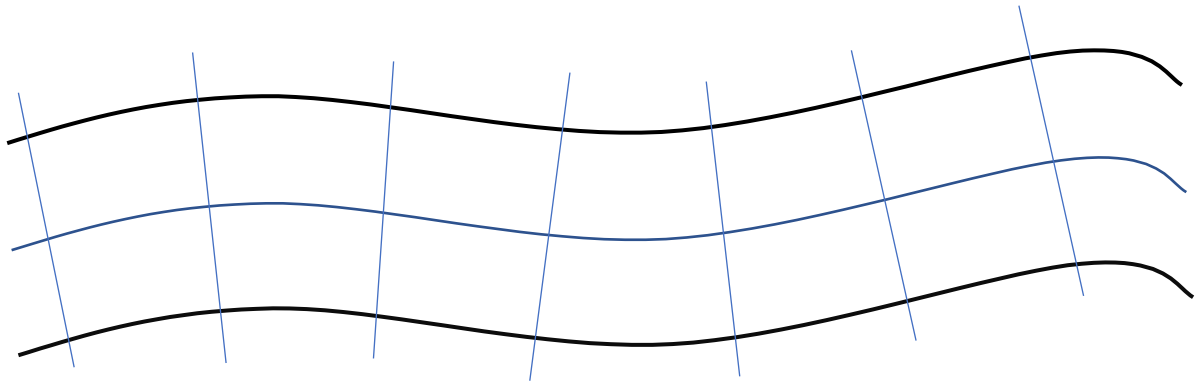
7.4.4 SINGLE BEAM ECO-SOUNDER (SBES)

The measured depths and drying heights shall be referenced to a vertical datum, i.e. the chart datum, which will be clearly referenced to the Mean Sea Level. Standard method will be adopted for transfer of datum in rivers/canals. For tidal reaches, standard transfer of datum as per Admiralty Manual will be adopted. Sounding datum already established by Port Authorities (Chart Datum), Central Water Commission / State Irrigation Department / Dam Authorities and at their gauge stations along the river/canal / reservoir will be accepted.

All bathymetric data collected will be logged directly to the survey computer system with event marks, generated by the internal annotator, recorded on the analogue record

7.4.5 LINE PLANNING

Run lines will be planned in such a way that complete river section under the survey scope is covered. A centre line for the entire river section will be planned and then planned lines will be made in perpendicular direction of that centre line. This will enable to undertake the surveys in the entire river section. Check lines will be run at discrete intervals



Riverbank Lines

Planned Lines

7.4.6 CURRENT VELOCITY AND DISCHARGE MEASUREMENT

The current velocity and discharge were observed. Two cross sections at each site were been shown by the officers where these observations will have to be taken.

FIGURE 35 CURRENT VELOCITY AND DISCHARGE MEASUREMENT INSTRUMENT

7.4.7 WATER & BED SAMPLERS

Water and bottom samples were collected from the positions demarcated by officers. Soil sample collected by a grab and water sample at 0.5d (d-measured depth of water) by any approved systems. The position of these collected samples are indicated in the charts.

FIGURE 36 SAMPLE COLLECTOR

7.4.8 RESULTS AND DELIVERABLES

Bathymetry Survey was conducted on site and witnessed by Client representative. Checklist for the survey were signed jointly. Bathymetry report was submitted with all the supporting documents and approved by client.

BATHYMETRY SURVEY REPORT IS ENCLOSED WITH THIS REPORT AS AN ANNEXURE.

7.5 OLS SURVEY

7.5.1 KEY OBSERVATIONS ABOUT WATER AERODROME AT SURAT-TAPI RIVER

The Runway centre of Water Aerodrome at Tapti River, Surat proposed location is 21°14'49.53" N & 72°49'52.38" E which would cater domestic flight operations. Nearest commercial airport is located on Southwest side of the Tapti River at Surat located at an aerial distance of approx. 16.56 kms as single runway, this site is accessible via Surat Riverfront Road.

The proposed site area of Water Aerodrome is approximately 2.5 acres.

The geographical coordinates, location on map and geographical stretch of land of the proposed Water Aerodrome along boundary, proposed runway is shown below in Map (*figure a*) with the list of boundary coordinates. Proposed runway is 1200 m in length with the width of 60 m.

FIGURE 37 PROPOSED RUNWAY AT TAPTI RIVER AT SURAT

TABLE 2 LIST OF COORDINATES

S.NO	Points	Latitude	Longitude	Easting	Northing
1	A	21°24'72.32"	72°82'82.53"	23,51,060.08	2,74,626.67
2	B	21°24'65.84"	72°82'89.57"	23,50,987.34	2,74,698.82
3	C	21°24'58.88"	72°82'82.07"	23,50,911.37	2,74,619.89
4	D	21°24'64.97"	72°82'75.39"	23,50,979.76	2,74,551.40
5	E	21°24'65.89"	72°82'74.27"	23,50,990.12	2,74,540.00
6	F	21°24'66.16"	72°82'74.18"	23,50,993.09	2,74,539.08
7	G	21°24'66.36"	72°82'74.41"	23,50,995.28	2,74,541.45
8	H	21°24'66.53"	72°82'74.76"	23,50,997.12	2,74,545.14
9	J	21°24'66.81"	72°82'75.50"	23,51,000.12	2,74,552.84
10	K	21°24'67.58"	72°82'77.92"	23,51,008.29	2,74,578.11
11	L	21°24'67.89"	72°82'79.02"	23,51,011.55	2,74,589.58
12	M	21°24'68.20"	72°82'79.60"	23,51,014.93	2,74,595.66
13	N	21°24'68.71"	72°82'80.39"	23,51,020.47	2,74,603.89
14	O	21°24'68.95"	72°82'80.59"	23,51,023.08	2,74,606.08
15	P	21°24'70.83"	72°82'81.91"	23,51,043.67	2,74,620.03
16	Q	21°24'70.20"	72°82'84.84"	23,51,036.24	2,74,650.31
17	R	21°24'70.12"	72°82'84.92"	23,51,035.39	2,74,651.16
18	S	21°24'74.41"	72°82'89.25"	23,51,082.32	2,74,696.76
19	T	21°24'74.34"	72°82'89.34"	23,51,081.51	2,74,697.65
20	U	21°24'75.19"	72°82'89.98"	23,51,090.83	2,74,704.48
21	V	21°24'75.12"	72°82'90.07"	23,51,090.03	2,74,705.37

22	W	21°24'76.21"	72°82'88.62"	23,51,102.26	2,74,690.55
23	X	21°24'76.86"	72°82'89.23"	23,51,109.42	2,74,696.91
24	Y	21°24'75.45"	72°82'90.99"	23,51,093.59	2,74,714.94
25	Z	21°24'74.79"	72°82'90.38"	23,51,086.33	2,74,708.51

7.5.2 Scope of Work

OLS survey was conducted for the proposed Tapti River at Surat, the main aim for the survey is to identify the significant objects in and around the proposed area and area within 2.5 km of radius from the centre for the proposed runway strip. aerial LiDAR system was used in order to capture the topography and other details in order to study the area of interest. The entire proposed area is bifurcated in various zones in order to identify the obstacles. The said work has been carried out as ASIA PACIFIC REGIONAL GUIDANCE ON REQUIREMENTS FOR THE DESIGN AND OPERATIONS OF WATER AERODROMES (WA) FOR SEAPLANE OPERATIONS of INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO).

7.5.3 Approach Surface area

Approach surface areas in the direction of the runway was surveyed to ensure the procedures are meeting ASIA PACIFIC REGIONAL GUIDANCE ON REQUIREMENTS FOR THE DESIGN AND OPERATIONS OF WATER AERODROMES (WA) FOR SEAPLANE OPERATIONS of INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO). The survey included identification of all man-made as well as natural structures/ features (Road, building, high ground, electric/ telephone lines, tower/ chimney, hills etc.) falling in the approach area on both sides of the proposed runway and establishing their location and elevation on a plan.

The objects were shown along with their location and elevation in the following manner.

Radius Distance 0 -2500 m from centre of strip – details are provided.

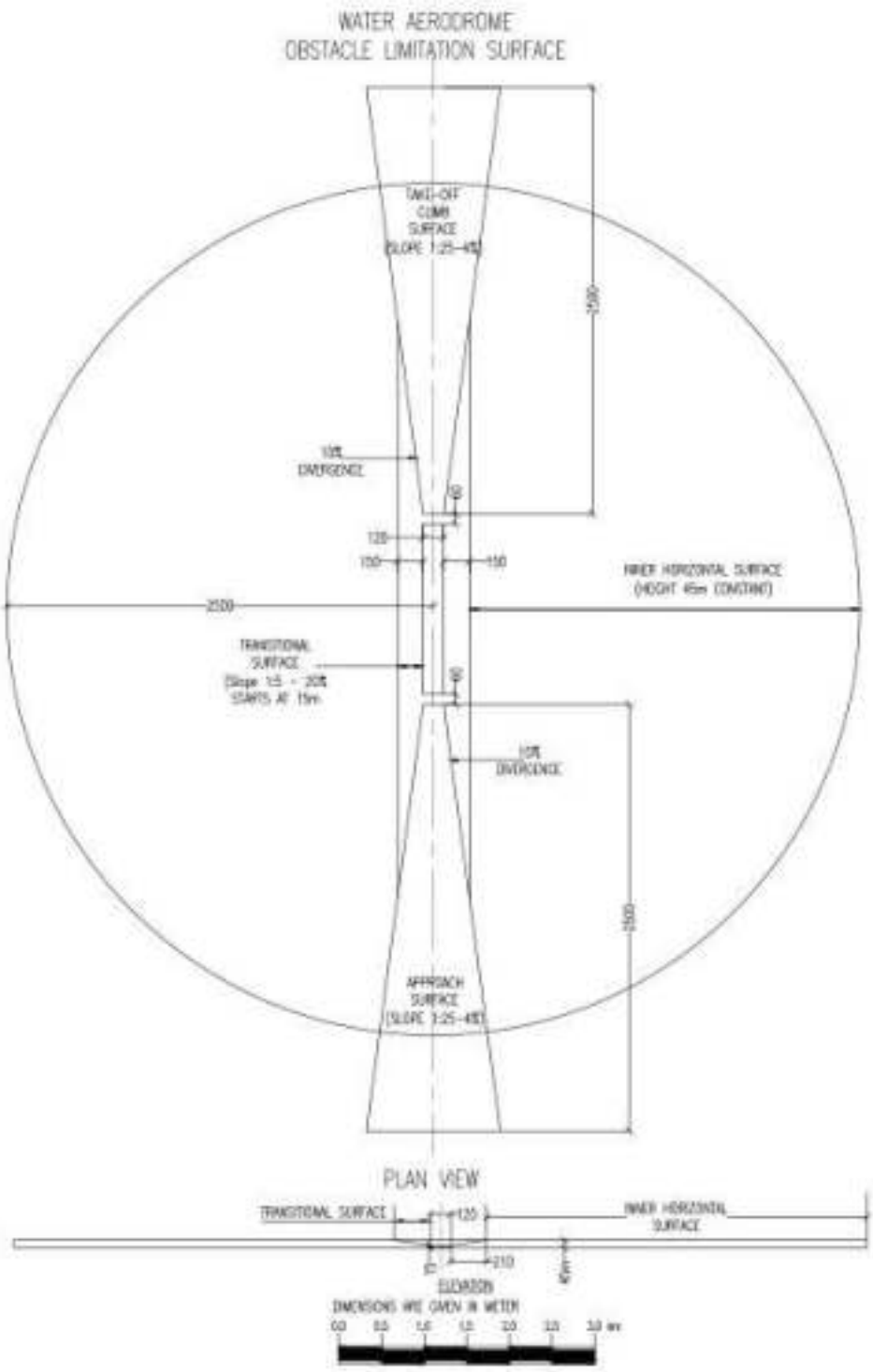


FIGURE 38 OBSTACLE LIMITATION SURFACE

As Per Asia Pacific Regional Guidance On Requirements For The Design And Operations Of Water Aerodromes (WA) For Seaplane Operations Of International Civil Aviation Organization (ICAO)

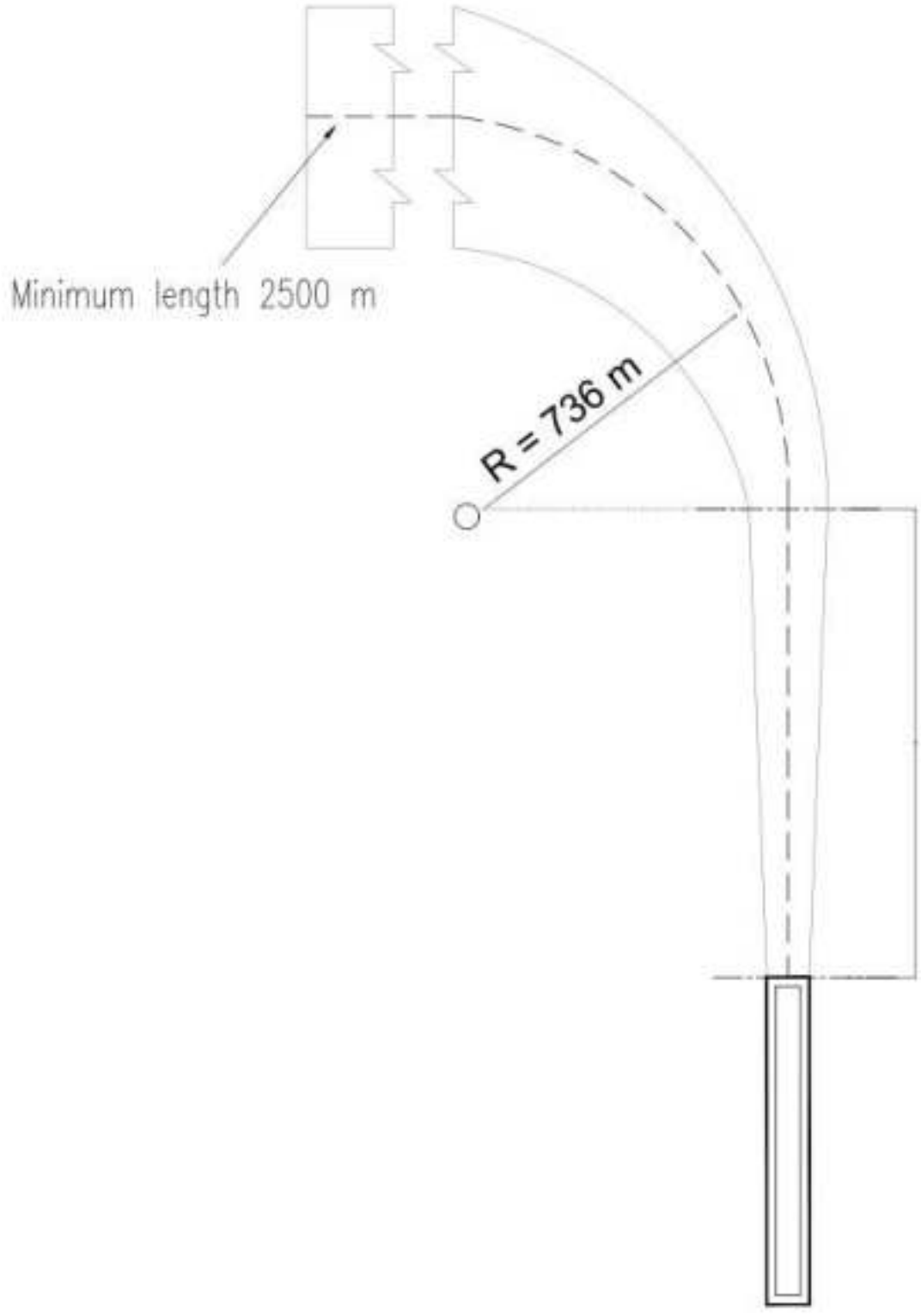


FIGURE 39 CURVED TAKE-OFF CLIMB/APPROACH SURFACE

As Per Asia Pacific Regional Guidance On Requirements For The Design And Operations Of Water Aerodromes (WA) For Seaplane Operations Of International Civil Aviation Organization (ICAO)

7.5.4 Inner Horizontal Surface

Identification of all man-made as well as natural structure/features (Roads, building, electric/ telephone lines, tower/chimneys, hill etc.) of height more than 45 m from ground level and all objects having top elevation more than 55 m above aerodrome elevation falling in the inner horizontal surface and establishing their location and elevation (Top and base) on a plan. Four or five prominent / highest trees in the group of trees in radius of 150 m may be shown (Instead of showing all trees). In case of building/houses, four or five prominent /highest building / houses in the radius from the highest structure of 150 m may be shown (Instead of showing all building).

7.5.5 List of Survey Equipment Deployed

Our team was equipped with following instruments on site for conducting the OLS survey along with highly skilled and experience team of surveyors and engineers:

1) e-VTOL fixed-wing UAV
2) Sony RX1R II (42.4 Megapixel RGB Optics Sensor)
3) LiDAR (Geomatics Grade LiDAR, Class 1 (Eye Safe)
4) Differential Global Positioning System (DGPS)

7.5.6 List of Geodetic coordinates in WGS84 System

Figure 40 All Ground Control Points Surrounding AOI

Table 3 List of Ground Control Points

Station ID	Latitude	Longitude	Ellipsoid Height (m)
PGCP	21°14'15.01556"N	072°50'10.41652"E	-40.280235
SGCP1	21°14'29.16684"N	072°48'16.09726"E	-40.624154
SGCP2	21°14'45.60877"N	072°48'29.63941"E	-40.20123
SGCP4	21°14'47.19453"N	072°49'37.51775"E	-39.354366
SGCP5	21°14'00.98397"N	072°50'26.57973"E	-39.294099
SGCP6	21°14'15.04518"N	072°50'49.95399"E	-38.969378
SGCP7	21°14'23.76649"N	072°50'44.36766"E	-40.140197
SGCP8	21°14'45.45862"N	072°50'31.04007"E	-39.830557
SGCP9	21°15'00.55186"N	072°50'17.09172"E	-39.926632
SGCP3	21°15'06.08129"N	072°49'00.85602"E	-39.980365

7.5.7 List of 2D Coordinates in Local System

Table 4 2D Coordinates in Local System

Station ID	North(m)	East(m)	Height(m)
PGCP	2349969.735	275439.6424	20.436665
SGCP1	2350450.482	272148.8702	20.035575
SGCP2	2350950.817	272546.4138	20.451232
SGCP4	2350972.564	274504.4974	21.324211
SGCP5	2349531.758	275899.8699	21.440276
SGCP6	2349955.081	276579.8519	21.763482
SGCP7	2350225.538	276422.4073	20.5836
SGCP8	2350898.019	276047.1779	20.870935
SGCP9	2351367.779	275651.3041	20.757607
SGCP3	2351568.089	273455.3121	20.670155

7.5.8 THE EVTOL FIXED-WING MAPPING DRONE FOR PROFESSIONALS

The e-VTOL fixed wing UAV demonstrates its range advantage and flying endurance in comparison to classic multi-copters and other fixed-wing drones due to the longer flight time and covers up to 20x larger areas. LiDAR and optic payloads are being mounted along with this UAV.

FIGURE 41 FIXED WING MAPPING DRONE

7.5.9 GEOGRAPHIC LOCATION OF RUNWAY

Geographic locations of both the runway ends, runway center point along with elevation which were identified are listed below.

TABLE 5 GEOGRAPHIC LOCATION OF RUNWAY

Sr No	Runway	Northing	Easting	Elevation (MSL, m)
1	Runway 13	2351453.351	274421.084	4.5
2	Runway 31	2350622.649	275446.916	4.5
3	Runway Centre	21°14'49.53"	72°49'52.38"	4.5

7.5.10 OBSTACLE DETAILS

All the vertical significant obstacles have been listed out and submitted with OLS report.

Submitted OLS report and drawings are attached as an Annexure.

8. PROPOSED DEVELOPMENT

We have studied the various guidelines for developing a Seaplane / Water Aerodrome. We also performed the required technical surveys as per NIT. Based on the policies and surveys, we propose the following developments for the proposed Water Aerodrome at Tapti River Surat.

8.1 OFF-SHORE DEVELOPMENTS

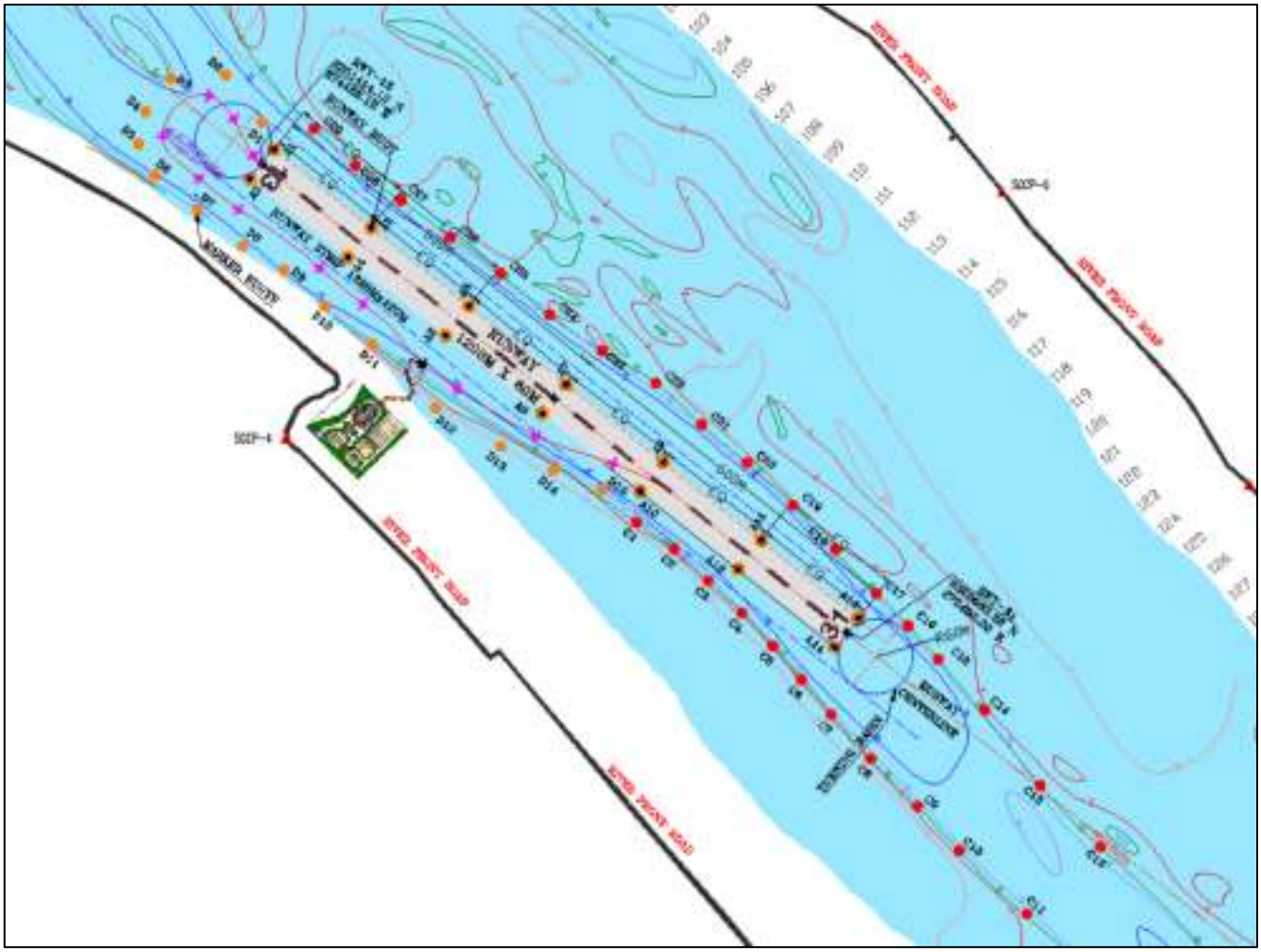


FIGURE 42 LAYOUT OF WATER RUNWAY STRIP

8.1.1 WATER RUNWAY STRIP

Water Runway strip is proposed with an adequate length of about 1320 m to meet the operational requirements of the critical seaplane for which the runway is intended and should be not less than the most extended length determined by applying the corrections for local conditions to the operations and performance characteristics of the relevant seaplanes.

The width of the water runway is provided at 120m, which complies with ICAO guidelines.

The proposed location for the water runway strip has the depth of more than 1.5 M from the Chart datum level.

The proposed length and width comply as per ICAO and DGCA guidelines.

8.1.2 WATER RUNWAY

Water runway for takeoff and landing of Seaplane is allotted in conjunction with all safety parameters and proposed future expansion. The runway strip is 1200m long, and 60m wide as per below centerline coordinates and illustrative graphics and the related plans are attached in conjunction of OLS data and maps.

Sr No	Runway	Northing	Easting	Elevation (MSL, m)
1	Runway 13	2351453.351	274421.084	4.5
2	Runway 31	2350622.649	275446.916	4.5
3	Runway Centre	21°14'49.53"	72°49'52.38"	4.5

8.1.3 TAXI CHANNELS

Taxi channels are proposed as per requirement and per site location availability, fulfilling the scheduled parameters as per ICAO and DGCA guidelines, providing a minimum 60m clearance for navigational safety.

8.1.4 TURNING BASINS

Turning Basins are proposed as per guidelines provided in DGCA & ICAO and matches with physical characteristics of a critical seaplane.

8.1.5 BUOYS

Guidelines provided in DGCA and ICAO for navigational parameters are fulfilled for safe navigation of Seaplane operations.

Provided Buoys are classified as below.

RUNWAY BUOYS- Runway Buoys are proposed at the periphery of the Runway; 6 layers and a total of 12 Buoys are proposed, named A1 to A14.

RUNWAY NUN BUOYS- Runway Nun Buoys are provided at the periphery of the Runway Strip, which is proposed total of 29nos naming C1 to C29.

MARKER BUOYS- Buoys provided along the taxi channel as a navigational aid are termed Marker Buoys. Marker Buoys are tagged as D1 to D15; a total of 15 nos buoys are proposed at the shoreline face across the taxi channels.

LEGEND FOR BUOYS

SYMBOL OF BUOYS	DESCRIPTION	CODING	COLOR	QUANTITY
	RUNWAY BUOY	A1 – A14	INT'L ORANGE & WHITE	14 nos.
	NUN BUOY	C1 – C29	RED	29 nos.
	MARKER BUOY	D1 – D15	INT'L ORANGE	15 nos.

8.1.6 PASSENGER TRANSFER VESSEL(PTV)

For emplaning and deplaning passengers during the high-water level, the water aerodrome shall be equipped with a transfer vessel to transfer passengers to the shore, which should cater to a capacity of critical seaplane passengers that is considered 19 passengers and their luggage.

FIGURE 43 PASSENGER TRANSFER VESSEL

8.2 SHORELINE DEVELOPMENT

8.2.1 PONTOON

Floating Pontoon proposed to cater a passenger transfer from/to seaplane towards terminal building via pathway ramp. Pontoon, having the size of 24 x 09 m proposed for boarding and deboarding of passengers from the seaplane. Which is placed at the shoreline and fixed by providing anchored mooring at the bottom.

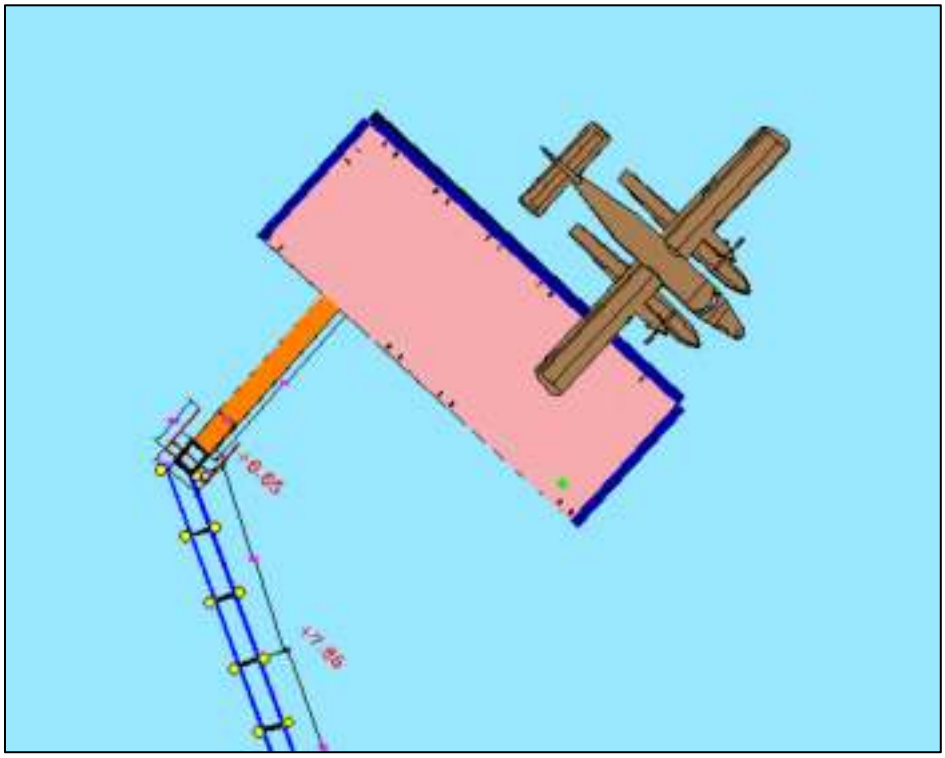


FIGURE 44 LAYOUT OF PONTOON

8.2.2 ANCHORAGE AREA

A pontoon is proposed, which is equipped with an Anchorage system for the critical seaplane. A separate anchorage area is not proposed.

8.2.3 GANGWAYS

A Gangway (mostly of aluminium structure to have corrosion resistance) is the connector between the ramp (landside) and pontoon (waterside structure). The contractor must design and get the approval of the respective element, details given are as illustrations.

FIGURE 45 ILLUSTRATIVE IMAGE FOR ACCESS GANGWAY

8.2.4 WIND INDICATORS

A wind direction indicator proposed of a conspicuous colour and in the form of a truncated cone at Pontoon and at onshore structure, which shall be visible from 1000 feet above.

FIGURE 46 ILLUSTRATIVE IMAGE FOR WIND INDICATOR

8.3 ON-SHORE DEVELOPMENT

8.3.1 RAMP CONNECTING TERMINAL BUILDING TO PONTOON

Ramps are proposed to transfer passengers towards Pontoon from the terminal building with a length of 120m from Terminal Building to Pontoon.

8.3.2 FUELING BOWSER

Fueling Bowser having Fuel Tank and Pump for safe delivery are proposed at the shoreline to cater a refueling of a seaplane.

FIGURE 47 ILLUSTRATIVE FUELLING BOWSER

8.4 DEVELOPMENT FOR PUBLIC USE

8.4.1 TERMINAL BUILDING

Terminal Building of 575 Sqm area is proposed as a steel structure with a glass facade and aluminium sheets. A terminal building has been submitted for the water aerodrome with the following salient features:

- Entry Point
- Public Concourse
- Manager Office
- Security Office
- Check-In Gates
- Baggage Screening and Handling Facility

- Departure Lounge
- Arrival Lounge
- Toilet facility (For Ladies / Gents / Specially abled) at all different sections
- Sitting Arrangements
- Surveillance Facility

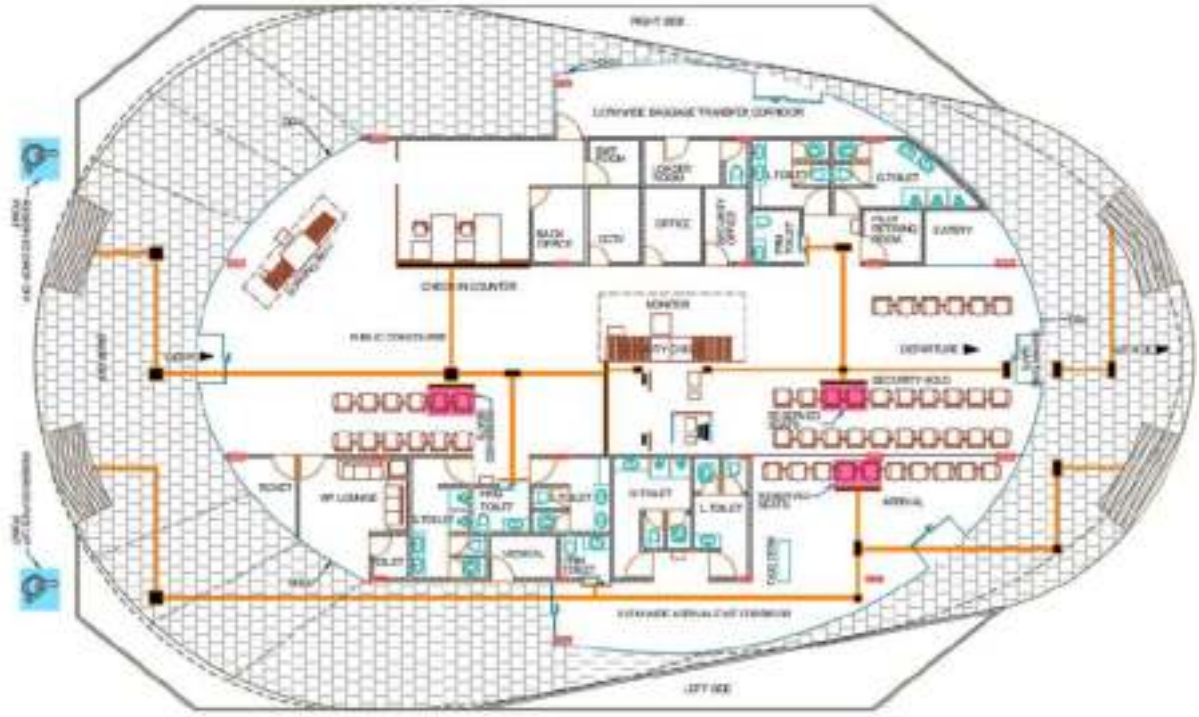


FIGURE 48 TERMINAL BUILDING LAYOUT PLAN

Allied infrastructures such as Security cabin & surveillance systems, utility buildings, internal roads, streetlights, sewage treatment plants, fire hydrants & CCTV etc.

8.4.2 SECURITY CABINS & GATES

Security Cabins are planned at each gate, controlling and restricting all the public and staff movement throughout the premises. The primary layout is as below.

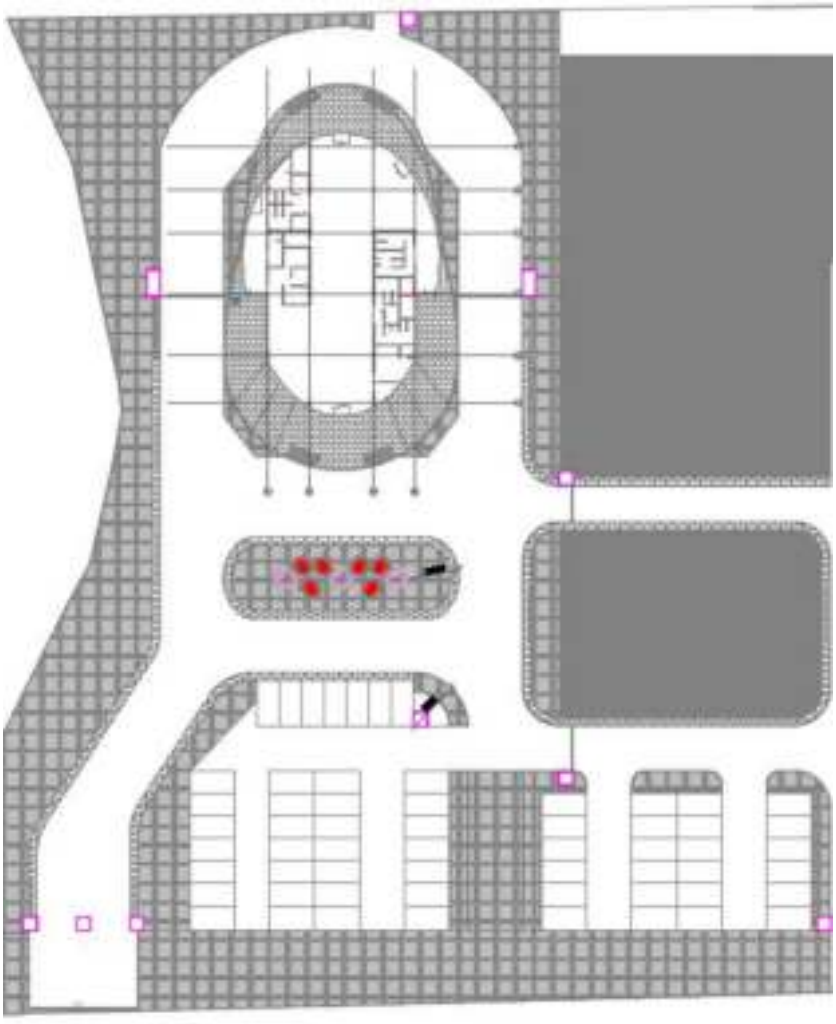


FIGURE 49 MAGENTA COLOURED BLOCKS REPRESENTS SECURITY CABINS BESIDE EACH GATES

8.4.3 PARKING AREA (STAFF AND VISITORS)

Functionally, the parking area should be located for safe, convenient access to the various onshore and shoreline facilities. Parking area for cars, including specially-abled spaces, and other transports proposed. Parking area offered with an area of 760 sqm.

FIGURE 50 PARKING LAYOUT

8.4.4 SECURITY AIDS

Security aids include the following features:

- Handheld metal detectors
- Door frame metal detector
- X-Ray machine/ manual for screening hand baggage and Checked-in baggage
- Dog squad
- Isolation bay

8.4.5 Assembly Area

A place that is a single gathering point during any emergency and a strategic emergency rescue point.

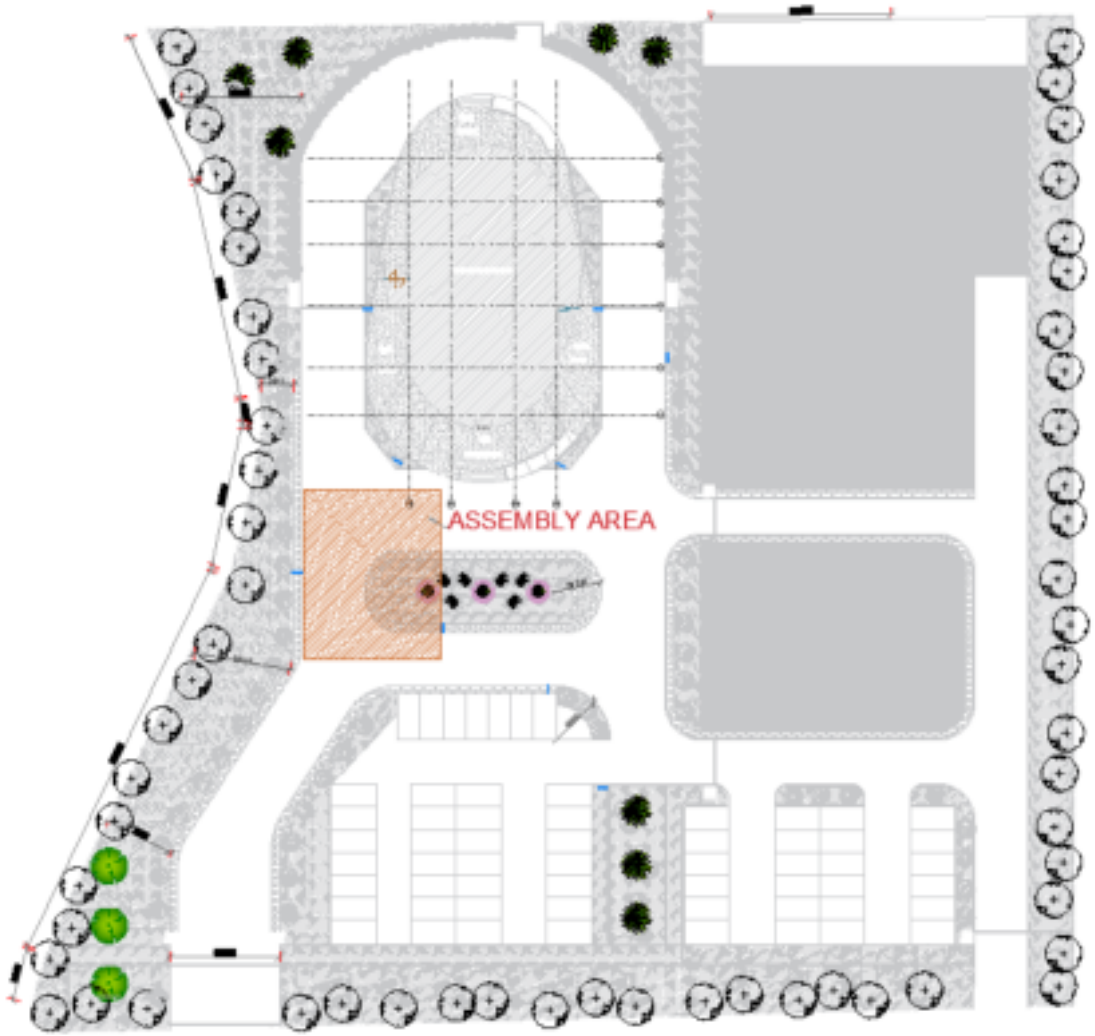


Figure 51 Proposed Assembly Area

8.4.6 Security Fencing

Internal and Periphery fencing has been proposed as per DGCA Guideline, considering safety parameters.

8.5 PROPOSED AMENITIES

8.5.1 RECREATIONAL LANDSCAPES

A landscaped area of 3273 sqm is proposed for the Water Aerodrome.

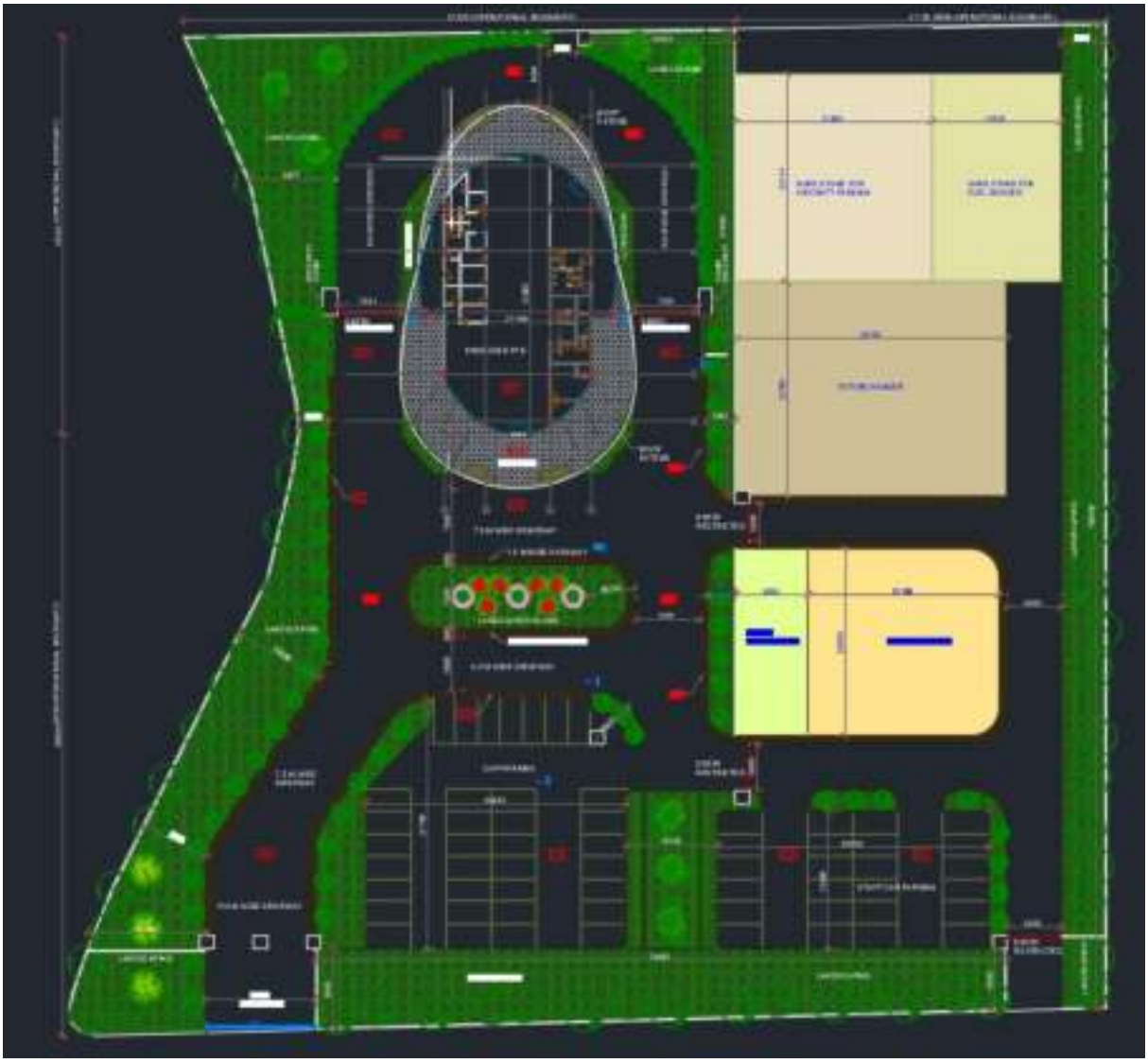


FIGURE 52 LANDSCAPE LAYOUT

8.5.2 SIGNAGES

As per AAI Guidelines and parameters, signages are proposed for outdoor and indoor premises, checkpoints, gates, navigational arrows, and locations. Illustrative signages are as below.

FIGURE 53 OUTDOOR SIGNAGES

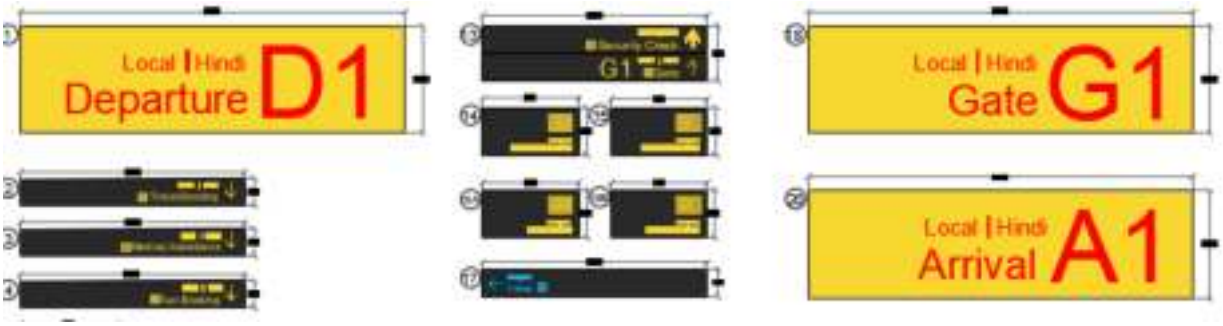


FIGURE 54 INDOOR SIGNAGES

8.5.3 EATERIES

Eateries are proposed at the arrival and departure lounge for public use.

8.5.4 Taxi Booking Desk

Taxi Booking Desk is proposed to facilitate passengers with instant and hassle-free taxi booking at the arrival lounge as per their needs.

8.5.5 DG Set Utility Room

The utility building of 170 Sqm has been proposed to accommodate the primary DG Set facility. The Utility building shall house the Electrical substation, Plumbing and Firefighting plant room.

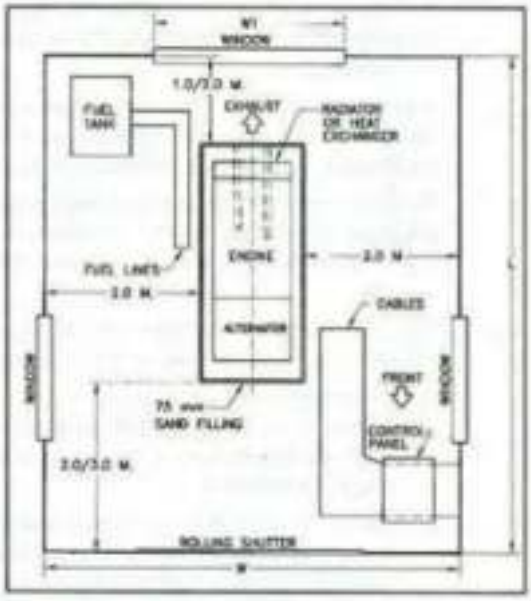


Figure 55 DG Set Utility Space Layout

8.5.6 Sewage Treatment Plant (STP)

The wastewater generated will be 60 KLD, Package STP with Moving Bed Biofilm Reactor. (MBBR) technology has been proposed at terminal building premises.

An underground RCC treated water tank has been proposed to store the treated water from STP and will be reused for gardening and flushing purposes. This will reduce the freshwater requirement regularly by at least 40%.

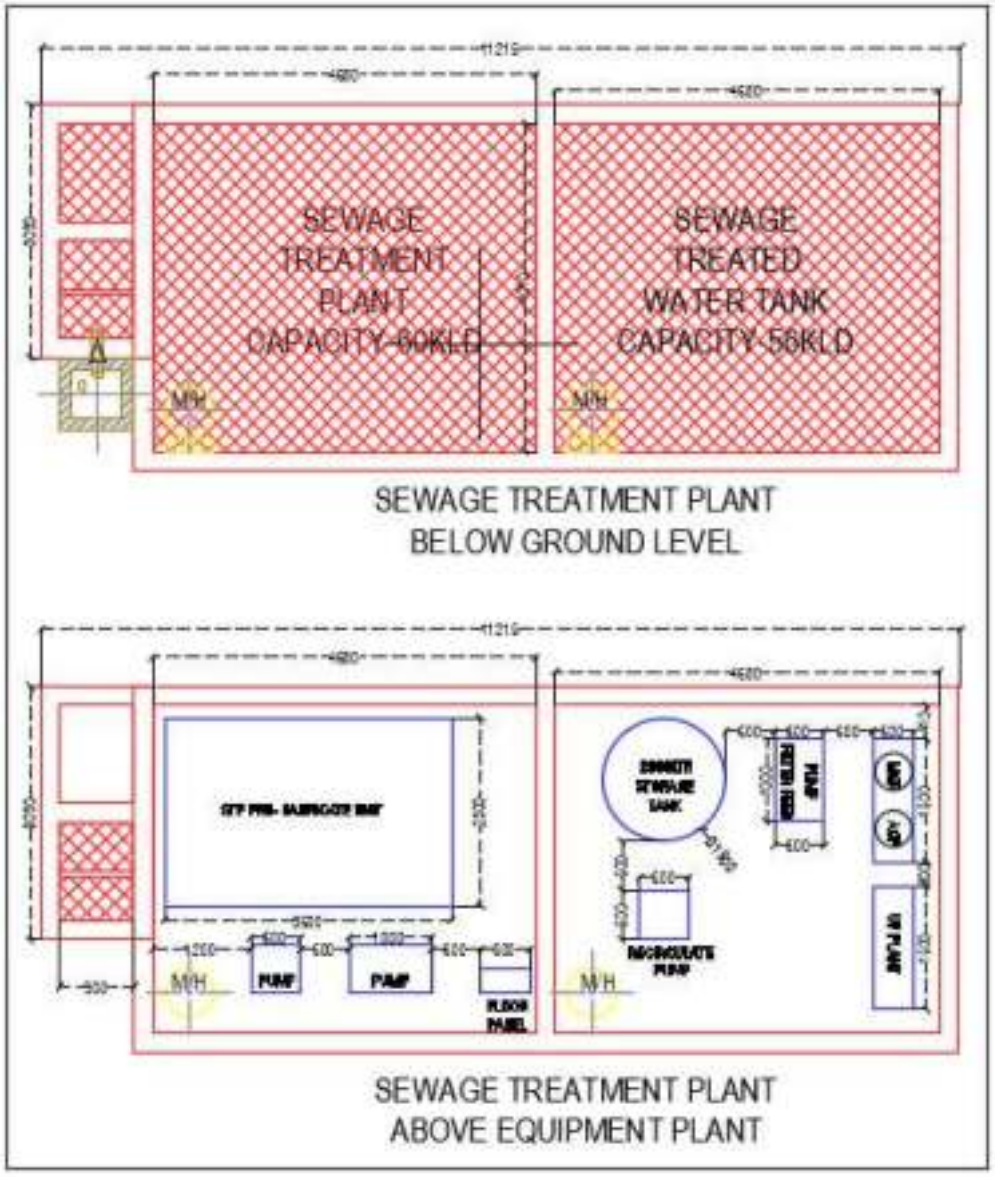


FIGURE 56 LAYOUT OF PROPOSED STP & EQUIPMENT PLANT

8.5.7 CCTV AND PAS

IP CCTV Surveillance System & Security system

The proposed CCTV surveillance Room is offered to cater to surveillance operations.

It is proposed to provide IP CCTV cameras at the following locations:

1. All Entry/Exit
2. Security Check
3. Corridors
4. Concourse
5. Arrival / Departure
6. External areas
7. Boundary wall
8. Loft Level
9. Utility Building

All cameras shall be IP-based and connected to the device ated switch and rack proposed at the server room. In addition, the entire system shall be connected to the Security system for viewing and storage of media.

Proximity card system or biometric recognition shall be provided at the doors of restricted areas such as back office, plant room, server rooms, data centre, Integrated Building Management Systems (IBMS) / control rooms, fire exits, etc.

8.5.8 External Lighting

The external lighting arrangement is proposed for the project as required.

