Addendum / Corrigendum No. 8

Tender for the Work Of "Construction of International and Domestic Cruise Terminal and Other Allied Facilities at Mormugao Port Trust, Goa, through Engineering, Procurement and Construction (EPC) Contract"
(TENDER NO. T15/T-1946/2021-C)

ADDITIONAL QUERIES RAISED BY THE BIDDERS AND CoPT'S RESPONSES THERETO

Sl. No	Section/ Clause/ Sub Cl. No.	Pg. No.	Brief Description	Queried from Bidders	Response of CoPT
1	2	3	4	5	6
Queries received after Pre Bid meeting					
1	CIVIL-ARCHITECTURE & PHE		General	To assess the structural strength of existing structure we have to perform some NDT tests which require time.	Already replied in Addendum / Corrigendum No.5. Please see Addendum/Corrigendum No.6 uploaded
2	--do-	Vol IV, Pg. 3, 2.1…V4	Structures to be partially dismantled	As per the condition of the existing structures as seen at site physically seems that new greenfield construction may be needed for this we need some time to analyze the structural sizing based on the design load as per Vol-IV – Employers Requirements.	Please see Addendum/Corrigendum No.6 uploaded
3	-do-		Structural dwgs.	Size of the steel members for roof truss is not mentioned in the shared structural drawings. We have to analyze and design of roof truss to get the actual costing. This requires extra time	Already replied in Addendum / Corrigendum No.5 Please see Addendum/Corrigendum No.6 uploaded

4	--do-		Civil works for road, drain, External filling / levelling and parking area, Sump, Pump Room, STP, Utility and Service buildings, Compound wall, parapet wall, Landscape, etc.	No drawing for road, drain, External filling / levelling and parking area, Pump Room, STP, Utility and Service buildings is available. Or please confirm whether these structures are not required or not. If required then we have to design and analyze that structures that requires more time.	Already replied in Addendum / Corrigendum No.5 Please see Addendum/Corrigendum No.6 uploaded Refer Architectural and MEP dwgs already uploaded. **Design Basis Report (DBR) is attached.** Since this is an EPC contract , Bidder has to facilitate as per Specifications, DBR, etc as per the locations specified in the tender . Kindly note this is not Item rate contract.
5	--do-	Structural Design	Is there any health audit report of existing structure is available or not?	HEALTH STUDY IS ESSENTIAL IN TERMS OF STRUCTURAL DESIGN CONSIDERATIONS OF RETAINING & UPGRADING THE OLD STRUCTURES.	Already replied in Addendum / Corrigendum No.5.
6	PHE	Dwg No: ARP-P101	Storm Layout:	Then why catch basins are provided.. What shall be the discharge invert /High sea level. Drain depths not available. Is it to be designed? More over all open drains width and hume pipe dia are mentioned as 300mm. Sizes may increase as more storm water gets into the system. Please clarify.	Refer PHE / MEP drawings already uploaded. Design Basis Report (DBR) is attached. Since this is an EPC contract, Bidder has to facilitate as per Specifications, DBR, etc as per the locations specified in the tender .Kindly note this is not Item rate contract.
7	PHE	DWG: 1911/A/AB/100/DS-105	Ancillary Bldg drainage scheme.	Both floor water and WC from toilet shall be fed to STP. In a drainage scheme FT are discharged to storm drains. Please clarify.	Yes, it should both floor water and WC from toilet shall be fed to STP.
8	PHE	DWG NO: 1911/A/AB/100/WSS-106	STP	Please mention any specific requirement of MOC of pipe lines in STP, MOC of pumps, blowers and capacities and MOC of Filters. Shall a Bldg to be considered for the entire STP? What is the purpose of rolling shutter? Or a shed above the STP shall do? BSC, O&G traps and EQT in STP are above ground so there shall a main sewage receiving sump cum lifting station.	Refer PHE / MEP drawings already uploaded. Design Basis Report (DBR) is attached. Since this is an EPC contract, Bidder has to facilitate as per Specifications, DBR, etc as per the locations specified in the

				Otherwise these structures need to be underground. What does manhole for equipment loading and unloading means?	tender .Kindly note this is not Item rate contract.
9	PHE	Dwg no: 1911/A/MP/100/MP-100	Water Pumps	Please mention raw water and treated water pump capacities. Water treatment plant capacity /Please mention SF, PSF, ASF etc. capacities and MOC requirement. Please mention pipe sizes for Water schematic.	Refer PHE / MEP drawings already uploaded. Design Basis Report (DBR) is attached. Since this is an EPC contract, Bidder has to facilitate as per Specifications, DBR, etc as per the locations specified in the tender .Kindly note this is not Item rate contract.
10	PHE	DWG NO: 1911/Ex-D-100 1911/A/100/EX-100		Master plan and external drawings showing different sewer, domestic and flushing water network. In master plan no inverts are given for sewer line.	Since this is an EPC contract, Bidder has to facilitate as per Specifications, DBR, etc as per the locations specified in the tender. Kindly note this is not Item rate contract.
11	ELECTRICAL	Electrical key single line diagram		Please provide Specification of 110V Dc Power Pack and make.	Kindly consider CPWD spec. and CPWD approved make. Please Note it is EPC project and bidder to workout from his own team
12	ELECTRICAL	APPENDIX-22 sl no. 7,8		Please confirm the % impedance (Z) of HT and LT transformer.	% Impedance has to be considered as per the site conditions of HT & LT switchgears
13	ELECTRICAL	Electrical Item make List		Other than the make list provided for electrical items, can we consider other reputed qualified vendors or manufacturers.	Consider CPWD list of approved makes.
14	HVAC & MECHANICAL	Drawing No. 1911/A/M/100/E/29 ANCILLARY BUILDING GROUND FLOOR LAYOUT	GF CSAHU: 01 Cap. 2000 CFM Air quantity in the duct 1600 CFM	It is not clear how the air quantity at the starting of the ductwork is less than the selected capacity of unit. Please clarify which one to follow.	Attached corrected dwg
15	HVAC & MECHANICAL	Drawing No. 1911/A/M/100/E/29 ANCILLARY BUILDING FIRST FLOOR LAYOUT	FF CSAHU: 01 Cap. 1200 CFM Air quantity in the duct 2000 CFM FF CSAHU: 04 Cap. 1200 CFM Air quantity in the duct 2000 CFM FF CSAHU: 10 Cap. 1600 CFM	It is not clear how the air quantity at the starting of the ductwork is different from that of selected capacity of unit. Please clarify which one to follow.	Attached corrected dwg

			Air quantity in the duct 2000 CFM FF CSAHU: 08 & 09 Cap. 2000 CFM Air quantity in the duct 2400 CFM		
16	HVAC & MECHANICAL	Drawing No. 1911/A/M/100/E/29 TERMINAL BUILDING HVAC SLD& Page no. 27, Appendix-12, DESCRIPTION OF ITEM, Sl. no. 1, VOLUME-V B, TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS	VFD Air Cooled Chiller (1 Working + 1 Standby) Capacity: 400 TR &AIR COOLED VFD CHILLERS WITH DUAL COMPRESSOR - 160TRx2 NOS. Tag No. SH WCC - 01 (1W), Actual Capacity 320 TR -160TRx2 (DUAL COMPRESSOR)	Capacity and redundancy of Chiller are not matching between drawing and Specification. Please clarify.	Kindly follow Air cooled VFD chillers with dual compressors 160 TR x 2 with actual capacity of 320 TR (refer page no 119 in Design brief report)
17	HVAC & MECHANICAL	Drawing No. 1911/A/M/100/E/29 TERMINAL BUILDING HVAC SLD, at H-1 & Page no. 56, Appendix-20, DESCRIPTION OF ITEM, PART-1: Sl. no. 1, VOLUME-V B, TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS	400 TR (TERMINAL BUILDING LOAD)+144.5 TR (ANCILLARY BUILDING LOAD) 960 USGPM (TERMINAL BUILDING LOAD)+346.8 USGPM (ANCILLARY BUILDING LOAD) & VRV/VRF UNITS & CONTROLS,	As per write up Ancillary Building is provided with VRF system, which has no relation with chilled water system of Terminal Building. Please clarify.	Kindly read Ancillary building with VRF system only .
18	HVAC & MECHANICAL	Drawing No. 1911/A/M/100/E/29 TERMINAL BUILDING GROUND FLOOR HVAC LAYOUT & Page no. 30, Appendix-12,	Electrical Room is provided with High Wall Split AC, CAP: 600 CFM, 1.5 TR & Supply installation ,testing , & commissioning of Cabinet type Inline	Please confirm whether Electrical Room is provided with both High Wall Split AC and Cabinet type Inline type centrifugal fan?	Both High Wall Split AC and Cabinet type Inline type centrifugal fan

		CENTRIFUGAL FANS FOR VENTILATION, Sl. no. 9.05, VOLUME-V B, TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS	type centrifugal fan (1500 CFM, 20MM) (ELECTRICAL ROOM)		
19	HVAC & MECHANICAL	Cl. no. 2 - Scope of Work, Page no. 3 of 139, VOLUME-V B, HVAC TECHNICAL SPECIFICATION	The general character and the scope of work to be carried out under this contract is illustrated in Drawings, Specifications and Schedule of Quantities.	Schedule of Quantities has not been found. Please provide the document.	Kindly read schedule of quantities which are not part of EPC tender . Contractor to work on his own for quantities based on dwgs & specification .
20	HVAC & MECHANICAL	Cl. no. 2, sub cl. no. b - Scope of Work, Page no. 4 of 139, VOLUME-V B, HVAC TECHNICAL SPECIFICATION & Cl. no. 12 - CHILLED WATER HI-WALL TYPE SPLIT AC SYSTEM, Page no. 82 of 139, VOLUME-V B, HVAC TECHNICAL SPECIFICATION	Air cooled Split Unit & CHILLED WATER HI-WALL TYPE SPLIT AC SYSTEM	Please confirm whether High Wall Split AC units are air cooled with refrigerant as cooling medium or it is a High wall Fan coil unit to be cooled by Chilled water.	Follow High Wall Split AC units are air cooled with refrigerant as cooling medium
21	HVAC & MECHANICAL	Cl. no. 8, sub cl. no. - CEILING SUSPENDED AIR HANDLING UNITS (CAHU) / TREATED FRESH AIR UNIT (TFA)-DATA SHEET - A, Page no. 44 of 139, DATA SHEET - B, Page no. 45 of	Numbers and minimum capacity - Refer Boq Chilled water flow rate – m3/hr - Refer schedule Minimum Supply Air Quantity (S/A – CMH) – As per Schedule	Schedule/ BOQ has not been found. Please provide the document.	Kindly read schedule of quantities which are not part of EPC tender . Contractor to work on his own for quantities based on dwgs & specification .

		139, VOLUME-V B, HVAC TECHNICAL SPECIFICATION	Minimum Outside Air Quantity (O/A – CMH) - As per Schedule		
22	HVAC & MECHANICAL	Cl. no. 25, sub cl. no. - GUARANTEE, Page no. 133 of 139, VOLUME-V B, HVAC TECHNICAL SPECIFICATION	The contractor shall guarantee that the air-conditioning plant and system shall maintain the desired inside temperature within ± 1 °C and relative humidity within ± 5%.	Indoor Condition to be maintained not found. Please provide.	Kindly follow as per ISHRAE standard . Refer Design brief report Page No 106 to 134
23	HVAC & MECHANICAL	Drawing No. 1911/A/M/100/E/28 TERMINAL BUILDING GROUND FLOOR HVAC LAYOUT & Page no. 30, Appendix-12, FRESH AIR FANS, Sl. no. 10, VOLUME-V B, TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS	Supply, installation, testing , & commissioning of Cabinet type Inline type centrifugal fan with single phase, FOR FRESH AIR FAN (INLINE TYPE)(GRAND LOBBY) 3000 CFM, 20MM	Nos. of fans is neither found in the drawing as well as in the specification. Please give.	As per EPC clauses, it is design and built project and contractor to check the same and validate his own design fitting to the location standards as per IS /Local State standards /reference codes as indicated in the Specifications. EPC vendor to read Dwgs , specifications , Design brief reports along with Contractual clauses
24	HVAC & MECHANICAL	Drawing No. 1911/A/M/ 100/E/28 ANCILLARY BUILDING GF LAYOUT & Page no. 59, Appendix-20, DESCRIPTION OF ITEM, PART-4: TOILET VENTILATION SYSTEM, Sl. no. 1 a & b, VOLUME-V B, TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS	1300 CFM ; SP of 15 m 1600 CFM ; SP of 15 mm	Nos. of fans of each capacity is neither found in the drawing as well as in the specification. Please give.	As per EPC clauses, it is design and built project and contractor to check the same and validate his own design fitting to the location standards as per IS /Local State standards /reference codes as indicated in the Specifications. EPC vendor to read Dwgs , specifications , Design brief reports along with Contractual clauses

25	HVAC & MECHANICAL	Drawing No. 1911/A/M/100/E/28 ANCILLARY BUILDING GROUND FLOOR LAYOUT	MARKET HALL 1	In the drawing it is seen Ceiling suspended AHU “GF CSAHU:01” is supplying Air to Market Hall 1, Electrical Room, BMS Room and UPS Room. But no return air arrangement is shown. Please clarify how return air shall come back to the CSAHU.	As per EPC clauses, it is design and built project and contractor to check the same and validate his own design fitting to the location standards as per IS /Local State standards /reference codes as indicated in the Specifications. EPC vendor to read Dwgs , specifications , Design brief reports along with Contractual clauses
26	HVAC & MECHANICAL	Drawing No. 1911/A/M/100/E/29 ANCILLARY BUILDING GROUND FLOOR LAYOUT	MARKET HALL 3 & MARKET HALL 4	The total capacity of supply air in Market Hall 3 from 3 nos. CSAHUs are 3x2400 CFM, which is not matching with the total air quantity of air supplied by diffusers. Same is true for Market hall 4 Please clarify.	As per EPC clauses, it is design and built project and contractor to check the same and validate his own design fitting to the location standards as per IS /Local State standards /reference codes as indicated in the Specifications. EPC vendor to read Dwgs , specifications , Design brief reports along with Contractual clauses
27	HVAC & MECHANICAL	Drawing No. 1911/ A/M/ 100/E/29 TERMINAL BUILDING HVAC SLD 1911/A/TB/100/E/20 TERMINAL BUILDING GROUND FLOOR HVAC LAYOUT & 1911/A/TB/100/E/21 TERMINAL BUILDING GROUND FLOOR HVAC LAYOUT	Chiller, Primary Chilled water pump, secondary chilled water pump	Location of Chiller, Primary Chilled water pump, secondary chilled water pump not found in drawing and specification. Please give.	As per EPC clauses, it is design and built project and contractor to check the same and validate his own design fitting to the location standards as per IS /Local State standards /reference codes as indicated in the Specifications. EPC vendor to read Dwgs , specifications , Design brief reports along with Contractual clauses
28	BMS & OTHERS Page 7 (Electronic page no. 525 of 618), IBMS & CCTV TECHNI	Communication Network: The Access Control System will use the same network as CCTV and the system integrator has to ensure both the Access Control system and the	The referred clause is self-contradictory. Access Control System will use the same network as CCTV and also the system integrator has to ensure both the Access Control system and the CCTV are on separate Stand	Please indicate the number and type of CCTV and Access Control signals which will be integrated with IBMS. These signals will be required to quantify IBMS Controller I/O Capacity.	Required quantity in contractor scope of work is attached