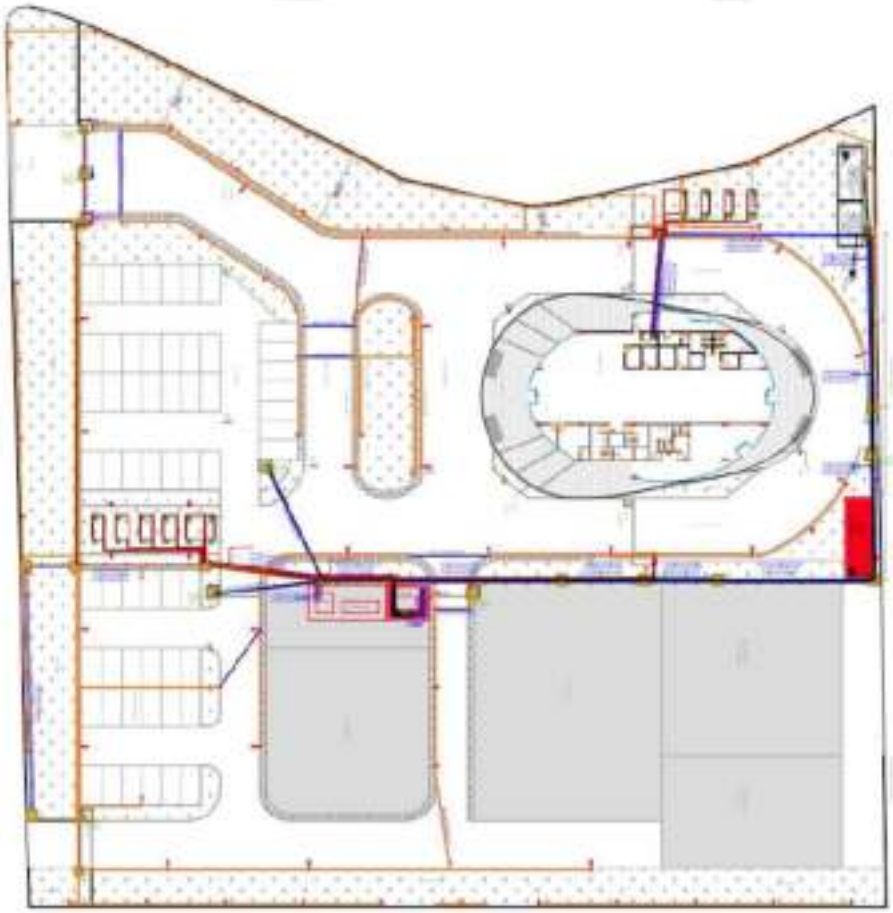


Figure 57 Layout of External Lighting Arrangement

8.6 FUTURE PROPOSED DEVELOPMENT

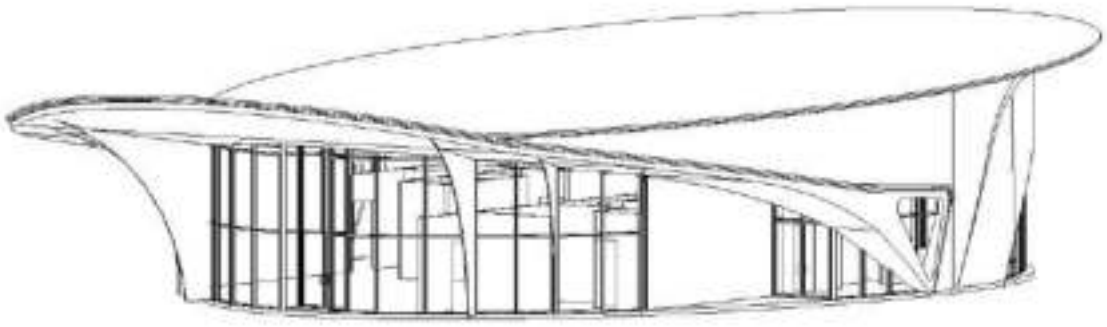
Considering the future expansion, we have proposed a few structures to cater and to grow an aviation service to match the increased demand for aviation services.

- Administrative Building
- Hanger
- Service Apron
- Aviation Catch area

9. DESIGN PHILOSOPHY

9.1 ARCHITECTURAL DESIGN APPROACH

SOPHISTICATED INTERACTION BETWEEN THE LOCAL CULTURE AND THE BUILT FORM….



9.1.1 PROJECT SUMMARY

CONCEPT: *CURVILINEAR BUILT FORM*

SITE AREA: *2.5 ACRES*

PTB AREA: *575 SQM*

9.1.2 DESIGN APPROACH

Surat is the commercial and the economic hub of south Gujarat and one of the largest urban areas of western India. The city is growing rapidly and is also known as the diamond city of the India because of its diamond cutting and polishing industries.

Considering the rapid growth of the city and being a public terminal, focusing on the function, we have tried to achieve an appropriate balance between impressive visual appearance and convenient and comfortable facilities.

Grand entrance area at the front welcomes visitors. A sculpture like structure with a curvilinear façade and extended roofline adds grandeur to the built form. Located at the bank of Tapti, building form from the land side as well as the airside is the sophisticated interaction between the local culture and the site characteristics. Good circulation strategy with large glazed façade provides visual connect with riverine landscape.

Advance use of BIM (Building Information Modelling) to design complex geometry and structural solutions helps architects, engineers and clients to see how all component of the design works together.

9.2 STRUCTURAL DESIGN

The main considerations for the design of structure should be follows: -

a) Structure safety and stability.
b) To meet the demands of aesthetics conceived by the architect.
c) Availability of material, equipment, and expertise.
d) Constructability and ease of maintenance.
e) Durability.

9.2.1 STRUCTURAL SYSTEM

The structure shall be designed as composite frame structure consisting of both RCC members and structural steel members.

All the structures shall be designed in accordance with the relevant Indian code of practice for civil works i.e., IS 456:2000, IS 875:1987, IS 1893:2016, IS 4326:1993, IS 13920:2016, IS 800: 2007, IS: 808: 1989.

9.2.2 DESIGN APPROACH

9.2.2.1 STRUCTURAL MODELLING

Three-dimensional model of building shall be generated using ETABS. All the slab panels shall be idealized as plate / shell elements, columns and beams will be idealized as line Elements. All the shear walls will be idealized as plate / shell element. The structure shall be analyzed and designed for all possible combinations of gravity loads (dead and live loads), and lateral loads (earthquake load and wind loads).

All the buildings of Type II shall be designed for earthquake loading (DL+LL+EQ).

DL = Dead Load, LL = Live Load, EQ = Earthquake Load

Computer Models, Structural Analysis and Design:

A preliminary three – dimensional finite element computer model has been formulated, incorporating all gravity, wind, and seismic loads to develop the concept framing for the building and ensure that the designed structural system provides satisfactory global building response. The model will be further developed during subsequent design stages to carry out

detailed design. In general, the following software shall be utilized during the various stages of the design process.

TABLE 6

Software	Description
ETABS – 18.1.1	3 – Dimensional FEM Software for Building Analysis & Design
AutoCAD 2020	Software for Drafting and Detailing

9.2.3 FOUNDATION SYSTEM

- Considering good bearing capacity, isolated pad footings may be proposed below the building area.
- Following allowable bearing pressure given in the corresponding to various foundation widths at a depth of founding level below NGL in the soil report; same shall be adopted for the design.
- The contractor shall carry out extensive soil investigation before the final detailed design.
- Design of Water Retaining Structures – All water retaining structures shall be designed as per IS 456 & 3370, with a crack width of 0.2 mm for severe or very severe exposure. In addition, concrete for such structures shall be waterproof concrete.
- Foundation and Ground Retention System –. It shall be noted that the Contractor shall carry out his own Soil Testing and analysis and shall follow the same.

9.2.4 STUDY OF LOAD CASES

9.2.4.1 MATERIAL DEAD LOAD

All the permanent loads on the structure shall be applied as dead load. The dead load in a building shall comprise of self-weight of beams, columns, walls, partitions, floors, roofs and include the weight of all other permanent constructions in the building and shall conform to IS: 1911-Schedule of unit weights of buildings materials. Unit weight of various materials considered on the structural members considered follows:

TABLE 7

S. No.	Item	Density (T/m^3)
1.	Reinforced Cement Concrete	2.50
2.	Steel	7.85
3.	Saturated Soil	2.0
4.	Water	1.0
5.	Glass	2.6
6.	Aluminum	2.7
7.	Dry Wall Partitions (102 mm thick)	0.05
8.	115mm Brick Work with 25mm Plaster	1.0
9.	230mm Brick Work with 25mm Plaster	2.0

Following loads shall be considered in structure for analysis: -

I) Self weight of structure.

II) Slab thickness and floor finish – as per actual.

III) Earth fills above basement roof – as per actual.

IV) Wall loads – as per actual.

V) Any other loads envisaged during the detailed engineering.

9.2.4.2 LIVE LOAD

Live loads on the entire floor shall comprise all loads other than dead loads. The minimum live loads on different occupancies shall be considered as per IS: 875 (Part 2).

Live load shall be considered in design as per Table 1 of IS: 875 (Part 2)-1987 as follows: -

TABLE 8

S. No.	Area	Live Load (T/m^2)
1.	Loft	0.2
2.	Roof	0.075

Note: Any other loads not specified in this report shall be considered as per national building codes of India.

9.2.4.3 EARTHQUAKE LOADING

The structure is to be designed for the minimum static seismic base shear set out by IS 1893 (Part 1):2016 using the parameters shown in the table below. These forces are treated as ultimate forces.

TABLE 9 EARTHQUAKE LOAD PARAMETERS

Design Earthquake	10% chance of being exceeded within a 50-year return period
Seismic Zone	Zone III
Seismic Zone Factor, Z	0.16
Soil Profile, Type-II	Medium
Occupancy of building	Commercial
Seismic Importance Factor ,I	As per IS 1893-2016
Response Reduction Factor	As per IS 1893-2016
Fundamental Period of Vibration	T = 0.09 H/√(d) H – Height of Building above Ground Floor LVL d –Least lateral dimension of the building
Seismic Building Weight	To include all components of Self Weight, Superimposed Dead Load, any other permanent weight 25% of Live Load

Response spectrum method was used as per IS: 1893 (Part-1) 2016 with the following data:

Design horizontal seismic coefficient (Ah) = ZI (Sa)/2Rg

9.2.4.4 RESPONSE UNDER SEISMIC CONDITIONS

Seismic analysis of structure shall be carried out by response spectrum method for the design of beam elements (Columns and Beams), whereas static design method shall be applied for the design of plate elements (Shear walls). However, minimum base shear and mass participation is achieved in both the approaches as per the provision of IS: 1893.

9.2.4.5 WIND LOAD

The wind load has been taken as per IS: 875 (Part-3) – 2015 and wind pressure calculation done as follows:-

P_z	=	$0.6*V_z^2$ KN/sqm
V_z	=	$k_1*k_2*k_3*V_b$, Where,
V_z	=	Design wind velocity
k_1	=	Probability factor or Risk coefficient has been taken 1.0
k_2	=	Terrain, height and structure size factor, terrain category 2 and structure Class B been considered.
k_3	=	Topography factor = 1.0
V_b	=	Basic wind speed = 44 m/s

9.2.5 MATERIALS

Concrete: Concrete mix of M30 conforming with IS: 456 is used.

Steel Reinforcement: Fe 500 Grade (TMT bars) conforming with IS:1786.

Structural Steel: Fe 345

9.2.6 Design Limit States

The Limit state design method is used for the structural design of concrete and steel member. For design of the individual members loads are combined in accordance with the loading combinations specified in IS 875 to achieve the respective limit state. These are listed below:

Table 10

S. No.	Dead Load	Live Load	Earthquake/Wind load
1	1.5	1.5	---
2	1.2	1.2	1.2
3	1.5	---	1.5
4	0.9	---	1.5

9.2.7 Load Combinations

1. 1.5 * (DL + LL)
2. 1.5 * (DL+/-EQX)
3. 1.5 * (DL+/-EQY)
4. 0.9 * DL+/-1.5EQX
5. 0.9 * DL+/-1.5EQY
6. 1.2 * (DL+LL+/-EQX)
7. 1.2 * (DL+LL+/-EQY)
8. 1.5 * (DL+/-WLX)
9. 1.5 * (DL+/- WLY)
10. 0.9 * DL+/-1.5 WLX
11. 0.9 * DL+/-1.5 WLY
12. 1.2 * (DL+LL+/- WLX)
13. 1.2 * (DL+LL+/- WLY)

Notations

LL	=	Live Load
EQX	=	Earthquake Load in X-direction
EQY	=	Earthquake Load in Y-direction
WLX	=	Wind Load in X-direction
WLY	=	Wind Load in Y-direction

Whereas X & Y are two principal axes.

9.2.8 Requirements for Durability and Fire

Concrete cover requirement is governed by Indian Code. The values in the following table shall be appropriate for a fire rating of 2 hours.

The following classification also applies in the design of structural elements: -

Table 11 Structural Exposure Classification

Exposure	Classification
Members in contact with the ground	Very Severe
Members in interior environments	Mild
Members in above-ground exterior environments	Moderate

In general, adopting the minimum concrete strengths and reinforcement covers shall ensure the durability and fire resistance of concrete elements. Values shown on the drawings shall not be less than the following:

TABLE 12

Element/Location	Minimum Cover (mm)	Minimum thickness (mm)	Minimum f_{ck} (used in the design)
Cast In Place Concrete			
1. Concrete cast against and permanently exposed to earth	75	200	30
2. Concrete exposed to weather and not in contact with ground (moderate)			
a) RC slabs	25	125	30
b) RC walls	25	200	30
c) RC beams	30	230	30
d) RC columns (Ties)	40	300	30

9.2.9 DESIGN CODES, STANDARDS AND REFERENCE DOCUMENTS

TABLE 13 CODE TITLES

S. No.	CODE	NAME
1.	IS: 1893 – 2016	Criteria for Earthquake resistant deign of
2.	IS: 13920	Ductile detailing of Reinforced Concrete Structures subjected to Seismic forces.
3.	IS: 4326 – 1993	Earthquake resistant Design and construction of Buildings
4.	IS: 875 – 2015 (Part I to III & Part V)	Code and Practice for Design Loads (Other than earthquake) for Building and Structures like Dead, Imposed, Wind and other Loads
5.	IS: 456 – 2000	Plain and Reinforced Concrete (Code of practice)
6.	SP: 16	Design aids for Reinforced concrete Structure.
7.	SP: 34	Handbook on Concrete Reinforcement and Detailing
8.	IS: 3370 Part I, Part II and Part IV	Code of practice for Concrete structures for the storage of liquids.
9.	IS: 1786	Specification for High Strength Deformed Steel bars and wires for concrete reinforcement
10.	IS: 1904	Code and Practice for design and Construction of Foundations in Soils
11.	IS: 800-1980	Code of Practice for general Construction in Steel.
12.	BS 5950 – 1: 2000	Structural Use of Steelwork in Building
13.	IS 2911 (Part1 – Sec1 to 4): 1979	Code of practice for Design and Construction of Pile Foundation
14.	NBC – 2016	National Building Code of India – 2016

9.2.10 PLANNING & DESIGNING CLAUSES AS PER VULNERABILITY ATLAS OF INDIA

9.2.10.1 SEISMIC ZONE FOR EARTHQUAKES.

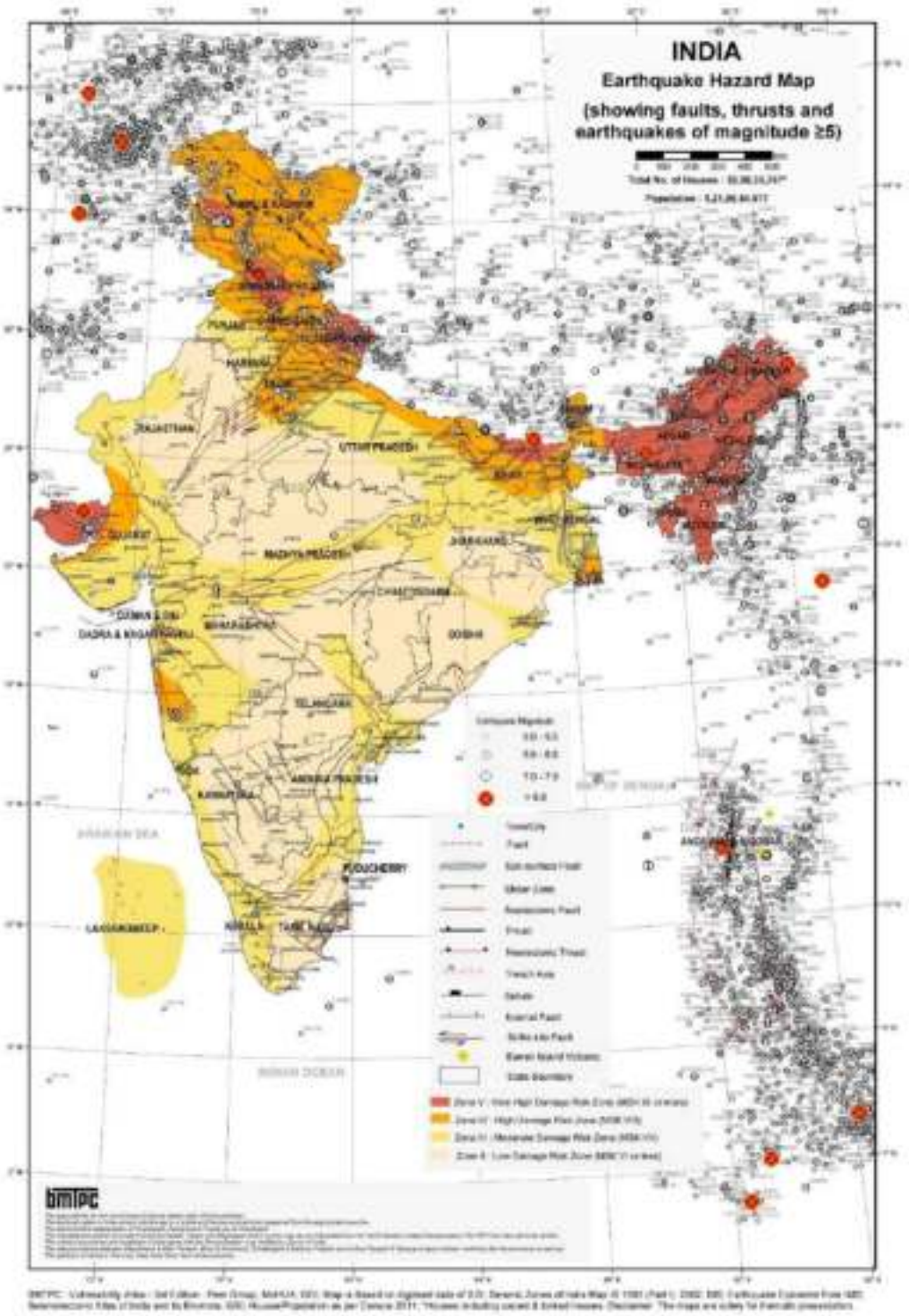


FIGURE 58 EARTHQUAKE HAZARD MAP

Surat Comes under Zone iii Moderate Damage Risk Zone (MSK VII).

This design phenomenon is considered in the ETABS model. Below given snapshots give the detail of the seismic criteria

Earthquake force definition in X direction

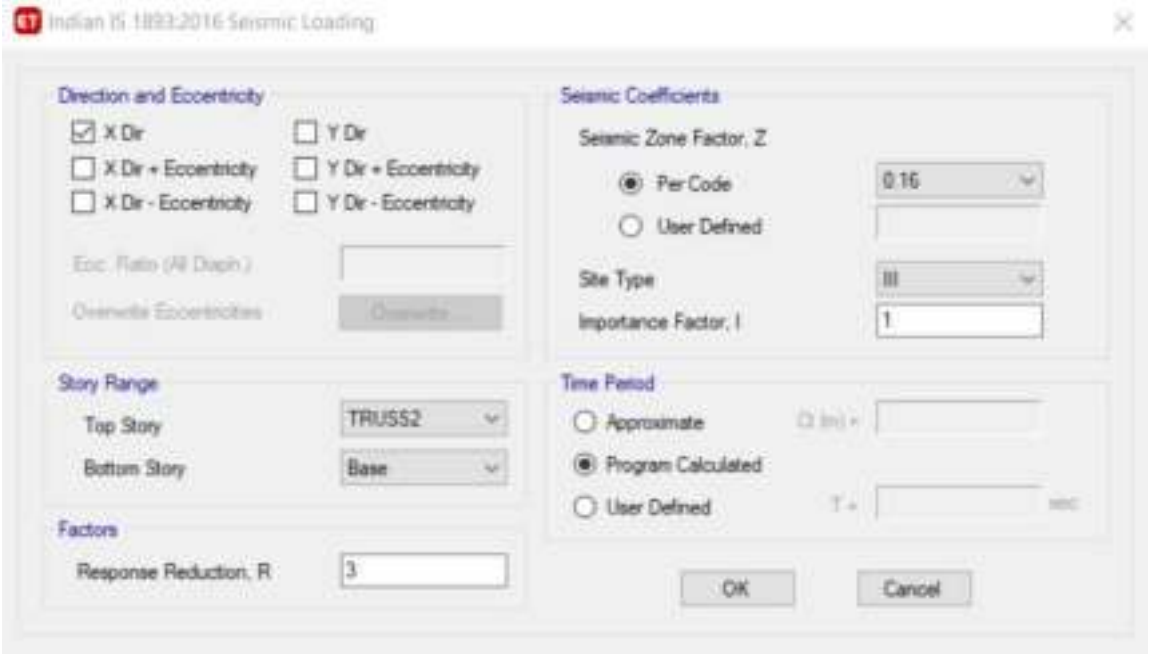


FIGURE 59 REFERENCE SNAP FROM ETABS

Earthquake force definition in Y direction

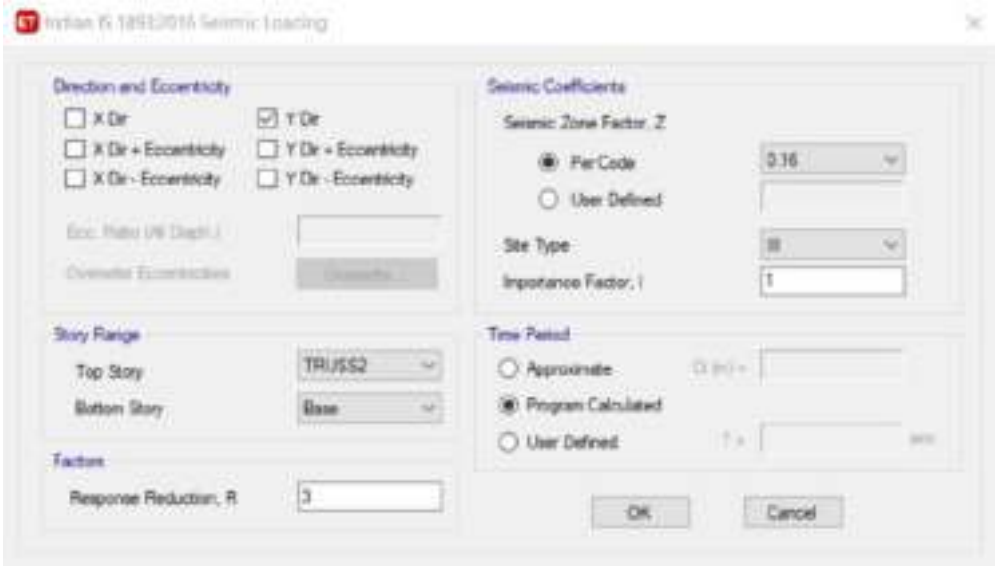


FIGURE 60 FIGURE 55 REFERENCE SNAP FROM ETABS

9.2.10.2 WIND VELOCITY

FIGURE 61 WIND HAZARD MAP

Surat Comes Under High Damage Risk Zone (V_b=44 m/s).

This design phenomenon is considered in the ETABS model. Below given snapshots give the detail of the wind load criteria.

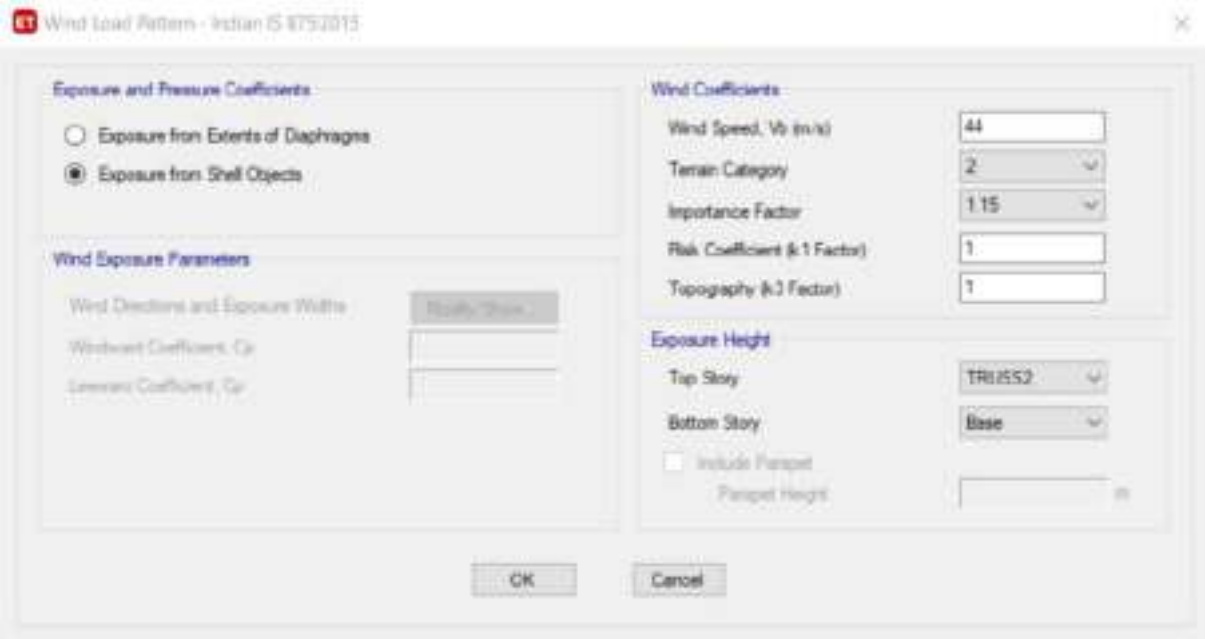


FIGURE 62 REFERENCE SNAP FROM ETABS

9.2.10.3 AREA LIABLE TO FLOOD AND PROBABLE MAX. SURGE HEIGHT

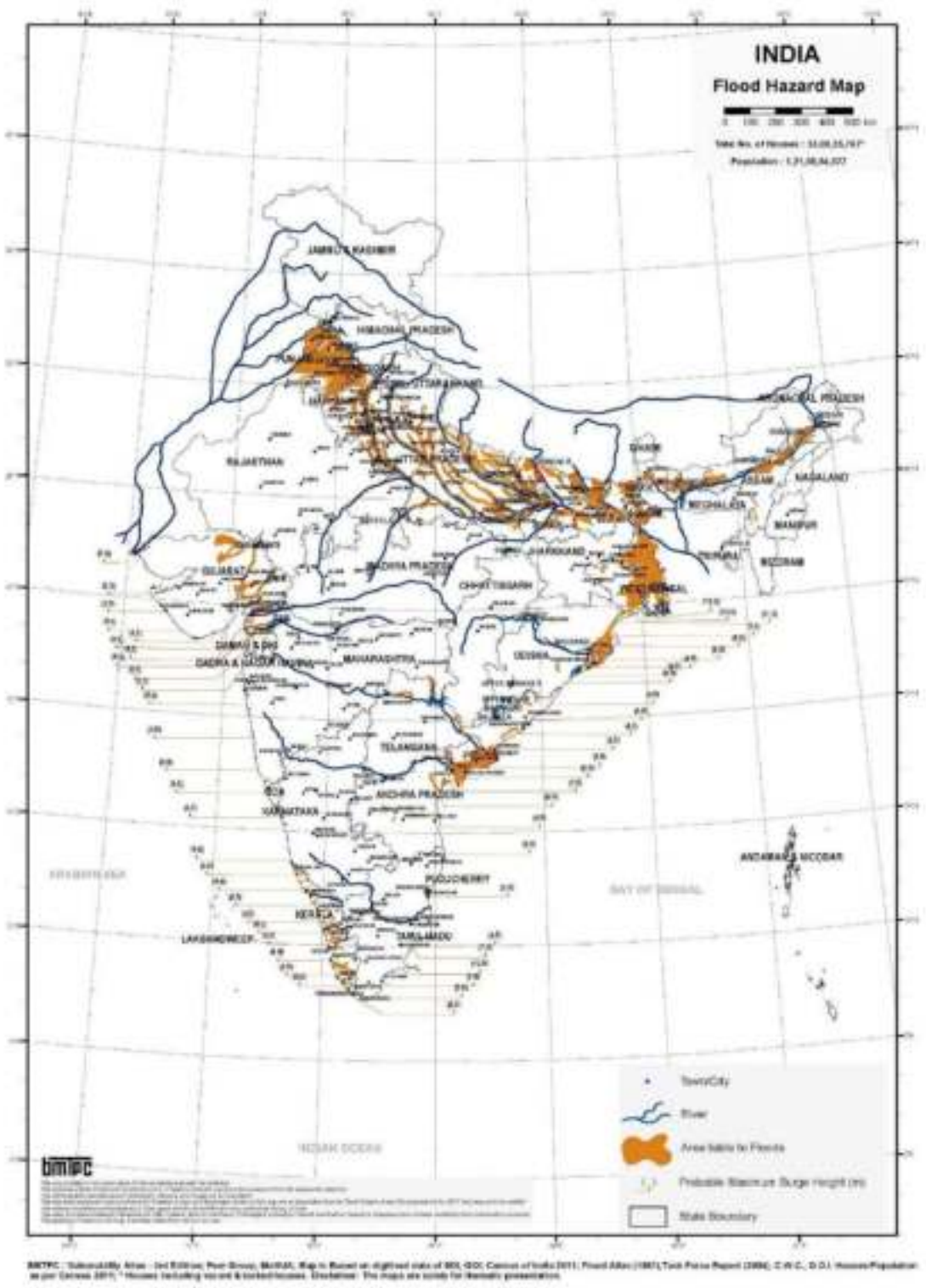


FIGURE 63 FLOOD HAZARD MAP

Surat Comes under Area liable to flood with surge height of 4.5 meter. HFL for the site is 14m and Plinth level considered is 14.5m.

9.2.10.4 THUNDERSTORM INCIDENCE HISTORY

FIGURE 64 THUNDERSTORM INCIDENCE MAP

As per map Surat city comes under first zone 1-15 nos of Thunderstorms and approx. 8 nos of Thunderstorms have been seen by Surat city. Hence no specific design required for thunderstorm, wind load consideration as per IS 875 part 3 is sufficient.

9.2.10.5 CYCLONE OCCURRENCE MAP

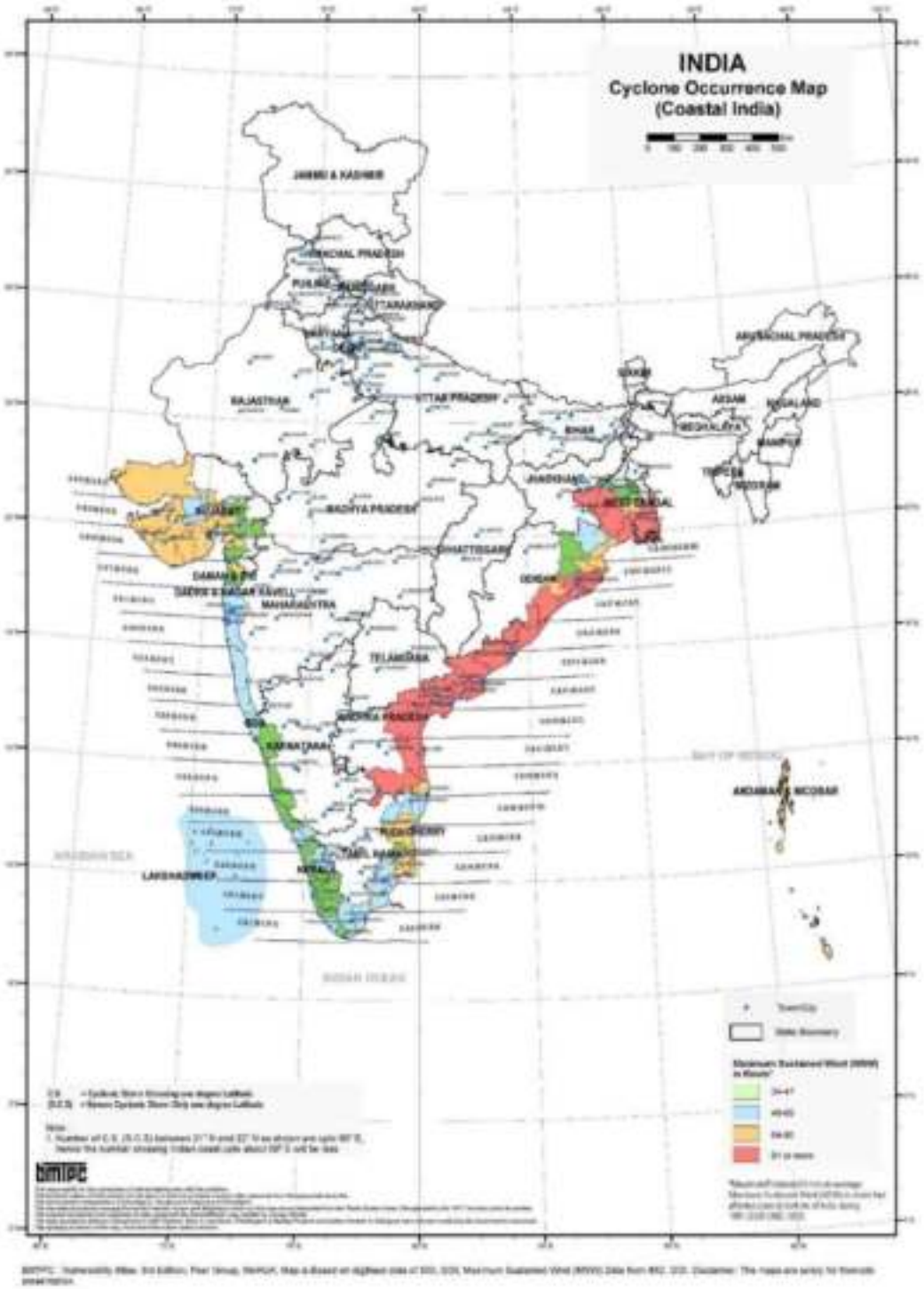


FIGURE 65 CYCLONE OCCURRENCE MAP

Surat City Comes under 34-47 Knots Maximum Sustained Wind, which is already considered in wind load.

1 Knot = 0.514 meters per second speed, so 34-47 Knots means 17.49 – 24.18 m/S speed

9.2.10.6 LANDSLIDES INCIDENCES WITH ANNUAL RAINFALL NORMAL

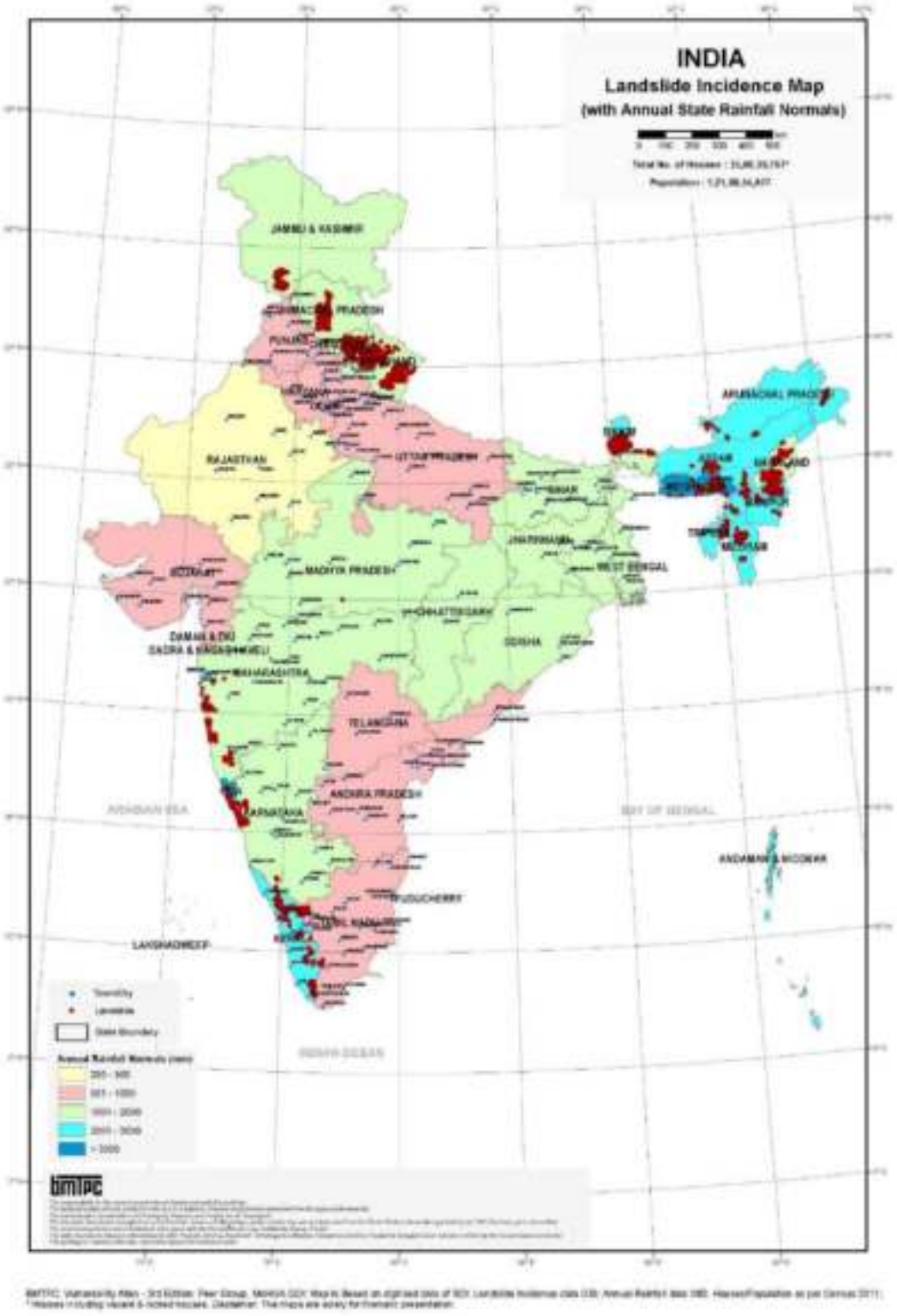


FIGURE 66 LANDSLIDES INCIDENCE MAP

Surat City comes under the No Landslide zone and has 501-1000 mm rainfall on average, hence no specific design consideration is required.

9.3 ELECTRICAL WORKS

9.3.1 DESIGN FACTORS

ELECTRICAL POWER DISTRIBUTION

- Power distribution system to be designed keeping in view the following:
- Continuity and reliability of power supply.
- The flexibility of operation.
- Concentration/distribution of loads.
- Safety of personnel and equipment.
- Investment and operational costs.
- Easy future extensions/modifications.
- Ease of maintenance.
- Maximum interchangeability of equipment resulting in minimum inventories and spare parts.
- Minimum fire risk.
- The simplicity of operation.

9.3.2 DESIGN REQUIREMENT

Internal & External Electrical works for all buildings being constructed under this project, including the following:

- Airport Terminal Building

➢ ELECTRICAL PANELS (MDB/SDB) PROVIDED FOR THE FOLLOWING:

- Main & Sub Distribution Boards for lighting
- Main & Sub Distribution Boards for Power
- Main & Sub Distribution Boards for UPS Supply
- External Lighting Distribution Panels

➢ LT CABLES PROVIDED FROM THE MAIN DISTRIBUTION PANEL IN TERMINAL BUILDING TO SUB-DISTRIBUTION BOARDS, VARIOUS EQUIPMENT, OTHER SERVICES PANELS ETC.

➢ GI cable tray (Perforated & ladder type) proposed shall be hot-dip galvanization as a minimum, complete with suspension / supporting arrangement for cables.

- Cabling, termination, earthing, feeder pillar, etc., complete in all respect.

9.3.3 Main/Sub-Distribution Boards & Floor Panels

- All the panels shall be wholly modular and compartmentalised with Form 4 Separation as per IS and CPWD guidelines. The panel shall be free-standing/ floor-mounted type. The panel shall be manufactured as per IS codes.
- All MDB/SDB/Electrical panel will be CPRI approved Panels.
- MDB / SDB Board shall be Indoor type of metal clad construction, partly draw out type having self-aligning type auxiliary contacts for circuit breakers and draw out modules. Bus bar of all panels shall be of aluminium except for MDB (UPS) /SDB (UPS), SDB(Lighting).
- The Main Distribution Boards shall have COS feeder of power supply, for reliability.
- The multifunction meters installed in panels shall be BMS compatible.

9.3.4 The following works shall be included in IE works

- MS Steel Conduiting & wiring of lights points, fan points, exhaust fan points, light plug point (6A Socket outlet points), Power Points (16A Socket outlet points) for general use, hand driers, water coolers, A/C indoor units and any other installation requiring electrical connections such as sensor operated sliding doors, LED screens, FIDS System, signage, mobile phone charging stations, signage (Directional& Emergency), shop branding etc. Point wiring shall be complete with modular switch sockets and accessories.
- Distribution boards for lighting, Power, UPS design load & voltage drop for branch circuit shall not exceed 2 % at design load.
- All wires shall be PVC insulated FRLS with copper conductor.
- Cable Trays shall be of G.I. Perforated/Ladder type construction for power & Control Cables.
- Widths shall be as required. The thickness of the material shall be 1 . 6 mm. Cable glands shall be made of Nickel-plated brass and shall be double compression type. However, for indoor termination, single compression type glands shall be used.
- GI raceways can be provided for taking wires/cables under floors.

9.3.5 INTERNAL LIGHTING & DISTRIBUTION BOARD

- The provision of luminaries in various areas to be designed to achieve the illumination levels as per relevant standards. The luminaries will be selected keeping in mind Aesthetics, location requirement, and ease of maintenance and energy conservation.
- All light fixtures provided in various areas will be designed to achieve illumination levels as per Lux Level general guidance of NBC.
- All light fixtures shall be of LED type.
- All the distribution board shall be provided as per IS Codes.
- Lighting & power distribution board will be provided with incomer / outgoing as MCCB/MCB.
- DP RCCB upto 30 mA for lighting & 100 mA power will be provided in each phase of the distribution board to provide safety.

9.4 EXTRA LOW VOLTAGE SYSTEM

9.4.1 ASSUMPTION/CONSIDERATION

- We have planned Dedicated Server room at S Building on Ground Floor and Further distribution racks planned at outdoor near security cabin with 10 Giga Fiber Backbone speed.
- we have Planned Centralized Monitoring from Main Server room for Integrated ELV Services, CCTV System, Fire Alarm System, Network equipment's etc.
- We are Considering IP-PBX with IP based Telephone instruments with the same 10 G Fiber backbone uplink.
- We have considered Open platform IP Based Surveillance/CCTV system as per given requirement list by client with 2MP and above CCTV and 24 X 7 X 30 days recording storage.
- We have considered Addressable Fire alarm & detection system with integrated digital evacuation / public address system and will design as per IS 2189(2008).

9.4.2 ICT (DATA & TELECOM) INFRASTRUCTURE

9.4.2.1 DESIGN ASSUMPTION

- Consider Ring Topology Architecture with 10G Fiber Optics Cable based backbone.
- Provision of LAN IO and Telephone IO as per occupant in offices and other areas.

- UTP CAT6A (23AWG) based structured cabling for the indoor areas of building for horizontal cabling.
- Fiber optic-based connectivity for horizontal cabling.
- Consider Two Tier architect Each Distribution Access layer switched Stack directly connected to Main Server room Core switch with 10G Speed.
- IP EPABX / VOIP Based Telecom Solution, which will integrate with Public System with additional required Licenses.

9.4.2.2 STANDARD & CERTIFICATIONS

In addition to the standards listed below, all applicable local building code, safety, environmental and other requirements have to met.

- ISO/IEC 11801:2002 - Information technology -Generic cabling for customer premises
- ANSI/TIA/EIA 568-B - Educational Building Telecommunications Cabling Standard, with addendums.
- ANSI/TIA/EIA 569-A - Educational Building Standard for Telecommunication Pathways and Spaces
- ANSI/TIA/EIA 598-A - Optical Fiber Cable Color Coding
- ANSI/TIA/EIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- ANSI/TIA/EIA-TSB-67 -Transmission Performance Specifications for Field Testing of Twisted Pair Cabling System
- EIA/TIA-526-7 “Optical Power Loss Measurements of Installed Single Mode Fiber Cable Plant
- EIA/TIA-526-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- TIA/EIA-854 Full Duplex Ethernet Specification for 1000Mbps Operating Over Category 6 Balanced Twisted Pair Cabling.
- Institute of Electrical & Electronics Engineers Sixteenth Edition
- IEEE 802.1 - LAN/MAN Bridging and Management.
- IEEE 802.11 -Wireless LAN’s.
- Building Industry Consulting Service International (BICSI) recommendations.

9.4.2.3 CONNECTIVITY & TOPOLOGY

- Main Server shall be considered in Server Room with 02 core Multi mode fiber cable in ring topology, Out of 6 core 02 core will be used for uplink connectivity to main server room, 02 core will consider as a back-up & another 02 core will consider as a redundancy or future scalability.
- Consider Layer 3 Core 24 Port Network switch with Minimum 4 SFP+ Port . 10Gbps backbone connectivity will consider between Access layer Switch to Main server room network switch. Layer 3 switch will consider with 40Gbps scalability featured.
- Distributed Network rack will consider with Layer-2 Non-POE & POE Network switch and connected with Layer -3 switch with 6 core single mode fiber cable in ring topology, 10 Gbps in Backbone connectivity will consider between outdoor rack to layer 3 switches.
- 1000Mbps/1Gbps (Ethernet) from Distributed rack to individual user/device
- Wi-Fi with 802.11ac consider for Indoor area includes Building, passages as per proposed requirement list by client, all Wireless access point will integrate & Control/Managed by Hardware based Wireless controller, 3X3 MIMO Access point with multiuser features.
- POE (Power over Ethernet) Network switch will consider for CCTV, Wi-Fi, IP Phone.

9.4.2.4 REQUIREMENT OF ELV SPACE

- The space requirement for data and voice services shall include provisioning for termination equipment's, active equipment's such as Networking Switches, passive UTP CAT6A based structured cabling, Network rack for installation of Active and passive components.
- Services wise Equipment Rack includes Data Communication, Voice Communication and iBMS Equipment's includes PA/ CCTV System Components

9.4.2.5 REQUIREMENT OF SERVER ROOM & SPACE

Server Room have planned on Ground Floor to minimizing intervention & privacy for maintenance personnel.

Equipment that will be installed in Server Room, including but not limited to the following:

- Terminations for copper cabling and fiber optics.

- Networking Racks, Server racks
- Main Fire Alarm Control Panel
- PA system main controller and amplifiers
- Monitoring Station for CCTV & Storage Equipment's.

9.4.2.6 SERVER ROOM REQUIREMENTS: -

- Min 4mtr X 3mtr of space or as per requirement to installed Multiple networking and server rack.
- Must be air-conditioned 24 x 7, with stand by redundancy.
- Clear top-to-bottom height shall be 10ft minimum, considering that the telecom racks can be as tall as 96",
- False flooring shall be required minimum 300mm from unfinished floor
- False ceiling - required
- A good quality earthing system.

9.4.2.7 UPS REQUIREMENT: -

- A separate local UPS is recommended for Server room Equipment's in case of power outage.
- Centralized UPS is recommended for Other Equipment's includes, computers, Printer, Scanner, Projectors, Smart Displays etc.

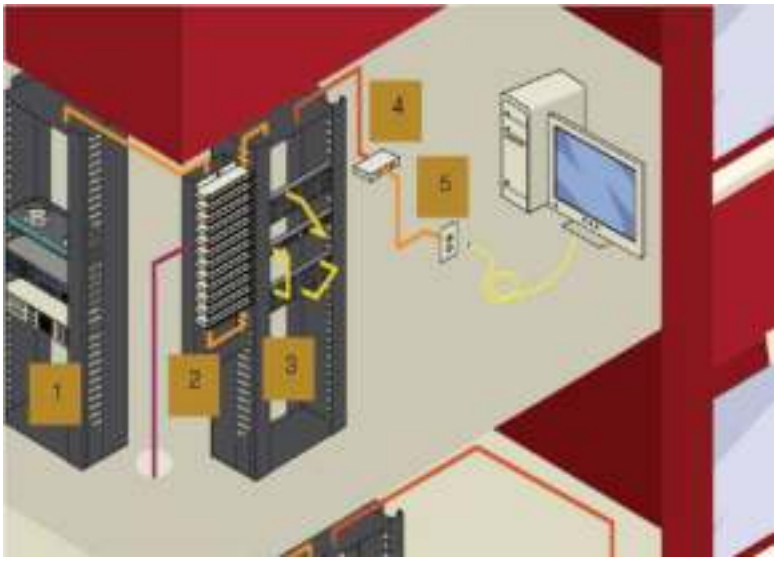


FIGURE 67 REPRESENTATIVE ILLUSTRATION: CONCEPT OF SERVER ROOM / EQUIPMENT ROOM

9.4.2.8 LEGEND

1) Enclosure or Telecom Rack
2) Field Side Termination from TSP/ISP / Fiber components.
3) Patching hardware, termination blocks / Network switches / NVR / Servers etc.
4) Zone Distribution Outlets / Distributed racks / uplink components.
5) IO – To connect field devices with patch cord which includes Computers, IP Phones, CCTV, Access control, iBMS Controller, Projectors, Display etc.

9.4.3 IP BASED VIDEO SURVEILLANCE/CCTV SYSTEM

9.4.3.1 DESIGN ASSUMPTION

We have considered IP Based CCTV & Access Control System Service will be centralized monitored from the Main Server Room.

CCTV Camera shall be considered on each Entry and Exit, Lobby, Perimeter of Entire Building and Important Area.

9.4.3.2 STANDARDS & CERTIFICATIONS

- ONVIF compliant and supporting H.264 High Profile
- Complete range of IEEE and ISO/OSI model standards and Ethernet protocols.
- UL listed, certified & approved components.
- Ruggedized, IP66 rated enclosures.
- IK10 compliant vandal-resistant enclosures.
- Full set of IEEE802.x, ANSI/EIA/TIA-568-C.2 standards, ISO/CENELEC specifications

9.4.3.3 SYSTEM DESCRIPTION

- A network camera-based surveillance system is proposed in the common areas, Entry/Exit and passages of the entire building
- The CCTV system is designed using UL listed and approved components.
- Types of Cameras

  - Veri-Focal IR Bullet network cameras – outdoor as required
  - Veri-Focal IR Dome network cameras – indoor as required
  - PTZ-Pan, Tilt, Zoom- network cameras – outdoor as required
  - Storage system including fail-safe and redundancy architecture for storage and retrieval of data; suggested storage is 24Hrs. x 30 days

- VMS application – inclusive of cameras' licensing server and monitoring application, industry standard Intel based server with appropriate operating system
- High resolution HDMI2.x supporting commercial LED Video Wall display with accessories.

- Cameras themselves will have in-built web-browser for direct access/viewing from any authorized personnel. In selected areas, the camera may have a two-way audio capability.
- The cameras proposed shall be high-definition, 4 megapixel and above cameras for excellent video clarity.
- The cameras suggested would support Power-over-Ethernet to minimize power supply cabling distribution for the cameras as well as protecting installation from power outages or miscreants
- A minimum resolution of 2 MP in HD format is suggested in PAL systems and a range of frame rates such as 25 fps to 30 fps.
- Protocol support for - IPv4, IPv6, TCP, UDP, ARP, ICMP, IGMP, HTTP, HTTPS, FTP, SMTP, DHCP, DNS, NTP, RTP/RTCP, RTSP, SNMP (MIB-2)
- Support for full motion video ranging from MPEG-4 to JPEG and H.264 main profile over network.
- Viewing and online storage shall be treated as two different simultaneous activities. Hence video streaming at two different levels or compressions is suggested.
- The cameras will have sensor and relay contacts for connecting to the other devices and systems.
- Implementation of error recovery mechanisms and fault tolerance of hard disk such as RAID levels shall be in place.
- Hard disks shall be replaceable 'on-the-fly', i.e., without shutting down the server, i.e., hot pluggable.

9.4.3.4 IP BASED CCTV SYSTEM COMPONENTS:

CAMERA REQUIREMENT

- TCP/IP based network cameras,
- Video Analytics – Intelligent Object Detection & Motion Detection,
- Full HD Format 1920 x 1080 pixels, 4 MP Camera with Built in IR
- Power-on-Ethernet – no separate power supply required
- Low Lux Application Cameras
- Vandal-proof IK10 housing, IP66 rated protection against environment,
- Compliance to ONVIF for third party integration and working with existing server and storage.
- IR Veri-Focal Dome Camera for Indoor area, IR Veri-Focal Bullet Camera for Outdoor area, IR PTZ Camera for Outdoor campus area.
- UL Listed Certified.
- Inbuilt Video analytics features includes Motion detection, Object Detection, People Counting.

SERVER & STORAGE AND DISPLAY:

- We considered 24 X 7 X 30 days Storage as per camera nos. with 50% extra expandability for future cameras with RAID features.
- Servers will be considered for 100 Channel Maximum, Client PC will be considered for monitoring of the CCTV system as per client requirements.
- 1nos. of 55-inch LED display considered for monitoring the CCTV System at Server room

FIGURE 68 CONCEPTUAL SCHEMATIC OF IP BASED CCTV SYSTEM

9.4.4 FIRE DETECTION & ALARM SYSTEM

9.4.4.1 OBJECTIVE

The objective is to install fire detection and alarm system to provide early warning in case of fire emergency. The purpose is to be alerted at an incipient stage of fire (smoke) to enable manually extinguishing of the fire even before it develops into a major hazard.

9.4.4.2 DESIGN ASSUMPTION

- Human Life Safety and security.
- Stringent certifications for high grade performance such as defined by international standards and product approvals and listings.
- Standard recommended installation practices to evolve minimum interruption of work and minimum loss of human life.
- Intelligent and accurate sensors
- Intelligent communications, monitoring and supervisory
- Future integration capability to 3rd party systems such as IBMS
- Multiple fire panels that can be connected to each other on peer-to-peer model and supporting TCP/IP interfaces for networking on copper (Ethernet / CAT6) as well as fiber optics media
- Integration of common fire alarm panel with the tenant fire alarm panel would be done on control module & monitor module with hardwire connectivity.

9.4.4.3 SYSTEM DESCRIPTION & FEATURES OF FIRE DETECTION & ALARM SYSTEM

- Addressable Fire Detection & Alarm System.
- Networking of Multiple panels with the entire campus.
- Zones – For the purpose of alarm annunciation, each floor of the building shall be considered a separate zone.
- If the system serves more than one building (i.e. Academic building, Support building, School hall etc.) each building shall be indicated separately.

- Detectors- Mix of Smoke, Heat, Rate of rise and Multi-Sensor Detectors at Admin Area, Sports complex. Beam Detection for High Ceiling Areas like Multipurpose Hall, Halls, Courts as per guidelines.
- Alarm Verification Feature – A feature of automatic fire detection and alarm systems to reduce unwanted alarms Occupant Notification Devices.
- Annunciator – A unit containing two or more indicator lamps, alpha-numeric displays.
- Evacuation Signal – Distinctive signal intended to be recognized by the occupants as requiring evacuation of the building.
- Fire Command Station (Fire Command Center) or ELV Room– The principle location where the status of the detection, alarm, communications and control systems is displayed, and from which the system(s) has the capability for manual control. Standards based, building codes compliant.
- Integration with PA system for EVAC in case of emergencies.
- Audible Alarms – Audible alarm notification appliances shall be provided and shall sound a distinctive sound Intelligent Ethernet based controllers for integration
- Visible Alarms– Visible alarm notification appliances shall be provided in accordance with NFPA 72
- Network Repeater Panel:- Should have E-map featured with required operated display and located to security person to easy operatability. Cabling shall be with 2 core 1.5sq. mm. copper multi-stranded conductor un-armored FRLS Cables.
- The system is proposed with backup power from UPS and independent power backup through maintenance-free storage batteries capable of 48 hrs of normal operation & 1 hr of operation under alarm condition with adequate spare capacity overhead.
- The entire fire alarm system network shall be integrated with building BMS through (Backnet/Modbus/ Lan) over IP gateway. All the devices and modules of the fire alarm panel shall be made available in BMS.
- GUI on FAS floor plan reflecting all devices with their online status shall be provided with complete penetration from building level to floor level to room level.

- The FACP shall have auto dialer facility which will call up predefined numbers (minimum Ten numbers) sending predefined emergency messages during the fire / emergency events.
- As per NFPA standard, in case of any fire event fire panel shall trip the AHU starter panel & AHU damper through potential free relay module.
- All pressurization fans & ventilation fans shall be integrated with fire alarm system through potential relay modules

9.4.4.4 MINIMUM REQUIREMENT FOR SAFETY

SR. NO.	SCOPE/EQUIPMENT	SAFETY LEVEL
1	Layer to support service level	**Fire detection warning alarm on reconfirm:**
		Report to fire services
		Report to facitly managers
		Report to end client
		Report equipment maintenance agency
		Alert message sequence as per evacuation guidelines
		Position Building /Infra evacuation guidelines
2	Layer to support management level	**Report to facility managers:**
		Fault Alarm on GUI
		Dirty Detectors status on GUI
		SLC, PA loop healthiness
		Perform regular system audit
		FACP, N/W controller healthiness

		Building performance wrt to design parameters report
3	Layer to support control level	Fire Alarm Control Panel
		Refuge floor level display, announcement
		Networked online FACPs/repeaters
		Floor level GUI
		Interfaces to other systems
4	Layers to support field level	**Detectors to identify:**
		Smoke
		Heat
		Rate of rise temperature
		Flame
		Fire in voids, shafts, Ducts
		Alerts Occupants:
		Strobe, hooter, exit guides
		Manual Pull Stations
		Fire exits
		Emergency exits
5	Support Third Party	**Soft Integration**
		FACP, GUI
		Mobile warning, alert messages

		Telephone warning, alert messages
		Shut down & startup operation

9.4.4.5 FIRE DETECTION & ALARM SYSTEM COMPONENTS

a) DETECTORS

- Smoke, Multi-sensor Detector (For general areas where ceiling Height is 3-4m)
- Passages, Faculty Cabins, Admin Areas, Workstation area, Waiting area, Reception area etc.
- Multi-Sensor Detector (above and below false ceiling areas)
- Heat & Rate of Rise Detectors (Kitchen and pantry areas, Electrical room etc.)
- Duct or CO2 Detection (HVAC Duct / AHU Rooms)
- Beam Detectors for high ceiling / double height areas etc.

b) INITIATING DEVICES

- Manual Call Point (Passages, stairs, entry/exit),
- Monitor module for Beam detector & iBMS Services, Flow switch etc..
- Relay module for other service like Access control etc..
- Control module for Sounder and other third party device.

c) NOTIFICATION DEVICES

- Visual Strobes
- Audible Directional Sounder

d) Fire Alarm Panel

- Main Panel capacity of 2/5/10 SLC (Signaling Line Circuit) Loops,
- Each loop have capacity of 250 Detectors or Devices,
- Networkable Panels,

- Communicate with IBMS software through BACnet/IP,
- Support multiple repeater panels,
- SLC Loop Length would be of 1500m,
- 640 Character or higher character LCD Displays,
- Battery backups.

9.4.4.6 DETECTOR SPACING & DESIGNING METHODS

- Following Detectors Spacing and Coverage is applicable for Smoke, Multi and Heat Detector.
- For general areas the spacing between any point in a protected area and the detector nearest to that point should not exceed 5.3m for a smoke detector.
- To ensure complete coverage for square layouts, spacing's between detectors and walls should be reduced to 3.5m for a smoke detector.

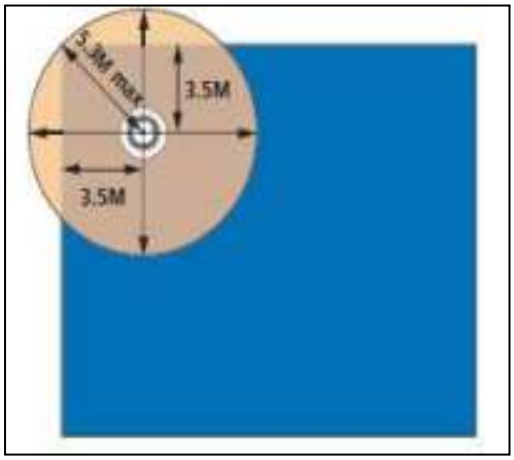


FIGURE 69 REFERENCE IMAGE

- For corridors less than 2m wide only the centre line need be considered therefore it is not necessary to reduce detector spacing's in order to provide complete coverage. Therefore for smoke detectors spacing becomes 7.5m from a wall and 15.0m between detectors.

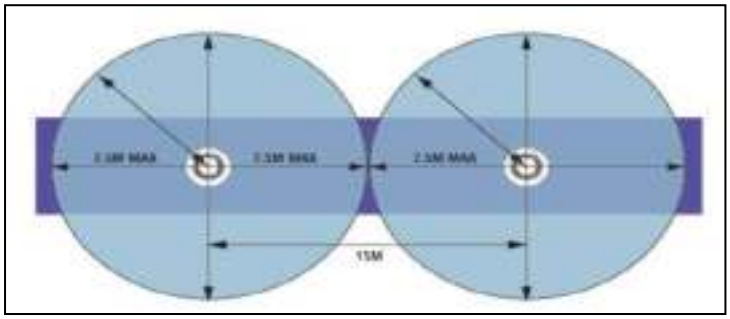


FIGURE 70 REFERENCE IMAGE

- Beam detectors generally meant for High Ceiling Areas like Halls, Auditoriums or Multipurpose Hall etc.

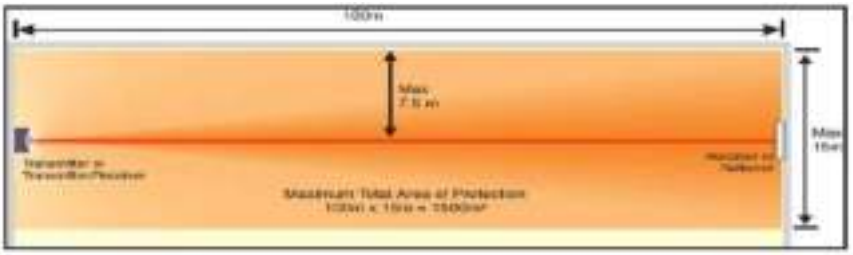


FIGURE 71 REFERENCE IMAGE

- Manual call points should be located on escape routes, at all exits to free air and at all exits from each level of multi-storey buildings.
- For general applications, call points should be located such that nobody needs to travel more than 45m to reach the nearest call point. If at the design stage the actual layout is unknown then a straight-line distance of 30m should be used as a design.

FIGURE 72 REFERENCE IMAGE

9.4.4.7 STANDARDS & CERTIFICATION

- National Building Code of India – 2016
- Bureau of Indian Standards (BIS) Codes : IS 2189

- NFPA 72/2010 edition or EN54
- Approvals or listings or certifications – UL or EN / FM or VdS

9.4.4.8 SELECTION OF EQUIPMENTS

- Main Fire Control Panel
- Repeater Panels
- Selection of Appropriate Automatic Detectors
- Beam Detectors
- Manual Call points
- Remote indicators
- Alarm & Notification Devices

MAIN FIRE CONTROL PANEL

It Shall be Featured with:

- Multiple Loops for to address detection and other devices, Single loop can support up to 250 devices includes detectors and devices.
- Fire Alarm panel will be considered with Inbuilt battery back up to avoid failure of power supply with necessary battery back-up as per mention in NFPA Guideline.
- Fire alarm Panel will be monitored with Integrated GUI Software E-Map Facilities.
- Any mix of detectors & Device support by panels such as photo, thermal, or multi-sensor with Adjustable sensitivities, Manual Call points, Sounder strobe devices.
- Fire alarm panel will be considered with network and Modus modules or card to integrate with other repeater panel through network and iBMS system with Modbus module.

REPEATER PANEL

FIGURE 73 REPEATER PANEL

- Main control panel is to be installed at LV System server room which is a secure, restricted entry location to compliment this, Active Repeater Panel(s) would be installed at Security Gate or Facility Manager's Cabin.
- Suggested Fire Alarm System shall support multiple repeaters.

SELECTION OF APPROPRIATE DETECTORS

FIGURE 74 MULTI-CRITERIA

- Multi-sensor fire detector – for protection against multiple/mix of causes of detecting one or any of smoke - heat.
- The proposed design would consider such factors and suggest an optimum mix of components considering various location, applications and operability.

THERMAL/HEAT DETECTORS

FIGURE 75 HEAT DETECTOR

- Heat detectors would be used in locations where the ambient conditions might cause false alarms if smoke detection were to be used, for example where there is a high level of dust, fumes, steam or smoke under normal conditions.
- The design shall suggest rate of rise type heat detection in selected areas to compliment other forms of detection such as in server room and other such critical equipment areas.

BEAM DETECTORS

- Beam detectors shall use the Transmitter/Receiver and reflector plates for protecting open areas with high and sloping ceilings, and wide-open areas where spot type smoke detectors are difficult to install and maintain.

MANUAL CALL POINT

FIGURE 76 MANUAL CALL POINT

- Manual call points shall be located on escape routes, at all Entry/exits & Staircases.
- Call points shall be located such that nobody needs to travel more than 45m to reach the nearest call point.

FRLS CABLES

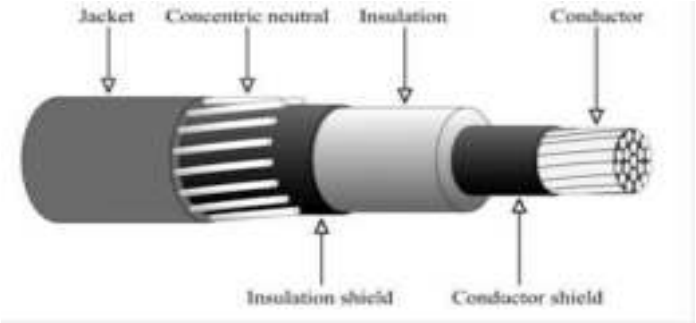


FIGURE 77 FRLS CABLE FOR FIRE DETECTORS CONNECTIVITY

- Fire-resistant/fire-retardant cables are suggested for all parts of the system to ensure cable integrity over a longer period. For example when connecting to alarm sounders or while interconnecting two panels or interconnecting detector elements in a hidden or concealed area.
- Fire alarm cables would be segregated from the cables of other systems; they would be clearly marked, preferably different colored and would be routed through parts of the building that provide minimum risk.

SOUNDER WITH STROBE AS A NOTIFICATION DEVICE

FIGURE 78 SOUNDER WITH STROBES

- Sounders with strobes providing high audio output with clear audibility would be deployed to meet the critical needs of the life safety and for effective emergency voice communications, tone signaling and visible signaling to alert the hearing impaired.

RESPONSE INDICATOR

- Response indicators would be used in areas where the detector mounting position is such that the detector is not easily viewed, for example in ceiling voids. Response indicators dramatically reduce search distances where detectors are mounted inside rooms that are normally closed, thus simplifying system zoning and reducing the time taken to locate the hidden source of an alarm.

MONITOR / CONTROL MODULE

- For monitoring of external, non-FAS devices such as for integration with firefighting system – status of pumps, electrical panels and flow switch, Beam Detector can be monitored. In such cases sprinkler system can take care of fire related emergencies.
- For Controlling of third party devices such as HVAC Dampers control, Access control Locks control, FAS Sounder control etc.

REQUIREMENT OF SPACE

- Main Fire Alarm Panel @ ELV Room
- Repeater Panel(s) @ security cabin/reception area/CCTV monitoring room.
- The space requirement for FAS services shall include provisioning for mounting fire alarm control panel, power supplies and battery apparatus, its various line monitoring and control modules, configuring and monitoring station.

9.4.5 ANALOG PUBLIC ADDRESS SYSTEM

9.4.5.1 CONSIDERATION

- Analog Public Address system
- Multiple paging zones with announcement
- Call station & keypad
- Provision for background music for a relaxed ambience
- Configurable system for pre-programmed relay of information
- Integration with fire detection and alarm system.

9.4.5.2 OBJECTIVE

- Conventional/Analog PA system is proposed for entire building.
- The controller shall be installed in the ELV Room, while Call Stations/Paging Microphones shall be installed in both reception and ELV room along-with other monitoring facilities such as CCTV and Fire Alarm repeater panel.
- The proposed system capabilities are as follows:
  - Monitor-able speaker loops, and speakers with zones.
  - Arrangement shall be possible to select individual zones or multiple zones.
  - Speakers of various capacities such as 6W, 10W,15W and 30W with adjustable line voltages of 70V or 100V are being proposed.
- In internal areas such as Passage and common waiting areas etc. rooms ceiling or wall mounted speakers are being proposed in the above range, while for basement areas horn type speakers are being proposed. Same loudspeaker wiring shall be used for line supervision and indication of faults.
- The controller shall operate both on mains power and on a 48 V battery power supply for emergency backup with automatic switchover. It provides for supervision of both power supplies.

9.4.5.3 BASIS OF DESIGN

- Apart from informative and public address function the system will back up as an emergency sound system.
- Compliance to international guidelines such as IEC60849, BS5839 and TUV standards or equivalent.

9.4.5.4 REFERENCE STANDARDS & CERTIFICATES

- Conformance to International Standards such as follows, but not limited to:
  - EN-60849
  - ISO

- BS 5839
- EVAC Specifications

9.4.5.5 REQUIREMENT OF SPACE

- Call Station Unit @ Main Server Room and or as per client requirement.
- Main Network Controller @ Main Server room PA rack
- Power Amplifiers @ Main Server room PA rack.
- The space requirement for PA system shall include provisioning for mounting Network Controller, Power Supplies; require power amplifiers and different types of Speakers used for Evacuation.

9.5 HVAC SERVICES

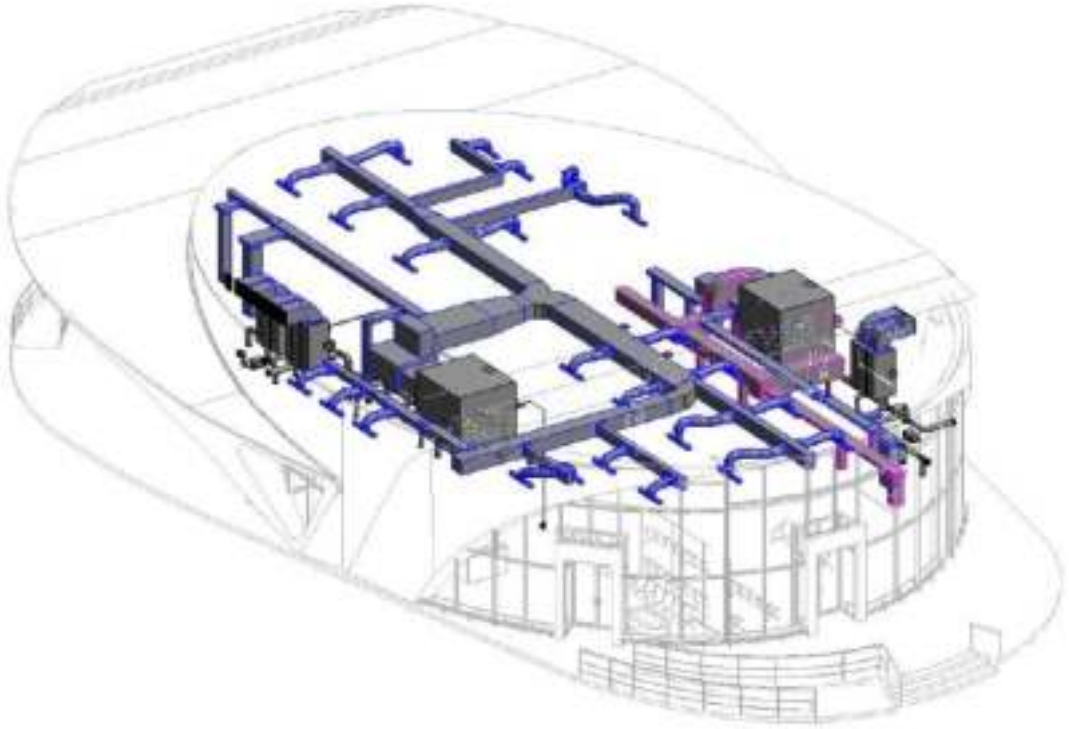


FIGURE 79 CONCEPTUAL HVAC MODEL

9.5.1 CONCEPTUAL APPLICATION

- COMFORT AIR-CONDITIONING FOR AIRPORT BUILDING- The building type is Airport Terminal with Departure / Arrival area, VIP Room, Office, Back Office & CCTV Rooms.

- VENTILATION- Exhaust air shall be ducted to each toilet.

9.5.2 AMBIENT CONDITION

SUMMER

Dry Bulb Temperature : 40ºC

Wet Bulb Temperature : 26ºC

Relative Humidity : 35%

9.5.3 Space Design Conditions

Dry Bulb Temperature : 23ºC ±1

Relative Humidity : 55% ±5%

LIGHTING LOA : 2Watts/SqFt

EQUIPEMENT LOAD : 17KW

FRESHAIRQUANTITY : 5 CFM per Person

OCCUPANCY : 145 Pax

9.5.4 VRV Air Conditioning System Configuration

Table 14 Capacity Configured

SR	AREA	AHU (Indoor Unit)	VRV Outdoor Unit	TOTAL TR
1	GROUND FLOOR-Office Area	7000 CFM	16 HP x 1No	13 TR
2	GROUND FLR Departure/ Other Area	16000 CFM	20 HP x 2Nos	32 TR

- Air Handling Unit will be connected to a group of outdoor units through refrigerant and communication cables. High quality refrigerant joints Refrigerant piping and cabling will be laid on the loft.
- Outdoor units will be located at loft/ground level of the blocks; sufficient maintenance and air circulation space will be available surrounding the outdoor units
- A close view of the system is given in the following figures described above VRV system will consist of the following components:

FIGURE 80 VRV SYSTEM ILLUSTRATIVE LAYOUT

9.5.5 ADVANTAGES OF VRV SYSTEM

- ENVIORNMENT FRIENDLY

The modern VRV system used HCFC free R 410A refrigerant as a media. Hence it does not contribute to ozone depletion. Also due to its high COP especially at the part load condition, commonly prevailing in Hotel application. VRV system has lower global warming impact on Environment.

- NOISE LEVEL

Indoor unit possess very low sound level in the range of 32 d to 38 dB., in addition outdoor units are also reasonably quiet and sound level of ODU are in the range of 60 dB. Moreover, VRV outdoor unit have very advance “NIGHT QUIET MODE “, which brings down noise level of outdoor units up to 13 dB when capacity requirement is lower during night operation. This can be achieved by both auto and manual mode.

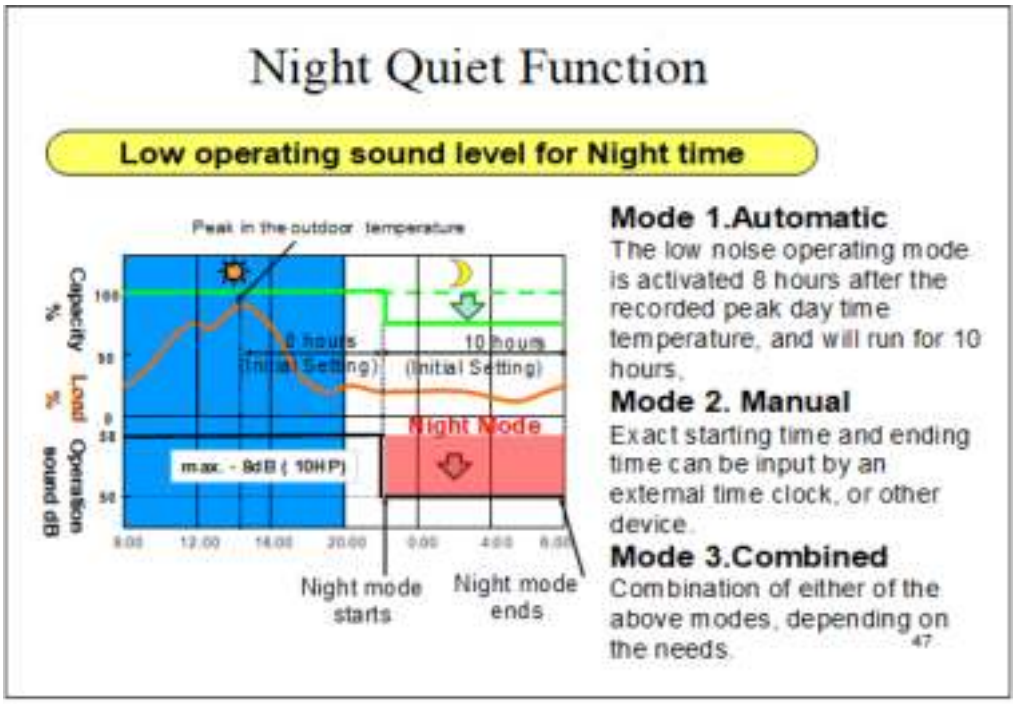


FIGURE 81 NIGHT QUIET FUNCTION

- OUTDOOR UNIT PLACEMENT :

It is very convenient to place outdoor units in between inclined roof. This will completely hide the outdoor units and also provide the sufficient service space. Also shafts containing refrigerant piping will be very close to outdoor unit location. VRV system can achieve long ref. pipe length up to 150 mt. between indoor and outdoor units. This makes it possible to have outdoor units at desired location.

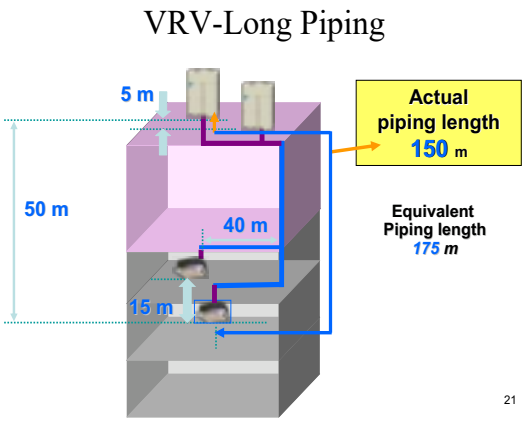


FIGURE 82

- LESS PIPING SPACE

VRV system involves comparatively very small ref. pipe diameter. approximately 1/3 of that of chilled water system. This results in less space utilization and good amount of space is left for other utilities.

FIGURE 83

- CENTRAL MONITORING & CONTROL :

Simplified but advance central control air conditioning management system that gives complete control of VRV air conditioning equipment can be provided in accordance with building management requirement. These controls can be used without full time supervision. VRV offers multifunctional centralized as well as localized control management system to centrally control and monitored Temperature settings, Time scheduling, change over, Malfunction alarm and various energy saving features. It can also be hooked up with Fire and Security system.

- INDIVIDUAL CONTROL

VRV is a completely variable system and has negligible fixed energy components. This characteristic makes it highly suitable for application such as this, which has constantly

changing occupancy of a bldg. It provides each room with independent control, allows system shutdown in rooms where No Air-conditioning is required and accordingly power consumption of the system will reduce proportionately. It has characteristic of better energy efficiency at part load condition, which is normally the case in Hotel building.

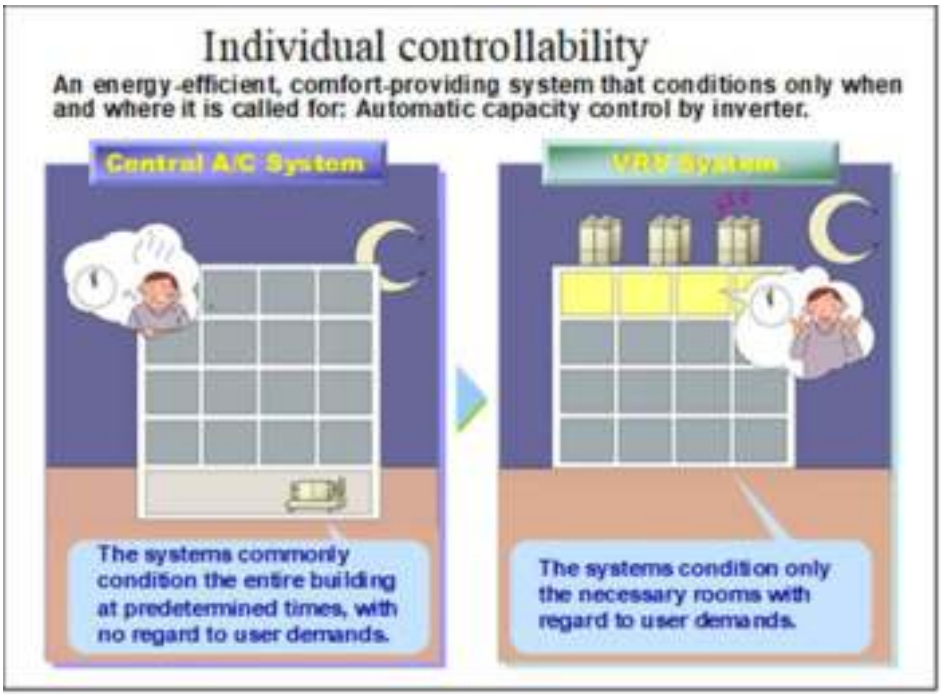


FIGURE 84

- EASY MAINTENANCE

It is completely self-diagnostic system and generates error codes on remote control display indicating the type of error occurred. Also, this being modular system doesn't need only standby equipment because if one compressor malfunctioning, other takes over emergency operation. If an outdoor units malfunctions, another provides emergency operation till repair.

9.6 PLUMBING SERVICES

9.6.1 ABOUT PUBLIC HEALTH ENGINEERING

- Public Health Engineering is responsive subject related to Human life safety, Inadequate or nonexistence Plumbing services can be source of sickness and death. Improper plumbing systems can result in structural weakness or damage.
- Providing least requirements and principles for the protection of the Public health, safety and welfare.

9.6.2 CODES & STANDARDS

The design for the above works has been based on the following Codes/ Guidelines/ standards/ SP.

- National Building Code of India – 2016
- Uniform Plumbing Codes – India – 2013.
- IS 1172-1993 (water supply & drainage services)
- IS 1239(part-1)- 2004 (Plumbing general practice)
- IS 1239(part-2)- 2011 (Plumbing general practice)
- IS 8034-2002 (submersible pump)
- IS 5659-1970 (process water pump)
- IS 5600-2002 (Sewage & Drainage pump)
- IS 1520-1980 (Centrifugal pump)
- IS 5120-1977 (Roto dynamic pump)
- IS 778 & 14846 (Valves)
- SP 35 -1987 Handbook on Water Supply and Drainage
- IS 651-2007 (Stoneware pipe & fitting)
- IS 4985-2000 (PVC pipe & Fitting)
- Provisional No objection certificate (NOC)from Local Fire Authority

9.6.3 SCOPE OF WORK

- Propose Plumbing System concepts and develop conceptual design to full system schematics.
- Propose appropriate material and equipment to meet preliminary design capacity and development.
- Provide preliminary Estimation, BOQ, design specification and drawing.
- Provide detailed routing of plumbing system and equipment layout.
- Providing documents and drawings to obtain the statutory approval from the regulatory authorities.
- Assist the client with technical bid evolution and vendor selection process.
- During construction stage conduct, periodic site visits to check compliance of the design inlet.
- Attend site meeting/visit on request for any technical assistance/technical queries during critical installations, execution and commissioning.
- Review/approval of Plumbing shop drawing prepared by the contractors.

9.6.4 ASSUMPTIONS/CONSIDERATIONS

Design bases report are prepared with considered following assumptions, which client has to authenticate.

- Average rainfall intensity to design rainwater disposal planning– 90 mm/ hr.
- Sewage Treatment Plant considered as per water demand sheet.
- Water Treatment Plant shall not be considered, it shall be confirmed after water test report received from client.
- Major source of water considered from Bore well, Secondary source shall be Corporation.
- Water supply through Corporation shall be single point supply, and water meter shall be provided by Corporation.
- Sewage Connection connected to Corporation drainage shall be by Single point only.
- Rain water shall be disposal on Road.

9.6.5 SOURCE OF WATER

The main source of water is considered from bore well, however, the client has to confirm the availability of water from the corporation.

The following parameters has to consider by the client for reliable water supply from Main source.

9.6.5.1 RAW WATER SOURCE (BORE WELL)

- Total water demands-50 KLD
- Bore well Flow rate-50 KL/Hr (Assumed)
- No of Bore well required: 1 Nos
- Water metering provision - Client
- Quality of water - Non-Potable (Water test report should be done)
- Depth and location of bore well

Depth and location of bore well are unable to predicted or design. It's only based on hydrogeology survey and same report can be considered for design rainwater harvesting pit.

9.6.5.2 DOMESTIC SOURCE (CORPORATION WATER)

- Alternate source of water – Corporation
- Water demand for project – 50 KLD
- Water supply hours - Considering 2 Hrs
- At least pipe dia shall be – 50 mm Dia
- Water metering provision - Corporation
- Quality of water - Potable (Since we proposed Water quality report.)

Following information need to provide by Client to consider in design for corporation water

- Location of corporation supply taps.
- Depth of Tapping

- Diameter of Pipe
- Criteria for Water meter provision.
- Water supply hours
- Quality of water (In General case quality of water shall be potable, however for safety purpose quality of water should verify.)

9.6.6 STORAGE OF WATER

- Storage of water shall be calculated based on daily water demand for occupant and Firefighting system demand.
- For the Domestic tank, 1.5 day storage of water shall be considered.
- For Firefighting National Building Code 2016 or Provisional No objection certificate from Chief fire officer.

9.6.6.1 UNDERGROUND STORAGE

Underground tanks are designed on basis of estimated daily water demand,

Underground storage tank capacities are following for this project.

Underground tanks			
Sr. No.	Descriptions	Capacity in KL	Remarks
1	Fire tank	50	As per NBC 2016
2	Domestic water tank	50	

9.6.7 WATER SUPPLY SCHEME

Following shall be scheme for Water supply arrangement.

DOMESTIC WATER SUPPLY SCHEME

- From Bore well water will be supply to Firefighting tank, Bore well operation shall be manual, However timer of Bore well should be maintain equally supply to maintain efficiency of Bore well pump.

- From Fire tank, water will be overflow in Domestic water tank. Necessary arrangement for overflow shall be plan at the time of construction of tanks.
- From Domestic underground tank, Water shall be transfer via Pressure system to source utility.

FIGURE 85 DOMESTIC WATER SUPPLY & SEWAGE DISPOSAL SCHEME LAYOUT

SEWAGE DISPOSAL SCHEME

The system shall be designed on the basis of standard criteria as stipulated in the "Manual for sewerage & Treatment "published by the Central Public Health & Environmental Engineering Organization (CPHEEO), NBC-2016, SP-35(S&T) -1987 and other National & International practices on the subject.

- Two pipe systems shall plan to disposed sewage from Toilets. Soil down take pipe will collect sewage from WC. Waste down take pipe will collect sewage from Wash basin and Floor drains etc.
- Down takes will require Anti siphonage arrangement for maintaining trap water seal level.
- Parallel pipe shall be run with connection to Waste down take line at each floor. It will help to prevent symphonic action.
- All drainage line will divert from ground level and it will collect to Manhole network.
- Waste line will connect to STP Plant via Manhole & Gulley trap.

- SOIL line will connect to STP Plant via Manhole.
- Following criteria shall be consider during design of external network

  - Flow of Sewage : 95% of water supply daily
  - Peak flow : 3times of average flow
  - Min Dia of pipe : 150/200 mm dia
  - Min. Velocity in pipe : 0.6 m/s
  - Max velocity : 3.0 m/s
  - Flow Condition in pipes : Up 400mm Dia Half filled
  - Above 400mm Dia : 2/3 Filled

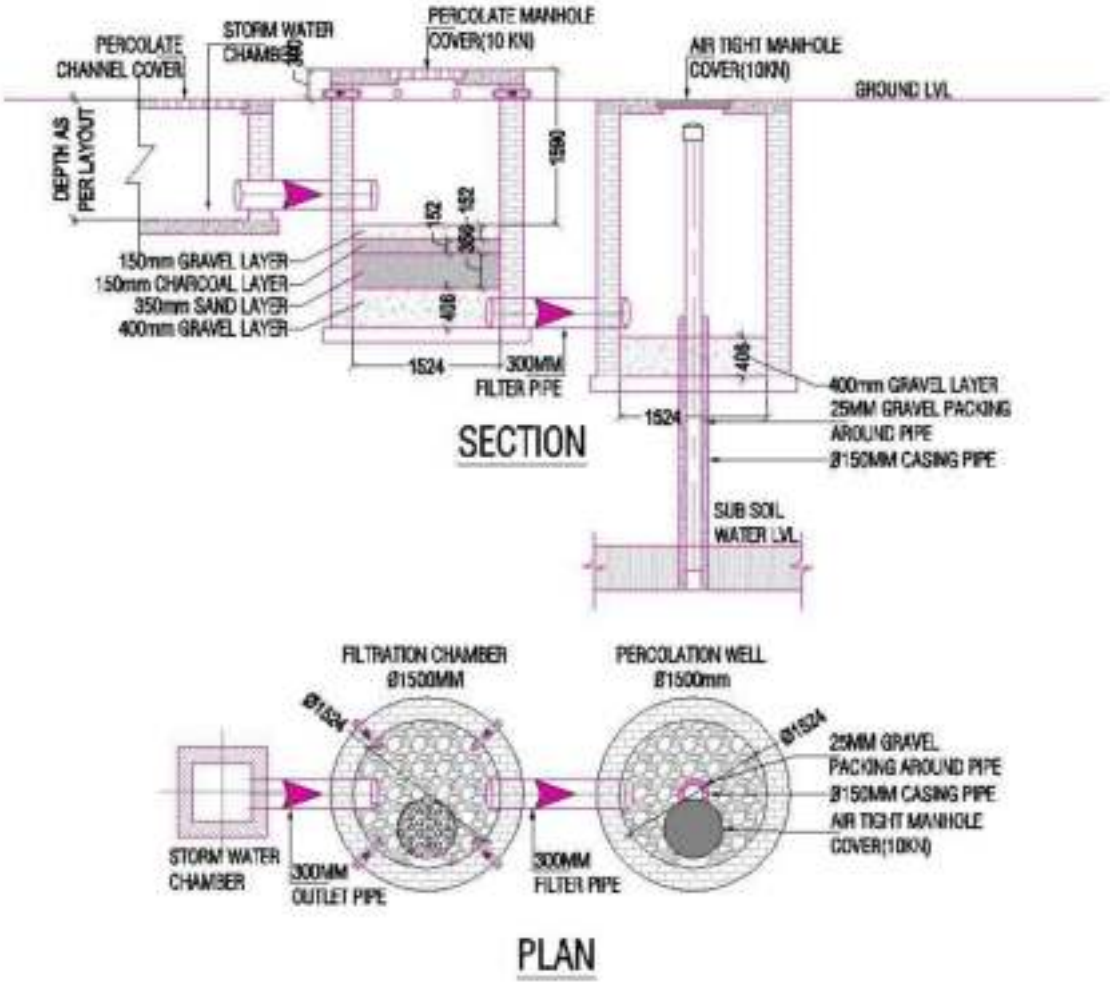
9.6.8 RAINWATER DISPOSAL/HARVESTING SCHEME

As per Indian metrological survey Average rainfall intensity of Guwahati city is 90 mm/hr.

A) Rain water Harvesting

As Social responsibility and norms it is necessary to percolate maximum rain water within earth. It will help to improve water level of Aquifer River as well as improvement of water quality.

According to norms and site area at least one Percolation well has to be executed.



9.6.9 WATER DEMAND CALCULATION

Sr.No.	Discription Fixture o r Group	Qty.	Building type	Water Demand (Load) Fixture units	Domestic Water Demand (Load) Fixture units	Flushing Demand (Load) Fixture units	Total Domestic water demand (LPM)	Total Flushing water demand (LPM)	Total water demand (LPM)
1	WC (flush Tank)	17	Public	3	0	51	0.0	109.0	109.0
2	Urinals (sensor operated)	6	Public	2		12	0.0	46.1	46.1
3	Lavatories (with standard faucet)	14	Public	1.5	21	0	58.4	0.0	58.4
4	Ablution faucet	17	Public	1	17	0	52.8	0.0	52.8
	Water Demand in LPM						111.0	155.1	266
	Water Demand in LPH						6660.6	9308.4	15969
	Water Demand for 4 Hrs.						26642.4	37233.6	63876
17		Landscaping	3200 sq Mtr			7		22400	22400
	Total						26642	59654	86296
*		Total Domestic water demand per day					26,642	Ltr.	
*		Total stored Domestic water demand per 1.5 day					39,964	Ltr.	
*		Underground water tank capacity per day					39,964	Ltr.	(4082)
*		Total Flushing stored water demand per 1.0 day					57,488	Ltr.	(5798)
*		Underground Flushing water tank capacity per day					54,614	Ltr.	(5530)
*		Underground fire fighting water tank capacity per day					50,000	Ltr.	(5082)

9.7 FIRE FIGHTING SYSTEM

9.7.1 SCOPE

- Designing of Firefighting system according to the code requirement
- Designing of Sprinkler system, Fire hydrant system at necessary location

9.7.2 DESIGN GOAL

- Firefighting services are responsive to subject related to Human life safety and property damage. Improper Firefighting systems can cost Human life.
- We are providing the least requirements and principles for protecting the Building from Fire.

9.7.3 REFERENCE STANDARDS

The design for the above works have been based on the following Codes/ Guidelines/ standards.

- National Building Code of India – 2016
- NFPA – 13 – Standard for the Installation of Automatic Sprinkler Systems.

- NFPA 14 – Standard for the Installation of Standpipe Systems
- No objection certificate (NOC)from the Local Fire Authority
- IS 3844 (1989) – Code of practice for installing and maintaining internal fire hydrants and hose reels on-premises.
- IS 15105 (1989) – Code of practice for installation and maintenance of sprinkler system.
- IS 13039 (1989) – Code of practice for installation and maintenance of External fire hydrants and hose reels on-premises.

9.7.4 ASSUMPTION FOR DESIGN BASES REPORT

Firefighting system design is on the basis Codes, Rules and Regulations. However following criteria are prevailing for local practices which need to verify by CFO.

- Sprinkler not required as per local practice.
- Main pump for Hydrant system.

9.7.5 BUILDING CLASSIFICATION BASED ON OCCUPANCY

As per NBC 2016-part 4, building is classified in different group based on the occupancy.

Based on the classification NBC 2016 - part 4 & Draft GDR 2021 specifies minimum requirements for firefighting installations. Requirements for the building based on the classification, occupancy & the height of the building, which is 7 m. The table summarizes the minimum requirements for firefighting installations. However, these will take as only the guidelines as the final provisions to be done in the building are governed by the local fire authority i.e. CFO's provisional fire NOC.

TABLE 15 MINIMUM REQUIREMENTS OF FIRE FIGHTING INSTALLATIONS AS PER NBC-2016 PART 4, TAC

Sr. No.	Description	Minimum required for building as per NBC	Provided for Assembly Building as per FOS
		Refer Code TAC, NBC-2016 part IV	
1	Name of Building	Assembly	Assembly
2	Occupancy Class	D	D
3	Fire Extinguisher	Required	Required
4	Hose Reel	Required	Required
5	Dry Riser	Not Required	Not Required
6	Wet Riser	Not Required	Required
7	Down Comer	Required	Not Required
8	Yard Hydrant	Not Required	Required
9	Automatic Sprinkler System	Not Required	Not Required
10	Manually Operated Electric Fire Alarm System	Required	Required
11	Automatic Detection and Alarm System	Not Required	Required
12	Under Ground Static Water Storage Tank	Not Required	50 KL
13	Terrace Tank	25KL	Not Required

14	Pump Near Under Ground Storage Tanks	Not Required	1 No.- 1620 LPM Electrical pumps 1No. -180 LPM jockey pump
15	Pump at the Terrace Tanks	1No. -900 LPM pump	Not Required

9.7.6 WATER SUPPLY & WATER STORAGE FOR FIRE FIGHTING

Classification based on occupancy class & height of the building; it is recommended to provide minimum storage of 25 KL, but we selected 50 KL in the UGR (suction tank) as per NBC 2016 Part-4.

The fire tank shall plan next to the Domestic water tank. Domestic water will be filled by overflow from the Fire tank. This will ensure the minimum fire water storage availability at all times & also avoid the firewater from being stagnant.

- 2-way fire brigade breaching inlet for water supply to UGR in case of a fire emergency.
- 2-way fire brigade Siamese connection for water supply to the ring main from fire tender.

9.7.7 FIRE FIGHTING PUMPS

- Based on the classification based on occupancy class & height of the building, it is recommended to provide the following configuration of firefighting pumps.
- Main hydrant pump (Electrical) - 1 No.-1620 LPM @ head required to give minimum residual charge of 3.5 Kg/ Sq.cm. At the farthest hydrant point of the building.
- Jockey pump (Electrical) - 1 No.180 LPM @ head required to give minimum residual charge of 3.5 Kg/ Sq.cm.

9.7.8 INTERNAL HYDRANT SYSTEM

- An internal hydrant system is an arrangement for firefighting within the building using vertical rising mains with landing valves and hose reels on each floor and permanently charged with

water using pumps. The System mainly consists of a Pipe network, Landing Valves, Hose reels & other accessories.

- The building is provided with a double-headed landing valve and a hose reel drum having a 20 mm dia hose of 30 m long with nozzle along with two (2) Nos. of RRL hoses (63 mm size x 15 m long with couplings) and one (1) no. Branch pipe with nozzle (20 mm bore).
- A minimum pressure of 3.5 kg/cm2 will be ensured at the remotest hydrant point.
- Each hydrant shall cover a 1000 sq. mtr—area of each floor.

9.7.9 EXTERNAL HYDRANT SYSTEM

- It is proposed to provide an external hydrant system for protecting the building from outside in a fire emergency. External hydrant system for the facility shall be as follows:
- 100 mm dia M.S. heavy class external hydrant central in the upper basement ceiling.
- Provision of External hydrants at every 45 m distance given moderate hazard occupancy.
- 2-way fire brigade breaching inlet for water supply to UGR in case of a fire emergency.
- 2-way fire brigade Siamese connection for water supply to ring primary from fire tender.
- Locations of external hydrants & other fire equipment shall be coordinated with overall external services & landscape design in particular.

9.7.10 NON-WATER BASED FIRE EXTINGUISHING SYSTEMS

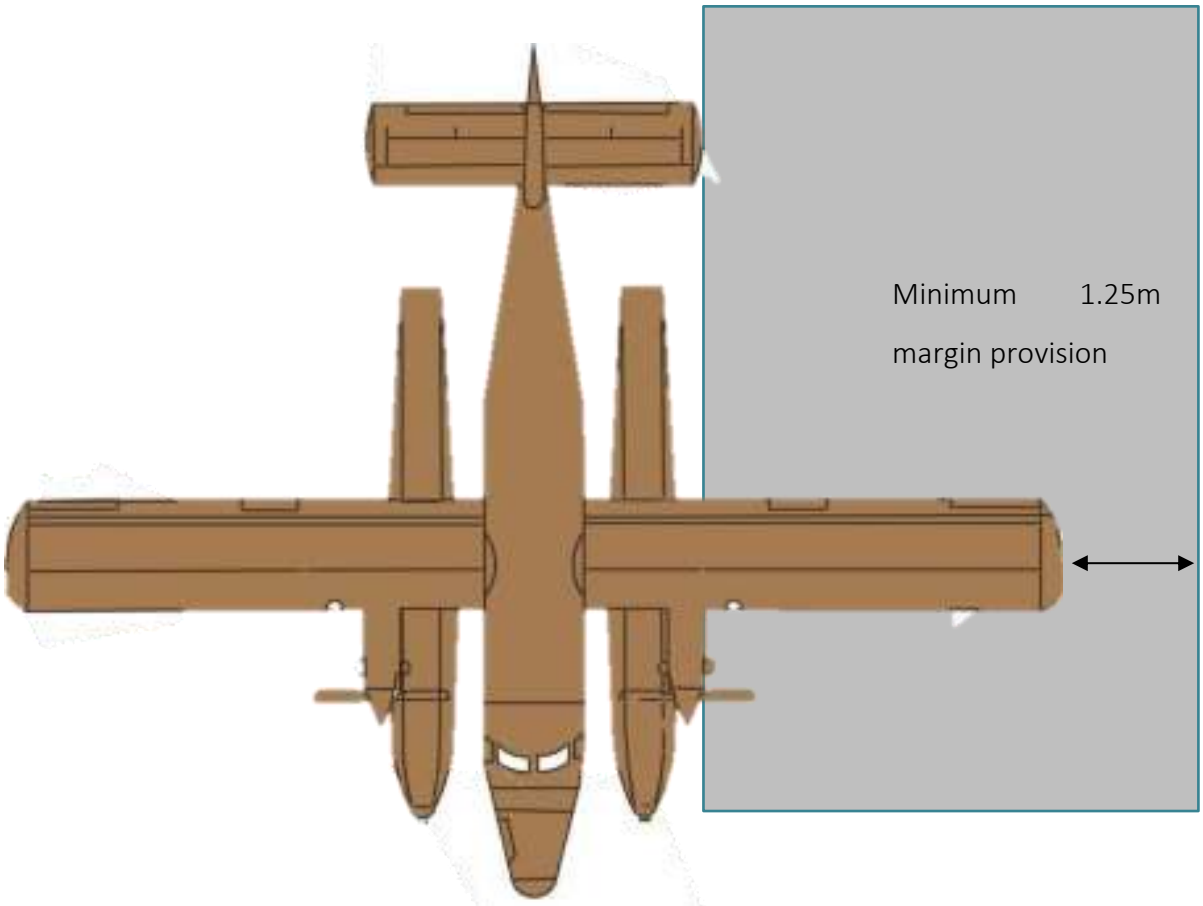
It is proposed to provide fire extinguishers as per IS 2190. Type of extinguishers & nos. Shall be decided based on the area of rooms & the application.

- The ABC type extinguisher shall be distributed over the entire common area, where the person is not required to travel more than 15 m to reach the nearest extinguisher.
- Carbon dioxide type fire extinguishers conform to IS 2878.
- Each floor shall have the provision of Extinguishers as per local practice.

9.8. FLOATING JETTY – RCC STRUCTURE

9.8.1 GENERAL ARRANGEMENT

The proposed Floating jetty is 24m X 9m X 1.7m in size, allowing smooth flow of every service operation. The width of the jetty is also selected to allow safe docking of any typical seaplane giving enough margin between the gangway and the wings extend. For which a thorough study is done of the dimensions of many seaplanes with varying sitting capacity. Reference for the size of seaplanes of different sitting capacities is taken from the website of Canada-based aircraft manufacturer Vikings Pvt Ltd.



9.8.2 GENERAL SPECIFICATION OF FLOATING JETTY

A floating jetty, RCC ENCAPSULATED EPS POLYSTYRENE CONCRETE PONTOONS of size 9 m wide and 24 m long is proposed for docking of the sea plane. This arrangement is made by joining 6 blocks of concrete pontoon, each to be 12m long & 03m wide, connected end - to – end using strong flexible oil filled connectors with sturdy rubber cushioning and side by side using rigid sturdy connectors. Connectors on the gables of the pontoons should be flexible with Rubber joints allowing for some movement. Each connector should have a minimum break load of 35 Ton, meeting the general specifications of net deck capacity of minimum 2kN/m2 or 86000 kg of monolithic construction, utility ducts, and certification standards as specified including providing concrete anchor blocks at each location, transportation of all materials to work site, cost of all labour charges, tools & plants.

The following aspects are to be considered for Floating Jetty

- Test certificates from IRS/any IACS members should be submitted for pre- and post-installation of RCC Floating Pontoons in water that is acceptable internationally to be submitted to the Department.
- Unloaded freeboard should be a minimum of 45 cm and fully loaded freeboard should be 25 cm corresponding to the 2 kN load specified.
- Piping for water electricity etc should be interna in the pontoons, which should be prepared with connection boxes etc for accessories.
- Parallel connection bars should be stainless steel and dimensioned to hold the loads calculated.
- Connectors on the gables of the pontoons should be flexible with rubber joints allowing for some movement. Each connector should have a minimum break load of 35 tons.
- Connectors should be easily replaceable for maintenance purposes.

9.8.3 GENERAL SPECIFICATION OF MOORING CHAIN & ANCHOR

- The mooring design to be proposed by the EPC Contractor, to resist wind, wave, and current and aircraft engine run-up loads. For the detailed design of the moorings, study of wind speed and thrust created by seaplane engines, design wind speed and the force

that would be generated by one of the seaplanes running up its engines when moored to the pontoons is to be made.

- Anchors of a suitable type should be used considering the price and life span. This could be of Dan forth, fluke, or concrete type. A calculation shall be provided justifying sufficient holding power in the given bottom conditions. A proven track record of using the offered anchor type to moor pontoons should be provided.
- The Dan forth or fluke anchor uses a stock at the crown to which two large flat triangular flukes are attached. The stock is hinged so the flukes can orient toward the bottom (on some designs they may be adjusted for an optimal angle, depending on the type of bed).
- The mooring length of the chains should be at least 4 times the water depth to allow for having mainly horizontal forces on the anchors, whilst minimizing movement of the pontoons.
- The mooring chain diameter must be selected with a 10-year corrosion allowance and a factor of safety after corrosion of not less than 3.
- The EPC contractor will be responsible to justify his anchor/chain selection to describe the method of connection to the pontoon.

9.8.4 Structural Arrangement & Grade of Material

The jetty is made up of 6 identical RCC U-type section which is filled with Styrofoam, connected strongly to each other to make a single steady platform. The size of each unit is 3 X 12 X 1.7 m, RCC top slab thickness is 120 mm, while the side walls and mid-wall thickness is 100 mm. Service duct provision by an open recess is made in the top slab to pass any utility ducts and/or cables. RCC top slab, mid-wall, and side walls are reinforced by HYSD 500 rebars with a clear cover of 50 mm for protection against any kind of impact load.

Grade of material:

RCC: M45 grade with a density of 2500 kg/cub m

Expanded Polystyrene: moulded density of 15kg/m,
water absorption for 96 hours of 3-3.5 % by volume
Compressive strength of 65-110 Psi at 10% deflection

Reinforcement: Fe 500 TMT bars

9.8.5 LEVEL OF FLOATING JETTY & HIGH FLOOD LEVEL

Chart datum level: (+) 5.65 m (from M.S.L.)

High flood level: (+) 14.0m (from M.S.L.)

Free board – 0.400m

9.8.6 LOAD DATA

9.8.6.1 DEAD LOAD

The dead loads shall be assessed considering the following unit weight of materials.

Structural steel: 7850.0 kN/m^3

Reinforced Concrete: 25.0 kN/m^3

9.8.6.2 LIVE LOAD

A live load of 6kN/m^2 is considered for the floating jetty and 3kN/m^2 for the gangway, Concentrated load of 4.5 kN at the far end of the jetty

9.8.6.3 CURRENT LOAD

Water current velocity for the given site

$$Fd = 0.5\rho C_D A_P V_c^2$$

Where C_D = drag coefficient, 2 for rectangular body

Vc = current velocity

9.8.6.4 WIND LOAD

Fw = $0.6\ C_D\ A_p V_z^2$

Where C_D = drag coefficient, 2 for rectangular body

Vz = wind speed, 44 m/s for Surat

9.8.6.5 MOORING LOAD

The mooring loads are the lateral loads caused by the lines when they pull the seaplane into or along the dock or hold it against the forces of wind or current.

The maximum mooring loads are due to the wind forces on exposed area on the broadside of the plane in light condition

9.8.6.6 BERTHING LOAD

Berthing load can be calculated by the energy absorbed by the fender with some value of displacement.