	CAL SPECIFICATION	CCTV are on separate Stand Alone network.	Alone network cannot happen simultaneously. The point shall be clarified.		
29	Page 4 (Electronic page no. 522 of 618), IBMS & CCTV TECHNICAL SPECIFICATION	Door and Master Controller: The door controller shall mean……. The controllers shall be RS485 / TCP/IP compatible. All controller shall be connected to the master controller	There is no mention of Master Controller in the specification although datasheet of Door Controller is given. The specification and Datasheet of Master Controller shall be provided.	Whether Card Reader will be installed on two doors or only in one door?	Installed to all doors
30	Page 19 (Electronic page no. 20 of 618), Appendix -11, item sl no. 5 Page 6 (Electronic page no. 524 of 618), IBMS & CCTV TECHNICAL SPECIFICATION	IP base two reader Door Controller Cables: Data cables for controller to master controller - 2 Pair, 1.5 sq. mm. PVC insulated & FPR networking &sheathed, twisted pair, shielded annealed tinned copper cable in PVC conduit Data cables 12 & 4 core, 0.5 sq.mm. PVC insulated between Controller & door.	IP based controllers can communicate to Master Controller through Cat 6 cable whereas the communication cable between two controllers have been shown as twisted pair copper cable. These two types of cables are not matching. Client shall clarify this mismatch.	Please clarify whether cable used will be Cat 6 or Cat 6A? These two are different cables with different technical and commercial implication.	Confirming CAT 6A cable
31	Page 51 (Electronic page no. 569 of 618),	The CCTV cameras shall be installed in the lift lobbies to cover the people movement in the floors. The entrance of the Server Room,	The Client is requested to confirm whether the qty of CCTV Cameras shall be as the referred clause or, as per the CCTV Layout Plan	Entry/Exit Gates, Car Parking Area, are very risk prone areas. But as per your drawing , no CCTV Cameras are envisaged for such areas. Please reconfirm that these areas shall not have any cameras.	Refer quantity sheet, IO summary

	IBMS & CCTV TECHNICAL SPECIFICATION, cl no.18	Security control room and the other high value equipment rooms shall be covered with the CCTV cameras.	drawing for Ancillary Building and Terminal Building. Which document shall be followed for qty finalisation of the CCTV cameras, has to be confirmed by the Client.		
32	Page 81 (Electronic page no. 599 of 618), IBMS & CCTV TECHNICAL SPECIFICATION, cl no.22		The qty of Boom Barrier, UVSS, ANPR, Baggage Scanner, Door Frame Metal Detector and Bollards have not been mentioned in the document. These items are important and their qty indication is necessary by Client. Also the Location and Layout drawing have to be provided by the Client	Required qty sheet is not traceable. Please resend it again.	Attached relevant documents(required quantity) pertaining to EPC contractor scope like BMS , CCTV , Water leakage detection , Rodent repellent system , Very early smoke detection system and access control system and rest all items kept in Operator scope/lease terminal operator scope like 1. Boom barriers 2. UVSS 3. ANPR 4. Baggage scanners 5. Door frame metal detectors 6. security Bollards /etc complete
33	Page 76 (Electronic page no. 343 of 618), FIRE FIGHTING SYSTEM SPECIFICATION SPECIFICATION, cl no.5.21.21.12	FIRE FIGHTERS TELEPHONE SYSTEM	The Fire Fighting Telephone System is a part of Fire Fighting System and not a part of IBMS and CCTV System. The Client shall confirm this.	Please indicate the number and type of FA and PA System signals which are to be integrated with IBMS.	Kindly refer Architectural and Available MEP dwgs and it is available . Since it is EPC contract bidder to facilitate as per Specifications ,DBR /etc as per the locations specified in the tender .kindly note this is not Item rate contract

34	BMS & OTHERS	Page 81	Electronic page no. 599 of 618), IBMS & CCTV TECHNICAL SPECIFICATION, cl no.22	The ANPR Camera and the system, Bollard, Bggage Scanner etc usually are installed at Entry Exit Gates. However, no drawing showing the installation of Boom Barrier, UVSS, ANPR, Baggage Scanner, Door Frame Metal Detector and Bollards etc have been furnished. Please send the Drawings , showing the distribution and layout of Boom Barrier, UVSS, ANPR, Baggage Scanner, Door Frame Metal Detector and Bollards etc.	Required quantity in contractor scope of work is attached . Attached relevant documents(required quantity) pertaining to EPC contractor scope like BMS , CCTV , Water leakage detection , Rodent repellent system , Very early smoke detection system and access control system and rest all items kept in Operator scope/lease terminal operator scope like 1. Boom barriers 2. UVSS 3. ANPR 4. Baggage scanners 5. Door frame metal detectors 6. security Bollards /etc complete
35	**Commercial Queries:** Cl.10B.IV, Vol-II	P-24 of GCC	Mobilisation Advance & Advance against Plant & Machinery	As per Cl.10B.IV, P-24, GCC, Vol-II, The mobilization advance and plant and machinery advance shall bear simple interest at the rate of 10 percent per annum and shall be calculated from the date of payment to the date of recovery. However as per Cl. No. Cl.10B.II, P-23, GCC, Vol-II, Mobilisation advance shall be provided against submission of Bank guarantee of the amount equal to 110% of the amount of advance and valid for the period till recovery of advance. Both the clause is contradictory. Hence may please remove the Cl. No. Cl.10B.IV, P-24, GCC, Vol-II.	Not acceptable. Tender conditions shall prevail.

CORRIGENDUM TO REPLIES TO PRE BID QUERIES ISSUED AS PER ADDENDUM/CORRIGENDUM NO. 5			
Sl. No	**Particulars as per Addendum/ Corrigendum No. 5**	**Response of CoPT Issued as per Addendum/Corrigendum No. 5**	**To be Read As**
1	Part –I, Item No. 6	Since the project entails refurbishment of existing buildings only, Environmental and CRZ clearances may not be required. Obtaining other statutory permissions, if any required from local Govt. authorities etc. during the construction stage is part of the work and included in the scope of Contractor.	Since the project entails refurbishment of existing buildings only, Environmental and CRZ clearances may not be required. **Obtaining other statutory permissions / approval, if any required from local Govt. authorities etc. during the preconstruction stage and the construction stage are part of the work and included in the scope of EPC Contractor**. **EPC Contractor has also to take Post-construction NOCs as required before hand over the facility**
2	Part –I, Item No. 40	Required Qty sheet is attached.	Required Qty sheet is attached with this Addendum No. 8
3	Part –I, Item No. 59	1. Please see the reply to query No. 10 2.Please see the reply to query No. 40. 3. (i) The existing portable cabin at Berth-01 is to be shifted to the Ferry Terminal; (ii) The proposed portable cabin for security units shall be of Modular type. 4. Please refer architectural drawing. 5.Please refer architectural Master Plan Layout. 6. Please refer Master Plan Cable Trench Routing Layout 7. Please refer architectural Master Plan Layout 8 & 9. Please refer Plumbing drawing 10. Please refer Plumbing drawing. Schematic diagram is provided. Detailed design and structural drawings are part of EPC Contractor's scope. 11. Editable Auto Cad version of all the drawings are attached at separate Google Drive link provided. Images of finished facilities are also attached for reference.	1. Please see the reply to query No. 10 2.Please see the reply to query **No. 45.** 3. (i) The existing portable cabin at Berth-01 is to be shifted to the Ferry Terminal; (ii) The proposed portable cabin for security units shall be of Modular type. 4. Please refer architectural drawing. 5.Please refer architectural Master Plan Layout. 6. Please refer Master Plan Cable Trench Routing Layout 7. Please refer architectural Master Plan Layout 8 & 9. Please refer Plumbing drawing 10. Please refer Plumbing drawing. Schematic diagram is provided. Detailed design and structural drawings are part of EPC Contractor's scope. 11. Editable Auto Cad version of all the drawings are attached at separate Google Drive link provided. Images of finished facilities are also attached for reference.
4	Part –I, Item No. 68	Query is not clear, being generic. If it is related to: (i) Paints-please refer Points No 1 & 2 (ii) existing columns – it shall be wrapping/jacketing/hollow core structure with RCC type, as per Bidder's design	Query is not clear, being generic. If it is related to: (i) Paints-please refer **Reply to Item No. 67 above** (ii) existing columns – it shall be wrapping/jacketing/hollow core structure with RCC type, as per Bidder's design.

Sd/-
CHIEF ENGINEER

Access Control System for Terminal building

Sl.No	DESCRIPTION	Unit	Quantity
1	Supply and laying of following heavy gauge FRLS PVC 32mm dia conduit concealed in wall/ above false ceiling/ cable tray for taking control cables including all accessories such as Conduit junction boxes, bends etc as required (shall be on actuals).	Mtr	250
2	Supply and laying of following FRLS PVC 32mm dia flexible conduit at above false ceiling for taking control cables including all accessories as required (shall be on actuals).	Mtr	250
3	Supply, laying, testing and commissioning of following size 650V grade shielded twisted PVC insulated copper conductor flexible cables through existing PVC conduit along with all fixing accessories. (Shall be on actuals).		
a	6 core for (Entry Reader 01 Run, Exit Reader 01 Run)	Mtr	300
b	4 core for (EM Lock and Magnetic Contacts 01 Run)	Mtr	300
c	2 core for (Fire alarm integration 01 Run and Buzzer 01 Run)	Mtr	300
4	Supply and laying of CAT 6 cable for controllers communication along with all fixing accessories (between controllers - shall be on actuals)	Mtr	305

Access Control System for Anciliary building			
Sl.No	DESCRIPTION	Unit	Quantity
1	Supply, Installation, Testing and Commissioning of Proxy Card Readers with read range of 4-6" inches and beeper facility including all fixing accessories in complete.	Nos	14
2	Supply, fixing, testing and commissioning of the Electromagnetic locks , electronic buzzer along with magnetic contact and suitable power units for Access doors along with all fixing accessories.		
a	Single leaf EM Lock 600 lbs (shall be inclusive of magnetic contacts and power units and Clamps wherever necessary)	Nos	12
b	Double leaf EM Lock 1200 lbs (shall be inclusive of magnetic contacts, power units and Clamps wherever necessary)	Nos	2
3	Supply, fixing, testing and commissioning of the Emergency glass break switch for Access doors along with all fixing accessories .	Nos	14
4	Supply and installation testing and commissioning of MASTER Controller for controlling Reader Controller's along with all fixing accessories. The controller shall be compatible to integrate with All range of IP based HID Series Controllers	Nos	2
5	Supply and installation testing and commissioning of IP based 2 reader Door Controller for Access Card readers along with SMPS units, Additional relay for hard wired fire alarm integration, including all fixing accessories.	Nos	7
6	Supply and laying of following heavy gauge FRLS PVC 32mm dia conduit concealed in wall/ above false ceiling/ cable tray for taking control cables including all accessories such as Conduit junction boxes, bends etc as required (shall be on actuals).	Mtr	
7	Supply and laying of following FRLS PVC 32mm dia flexible conduit at above false ceiling for taking control cables including all accessories as required (shall be on actuals).	Mtr	
8	Supply, laying, testing and commissioning of following size 650V grade shielded twisted PVC insulated copper conductor Armoured cables through existing PVC conduit along with all fixing accessories. (Shall be on actuals).		
a	6 core for (Entry Reader 01 Run, Exit Reader 01 Run)	Mtr	150
b	4 core for (EM Lock and Magnetic Contacts 01 Run)	Mtr	150
c	2 core for (Fire alarm integration 01 Run and Buzzer 01 Run)	Mtr	175
9	Supply and laying of CAT 6A cable for controllers communication along with all fixing accessories (between controllers - shall be on actuals)	Mtr	305
10	A PC with LCD monitor with 8 GB RAM loaded, 1TB HDD , with per-loaded software's for access control system, and along with all fixing accessories . The PC shall be used for Safety and security schemes softwares. (The said item shall be in client scope)	Nos	1
11	Supply ,installation, testing and commissioning of RF proxy access cards along with accessories	Nos	100
12	Supply and Installation of Panic bar with all fixing accessories	Nos	
13	Supply ,Installation and commissioning of magnetic contact, including all fixing accessories, for panic bar doors that shall be compatible for FAS integration.	Nos	

Building Management System for Terminal Building			
Sl.No	**Description**	**Unit**	**Quantity**
1	Supply installation testing and commissioning of Central computer server system with required pre-loaded genuine softwares comprising of Intel Xeon Quad / Hexa core processor with 8 / 16 GB RAM, 1 TB HDD, 0.1, Gigabit NIC, WIN 2008 std OS 21" TFT colour monitor, Multi fuction key board, network adapter etc graphical interface software with multi tasking enviorment, mouse, serial & parellel ports, gateway card, real time clock with battery back-up, connecting card, communication card, network adapter as expalined above,	Set	1
2	Supply installation testing and commissioning of Laser A4 color printer for printing reports complete with communication cable, power cable, printer driver software etc	Set	1
	BMS Software		
3	Supply installation testing and commissioning of BMS Software including of client software required with complete monitoring and control applications, graphics screens and to generate all management information systems (MIS) reports It shall be operable via internet / TCP IP by at least 4 user licenses. The software shall include the energy data management system module with report generation and be compatible to work and take inputs from any given equipment.	Set	1
4	Commissioning charges for GUI SOFTWARE screens development, with dash board application with graphical representation analysis capable of showing the energy consumption, Temperature distribution corelation etc as per RTC (real time clock) .	Set	0
5	Supply installation testing and commissioning of Ethernet switches required for connectivity of various DDC's and other related equipments. Including weather proof Enclosures, Vendor to calculate with the IO summary given in the document.	Lot	1
7	Supply installation testing and commissioning of L2 Core Switch for connectivity various edge switches of various DDC's and other related equipments. Including weather proof Enclosures, Vendor to calculate with the IO summary given in the document.		
8	Supply installation testing and commissioning of Edge Switch for connectivity between various DDC's and other related equipments. Including weather proof Enclosures, Vendor to calculate with the IO summary given in the document.		
9	Supply of Portable Operating Terminal for Programming Purpose	Set	1
10	INTEGRATION OF FOLLOWING SYSTEMS ON BACNET / MODBUS with required Hardware (integrators/ Converters), software and Developing the customized graphics screens		
a	Integration of Chiller Plant Manager(100 Points)	Lot	0
b	Integration of UPS (10 Points per UPS)	Lot	1
c	Integration of Lift Panel (10 Points per Lift)	Lot	0
d	Integration of VFD's for Secondary pumps(10 Points per Pump)	Lot	0
e	Integration of VFD's for Condenser pumps(10 Points per Pump)	Lot	0
f	Integration of VFD's for TES pumps of Brine Chillers(10 Points per Pump)	Lot	0
g	Integration of VFD's of AHU's CSU's(10 Points per VFD)	Lot	1
h	Integration of Basement Ventilation Jet fans(10 Points per Fan)	Lot	1
i	Integration of KW transducers(10 Points per Transducer)	Lot	1
j	Any other soft integrations (furture)	Lot	1
11	DDC CONTROLLER IP BASED WITH REQUIRED PANEL ENCLOSURE, BATTERY BACK UP AND CONTROL WIRING ETC.		
a	Supply installation testing and commissioning of DDC Controller for AHU	Nos	4
b	Supply installation testing and commissioning of DDC Controller for CSU	Nos	13
c	Supply installation testing and commissioning of DDC Controller for FCU	Nos	9
d	Supply installation testing and commissioning of DDC Controller for Electrical Management System	Lot	1
e	Supply installation testing and commissioning of DDC Controller for Chillers	Lot	0
f	Supply installation testing and commissioning of DDC Controller for Ventillation Fans	Nos	0
g	Supply installation testing and commissioning of DDC Controller for Pressurization Fans	Nos	0
h	Supply installation testing and commissioning of DDC Controller for Water Management System	Nos	1
i	Supply installation testing and commissioning of DDC Controller for Fire Fighting System	Nos	1
12	Field Devices		
a	Supply installation testing and commissioning of Ductable type Combined Temperature & RH Sensors	Nos	29
b	Supply installation testing and commissioning of Filter Differential Pressure Switches	Nos	29
c	Supply Installation testing and commissioning of CO2 Sensors	Nos	29
d	Supply installation testing and commissioning of Out Side Air T&RH Sensor and Shall be IP68 Protected	Nos	1