Berthing energy is calculated in kNm as

$$E = \frac{W_D \times V^2}{2g} \times Cm \times Ce \times Cs$$

Where, W_D - displacement tonnage (DT) of the vessel, in tonnes;
V - velocity of vessel in m/s, normal to the berth
g - acceleration due to gravity in m/s^2
Cm - mass coefficient
Ce - eccentricity coefficient
Cs - softness coefficient

9.8.6.7 STABILITY LOAD

As per AS standard stability load for the restricted pontoon area is taken at 1.5 kN/sqm

9.8.6.8 FLOATATION LOAD

As per AS standards floatation load for the restricted pontoon is taken 2.0 kN/sqm

9.8.7 LOAD COMBINATION

Load combination for flotation:

1 Self-weight + 1 Service load + 1 Live load: 400 mm freeboard required

1 Self-weight + 1 Service load + 1 Live load + 1 Flotation + 1 Stability: 50 mm reserve freeboard required

1 Self-weight + Live load of 4.5 kN on edge: Tilt not more than 15 degrees

9.8.8 REFERENCES

Guidelines for Floating Jetties / Platforms for Marinas, Minor Harbours, Fishing Harbours, Fish landing canters, Water Aerodromes, and other similar facilities in coastal areas, estuaries, waterways, rivers, and reservoirs.

IS 800: 2007 – General Construction in Steel – Code of Practice

IS 4651 - Planning and Design of Ports and Harbours – Code of Practice (all Parts)

IS 226: 1975 - Structural steel (Standard Quality)

IS 875 (Part-3) Design Loads for Buildings and Structures

AS 3962-2020 Marina Design

9.8.9 PROJECT STRATEGY

The work will be executed by the SMPK by engaging contractors/ firms under Engineering, Procurement & Construction (EPC) mode with the requisite capacity through the call of tender.

9.8.10 LEGAL FRAMEWORK

The SMPK has entrusted M/s Nektor Engineers and Project Consultant (NEPC) to carry out Survey & Investigation, DPR preparation, and PMC work. The details provided in the DPR are based on the surveys conducted by NEPC during specific times. As a river is having flowing water, there may be changes in the actual data during the construction work, EPC contractor has to verify all the site conditions in all manners during the execution of work prior to submitting their design which affects the design. The design carried out by the EPC contractor should be submitted to PMC & SMPK for their review and approval. Once the design is approved by SMPK & PMC it should be vetted by any IIT and all hydrology & hydrological structures shall be vetted by Naval Architect. All legal frameworks will be specified in the contract/ legal document of fixed time and fixed cost wherein it will be the responsibility of the Contracting Agency to execute and complete the work and hand it over within the stipulated time and cost. Relevant specifications laid down by the BIS codal guideline will be the basis for entering into an agreement with the Contractor wherever applicable. The Standard Bidding Documents (SBD) approved by SMPK will also form the basis for the agreement. Any legal dispute will be settled within the terms and conditions of the contract or as decided by the Chief Engineer (SMPK), or Arbitrator legally appointed for the purpose. Local disputes will be settled by the local administration through the district court of law or Panchayat or village councils as per admissible.

"Carrying Out Bathymetric Survey, OLS Survey and Preparation of DPR for Construction of Water Aerodrome for Seaplane Operations at Brahmaputra Riverside in Guwahati, Assam."

Transmittal

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Document History:

Sr No	Description	Date Of Submission	Revision
1)	Detailed Project Report – Guwahati Water Aerodrome	25-Feb-22	R0
2)	Detailed Project Report – Guwahati Water Aerodrome	30-Mar-22	R1
3)	Detailed Project Report – Guwahati Water Aerodrome	22-Jul-22	R2

Client Signoff:

Client	SYAMA PRASAD MOOKERJEE PORT, KOLKATA
Project	Carrying out the bathymetric survey, OLS Survey, and preparation of DPR for construction of water aerodrome for seaplane operations at Brahmaputra riverside in Guwahati, Assam under the directions of Marine Department of SMP, Kolkata
Document Title	Detailed Project Report

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Abbreviations

AAI	:	Airports Authority of India
AIMS	:	Airport Information Management System
AMIS	:	Interface of Airport Management Information System
AMSS	:	Aeronautical Mobile Satellite Service
ATC	:	Air Traffic Control
ATM	:	Aircraft Movement
BCAS	:	Bureau of Civil Aviation Security
BOQ	:	Bill of Quantity
CAG	:	Comptroller and Auditor General of India
CAR	:	Civil Aviation Regulations
DGCA	:	Directorate General of Civil Aviation
DoNER	:	Department of Development of Northeastern Region
ER	:	Eastern Region (FIR)
GST	:	Goods and Services Tax
IA	:	Implementing Agency
IACS	:	International Air Connectivity Scheme
IAF	:	Indian Air Force
ICAO	:	International Civil Aviation Organization
ICMR	:	Indian Council of Medical Research
IT	:	Information Technology
LOIA	:	Letter of Intent to Award

LOA	:	Letter of Award
MHA	:	Ministry of Home Affairs
MoCA	:	Ministry of Civil Aviation
MoHFW	:	Ministry of Health and Family Welfare
MoU	:	Memorandum of Understanding
NCAP	:	National Civil Aviation Policy
NEC	:	Northeastern Council
NER	:	Northeastern Region (FIR)
NR	:	Northern Region (FIR)
NSOP	:	Non-Scheduled Operator's Permit
PG	:	Performance Guarantee
PPE	:	Personal Protective Equipment
RCS	:	Regional Connectivity Scheme
RCF	:	Regional Connectivity Fund
SAO	:	Selected Airline Operator
SAOA	:	Selected Airline Operator Agreement
SCO	:	Scheduled Commuter Operator
SR	:	Southern Region (FIR)
TNCL	:	Terminal Navigation Landing Charge
UDAN	:	Ude Desh ka Aam Naagrik
UT	:	Union Territory

Definitions / Glossary

Aerodrome: A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure, and surface movement of aircraft.

Aerodrome beacon: Aeronautical beacon is used to indicate the location of an Aerodrome from the air.

Aerodrome License: A license issued by the Director-General of Civil Aviation under applicable regulations for the operation of an Aerodrome.

Aerodrome Mapping Data (AMD): Data collected to compile Aerodrome mapping information for aeronautical uses.

Aerodrome Mapping Database (AMDB): A collection of Aerodrome mapping data organized and arranged as a structured data set.

Aerodrome Elevation: The elevation of the highest point of the landing area.

Aerodrome Identification Sign: A sign placed on an Aerodrome to aid in identifying the Aerodrome from the air.

Aerodrome Reference Point: The designated geographical location of an Aerodrome. Amphibian

Plane: an aircraft that can take off and land on both land and water.

Anchorage Area: A dedicated area along the shoreline within the protected waters to secure a Seaplane.

Dock/Docking Area: A floating platform extending from the shore, on water, and supported by pillars or pontoons to hold in position, intended alongside seaplanes for loading or unloading passengers, cargo, fueling, or parking.

Floating Jetty: An anchored, defined platform inside protected waters licensed for embarkation and disembarkation of passengers or cargo by aircraft.

Gangway: A movable walkway where people embark or disembark decks, piers, and barges.

Licensee: The license holder of the Water Aerodrome.

Landing Area (WA): Part of a movement area (WA) on Water Aerodromes intended for the landing or take-off of aircraft.

Movement Area (WA): part of a Water Aerodrome to be used for the take-off, landing, and taxiing of aircraft, consisting of the maneuvering area (WA) and the apron(s).

Manoeuvring Area (WA) that part of a Water Aerodrome to be used for the take-off, landing, and taxiing of aircraft, excluding aprons.

Mooring Buoy: A floating marker held in place by chain or cable to a permanent unmovable anchor sunk deeply into the bottom within the Water Aerodrome. These buoys are mainly used to secure a Seaplane.

Protected Area: An area usually located on the atoll-ward side near islands, which is protected from large waves by the surrounding reef or lagoon.

Response Time: The time between the initial call to the Rescue and Fire Fighting Services (RFFS) and the first effective intervention at the accident site by a rescue and firefighting vessel.

Water Aerodrome: A defined area on water (including any buildings installations and equipment) intended to be used either wholly or in part for the arrival, departure, and movement of aircraft.

Water Runway/Sea Lane: A defined rectangular area on a Water Aerodrome, intended for aircraft's landing and take-off run along its length.

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CHAPTER 1 INTRODUCTION

Aviation Industry in India has grown multi-fold in the past 3-4 years. With the launch of the UDAN scheme, the Government of India is emphasizing air connectivity between the various cities/towns of India. With the current growth scenario in civil aviation, particularly in India, the Central Government has launched Regional Connectivity Scheme (RCS) to reach out to remote areas. Seaplane operation from coastal/ river/ canal and terrestrial water bodies will extend the connectivity to those areas where there is no land-based airport. Usually, setting up Airports with all the required infrastructure needs a huge investment, against which for water aerodromes, the investment cost is very low with the availability of water as landing strips reducing the infrastructure cost. Hence as per directives of MoCA, SMP, Kolkata has floated the tender for Carrying out the bathymetric survey, OLS Survey, and preparation of DPR for water aerodrome for seaplane operations at Brahmaputra riverside in Guwahati, Assam, under the directions of Marine Department of SMP, Kolkata.

Guwahati is the biggest city in the Indian state of Assam and the largest metro city in North-eastern India. Guwahati is situated on the south bank of the Brahmaputra. Guwahati is also known as the 'Gateway to North-East India' and is famous for Tea cultivation.

Guwahati is located approximately 20 Kms from the State Capital of Assam – Dispur, and Guwahati. Many ancient Hindu temples are located in and around Guwahati city; hence, it is also known as the 'City of Temples'. Guwahati region hosts diverse wildlife, including rare animals such as Rhinoceros, Pythons, Tigers, and Asian Elephants. Hence, Guwahati city is a very important location from a tourist point of view.

The city has a comparatively high-quality life. It has competitive residential and working environments with beautiful landscapes and modern infrastructure. The city is well connected to the rest of the country through Highways, Railways, and Air Connectivity. A Four-lane East-West corridor connects all the state capitals of Northeast India to Guwahati. Guwahati has an international airport that is 20km away from the heart of the city. Pandu port is a river port developed on the banks of the Brahmaputra River, serving Guwahati. The railway station is situated in the heart of Guwahati city and connects Guwahati by rail to the various cities of India.

The Brahmaputra River is one of the largest rivers in Southeast Asia that flows through three countries: India, China and Bangladesh. This river originates from the Chemayungdung glacier in Tibetan China and then ultimately fell into the Bay of Bengal. This river has got different

names in different places. i.e., Yarlung Tsangpo in China, Brahmaputra in India, Jamuna in Bangladesh. It is used as an essential part of water transport. Multiple dams are built on the Brahmaputra River for water supply, irrigation, and hydroelectricity projects.

The above points summarise that Guwahati is a city with good development and has multiple tourist attractions in its vicinity hence the water Aerodrome is considered by the Government.

SECTION 1.1 IMPORTANCE AND REGIONAL ASPECTS

Assam, the state of India. It is located in the north-eastern part of the country. It is bounded to the north by the kingdom of Bhutan and the state of Arunachal Pradesh, to the east by the states of Nagaland and Manipur, to the south by the states of Mizoram and Tripura, to the west by Bangladesh and the states of Meghalaya and West Bengal. The name Assam is derived from *asama*, meaning "peerless" in the now-extinct Ahom language. The neighbouring states of Arunachal Pradesh, Nagaland, Mizoram, and Meghalaya were once part of Assam. The capital, formerly Shillong (now the capital of Meghalaya), was shifted to Dispur, a suburb of Guwahati, in 1972. Area 30,285 square miles (78,438 square km). Pop. (2011) 31,169,272.

Guwahati, formerly **Gauhati**, city, western Assam state, north-eastern India. It lies along the Brahmaputra River (there bridged) and is picturesquely situated with an amphitheatres of wooded hills to the south.

Guwahati was the capital of the Hindu kingdom of Kamarupa (under the name of Pragjyotisa) in about 400 CE. In the 17th century, the town repeatedly changed hands between the Muslims and the Ahoms (a Tai-speaking people who had migrated from Yunnan province, China, and ruled much of Assam from the 13th century CE) until it became the seat of the Ahom governor of Lower Assam in 1681; in 1786 the Ahom Raja made it his capital. Myanmar (Burmese) held Guwahati from 1816 until 1826 when it became the British capital of Assam. The capital was moved 67 miles (108 km) south to Shillong in 1874. Guwahati is an important river port and Assam's principal commercial centre. It has an oil refinery and a state farm, and its industries include tea processing, milling of agricultural products, and soap manufacturing. Gauhati University (founded in 1948), Earle Law College, the state high court, the state museum, several scientific museums, and a zoological garden. Several Hindu pilgrim centres and temple ruins are nearby. Guwahati is served by an airport and a rail line. Manas Wildlife Sanctuary (or Manas

National Park), designated a UNESCO World Heritage site in 1985, is about 60 miles (100 km) northwest of the city. Pop. (2001) 809,895; (2011) 957,352.

SECTION 1.2 TRANSPORTATION

Historically, geography has inhibited the growth of efficient transport systems, and underdeveloped transport and communication systems have in turn hindered economic development in Assam. The Brahmaputra, for example, long has been a major barrier to integrating the transportation networks lying north and south of the river. However, the situation improved with the opening of several rail and road bridges in the late 20th century.

With Assam's abundance of waterways, inland water transport is essential. The Brahmaputra and Barak (Surma) rivers are the state's primary water channels. Numerous passenger ferries operate between various points on the Brahmaputra, and freight service is offered between Guwahati and Kolkata, West Bengal.

There is considerable air traffic between Assam and Kolkata. Guwahati, Dibrugarh, Jorhat, Tezpur, and Silchar are among the towns with air service. Guwahati airport offers international service.

SECTION 1.3 TOURIST ATTRACTION

Guwahati city is an important location from a tourism point of view. It is one of the country's oldest cities. Guwahati city is also surrounded by ancient temples, Wildlife National Parks, Museum, dams, lakes, & Zoos, which attract a massive crowd around the Globe. Following are the well-known attractions at/around Guwahati.

- Kamakhya Temple
- Assam State Museum
- Guwahati War Memorial
- Guwahati Regional Science Museum
- Kaziranga National Park
- Pabitora National Park
- Umium Lake

CHAPTER 2 SCOPE OF WORK

1) Bathymetry survey of the area (approx. area 5 - 6 sq. km) conforming to Special Order surveys under IHO's S-44 standards. Hydrological observation includes current velocity observation, tidal data collection, bed sampling, analysis, etc. One officer of SMPK may monitor data acquisition work by the party for a maximum of 7 days at the site (whose boarding, lodging, and transport (Kolkata to Kolkata by air) during their stay at the site is to be arranged by the bidder) for the acceptance of the work by SMP, Kolkata.
2) OLS survey includes establishing the Primary Airport Control Station (PACS)and Secondary Airport Control Station (SACS) by AAI aeronautical survey Manual-Part II and meeting ICAO and DGCA norms. SMP, Kolkata will forward the report to AAI/ MoCA for acceptance.
3) Preparation of BIM models with DPR for each site. SMP, Kolkata will forward the report to AAI/ MoCA for acceptance.
4) Finalised format of Location survey and submission of the report as per deliverables lists, both in hard copies and soft copies along with raw data.
5) Project Management Consultancy (PMC) and technical support for 2 years including getting permissions and liaison with other government bodies.

CHAPTER 3 WATER AERODROME

The Seaplane offers the unique feature, speed of the airplane with the utility of the boat – A valuable means of air transportation. The seaplane operation site, which deals explicitly with landing and take-off, is referred to as the Seaplane Base. Seaplane Base, also called Water Aerodrome, is operational with basic facilities and arrangements for aviation operations.

SECTION 3.1 KEY BENEFITS

Aviation, as a whole, plays a significant role in the nation's economy and transportation network. Water Aerodrome serves the flying community like a marina serves boating enthusiasts. A water aerodrome provides the aviation, business, and tourism community with an operational base and supports the community with economic, employment, and recreational opportunities. Seaplanes can be used to access remote areas that may not have runways for normal planes but may have suitable water bodies on which seaplanes can land. Seaplanes can help the field of aviation expand to an area that is not ready for expensive ground runway operations, which will emerge the utilization of suitable shorelines, lakes, rivers, and harbors that offer natural landing sites for seaplane operations. Seaplane routes have proven desirable where land or water vessel surface transportation may not exist or is tedious and time-consuming.

SECTION 3.2 REGULATORY REQUIREMENTS

SECTION 3.2.1 RELATED GUIDELINES

1) Civil Aviation Requirements Section 4 – Aerodrome Standards & Licensing Series 'F' Part IV - **Procedure and Requirements for Licensing of Water Aerodrome** published by the Office of Director General of Civil Aviation on 21St June 2018.
2) **Draft Asia Pacific Regional Guidance on Requirements for the Design and Operations of Water Aerodromes for Seaplane Operations.** This Guidance Material is approved by the Third Meeting of Water Aerodromes Small Working Group (WASWG/3) (Hulhulé, Maldives, 6 to 8 February 2018) and published by ICAO Asia and Pacific Office, Bangkok
3) **FAA Advisory Circular, AC No. 150/5395-1B – Seaplane Bases**
4) **Annex 14 — Aerodromes**, Volume I — Aerodrome Design and Operation

SECTION 3.2.2 GOVERNING AUTHORITIES

Following mandatory clearances are required to be obtained from the following authorities before introducing Seaplane services:

1. Ministry of Defence
2. Ministry of Environment and State Department of Environment as applicable
3. Local Body (under whom the Site/ area belongs)
4. Department of Forest if water aerodromes are located in forest areas

Besides the above clearances, an agency must also liaise and obtain a no objection certificate to import and operate a Seaplane in the specified location(s). Inspection of all locations is mandatory by DGCA and BCAS officials as required will also be applicable. Site Selection for Water Aerodrome

Water Aerodrome site selection criteria recommend larger dimensional clearances and separations based on the physical characteristics of seaplanes, their unique operating characteristics, the interplay of winds and water currents, and water depth.

SECTION 3.2.3 SEAPLANE CHARACTERISTICS

There are mainly two types of seaplanes: Floatplanes & Flying Boats. Reference to amphibious aircraft can be either type of seaplane that has a retractable wheel gear to allow operation on land or ingress and egress from the water via a ramp. The characteristics described below from FAA-H-8083-23, Seaplane, Ski plane, and Float/Ski Equipment Helicopter Operations Handbook, are the more pertinent characteristics used in this report.

FLOATPLANES

Floatplanes typically are conventional land airplanes that have been fitted with separate floats (sometimes called pontoons) in place of their wheels. The fuselage of a floatplane is supported well above the water's surface. Here, the term "seaplane" will be used in place of the term "floatplane."

Figure 1 Floatplanes

FLYING BOATS

The bottom of a flying boat's fuselage is its main landing gear. This is usually supplemented with smaller floats near the wingtips, called wing or tip floats. Some flying boats have sponsons, which are short, wing-like projections from the sides of the hull near the waterline. Their purpose is to stabilize the hull from rolling motion when the flying boat is on the water, and they may also provide some aerodynamic lift in flight. Tip floats are sometimes known as sponsons. The hull of a flying boat holds the crew, passengers, and cargo; it has many features in common with the hull of a ship or boat.

Figure 2 Flying Boats

AMPHIBIANS

Some flying boats and floatplanes are equipped with retractable wheels for landing on dry land. These aircraft are called amphibians. On amphibious flying boats, the main wheels generally retract into the sides of the hull above the waterline. The main wheels for amphibious floats retract upward into the floats themselves, just behind the step.

Figure 3 Amphibians

SECTION 3.2.4 OPERATING CHARACTERISTICS - SEA PLANES

The following points highlight several operational difficulties that seaplane pilots face as compared to pilots operating land aircraft and to mitigate such difficulties, the water aerodrome must be provided with larger sea lanes than paved runways and greater water operating areas to manoeuvre seaplanes near objects. (Reference: FAA-H-8083-23)

NO BRAKES

Many of the operational differences between land airplanes and seaplanes relate to the fact that seaplanes have no brakes. From the time a seaplane casts off or is untied, the seaplane floats freely along the water's surface. That is, it is virtually always in motion due to the wind and current effects, propeller thrust, and inertia. To control such movements from the pilot end and safer water operations, it is recommended to provide extra-dimensional space design criteria for taxi channels, turning basins, and manoeuvring seaplanes towards and within seaplane bases located in the water operating area and the shoreline.

WEATHERVANING

Another major operational difference is the effect of the wind to cause an airplane to weathervane while on the water, i.e., yaw the nose into the wind. This tendency very evident in seaplanes can possibly impact the pilot's ability to manoeuvre seaplanes. To deal with this condition, water aerodrome design criteria should be included with extra-dimensional space for anchoring and mooring seaplanes in the anchorage area (anchors and mooring buoys), tie downs at piers/docks, and water taxiing along with shoreline facilities.

LANDING

For water operations, the pilot must evaluate the characteristics of the water surface, determine wind direction, and speed, and choose a landing direction. Also once landed, water taxiing is more complicated given that seaplanes are in constant motion without the benefits of braking actions.

TAKE-OFF

For most seaplanes, the water take-off distance is usually much longer than the distance required for taking off from land. This is due to the drag of the water on the floats or hull. As seaplane weight increases, the floats or hull will sink deeper into the water, creating more drag during initial acceleration and significantly increasing the required take-off distance.

SECTION 3.2.5 CRITERIA TO BE FOLLOWED FOR SELECTING THE PROPER SITE LOCATION

This section provides proponents site selection criteria for determining a safer and more efficient seaplane base. The following figure shows one potentially safe, efficient, and compatible siting of a seaplane base to a typical community in general terms and particularly to the other waterfront activities. Two seaplane base locations are illustrated in this "close" relationship with town businesses, the industrial waterfront area, and the convenient access routes to the residential areas. In addition, the approach/departure paths and the traffic pattern do not pass over the existing community. Recreational boating can safely operate along the west shoreline without interference or disturbance from seaplane operations. If the community can attract itinerant aviation, it would be possible to provide additional shoreline facilities, such as a floating dock with tie downs, for enplaning and deplaning passengers.

Seaplane servicing is provided at the main north hangar facility. Generally, river shipping is along the east shoreline with a great seaplane turning and docking area north of the railroad and bridge. This site location further protects both seaplane base sites from down-river currents and prevailing north winds. All take-off climbs and approaches are over water, thereby providing a higher degree of safety than overland paths.

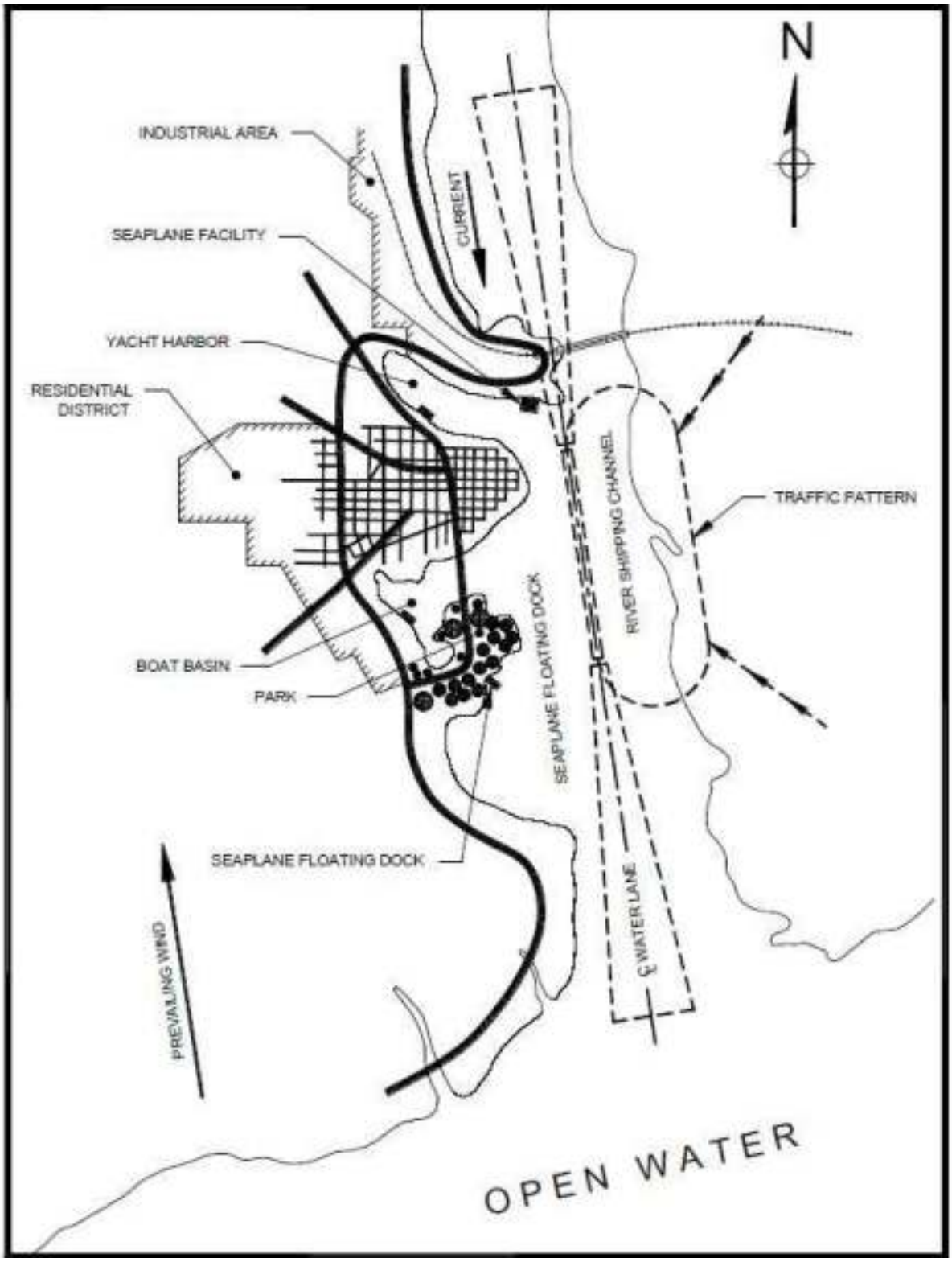


Figure 4 Seaplane Water Landing Area about a Waterfront Community

Water Operating Area and Shore Facilities

The following factors affect the required size and location of the operating water area and shore facilities:

1) The performance characteristics and number of seaplanes expected to use the operating water area,
2) Presence or absence in the surrounding area of existing or potential obstructions,
3) Presence in the surrounding area of wildlife attractants such as bird sanctuaries or areas that attract flocks of birds due to terrain, vegetation, and the presence of food sources (landfills, seafood processing facilities, fish hatcheries, etc.). A local university cooperative extension may assist in identifying these areas.
4) Strength of water currents, water depth, wave action,
5) Shoreline, river, or channel geography,
6) Local regulations,
7) Noise considerations,
8) Prevailing wind direction,
9) Presence of other seaplane bases and airports in the general area,
10) Public accessibility,
11) The character of development within the surrounding area, and
12) Commercial ship operating routes, pleasure boating activities, and shared recreational boating paths of travel.

Approach and Departure Paths

The recommended location for seaplane approach/departure paths is over water, preferably not occupied by large vessels. This site selection criterion permits reasonably safer landings during the approach and the initial take-off climb in the event of power failure. An over-water climbing turn or let-down procedure may be possible where a suitable sea lane (within the water operating area) exists, but the shore and surrounding development prohibit straight-in approach and departure paths.

The approach/departure paths should be clear of obstructions to air navigation to avoid operational limitations. Suppose an obstruction to air navigation is determined to be a hazard to air navigation and cannot be altered or removed. In that case, the AAI will impose seaplane operational limitations, e.g., limit the type of seaplane operations to mitigate the hazard

determination. Another mitigating alternative is the practice of lighting or/and marking evaluated obstructions to air navigation, which may preclude such an object from being determined as a hazard.

SECTION 3.2.6 WIND DATA

Recorded wind observations taken in the site's immediate vicinity over an extended period are the most desirable. When local comments are not available, data from a nearby locality or airport can be used. Keep in mind that wind data of this source may not be directly applicable to the site considered, as many on-site factors can change wind conditions considerably.

SECTION 3.2.7 WATER CURRENTS AND WATER-LEVEL VARIATIONS

WATER CURRENTS

It is recommended that the landing and take-off areas be located where the currents are less than 3 knots (5 mph). Landing and take-off operations can be conducted in water currents more than 6 knots, but any taxiing operation between the sea lane (or water operating area) and the shoreline facilities will usually require the assistance of a surface craft. Currents more than 3 knots cause generally some difficulty in handling seaplanes, particularly in slow taxiing mode. Locations of the following types should be avoided:

1) Where the currents exceed 6 knots (7.0 mph).
2) Where unusual water turbulence is caused by a sharp bend in a river, the confluence of two currents, or where tide rips are prevalent.

WATER LEVELS

As a general rule, if the change in water levels exceeds 18 inches, it will be necessary to utilize floating structures or moderately inclined beaching accommodations to facilitate the handling of seaplanes at the shoreline or waterfront. Where water-level variations are more than 6 feet, special or extended developments to accommodate seaplanes must be made.

SECTION 3.2.8 WATER SURFACE CONDITIONS

All water surface condition evaluations should include the height of wave action and the existence of floating debris. Open or unprotected water operating areas may become so rough under certain

conditions of winds and currents as to prohibit operations; hence, the varying water conditions at the proposed site must be investigated. The most desirable conditions exist where the water's surface is moderately disturbed, having ripples or waves approximately 3 to 6 inches in height. At the other extreme, smooth or dead calm water is undesirable because of the difficulty experienced in lifting the floats or pulling off the water during take-off. Lastly, the presence of floating debris must be determined. Areas in which there is an objectionable amount of trash for considerable periods should be avoided, or debris should be removed.

SECTION 3.2.9 SHELTERED ANCHORAGE AREAS

A sheltered area protected from winds and currents is recommended, mainly if overnight or unattended seaplane tie-ups are to be made at locations where sudden and sometimes unexpected storms or squalls develop.

SECTION 3.2.10 BOTTOM CONDITIONS

The type and condition of the bottom at the site of a proposed seaplane base can influence the arrangement of the various components thereof, the means of construction of the fixed structures, and the water operation areas to and from the shoreline.

SECTION 3.2.11 ENVIRONMENTAL FACTORS

In seeking approval to establish a seaplane base, the permitting authority may require environmental analysis. This evaluation should include an analysis of the proposal’s impact on water quality, wildlife, existing and proposed land use, noise, and historical/archaeological factors.

SECTION 3.3 STANDARD SPECIFICATIONS - SUITABLE AREA FOR SEAPLANE OPERATIONS

1) Location of water aerodrome- The proposed water aerodrome's location should be in protected water where security and operation of seaplanes can easily be monitored, and there should not be any obstructions in the flying funnels.
2) Dimensions of Floating Jetty – At least 7mX7m or as per the size of the aircraft.
3) Length of water runway - Approximately 2000-2500ft is required, which should be free of marine areas, fishing nets, corals, and boulders.
4) Depth of water- Not less than 1.5 Meters at any place of operation, which also includes a taxiway.
5) Height of waves - Not greater than 0.25 Meters.
6) Water Currents- Not more significant than 3 Kts.
7) Winds - Not greater than 20 Kts, upwind operations.
8) Distance of water aerodrome from servicing location/island - The distance of the water aerodrome from the servicing location/jetty should not be less than the width of 2 Wingspans of the seaplane.
9) Maritime movement in the vicinity- The maritime movement in the vicinity of the water aerodrome should be a bare minimum so as not to cause any obstruction/disorientation of the operation of the seaplane.
10) Bird Hazard - The bird activity at any given place cannot be controlled, however, all precautions are to be observed to keep the same to a bare minimum and a strict watch is to be maintained in order to ensure safe operations.
11) Mooring - The dimensions of jetties should normally be 7mX7m, with protective breakwater, clear entrance, and egress with no obstructions over 1M on the dock or within 8M of the docking side of the aircraft to enable wing clearance. In addition, a pontoon 4MX3MX1M height with rubberized edges, fenders, bollards, rope rails, and a boarding ramp needs to be provided with the jetty. The mooring site shall be equipped with the following equipment in the interest of passenger safety which is fastened to the floating platform. The life buoys shall be easily accessible for use in case of any eventuality:
    - → 01 Axe
    - → 30M Lifeline rope
    - → 01 Crowbar
    - → 01Fire Extinguisher

- → 01 Bucket
- → 01 Bolt cutter
- → 01 Tin sniper
- → 01 Harness Cutting tool
- → 01 Pair of gloves (fire resistant)
- → 01 First Aid kit
- → Lifebuoy

12) Beacon Flashing Beacon (white/yellow flashes of 22-30 fpm) should be installed in all locations to indicate the prohibited area so as to enable other marine movements to be outside this zone. The height of the beacon shall be 1M from the level of the platform and made of a frangible material. Besides this facility, a hotter/siren should also be installed to inform the marine movement regarding seaplane operation. The local fisheries and other agencies should be educated regarding this facility to eliminate ambiguity during operation. The above needs to be fine-tuned as per the local requirements.

13) Provision to be made for a Hooter/ Siren for cautioning fishing boats and people around jetty about taking off and landing of Aircraft.

SECTION 3.4 INFRASTRUCTURE REQUIREMENT

The essential public-use seaplane base will include:

1) A designated Water Lane (referred to as a sea lane)
2) A suitable water operating area, including identified approach and departure paths
3) Shore/Land Access

Considering the purpose of the Water Aerodrome, facilities for public use and cargo requirements, and facilities for seaplane operation are to be fulfilled.

Water Aerodrome facilities are classified by

1) Off-Shore Facilities

- Marked/Unmarked Water Lane (Air Strip)
- Taxi Channels
- Turning Basins
- Buoys
- Anchorage Area
- Fire and Rescue Boat

2) **Shoreline Facilities**
   - Docks
   - Pontoon
   - Gangways
   - Ramps
   - Floats
   - Barges (Floating or Fixed), etc.,

3) **On-Shore Facilities**

On Shore facilities are further classified as follows:

- Facilities for Aviation Operations
  - Ramp Connecting Terminal Building to Jetty
  - Fuelling Bowser
  - Service Apron
  - Aviation Catch area
  - Hanger
  - Administrative Building
- Public Facilities
  - Parking Area (Staff and Visitors)
  - Terminal Building
  - Entry Point
  - Public Concourse
  - Manager Office
  - Security Office
  - Check-In Gates
  - Baggage Screening and Handling Facility
  - Departure Lounge
  - Toilet facility (separate for Ladies and Gents) at all different sections
  - Sitting Arrangements
  - Surveillance Facility
  - Security Cabins & Gates
  - Security Aids
  - Assembly Area
  - Utility Area

- Amenities
  - Recreational Landscapes
  - Signages
  - Eateries
  - Shops
  - Taxi Booking Desk

CHAPTER 4 SERVICES REQUIRED AT WATER AERODROME

Considering the purpose of the Water Aerodrome, facilities for public use and cargo requirements, and facilities for seaplane operation are to be fulfilled.

Water Aerodrome facilities are classified by

1) Off-Shore Facilities
2) Shoreline Facilities
3) On-Shore Facilities

SECTION 4.1 OFF-SHORE FACILITIES

The basic offshore facilities include a sea lane, a taxi channel, and an anchorage area. The anchorage area is where pilots can use single-line anchors to secure their seaplanes to the bottom or mooring buoy anchoring sites that use permanently anchored mooring buoys.

In unconstrained open water, it may be tempting to establish much larger facilities than the facilities needed. Reasons for this may include accounting for varying winds/water conditions, uncertainty on aircraft types and performance, or accommodating potential future demand. It is essential to right-size the offshore facilities, considering aviation needs and the needs of other users.

SECTION 4.1.1 MARKED/UNMARKED WATER LANE

Many runway design standards apply to a water-based runway in concept, but because aircraft are operating on a water surface, distinguishing between the operational surfaces and the safety/clearance areas can be problematic.

1) Determining Length

The aircraft using the seaplane base is the driving factor in identifying take-off and landing length requirements. To determine the water lane length, identify the most demanding aircraft and size the water lane to accommodate their needs plus a safety buffer.

- If the seaplane base only serves visual approaches, the distance to the 50 feet obstacle will be 1,000 feet, based on a 20:1 visual approach and departure slope.

- If the seaplane base supports instrument approach procedures, the obstacle is assumed at 2,000 feet from the departure threshold based on a 40:1 instrument departure surface.

Typically, the take-off distance requirement is greater than the landing distance for seaplanes. Adjust the length for mean high monthly temperature and airport elevation. Refer to the Runway Length Requirement in AC 150/5300-13 to account for temperature and elevation.

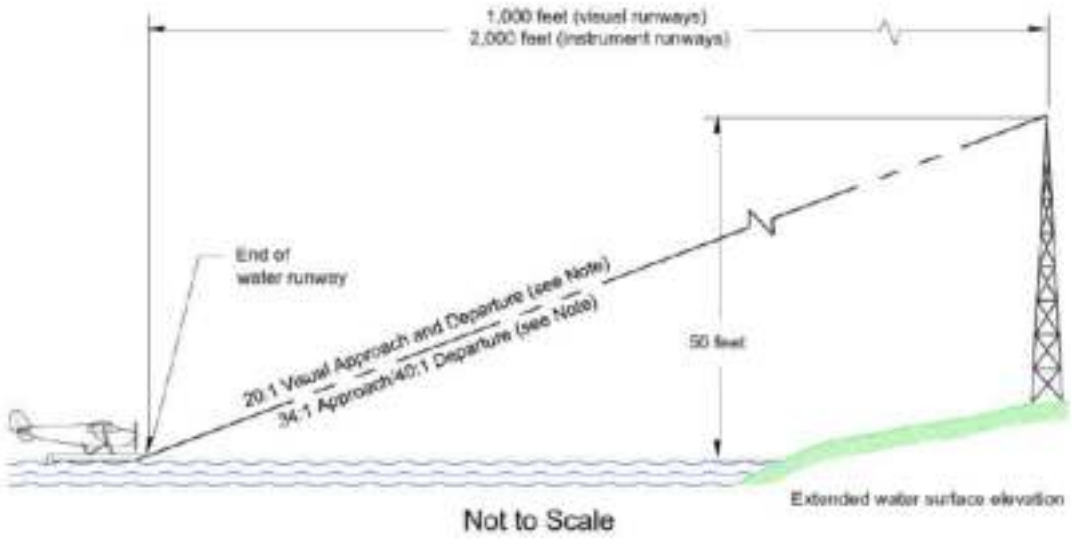


Figure 5 Water-based Runway Obstacle Clearance

2) Determining the Width

When there are no constraints on the width of the water lane, 200 feet wide is considered a reasonable minimum width for most seaplane bases. This width accommodates the water runway and runway safety area (RSA) for most seaplanes; accommodates variation in water and wind conditions to minimize effects on aircraft; and provides a safety buffer.

However, the 200-foot width does not include the runway Object Free Area (OFA).

(AC150/5300-13)

A wider water lane is necessary for areas where the prevailing wind or water currents vary, and 95% wind coverage cannot be achieved across a 200-foot water lane width. When necessary, increase the water lane width in a method similar to a land-based runway.

3) Determining Depth

The water operating areas should provide a minimum of four feet of depth; six feet is recommended.

In open water, the operating areas should be clear of underwater obstructions less than four feet below the low tide line. If not possible to avoid or remove the obstruction, it should be identified with a marker or buoy.

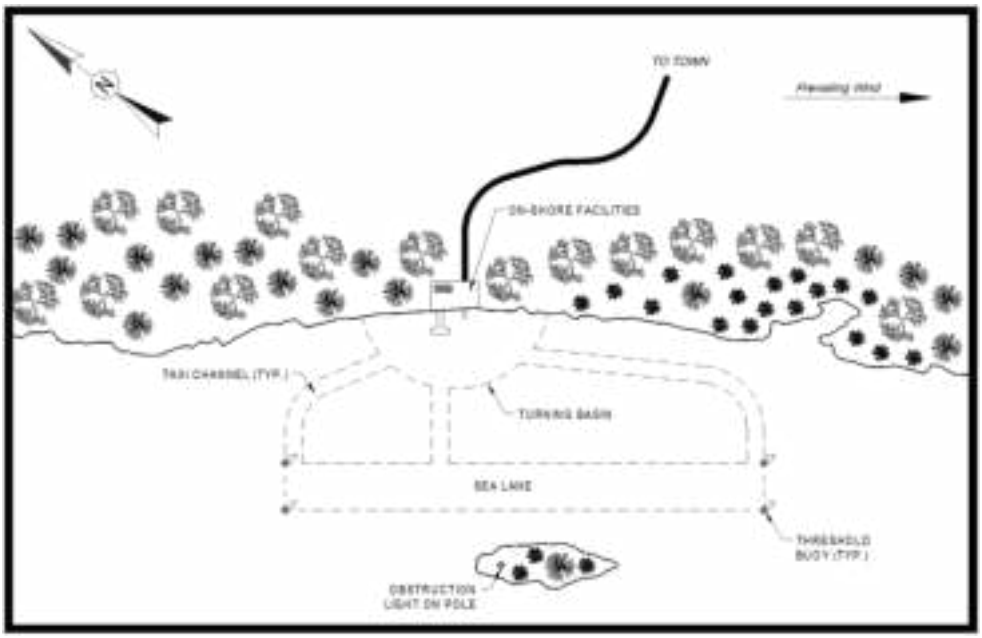


Figure 6 Example of a Marked Water Lane and Taxi Channel

SECTION 4.1.2 TAXI CHANNELS

A taxi channel is a basic, minimum facility of a seaplane base that allows adequate separation for water taxing, as shown in 7. The taxi channel provides direct access from the sea lane to the anchorage area and onshore facilities. The taxi channel should be oriented. The approach to the shoreline and onshore facilities, such as the anchorage area and ramp, and pier, will be into the prevailing wind or current. Dimensions are as follows:

- Minimum Width: 125 feet (recommend 150 feet)
- Minimum Depth: 4 feet
- Wingtip to Wingtip Clearance for passing seaplanes (dual-directional taxi channels): 50 feet

SECTION 4.1.3 TURNING BASINS

As shown in Figure, turning basins are extra wide water maneuvering areas to facilitate water taxiing, turn maneuvers, and accommodate periods of changing wind and current conditions.

A turning basin should offer seaplane pilots an extra-wide water taxi maneuvering area to enter/exit an anchorage area and facilities located on the shoreline, for example, ramps, piers, and hoisting equipment. For narrower, restricted sea lanes under 200 feet (60 m) in width, both ends of such restricted sea lanes should have turning basins of a minimum diameter of 200 feet (60 m).

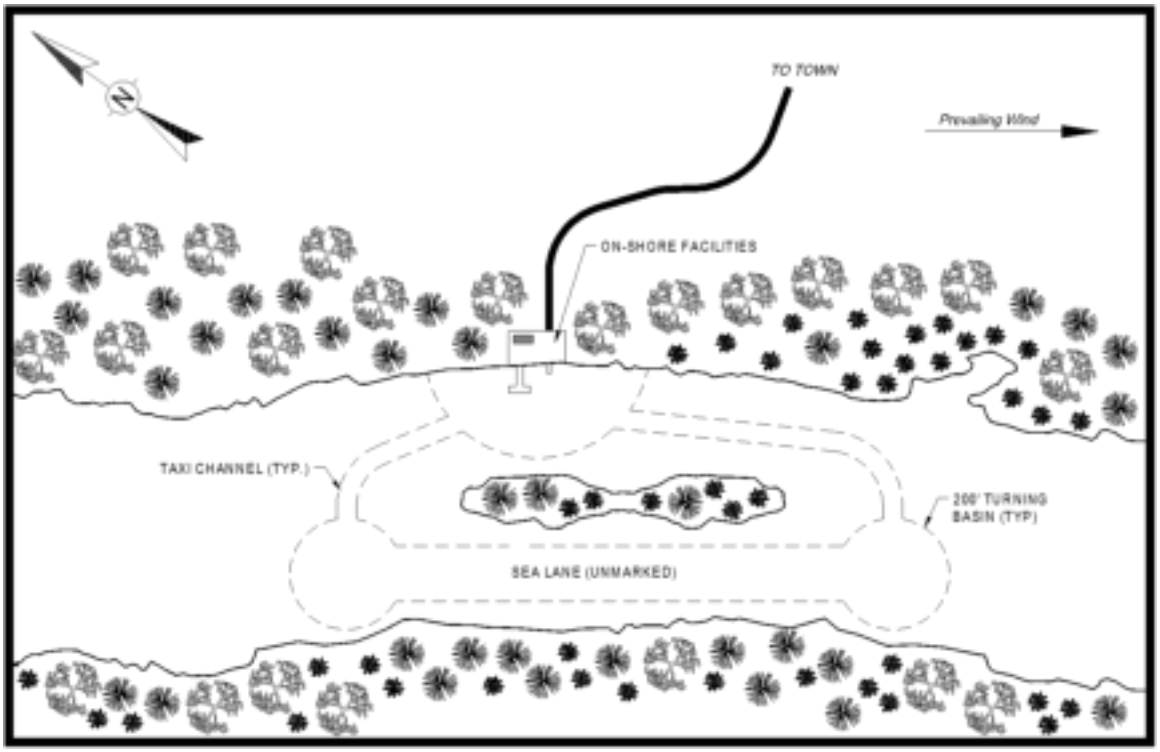


Figure 7 Example of a Constricted Sea Lane and Taxi Channel

SECTION 4.1.4 BUOYS

The installation of buoys may require coordination with multiple resources and government agencies, and tribal groups (if concerned). It is the responsibility of the seaplane base owner/operator to identify and coordinate with all applicable authorities, Central, State, or Local. Appendix C FAA AC for Seaplane Base provides a partial list of agencies with jurisdiction.

SECTION 4.1.5 ANCHORAGE AREAS

The basic seaplane base has a dedicated anchorage area along the shoreline for securing seaplanes. As shown in the Figure below, Anchoring is an easy, inexpensive way to ensure a seaplane is near the shoreline.

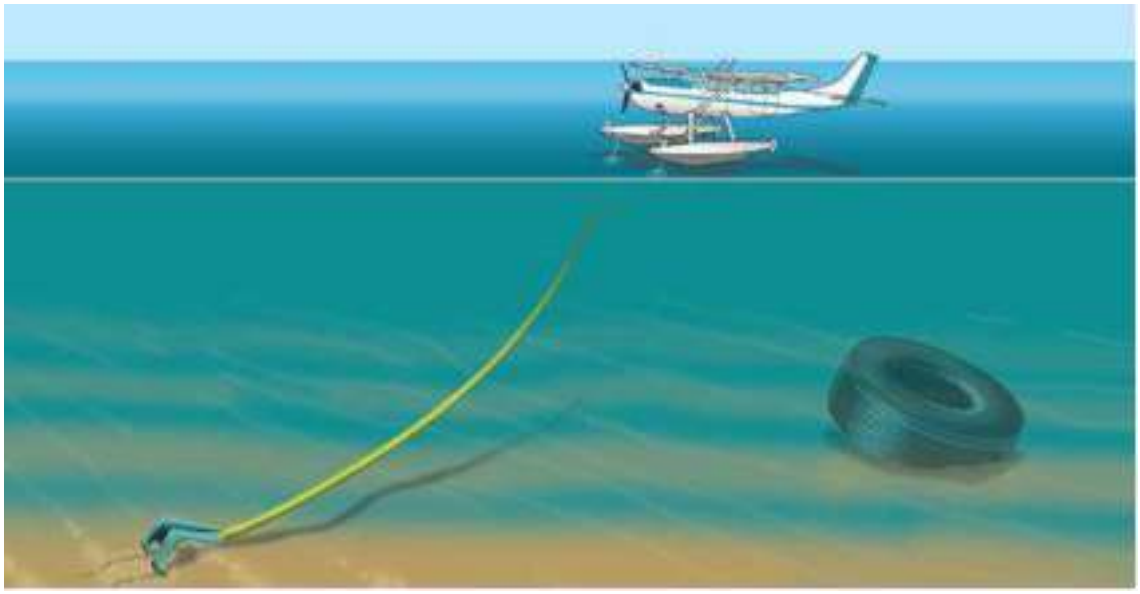


Figure 8 Anchoring (Single Anchor Line)

Figure 9Example of a Mooring Buoy Anchorage Area (Dual Anchor Line Plus Bridle)

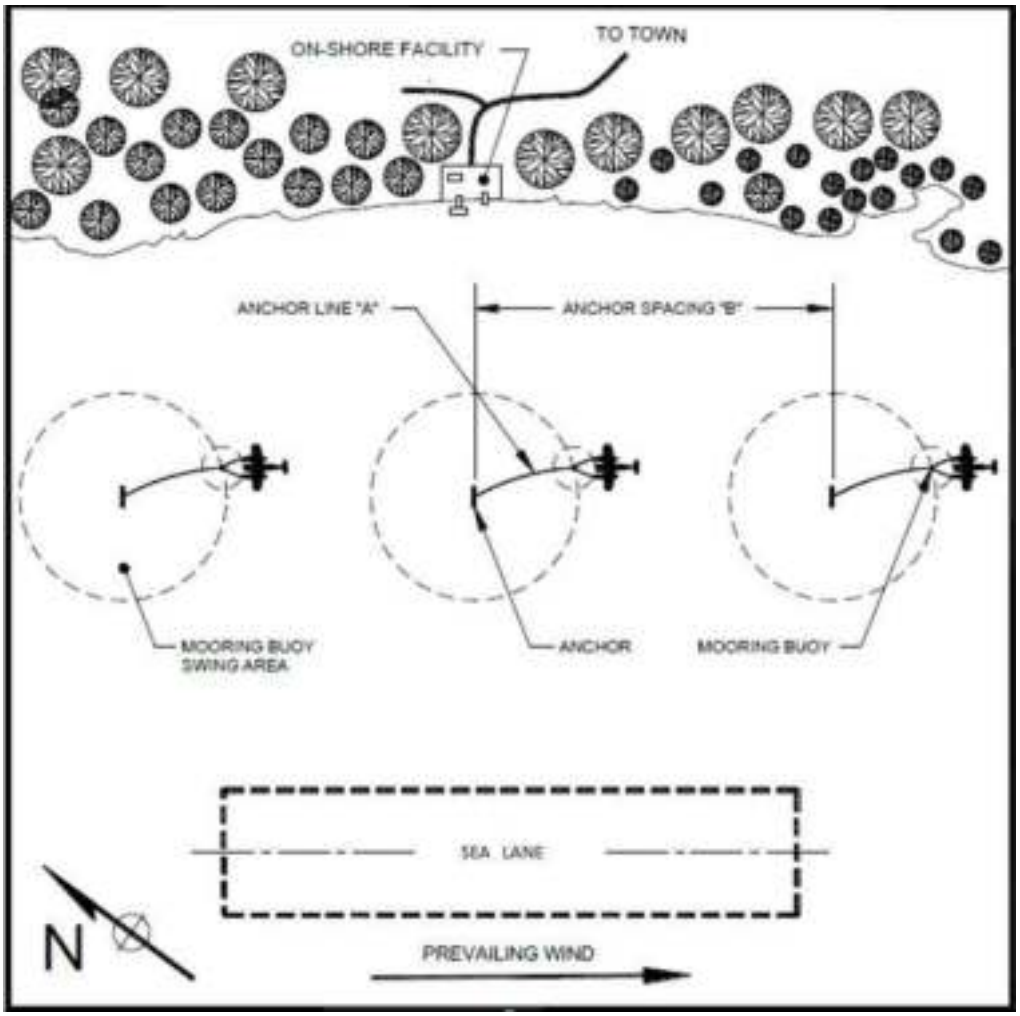


Figure 10Example of an Anchorage Area with Permanent Mooring Buoys Swing Areas

The anchorage area selected should be out of the way of moving vessels and in water deep enough that the seaplane will not be left aground during low tide.

SECTION 4.1.6 FOREIGN OBJECT DEBRIS REMOVAL BOAT

Generally, all the water bodies carry debris such as waste created by humans, wooden logs, garbage, and silt by erosion in the direction of flow. Where velocity gets minimized, all this debris material will be settled on the bed of the water body.

For Sea Plane operations, it is necessary to have clear water in & around the landing-take-off areas, and taxi channels. These water body areas should be free from debris or floating material etc. The floating material or debris settled on the bed will reduce the minimum water depth required for safe Sea Plane operations. Even such materials can damage the floats of Sea Planes or engines if the debris enters the engine.

Hence, before every take-off & landing of a Sea Plane, it is necessary to remove any debris or floating material from the Sea Plane's operational area. To remove this material, it is essential to have a debris removal boat at every Water Aerodrome. The size & capacity of this boat will depend upon the type & quantity of debris to be removed.

Figure 11 Typical Debris Removal Boat

SECTION 4.1.7 FIRE AND RESCUE BOAT

I. RESCUE & FIREFIGHTING VESSEL EQUIPPED WITH LIST OF EQUIPMENT

The following equipment shall be available in recovery and firefighting vessels:

1) Area Maps
2) Navigational Charts
3) Bailing Buckets
4) Water Pumps
5) Woolen Blankets (for passengers and crew)
6) Bullhorn(s)
7) Communication Equipment
8) Emergency Lights

9) Flares
10) Forcible Entry Tools
11) Marine Night Vision Binoculars
12) Life rafts (with paddles or oars)
13) Medical Kit
14) Navigational Equipment
15) Portable Resuscitation Equipment
16) Flood Lights (500 watts or greater)
17) Rescue Nets
18) Stretchers and Litters

II. RESCUE THROWING BAGS AND ANCHORS DETAILS OF FIREFIGHTING BOAT

Table 1 Details of Firefighting Boat

DESCRIPTION	NEW BUILD - 15m Firefighting Boat
LENGTH	17.3m (56ft 9in)
BEAM	4.92m (16ft)
DRAFT	0.83m (2ft 8in)

III. HIGHLIGHTED DESIGN FEATURES:

1) High speed in rough seas with superior acceleration and maneuverability.
2) Excellent sea keeping ability with very low slamming in all defined sea conditions for best crew comfort and safest operations.
3) Truly dry deck at all speeds with extremely excellent stability for coastal firefighting, patrol, and SAR operations.
4) The boat is heavily designed with two firefighting monitors, among which 1 x 840m3/hr Fifi Monitor to be installed on the forward deck and 1 x115m3/hr firefighting monitor on the roof of the pilothouse, providing 360 deg. of extremely high efficient firefighting service.