e	Supply installation testing and commissioning of Floating type Level transmitters for overhead tanks	Nos	1
f	Supply installation testing and commissioning of Flow Switches for the plumbing & fire fighting pumps	Nos	6
g	Supply installation testing and commissioning of flame proof Level transmitters for HSD tanks.	Nos	0
13	Cables suitable for DDC System, complete with terminations, junction boxes, etc Quantity mentioned in tentative and will differ with site condition, however it shall be on actuals		
a	Supply and laying of 4 Core 1 sqmm armoured multistranded cable	Rmtrs	1125
b	Supply and laying of 2 Core 1 sqmm unarmoured multistranded PVC flexible cable	Rmtrs	1500
c	Supply and laying of 4 Core 1 sqmm unarmoured multistranded PVC flexible cable	Rmtrs	1500
d	Supply and laying of 4 Core 1 sqmm unarmoured multistranded shielded twisted overall PVC cable	Rmtrs	1350
e	Supply & laying of CAT 6 twisted cable for connecting of all DDC's to router and system	Rmtrs	915
14	Supply, Installation, Testing & commissioning of cable trays with Covers and providing closed type GI wire way complete with all supports, bends, tees, fittings & accessories of the following sizes		
a	450 x 50 x 2 mm	Rmtrs	100
b	300 x 50 x 2 mm	Rmtrs	50
c	150 x 50 x 2 mm	Rmtrs	50
15	Supply and laying of 32 mm FRLS PVC conduits along with all fixing accessories withbase plates for the total qty of conduits	Rmtrs	500
16	Supply and laying of 32 mm PVC Flexible conduits along with all fixing accessories with base plates for the total qty of conduits	Rmtrs	200
17	Supply and laying of 25 mm FRLS PVC conduits along with all fixing accessories with base plates for the total qty of conduits	Rmtrs	500
18	Supply and laying of 25 mm PVC Flexible conduits along with all fixing accessories with base plates for the total qty of conduits	Rmtrs	200

CCTV System for Terminal Building

Sl. No	Description of Work		
	CAMERAS	Units	Quantity
1	Supply, installation, Testing and commissioning of 1/3" colour motion based, **IR Dome type** IP vandal proof POE cameras with resolution of minimum 02 Mega pixel or higher , Day & Night type and min illumination of 0.001 lux with Motorinzed varifocal lens suitable for covering distance of 50 – 60 mtrs for indoor application with Audio at Double Height Areas along with complete fixing accessories like ceiling Mounts and required software and licenses for the cameras.(Common Areas)	Nos	40
2	Supply, installation, Testing and commissioning of 1/3" colour motion based, **IR Dome type** IP vandal proof POE cameras with resolution of minimum 02 Mega pixel or higher, Day & Night type, WDR and min illumination of 0.001 lux with Motorized varifocal lens suitable for covering distance of 50-60 mtrs for indoor application with Audio at Double Height Areas along with complete fixing accessories like ceiling Mounts and required software and licenses for the cameras.(Entrances and Exits)	Nos	10
3	Supply, installation, Testing and commissioning of 1/3" colour motion based, **IR Box Camera** type IP vandal proof POE weather proof cameras with Varifocal lens resolution of minimum 02 Mega pixel or higher, Day & Night type, WDR, and min illumination of 0.001 lux with lens suitable for covering distance of 50-60 mtrs for indoor application with Audio along with complete fixing accessories like ceiling Mounts and required software and licenses for the cameras.	Nos	12
4	Supply, installation, Testing and commissioning of 1/3" colour motion based, **IR Bullet type** Camera IP vandal proof POE cameras with Motorized Varifocal lens resolution of minimum 02 Mega pixel or higher, Day & Night type and min illumination of 0.001 lux with lens suitable for covering distance of 50-60 mtrs for outdoor application along with complete fixing accessories like ceiling Mounts/Clamps and required software and licenses for the cameras.	Nos	2
5	Supply, installation, Testing and commissioning of 1/3" colour motion based, **IR Box type** IP vandal proof POE weather proof ANPR cameras with 10-40mm Varifocal lens resolution of minimum 02 Mega pixel or higher, Day & Night type and min illumination of 0.001 lux with lens suitable for covering distance of 10-20 mtrs for Vehicle monitoring, Number Plate and Driver identification along with complete fixing accessories like ceiling Mounts and Clamps and required software and licenses for the cameras. Able to be integrated with the UVSS System	Nos	4
6	Supply and installation, Testing and commissionig of ¼ colour high speed MPEG4 compliant with 30 X PTZ adjustment IP POE camera with resolution ,min illumianance of .001 lux under day night application should be able to cover a distance of minimum 100 Mtrs along with software & license . It should have weather proof housing with IP66 certification shall be along with mounting brackets. (Note: *Single port POE injector with OFC media convertor, weatherproof enclosure.)	Nos	4
7	Supply, installation , testing and Commissioning of Joy-Stick Keyboard Controller for PTZ	Nos	1
	SWITCHES, NVR, SOFTWARE, STORAGE & MONITORS		
1	Supply and installation testing and commissioning of **24 port Power on Ethernet (POE) with 2 FPS** 100/1000 gigabit switch suitable for above cameras , 2 No's of Fiber optic module Pigtails, along with all required connectors, Adequate weatherproof Enclosures and fixing accessories.	Nos	3
2	Supply and installation testing and commissioning of **16 port Power on Ethernet (POE) with 2 FPS** 100/1000 gigabit switch suitable for above cameras , 2 No's of Fiber optic module Pigtails, along with all required connectors, Adequate weatherproof Enclosures and fixing accessories.	Nos	2
3	Supply, installation, testing and commissioning of**04** channel Embedded NVR suitable for the above mentioned ANPR Cameras, including Storage of 16 TB Minimum, Fulltime recording , @ 24 frames and above, Recording for 30 days minimum, including all required connectors and fixing accessories in complete.	Nos	0
4	Supply, installation, testing and commissioning of 64 channel NVR with VMS Software, and 4 user licenses to work with suitable high end SERVER for the as mentioned below for control and monitoring along with other accessories in complete. This shall be similar to Mile stone or One view software considering software license for all the above cameras. And shall be comparatable for remote viewing in Multiple OS & Browsers. and shall be Expandable for any number of cameras with licence upgradation as required. the software shall be comparatable to integrate the Encoders for live view & playback in single window. with 50" moniter	Nos	1
5	Supply installation testing and commissioning of**Video management server** with configuration of Intel Xeon Quad Core processor (2.9 Ghz) or better, 10MB level 3 cache, 8 GB RAM (DDR3-1333SFB), RAID5, support for hot plug fully redundant power supply with 2 different power options available Integrated Controller Card,DVD ROM Drive, original Windows 8 Server, Original OS, back end, MS office, 21" LED monitor, 100/1000Mbps network card,along with all required accessories.	Nos	1
6	Supply installation testing and commissioning of 24 bay DAS storage of 144 TB minimum or suitable storage discs - supported drives 3.5"SAS / SATA, maximum storage capacity – 24 drive slots with a Maximum of 6TB per unit or what ever is maximum. It shall support Cascading of 4 units i.e.48 drives, host interface, smart array system controller support, Boot from storage, software support-web or remote web based and off line configuration etc. with Hard Disk capacity for minimum 180 days storage including suitable rack to house the above. (Storage @ of 25 fps min with 70% motion recording.)	Nos	1
7	Supply installation, testing and commissioning of latest configuration PC, CPU with 50'' LED Display Monitor for Remote monitoring purpose, The PC is expected to be with preloaded OS and suitable software's, Graphic Cards, 8gb RAM Minimum and with 500gb Hard Disk. Including all accessories as required.	Nos	0
8	Supply and installation of 42 U standard wall / Floor mount Rack to Accomodate the Server & DAS storage, along with all interconnection, Power Extension Boxes, and all accessories as required	Nos	1
9	Supply and installation testing and commissioning of 24 port L2 switch fully managed SNMP (simple network management protocol) 10/100/1000 with 04 port Fiber uplink SFP (Small form factor) gigabit switch suitable for above connectivity along with all required connectors and fixing accessories.	Nos	1
	CABLES & CONDUIT		
1	Supply and Laying of Cat6 A Cable with required RJ45 connectors for interconnections of cameras, Server and monitoring stations	Rmtrs	1525
2	Supply and Laying of 6 Core Single mode armoured Fibre optic cable & HDPI Pipe with all required connectors, Pigtails and all accessories.	Rmtrs	850
3	Supply and installation of 12 port LIU's, Single mode Media convertors set for both the End, Slicing, Power adaptors and all required accessories with Enclosures	Nos	12
4	Supply and installations of 6 meters tappered pole for cameras with weather proof enclosure for mounting media convertors and required accessories.	Nos	0
5	Supply, laying, testing and commissioning of 2 core X 1.5 sq mm unarmoured cable for powering up the analog cameras along with required accessories.	Rmtrs	600
6	Supply and laying of Hume pipe of 50mm Gi Class 'C' for laying across the drive way.	Rmtrs	0
7	Supply and fixing of 20mm dia heavy guage FRLS PVC conduit concealed in wall/ above false ceiling for taking copper wires including all accessories such as Conduit junction boxes, bends etc as required (Shall be on actuals).	Rmtrs	0

8	Supply and fixing of 20mm dia PVC Flexible conduit for taking copper wires including all accessories (Shall be on actuals).	Rmtrs	0

CCTV System for Ancillary Building

Sl. No	Description of Work		
	CAMERAS	Units	Quantity
1	Supply, installation, Testing and commissioning of 1/3" colour motion based, **IR Dome type** IP vandal proof POE cameras with resolution of minimum 02 Mega pixel or higher , Day & Night type and min illumination of 0.001 lux with Motorinzed varifocal lens suitable for covering distance of 50 – 60 mtrs for indoor application with Audio at Double Height Areas along with complete fixing accessories like ceiling Mounts and required software and licenses for the cameras.(Common Areas)	Nos	0
2	Supply, installation, Testing and commissioning of 1/3" colour motion based, **IR Dome type with Recognition** IP vandal proof POE cameras with resolution of minimum 02 Mega pixel or higher, Day & Night type, WDR and min illumination of 0.001 lux with Motorized varifocal lens suitable for covering distance of 50-60 mtrs for indoor application with Audio at Double Height Areas along with complete fixing accessories like ceiling Mounts and required software and licenses for the cameras.(Entrances and Exits)	Nos	0
3	Supply, installation, Testing and commissioning of 1/3" colour motion based, **IR Box Camera with Recognition** type IP vandal proof POE weather proof cameras with Varifocal lens resolution of minimum 02 Mega pixel or higher, Day & Night type, WDR, and min illumination of 0.001 lux with lens suitable for covering distance of 50-60 mtrs for indoor application along with complete fixing accessories like ceiling Mounts and required software and licenses for the cameras.	Nos	2
4	Supply, installation, Testing and commissioning of 1/3" colour motion based, **IR Bullet type Camera with Recognition** IP vandal proof POE cameras with Motorized Varifocal lens resolution of minimum 02 Mega pixel or higher, Day & Night type and min illumination of 0.001 lux with lens suitable for covering distance of 50-60 mtrs for outdoor application along with complete fixing accessories like ceiling Mounts/Clamps and required software and licenses for the cameras. (For External Areas like Roadways Etc)	Nos	4
5	Supply, installation, Testing and commissioning of 1/3" colour motion based, **IR Bullet type Camera** IP vandal proof POE cameras with Motorized Varifocal lens resolution of minimum 02 Mega pixel or higher, Day & Night type and min illumination of 0.001 lux with lens suitable for covering distance of 50-60 mtrs for outdoor application along with complete fixing accessories like ceiling Mounts/Clamps and required software and licenses for the cameras.	Nos	4
6	Supply, installation, Testing and commissioning of 1/3" colour motion based, **IR Box type** IP vandal proof POE weather proof ANPR cameras with 10-40mm Varifocal lens resolution of minimum 02 Mega pixel or higher, Day & Night type and min illumination of 0.001 lux with lens suitable for covering distance of 10-20 mtrs for Vehicle monitoring, Number Plate and Driver identification along with complete fixing accessories like ceiling Mounts and Clamps and required software and licenses for the cameras. Able to be integrated with the UVSS System	Nos	0
7	Supply and installation, Testing and commissionig of ¼ colour high speed MPEG4 compliant with 30 X PTZ adjustment IP POE camera with resolution ,min illumianance of .001 lux under day night application should be able to cover a distance of minimum 100 Mtrs along with software & license . It should have weather proof housing with IP66 certification shall be along with mounting brackets. (Note: *Single port POE injector with OFC media convertor, weatherproof enclosure.)	Nos	0
8	Supply, installation , testing and Commissioning of Joy-Stick Keyboard Controller for PTZ	Nos	0
	SWITCHES, NVR, SOFTWARE, STORAGE & MONITORS		
1	Supply and installation testing and commissioning of **24 port Power on Ethernet (POE) with 2 FPS** 100/1000 gigabit switch suitable for above cameras , 2 No's of Fiber optic module Pigtails, along with all required connectors, Adequate weatherproof Enclosures and fixing accessories.	Nos	1
2	Supply and installation testing and commissioning of**16 port Power on Ethernet (POE) with 2 FPS** 100/1000 gigabit switch suitable for above cameras , 2 No's of Fiber optic module Pigtails, along with all required connectors, Adequate weatherproof Enclosures and fixing accessories.	Nos	1
3	Supply, installation, testing and commissioning of**04** channel Embedded NVR suitable for the above mentioned ANPR Cameras, including Storage of 16 TB Minimum, Fulltime recording , @ 24 frames and above, Recording for 30 days minimum, including all required connectors and fixing accessories in complete.	Nos	0
4	Supply, installation, testing and commissioning of 32 channel NVR with PoE Software, and 4 user licenses to work with suitable high end SERVER for the as mentioned below for control and monitoring along with other accessories in complete. The NVR should have 8 HDD Slots upto a maximum storage capacity of 12TB per slot This shall be similar to Mile stone or One view software considering software license for all the above cameras. And shall be comparatable for remote viewing in Multiple OS & Browsers. and shall be Expandable for any number of cameras with licence upgradation as required. the software shall be comparatable to integrate the Encoders for live view & playback in single window.	Nos	1
5	Supply installation testing and commissioning of**Video management server** with configuration of Intel Xeon Quad Core processor (2.9 Ghz) or better, 10MB level 3 cache, 8 GB RAM (DDR3-1333SFB), RAID5, support for hot plug fully redundant power supply with 2 different power options available Integrated Controller Card,DVD ROM Drive, original Windows 8 Server, Original OS, back end, MS office, 21" LED monitor, 100/1000Mbps network card,along with all required accessories.	Nos	0
6	Supply installation testing and commissioning of 24 bay DAS storage of 192 TB minimum or suitable storage discs - supported drives 3.5"SAS / SATA, maximum storage capacity – 48 drive slots with a Maximum of 16TB per unit or what ever is maximum. It shall support Cascading of 4 units i.e.48 drives, host interface, smart array system controller support, Boot from storage, software support-web or remote web based and off line configuration etc. with Hard Disk capacity for minimum 180 days storage including suitable rack to house the above. (Storage @ of 25 fps min with 70% motion recording.)	Nos	0
7	Supply installation, testing and commissioning of latest configuration PC, CPU with 50'' LED Display Monitor for Remote monitoring purpose, The PC is expected to be with preloaded OS and suitable software's, Graphic Cards, 8gb RAM Minimum and with 500gb Hard Disk. Including all accessories as required.	Nos	0
8	Supply and installation of 42 U standard wall / Floor mount Rack to Accomodate the Server & DAS storage, along with all interconnection, Power Extension Boxes, and all accessories as required	Nos	1
9	Supply and installation testing and commissioning of 24 port L2 switch fully managed SNMP (simple network management protocol) 10/100/1000 with 04 port Fiber uplink SFP (Small form factor) gigabit switch suitable for above connectivity along with all required connectors and fixing accessories.	Nos	1
	CABLES & CONDUIT		
1	Supply and Laying of Cat6 A Cable with required RJ45 connectors for interconnections of cameras, Server and monitoring stations	Rmtrs	915
2	Supply and Laying of 6 Core Single mode armoured Fibre optic cable & HDPI Pipe with all required connectors, Pigtails and all accessories.	Rmtrs	400
3	Supply and installation of 12 port LIU's, Single mode Media convertors set for both the End, Slicing, Power adaptors and all required accessories with Enclosures	Nos	12

4	Supply and installations of 6 meters tappered pole for cameras with weather proof enclosure for mounting media convertors and required accessories.	Nos	0
5	Supply, laying, testing and commissioning of 2 core X 1.5 sq mm unarmoured cable for powering up the analog cameras along with required accessories.	Rmtrs	400
6	Supply and laying of Hume pipe of 50mm Gi Class 'C' for laying across the drive way.	Rmtrs	0
7	Supply and fixing of 20mm dia heavy guage FRLS PVC conduit concealed in wall/ above false ceiling for taking copper wires including all accessories such as Conduit junction boxes, bends etc as required (Shall be on actuals).	Rmtrs	0
8	Supply and fixing of 20mm dia PVC Flexible conduit for taking copper wires including all accessories (Shall be on actuals).	Rmtrs	0

Rodent Repellent System for Terminal Building

Sl.No	Description	Unit	Quantity
1	Supply & Installation of Master console Ultrasonic rodent / pest Repeller panel along with all fixing accessories and cable.	Nos	1
2	Supply & Installation of Transducers with all fixing accessories	Nos	24
3	Supply & Installation of Wire Bundles –2 core flexible (14/40) SWG specially coated wires of 300 Mtrs	Rmtrs	1
4	Supply & Installation Electronic / Piezo sounders powered from the control panel or with built in supply - 85 / 90 db	Nos	1
5	Supply and laying of 20mm dia heavy duty PVC Conduit including all fixing accessories. (Shall be on actuals).	Rmtrs	75
6	Supply and fixing of 20mm dia Flexible conduit at above false ceiling for taking wires including all accessories (Shall be on actuals).	Rmtrs	10

Very Early Smoke Detection and Aspiration System for Terminal Building

Sl.No	**Description**	**Unit**	**Quantity**
1	Vesda laser Aspiration suitable Detection Panel along with laser detector, fan and power supply unit and monitor module for addressability to main fire alarm panel complete with required accessories	Set	1
2	Supply and installation of capillary sampling points with sampling capillary tubes as required	Nos	24
3	Supply and laying of 25mm Heavy guage FRLS LSZH (low smoke zero halogen) PVC pipes with sampling holes and fittings with all accessories, supports, fixing hardware etc	Rmtrs	40
4	Supply and laying of 2 core x 1.5 sq. mm Twisted pair shielded FRLS cable in existing PVC Conduit including all connections for connectivity from Vesda panel to monitor module .	Rmtrs	40
5	Supply and fixing of 20mm dia heavy guage FRLS PVC conduit concealed in wall/ above false ceiling for taking copper wires including all accessories such as Conduit junction boxes, bends etc as required (Shall be on actuals)	Rmtrs	40

Water Leak Detection System for Terminal Building

Sl.No	Description	Unit	Quantity
1	Four Zone Control panel with One Form C, single pole/double throw, mechanically latching 3 Amp relay, power supply with batteries for 4 hrs backup, One supervised or unsupervised NO/NC contacts, LCD display, keypad, enclosure along with detector modules etc.	Nos	1
2	Supply and laying of Water leak Detection hydro sense cable and all accessories, termination boxes, fixing clips etc.	RMtrs	45
3	Supply, installation, testing and commissioning of water leak detection module	Nos	4
4	Supply and installation of Electronic / Piezo sounders powered from the control panel or with built in supply - 85 / 90 db	Nos	2
5	Supply and laying of Twisted pair 1.0 sq. mm shielded cable in Existing PVC Conduit including all connections.(Shall be on actuals).	RMtrs	30
6	Supply and laying of 20mm dia heavy duty PVC Conduit including all fixing accessories. (Shall be on actuals).	RMtrs	30

INTERNATIONAL AND DOMESTIC CRUISE TERMINAL AND ALLIED FACILITIES AT MORMUGAO PORT, GOA

ARCHITECTURAL, STRUCTURAL & MEP CONSULTANTS

TEAM ONE INDIA PVT., LTD.
Architecture-Engineering-Project Management
#5th Floor, Anvi's Eco Grand, Near Wipro Lake
Nanakramguda Road, Financial District,
Hyderabad:-500008

DESIGN BRIEF REPORT

INTERNATIONAL AND DOMESTIC CRUISE TERMINAL AND ALLIED FACILITIES AT MORMUGAO PORT, GOA

SITE AREA: 13.40 ACRES

LOCATION: MORMUGAO PORT, GOA

ARCHITECTURAL INDEX

1. SITE DETAILS

Site is located at Mormugao, Goa with a site area of 13.40 acres

1.1 Design for International Cruise Terminal

Well-designed futuristic cruise terminal catering international as well as domestic arrivals/departures with basic amenities like retail shops, food courts, restaurants, lounge's and beautiful viewing decks.
Since its one of a kind project which sets the major landmark on Indian sub-continent.

1.2 Design for Ancillary Building

These inculde the design of spaces like premium lounge's, lounges, food courts, restaurents, office spaces and retail spaces.

2. CONTEXT STUDY

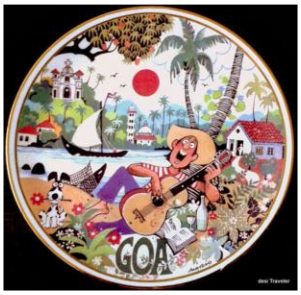
The architecture of Goa is a combination of Indian, Islamic and Portuguese styles. Since the Portuguese ruled for four centuries, many churches and houses bear a striking element of the Portuguese style of architecture.

BEACH MAP IN GOA

Architectural influences

Confluence of **Indian, Mughal** and **Portuguese** styles.p

Mixture and adaptation of design elements and influences from all over the world.

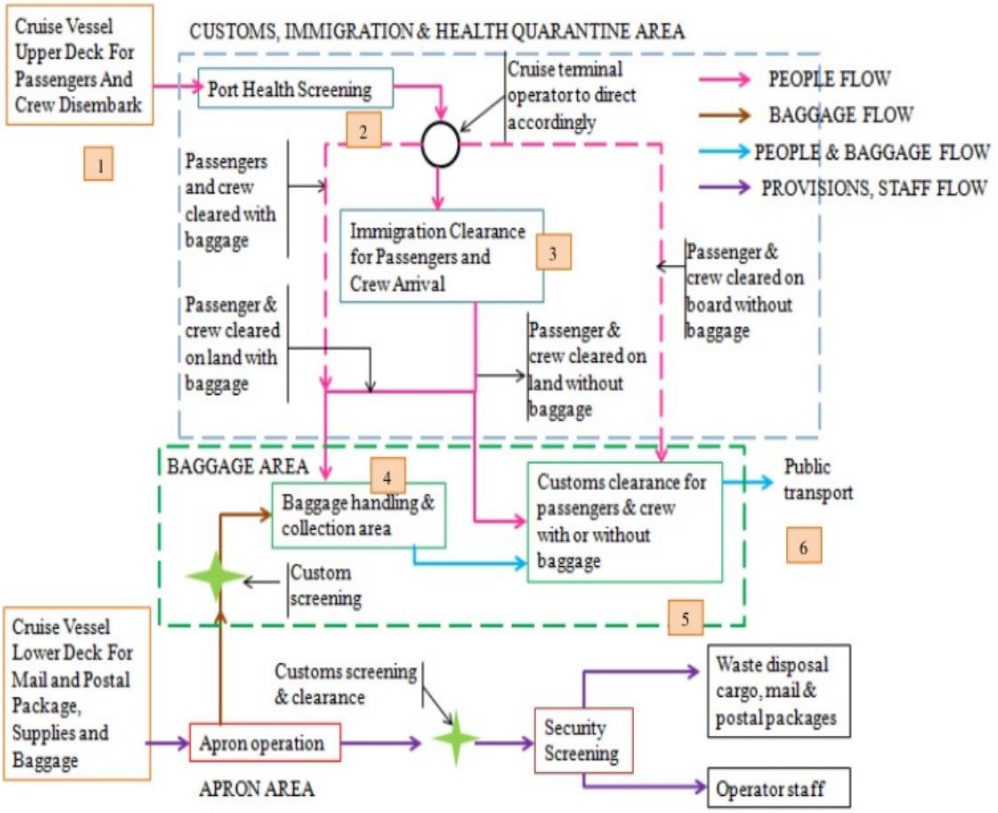


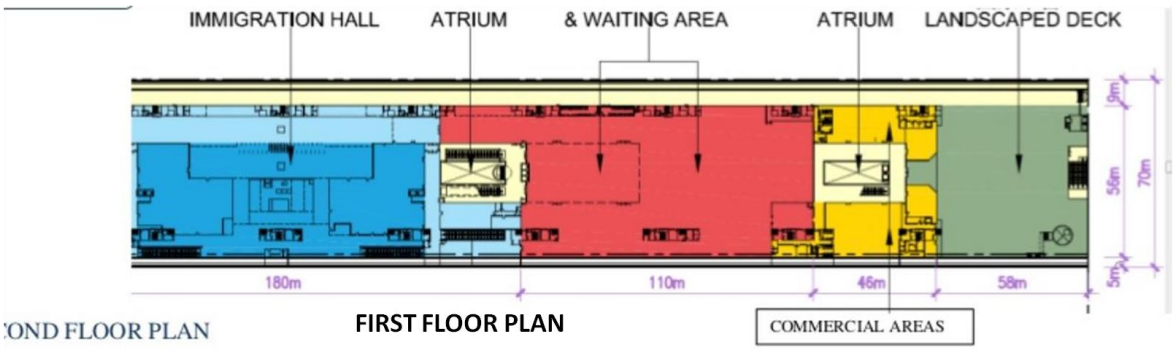
3. CASE STUDIES

KAITAK CRISE TERMINAL, HONG KONG

ARCHITECT : FOSTERS & PARTNERS
LOCATION : HONG KONG
AREA : 52,000SQM
CAPACITY : 8400 PASSENGERS

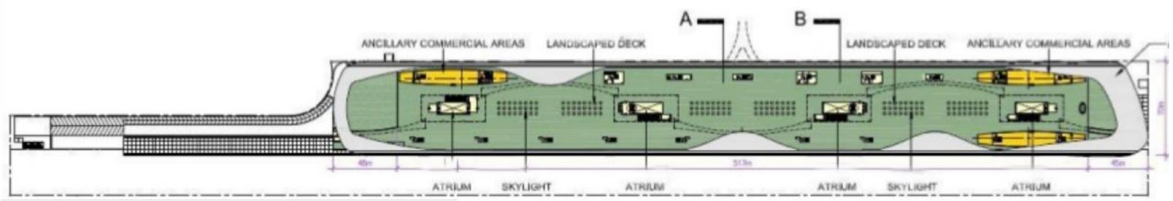
The terminal has a large, rectangular footprint and is arranged over three main levels, punctuated by four atria that draw daylight deep inside the building. A pedestrian promenade rises up through the terminal and opens onto a large **public roof garden**, with open and sheltered spaces, outdoor dining and more formal events, all set against backdrop of the city.





FIRST FLOOR PLAN

:OND FLOOR PLAN



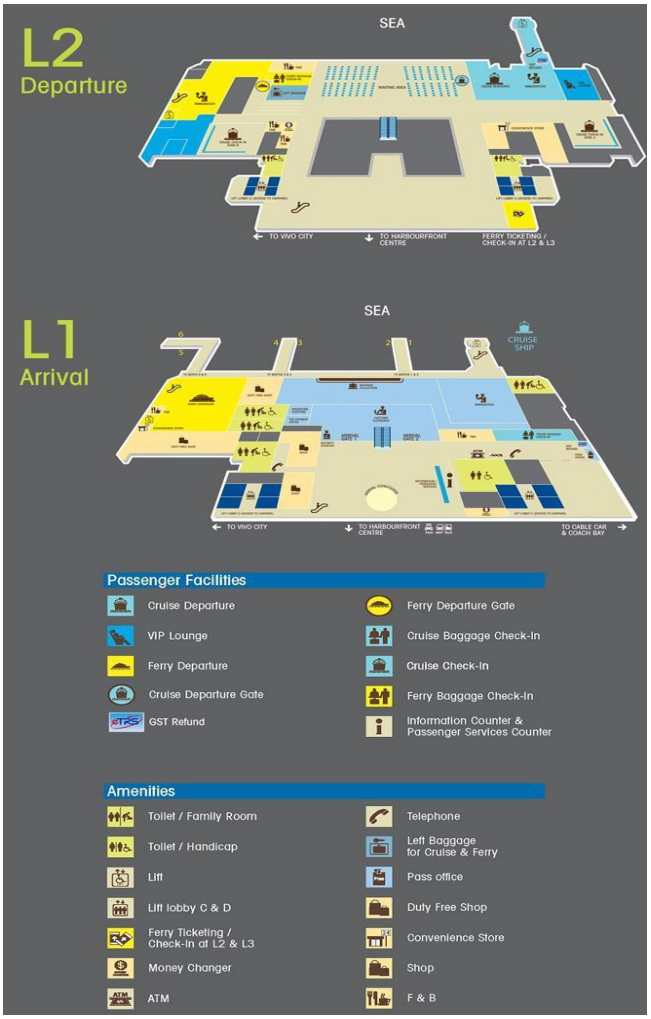
SECOND FLOOR PLAN

BAY CRUISE CENTRE AND MARINA,SINGAPORE

ARCHITECTS : RSP
LOCATION **:** SINGAPORE
AREA : 60000.0 M2

The terminal it commands a prominent waterfront location with the downtown Singapore skyline as its backdrop. Its interior has a clear and functional layout to ensure smooth and seamless passenger service whilst the exterior adopts a marine theme with the motif of waves breaking into shore.