5) The bow is mounted with one 5" vertical and horizontal heavy-duty D section rubber on the push knee to provide safe boarding for survivor transfer from a large vessel and marine facilities that is on fire.

IV. GENERAL DESCRIPTION

This specification describes the design and construction of the proven reliable, rough sea-going 15M aluminum vessel which will be arranged as a fast coastal craft (hereafter referred to as "vessel") to use in coastal waters with equipment capacities to focus on below Operating missions:

1) Harbor and coastal patrol and interception.
2) Search and rescue operations in high sea waves. c. Rapid deployment for firefighting.
3) Offshore facilities protection and crew transfer.
4) Oil field security.

The vessel will be constructed to a high commercial standard with particular attention to minimizing noise transference and vibration while enhancing structural rigidity and offering the best crew comfort.

SECTION 4.2 SHORELINE FACILITIES

Shoreline facilities are partly on land and in the water. These installations perform two general functions:

1) Enable servicing, loading, unloading, handling, and tying-up facilities for seaplanes without removing them from the water, and

2) Provide hauling-out facilities for removing seaplanes from the water.

Facilities along the shoreline, which vary according to need and topography, range from a simple wood-plank ramps and floating decks to more elaborate piers, fixed docks, barges, and possibly marine rail. The types, size, and arrangement of these various facilities will be determined by the water and wind conditions, the topography of the land adjacent to the shoreline, the configuration and conditions of the bottom of the water operating area, and the number and type of seaplanes and amphibian airplanes to be moored, docked, or removed from the water.

SECTION 4.2.1 DOCKS

The term “dock” is often used as a catch-all term for any structure that can be used to secure watercraft (including floatplanes) to a fixed facility, either the shoreline or a structure affixed to the seabed/lakebed. These structures could be a dock, pier, wharf, or float.

A dock is a floating surface connected to land by some means, typically a ramp. It rises and falls with the water level. It remains in a relatively fixed position, either tied to a shoreline or the waterbed.

SECTION 4.2.2 WATER JETTY / FIXED PLATFORM

The dimensions proposed for single plane operation is **7m x 7m** in size and have to be made on floating material. The size of the jetty has to be extended three times if two seaplanes are in operation to keep a safe distance between the planes.

SECTION 4.2.3 GANGWAYS

Floating docks are commonly connected to the shore by a gangway offering flexibility in providing docking facilities shown in Figure. This type of facility rises and falls with wave actions, tides, and seasonal variations in water level.

Figure 12 Example of a Gangway

SECTION 4.2.4 RAMPS

A ramp, as shown in the Figures is a sloping platform extending well under the surface of the water that varies widely in size, shape, and construction materials, e.g., from rough logs to heavy-duty wood decks to concrete structures.

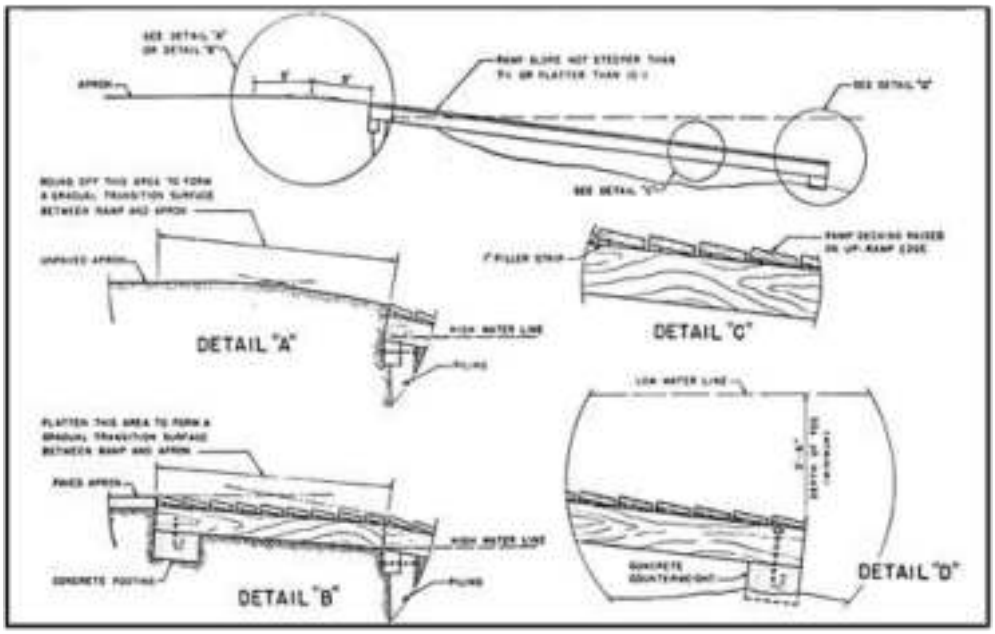


Figure 13 Ramp with Submerged Ramp Toe

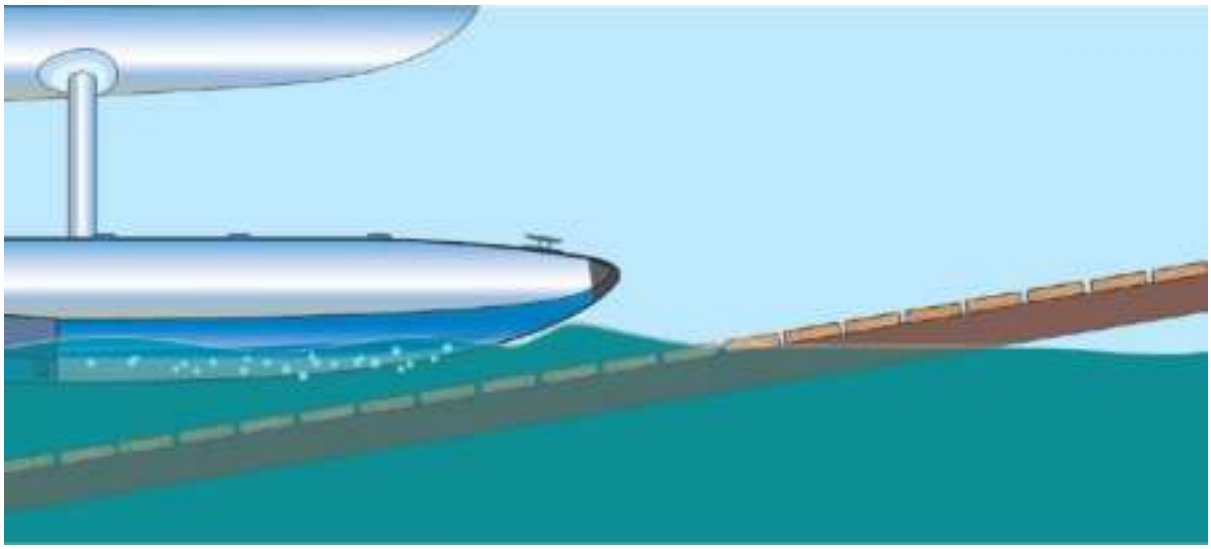


Figure 14 Illustration of a Submerged Ramp Toe

A typical ramp designed to accommodate seaplane floats is approximately 15 by 20 feet (5 m by 6 m) wide and extends into the water to allow seaplanes to be launched and retrieved easily. The ramp needs to be sized appropriately to accommodate the aircraft using it.

SECTION 4.2.5 FLOAT

A float is a floating surface not permanently affixed to the land. A seaplane docked at a float requires passengers and goods to be ferried to and from land. A float may be permanent or used seasonally and affixed to another structure such as a barge, pier or wharf. A float may be called a floating dock.

A float is a buoyant material or contrivance used to keep a floating dock or a float (definition a) buoyant remaining above the water's surface. Examples include Styrofoam blocks, empty barrels, logs, or inflated bladders.

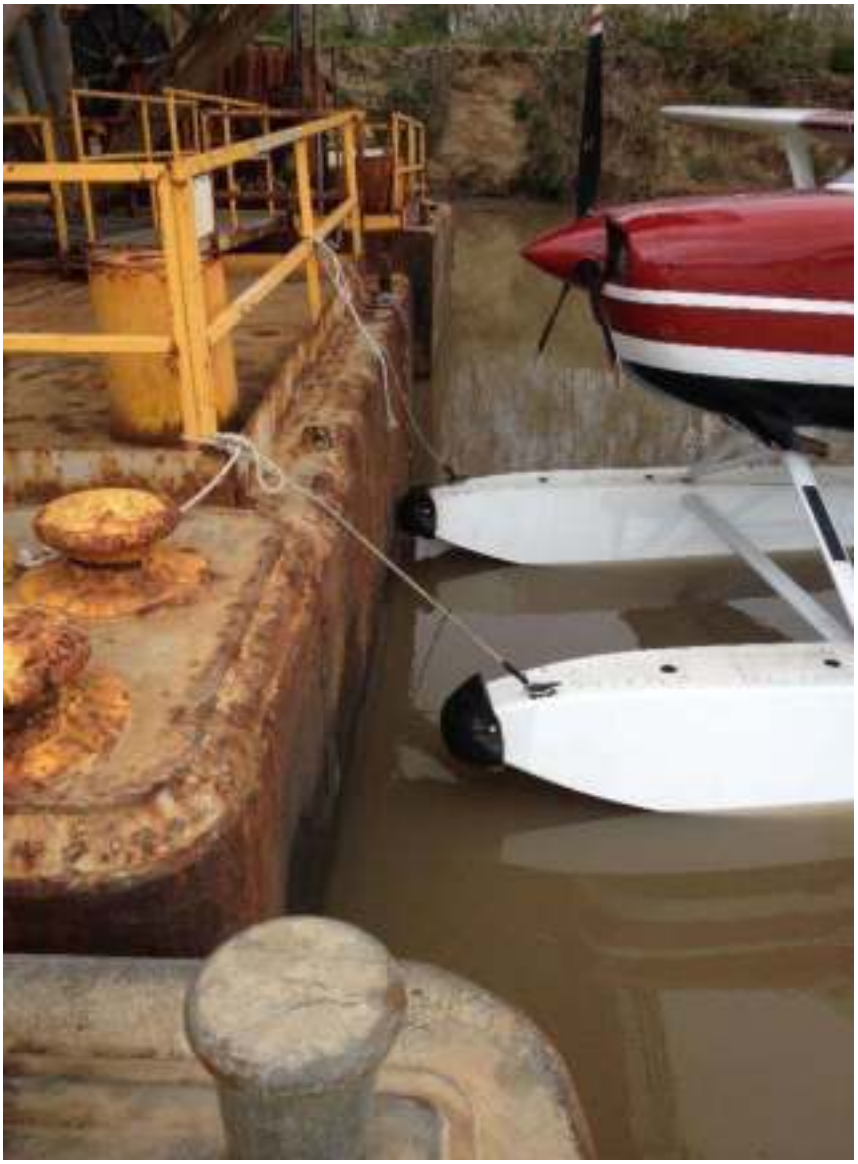


Figure 15 Example of Fixed Dock with Parking Ramps

SECTION 4.2.6 OPERATING SPACE BETWEEN SHORELINE FACILITIES

The desired clearances between the various docking and pier units, barges, and ramps decide their arrangement and location. Each of these units should be so located such that a seaplane may approach and tie up in anyone that a seaplane may approach and tie up in any of the available berths when adjacent units are occupied.

SECTION 4.2.7 NAVIGATIONAL CLEARANCE

The stronger the wind and current, the more room it takes to make a water turn. Hence under these conditions, a minimum clearance of 50 feet (15 m) should be provided between the side of the turning basin and the nearest object.

SECTION 4.3 ON-SHORE FACILITIES

A public-use seaplane base is recommended to conduct the following assessments before considering the installation of on-shore facilities. The addition of shoreline facilities ranges from simple aprons with tie-downs and public parking to moderate facilities that may include fueling, a hangar, a service repair shop, and a public building.

- Facilities for Aviation Operations
  - Ramp Connecting Terminal Building to Jetty
  - Fuelling Bowser
  - Service Apron
  - Aviation Catch area
  - Hanger
  - Hoisting Equipment
  - Administrative Building
- Public Facilities
  - Parking Area (Staff and Visitors)
  - Road Access & Roadway Planning
  - Restrooms
  - Terminal Building
  - Entry Point
  - Public Concourse
  - Manager Office

- Security Office
- Check-In Gates
- Baggage Screening and Handling Facility
- Departure Lounge
- Toilet facility (separate for Ladies and Gents) at all different sections
- Sitting Arrangements
- Administrative Building
- Security Cabins & Gateways
- Security Aids
- Assembly Area

- Amenities
  - Recreational Landscapes
  - Signages
  - Eateries
  - Shops
  - Taxi Booking Desk

The needs of the seaplane users will determine if and what types of onshore facilities are necessary at a public seaplane base. Public onshore facilities commonly include a service apron with storage/tiedown areas, marine fueling, basic public facilities (restrooms/chemical toilets, public parking), and possibly a marine store or hangar, a building serving the public common area, and/or an administrative building.

SECTION 4.3.1 PATHWAY / WATERWAY

The pathway leading to Water Jetty keeping low tide & high tide levels in mind is to be provided for reaching up to the seaplane. The said pathway can be on fixed cc pillars or floating type. Railings are to be provided on both sides of the path for safety purposes.

SECTION 4.3.2 FUELING BOWSER

Where aviation fuel is provided at a public seaplane base, care must be taken to ensure that the storage and delivery systems are safe and that precautions are taken to minimize the possibility of spills and the resulting adverse environmental effects of a fuel spillage.

SECTION 4.3.3 SERVICE APRON & AVIATION CATCH AREA

These features will occupy more space than any other onshore installations.

The desirable location is near ramps or where hoisted seaplanes onto the land have a short, direct route to the service apron and tiedown areas with minimum taxing conflicts with other seaplane movements.

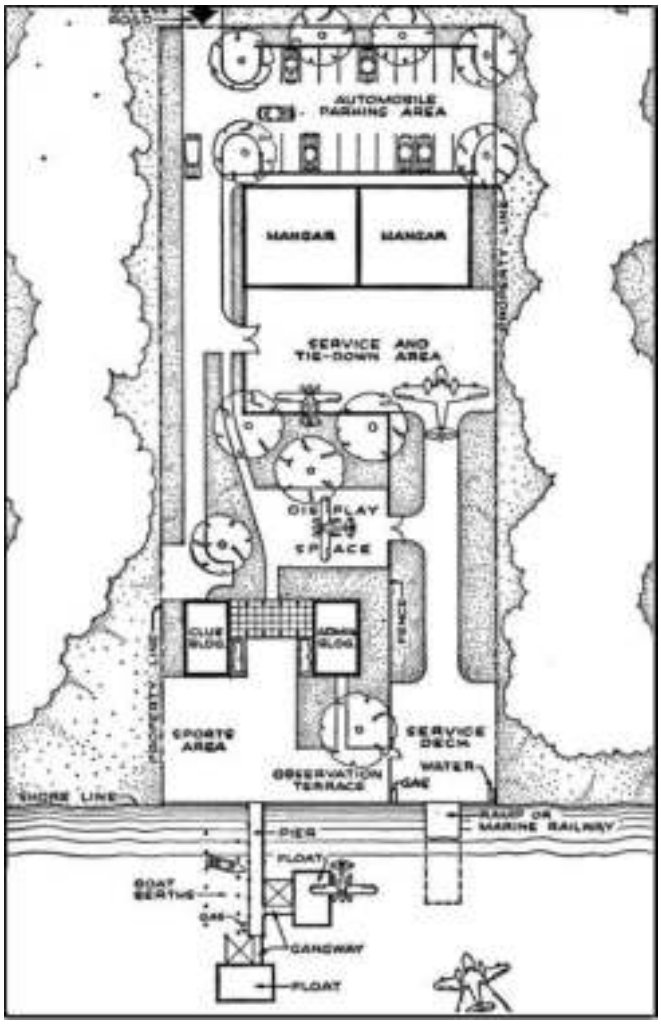


Figure 16 Illustration of a Seaplane Base with Various Capital Improvements

SECTION 4.3.4 HANGARS

Many standard hangars used for land-based aircraft are adaptable for use by waterborne aircraft Hangars should be functional and orderly. That is, determine how seaplanes using ramps or being hoisted onto the land can directly route to the hangar without interfering with tiedown areas, or any common public areas, and eliminate as much as possible taxing conflicts with other seaplane movements. The objective is to avoid the relocation of parked seaplanes. Both

storage and repair hangars should likewise be located so that delivery of materials and access by service personnel will not conflict with seaplane movements.

The space required for service hangars will depend upon the number and the type of aircraft to be accommodated. Sufficient additional space needs to be provided for taxiing, turning, and temporarily parking seaplanes.

SECTION 4.3.5 HOISTING EQUIPMENT

Types of hoisting equipment and their use vary with the operating needs of the individual site. They are frequently needed where a public use seaplane base is developed along a high seawall, bulkhead, or steep shoreline.

SECTION 4.3.6 ADMINISTRATION BUILDING AND COMMON PUBLIC AREA

A small, simply seaplane bases, a hangar can be used for seaplane services and an office. At larger seaplane bases, a separate administration building may be required to provide adequate space for the manager's office, passenger and pilot's lounge, display space, restaurant, snack bar, and observation deck. It is desirable to employ an uncomplicated, functional design that can adequately respond to the administrative needs of the facility. The location should be in a prominent position on the site, readily accessible to seaplane arrivals as well as to customers and visitors arriving from the surrounding community. Visibility of the water area from the administration building is another desirable feature. This condition is especially true when visibility of the operating water area from the administration building may be required for the control of seaplanes at locations where traffic in and out requires two-way radio communications.

SECTION 4.3.7 PARKING AREAS

Functionally, the parking area should be located for safe, convenient access to the various onshore and shoreline facilities. Hence, a parking area for cars, including handicapped spaces, and other transport must be made.

SECTION 4.3.8 ROAD ACCESS & ROADWAY PLANNING

Vehicular circulation must be provided for the public, service personnel, deliveries of gasoline, oil, fuel, and refuse removal. These routes will influence walks and interior road access. The

interior road access to the seaplane base (administration building and public areas) should be by an all-weather road. It is recommended that the seaplane base layout plan reflect the access road connection to a main highway or street.

The access or entrance road should have adequate width, serve the anticipated traffic, and permit safe and easy circulation throughout the landside of the facility.

- **Service Roadways**

A public highway should never be part of the internal road system of a seaplane base. Vehicular through vehicles, deliveries of gasoline, oil, fuel, and refuse removal, a limited-use access service roadway is needed. These limited use access roadways should be marked and controlled by devices such as removable posts or chains located at the entrance to the areas of aeronautical activity. Also, they serve to permit authorized access and provide circulation routes for emergencies.

SECTION 4.3.9 TERMINAL BUILDING

The terminal station/ building is to be designed keeping the passenger load in mind. At present, it is proposed that a building with a minimum 20 passenger capacity be taken into consideration which can cater passenger load of two seaplanes of 09-seater capacity or a single plane of 19-seater capacity at a time. This building shall also be constructed of steel with a glass facade and aluminum sheets.

A terminal station/ building can be divided into four parts in order of sequence:

ENTRY POINT

In this area, the Security Check of passengers shall be dealt with by Security with an X-Ray machine for baggage screening. Office of Terminal Manager and Security In charge. Toilets for Ladies and Gents. Chairs for minimum of 20 passengers. Provision for a small shop can also be made.

DEPARTURE LOUNGE

Departure Lounge with seating capacity for minimum of 20 passengers. Provision for small shops and toilets is proposed.

ARRIVAL LOUNGE

Arrival Lounge is also proposed with toilets. The baggage area is earmarked separately, with seating chairs for 8 to 10 passengers.

ARRIVAL LOUNGE AMENITIES

This section shall be utilized for Shops/Offices of Sea-Plane operators, Tourism Department Offices, Resort Owners Booking Counter, Transporter, etc. This can be allocated for revenue generation.

SECTION 4.3.10 SECURITY AIDS

Procedures for security check of passengers and their hand baggage inside the terminal building and the procedure for checking the entry of passengers, visitors and other pre boarding anti hijacking check should be formulated in accordance with the standards and recommended practices of Annex 17 of ICAO and the instructions of the BCAS and Home Ministry Circulars.

Arrangements for guarding or protecting the vital installations at the Water Aerodrome serving the ATC Services and other Navigation and Landing Aids. Security coverage shall be in accordance with ICAO requirements as well as that of Ministry of Home Affairs.

Key facilities:

i. System of checking the entry of passenger and visitors inside the terminal building.

ii. Provision of anti-hijacking control room and facilities provided therein.

iii. Availability of.

a) Handheld metal detectors

b) Door frame metal detector

c) X-Ray machine/ manual for screening hand baggage and the Checked in baggage

d) Dog squad

e) Bomb disposal unit

f) Isolation bay

g) Cooling Pit

SECTION 4.3.11 OUTDOOR SPACE/LANDSCAPES

It is desirable to reserve an outdoor space immediately adjacent to the administration building for public use and for recreational type purposes. This outdoor space may consist of a small lawn or paved terrace, preferably overlooking the shoreline and suitable for informal gatherings, outdoor picking tables. Any common public use area should be physically separated from the aeronautical activity area and/or areas used for fueling or storage of flammable materials.

SECTION 4.3.12 AMENITIES

It is also most desirable to provide general amenities across the premises, such as

- Signages
- VIP Lounge
- Eateries
- Shops
- Taxi Booking Desk

CHAPTER 5 PHYSICAL CHARACTERISTICS – WATER AERODROME

SECTION 5.1 UNITS OF MEASUREMENT

Except as specified, units of measurement shall be as follows and the same shall be included in the Water aerodrome Operations

Manual:

a) Elevations to the nearest meter.

b) Linear dimensions to the nearest one-half meter.

c) Geographic coordinates in latitude and longitude to the nearest second.

d) Geographic co-ordinates measured in accordance with WGS 84

reference datum.

e) Bearings given to the nearest degree.

f) Water depth to the nearest meter to the nearest decimal; and

g) Range of tides or water levels to the nearest meter to the nearest decimal.

SECTION 5.2 REFERENCE POINT

The water aerodrome reference point (WRP) should be located at the planned geometric center of the maneuvering area, or of the main one if more than one is provided.

SECTION 5.3 REFERENCE ELEVATIONS

A Water aerodrome Reference Elevation (WRE) should be determined at the WRP. This elevation should be determined from the Chart Height, or the lowest recorded water level, converted to an elevation in meters above Means Sea Level.

SECTION 5.4 MOVEMENT AREA FOR WATER AERODROME

a) License holder shall determine the area of any land and water on which seaplane operations may take place. This area will be designated as movement area (WA).

b) Water runway and runway strip

The movement/landing area (WA) should be rectangular in shape and should encompass all parts of the water surface intended for the taking off and landing operations.

The following Water Aerodrome dimensions shall be available for the landing area (WA).

I. The dimension of the landing area (WA) (Runway) shall be a minimum 800m X 60m.

II. The dimension of the landing area (WA) including the strip shall not be less than 920m X 120m; and

III. The water depth in the take-off and landing area (WA) shall not be less than 1.8m unless the airport is restricted to aircraft requiring less than 1.8m, in which case the depth of the water shall be based on the requirements of the aircraft type.

c) Taxiways

I. To permit safe and expeditious surface movement of aircraft, taxiways should be provided where required.

II. The width of taxiways shall not be less than 45 meters.

III. The depth of taxiways shall not be less than 1.2 m (4 ft).

d) Apron

Facilities to emplane and deplane passengers, Baggage and Cargo shall be provided in the form of a dock, ramp or beach, and a floating platform shall be based on the requirements of the seaplanes using the Water Aerodrome.

I. Where a dock is provided, It shall.

- It should be designed in such a way as to provide a safe clearance between an aircraft wing and any object the dock which could come in contact with.
- It should permit constant use without injury to persons or damage to aircraft.
- Where applicable, be attached or anchored in a manner that prevents it from shifting position or becoming detached.
- It should have access from the shore that provides the safe movement of persons using the facility.
- Should have enough tie-down points at each aircraft parking position to secure aircraft in Position; and

- When an aircraft is usually secured in a position where any aircraft propeller overhangs the dock and constitutes a hazard to the movement of persons using the facilities, the hazard shall be clearly indicated.

II. Where a ramp or beach is provided, it shall.

- Should be at least 1.5 times the width of floats or landing gear of the largest seaplane intended to use the facility.
- be designed in such a manner as to provide a safe clearance between an aircraft and any object it could come in contact with, and
- be designed for the seaplane using the facility.

III. Where a Floating Platform is provided, it shall

- provide adequate support and buoyancy for the loads imposed by embarking/disembarking passengers and their luggage.
- Be properly anchored so as to prevent it from shifting from its position or becoming detached.

SECTION 5.5 OBSTACLE LIMITATION SURFACES (OLS)

Obstacle limitation Surfaces of the Water Aerodrome shall correspond to the dimensions for land-based runway code numbers 1, 2 and 3, respectively, as given in ICAO, Annex 14 Volume I Table 4-1/ GSR 751.

SECTION 5.6 VISUAL AIDS

SECTION 5.6.1 WIND INDICATORS

- A wind direction indicator shall be installed of a conspicuous colours and in the form of a truncated cone.
- The wind direction indicator shall be visible from any portion of the movement area & from a height of 1000 feet above the indicator.

SECTION 5.6.2 MARKER BUOYS

Marker buoys shall be visible to landing aircraft from a height of 300m and maneuver aircraft in any part of the movement area (WA).

SECTION 5.6.3 TAKE-OFF AND LANDING AREA (WA) MARKERS

I. Where there is no conflict with marine traffic or marine regulations.

a) With the help of floating markers, both ends of the take-off and landing area (WA) shall be marked.

b) The markers shall be visible from a distance not less than 5 nautical miles.

c) Each marker shall be

I. Colored International orange and white; or

II. Alternating international orange and white

III. Where it is impracticable to mark the take-off/ landing area (WA) as specified in

1. Guidance such as geographical points and other visual references shall be provided to designate the take-off and landing area (WA); and

2. These visual references shall be identified and published.

SECTION 5.6.4 STROBE LIGHTS / BEACON LIGHTS

For floating platforms located outside the house reef and in open waters, strobe lights/beacon lights shall be installed; it shall be:

I. White or coloured flashes shall be yellow and white.

II. Total flashes shall be between 20 to 30 flashes per minute.

III. It should be in an area that is quickly and constantly visible by both marine and air traffic; And

IV. Radio activated or activated by the Water Aerodrome operator or designated agency.

V. Beacon lights shall be installed on the floating platforms on the outer reef, and its height shall not be one (1) meter from the level of the forum. The beacon and its fixing strut shall be made from a frangible material. The beacon shall be 'ON' from dusk to dawn or as approved in Water Aerodrome Operation Manual.

SECTION 5.6.5 HAZARDOUS AREAS

when the aircraft is docked to the floating platform Danger zone on the platform underneath the Aircraft wing shall be marked with a "DANGER" sign and painted alternating international orange and white.

I. Marker buoys shall indicate the hazardous area where shoals or other hazards could endanger a seaplane.

II. Marker buoys for delineating hazardous areas shall be coloured international orange.

III. Diagonal stripes restrict passengers from the docking area until aircraft propellers have completely stopped.

SECTION 5.7 PASSENGER TRANSFER VESSEL (PTV)

a) Suppose floating platforms are provided for emplaning and deplaning passengers. In that case, the water aerodrome operator shall give a mechanized transfer vessel available for transferring passengers to and from the floating platforms to the shore.

b) The water aerodrome operator shall ensure that instructions are given to the PTV drivers about the direction of the water runway, the aircraft's movements for taxi, and the specific time of its arrival.

SECTION 5.8 RESCUE AND FIRE FIGHTING SERVICES (RFFS)

a) The RFFS should be available from a minimum of 15 minutes before till 15 minutes after the times published at a water Aerodrome where the hours of operation are notified. Where the hours of operation are not reported, the RFFS should be available before the engine start of the first departing seaplane or to the first arriving seaplane commencing its final approach; and until the last arrival is moored, or 15 minutes after take-off of the final seaplane whichever is later.

b) Initial and recurrent competence-based training relevant to their role and task shall be given to the RFFS personnel. It shall at all-time be physically capable of performing the functions expected.

c) Procedures for the enhancement of passenger and crew post-accident survival should be developed. Facilities should be provided in terms of staff and equipment appropriate to the type

of seaplane operations anticipated at the Water Aerodrome. Within the provision of these procedures and facilities, account should be taken of the effect that variable environmental conditions might have on the ability of the rescue staff to respond rapidly to accidents and incidents.

d) A rescue vessel should be of a design and size that would allow survivors to be brought aboard & it should be equipped with an adequate number of floatation devices of a design that would enable survivors to remove themselves from the water.

e) All vessels shall be at least 200 m away from the floating platform when the seaplane is about to land or ready for take-off.

f) The level of protection provided at a Water Aerodrome for rescue and firefighting shall be appropriate to the Water Aerodrome using principles in paragraphs 9.2.4 and 9.2.5 of CAR Section 4 Series B Part I.

g) Types of extinguishing agents and the amount of water for foam production and complimentary agents shall be provided on the rescue and firefighting vessel/(s) by the Water Aerodrome category determined under Table 9-1 and Table 9-2 of CAR Section 4 Series B Part I.

h) A proper communication system shall be provided linking the Water Aerodrome fire station, control tower, fire and rescue vessel/(s), fire and rescue vehicles and any other fire station.

i) An alternate system for rescue and fire-fighting personnel, capable of being operated by that station, shall be provided at a fire station.

SECTION 5.9 RESPONSE TIME

Response Time' is the time between the initial contact with the Rescue and Fire Fighting Services (RFFS) and the first practical action at the accident site by a rescue and firefighting vessel.

For water aerodromes within the house reef, the operational objective of the RFFS shall be to achieve a response time not exceeding three (03) minutes to any point of each operational water runway in optimum visibility and surface conditions.

As per ICAO, response time is **2 min** for runway and taxiway area and **3 min** for an operational area, including an apron.

The following equipment shall be available in rescue and firefighting vessels:

1) Area Maps
2) Navigational Charts
3) Bailing Buckets
4) Bullhorn(s)
5) Forcible Entry Tools
6) Marine Night Vision Binoculars
7) Water Pumps
8) Wool Blankets (for passengers and crew)
9) Life rafts (with paddles or oars)
10) Medical Kit
11) Communication Equipment
12) Emergency Lights
13) Flares
14) Navigational Equipment
15) Portable Resuscitation Equipment
16) Rescue Nets
17) Flood Lights (500 watts or greater)
18) Stretchers and Litters
19) Rescue Throwing Bags and Anchors

SECTION 5.10 ARRANGEMENT WITH AIR TRAFFIC SERVICES

The Water Aerodrome will fall within the jurisdiction of an ATS unit. An applicant for the Water Aerodrome to be licensed shall, in coordination with AAI, establish a procedure for the provision of Advisory or Flight Information services. Where the Water Aerodrome is situated within the control zone of an Aerodrome, the procedure of the controlling ATS shall be followed.

SECTION 5.11 GENERAL ADOPTIONS

a) In the design of the Water Aerodrome, Architectural and Infrastructure related requirements for the optimal implementation of security requirements shall be integrated as per the Bureau of Civil Aviation Security (BCAS) guidelines issued in this regard from time to time.

b) GCA may do inspections of the water aerodromes during the construction period if required to assess the progress, quality assurance system and security adopted by the applicant. A final inspection will be done after the applicant gives the completion report and makes a request for licensing of the water aerodrome.

c) The Water Aerodrome operator shall conduct inspections regularly to check the underwater and above water structural conditions of platforms, docks and ramps, including the safety equipment provided. Records of such inspections shall be maintained and made available for review by Regulatory Authority.

d) The following safety equipment shall be readily available on the floating platforms, dock and ramps:

a) 30 m lifeline ropes – adequate to cater for the number of seaplanes docking positions

b) Life Rings - adequate to cater for the number of seaplanes docking positions

c) Fire extinguishers – 1 for each seaplane docking.

Note: The objectives of emergency planning outlined in CAR SEC4 Series B Part I Chapter 9, Additional guidance on seaplane ICAO Airport Services Manual (Doc 9137) Part.7

CHAPTER 6 SITE SELECTION

The seven States in the North-East part of India are called the 'Seven Sisters'. Both Assam and Meghalaya are part of North-Eastern States.

Assam is, situated south of the eastern Himalayas range at the bank of mighty river Brahmaputra. Assam covers an area of 78,438 Sq. Km. It's State Capital Guwahati is well connected with rest of India by rail, road and air. For its reach of flora and fauna the State has great tourism potential which remains untapped.

In Meghalaya, tourist inflow has doubled in the past 10-years and the number is increasing at a rapid rate. The primary reason is the improved internal security within the state. Tourist inflow, both domestic and international, has increased from 4.04 lakh in 2006 to 8.39 lakh till last year, according to statistics from the tourism department. During the same period, the foreign tourist has increased from four thousand to nearly 8500 till December last year. At this rate, the number of tourists will double in the next 7–8 years. The state government has also increased investment under the tourism mission and implemented several schemes.

Figure 17 Area of interest as given in NIT

Once after mobilization of resources and adopting reconnaissance survey for the site area, we have made observations as following:

- → Location is adjoining the road and has good connectivity.
- → Required flat terrain to develop the Terminal building is not available
- → To develop the Terminal building, Ground development to be taken up with large extent of Earth work and huge retaining structure.
- → Connectivity of the Developed terminal with the floating jetty / pontoon for the seaplane will also be a concern.

A per the tender Proposed coordinates for the terminal building are 26°11'55.52" N, 91°46'17.67" N. We have visited the site and as per the site condition this location needs high amount of earth work development. Few site photos are attached for reference.

To check the alternative location, we visited the nearby locations which can be more feasible for the Terminal Building. We found a location near Water Treatment Plant, which may be a good alternative for the Terminal Building location. Images for the location are attached below for reference.

Figure 18 Location of Proposed Terminal Building location by NETRA

SECTION 6.1 SITE INFORMATION

A reconnaissance survey has been carried out with our team of experts and engineers, prior to start of bathymetry survey, which was conducted at the proposed site location.

Name of River: Brahmaputra (Guwahati, Assam)

Proposed Terminal Building Location as per NIT: 26°11'55.52" N, 91°46'17.67" N

Total Length of River: 3848 km

Figure 19 Site Visit Prior Starting of Bathymetric Survey

SECTION 6.2 GEOTECHNICAL INVESTIGATION

Geotechnical Investigation carried out for the proposed site and report has been attached as an Annexure-1.

SECTION 6.3 BATHYMETRY SURVEY

The scope of work covers the bathymetric survey and hydrological observations at par with IHO Standards S-44, 5th edition, Special Order Surveys. The detailed bathymetric survey is to be carried out by using Automated Hydrographic Survey System (using digital Echo measurement, DGPS Receivers for position fixing and sounder for depth Hypack or equivalent software for data logging& processing), to achieve the desired S-44 accuracies.

This document covers the general procedures adopted for the Bathymetric Survey and hydrological observations. We have ensured to use the methodology which is suitable and complying to the TOR guidelines.

We have covered the details of survey equipment calibration used for the survey.

NETRA deployed experienced team to undertake the bathymetric survey. The persons deployed on site included Survey Party Chief who worked closely with Client and their representatives. All acquired survey data was processed and final drawings are prepared for submission.

SECTION 6.3.1 LIST OF EQUIPMENT

SECTION 6.3.1.1 BOAT FOR BATHYMETRY SURVEY

A boat powered with diesel engine was deployed to perform all the bathymetric survey operations and take the hydrographic observations. The boat with shallow draft and enough space for a team of around 10 persons who can easily operate and undertake the survey activities with all the equipment, power back up system and safety PPEs.

Figure 20 SURVEY VESSEL DEPLOYED ON SITE

SECTION 6.3.1.2 DIFFERNTIAL GLOBAL POSITIONING SYSTEM

GCPs are fixed using RTK DGPS in fix mode using UHF Radio Modem with IHO accuracy standards. Positioning during survey works shall be provided using Trimble SPS356 or equivalent Differential Global Positioning Systems (DGPS). Satellite-Based Augmentation System (SBAS) correct the coded raw pseudo ranges received from selected GPS satellites not less than 12, to mobile receiver(s). The mobile receiver(s) apply these corrections to their own observed satellite pseudo ranges and so obtain the corrected pseudo ranges to be used for the position computations. The positions derived by the DGPS receiver are calculated in WGS84 spheroid and since the entire project work is based on WGS-84 spheroid, can be directly converted to UTM coordinates using map projections (Geodetic parameters and reference levels), with sub-meter accuracies.

The position of soundings, dangers, other significant submerged features, nav- aids (fixed and floating), features significant to navigation, the coastline and topographical features will be determined as per the requirements specified in S-44.

Table 2 List of GCP established

Point ID	North(m)	East(m)	Height(m)
PGCP	2898066.373	375907.871	48.9345
SGCP-A	2899227.691	374915.662	84.6937
SGCP-B	2899576.739	374131.333	54.4198
SGCP-C	2901764.324	374107.746	56.3167
SGCP-D	2902837.232	374868.053	53.7119
SGCP-E	2903153.279	376471.731	49.6748
SGCP-F	2898771.373	379097.914	57.0288
SGCP-G	2898509.420	378207.077	70.9272
SGCP-H	2898258.190	377214.775	53.0934
SGCP-I	2898294.497	376403.818	73.1328

SECTION 6.3.1.3 AUTO LEVEL

The site was be equipped with an Auto Level instrument, Sokkia B40. The Level instrument is required to control measurements and for accurate transfer of benchmark heights.

Figure 21 Auto level – Sokkia B40

SECTION 6.3.1.4 SINGLE BEAM ECHO-SOUNDER

The measured depths and drying heights shall be referenced to a vertical datum, i.e., the chart datum, which will be clearly referenced to the Mean Sea Level. Standard method will be adopted for transfer of datum in rivers/canals. For tidal reaches, standard transfer of datum as per Admiralty Manual will be adopted. Sounding datum already established by Port Authorities (Chart Datum), Central Water Commission / State Irrigation Department / Dam Authorities and at their gauge stations along the river/canal / reservoir will be accepted.

Figure 22 Single Beam Echo Sounder

SECTION 6.3.1.5 AUTOMATIC DATA ACQUISITION SOFTWARE (HYPACK)

All bathymetric data collected will be logged directly to the survey computer system (i.e., Hypack Software) with event marks, generated by the internal annotator, recorded on the analogue record.

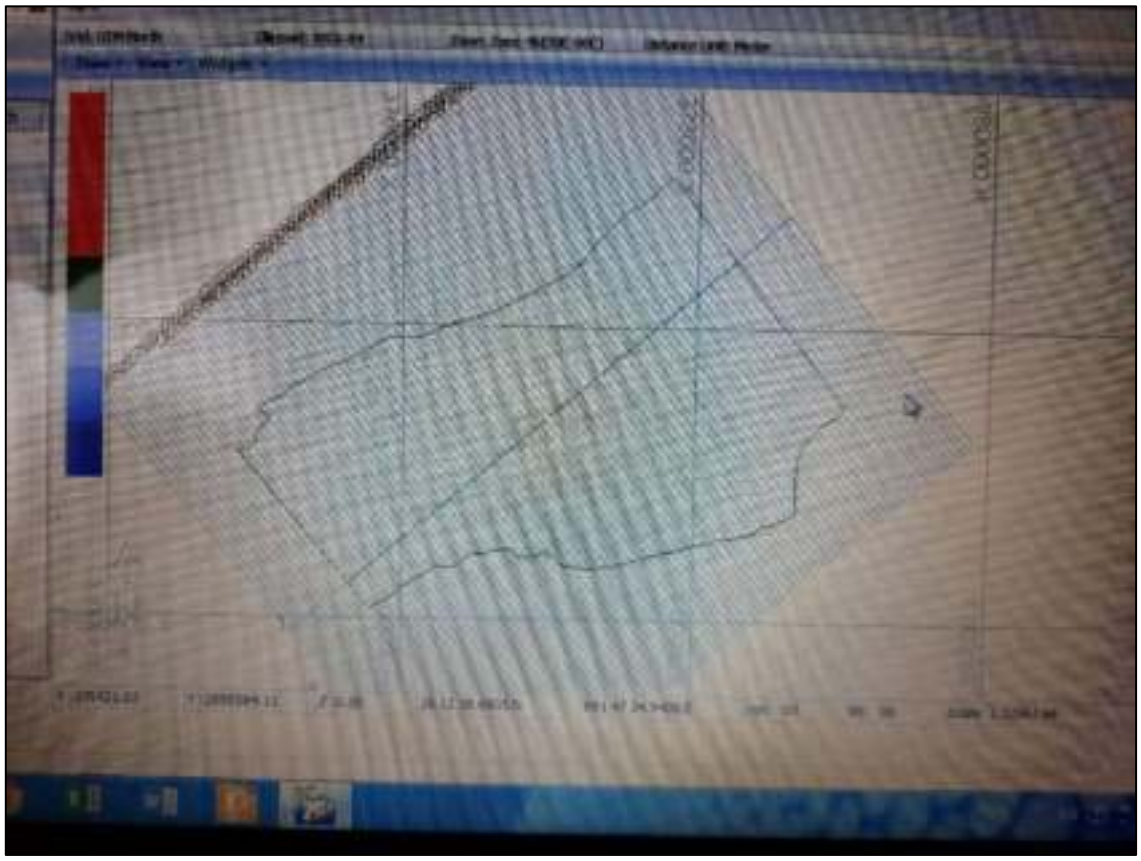


Figure 23 Snap from Hypack Software

SECTION 6.3.1.6 SOUND VELOCITY PROFILER

A Sound Velocity Sensor is a device that is used for measuring the speed of sound, specifically in a body of water.

SECTION 6.3.1.7 WATER CURRENT METER

Water current meter is an instrument used to measure velocity of water or fluid at any given location in water body.

SECTION 6.3.2 HORIZONTAL POSITIONING SYSTEM

Positions from GTS Benchmarks or positions established at bridges, barrages, Railway Stations, etc., if available in the vicinity, will be cross-checked with the established horizontal control.

GCPs are fixed using RTK DGPS in fix mode using UHF Radio Modem with IHO accuracy standards. Positioning during survey works shall be provided using Trimble SPS356 or equivalent Differential Global Positioning Systems (DGPS). Satellite-Based Augmentation

System (SBAS) correct the coded raw pseudo ranges received from selected GPS satellites not less than 12, to mobile receiver(s). The mobile receiver(s) apply these corrections to their own observed satellite pseudo ranges and so obtain the corrected pseudo ranges to be used for the position computations. The positions derived by the DGPS receiver are calculated in WGS84 spheroid and since the entire project work is based on WGS-84 spheroid, can be directly converted to UTM coordinates using map projections. (Geodetic parameters and reference levels), with sub-meter accuracies.

The position of soundings, dangers, other significant submerged features, nav- aids (fixed and floating), features significant to navigation, the coastline and topographical features will be determined as per the requirements specified in S-44.

SECTION 6.3.3 VERTICAL POSITIONING SYSTEM

The site was be equipped with an Auto Level instrument, Sokkia B40, or Similar. The Level instrument is required to control measurements and for accurate transfer of benchmark heights.

SECTION 6.3.4 LINE PLANNING

Run lines will be planned in such a way that complete river section under the survey scope is covered. A centre line for the entire river section will be planned and then planned lines will be made in perpendicular direction of that centre line. This will enable to undertake the surveys in the entire river section. Check lines will be run at discrete intervals.

Cross Section Line Spacing: 50 m

Check Lines Spacing: 500 m (not more than 15 times the spacing of cross lines)

SECTION 6.3.5 RESULTS AND DELIVERABLES

Bathymetry Survey was conducted on site and witnessed by Client representative. Checklist for the survey were signed jointly. Bathymetry report was submitted with all the supporting documents and approved by client.

Bathymetry Survey Report is Enclosed with this report as an Annexure 2.

SECTION 6.4 OLS SURVEY

SECTION 6.4.1 INTRODUCTION

The Runway centre of Water Aerodrome at Brahmaputra River, Guwahati proposed location - 26°11'58.04"N, 91°45'29.98"E as per the site feasibility and based on the bathymetry and OLS surveys. This location will cater the seaplane operations. Nearest commercial airport is located at Guwahati located at an aerial distance of approx. 20 Km.

The proposed site area of Water Aerodrome is approximately 1825 Sqm.

The geographical coordinates, location on map and geographical stretch of land of the proposed Water Aerodrome along boundary, proposed runway is shown below in Map (figure a) with the list of boundary coordinates in table 1. Proposed runway is 1200 m in length with the width of 120 m each.

SECTION 6.4.2 SELECTION OF PROPOSED TERMINAL BUILDING

As per the tender Proposed coordinates for the terminal building are 26°11’55.52” N, 91°46’17.67” N. We have visited the site and as per the site condition this location needs high amount of earth work development. Few site photos are attached for reference.

Figure A: Proposed Terminal Building location as per TOR

Figure B: Images of Proposed Terminal Building location as per TOR

Figure C: Images of Proposed Terminal Building location as per TOR

Observations from the site visit for the proposed location are as below:

- Location is adjoining the road and has good connectivity.
- Required flat terrain to develop the Terminal building is not available
- To develop the Terminal building, Ground development to be taken up with large extent of Earth work and huge retaining structure.
- Connectivity of the Developed terminal with the floating jetty / pontoon for the seaplane will also be a concern.

To check the alternative location, we visited the nearby locations which can be more feasible for the Terminal Building. We found a location near Water Treatment Plant, which may be a good alternative for the Terminal Building location. Images for the location are attached below for reference.

Figure 24 Location of Proposed Terminal Building location by NETRA

Figure 25 Figure D: Location of Proposed Terminal Building location by NETRA

Figure 26 Figure F: Images of Proposed Terminal Building location by NETRA

Observations from the site visit for the proposed location are as below:

- The location is adjoining the road and has good connectivity.
- The terrain is not much steep and can be developed for the terminal building.
- To develop the Terminal building, Ground development is to be taken up with few extents of Earthwork and comparatively less height retaining structure.
- Connectivity of the Developed terminal with the floating jetty/pontoon for the seaplane shall be easy with the longshore available in front of the proposed location.
- Currently, Jetties are in operation for Boats and Vessels movement, in the same manner, our Terminal building and its connectivity to floating Jetty can be thought of.
- Coordinates for the proposed terminal building are tabulated below in Table 3.

We request you to guide us further in finalising the location of the water aerodrome.

Table 3: List of Coordinates for Proposed Terminal Building

S.NO	Points	Latitude	Longitude
1	A	26° 11' 53.12"	26° 11' 53.12"
2	B	26° 11' 53.98"	26° 11' 53.98"
3	C	91° 45' 36.56"	91° 45' 36.56"
4	D	26° 11' 52.14"	91° 45' 37.2"

SECTION 6.4.3 SCOPE OF WORK

OLS survey was conducted for the proposed Brahmaputra River at Guwahati. The ultimate aim to perform this survey is to locate and identify the objects surrounding the proposed airstrip area. We have surveyed the area within a 2.5 km radius of the proposed airstrip's centre. We watched the area with the help of a UAV mounted with an Aerial LiDAR system to capture the topography and other details of area of interest. “Asia Pacific Regional Guidance on Requirements for The Design and Operations of Water Aerodromes (WA) For Seaplane Operations of International Civil Aviation Organization (ICAO)” is used as a guideline to perform the survey and capture the required data.

SECTION 6.4.4 APPROACH SURFACE AREA

Approach surface areas – the area in the direction of the airstrip, was surveyed to ensure the outcomes are meeting Asia Pacific Regional Guidance on Requirements for The Design and Operations of Water Aerodromes (WA) For Seaplane Operations of International Civil Aviation Organization (ICAO).

The survey included identification of all man-made as well as natural structures/ features falling in the approach area on both sides of the proposed airstrip and establishing their location and elevation on a plan. Objects covered are listed below but are not limited to it:

- Road
- Building
- High ground
- Electric/ telephone lines
- Tower/ chimney / Ropeways
- Hills

The objects were shown along with their location and elevation in the following manner.

Radius Distance 0 -2500 m from centre of the strip – details are provided.

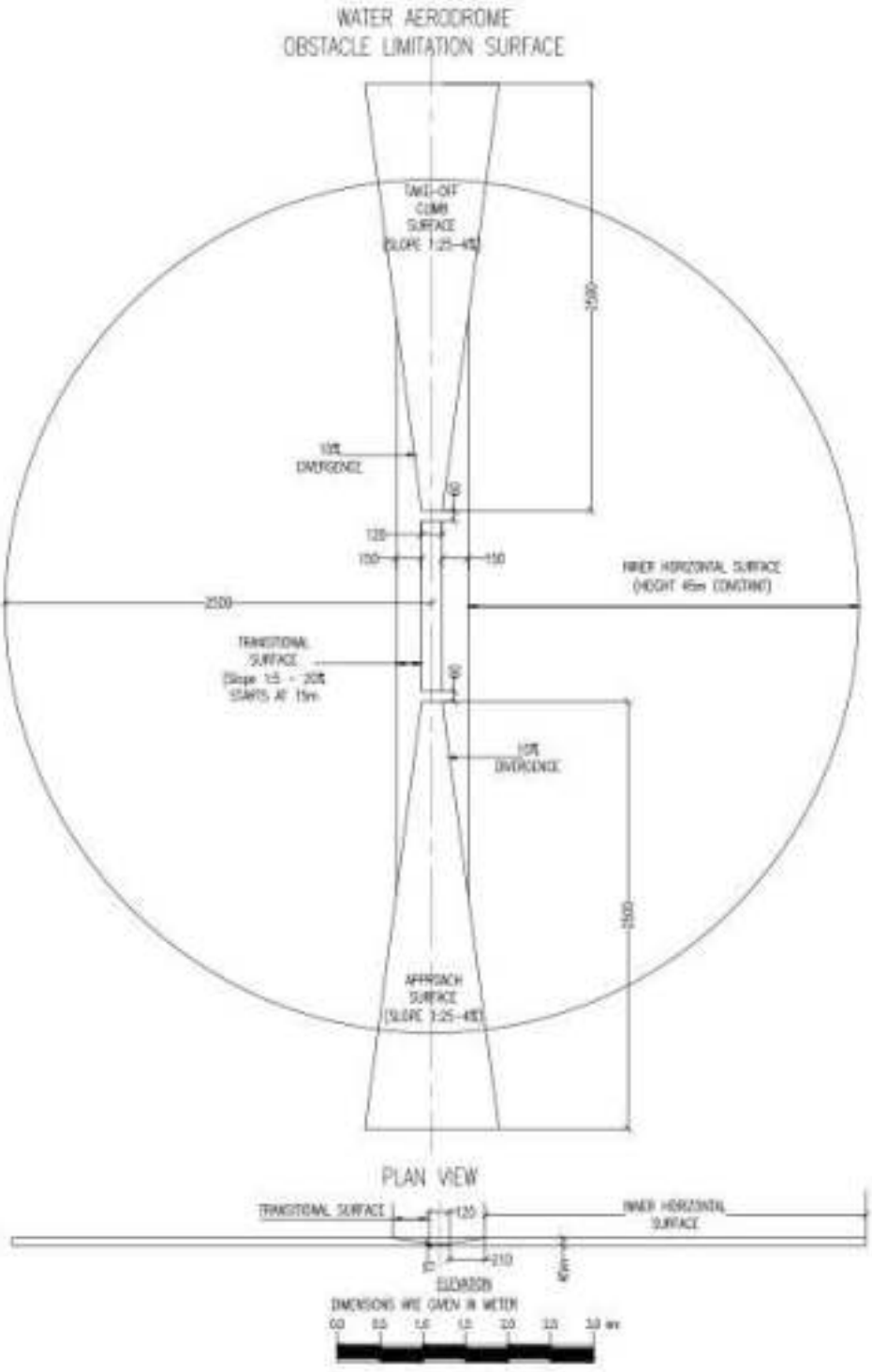


Figure 27 Obstacle Limitation Surface

As Per Asia Pacific Regional Guidance on Requirements for The Design and Operations of Water Aerodromes (WA) For Seaplane Operations of International Civil Aviation Organization (ICAO).