The terminal complements several other developments which are icons of Singapore, and represent it as a complete destination with world-class attractions, infrastructure, and leisure facilities.



4. DESIGN PRINCIPLES

A WORLD CLASS DEVELOPMET AS A GATEWAY TO THE COUNTRY

- The Building must be in contemporary world class standard with all modern facilities
- Must be future ready to cater to the growing demand from the industry
- Technology used effectively to automate streamline processes

•World Class Entry Lobbies

•Double Height Waiting Lounges

•World class services and baggage handling areas

- Airports/Terminals and such Passenger/Visitor Facilities are the first point of

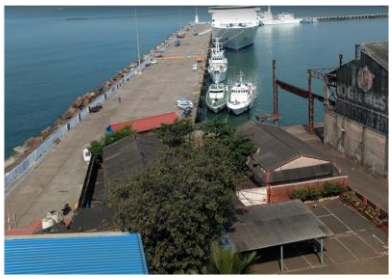
- Arrival for a visitor to the Country/City.
- Terminal Design influences the first impression of development of the country. Hence they need to be world class and have a Iconic competent Design to leave a lasting impression.

•Delhi Airport •Singapore Changi Airport

DEVELOPING NEW IDENTITY TO THE CITY

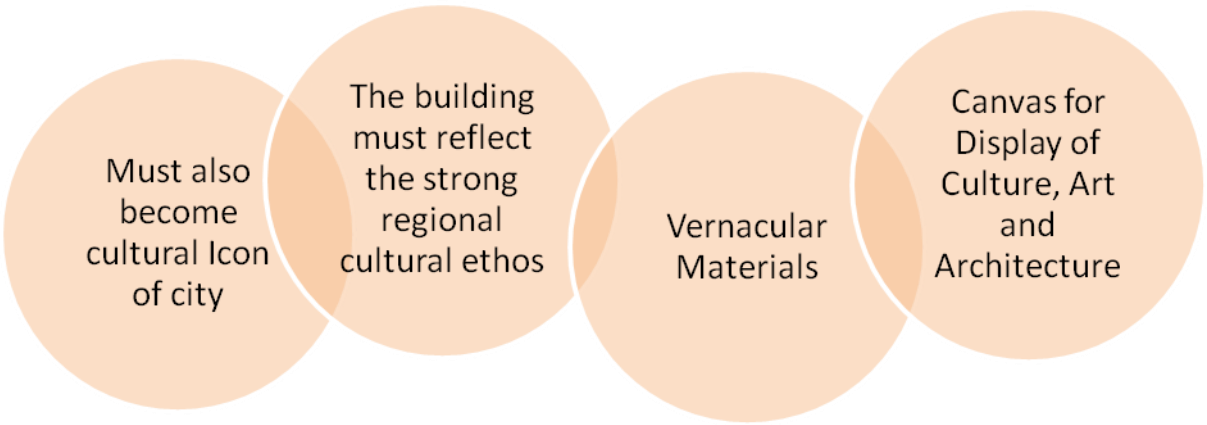
- Need for new identity for one of the fastest Growing State.
- Modern Icon to showcase the rich maritime history as well as culture of the city
- Should interpret the many layers of history and architectural styles while creating a modern, contemporary visionary icon
- Place identity is a core concept in the field of environmental psychology which proposes that identities form in relation to environments.
- Place makes memories cohere in complex ways. People's experiences of the urban landscape intertwine the sense of place

DEVELOPING NEW IDENTITY TO THE PLACE

- Poor and Weak Image able Elements at Site
- Need to implement Urban place making strategies to create new visual elements to reinvent the identity of the area
- The identity of the terminal needs to correlate to that of the surroundings while creating a subtle modern emphasis at the same time

REDEFINING THE CULTURAL CONTEXT



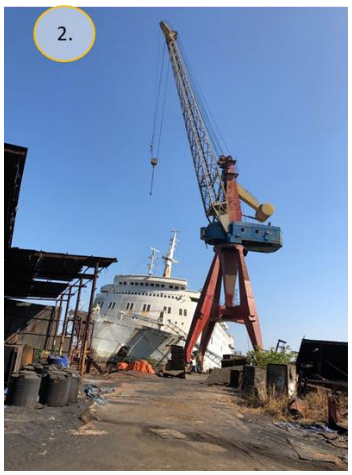
- Terminal Buildings worldwide are moving towards the trend of showcasing the regions art and culture
- Terminal Building design are getting influenced from traditional and vernacular elements, which are re-interpreted as new cultural and landmark icons

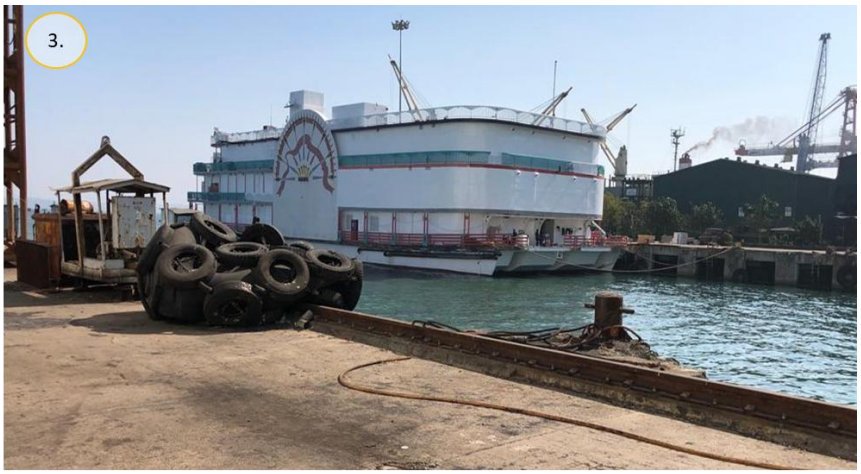
•Mumbai Airport "Art Wall "exhibition center

•Netaji subhash chandrabose Airport writing of poet Rabindranath Tagore on terminal ceiling

•Reinterpreted Mudras at IGIA,Delhi Airport

REDEVELOPMENT OF EXISTING SCRAP YARD





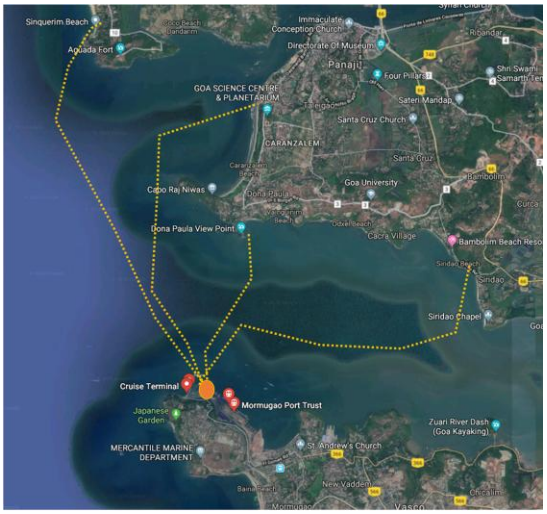
- Need for redevelopment of existing ship dismantling unit center and scrap yards
- Dilapidated structures and Scrap to be demolished
- Existing warehouse shed structures to be retained as much as possible. The place needs to be transformed with minimal invasion to the existing structures.
- Edge between the water and built Form to be redeveloped and emphasized.

DEVELOPMENT OF ROPAX AND PASSENGER FERRY

•Passenger Ferry

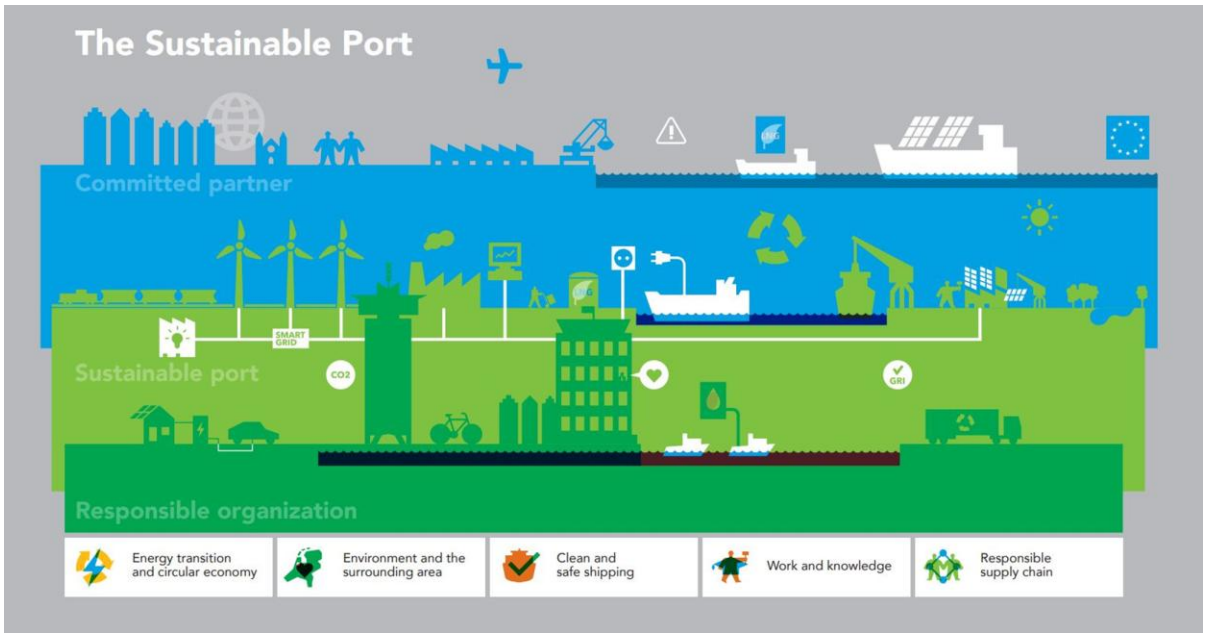
•Typical Ro-Pax Ferry Terminal Layout

•Ro-Pax Ferry

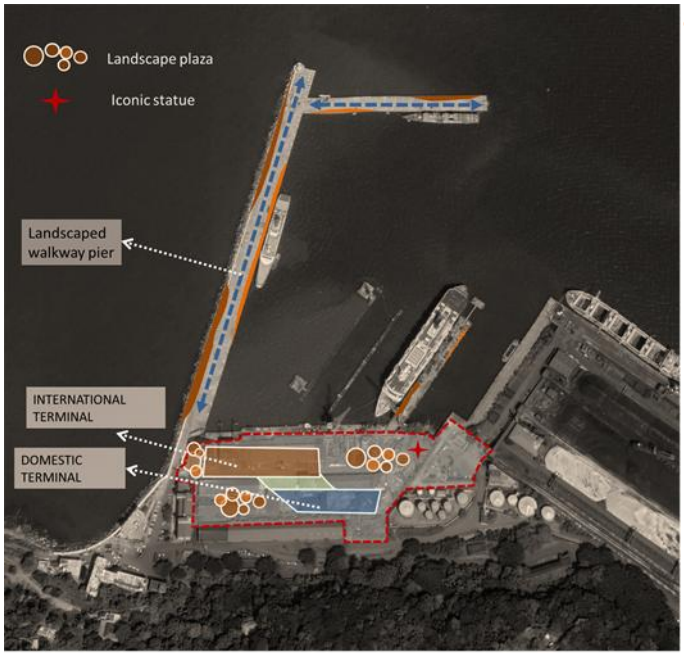


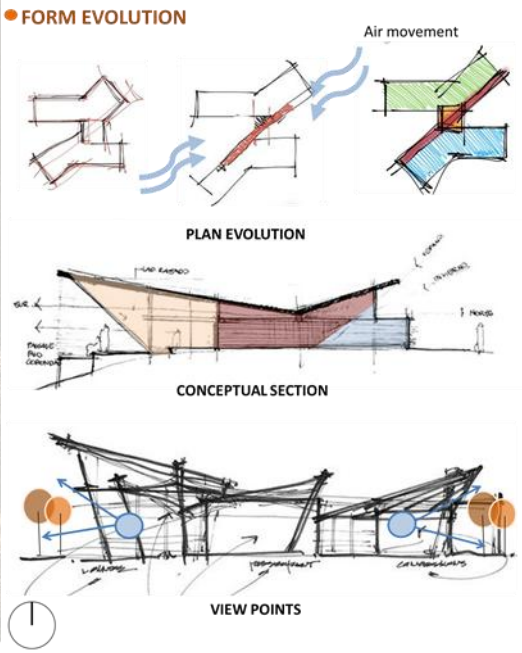
- Development for Facilities for Roll on Roll off Passenger (R0-Pax) Ferry Services as well as normal Passenger Ferry Services to connect Murmagao to other Beach points
- Develop suitable facilities for passengers
- Connect to the Cruise terminal
- Provide ample parking, taxi/bus connectivity

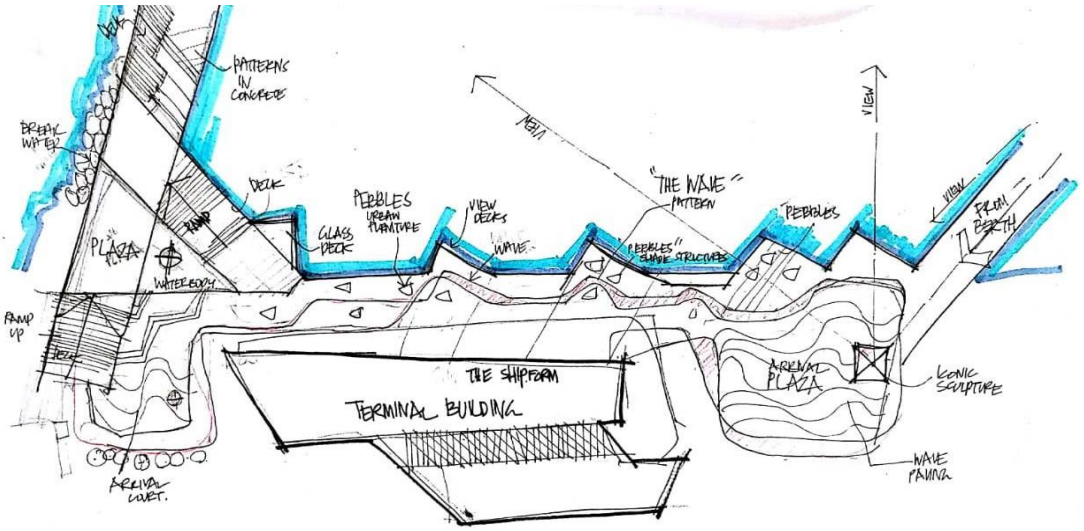
DEVELOPING A SUSTAINABLE BUILT ENVIRONMENT

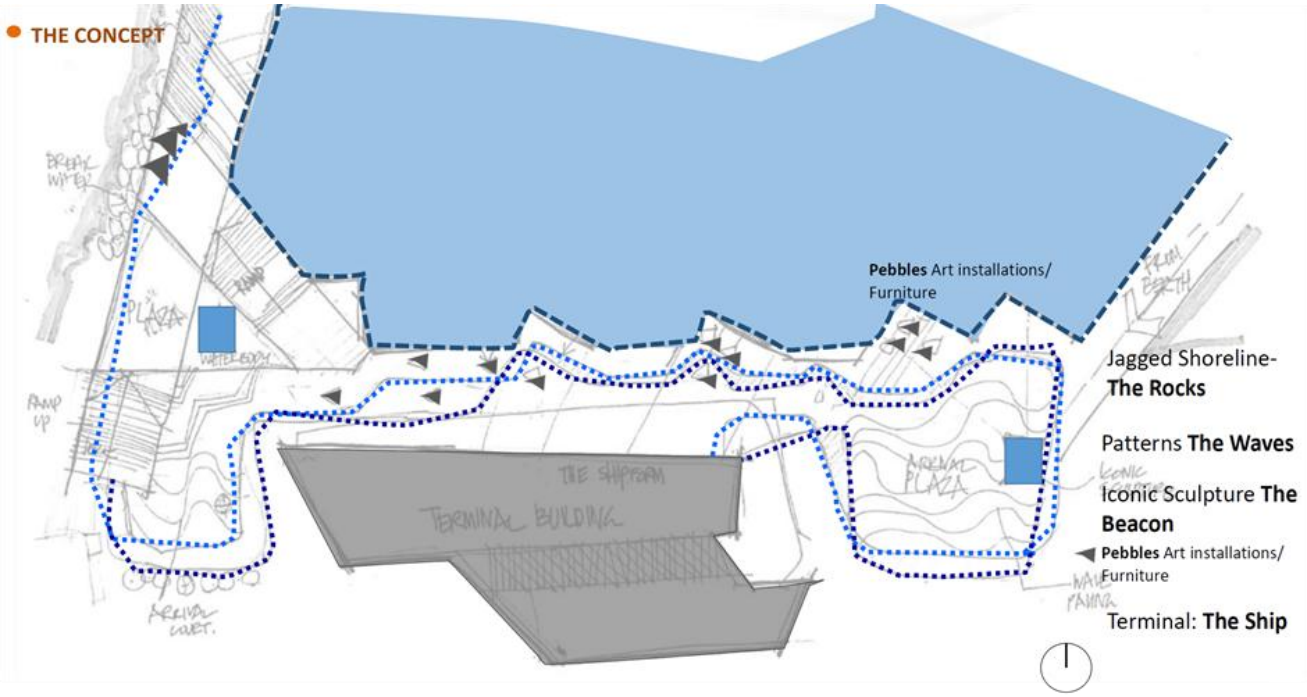


5. DESIGN CONCEPTS

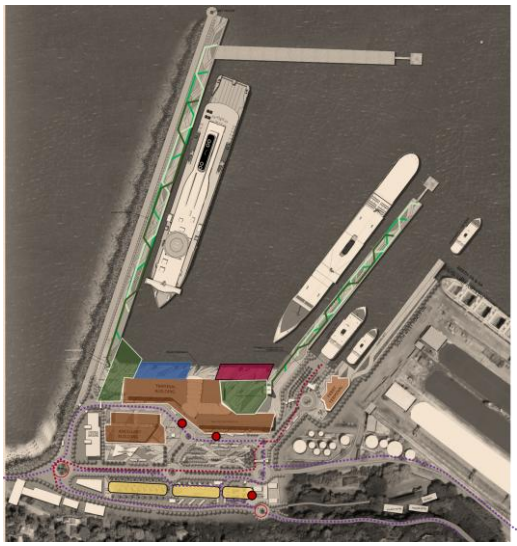




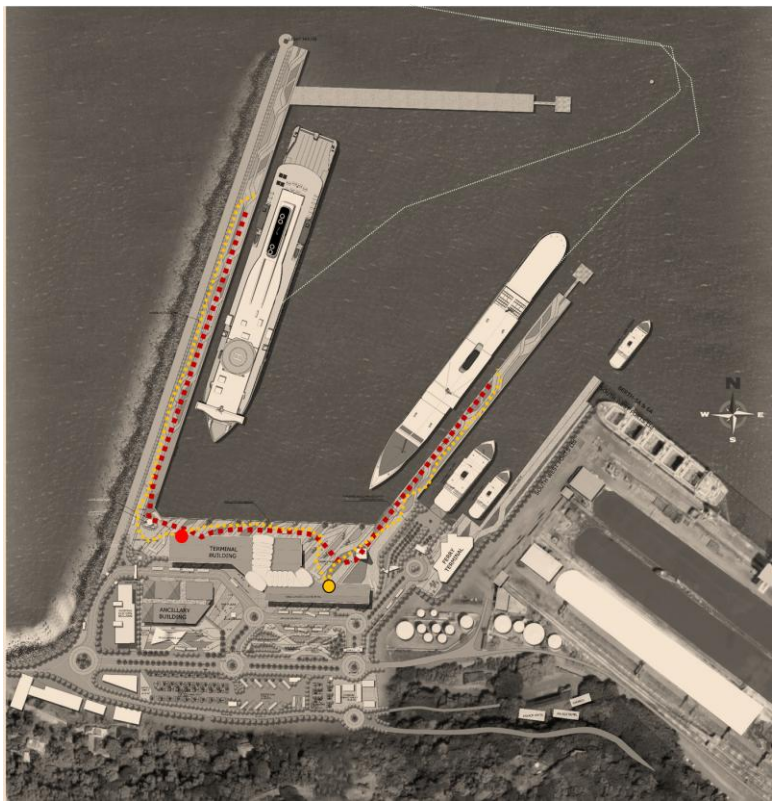



THE CONCEPT
Pebbles Art installations/ Furniture
Jagged Shoreline- The Rocks
Patterns The Waves
Iconic Sculpture The Beacon
Pebbles Art installations/ Furniture
Terminal: The Ship

6. PROPOSED MASTERPLAN



- Vehicular Entrances
- Main Road connectivity
- Car access to ferries
- Drop off
- Terminal Buildings
- Arrival bays
- Departure bays
- Plazas
- Urban landscaped pier
- Parking



- International Cruise Passenger Arrival Arrival Gate
- Domestic Cruise Passenger Arrival Arrival Gate