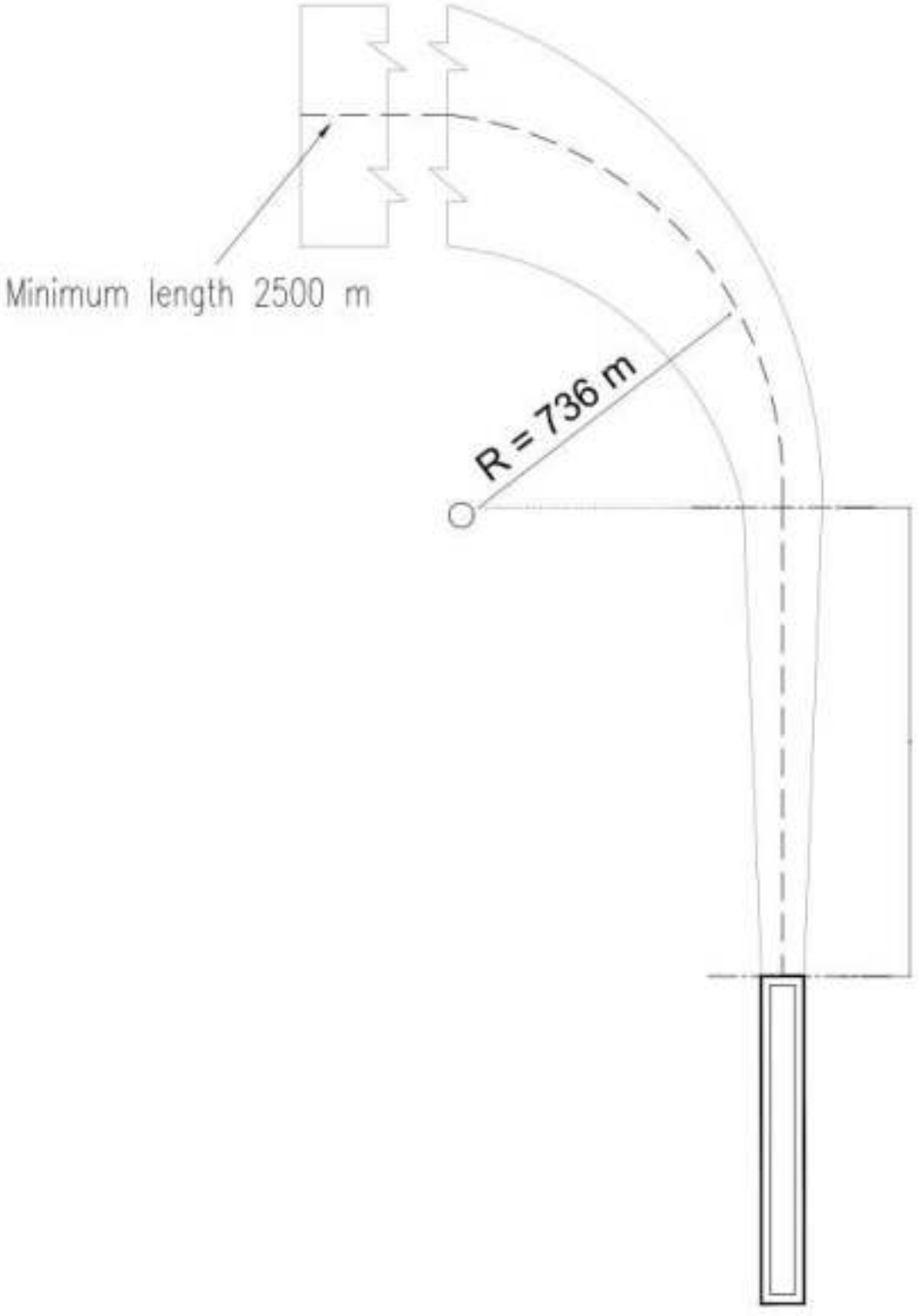


Figure 28 Curved Take-Off Climb/Approach Surface

As Per Asia Pacific Regional Guidance on Requirements for The Design and Operations of Water Aerodromes (WA) For Seaplane Operations of International Civil Aviation Organization (ICAO)

SECTION 6.4.4.1 INNER HORIZONTAL SURFACE

Inner Horizontal Surface covers the area surveyed for which all the manmade and natural objects as covered in Approach Surface area but not limited to it like,

- Road
- Building
- High ground
- Electric/ telephone lines
- Tower/ chimney / Ropeways
- Hills

Objects were identified from the surveyed data and shown on the drawings with the following details.

- Objects with a height of more than 45 M from the ground level
- Objects with height of more than 55 m from the airstrip elevation
- 4-5 trees with a maximum height from the group of trees are shown
- 5 buildings with maximum height within a radius of 150 M are shown

SECTION 6.4.5 LIST OF SURVEY EQUIPMENT DEPLOYED

We have engaged the latest equipment to carry out the survey. A team with sound skills in capturing and processing the OLS data was engaged.

The equipment used are listed below:

- e-VTOL fixed-wing UAV
- Sony RX1R II (42.4 Megapixel RGB Optics Sensor)
- LiDAR (Geomatics Grade LiDAR, Class 1 (Eye Safe)
- Differential Global Positioning System (DGPS)

SECTION 6.4.6 TOPOGRAPHY SURVEY

We engaged various instruments and equipment to survey as mentioned above. The data collected on the field was then integrated on a single platform and processed to bring out the

final details. Based on the processed data, topographical features of the area surrounding our area of interest are derived.

SECTION 6.4.7 DGPS GROUND CONTROL POINTS

A Differential Global Positioning System (DGPS) enhances the Global Positioning System (GPS) which provides improved location accuracy. DGPS uses a network of fixed ground-based reference stations to broadcast the difference between the positions indicated by the GPS satellite system and known fixed positions. These stations broadcast the difference between the measured satellite pseudo ranges and actual (internally computed) pseudo ranges, and receiver stations may correct their pseudo ranges by the same amount. To determine its position, a satellite navigation receiver will determine the ranges of (at least) four satellites and their positions at the time of transmitting. Knowing the satellites' orbital parameters, these positions can be calculated for any point in time.

Ground control points are fixed locations on our earth's surface with known X, Y (i.e., latitude and longitude) and Z (i.e., height above mean sea level in meters). For any survey application, correct & Accurate GCP is very important. We have established our GCP with the use of the DGPS system. DGPS gather the coordinates of a fixed position from multiple GPS satellites and apply corrections with inbuilt algorithms with observations on the base and rover stations for a certain time. The longer the observations we take, the DGPS provides more accurate results. The position of each GPS satellite is then verified and corrected by a series of ground stations monitoring their orbit, velocity, and direction of movement, usually called post-processing of the DGPS observations using a suitable operating system.

Post-processing is used in Differential GPS to obtain precise positions of unknown points by correlating them to known points such as survey markers. The software computes baselines using simultaneous measurement data from two or more GPS receivers. Initially, we have started to fix the Preliminary Ground control point (PGCP) with the help of DGPS. Then, we have begun to establish the secondary Ground Control Points (SGCPS) with reference to the PGCP.

Figure 29 GCP point Establishment

Figure 30 GCP point Establishment

Figure 31 All Ground Control Points Surrounding AOI

Table 4: List of Ground Control Points

GCP No.	Easting	Northing	HEIGHT	Degree,Decimal	
				Latitude	Longitute
PGCP	375907.871	2898066.373	48.934	26°11'48.28782"N	091°45'28.89112"E
S GCP-A	374915.662	2899227.691	84.693	26°12'25.71940"N	091°44'52.74437"E
S GCP-B	374131.333	2899576.739	54.419	26°12'36.81621"N	091°44'24.36539"E
S GCP-C	374107.746	2901764.324	56.316	26°13'47.90221"N	091°44'22.74950"E
S GCP-D	374868.053	2902837.232	53.711	26°14'23.00983"N	091°44'49.77250"E
S GCP-E	376471.731	2903153.279	49.674	26°14'33.78168"N	091°45'47.45556"E
S GCP-F	379097.914	2898771.373	57.028	26°12'12.17931"N	091°47'23.57255"E
S GCP-G	378207.077	2898509.42	70.927	26°12'03.39501"N	091°46'51.56774"E
S GCP-H	377214.775	2898258.19	53.093	26°11'54.92603"N	091°46'15.90547"E
S GCP-I	376403.818	2898294.497	73.132	26°11'55.85556"N	091°45'46.67871"E

SECTION 6.4.8 THE EVTOL FIXED-WING MAPPING DRONE FOR PROFESSIONALS

The e-VTOL fixed wing UAV demonstrates its range advantage and flying endurance compared to classic multi-rotors and other fixed-wing drones due to the longer flight time and covers up to 20x larger areas. LiDAR and optic payloads are being mounted along this UAV to capture the data.

Image 1 UAV used for OLS Survey

SECTION 6.4.9 GEOGRAPHIC LOCATION OF RUNWAY

Geographic locations of both ends of the airstrip, centre point of the airstrip and the elevation of the airstrip which were identified are tabulated below.

Table 3: Geographical Location of Runway

Sr No	Runway	Northing	Easting	Elevation (MSL, m)
1	Runway 08	2898215.3622	375360.9755	41.19
2	Runway 26	2898512.9449	376523.4920	41.19

SECTION 6.4.10 OBSTACLE DETAILS

The proposed Water Aerodrome area is located at Brahmaputra Riverside in Guwahati city. The distance and bearing of all the objects lying within various limitation surfaces are detailed in the attached annexures.

CHAPTER 7 PROPOSED DEVELOPMENTS

We have studied the various guidelines for developing a Seaplane / Water Aerodrome. We also performed the required technical surveys as per NIT. As a part of project exercise, we conducted detailed feasibility survey to identify suitable location for Aerodrome Proposal on the southern bank of river Brahmaputra. As per our prepared DPR, we are able to find the location of Aerodrome on the Southern Bank of Brahmaputra near the foothill of Kharguli Hills.

As per our GMC Area Map study, we learned that the Proposed Sea Plane Water Aerodrome Location falls under the purview of GMC Area of Ward No. 32. Hence, we consider GMC as nodal authority to issue any permission regarding Proposed Sea Plan Water Aerodrome project for any development.

Brahmaputra river observes very high-water level variations across the year. As per the data recorded by the Inland Water Ways Authority of India, the following are the ruling levels for the Brahmaputra River in Guwahati varying around the year.

Lowest Water Level – 41.90 M from MSL

Danger Water Level – 49.230 M from MSL

High Flood Level – 51.46 M from MSL

As per the above-mentioned levels, when water level crosses 49.230 M, it is considered as danger level for the Guwahati city. Hence we propose that seaplane operations shall not be continued once the water level crosses 49.230 M level.

SECTION 7.1 OFF-SHORE DEVELOPMENTS

Figure 32 Layout of Water Runway Strip

SECTION 7.1.1 WATER RUNWAY STRIP

Water Runway strip is proposed with an adequate length of about 1320 m to meet the operational requirements of the critical seaplane for which the runway is intended and should be not less than the most extended length determined by applying the corrections for local conditions to the operations and performance characteristics of the relevant seaplanes.

The width of the water runway is provided at 120m, which complies with ICAO guidelines.

The proposed location for the water runway strip has the depth of more than 1.5 M from the Chart datum level.

The proposed length and width comply as per ICAO and DGCA guidelines.

SECTION 7.1.2 WATER RUNWAY

Water runway for takeoff and landing of Seaplane is allotted in conjunction with all safety parameters and proposed future expansion. The runway strip is 1200m long, and 60m wide as per below centerline coordinates and illustrative graphics and the related plans are attached in conjunction of OLS data and maps.

Sr No	Runway	Northing	Easting	Elevation (MSL, m)
1	Runway 08	2898215.3622	375360.9755	41.19
2	Runway 26	2898512.9449	376523.4920	41.19

SECTION 7.1.3 TAXI CHANNELS

Taxi channels are proposed as per requirement and per site location availability, fulfilling the scheduled parameters as per ICAO and DGCA guidelines, providing a minimum 60mtr clearance for navigational safety.

SECTION 7.1.4 TURNING BASINS

Turning Basins are proposed as per guidelines provided in DGCA & ICAO and match with the physical characteristics of a critical seaplane.

SECTION 7.1.5 BUOYS

Guidelines provided in DGCA and ICAO for navigational parameters are fulfilled for safe navigation of Seaplane operations.

Provided Buoys are classified as below.

Runway Buoys- Runway Buoys are proposed at the periphery of the Runway, 6 layers and total of 14 Buoys are proposed named A1 to A14.

Nun Buoys- Runway Nun Buoys are provided at the periphery of the Runway Strip, which are proposed total of 41nos naming C1 to C41.

Marker Buoys- Buoys provided along the taxi channel as a navigational aid are termed Marker Buoys. Marker Buoys are tagged as D1 to D15, a total of 15 nos buoys are proposed at the shoreline face across the taxi channels.

LEGEND FOR BUOYS

SYMBOL OF BUOYS	DESCRIPTION	CODING	COLOR	QUANTITY
	RUNWAY BUOY	A1 – A14	INT'L ORANGE & WHITE	14 nos.
	NUN BUOY	C1 – C41	RED	41 nos.
	MARKER BUOY	D1 – D14	INT'L ORANGE	15 nos.

SECTION 7.1.6 PASSENGER TRANSFER VESSEL(PTV)

For the purpose of emplaning and deplaning passengers during the high-water level, the water aerodrome shall be equipped with a transfer vessel to transfer passengers to the shore, which should cater for a capacity of critical seaplane passengers, that is considered 19 passengers and their luggage.

Figure 33 Passenger Transfer Vessel

SECTION 7.2 SHORELINE DEVELOPMENT

SECTION 7.2.1 PONTOON/FLOATING JETTY

Floating Pontoon/Jetty proposed to cater a passenger transfer from/to seaplane towards terminal building via pathway ramp. Pontoon, having the size of 24 x 09 m proposed for boarding and deboarding of passengers from the seaplane. Which is placed at the shoreline and fixed by providing anchored mooring at the bottom.

Pontoon with structural steel is a proven method for usage in high water level fluctuations. Hence we have proposed a structural steel Pontoon vetted by Naval Architect in this DPR..

Further nowadays, Floating RCC Jetties are used as an option to structural steel pontoons, which provides better aesthetics and use of new age construction technology. So, we have also provided basic details of Floating RCC jetty which have been taken from other executed references. RCC Floating jetty may be considered as an alternative to Structural Steel Pontoon during execution stage, if found more feasible and viable considering site conditions and river conditions at the time of execution.

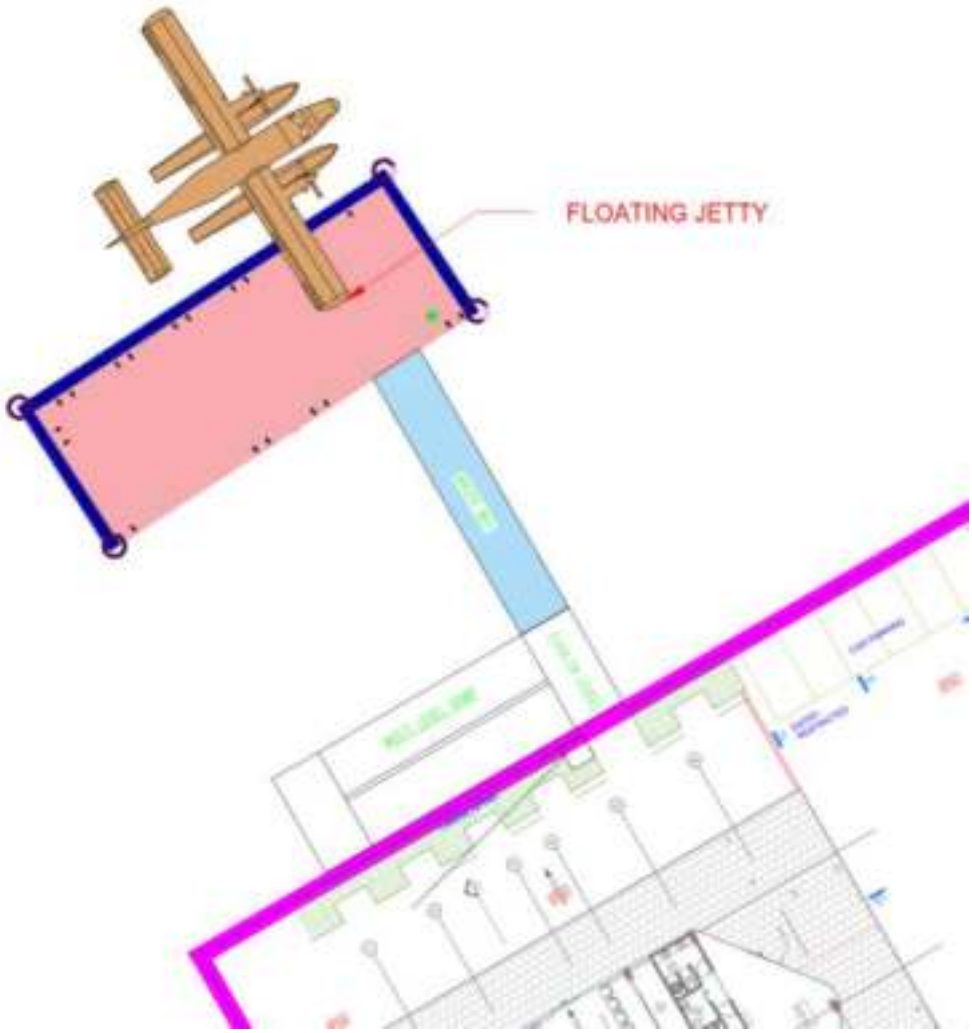


Figure 34 Layout of Pontoon

SECTION 7.2.2 ANCHORAGE AREA

A pontoon is proposed which is equipped with an Anchorage system for the critical seaplane.

A separate anchorage area is not proposed.

SECTION 7.2.3 GANGWAYS

A Gangway (mostly of aluminum structure to have corrosion resistance) is the connector between the ramp (landside) and pontoon (waterside structure). The contractor must design and get the approval of the respective element, details given are as illustrations.

Figure 35 Illustrative Image for Access Gangway

SECTION 7.2.4 WIND INDICATORS

A wind direction indicator proposed of a conspicuous colours and in the form of a truncated cone at Pontoon and at onshore structure, which shall be visible from 1000 feet above.

Figure 36 Illustrative Image for Wind Indicator

SECTION 7.3 ON-SHORE DEVELOPMENT

SECTION 7.3.1 ARRANGEMENT FOR CONNECTING DOCKING STRUCTURE TO TERMINAL BUILDING

Brahmaputra river observes very high-water level variations througout the year. As per the data recorded by the Inland Water Ways Authority of India, the following are the ruling levels for the Brahmaputra River at Uzan Bazar, Guwahati.

Lowest Water Level – 41.90 M from MSL

Danger Water Level – 49.230 M from MSL

High Flood Level – 51.46 M from MSL

As per the topography of the area and site location, the proposed docking structure and the terminal building are approximately 85 M away from each other in the plan. We has a challenge to cover the horizontal as well as the elevation to connect the Docking Structure to the Terminal Building for operations throughout the year with respect to change in water levels. After deep thought process and brainstorming by our team on the prevailing site conditions and challenges, we have proposed two options for connecting the Docking Structure and Terminal Building. Detailed description of both the options are presented below.

OPTION-1: TERMINAL BUILDING - RCC BRIDGE - RAMP STRUCTURE – DOCKING STRUCTURE

In this option we have proposed a ramp structure near the Docking Structure to cater the vertical level difference during different water levels. Other side this ramp structure is connected with the terminal building with walkway Bridge Structure. When the Sea Plane is docked with the Docking Structure, passengers will deboard from the Sea Plane to Docking Structure. Provisions in the Ramp structures are considered at different landing levels to connect Docking Structure to the Ramp structure by means of Gangway. Ramp is provided with multiple flights running in two directions with the slope of 1:12 to have smooth transition of passengers and luggage. Each Flight is covering 1.3 M elevation, which is planned to have connectivity of Docking structure with Ramp at Landing level. Connecting Gangway shall be arranged with Maximum Slope of 1:3.5 and accordingly the length of Maximum Gangway required is 4.55 M resulting in proposed distance between Docking structure and Ramp structure as 4.5 M.

Once the Passengers are transferred from Docking structure to Ramp structure, they will reach to the top of ramp structure and then move towards the Terminal Building via connecting walkway Bridge. The Pros and Cons of this alternative is discussed below.

PROS	CONS
• This solution gives most stable access to the Passengers from Docking structure to Terminal Building. • This will allow uninterrupted operations across throughout the year in safe weather and discharge conditions of river. • Dredging is not required to maintain the channel for transfer of passengers. • Operational Cost are low with this option.	• Length of Ramp to cater the vertical distance with gentle gradient is leading to long distance to be covered by walking, which may lead to tiredness or fatigue to the users. • Ramp structure will may obstruct the view of Docking structure and sea plane landing and take-off from the terminal building. • Construction of Ramp is to be carried out in water, which is a slight challenging task. • Cost for construction of ramp and connecting Bridge is high and hence need comparatively higher capital investment.

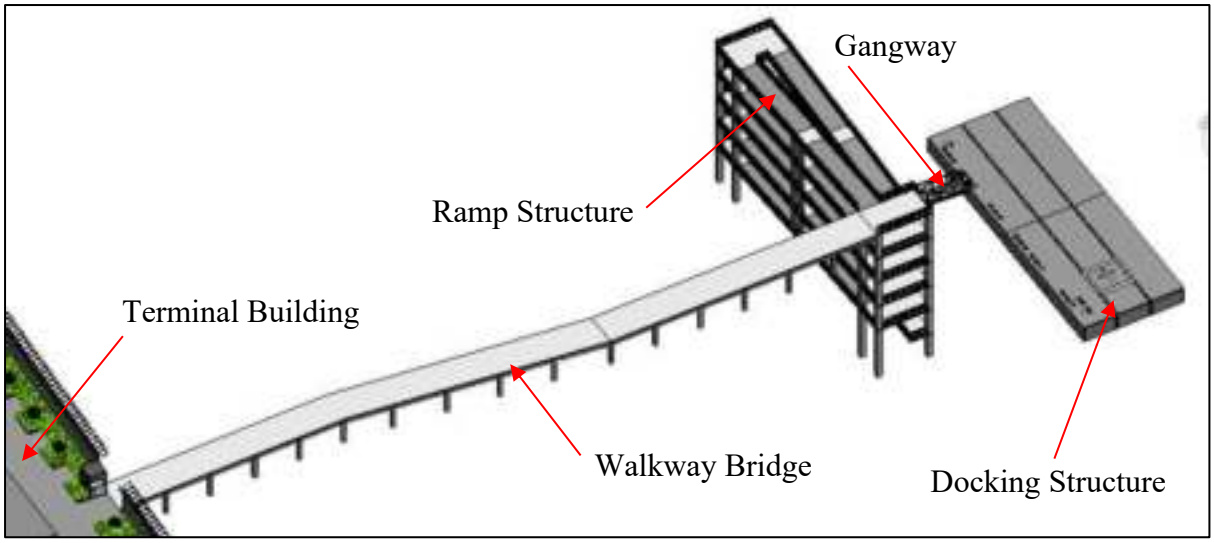


Figure 37 3D Illustation for Option-1

Figure 38 Option-1 Layout

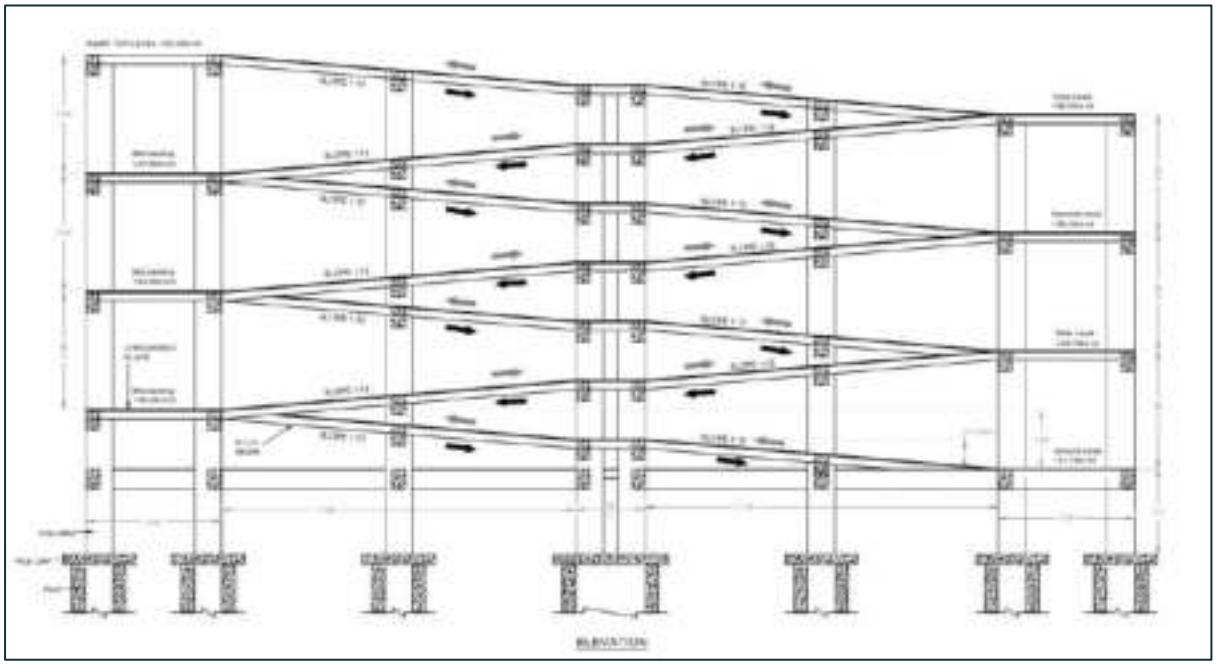


Figure 39 Option-1 Sectional Elevation of Ramp Structure

OPTION-2: TERMINAL BUILDING - RAMP STRUCTURE – CONCRETE WALKWAY OR WATER WAY – DOCKING STRUCTURE

In this option, we have proposed connection by two means from the Docking Structure to the Terminal building. Minimum Water level is 40.19 M and the adjoining Land at the shore is 43.0 M. Level of Ground from the shore to the Terminal Building compound boundary is varying from 43.0 M to 45.0 M. During the time when Water level is lower than 43.0 M Docking Structure will be connected with land on the shore by Gangway. An RCC ground supported walkway is proposed from the land on shore to the terminal Building for passenger transfer. Once the Passengers reach near the terminal Building, a Ramp Structure is proposed adjoining to terminal building to cover the elevation from the level 45.0 M to 54.15 M.

A water channel has been proposed for transfer of passengers through boats once the water level rises above 43.0 M level as passengers cannot reach by ground supported walkway. In this case passengers will be transferred from Docking structure to the Boat. Boat will take the passengers to the terminal building where boat will be connected to the ramp structure landings at different elevations. Ramp structure is proposed with slope of 1:12 gradient for easy and smooth transfer of passengers. Each flight of Ramp structure covers 1.3 M elevation. Boats to transfer Passengers are normally having 1.0-1.2 M height with 0.35-0.4 M draft. So, Boat top will be approximately 0.7-0.8 M above the water level. Considering the top of boat and landing level difference passengers have to climb 0.6 M height from Boat to Landing which shall be catered by small portable detachable stair always, be kept in boat.

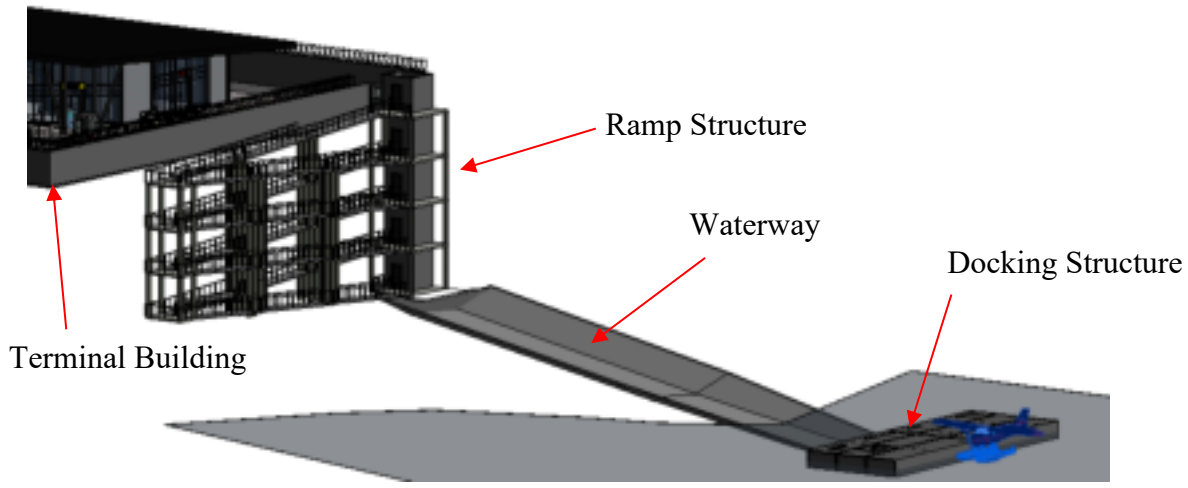


Figure 40 3D Illustration for Option-2

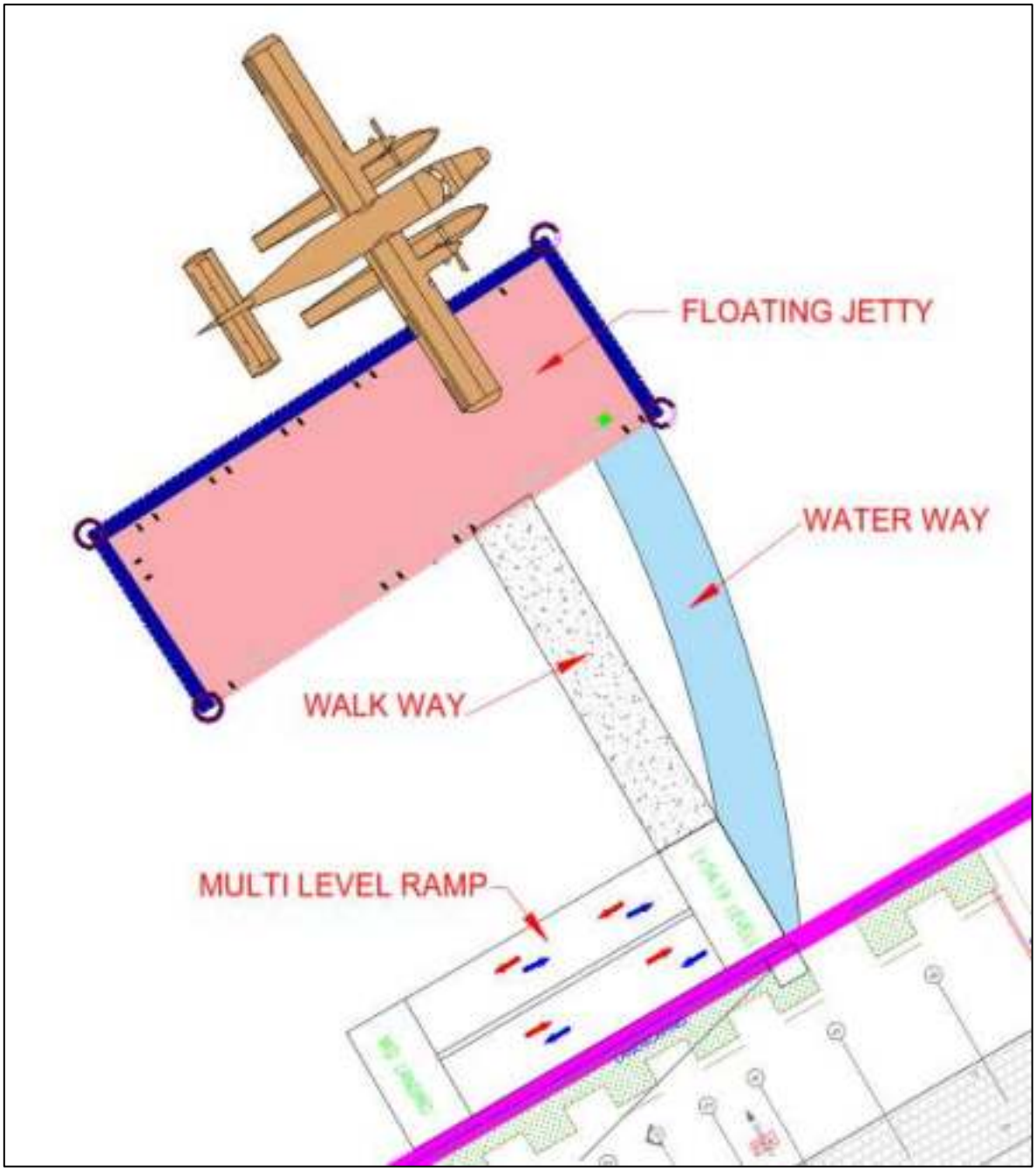


Figure 41 Option-2 Layout

PROS

- In this option, ramp is provided adjacent to the Terminal Building and hence it will not create the obstruction for viewing the takeoff and landing of seaplane from Terminal Building.
- Ramp structure to be constructed on land near bank and hence construction is easy and cost effective.
- Cost of connecting bridge is not involved, making it cheaper option on capital investment.
- This option provides boat travel with sea plane, which is an added adventures experience to the travelers.

CONS

- Boat operation will need additional operational costs & resources.
- Dredging will be required to maintain the depth of channel to keep boats operational after the event of flood and silting.
- Additional Safety provisions required in boats for safety of passengers.

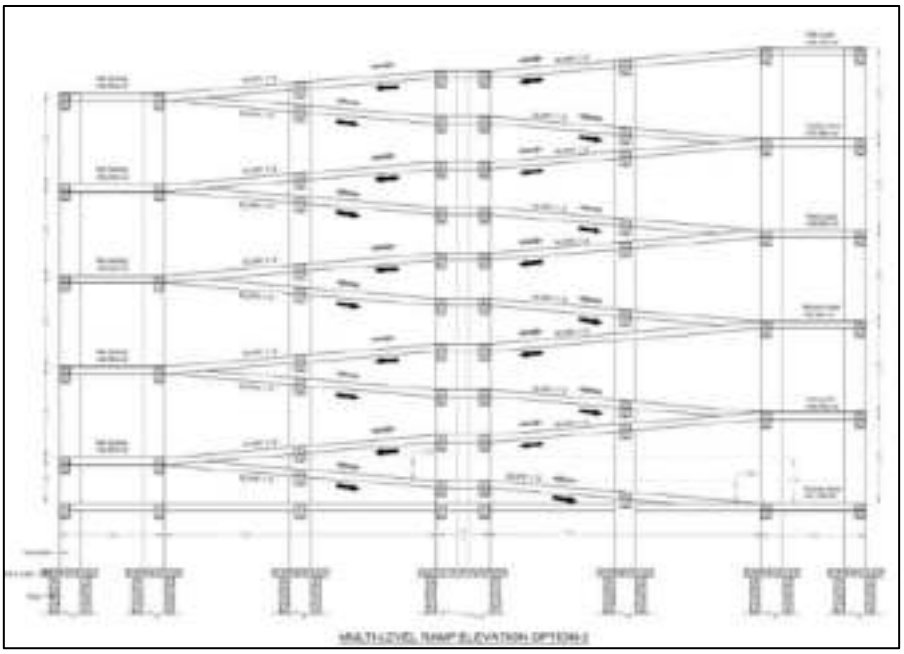


Figure 42 Option-2 Sectional Elevation of Ramp Structure

SECTION 7.3.2 FUELING BOWSER

Fueling Bowser having Fuel Tank and Pump for safe delivery are proposed at the shoreline, to cater a refueling of a seaplane.

Figure 43 Illustrative Fuelling Bowser

SECTION 7.4 DEVELOPMENT FOR PUBLIC USE

SECTION 7.4.1 TERMINAL BUILDING

Terminal Building of 1000 Sqm area is proposed as a steel structure with glass facade and aluminum sheets.

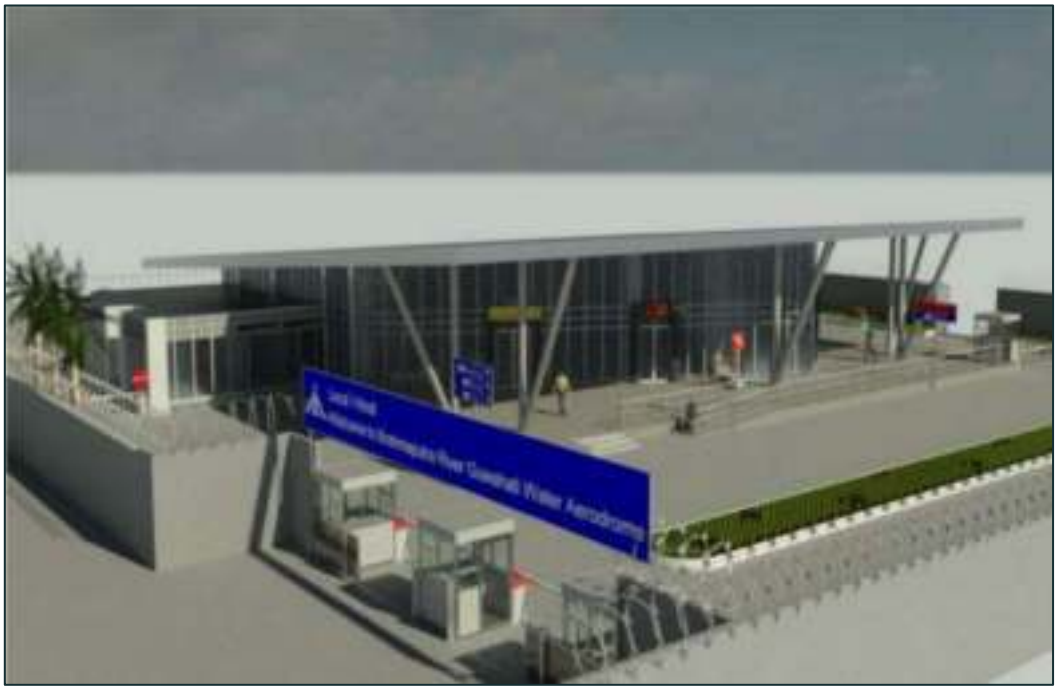


Figure 44 Terminal Building Layout Plan

A terminal building has been proposed for the water aerodrome with the following salient features:

- Entry Point
- Check-In Gates
- Public Concourse
- Baggage Screening and Handling Facility
- Toilet facility (For Ladies / Gents / Specially abled) at all different sections
- Sitting Arrangements
- Departure Lounge
- Arrival Lounge
- Manager Office
- Security Office
- Surveillance Facility

Allied infrastructures such as Security cabin & surveillance system, utility building, internal road, streetlights, sewage treatment plant, fire hydrant & CCTV etc.

SECTION 7.4.2 SECURITY CABINS & GATES

Security Cabins are planned at each gate, controlling, and restricting all the public and staff movement throughout the premises. Primary layout is as below.

SECTION 7.4.3 PARKING AREA

Small Parking area has been proposed as per the available site space. Same area shall be used for parking the staff vehicle and emergency vehicles.

Figure 45 PARKING LAYOUT

SECTION 7.4.4 SECURITY AIDS

Security aids include following features:

- Handheld metal detectors
- Door frame metal detector
- X-Ray machine/ manual for screening hand baggage and checked in baggage
- Dog squad
- Isolation bay

SECTION 7.4.5 ASSEMBLY AREA

A common place is proposed as an assembly area for emergency gathering and evacuation in case of any emergency situation.

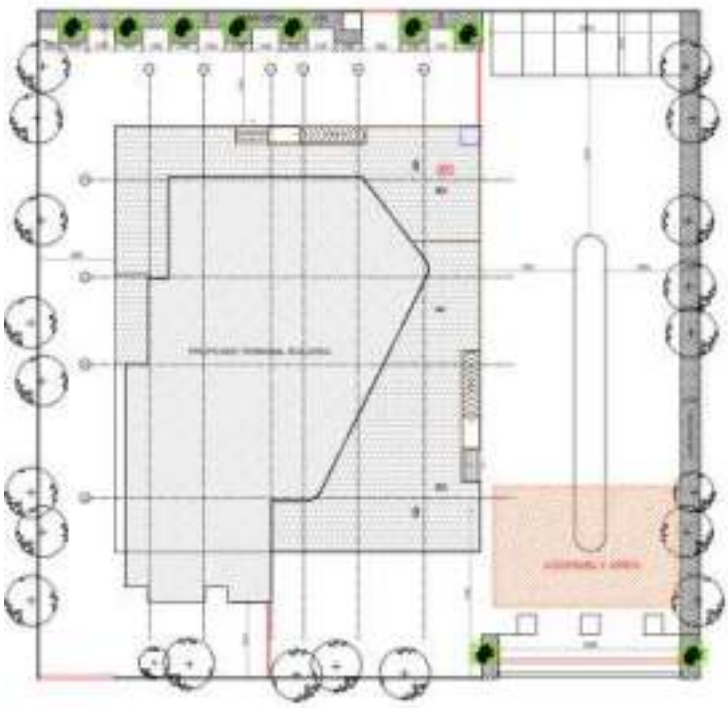


Figure 46 Proposed Assembly Area

SECTION 7.4.6 SECURITY FENCING

Internal and Periphery fencing has been proposed as per DGCA Guideline, considering safety parameters.

SECTION 7.5 PROPOSED AMENITIES

SECTION 7.5.1 RECREATIONAL LANDSCAPES

A landscape area of 130 sqm is proposed for the peripheral area of the for the Water Aerodrome.

Figure 47 Landscape Layout

SECTION 7.5.2 SIGNAGES

As per AAI Guidelines and parameters, signages are proposed for outdoor and indoor premises and checkpoints, gates, navigational arrows, and locations. Illustrative signages are as below.

Figure 48 Outdoor Signages

Figure 49 Indoor Signages

SECTION 7.5.3 EATERIES

Eateries are proposed at the arrival and departure lounge for public use having area 9spm size of 5.5mx1.6m.

SECTION 7.5.4 DG SET UTILITY ROOM

The utility area of 170 Sqm area has been proposed to accommodate basic DG Set facility. The Utility area covers the Electrical substation, Plumbing and Firefighting plant room.

SECTION 7.5.5 SEWAGE TREATMENT PLANT (STP)

As the wastewater generated will be of 60 KLD, Package STP with Moving Bed Biofilm Reactor (MBBR) technology has been proposed at terminal building premises.

An underground RCC treated water tank has been proposed to store the treated water comes from STP and will be reused for gardening and flushing purpose. This will reduce the requirement of the fresh water on regular basis by at least 40%.

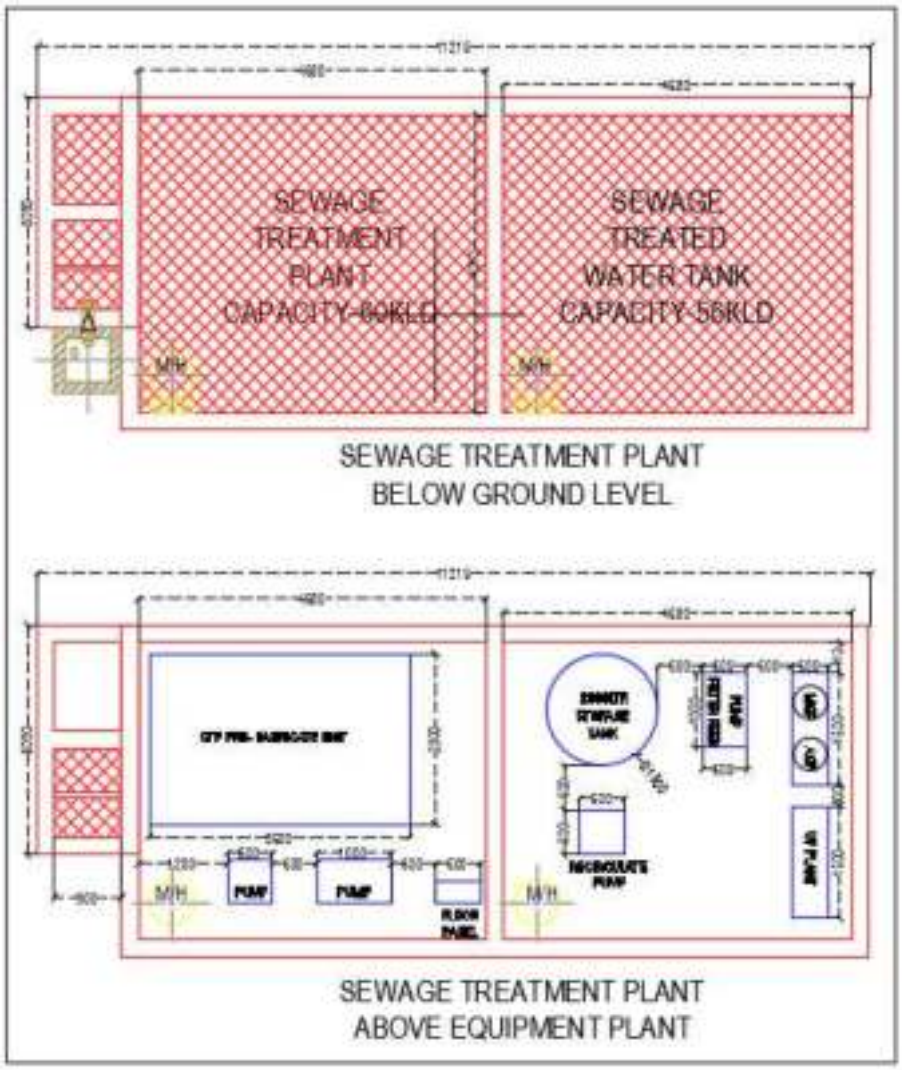


Figure 50 Layout of Proposed STP & Equipment Plant

SECTION 7.5.6 CCTV AND PAS

IP CCTV Surveillance System & Security system

IP CCTV cameras are to be installed at following locations:

1. All Entry/Exit
2. Security Check
3. Corridors
4. Concourse
5. Arrival / Departure
6. External areas
7. Boundary wall
8. Loft Level
9. Utility Building

All cameras shall be IP based and shall be connected to dedicated switch and rack proposed at Server room. In addition, the entire system shall be connected to the Security system for viewing and storage of media.

Proximity card system or biometric recognition shall be provided at the doors of restricted areas such as back office, plant room, server rooms, data center, Integrated Building Management Systems (IBMS) / control rooms, fire exits, etc.

SECTION 7.5.7 EXTERNAL LIGHTING

The external lighting arrangement is proposed for the terminal building to have sufficient illumination round the clock. This will enhance the beauty of the terminal building at nighttime as well as increase the security features.

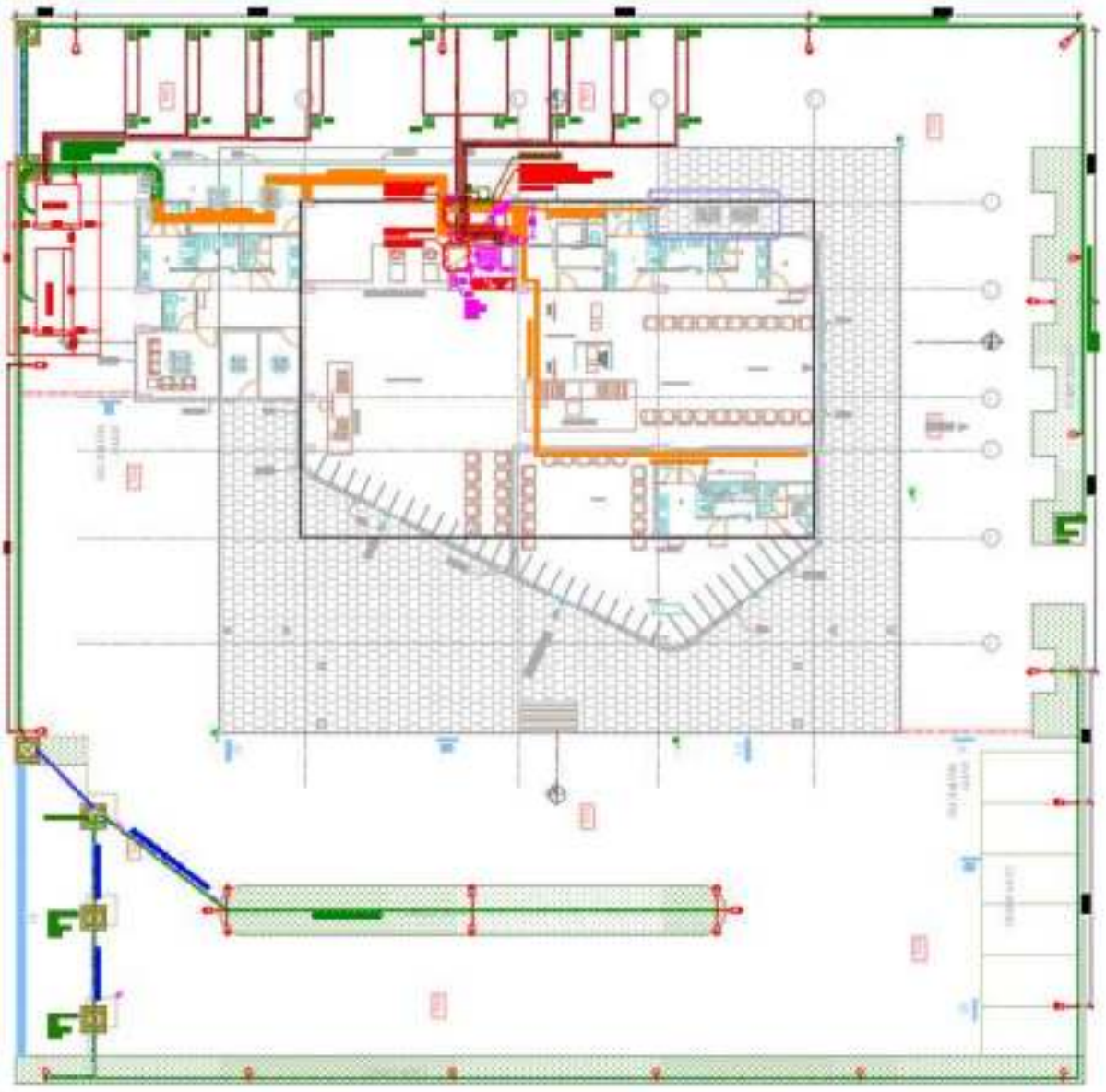


Figure 51 Layout of External Lighting Arrangement

CHAPTER 8 DESIGN PHILOSOPHY

SECTION 8.1 ARCHITECTURAL DESIGN APPROACH

SECTION 8.1.1 PROJECT SUMMARY

Concept ***: Curvilinear Built Form***

Site area ***: 2650 sqm***

PTB Area ***: 1000 Sqm***

SECTION 8.1.2 DESIGN APPROACH

A major riverine port city along with hilly terrain, Guwahati is one of the fastest growing cities of India. It lies between the foothills of Shillong plateau and the banks of the river Brahmaputra. It is also called the "Gateway to Northeast."

Guwahati region hosts diverse wildlife. Also, an important link in tourist circuit (air, road, rail and water).

Concept is driven by challenging site location and the function of the building. Internal circulation is designed to have smooth uninterrupted movement of passengers. Glazed panels with large spans allow enough light as well as visual connection with the beautiful sight of Brahmaputra and its riverine landscape.

PTB under large roof with extended roof line built an elegant structure with well-established interaction between interior and exterior environment. The glazed façade gives lighter

appearance to the big mass at the same time the roof line builds impact of the form being a terminal building. The form is appealing from the airside as well as landside.

BIM (Building Information Modelling) is prepared with advanced detailing to help designers, engineers and client to see and understand how each aspect of design and component of detailing is working together to create a comfortable, convenient and unique built environment.

SECTION 8.2 STRUCTURAL DESIGN

The main considerations for the design of structure should be follows: -

a) Structure safety and stability.
b) To meet the demands of aesthetics conceived by the architect.
c) Availability of material, equipment, and expertise.
d) Constructability and ease of maintenance.
e) Durability.

SECTION 8.2.1 STRUCTURAL SYSTEM

The structure shall be designed as composite frame structure consisting of both RCC members and structural steel members.

All the structures shall be designed in accordance with the relevant Indian code of practice for civil works i.e., IS 456:2000, IS 875:1987, IS 1893:2016, IS 4326:1993, IS 13920:2016, IS 800: 2007, IS: 808: 1989.

SECTION 8.2.2 DESIGN APPROACH

SECTION 8.2.2.1 STRUCTURAL MODELLING

Three-dimensional model of building shall be generated using ETABS. All the slab panels shall be idealized as plate / shell elements, columns and beams will be idealized as line Elements. All the shear walls will be idealized as plate / shell element. The structure shall be analyzed and designed for all possible combinations of gravity loads (dead and live loads), and lateral loads (earthquake load and wind loads).

All the buildings of Type II shall be designed for earthquake loading (DL+LL+EQ).

DL = Dead Load, LL = Live Load, EQ = Earthquake Load

Computer Models, Structural Analysis and Design:

A preliminary three – dimensional finite element computer model has been formulated, incorporating all gravity, wind, and seismic loads to develop the concept framing for the building and ensure that the designed structural system provides satisfactory global building response. The model will be further developed during subsequent design stages to carry out

detailed design. In general, the following software shall be utilized during the various stages of the design process.

Software	Description
ETABS – 18.1.1	3 – Dimensional FEM Software for Building Analysis & Design
AutoCAD 2020	Software for Drafting and Detailing

SECTION 8.2.3 FOUNDATION SYSTEM

- Pile foundation may be proposed below the building area considering the location of the project site.
- The contractor shall carry out extensive soil investigation before the final detailed design.
- Design of Water Retaining Structures – All water retaining structures shall be designed as per IS 456 & 3370, with a crack width of 0.2 mm for severe or very severe exposure. In addition, concrete for such structures shall be waterproof concrete.
- Foundation and Ground Retention System –. It shall be noted that the Contractor shall carry out his own Soil Testing and analysis and shall follow the same.

SECTION 8.2.4 STUDY OF LOAD CASES

SECTION 8.2.4.1 MATERIAL DEAD LOAD

All the permanent loads on the structure shall be applied as dead load. The dead load in a building shall comprise of self-weight of beams, columns, walls, partitions, floors, roofs and include the weight of all other permanent constructions in the building and shall conform to IS: 1911-Schedule of unit weights of buildings materials. Unit weight of various materials considered on the structural members considered follows:

Table 5 Density of Material

S. No.	Item	Density (T/m^3)
1.	Reinforced Cement Concrete	2.50
2.	Steel	7.85
3.	Saturated Soil	2.0
4.	Water	1.0
5.	Glass	2.6
6.	Aluminum	2.7
7.	Dry Wall Partitions (102 mm thick)	0.05
8.	115mm Brick Work with 25mm Plaster	1.0
9.	230mm Brick Work with 25mm Plaster	2.0

Following loads shall be considered in structure for analysis: -

I) Self weight of structure.

II) Slab thickness and floor finish – as per actual.

III) Earth fills above basement roof – as per actual.

IV) Wall loads – as per actual.

V) Any other loads envisaged during the detailed engineering.

SECTION 8.2.4.2 LIVE LOAD

Live loads on the entire floor shall comprise all loads other than dead loads. The minimum live loads on different occupancies shall be considered as per IS: 875 (Part 2).

Live load shall be considered in design as per Table 1 of IS: 875 (Part 2)-1987 as follows: -

S. No.	Area	Live Load (T/m^2)
1.	Loft	0.2
2.	Roof	0.075

Note: Any other loads not specified in this report shall be considered as per national building codes of India.

SECTION 8.2.4.3 EARTHQUAKE LOADING

The structure is to be designed for the minimum static seismic base shear set out by IS 1893 (Part 1):2016 using the parameters shown in the table below. These forces are treated as ultimate forces.

Design Earthquake	10% chance of being exceeded within a 50-year return period
Seismic Zone	Zone V
Seismic Zone Factor, Z	0.36
Soil Profile, Type-II	Medium
Occupancy of building	Commercial
Seismic Importance Factor I	As per IS 1893-2016
Response Reduction Factor	As per IS 1893-2016
Fundamental Period of Vibration	$T = 0.09\ H/\sqrt{(d)}$ H – Height of Building above Ground Floor LVL. d –Least lateral dimension of the building

Seismic Building Weight	To include all components of Self Weight, Superimposed Dead Load, any other permanent weight 25% of Live Load

Response spectrum method was used as per IS: 1893 (Part-1) 2016 with the following data:

Design horizontal seismic coefficient (Ah) = ZI (Sa)/2Rg

SECTION 8.2.4.4 RESPONSE UNDER SEISMIC CONDITIONS

Seismic analysis of structure shall be carried out by response spectrum method for the design of beam elements (Columns and Beams), whereas static design method shall be applied for the design of plate elements (Shear walls). However, minimum base shear and mass participation is achieved in both the approaches as per the provision of IS: 1893.

SECTION 8.2.4.5 WIND LOAD

The wind load has been taken as per IS: 875 (Part-3) – 2015 and wind pressure calculation done as follows:

P_z = $0.6*V_z^2$ KN/sqm

V_z = $k_1*k_2*k_3*V_b$, Where,

V_z = Design wind velocity

k_1 = Probability factor or Risk coefficient has been taken 1.0

k_2 = Terrain, height and structure size factor, terrain category 2 and structure Class B been considered.

k_3 = Topography factor = 1.0

V_b = Basic wind speed = 50 m/s

SECTION 8.2.5 MATERIALS

Concrete: Concrete mix of M30 conforming with IS: 456 is used.

Steel Reinforcement: Fe 500 Grade (TMT bars) conforming with IS:1786.

Structural Steel: Fe 345

SECTION 8.2.6 DESIGN LIMIT STATES

The Limit state design method is used for the structural design of concrete and steel member. For design of the individual members loads are combined in accordance with the loading combinations specified in IS 875 to achieve the respective limit state. These are listed below:

S. No.	Dead Load	Live Load	Earthquake/Wind load
1	1.5	1.5	---
2	1.2	1.2	1.2
3	1.5	---	1.5
4	0.9	---	1.5

SECTION 8.2.7 LOAD COMBINATIONS

1. 1.5 * (DL + LL)
2. 1.5 * (DL+/-EQX)
3. 1.5 * (DL+/-EQY)
4. 0.9 * DL+/-1.5EQX
5. 0.9 * DL+/-1.5EQY
6. 1.2 * (DL+LL+/-EQX)
7. 1.2 * (DL+LL+/-EQY)
8. 1.5 * (DL+/-WLX)
9. 1.5 * (DL+/- WLY)
10. 0.9 * DL+/-1.5 WLX
11. 0.9 * DL+/-1.5 WLY
12. 1.2 * (DL+LL+/- WLX)
13. 1.2 * (DL+LL+/- WLY)

Notations

LL	=	Live Load
EQX	=	Earthquake Load in X-direction
EQY	=	Earthquake Load in Y-direction
WLX	=	Wind Load in X-direction
WLY	=	Wind Load in Y-direction

Whereas X & Y are two principal axes.

SECTION 8.2.8 REQUIREMENTS FOR DURABILITY AND FIRE

Concrete cover requirement is governed by Indian Code. The values in the following table shall be appropriate for a fire rating of 2 hours.

The following classification also applies in the design of structural elements: -

Table 6 Structural Exposure Classification

Exposure	**Classification**
Members in contact with the ground	Very Severe
Members in interior environments	Mild
Members in above-ground exterior environments	Moderate

In general, adopting the minimum concrete strengths and reinforcement covers shall ensure the durability and fire resistance of concrete elements. Values shown on the drawings shall not be less than the following:

Table 7 Minimum Criteria for Concrete

Element/Location	**Minimum Cover (mm)**	**Minimum thickness (mm)**	**Minimum f_{ck} (used in the design)**
Cast In Place Concrete			
1. Concrete cast against and permanently exposed to earth	75	200	30
2. Concrete exposed to weather and not in contact with ground (moderate)			
a) RC slabs	25	125	30
b) RC walls	25	200	30
c) RC beams	30	230	30
d) RC columns (Ties)	40	300	30

SECTION 8.2.9 DESIGN CODES, STANDARDS AND REFERENCE DOCUMENTS

Table 8 Code Titles

S. No.	CODE	NAME
1.	IS: 1893 – 2016	Criteria for Earthquake resistant deign of
2.	IS: 13920	Ductile detailing of Reinforced Concrete Structures subjected to Seismic forces.
3.	IS: 4326 – 1993	Earthquake resistant Design and construction of Buildings
4.	IS: 875 – 2015 (Part I to III & Part V)	Code and Practice for Design Loads (Other than earthquake) for Building and Structures like Dead, Imposed, Wind and other Loads
5.	IS: 456 – 2000	Plain and Reinforced Concrete (Code of practice)
6.	SP: 16	Design aids for Reinforced concrete Structure.
7.	SP: 34	Handbook on Concrete Reinforcement and Detailing
8.	IS: 3370 Part I, Part II and Part IV	Code of practice for Concrete structures for the storage of liquids.
9.	IS: 1786	Specification for High Strength Deformed Steel bars and wires for concrete reinforcement
10.	IS: 1904	Code and Practice for design and Construction of Foundations in Soils
11.	IS: 800-1980	Code of Practice for general Construction in Steel.
12.	BS 5950 – 1: 2000	Structural Use of Steelwork in Building
13.	IS 2911 (Part1 – Sec1 to 4): 1979	Code of practice for Design and Construction of Pile Foundation
14.	NBC – 2016	National Building Code of India – 2016

SECTION 8.2.10 PLANNING & DESIGNING CLAUSES AS PER VULNERABILITY ATLAS OF INDIA

SECTION 8.2.10.1 SEISMIC ZONE FOR EARTHQUAKES.

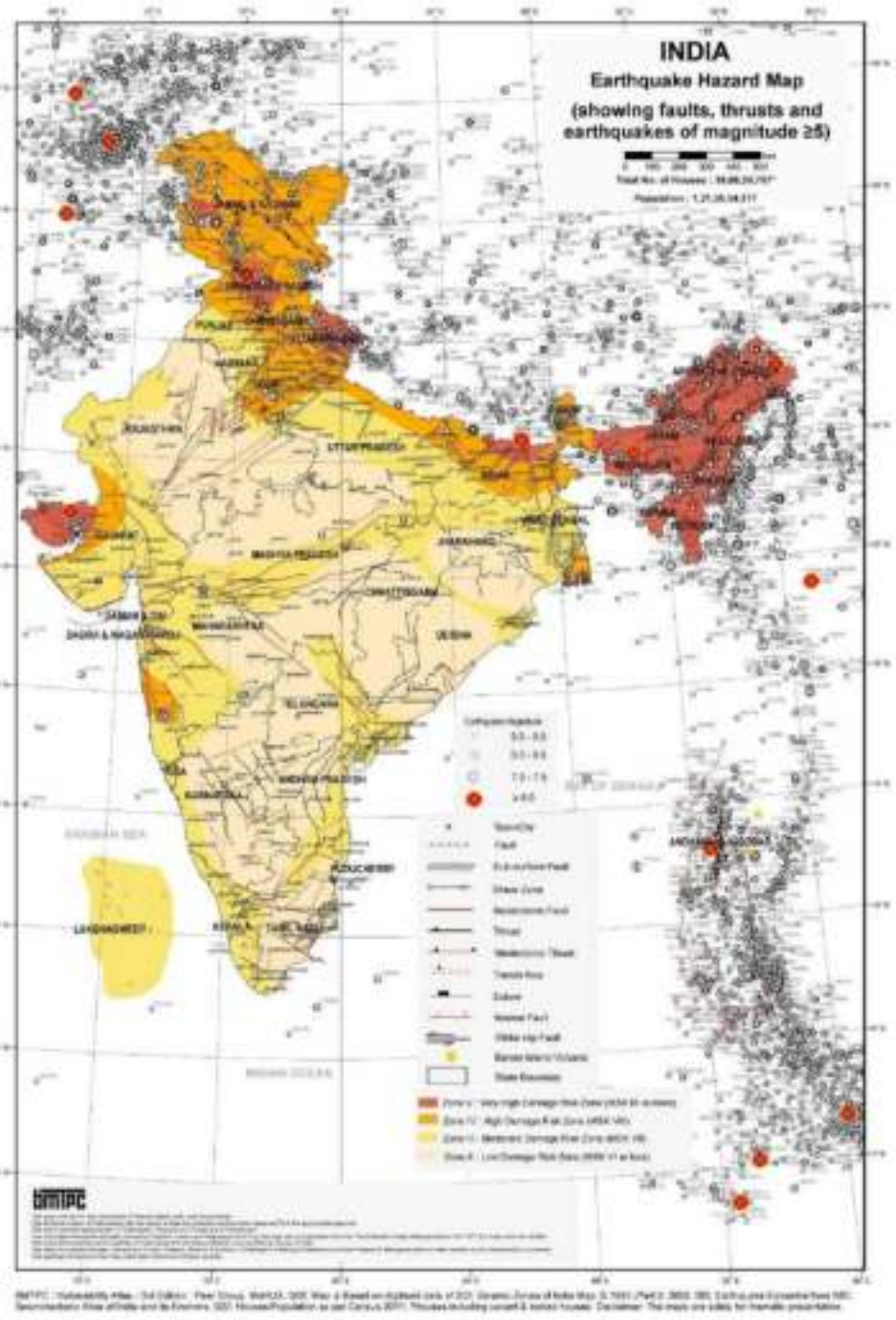


Figure 52 Earthquake Hazard Map

Guwahati Comes under Zone V: Very High Damage Risk Zone (MSK IX or more).

This design phenomenon is considered in the ETABS model. Below given snapshots give the detail of the seismic criteria Earthquake force definition in X direction

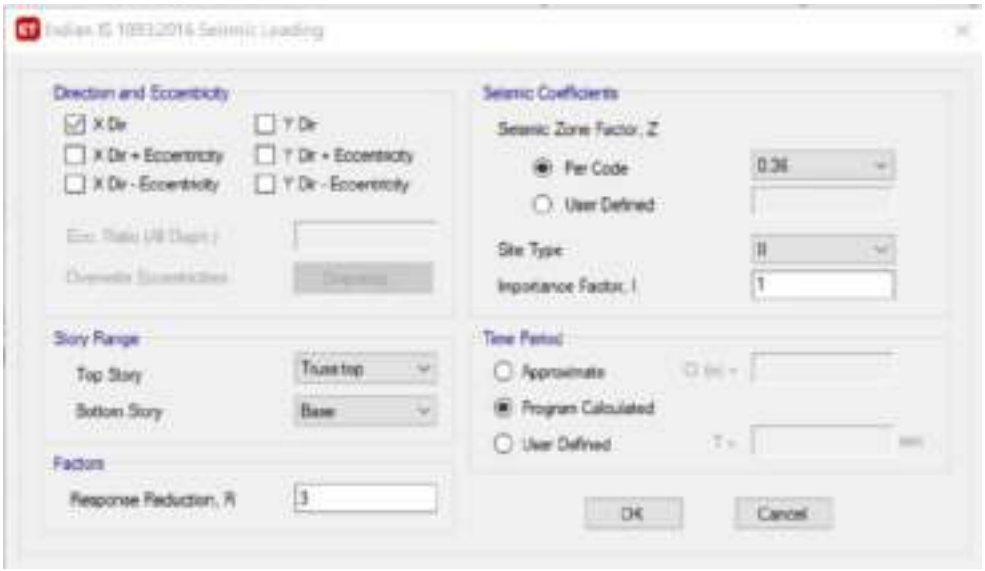


Figure 53 Reference Snap from ETABS

Earthquake force definition in Y direction

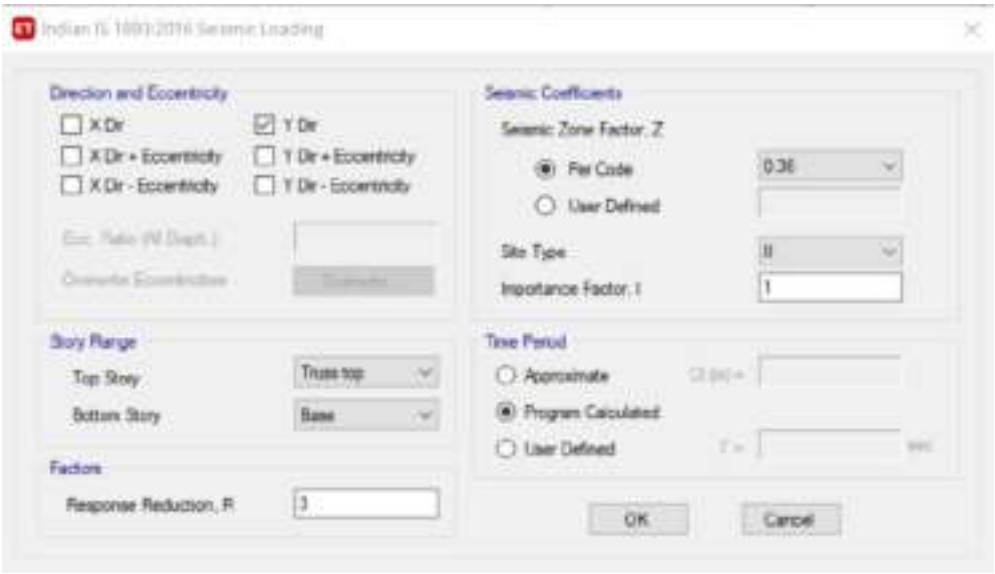


Figure 54 FIGURE 55 REFERENCE SNAP FROM ETABS

SECTION 8.2.10.2 WIND VELOCITY

Figure 55 Wind Hazard Map

Guwahati Comes Under High Damage Risk Zone - B (V_b=50 m/s).

This design phenomenon is considered in the etabs model. Below given snapshots give the detail of the wind load criteria

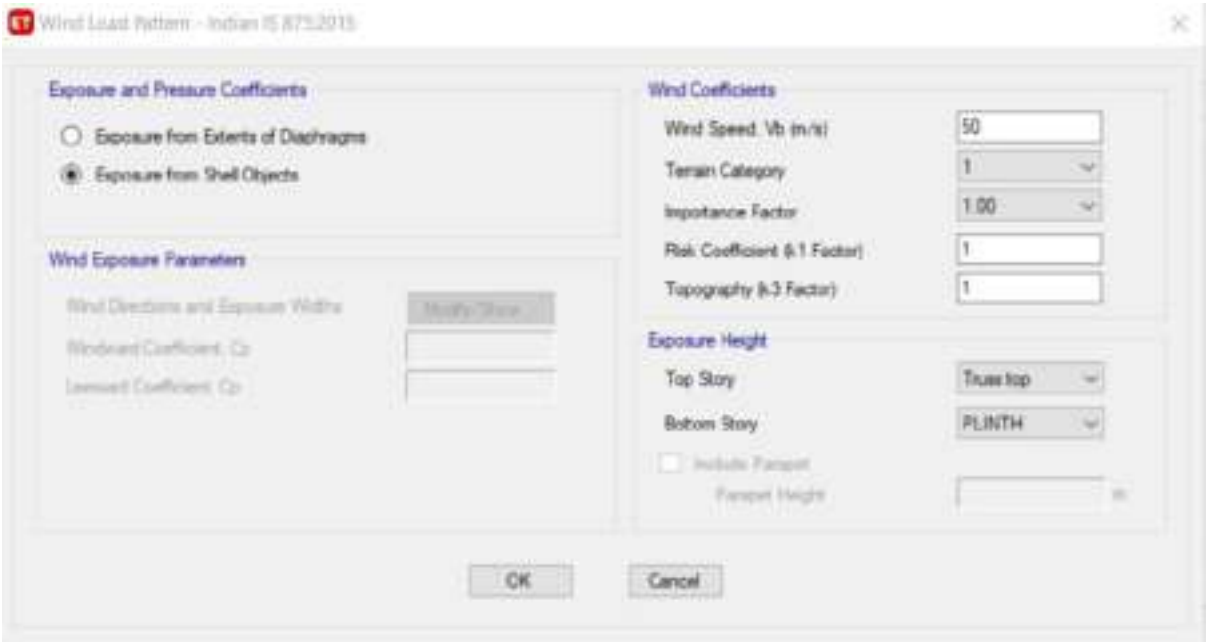


Figure 56 Reference Snap from ETABS

SECTION 8.2.10.3 AREA LIABLE TO FLOOD AND PROBABLE MAX. SURGE HEIGHT

Figure 57 Flood Hazard Map

Guwahati Comes under Area liable to flood site location is finalized taking this in regards also provision of retaining wall and gabion walls made as required.

SECTION 8.2.10.4 THUNDERSTORM INCIDENCE HISTORY

Figure 58 Thunderstorm Incidence Map

As per map Guwahati comes under first zone 40-60 nos of Thunderstorms

SECTION 8.2.10.5 CYCLONE OCCURRENCE MAP

Figure 59 Cyclone Occurrence Map

Guwahati Comes under cyclone safe zone as per map, no special design criteria required.

1 Knots = 0.514 meter per second speed, so 34-47 Knots means 17.49 – 24.18 m/S speed

SECTION 8.2.10.6 LANDSLIDES INCIDENCES WITH ANNUAL RAINFALL NORMAL

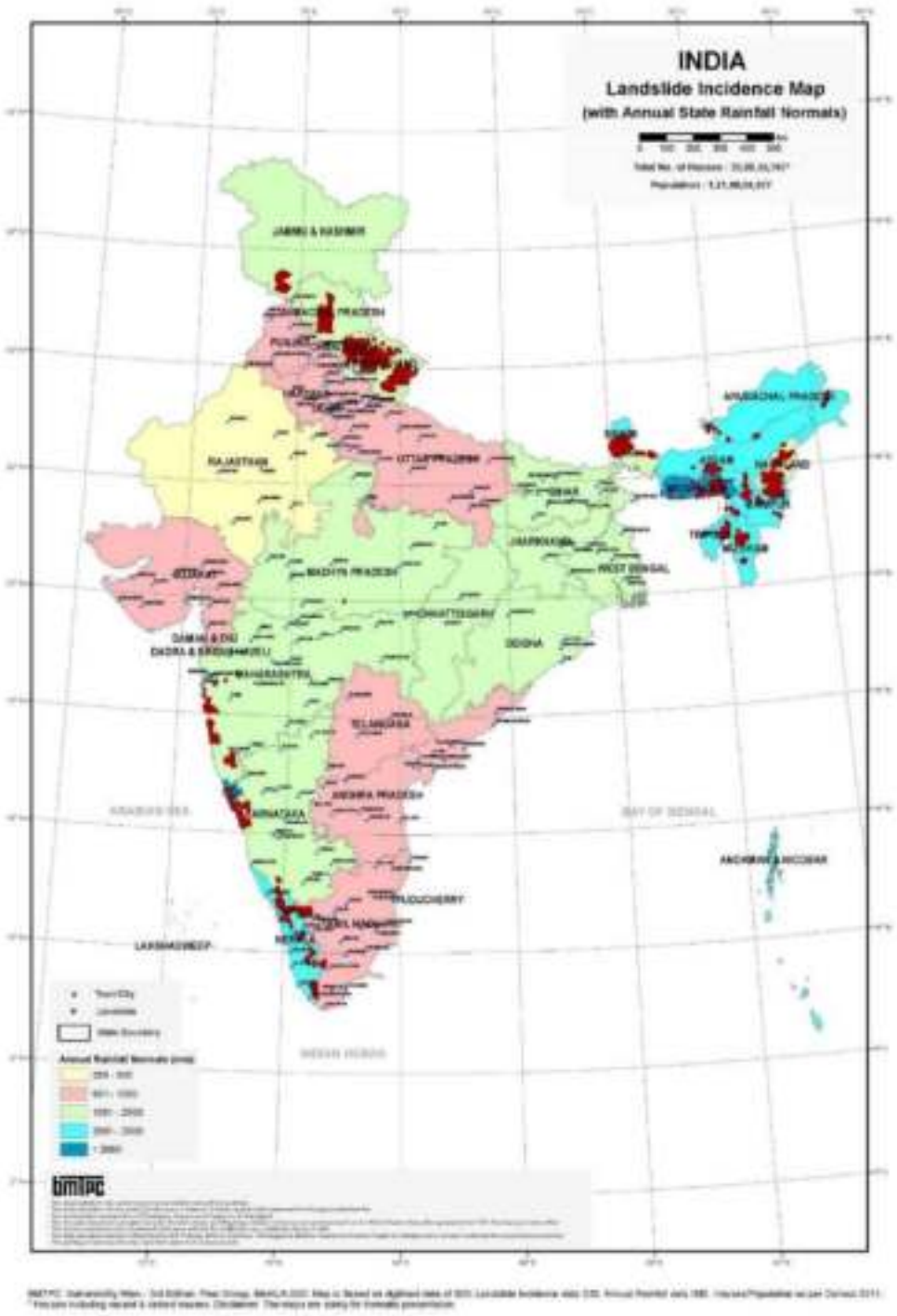


Figure 60 Landslides Incidence Map

Guwahati comes under Landslide zone and having 2001-3000 mm rainfall in normal. Provision of piles, retaining wall and gabion wall is made for the protection against landslide.

SECTION 8.3 FLOATING JETTY

SECTION 8.3.1 GENERAL ARRANGEMENT

The proposed Floating jetty is 24m X 9m X 2.2m in size, allowing smooth flow of every service operation. The width of jetty is also selected to allow safe docking of any typical seaplane with giving enough margin between gangway and the wings extend. For which a thorough study is done of the dimensions of many sea planes with varying seating capacity. Reference for the size of sea planes of different sitting capacity is taken from the website of Canada based aircraft manufacturer 'Vikings Pvt ltd'.

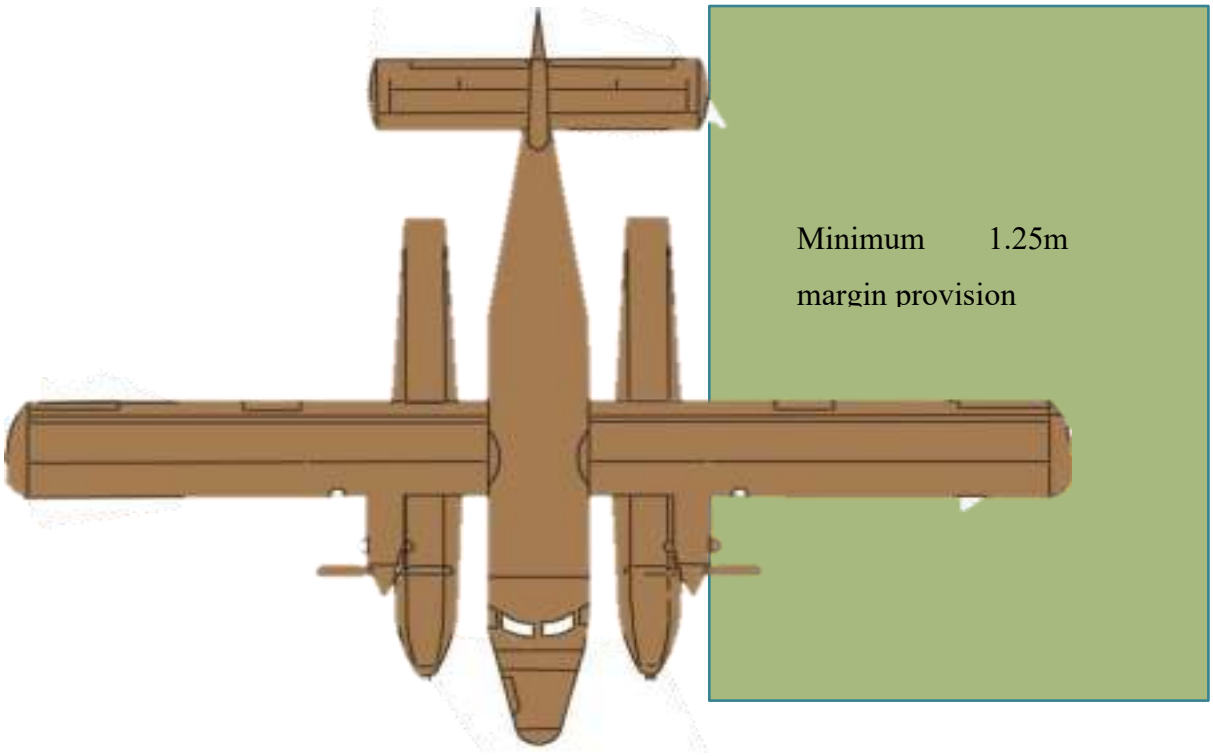


Figure 61 Floating Jetty Margin Provision

SECTION 8.3.2 STRUCTURAL ARRANGEMENT & GRADE OF MATERIAL

The jetty is designed with steel plates and girder, the hollow box type of section is proposed made up of plates, supported by intermediate pillars, girders, and stiffeners at suitable spacing to provide enough strength and stiffness to the plate coverings

Grade of material:

The grade of structural steel shall be as following:

M.S. plate: 235 MPa,

Steel members (Girder & Frames): 355 MPa.

Steel members (Stiffener & Pillars): 235 MPa.

The sizes of members of the floating jetty considered as listed below

Table 9 MS Plate Sizes

M.S Plate Sizes (mm)		
Sr No.	**Location**	**Plate Thickness**
1	Bottom plate	10
2	Deck plate	10
3	Side plate	10
4	Longitudinal plate	10

Table 10 Stiffener & Pillars Sizes

Stiffener & Pillars sizes (mm)		
Sr	**Location**	**Member &**
1	Bottom stiffener	Bulb section 140 X
2	Deck stiffener	Bulb section 140 X
3	Side stiffener (Deck port & star	Bulb section 140 X
4	Side stiffener (other side)	Bulb section 140 X
5	Bulkhead stiffener (Longitudinal)	Bulb section 140 X
6	Pillars & Bracing	S.H.S 200 X 12.5

Table 11 Girder & Frame Sizes

Girder & Frame sizes (mm)					
Sr. No.	**Location & Member**	**Web Height**	**Flange Width**	**Web Thickness**	**Flange Thickness**
1	Bottom girder - T 300 X 200	300	200	11	17
2	Bottom frame- T 250 X 200	250	200	11	16
3	Deck girder- T 300 X 200	300	200	11	17
4	Deck frame- T 250 X 200	250	200	11	16
5	Side frame- T 250 X 200	250	200	11	16

SECTION 8.3.3 LEVEL OF FLOATING JETTY & HIGH FLOOD LEVEL

Chart Datum level: (+) 40.19 m (from M.S.L.)

High flood level: (+) 51.46 m (from M.S.L.)

Free Board – 0.400 m

SECTION 8.3.4 LOAD DATA

SECTION 8.3.4.1 DEAD LOAD

The dead loads shall be assessed considering following unit weight of materials.

Structural steel: 7850.0 kN/m^3

Reinforced Concrete: 25.0 kN/m^3

SECTION 8.3.4.2 LIVE LOAD

A live load of 6 kN/m^2 is considered for floating jetty and 3 kN/m^2 for gangway, Concentrated load of 4.5 kN at the far end of jetty

SECTION 8.3.4.3 CURRENT LOAD

Water current velocity for the given site

$$Fd = 0.5\rho C_D A_P V_c^2$$

Where C_D = drag coefficient, 2 for rectangular body

Vc = current velocity

SECTION 8.3.4.4 WIND LOAD

$$Fw = 0.6\ C_D\ A_p V_z^2$$

Where C_D = drag coefficient, 2 for rectangular body

Vz = wind speed 50 m/s for Guwahati

MOORING LOAD

As per details received, taking maximum displacement of vessel as 3300 T. As per I.S 4651-part 3, table 4, the bollard shall be 50 tons as per the requirement of Coast Guard. Line pull shall be taken as 50 Tonnes i.e., = 500 KN

SECTION 8.3.4.5 BERTHING LOAD

Berthing load can be calculated by the energy absorbed by the fender with some particular value of displacement.

Berthing energy is calculated in kNm as

E = 0.5*Cm*Mv*Vb2*Ce*Cs*Cc

Where, Cm is hydrodynamic coefficient taken 1.5

Mv is displacement of vessel

Vb is velocity of vessel to be taken 0.3 m/s

Cs is softness coefficient; Cc is berth configuration coefficient is eccentricity coefficient taken as 1.

SECTION 8.3.4.6 STABILITY LOAD

As per AS standard stability load for the restricted pontoon area is taken 1.5 kN/sqm

SECTION 8.3.4.7 FLOATATION LOAD

As per AS standards floatation load for the restricted pontoon is taken 2.0 kN/sqm

SECTION 8.3.5 LOAD COMBINATION

Load combination for flotation:

1 Self-weight + 1 Service load + 1 Live load: 400 mm freeboard required

1 Self-weight + 1 Service load + 1 Live load + 1 Flotation + 1 Stability: 50 mm reserve freeboard required

1 Self-weight + Live load of 4.5 kN on edge: Tilt not more than 15 degrees

Strength combination:

1.5 Self-weight + 1.5 Service load + 1.5 Live load

1.5 Wind Load + 1.5 Wave force + 1.5 current Force

1.5 Berthing load

SECTION 8.3.6 REFERENCES

IS 4651-1974: Code of practice for Planning and Design of ports and harbours

Guidelines for Floating Jetties / Platforms for Marinas, Minor Harbours, Fishing Harbours, Fish landing centres, Water Aerodromes and such other similar facilities in coastal areas, estuaries, waterways, rivers and reservoirs.

IS 800: 2007 – General Construction in Steel – Code of Practice

IS 4651 - Planning and Design of Ports and Harbours – Code of Practice (all Parts)

IS 226: 1975 - Structural steel (Standard Quality)

IS 875 (Part-3) Design Loads for Buildings and Structures

SECTION 8.4 ELECTRICAL WORKS

SECTION 8.4.1 DESIGN FACTORS

ELECTRICAL POWER DISTRIBUTION

- Power distribution system to be designed keeping in view the following:
- Continuity and reliability of power supply.
- Flexibility of operation.
- Concentration/distribution of loads.
- Safety of personnel and equipment.
- Investment and operational costs.
- Easy future extensions/modifications.
- Ease of maintenance.
- Maximum interchangeability of equipment resulting in minimum inventories and spare parts.
- Minimum fire risk.
- Simplicity of operation.

SECTION 8.4.2 DESIGN REQUIREMENT

Internal & External Electrical works for all buildings being constructed under this project including the following:

- Airport Terminal Building

➢ ELECTRICAL PANELS (MDB/SDB) PROVIDED FOR FOLLOWING:

- Main & Sub Distribution Boards for lighting
- Main & Sub Distribution Boards for Power
- Main & Sub Distribution Boards for UPS Supply
- External Lighting Distribution Panels

- LT CABLES PROVIDED FROM MAIN DISTRIBUTION PANEL IN TERMINAL BUILDING TO SUB-DISTRIBUTION BOARDS, VARIOUS EQUIPMENT, OTHER SERVICES PANELS ETC.
- GI cable tray (Perforated & ladder type) proposed, shall be hot- dip galvanization as a minimum complete with suspension / supporting arrangement for cables.
- Cabling, termination, earthing, feeder pillar, etc. complete in all respect.

SECTION 8.4.3 MAIN/SUB-DISTRIBUTION BOARDS & FLOOR PANELS

- All the panels shall be completely modular and compartmentalized with Form 4 Separation as per IS and CPWD guidelines. The panel shall be free standing/ floor mounted type. The panel shall be manufactured as per IS codes.
- All MDB/SDB/Electrical panel will be CPRI approved Panels.
- MDB / SDB Board shall be Indoor type of metal clad construction, partly draw out type having self-aligning type auxiliary contacts for circuit breakers and draw out modules. Bus bar of all panels shall be of aluminum except for MDB (UPS) /SDB (UPS), SDB(Lighting).
- The Main Distribution Boards shall have COS feeder of power supply, for reliability.
- The multifunction meters installed in panels shall be BMS compatible.

SECTION 8.4.4 THE FOLLOWING WORKS SHALL BE INCLUDED IN IE WORKS

- MS Steel Conduiting & wiring of lights points, fan points, exhaust fan points, light plug point (6A Socket outlet points), Power Points (16A Socket outlet points) for general use, hand driers, water coolers, A/C indoor units and any other installation requiring electrical connections such as sensor operated sliding doors, LED screens, FIDS System, signage, mobile phone charging stations, signage (Directional& Emergency), shop branding etc. Point wiring shall be complete with modular switch sockets and accessories.

- Distribution boards for lighting, Power, UPS design load & voltage drop for branch circuit shall not exceed 2 % at design load.
- All wires shall be PVC insulated FRLS with copper conductor.
- Cable Trays shall be of G.I. Perforated/Ladder type construction for power & Control Cables.
- Widths shall be as required. Thickness of material shall be 1.6 mm. Cable glands shall be made of Nickel-plated brass and shall be double compression type. However, for indoor termination, single compression type glands shall be used.
- GI raceways can be provided for taking wires/cables under floors.

SECTION 8.4.5 INTERNAL LIGHTING & DISTRIBUTION BOARD

- The provision of luminaries in various areas to be designed to achieve the illumination levels as per relevant standards. The luminaries will be selected keeping in mind Aesthetics, location requirement, and ease of maintenance and energy conservation.
- All light fixtures provided in various areas will be designed to achieve illumination levels as per Lux Level general guidance of NBC.
- All light fixtures shall be of LED type.
- All the distribution board shall be provided as per IS Codes.
- Lighting & power distribution board will be provided with incomer / outgoing as MCCB/MCB.
- DP RCCB upto 30 mA for lighting & 100 mA power will be provided in each phase of the distribution board to provide safety.

SECTION 8.5 EXTRA LOW VOLTAGE SYSTEM

SECTION 8.5.1 ASSUMPTION/CONSIDERATION

- We have planned Dedicated Server room at Guwahati Building on Ground Floor and Further distribution racks planned at outdoor near security cabin with 10 Giga Fiber Backbone speed.
- We have Planned Centralized Monitoring from Main Server room for Integrated ELV Services, CCTV System, Fire Alarm System, Network equipment's etc.
- We are Considering IP-PBX with IP based Telephone instruments with the same 10 G Fiber backbone uplink.
- We have considered Open platform IP Based Surveillance/CCTV system as per given requirement list by client with 2MP and above CCTV and 24 X 7 X 30 days recording storage.
- We have considered Addressable Fire alarm & detection system with integrated digital evacuation / public address system and will design as per IS 2189(2008).

SECTION 8.5.2 ICT (DATA & TELECOM) INFRASTRUCTURE

SECTION 8.5.2.1 DESIGN ASSUMPTION

- Consider Ring Topology Architecture with 10G Fiber Optics Cable based backbone.
- Provision of LAN IO and Telephone IO as per occupant in offices and other areas.
- UTP CAT6A (23AWG) based structured cabling for the indoor areas of building for horizontal cabling.
- Fiber optic-based connectivity for horizontal cabling.
- Consider Two Tier architect Each Distribution Access layer switched Stack directly connected to Main Server room Core switch with 10G Speed.
- IP EPABX / VOIP Based Telecom Solution, which will integrate with Public System with additional required Licenses.

SECTION 8.5.2.2 STANDARD & CERTIFICATIONS

In addition to the standards listed below, all applicable local building code, safety, environmental and other requirements have to met.

- ISO/IEC 11801:2002 - Information technology -Generic cabling for customer premises
- ANSI/TIA/EIA 568-B - Educational Building Telecommunications Cabling Standard, with addendums.
- ANSI/TIA/EIA 569-A - Educational Building Standard for Telecommunication Pathways and Spaces
- ANSI/TIA/EIA 598-A - Optical Fiber Cable Color Coding
- ANSI/TIA/EIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- ANSI/TIA/EIA-TSB-67 -Transmission Performance Specifications for Field Testing of Twisted Pair Cabling System
- EIA/TIA-526-7 "Optical Power Loss Measurements of Installed Single Mode Fiber Cable Plant
- EIA/TIA-526-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- TIA/EIA-854 Full Duplex Ethernet Specification for 1000Mbps Operating Over Category 6 Balanced Twisted Pair Cabling.
- Institute of Electrical & Electronics Engineers Sixteenth Edition
- IEEE 802.1 - LAN/MAN Bridging and Management.
- IEEE 802.11 -Wireless LAN's.
- Building Industry Consulting Service International (BICSI) recommendations.

SECTION 8.5.2.3 CONNECTIVITY & TOPOLOGY

- Main Server shall be considered in Server Room with 02 core Multi mode fiber cable in ring topology, out of 6 core 02 core will be used for uplink connectivity to main server room, 02 core will consider as a back-up & another 02 core will consider as a redundancy or future scalability.

- Consider Layer 3 Core 24 Port Network switch with Minimum 4 SFP+ Port. 10Gbps backbone connectivity will consider between Access layer Switch to Main server room network switch. Layer 3 switch will consider with 40Gbps scalability featured.

- Distributed Network rack will consider with Layer-2 Non-POE & POE Network switch and connected with Layer -3 switch with 6 core single mode fiber cable in ring topology, 10 Gbps in Backbone connectivity will consider between outdoor rack to layer 3 switches.

- 1000Mbps/1Gbps (Ethernet) from Distributed rack to individual user/device
- Wi-Fi with 802.11ac consider for Indoor area includes Building, passages as per proposed requirement list by client, all Wireless access point will integrate & Control/Managed by Hardware based Wireless controller, 3X3 MIMO Access point with multiuser features.
- POE (Power over Ethernet) Network switch will consider for CCTV, Wi-Fi, IP Phone.

SECTION 8.5.2.4 REQUIREMENT OF ELV SPACE

- The space requirement for data and voice services shall include provisioning for termination equipment's, active equipment's such as Networking Switches, passive UTP CAT6A based structured cabling, Network rack for installation of Active and passive components.
- Services wise Equipment Rack includes Data Communication, Voice Communication and iBMS Equipment's includes PA/ CCTV System Components

SECTION 8.5.2.5 REQUIREMENT OF SERVER ROOM & SPACE

Server Room have planned on Ground Floor to minimizing intervention & privacy for maintenance personnel.

Equipment that will be installed in Server Room, including but not limited to the following:

- Terminations for copper cabling and fiber optics.
- Networking Racks, Server racks
- Main Fire Alarm Control Panel
- PA system main controller and amplifiers
- Monitoring Station for CCTV & Storage Equipment's.

SECTION 8.5.2.6 SERVER ROOM REQUIREMENTS

- Min 4mtr X 3mtr of space or as per requirement to installed Multiple networking and server rack.
- Must be air-conditioned 24 x 7, with stand by redundancy.
- Clear top-to-bottom height shall be 10ft minimum, considering that the telecom racks can be as tall as 96",

- False flooring shall be required minimum 300mm from unfinished floor
- False ceiling - required
- A good quality earthing system.

SECTION 8.5.2.7 UPS REQUIREMENT

- A separate local UPS is recommended for Server room Equipment's in case of power outage.
- Centralized UPS is recommended for Other Equipment's includes, computers, Printer, Scanner, Projectors, Smart Displays etc.

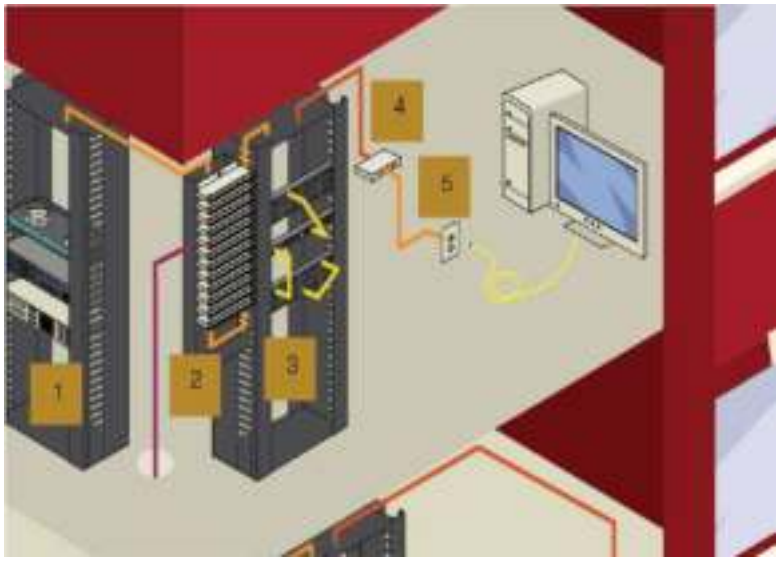


Figure 62 Representative Illustration: Concept of Server Room / Equipment Room

SECTION 8.5.2.8 LEGEND

1) Enclosure or Telecom Rack
2) Field Side Termination from TSP/ISP / Fiber components.
3) Patching hardware, termination blocks / Network switches / NVR / Servers etc.
4) Zone Distribution Outlets / Distributed racks / uplink components.
5) IO – To connect field devices with patch cord which includes Computers, IP Phones, CCTV, Access control, iBMS Controller, Projectors, Display etc.

SECTION 8.5.3 IP BASED VIDEO SURVEILLANCE/CCTV SYSTEM

SECTION 8.5.3.1 DESIGN ASSUMPTION

We have considered IP Based CCTV & Access Control System Service will be centralized monitored from the Main Server Room.

CCTV Camera shall be considered on each Entry and Exit, Lobby, Perimeter of Entire Building and Important Area.

SECTION 8.5.3.2 STANDARDS & CERTIFICATIONS

- ONVIF compliant and supporting H.264 High Profile
- Complete range of IEEE and ISO/OSI model standards and Ethernet protocols.
- UL listed, certified & approved components.
- Ruggedized, IP66 rated enclosures.
- IK10 compliant vandal-resistant enclosures.
- Full set of IEEE802.x, ANSI/EIA/TIA-568-C.2 standards, ISO/CENELEC specifications

SECTION 8.5.3.3 SYSTEM DESCRIPTION

- A network camera-based surveillance system is proposed in the common areas, Entry/Exit and passages of the entire building
- The CCTV system is designed using UL listed and approved components.
  - Types of Cameras
    - Veri-Focal IR Bullet network cameras – outdoor as required
    - Veri-Focal IR Dome network cameras – indoor as required
    - PTZ-Pan, Tilt, Zoom- network cameras – outdoor as required
    - Storage system including fail-safe and redundancy architecture for storage and retrieval of data; suggested storage is 24Hrs. x 30 days

- VMS application – inclusive of cameras' licensing server and monitoring application, industry standard Intel based server with appropriate operating system
- High resolution HDMI2.x supporting commercial LED Video Wall display with accessories.

- Cameras themselves will have in-built web-browser for direct access/viewing from any authorized personnel. In selected areas, the camera may have a two-way audio capability.
- The cameras proposed shall be high-definition, 4 megapixel and above cameras for excellent video clarity.
- The cameras suggested would support Power-over-Ethernet to minimize power supply cabling distribution for the cameras as well as protecting installation from power outages or miscreants
- A minimum resolution of 2 MP in HD format is suggested in PAL systems and a range of frame rates such as 25 fps to 30 fps.
- Protocol support for - IPv4, IPv6, TCP, UDP, ARP, ICMP, IGMP, HTTP, HTTPS, FTP, SMTP, DHCP, DNS, NTP, RTP/RTCP, RTSP, SNMP (MIB-2)
- Support for full motion video ranging from MPEG-4 to JPEG and H.264 main profile over network.
- Viewing and online storage shall be treated as two different simultaneous activities. Hence video streaming at two different levels or compressions is suggested.
- The cameras will have sensor and relay contacts for connecting to the other devices and systems.
- Implementation of error recovery mechanisms and fault tolerance of hard disk such as RAID levels shall be in place.
- Hard disks shall be replaceable 'on-the-fly', i.e., without shutting down the server, i.e., hot pluggable.

SECTION 8.5.3.4 IP BASED CCTV SYSTEM COMPONENTS:

CAMERA REQUIREMENT

- TCP/IP based network cameras,
- Video Analytics – Intelligent Object Detection & Motion Detection,
- Full HD Format 1920 x 1080 pixels, 4 MP Camera with Built in IR
- Power-on-Ethernet – no separate power supply required
- Low Lux Application Cameras
- Vandal-proof IK10 housing, IP66 rated protection against environment,
- Compliance to ONVIF for third party integration and working with existing server and storage.
- IR Veri-Focal Dome Camera for Indoor area, IR Veri-Focal Bullet Camera for Outdoor area, IR PTZ Camera for Outdoor campus area.
- UL Listed Certified.
- Inbuilt Video analytics features includes Motion detection, Object Detection, People Counting.

SERVER & STORAGE AND DISPLAY:

- We considered 24 X 7 X 30 days Storage as per camera nos. with 50% extra expandability for future cameras with RAID features.
- Servers will be considered for 100 Channel Maximum, Client PC will be considered for monitoring of the CCTV system as per client requirements.
- 1nos. of 55-inch LED display considered for monitoring the CCTV System at Server room

Figure 63 Conceptual Schematic of IP Based CCTV System

SECTION 8.5.4 FIRE DETECTION & ALARM SYSTEM

SECTION 8.5.4.1 OBJECTIVE

The objective is to install fire detection and alarm system to provide early warning in case of fire emergency. The purpose is to be alerted at an incipient stage of fire (smoke) to enable manually extinguishing of the fire even before it develops into a major hazard.

SECTION 8.5.4.2 DESIGN ASSUMPTION

- Human Life Safety and security.
- Stringent certifications for high grade performance such as defined by international standards and product approvals and listings.
- Standard recommended installation practices to evolve minimum interruption of work and minimum loss of human life.
- Intelligent and accurate sensors
- Intelligent communications, monitoring and supervisory
- Future integration capability to 3rd party systems such as IBMS
- Multiple fire panels that can be connected to each other on peer-to-peer model and supporting TCP/IP interfaces for networking on copper (Ethernet / CAT6) as well as fiber optics media

- Integration of common fire alarm panel with the tenant fire alarm panel would be done on control module & monitor module with hardwire connectivity.

SECTION 8.5.4.3 SYSTEM DESCRIPTION & FEATURES OF FIRE DETECTION & ALARM SYSTEM

- Addressable Fire Detection & Alarm System.
- Networking of Multiple panels with the entire campus.
- Zones – For the purpose of alarm annunciation, each floor of the building shall be considered a separate zone.
- If the system serves more than one building (i.e., Academic building, Support building, School Hall etc.) each building shall be indicated separately.
- Detectors- Mix of Smoke, Heat, Rate of rise and Multi-Sensor Detectors at Admin Area, Sports complex. Beam Detection for High Ceiling Areas like Multipurpose Hall, Halls, Courts as per guidelines.
- Alarm Verification Feature – A feature of automatic fire detection and alarm systems to reduce unwanted alarms Occupant Notification Devices.
- Annunciator – A unit containing two or more indicator lamps, alpha-numeric displays.
- Evacuation Signal – Distinctive signal intended to be recognized by the occupants as requiring evacuation of the building.
- Fire Command Station (Fire Command Center) or ELV Room– The principal location where the status of the detection, alarm, communications and control systems is displayed, and from which the system(s) has the capability for manual control. Standards based, building codes compliant.
- Integration with PA system for EVAC in case of emergencies.
- Audible Alarms – Audible alarm notification appliances shall be provided and shall sound a distinctive sound Intelligent Ethernet based controllers for integration

- Visible Alarms– Visible alarm notification appliances shall be provided in accordance with NFPA 72
- Network Repeater Panel: - Should have E-map featured with required operated display and located to security person to easy operability. Cabling shall be with 2 core 1.5sq. mm. copper multi-stranded conductor un-armored FRLS Cables.
- The system is proposed with backup power from UPS and independent power backup through maintenance-free storage batteries capable of 48 hrs of normal operation & 1 hr of operation under alarm condition with adequate spare capacity overhead.
- The entire fire alarm system network shall be integrated with building BMS through (Backnet/Modbus/ Lan) over the IP gateway. All the fire alarm panel devices and modules shall be made available in BMS.
- GUI on FAS floor plan reflecting all devices with their online status shall be provided with complete penetration from building level to floor level to room level.
- The FACP shall have an auto dialer facility that will call up predefined numbers (minimum of Ten numbers) and send predefined emergency messages during the fire/emergency events.
- As per NFPA standard, in case of any fire event fire panel shall trip the AHU starter panel & AHU damper through a potential free relay module.
- All pressurization fans & ventilation fans shall be integrated with the fire alarm system through potential relay modules

MINIMUM REQUIREMENT FOR SAFETY

SR. NO.	SCOPE/EQUIPMENT	SAFETY LEVEL
1	Layer to support service level	**Fire detection warning alarm on reconfirm:**
		Report to fire services

SR. NO.	SCOPE/EQUIPMENT	SAFETY LEVEL
		Report to facility managers
		Report to end client
		Report equipment maintenance agency
		Alert message sequence as per evacuation guidelines
		Position Building /Infra evacuation guidelines
2	Layer to support management level	**Report to facility managers:**
		Fault Alarm on GUI
		Dirty Detectors status on GUI
		SLC, PA loop healthiness
		Perform regular system audit
		FACP, N/W controller healthiness
		Building performance wrt to design parameters report
3	Layer to support control level	Fire Alarm Control Panel
		Refuge floor level display, announcement

SR. NO.	SCOPE/EQUIPMENT	SAFETY LEVEL
		Networked online FACPs/repeaters
		Floor level GUI
		Interfaces to other systems
4	Layers to support field level	**Detectors to identify:**
		Smoke
		Heat
		Rate of rise temperature
		Flame
		Fire in voids, shafts, Ducts
		Alerts Occupants:
		Strobe, hooter, exit guides
		Manual Pull Stations
		Fire exits
		Emergency exits
5	Support Third Party	**Soft Integration**
		FACP, GUI

SR. NO.	SCOPE/EQUIPMENT	SAFETY LEVEL
		Mobile warning, alert messages
		Telephone warning, alert messages
		Shut down & startup operation

SECTION 8.5.4.4 FIRE DETECTION & ALARM SYSTEM COMPONENTS

A) DETECTORS

- Smoke, Multi-sensor Detector (For general areas where ceiling height is 3-4m)
- Passages, Faculty Cabins, Admin Areas, Workstation area, Waiting area, Reception area etc.
- Multi-Sensor Detector (above and below false ceiling areas)
- Heat & Rate of Rise Detectors (Kitchen and pantry areas, Electrical room etc.)
- Duct or CO2 Detection (HVAC Duct / AHU Rooms)
- Beam Detectors for high ceiling / double height areas etc.

B) INITIATING DEVICES

- Manual Call Point (Passages, stairs, entry/exit),
- Monitor module for Beam detector & iBMS Services, Flow switch etc.
- Relay module for other services like Access control etc.…
- Control module for Sounder and other third-party device.

C) NOTIFICATION DEVICES

- Visual Strobes

- Audible Directional Sounder

d) Fire Alarm Panel

- Main Panel capacity of 2/5/10 SLC (Signaling Line Circuit) Loops,
- Each loop has capacity of 250 Detectors or Devices,
- Networkable Panels,
- Communicate with IBMS software through BACnet/IP,
- Support multiple repeater panels,
- SLC Loop Length would be of 1500m,
- 640 Character or higher character LCD Displays,
- Battery backups.

SECTION 8.5.4.5 DETECTOR SPACING & DESIGNING METHODS

- Following Detectors Spacing and Coverage is applicable for Smoke, Multi and Heat Detector.
- For general areas the spacing between any point in a protected area and the detector nearest to that point should not exceed 5.3m for a smoke detector.
- To ensure complete coverage for square layouts, spacing's between detectors and walls should be reduced to 3.5m for a smoke detector.

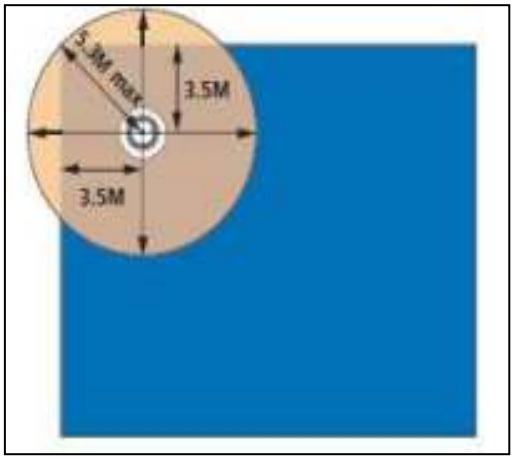


Figure 64 Reference Image

- For corridors less than 2m wide, only the centre line needs be considered therefore it is not necessary to reduce detector spacing's to provide complete coverage. Thus, for smoke detectors, spacing becomes 7.5m from a wall and 15.0m between detectors.

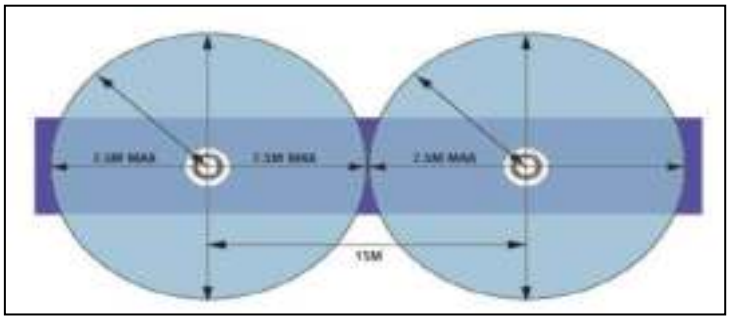


Figure 65 Reference Image

- Beam detectors are generally meant for High Ceiling Areas like Halls, Auditoriums, Multipurpose Hall, etc.

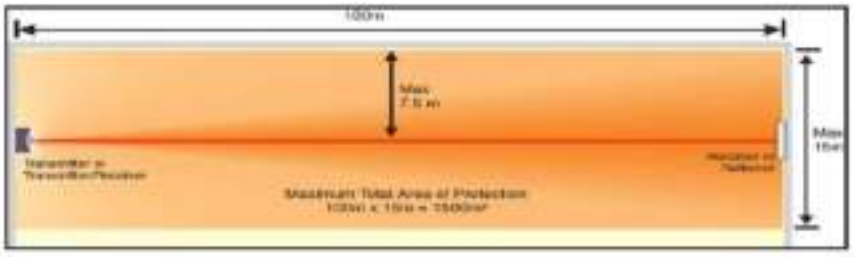


Figure 66 Reference Image

- Manual call points should be located on escape routes, at all exits to free air and all exits from each level of multi-storey buildings.