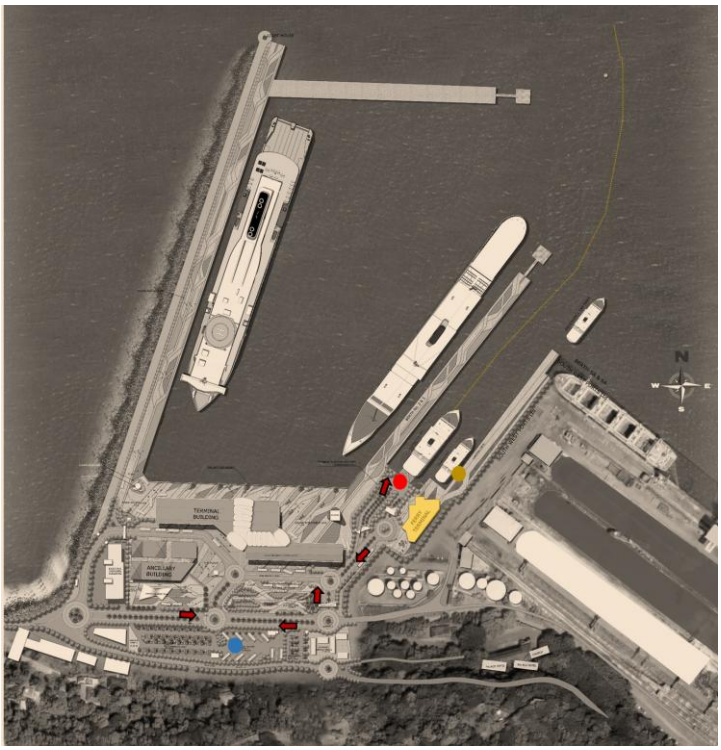
Passenger Ferry Point

Ro-Pax Ferry Point

Ferry Terminal

Car Traffic

Parking



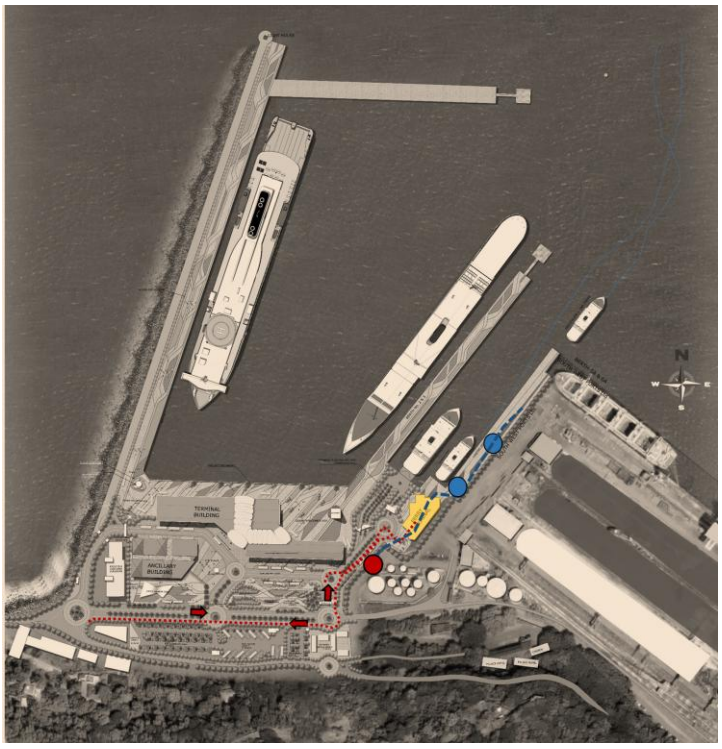
Passenger Ferry Point

Ferry Terminal

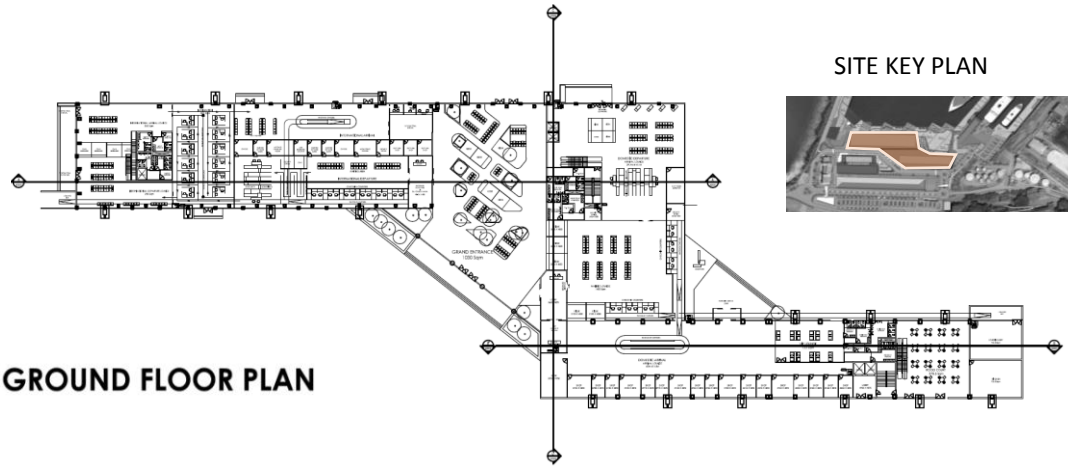
Car/Bus Traffic

Pedestrian Traffic

Bus Parking

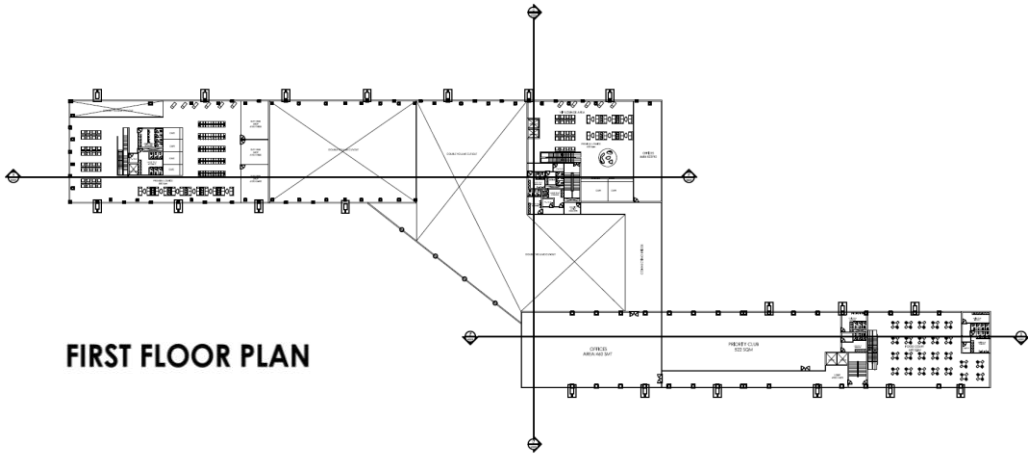


6.1. TERMINAL FLOOR PLANS

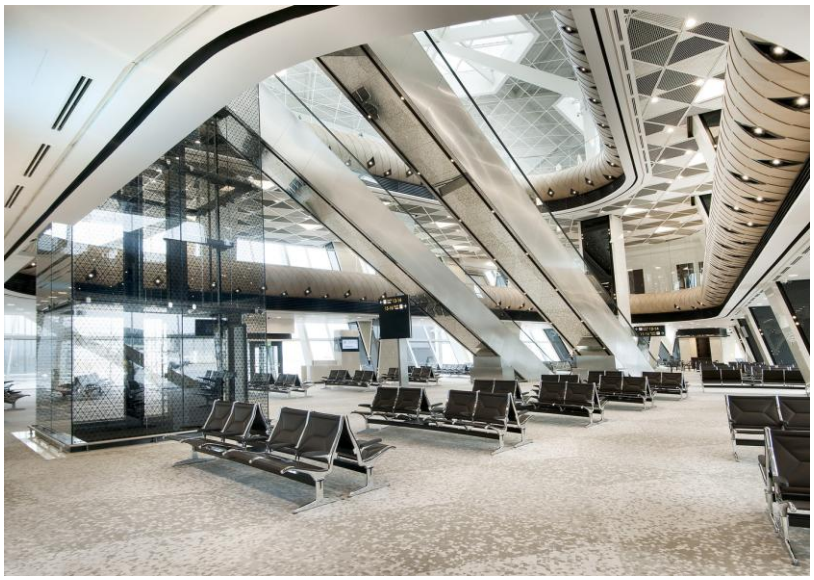


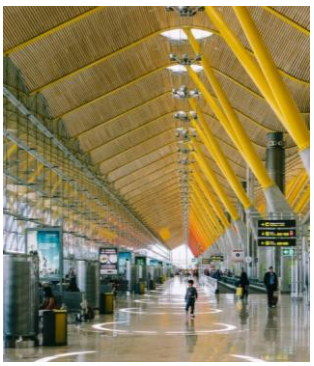
GROUND FLOOR PLAN

SITE KEY PLAN

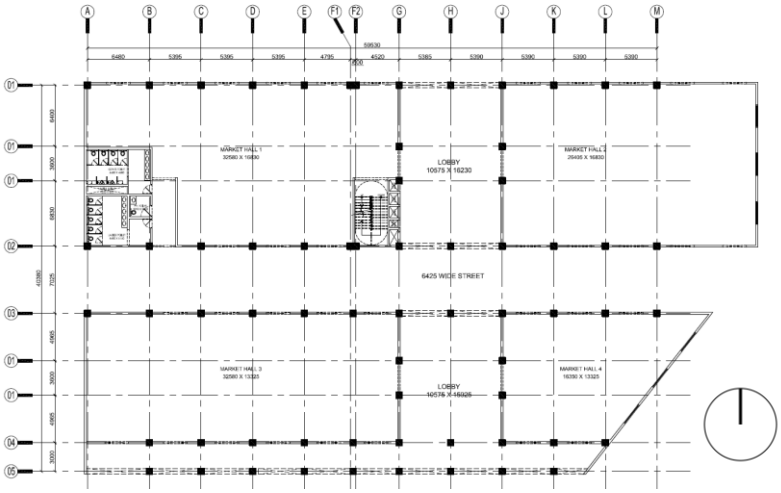


FIRST FLOOR PLAN





6.2. ANCILLARY FLOOR PLANS



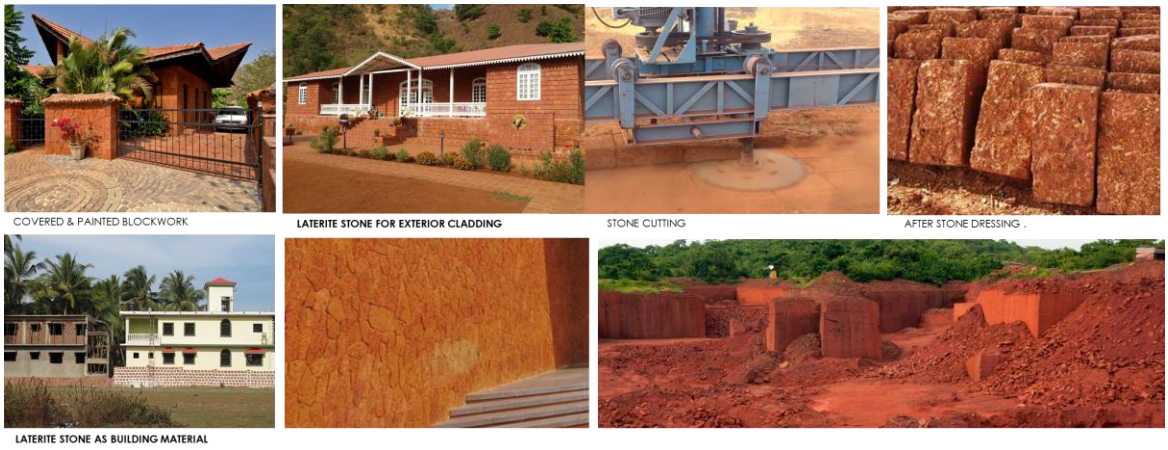
GROUND FLOOR PLAN

CRUISE LINE OFFICE

MARKET SPACES

7. ELEVATION

LATERITE STONE



Laterite is a residual ferruginous rock, commonly found in tropical regions and has close genetic association with bauxite.
What appear to be red bricks below are in fact quarried blocks of laterite, a porous red stone common in India.
In Goa the laterite blocks are usually grouted and then cemented or plastered over and painted

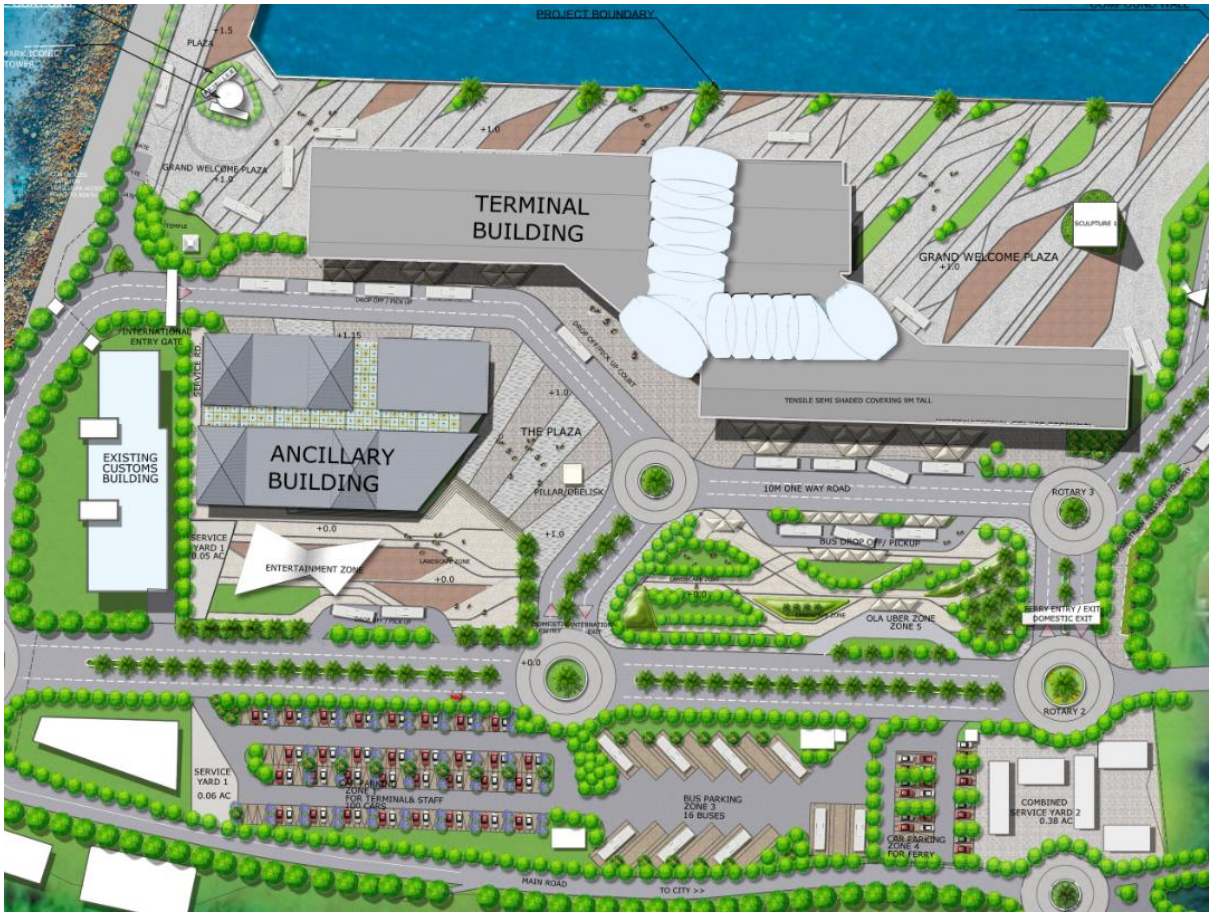
RECKLI EXTERIOR SURFACES

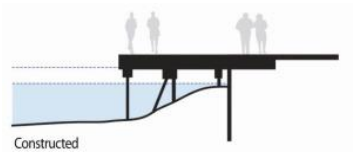
Natural stone patterns and textures can now easily and efficiently be replicated in Reckli pattern form liner.

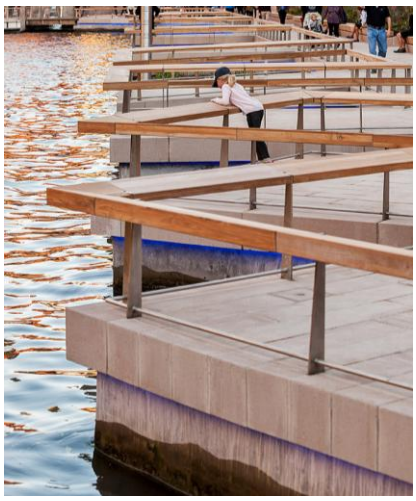
The combination of state-of-the-art mechanical technology and traditional craftsmanship allows for the implementation of customized patterns, images, photos and three-dimensional visualizations.

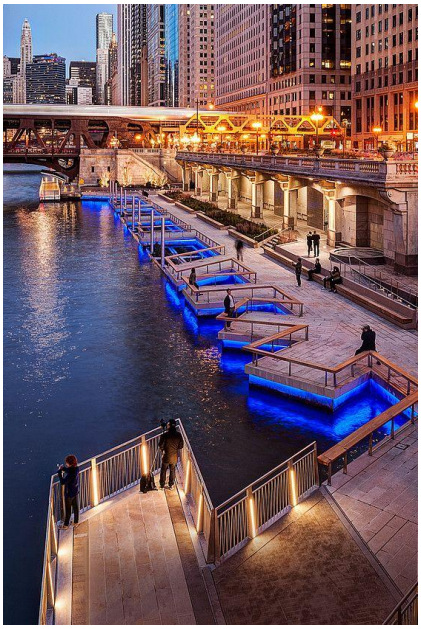
8. 3D VISUALISATION

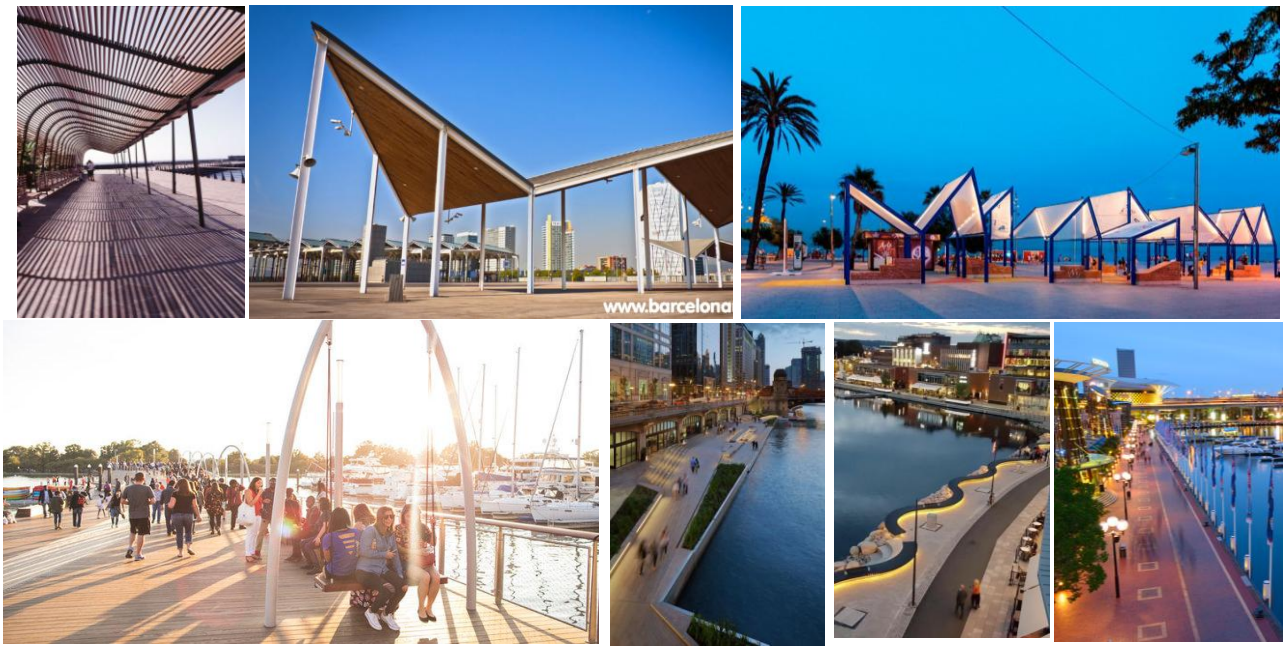
8.1. LANDSCAPE







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9. AREA STATEMENT

PROPOSED GOA CRUISE TERMINAL - AREA STATEMENT - BUILDING LEVEL						
TOTAL SITE AREA		54227 Sqm	583700 Sqft	64855 Syds.	13.40	Acre
TERMINAL BUILDING - SHED 01 & 02						
S.NO	FLOOR	DESCRIPTION	TOTAL AREA/FLOOR			
			SQ.M		SQ.FT	
GROUND FLOOR						
1	INTERNATIONAL ARRIVAL	LOUNGE	157		1685	
		IMMIGRATION	156		1678	
		BAGGAGE COROUSEL	272		2929	
		OFFICES	134		1440	
		RETAIL STORES	16		174	
		CAFÉ	23		244	
		TOILETS	38		404	
		TOTAL	**795**		**8554**	
2	INTERNATIONAL DEPARTURE	WAITING AREA	160		1722	
		CHECK IN COUNTERS	95		1018	
		BAGGAGE SCREENING AND HANDLING	62		665	
		SECURITY CHECK	185		1987	
		IMMIGRATION	153		1650	
		OFFICES	81		868	
		LOUNGE	195		2096	
		CAFÉ	22		231	
		TOILETS	50		540	
		TOTAL	**1001**		**10778**	
3	DOMESTIC ARRIVAL	LOUNGE	478		5145	
		BAGGAGE COROUSEL	65		699	
		TOILETS	103		1104	
		WAITING AREA	180		1938	
		SHOPS	493		5302	
		TOTAL	**1318**		**14188**	
4	DOMESTIC DEPARTURE	WAITING AREA	393		4231	
		CHECK IN COUNTERS	138		1488	
		SECURITY CHECK	211		2271	
		OFFICES	47		503	
		CAFÉ	58		629	
		TOILETS	48		515	
		LOBBY	62		671	
		LOUNGE	422		4538	
		TOTAL	**1379**		**14845**	
5	PUBLIC COMMON SPACE	Grand Lobby, Booking Counter, Café & Food Kiosks, Terminal Office Entry, Restaurants	1605		17273	
TOTAL GROUND FLOOR AREA			**6098**		**65638**	
FIRST FLOOR						
1	INTERNATIONAL DEPARTURE	Premium Lounge, Toilets, Duty Free Store	1032		11108	
2	DOMESTIC DEPARTURE	Premium Lounge, Toilets, Duty Free Store	542		5838	
3	PUBLIC COMMON SPACE	Priority Lounge, Toilets, Café, Food Court	1046		11259	
4	OFFICE	Office Space, Toilets	1154		12422	
TOTAL FIRST FLOOR AREA			**3774**		**40628**	
TOTAL			**9872**		**106265**	

1. Introduction

1.1Introduction To Landscape

Landscape design for the project is envisioned to be incorporated into a wide variety of elements. The design is thought out to help soften spaces between buildings, provide links between spaces, provide routes for people, assembly or recreation, can provide a space for gardening, can help improve environmental quality, and so on. A well-designed and maintained landscape can attract people to a site and can have a positive impact on property value and personal wellbeing.