- For general applications, call points should be located such that nobody needs to travel more than 45m to reach the nearest call point. If the actual layout is unknown at the design stage, then a straight-line distance of 30m should be used as a design.

Figure 67 Reference Image

SECTION 8.5.4.6 STANDARDS & CERTIFICATION

- National Building Code of India – 2016
- Bureau of Indian Standards (BIS) Codes: IS 2189
- NFPA 72/2010 edition or EN54
- Approvals or listings or certifications – UL or EN / FM or VdS

SECTION 8.5.4.7 SELECTION OF EQUIPMENT

- Main Fire Control Panel
- Repeater Panels
- Selection of Appropriate Automatic Detectors
- Beam Detectors
- Manual Call points
- Remote indicators
- Alarm & Notification Devices

MAIN FIRE CONTROL PANEL

It Shall be Featured with:

- Multiple Loops to address detection and other devices, Single loop can support up to 250 devices, includes detectors and devices.

- The fire Alarm panel will be considered with an Inbuilt battery backup to avoid failure of power supply with necessary battery back-up as mentioned in NFPA Guideline.
- The fire alarm Panel will be monitored with Integrated GUI Software E-Map Facilities.
- Any mix of detectors & Device support by panels such as photo, thermal, or multi-sensor with Adjustable sensitivities, Manual Call points, Sounder strobe devices.
- The fire alarm panel will be considered with network and Modus modules or card to integrate with other repeater panels through network and iBMS system with Modbus module.

REPEATER PANEL

Figure 68 Repeater Panel

- Central control panel is to be installed at LV System server room, which is a secure, restricted entry location to compliment this, Active Repeater Panel(s) would be installed at Security Gate or Facility Manager's Cabin.
- Suggested Fire Alarm System shall support multiple repeaters.

SELECTION OF APPROPRIATE DETECTORS

Figure 69 Multi-Criteria

- Multi-sensor fire detector – for protection against multiple/mix of fire cau detecting one or any of smoke - heat.

- The proposed design would consider such factors and suggest an optimum mix of components considering various locations, applications and operability.

THERMAL/HEAT DETECTORS

Figure 70 Heat Detector

- Heat detectors would be used in locations where the ambient conditions might cause false alarms if smoke detection were to be used, for example, where there is a high level of dust, fumes, steam or smoke under normal conditions.
- The design shall suggest the rate of rise type heat detection in selected areas to compliment other forms of detection such as in server room and other such critical equipment areas.

BEAM DETECTORS

- Beam detectors shall use the Transmitter/Receiver and reflector plates for protecting open areas with high and sloping ceilings, and wide-open areas where spot type smoke detectors are difficult to install and maintain.

MANUAL CALL POINT

Figure 71 Manual Call Point

- Manual call points shall be located on escape routes, at all Entry/exits & Staircases.
- Call points shall be located such that nobody needs to travel more than 45m to reach the nearest call point.

FRLS CABLES

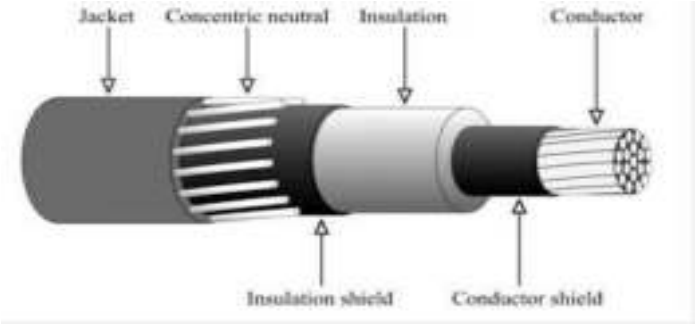


Figure 72 FRLS Cable for Fire Detectors Connectivity

- Fire-resistant/fire-retardant cables are suggested for all parts of the system to ensure cable integrity over a longer period. For example, when connecting to alarm sounders or while interconnecting two panels or interconnecting detector elements in a hidden or concealed area.
- Fire alarm cables would be segregated from the cables of other systems; they would be clearly marked, preferably different colored and would be routed through parts of the building that provide minimum risk.

SOUNDER WITH STROBE AS A NOTIFICATION DEVICE

Figure 73 Sounder with Strobes

- Sounders with strobes providing high audio output with clear audibility would be deployed to meet the critical needs of life safety and for effective emergency voice communications, tone signaling and visible signaling to alert the hearing impaired.

RESPONSE INDICATOR

- Response indicators would be used in areas where the detector mounting position is such that the detector is not easily viewed, for example in ceiling voids. Response indicators dramatically reduce search distances where detectors are mounted inside rooms that are normally closed, thus simplifying system zoning and reducing the time taken to locate the hidden source of an alarm.

MONITOR / CONTROL MODULE

- For monitoring of external, non-FAS devices such as for integration with firefighting system – status of pumps, electrical panels and flow switch, Beam Detector can be monitored. In such cases, sprinkler system can take care of fire-related emergencies.
- For Controlling third party devices such as HVAC Dampers control, Access control, Locks control, FAS Sounder control etc.

REQUIREMENT OF SPACE

- Main Fire Alarm Panel @ ELV Room
- Repeater Panel(s) @ security cabin/reception area/CCTV monitoring room.

- The space requirement for FAS services shall include provisioning for mounting fire alarm control panel, power supplies and battery apparatus, its various line monitoring and control modules, configuring and monitoring station.

SECTION 8.5.5 ANALOG PUBLIC ADDRESS SYSTEM

SECTION 8.5.5.1 CONSIDERATION

- Analog Public Address system
- Multiple paging zones with the announcement
- Call station & keypad
- Provision of background music for a relaxed ambience
- Configurable system for pre-programmed relay of information
- Integration with fire detection and alarm system.

SECTION 8.5.5.2 OBJECTIVE

- Conventional/Analog PA system is proposed for the entire building.
- The controller shall be installed in the ELV Room, while Call Stations/Paging Microphones shall be installed in both reception and ELV room along with other monitoring facilities such as CCTV and Fire Alarm repeater panel.
- The proposed system capabilities are as follows:
  - Monitor-able speaker loops, and speakers with zones.
  - The arrangement shall be possible to select individual zones or multiple zones.
  - Speakers of various capacities such as 6W, 10W,15W and 30W with adjustable line voltages of 70V or 100V are being proposed.
- In internal areas such as Passage and common waiting areas, etc. rooms, ceiling or wall mounted speakers are being proposed in the above range, while for basement areas, horn type speakers are being offered. Same loudspeaker wiring shall be used for line supervision and indication of faults.

- The controller shall operate both on mains power and a 48 V battery power supply for emergency backup with automatic switchover. It provides for supervision of both power supplies.

SECTION 8.5.5.3 BASIS OF DESIGN

- Apart from informative and public address functions, the system will back up as an emergency sound system.
- Compliance with international guidelines such as IEC60849, BS5839 and TUV standards or equivalent.

SECTION 8.5.5.4 REFERENCE STANDARDS & CERTIFICATES

- Conformance to International Standards such as follows, but not limited to:
  - EN-60849
  - ISO
  - BS 5839
  - EVAC Specifications

SECTION 8.5.5.5 REQUIREMENT OF SPACE

- Call Station Unit @ Main Server Room and or as per client requirement.
- Main Network Controller @ Main Server room PA rack
- Power Amplifiers @ Main Server room PA rack.
- The space requirement for the PA system shall include provisioning for mounting Network Controller, Power Supplies; require power amplifiers and different types of Speakers used for Evacuation.

SECTION 8.6 HVAC SERVICES

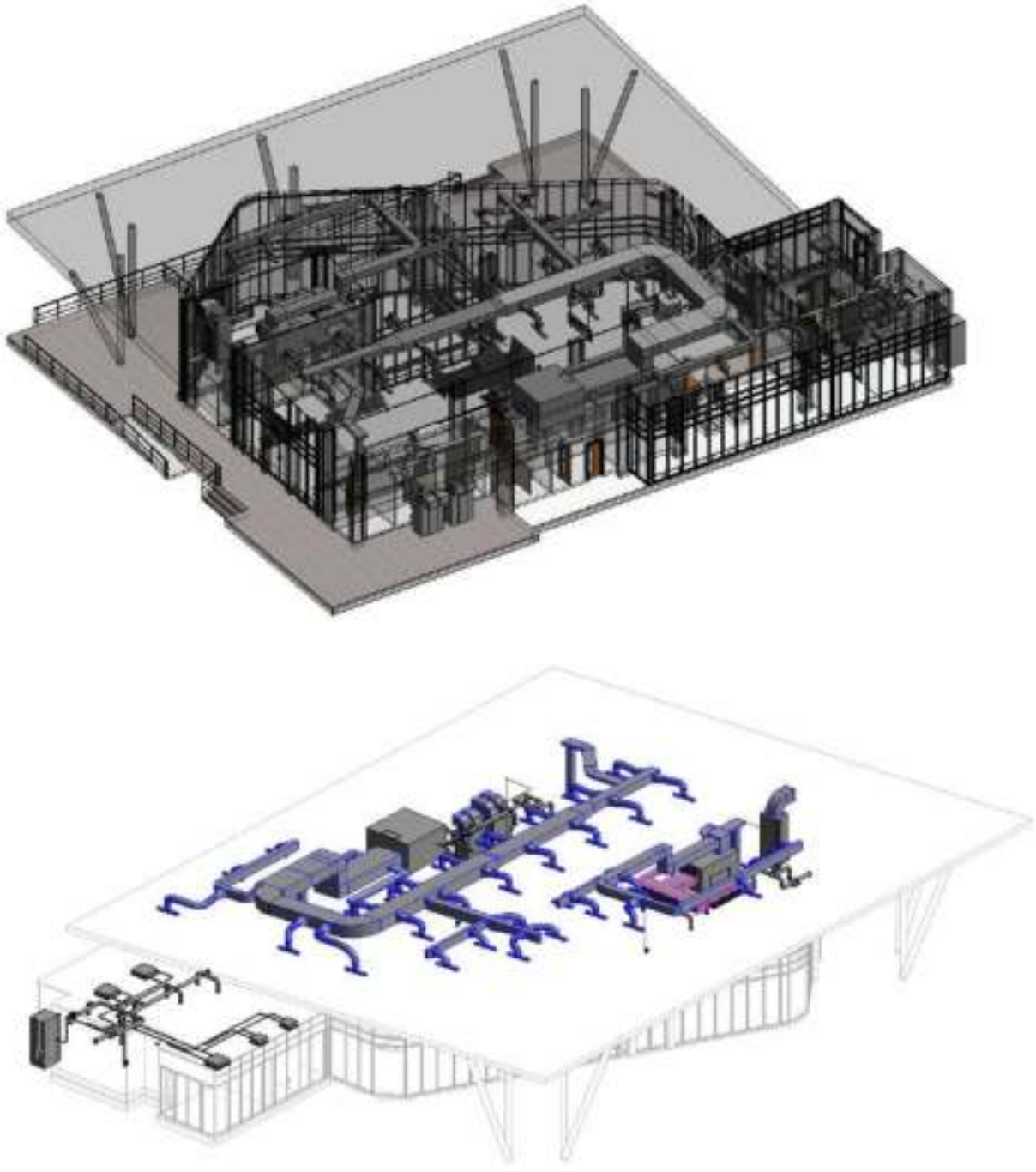


Figure 74 Conceptual HVAC Model

SECTION 8.6.1 CONCEPTUAL APPLICATION

- **COMFORT AIR-CONDITIONING FOR AIRPORT BUILDING-** The building type is Airport Terminal with Departure / Arrival area, VIP Room, Office, Back Office & CCTV Rooms.

- **VENTILATION-** Exhaust air shall be ducted to each toilet.

SECTION 8.6.2 AMBIENT CONDITION

SUMMER

Dry Bulb Temperature : 40ºC

Wet Bulb Temperature : 26ºC

Relative Humidity : 35%

SECTION 8.6.3 SPACE DESIGN CONDITIONS

Dry Bulb Temperature : 23ºC ±1

Relative Humidity : 55% ±5%

LIGHTING LOA : 2Watts/SqFt

EQUIPEMENT LOAD : 17KW

FRESHAIRQUANTITY : 5 CFM per Person

OCCUPANCY : 145 Pax

SECTION 8.6.4 VRV AIR CONDITIONING SYSTEM CONFIGURATION

Table 12 Capacity Configured

SR	AREA	AHU (Indoor Unit)	VRV Outdoor Unit	TOTAL TR
1	GROUND FLOOR-Office Area	7000 CFM	16 HP x 1No	13 TR
2	GROUND FLR Departure/ Other Area	16000 CFM	20 HP x 2Nos	32 TR

- Air Handling Unit will be connected to a group of outdoor units through refrigerant and communication cables. High quality refrigerant joints Refrigerant piping and cabling will be laid on the loft.
- Outdoor units will be located at loft/ground level of the blocks; sufficient maintenance and air circulation space will be available surrounding the outdoor units.
- A close view of the system is given in the following figures described above VRV system will consist of the following components:

Figure 75 VRV System Illustrative Layout

SECTION 8.6.5 ADVANTAGES OF VRV SYSTEM

- ENVIRONMENT FRIENDLY

The modern VRV system used HCFC free R 410A refrigerant as a media. Hence it does not contribute to ozone depletion. Also, due to its high COP especially at the part load condition, commonly prevailing in hotel applications. VRV system has a lower global warming impact on Environment.

- NOISE LEVEL

Indoor units possess very low sound levels in the range of 32 db to 38 db. In addition, outdoor units are also reasonably quiet and sound levels of ODUs are in the range of 60 dB. Moreover, VRV outdoor units have very advanced “NIGHT QUIET MODE “, which brings down the noise level of outdoor units up to 13 dB when the capacity requirement is lower during night operation. This can be achieved in both auto and manual modes.

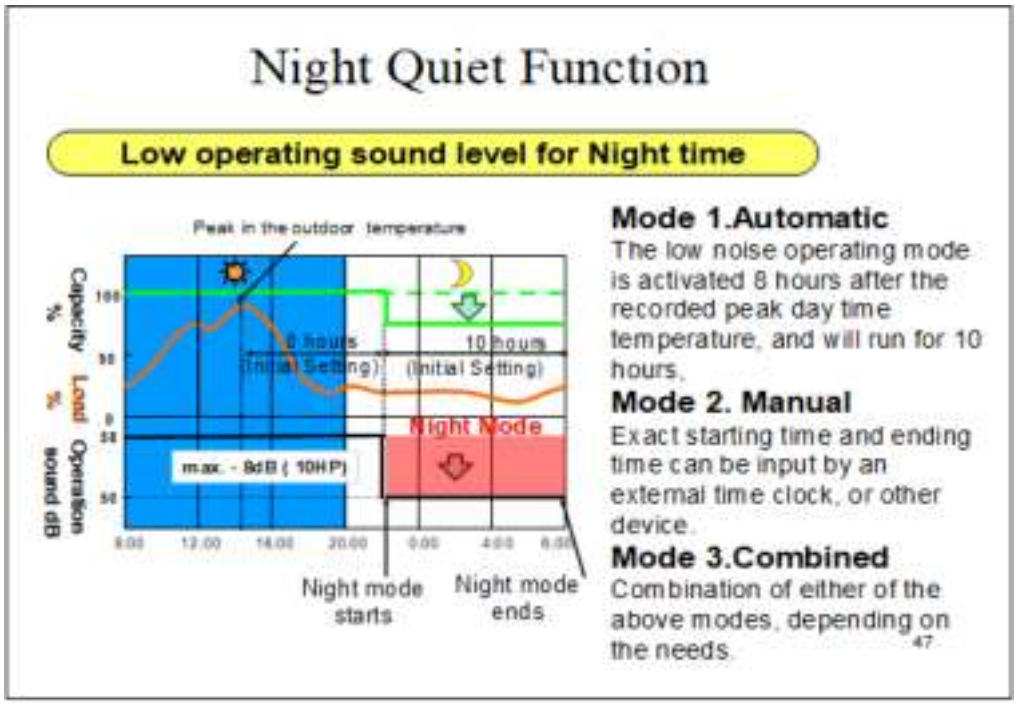


Figure 76 NIGHT QUIET FUNCTION

- OUTDOOR UNIT PLACEMENT:

It is very convenient to place outdoor units in between inclined roofs. This will completely hide the outdoor units and also provide sufficient service space. Also, shafts containing refrigerant piping will be very close to the outdoor unit location. VRV system can achieve long ref. Pipe length up to 150 mt. between indoor and outdoor units. This makes it possible to have outdoor units at the desired location.

VRV-Long Piping

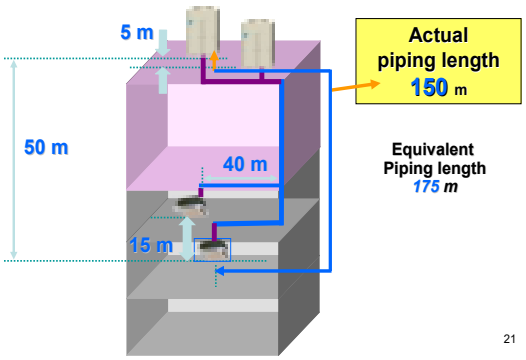


Figure 77

- LESS PIPING SPACE

VRV system involves comparatively tiny ref. Pipe diameter. Approximately 1/3 of that of the chilled water system. This results in less space utilization, and a good amount of space is left for other utilities.

Figure 78

- CENTRAL MONITORING & CONTROL:

A simplified but advanced central control air conditioning management system that gives complete control of VRV air conditioning equipment can be provided by building management requirements. These controls can be used without full time supervision. VRV offers multifunctional centralized and localized control management systems to centrally control and monitor Temperature settings, Time scheduling, change over, Malfunction alarm and various energy saving features. It can also be hooked up with a Fire and Security system.

- INDIVIDUAL CONTROL

VRV is an utterly variable system and has negligible fixed energy components. This characteristic makes it highly suitable for applications such as this, which has constantly changed occupancy of a bldg. It provides each room with independent control, allows system shutdown in rooms where No Air-conditioning is required and accordingly power consumption of the system will reduce proportionately. It has better energy efficiency at part load conditions, which is usually the case in hotel buildings.

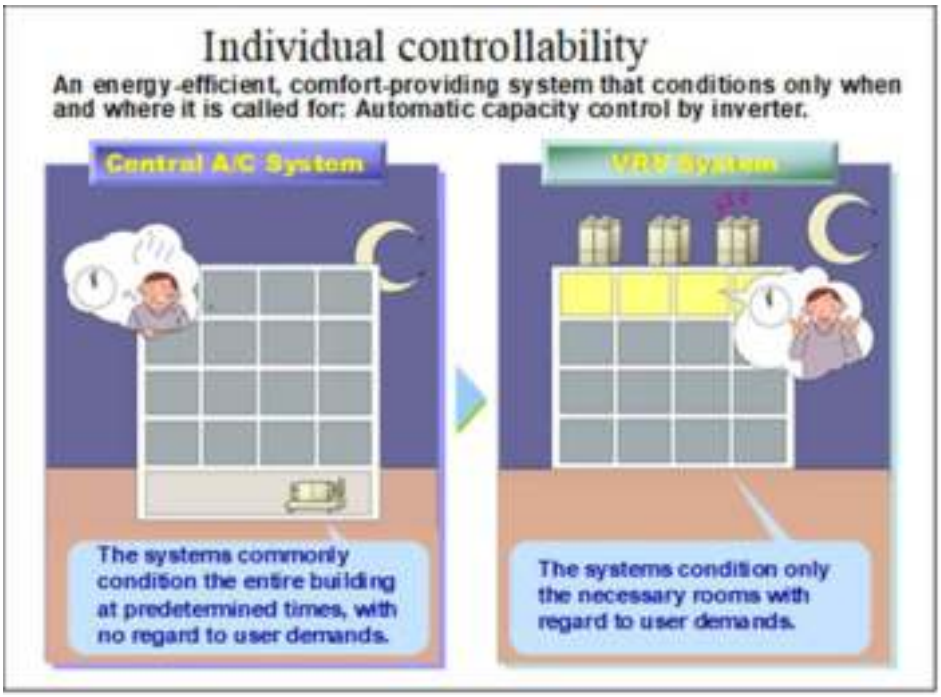


Figure 79

- EASY MAINTENANCE

It is an entirely self-diagnostic system and generates error codes on the remote-control display indicating the error type. Also, this modular system doesn't need only standby equipment because if one compressor malfunctions, the other takes over the emergency operation. If an outdoor unit malfunctions, another provides emergency operation till repair.

SECTION 8.7 PLUMBING SERVICES

SECTION 8.7.1 ABOUT PUBLIC HEALTH ENGINEERING

- Public Health Engineering is a responsive subject related to Human life safety; inadequate or nonexistent Plumbing services can be source of sickness and death. Improper plumbing systems can result in structural weakness or damage.
- Providing the least requirements and principles for the protection of public health, safety and welfare.

SECTION 8.7.2 CODES & STANDARDS

The design for the above works has been based on the following Codes/ Guidelines/ standards/ SP.

- National Building Code of India – 2016
- Uniform Plumbing Codes – India – 2013.
- IS 1172-1993 (water supply & drainage services)
- IS 1239(part-1)- 2004 (Plumbing general practice)
- IS 1239(part-2)- 2011 (Plumbing general practice)
- IS 8034-2002 (submersible pump)
- IS 5659-1970 (process water pump)
- IS 5600-2002 (Sewage & Drainage pump)
- IS 1520-1980 (Centrifugal pump)
- IS 5120-1977 (Roto dynamic pump)
- IS 778 & 14846 (Valves)
- SP 35 -1987 Handbook on Water Supply and Drainage
- IS 651-2007 (Stoneware pipe & fitting)
- IS 4985-2000 (PVC pipe & Fitting)

- Provisional No objection certificate (NOC)from Local Fire Authority

SECTION 8.7.3 SCOPE OF WORK

- Propose Plumbing System concepts and develop a conceptual design to complete system schematics.
- Propose appropriate material and equipment to meet preliminary design capacity and development.
- Provide preliminary Estimation, BOQ, design specification and drawing.
- Provide detailed routing of the plumbing system and equipment layout.
- Providing documents and drawings to obtain statutory approval from the regulatory authorities.
- Assist the client with technical bid evolution and vendor selection process.
- During the construction stage, conduct, periodic site visits to check compliance of the design inlet.
- Attend site meeting/visit on request for any technical assistance/technical queries during critical installations, execution and commissioning.
- Review/approval of Plumbing shop drawing prepared by the contractors.

SECTION 8.7.4 ASSUMPTIONS/CONSIDERATIONS

Design bases reports are prepared with considered following assumptions, which the client has to authenticate.

- Average rainfall intensity to design rainwater disposal planning– 90 mm/ hr.
- Sewage Treatment Plant considered as per water demand sheet.
- Water Treatment Plant shall not be considered, it shall be confirmed after the water test report is received from the client.
- The primary source of water considered from Borewell; secondary source shall be corporation.
- Water supply through Corporation shall be single point supply, and water meter shall be provided by Corporation.

- Sewage Connection connected to Corporation drainage shall be by Single point only.
- Rainwater shall be disposed of on Road.

SECTION 8.7.5 SOURCE OF WATER

The primary water source is considered from bore well, however; the client has to confirm the availability of water from the corporation.

SECTION 8.7.5.1 RAW WATER SOURCE (BOREWELL)

- Total water demands-50 KLD
- Borewell Flow rate-50 KL/Hr (Assumed)
- No of Borewell required: 1 Nos
- Water metering provision - Client
- Quality of water - Non-Potable (Water test report should be done)
- Depth and location of bore well

Depth and location of bore well are unable to be predicted or design. It's only based on a hydrogeology survey, and the same report can be considered for designing a rainwater harvesting pit.

SECTION 8.7.5.2 DOMESTIC SOURCE (CORPORATION WATER)

- Alternate source of water – Corporation
- Water demand for the project – 50 KLD
- Water supply hours - Considering 2 Hrs
- At least pipe dia shall be – 50 mm Dia
- Water metering provision - Corporation
- Quality of water - Potable (Since we proposed the Water quality report.)

The following information needs to provide by the client to consider in the design for corporation water

- Location of corporation supply taps.
- Depth of Tapping
- Diameter of Pipe
- Criteria for Water meter provision.
- Water supply hours
- Quality of water (In General case quality of water shall be potable, however, for safety purposes, the quality of water should verify.)

SECTION 8.7.6 STORAGE OF WATER

- Water storage shall be calculated based on daily water demand for occupants and Firefighting system demand.
- For the Domestic tank, 1.5-day storage of water shall be considered.
- For Firefighting National Building Code 2016 or Provisional No objection certificate from Chief fire officer.

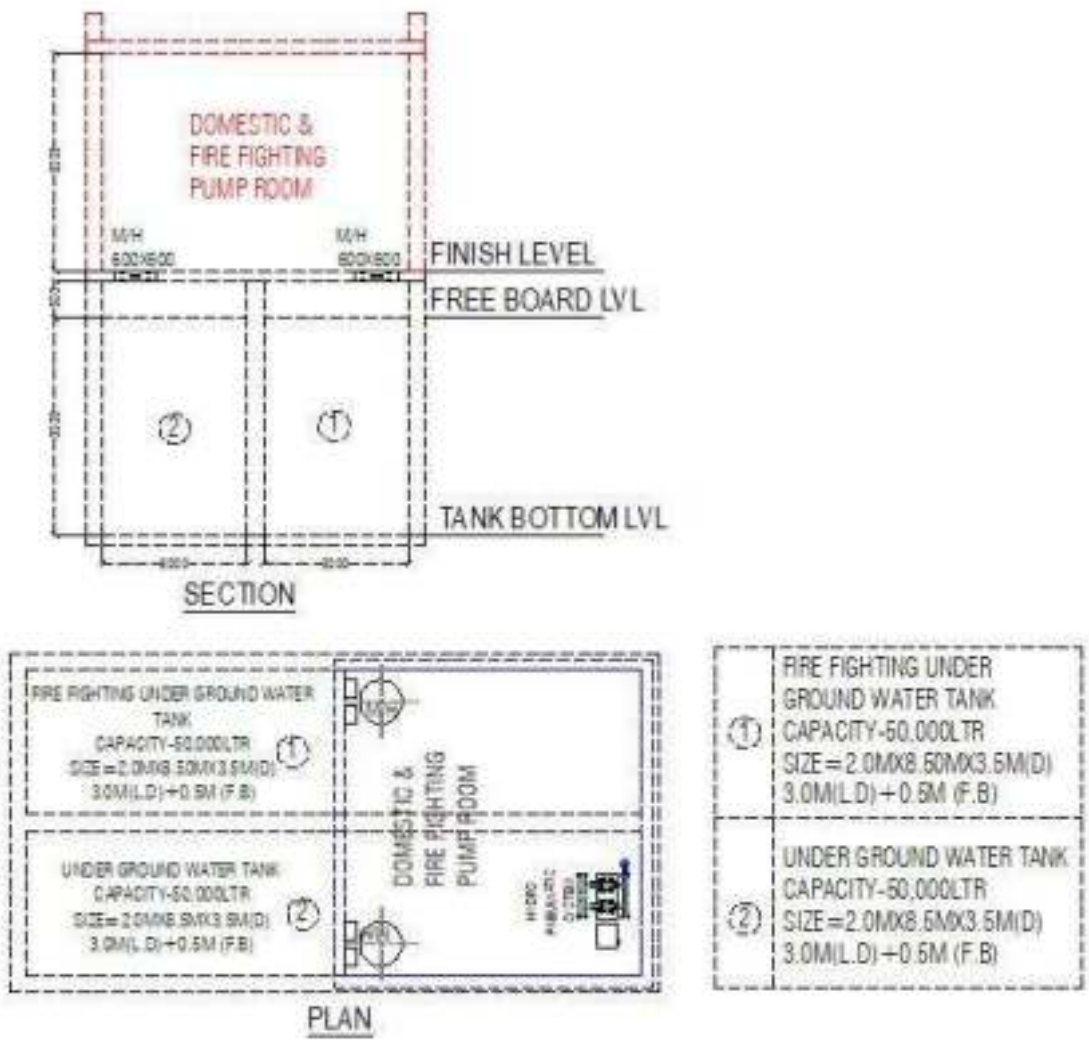
SECTION 8.7.6.1 UNDERGROUND STORAGE

Underground tanks shall be designed based on estimated daily water demand,

Underground storage tank capacities are following for this project.

Underground tanks			
Sr. No.	**Descriptions**	**Capacity in KL**	**Remarks**
1	Fire tank	50	As per NBC 2016
2	Domestic water tank	50	

SECTION 8.7.6.2 UNDERGROUND STORAGE TANK ARRANGEMENT



SECTION 8.7.7 WATER SUPPLY SCHEME

Following shall be a scheme for Water supply arrangement.

DOMESTIC WATER SUPPLY SCHEME

- From Borewell, water will be supplied to Firefighting tank, Borewell operation shall be manual. However, the timer of the Borewell should be maintained equally supply to maintain the efficiency of the Borewell pump.

- From the Fire tank, water will be overflow into Domestic water tank. Necessary arrangements for overflow shall be planned at the time of construction of tanks.
- From the Domestic underground tank, Water shall be transferred via the Pressure system to the source utility.

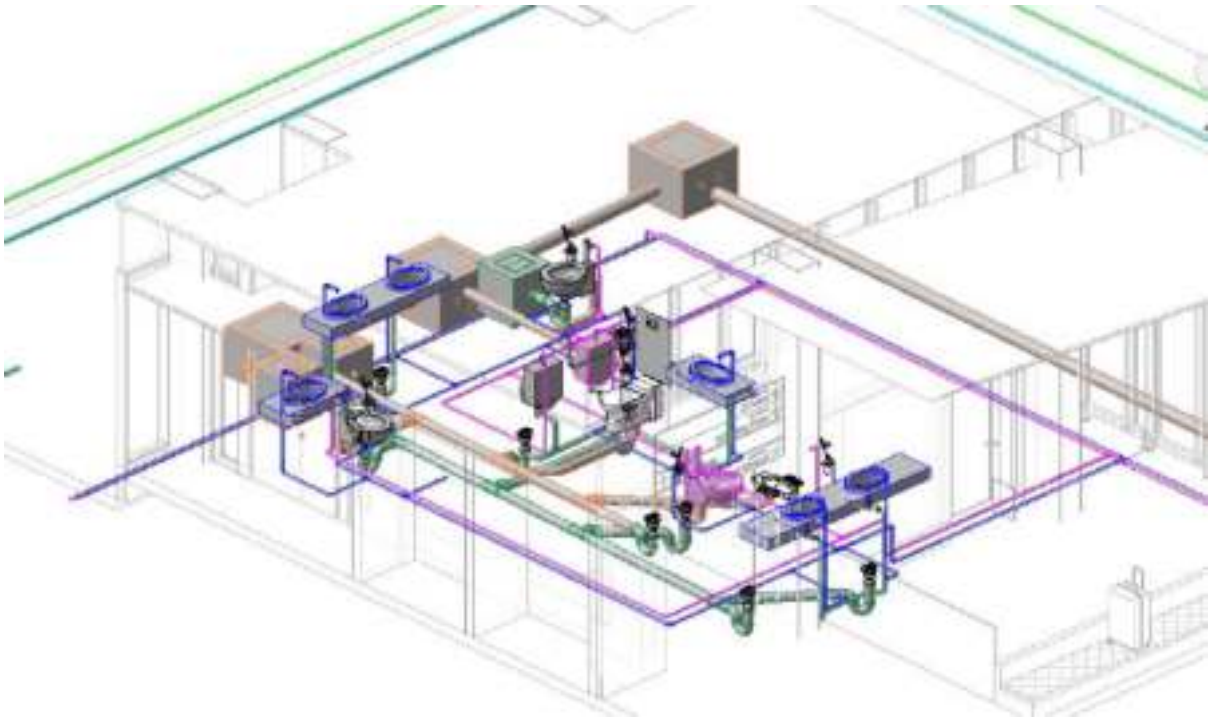
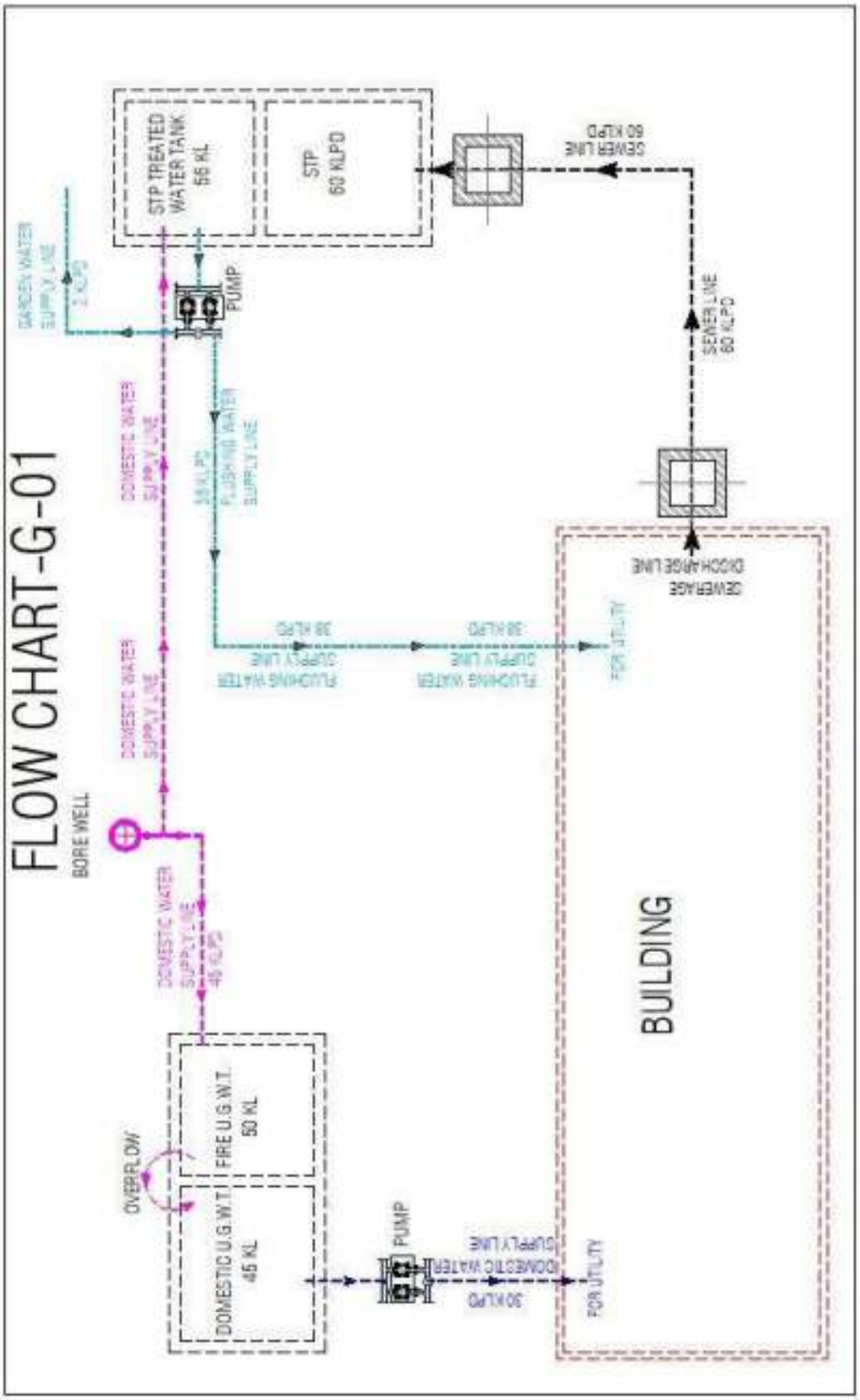


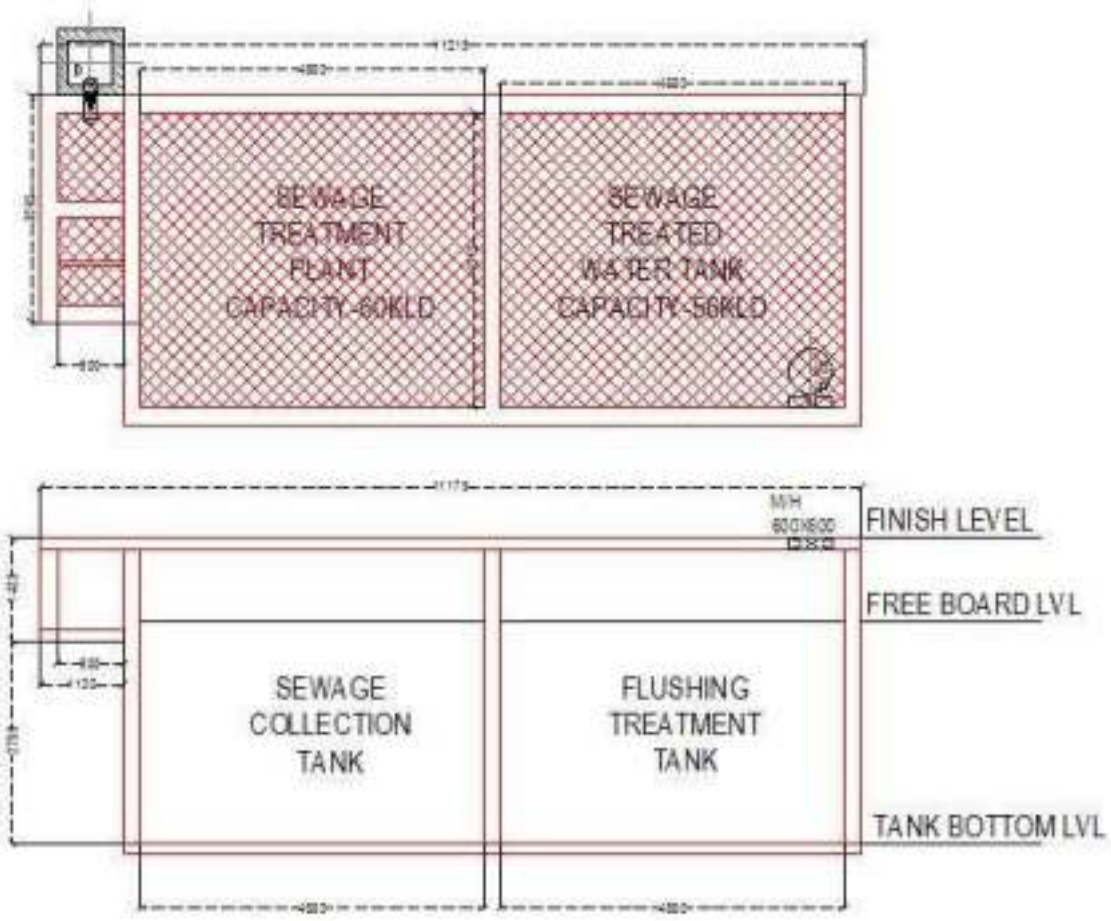
Figure 80 Domestic Water Supply & Sewage Disposal Scheme Layout


FLOW CHART-G-01
BORE WELL
STP TREATED WATER TANK 66 KL
STP 60 KLPD
PUMP
SEWER LINE 60 KLPD
DOMESTIC WATER SUPPLY LINE
FLUSHING WATER SUPPLY LINE
SEWERAGE DISCHARGE LINE
FIRE U.G.W.T. 60 KL
DOMESTIC U.G.W.T. 45 KL
OVERFLOW
PUMP
BUILDING
FOR UTILITY

SEWAGE DISPOSAL SCHEME

The system shall be designed based on standard criteria as stipulated in the "Manual for sewerage & Treatment "published by the Central Public Health & Environmental Engineering Organization (CPHEEO), NBC-2016, SP-35(S&T) -1987 and other National & International practices on the subject.

- Two pipe systems shall plan to dispose of sewage from Toilets. Soil down take pipe will collect sewage from WC. Waste down take pipe will collect sewage from Washbasin and Floor drains etc.
- Down takes will require Anti siphonage arrangement for maintaining the trap water seal level.
- Parallel pipe shall be run with connection to Waste down take line at each floor. It will help to prevent symphonic action.
- All drainage lines will divert from ground level, and it will collect to the Manhole network.
- The waste line will connect to STP Plant via Manhole & Gulley trap.
- SOIL line will connect to STP Plant via Manhole.
- The following criteria shall be considered during the design of external network.
    - Flow of Sewage : 95% of water supply daily
    - Peak flow : 3times of average flow
    - Min Dia of pipe : 150/200 mm dia
    - Min. Velocity in pipe : 0.6 m/s
    - Max velocity : 3.0 m/s
    - Flow Condition in pipes : Up 400mm Dia Half filled
    - Above 400mm Dia : 2/3 Filled


SEWAGE TREATMENT PLANT CAPACITY-60KLD
SEWAGE TREATED WATER TANK CAPACITY-56KLD
M/H 600X600
FINISH LEVEL
FREE BOARD LVL
SEWAGE COLLECTION TANK
FLUSHING TREATMENT TANK
TANK BOTTOM LVL

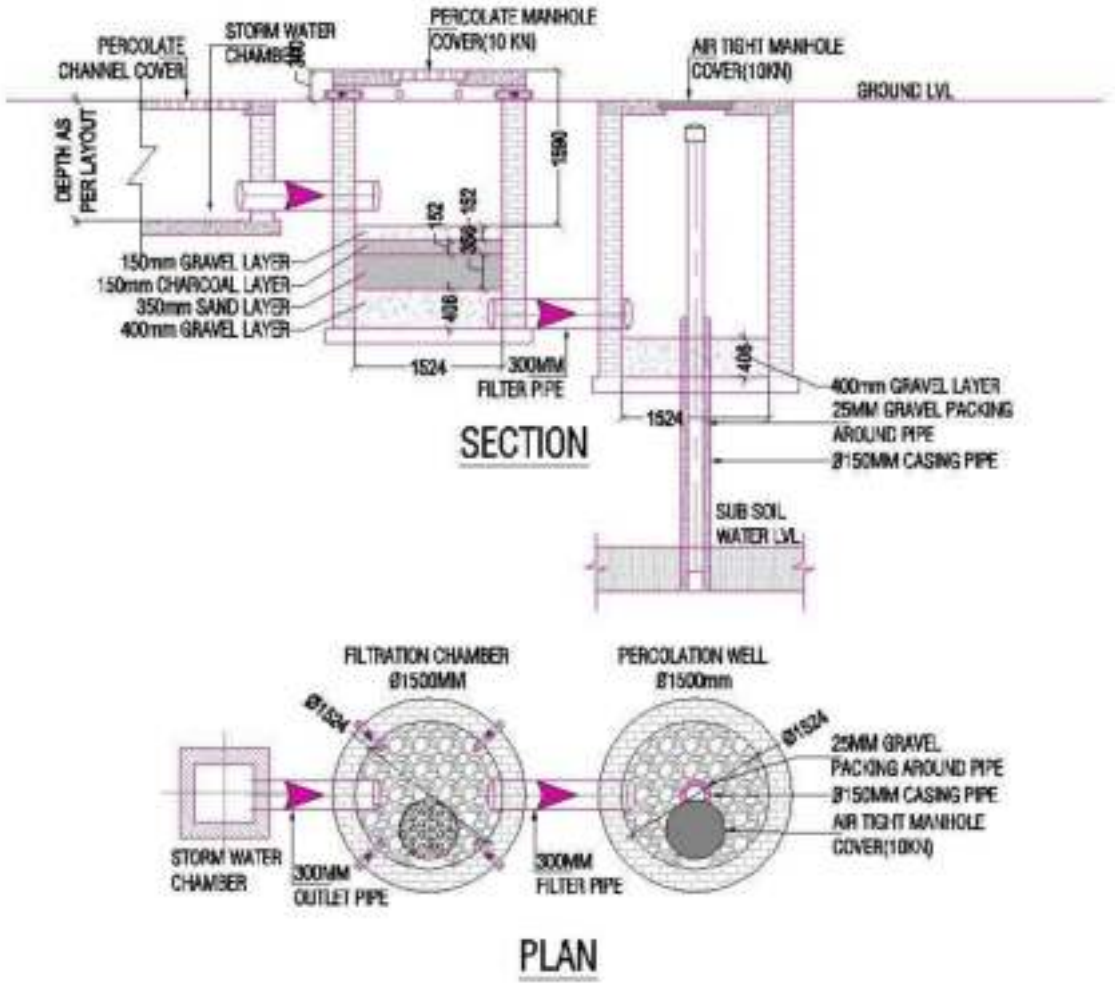
SECTION 8.7.8 RAINWATER DISPOSAL/HARVESTING SCHEME

As per the Indian metrological survey, the Average rainfall intensity of Guwahati city is 90 mm/hr.

A) Rainwater Harvesting

As Social responsibility and norms, it is necessary to percolate maximum rainwater within the earth. It will help to improve the water level of the Aquifer River and improve water quality.

According to norms and site area, at least one Percolation well has to be executed.



SECTION 8.7.9 WATER DEMAND CALCULATION

Sr.No.	Discription Fixture or Group	Qty	Building type	Water Demand (Load) Fixture units	Domestic Water Demand (Load) Fixture units	Flushing Demand (Load) Fixture units	Total Domestic water demand (LPM)	Total Flushing water demand (LPM)	Total water demand (LPM)
1	WC (flush tank)	17	Public	3	0	51	0.0	109.0	109.0
2	Urinals (sensor operated)	6	Public	2		12	0.0	46.1	46.1
3	Lavatories (with standard faucet)	14	Public	1.5	21	0	58.4	0.0	58.4
4	Ablution faucet	17	Public	1	17	0	52.8	0.0	52.8
	Water Demand in LPM						111.0	155.1	266
	Water Demand in LPH						6660.6	9308.4	15969
	Water Demand for 4 Hrs.						26642.4	37233.6	63876
17		Landscaping	3200 sq Mtr			7		22400	22400
	Total						26642	59634	86276
*		Total Domestic water demand per day					26,642	Ltr.	
*		Total stored Domestic water demand per 1.5 day					39,964	Ltr.	
*		Underground water tank capacity per day					39,964	Ltr.	(40K)
*		Total Flushing stored water demand per 1.0 day					57,488	Ltr.	(57K)
*		Underground Flushing water tank capacity per day					54,614	Ltr.	(55K)
*		Underground Fire Fighting water tank capacity per day					50,000	Ltr.	(50K)

SECTION 8.8 FIRE FIGHTING SYSTEM

SECTION 8.8.1 SCOPE

- Designing of Firefighting system according to the code requirement
- Designing of Sprinkler system, Fire hydrant system at necessary location

SECTION 8.8.2 DESIGN GOAL

- Firefighting services are responsive to human life safety and property damage subjects. Improper Firefighting systems can cost Human life.
- We are providing the least requirements and principles for protecting the Building from Fire.

SECTION 8.8.3 REFERENCE STANDARDS

The design for the above works has been based on the following Codes/ Guidelines/ standards.

- National Building Code of India – 2016

- NFPA – 13 – Standard for the Installation of Automatic Sprinkler Systems.
- NFPA 14 – Standard for the Installation of Standpipe Systems
- No objection certificate (NOC)from Local Fire Authority
- IS 3844 (1989) – Code of practice for installation and maintenance of internal fire hydrants and hose reels on premises.
- IS 15105 (1989) – Code of practice for installation and maintenance of sprinkler system.
- IS 13039 (1989) – Code of practice for installation and maintenance of External fire hydrants and hose reels on-premises.

SECTION 8.8.4 ASSUMPTION FOR DESIGN BASES REPORT

Firefighting system design is based on Codes, Rules and Regulations. However, the following criteria are prevailing for local practices, which need to be verified by the CFO.

- The sprinkler is not required as per local practice.
- Main pump for Hydrant system.

SECTION 8.8.5 BUILDING CLASSIFICATION BASED ON OCCUPANCY

As per NBC 2016-part 4, the building is classified into a different group based on its occupancy.

Based on the classification NBC 2016 - part 4 & Draft GDR 2021 specifies minimum requirements for firefighting installations. Requirements for the building are based on the type, occupancy & height of the building, which is 7 m. The table summarizes the minimum standards for firefighting installations. However, these will take as only the guidelines as the final provisions in the building are governed by the local fire authority i.e., CFO's provisional fire NOC.

Table 13 MINIMUM REQUIREMENTS OF FIRE FIGHTING INSTALLATIONS AS PER NBC-2016 PART 4, TAC

Sr. No.	Description	Minimum required for building as per NBC	Provided for Assembly Building as per FOS
		Refer Code TAC, NBC-2016 part IV	
1	Name of Building	Assembly	Assembly
2	Occupancy Class	D	D
3	Fire Extinguisher	Required	Required
4	Hose Reel	Required	Required
5	Dry Riser	Not Required	Not Required
6	Wet Riser	Not Required	Required
7	Down Comer	Required	Not Required
8	Yard Hydrant	Not Required	Required
9	Automatic Sprinkler System	Not Required	Not Required
10	Manually Operated Electric Fire Alarm System	Required	Required
11	Automatic Detection and Alarm System	Not Required	Required

12	Under Ground Static Water Storage Tank	Not Required	50 KL
13	Terrace Tank	25KL	Not Required
14	Pump Near Under Ground Storage Tanks	Not Required	1 No.- 1620 LPM Electrical pumps 1No. -180 LPM jockey pump
15	Pump at the Terrace Tanks	1No. -900 LPM pump	Not Required

SECTION 8.8.6 WATER SUPPLY & WATER STORAGE FOR FIRE FIGHTING

Classification based on occupancy class & height of the building; it is recommended to provide a minimum storage of 25 KL, but we selected 50 KL in the UGR (suction tank) as per NBC 2016 Part-4.

The fire tank shall plan next to the Domestic water tank. Domestic water will be filled by overflow from the Fire tank. This will ensure the minimum fire water storage availability at all times & also prevent the firewater from being stagnant.

- 2-way fire brigade breaching inlet for supply of water to UGR in case of a fire emergency.
- 2-way fire brigade Siamese connection for supply of water to ring main from fire tender.

SECTION 8.8.7 FIRE FIGHTING PUMPS

- Based on the classification based on occupancy class & height of the building, it is recommended to provide the following configuration of firefighting pumps.

- Main hydrant pump (Electrical) - 1 No.-1620 LPM @ head required to give minimum residual head of 3.5 Kg/ Sq.cm. at the farthest hydrant point of the building.
- Jockey pump (Electrical) - 1 No.180 LPM @ head required to give minimum residual charge of 3.5 Kg/ Sq.cm.

SECTION 8.8.8 INTERNAL HYDRANT SYSTEM

- An internal hydrant system is an arrangement for firefighting within the building by means of vertical rising mains with landing valves and hose reels on each floor and permanently charged with water using pumps. The System mainly consists of a Pipe network, Landing Valves, Hose reels & other accessories.
- The building is provided with a double-headed landing valve and a hose reel drum having a 20 mm dia hose of 30 m long with nozzle along with two (2) Nos. of RRL hoses (63 mm size x 15 m long with couplings) and one (1) no. branch pipe with nozzle (20 mm bore).
- A minimum pressure of 3.5 kg/cm2 will be ensured at the remotest hydrant point.
- Each hydrant shall cover 1000 sq. mtr. Area—area of each floor.

SECTION 8.8.9 EXTERNAL HYDRANT SYSTEM

- It is proposed to provide an external hydrant system for protecting the building from outside in a fire emergency. External hydrant system for the facility shall be as follows:
- 100 mm dia M.S. heavy class external hydrant central in the upper basement ceiling.
- Provision of External hydrants at every 45 m distance given moderate hazard occupancy.
- 2-way fire brigade breaching inlet for water supply to UGR in case of a fire emergency.
- 2-way fire brigade Siamese connection for supply of water to ring main from fire tender.
- 2-way fire brigade draws out connection.
- Locations of external hydrants & other fire equipment shall be coordinated with overall external services & landscape design in particular.

SECTION 8.8.10 NON-WATER BASED FIRE EXTINGUISHING SYSTEMS

It is proposed to provide fire extinguishers as per IS 2190. Type of extinguishers & nos. shall be decided based on the area of rooms & the application.

- The ABC type extinguisher shall be distributed over the entire common area, where the person is not required to travel more than 15 m to reach the nearest extinguisher.
- Dry chemical powder type fire extinguisher conforming to IS 2171 shall be located near large kitchen, generator rooms, pump room, car park area, lift machine room, etc.
- Carbon dioxide-type fire extinguishers conforming to IS 2878 shall be located in the electrical room, pump room, control room, transformer, server room, lift machine room, etc.
- Each floor shall have the provision of Extinguishers as per local practice.

CHAPTER 9 PROPOSED PROJECT IMPLEMENTATION STRATEGY

The work will be executed by the SMPK by engaging contractors/ firms under Engineering, Procurement & Construction (EPC) mode with the requisite capacity through the call of tender.

The SMPK has entrusted M/s North East Technology Research Alliance (NETRA) to carry out Survey & Investigation, DPR preparation, and PMC work. The details provided in the DPR are based on the surveys conducted by NETRA during specific times. As a river is having flowing water, there may be changes in the actual data during the construction work, EPC contractor has to verify all the site conditions in all manners during the execution of work prior to submitting their design which affects the design. The design carried out by the EPC contractor should be submitted to PMC & SMPK for their review and approval. Once the design is approved by SMPK & PMC it should be vetted by any IIT and all hydrology & hydrological structures shall be vetted by Naval Architect. All legal frameworks will be specified in the contract/ legal document of fixed time and fixed cost wherein it will be the responsibility of the Contracting Agency to execute and complete the work and hand it over within the stipulated time and cost. Relevant specifications laid down by the BIS codal guideline will be the basis for entering into an agreement with the Contractor wherever applicable. The Standard Bidding Documents (SBD) approved by SMPK will also form the basis for the agreement. Any legal dispute will be settled within the terms and conditions of the contract or as decided by the Chief Engineer (SMPK), or Arbitrator legally appointed for the purpose. Local disputes will be settled by the local administration through the district court of law or Panchayat or village councils as per admissible.