1.2 Site And Its Surroundings

Design of Block 1, 2 & 3 Total Site Area	13.40 acres (54227.46 sq. ft.)
The Project Comprises	Terminal Building And Ancillary Building
Heights of the buildings (Terminal Building)	19m
Heights of the buildings (Ancillary Building)	13.3m
No. of Floors (Terminal Building)	G+1
No. of Floors (Ancillary)	G+1

Site is located at Mormugao, Goa with an site area of 13.40 acres about 600Km South of Mumbai at lattitude15"24.7' and longitude 73"47.2'. The port is linked to all major centres within the country by rail, road and Airport.

2. General

Landscape forms for an integral part of an public space. Landscape amenities must serve as a differentiator from other communal spaces. Landscape design should encourage people to use outdoor spaces while encouraging interactive behavior. These spaces should be of both formal and informal in nature. Delightful spaces in landscape must be provided to promote productivity and collaboration. Areas between buildings must be used to create interest and breathe life into spaces. Public realm spaces must be integrated in the landscape design.

3. Objectives

The landscape planning exercise would be driven by the following broad concerns:

1. To create a high quality and high-performance landscape. The design should intend to create world class built-space, which reflects to the building and the environment inside.
2. Create unique recreational spaces in the limited external space available for the users.
3. To create a separate identity to the whole environment by distinctive design.
4. Reduce heat island effect, increase shaded regions with in the available space.
5. Provide visual urban forest and shaded regions for pedestrian walkways.

4. Design Philosophy

Creation of an environment-friendly campus, which shall be responsive and responsible towards its resources and assets. Socially and ecologically sustainable development to be planned with emphasis on low-maintenance landscape.

"***Inspirit the heart, imbue the senses, and inspire the eye of the beholder"***

-Michelle Derviss

5. Landscape Design Strategy

Improve the cohesiveness of the design of buildings and landscapes, by defining building sitting and massing, simplifying and specifying architectural and landscape material palettes, and identifying standard campus furniture and lighting.
To uplift the building quality and stature, design a well bound spaces with landscape elements, it will increase the urban quality and better living and recreation spaces like providing social gathering/ interaction spaces, sit outs, pedestrian pathways etc.,
Showcase the expression of the cultures within buildings on the building exteriors.
Based on these design strategies, this section presents guidelines that are relevant across the building for landscape, views, universal accessibility and sustainability.

6. Sustainability Practices

The design should aim to incorporate and achieve highest standard practices for Sustainability. To sustain and enhance unique landscapes within the site, and to support and connect ecological landscape systems beyond the building , requires deep understanding.
The main strategies should include

6.1 Use of Local Trees in softscape strategy

The landscape proposal will of low maintenance plantations suitable for local climate in combination of hardscape. Appropriate eco-friendly initiatives are employed in the planning,

execution, and maintenance of the landscape scheme. I.e. rain water harvesting, recycling of wastewater for irrigation, etc.

Softscape schedule should consist of low maintenance planting, which includes lawn shrubs and creepers, ground covers in accordance with local climatic condition. Transplanted trees and large nursery grown trees shall form part of the softscape.

Few of the Plants taken into consideration are as follows

- Pongamia Glabra (Millettia pinnata)
- Thespesiapopulnea
- Ficus Religiosa (Bonsai)
- Azadirachta Indica (Neem)
- Caplophyllum Inophyllum (Alexandrian laurel)
- Syzygium Cumini (Java Plum)
- Madhuca Longifolia (mahuwa/ mahua/mahwa)
- Mimusops Elengi (Spanish Cherry)
- Ficus Retusa (Chinese Banyan).

6.2Reduce Heat Island Effect

Heat Island is generally the area with varying temperatures. For example, an urban area is significantly warmer than its surrounding rural areas, it is called as heat island. These heat islands are formed due to increased energy consumption, human activities, increased pollution, lack of vegetation, changes in thermal properties of surface materials, etc.

These heat islands or heat island can be reduced by the following measures:

Increasing the shade:

i. Planting trees and other vegetation prevents the surface and air temperatures by proving a shade and cooling through evapotranspiration.

Installing Green roofs:

i. Green roofs are vegetative layers grown on a rooftop. These green roofs absorb heat and act as insulators, reducing temperatures of the roof surface.

Installing reflective materials:

i. Using reflective materials like light coloured concrete, using white colour for roofs, pavements, etc, use of reflective materials like vinyl helps in maintaining the temperatures and emitting solar radiation.

7. Softscape Strategy

It is proposed to follow a softscape strategy consisting of Tropical Green Plants and trees, which are suitable to the local climate. The plantation strategy would be dense, multi-tiered mixed palette to give the required character.

Plants with lesser watering requirements, better climate adaptability and better resistance to pests and local diseases are preferred over exotic species.
Planned and properly landscaped for building will be different in appearance and beauty than unplanned one. Moreover a good garden in the building inculcated aesthetic sense
Following are the few tropical plants which is used for the building landscape.

Callistemon lanceolatus

Cassia fistula

Lagerstroemia

flos-reginae

8. Hardscape Strategy

The Landscape design envisions minimal hardscape areas as necessary for the building, keeping in line with the overall vision. The materials envisioned are paver blocks for driveways to increase permeability, and concreted walkways which are hardy and easy to maintain. This will ensure public spaces are imbued with a coherent sense of place. Durable, robust materials facing the public realm will ensure longevity and minimise maintenance required. Richness of visual interest will be drawn from these strategies, establishing and defining the use of space.
Grass pavers are imagined in parking areas to reduce paving density as well as increase permeability. Stone pavers and stone cobbles are envisioned for highlight and special areas.
The material details are:

Concrete pavers: It is a piece is which made with concrete, commonly used for the exterior flooring like paving's on public streets, Campuses etc.

Paver Thickness: 80mm
Colour: Grey,.
Application: for light medium and heavy traffic
Broom finish concrete: It is a rough texture concrete paver which is used as hardscape landscaping material on parks, public/ Institutional buildings.
Grey Granite: Granite which is a grand look material generally in outdoor spaces it is used in sit out spaces. This material is easy to clean.

Granite Cobble stone: This material is used for pathways and parking bays. In crossing zones or heavy pedestrian walkways this stones are used for better rigidity and slowdown for vehicular movement.

x 20,

Kuppam grey, Saddler grey, Black.

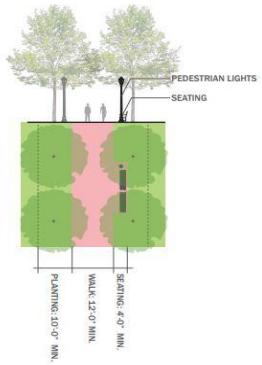
Crossing Zones: The changing of material will help in the crossing zones for slowdown vehicular movement and it will be guiding the physically abled people and also it will help for the percolation of water

9. Landscape Elements

9.1 Walkways & Pedestrian zones

Primary Walks support the highest volumes of cross-campus pedestrian traffic. All pedestrian walkways will be minimum 1.2m wide with recommended width of 1.5m. Pavements will be continuous and friends for physically challenged. All kerbs and walkways will not be more than +150mm from the road level. Slopes and Ramps have to be provided at all grade changes and junctions to aid cyclists as well as wheel chairs. Tactile tile border would be provided to aid visually challenged users.

ALL walkways are to be strictly shaded by trees or canopies as much as possible. Cyclists and Pedestrians will use shared pathways inside the campus.



9.2 Terminal Entry Points

A gate is the point of entry to the campus place which is enclosed by the walls and security. It controls the entry and exit of individuals or may be the merely decorative

Automatic security bollards

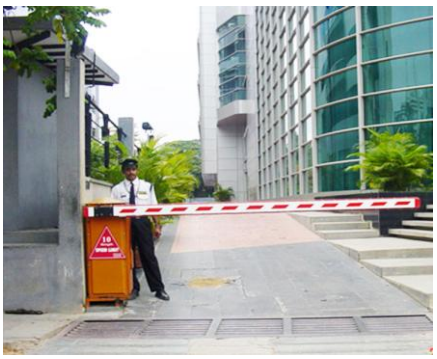
Generally automatic bollards are used in high traffic areas. To control the traffic it will raise above the ground level for 3 to 5 seconds

It can be use in the parking areas also. These automatic bollards will work with the sensors and touch pads

Boom barriers

Boom barriers is a bar or pole pivoted to allow the boom to block the vehicular access through a control access.

In generally these kind of systems used at gateways to control the vehicular access



9.2 Welcome Plazas

The plaza landscape design focuses on providing beautiful park with a landscape which draws its spirit from the regional gardens. The plaza uses pavement materials which will endure the long, challenging weather, while the patterning itself is designed based on the patterns of commercial landscapes. The plaza pattern stitches the areas of gathering and passage together while bringing a human scale to this large plaza space. The paved areas within the garden are carved out of the grove to allow for direct access to major entry points and public transportation.

9.3 Welcome Signage

Signage systems play a number of important roles: they provide information and directions for people to find their way around a site, help maintain the site's image and coherence, and encourage learning. Different materials can be used for signage: carved wooden signs are attractive in natural environments, but they are not resistant to theft and damage; metals can become bent and rusted; plastics can be broken or burned.

9.4 Surface Parking

Surface parking lots should utilize the most efficient layout and orientation. Each parking lot, access aisle and drive should be as small as practically possible. They should be constructed with durable materials and provide tree canopy for shade. Continuous planting islands should be provided to break down the large scale of surface parking lots. Storm water runoff should be captured and infiltrated on site where possible.

9.5 Pergolas And Canopies

Walkways are envisioned as shaded from sun and rain through a network of pergolas as well as canopies. These will be MS steel structures with Pergola Framework as well as covered with tensile/metal roofing covering the walkways.

9.6 Landscape Sculptures

Selected sculptures will be placed in focal areas and landscape highlight areas as per design. These sculptures will be exterior grade material, primarily stainless steel, copper, concrete

or stone as per design. Sizes would also be as per design. Concrete pedestal at location point along with provision for lighting will be provided.

9.7 Viewports Pockets

Terminal Deck is an observatory deck surrounded by the sea that offers a 270-degree panorama of ocean as well as breathtaking views of Island. It is one of the best venues to enjoy sunset and evening views, while being close to the terminal building.

9.8 Landscape Pavements Patterns

The widespread use and popularity of paving patterns dates back centuries. Starting with the Romans, who experimented with and pioneered various paving designs spanning thousands of mosaic and cobbled paths and roads.

Today, paving designs are modern, intricate and sophisticated, and the range of paving patterns and designs that modern builders can work with are vast because high quality modern pavers can be easily and meticulously cut and shaped.

LANDSCAPE LIGHTING

More adequate lighting is one of the most common design modification requests officials receive from patrons. Lighting can clarify the layout of outdoor spaces by emphasizing walkways, focal points, gathering places and building entrances. Ample lighting also boosts safety.

Here are three things to consider when planning exterior lighting design for parks and other **outdoor** recreation areas.

Street Lighting is the black standard acorn-type fixture on a non ornamental pole. The pole height varies depending on the street types, but generally between 6-10m. Single arm light on a pole of 27.1-34.8 Watt

Pedestrian Lighting Campus standard for pedestrian walk lighting is the black standard acorn-type fixture on a 3-6m tall fluted pole. Single light on a pole of 24-26 Watt

Open Space Lighting Campus standard for open spaces are bollards, Tree up-lighters and accent lights as shown in table. All of the equipments should be outdoor IP 65 rated and above

Make an eco-friendly choice

LED is the latest trend in pathway lighting. LED lights are an eco-friendly option in comparison to the fluorescent lights, which emit massive heat in the air. LED lights also deal with the problem of UV emission effectively. Moreover, LEDs have a longer shelf life in comparison to conventional bulbs and provide for energy savings.

Sl/no	Usage area	Company	Height in M	Applicable area	Light code
1	Periphery pole light	Philips	6-10	Access roads and Urban areas	BGP 381 BGS 451
2	Pathway lights	Philips	3-6	Urban pedestrian pathways	EPS 300 BDS 461 BDS 471 CDS 471 CDS 461
3	Bollards	Philips	1	Promenades, squares, Parks	HCP 170 HCP 171
4	Tree-up light	Philips	0.15-0.25	Tree Lighting	DVP 627
5	Wall washers	Panasonic	As per Design	Garden/Landscaping	AUD010043 AUD020063
6	LED strip light	Panasonic	NA	Hardscaping	ASL028302 ASL024602

ac e the landscape pathway lights strategy

LEDs work as recessed lights, lanterns, strip lights, bollard lights and more, to light up the park pathways. However, placing them at a safe distance is important. The placement of lights should be such that they do not obstruct the visitor's path.

- Spotlights and lanterns can be placed in a row on both sides of the pathway. Maintaining a distance of at least one foot on both sides to ensure the safety of the passerby is advisable.
- Strip lights can be placed a bit closer to the pathway to ensure an illuminated route throughout.
- For the raised pathways, the placement of upward lights should be at the lower edges on both the sides.
- The fixtures for downward lighting should be ideally placed at the height of around 14 inches to ensure uniform illumination in all directions.
- While illuminating the stairways, make sure that the landscape light sources guide people while climbing the steps. The lighting should not be too dim or too bright. If the light beams are too bright and intrusive, they may prove troublesome to a passerby.

STRUCTURAL INDEX

1.0 PROJECT BRIEF

The structure for proposed Terminals and Office Space facility is designed as per the above configuration.

Grade of concrete varies from M25 Grade to M60 for structural elements and for PCC works M15 Grade concrete and steel Fe500.

2.0 CODES, STANDARDS AND REGULATIONS

The design of the above structure is in accordance with the following latest design codes:

1 IS : 875 Part 1 -1987 – Unit weight of materials

2 IS : 875 Part 2 -1987 – Live loads

3 IS : 875 Part 3-2015 – Wind Loads

4 IS : 1893 Part 1- 2016 – Seismic loads

5 IS 13920: 2016 – Ductile detailing of RCC Structures Subjected to Seismic forces – Code of Practice.

6 IS: 456 – Code of practice for plain and reinforced concrete.

7 IS : 800 –Code of practice for Steel Design

8 IS : 1080 - Code of practice for Design and construction of shallow foundations

9 IS: 1904 - Code of practice for structural safety of building foundations.

10 SP: 16 - Design aid for reinforced concrete to IS 456.

11 SP :23 – Hand book on concrete mixes

12 IS : 226 – Structural steel (standard Quality)

13 IS : 2062 – Structural steel (fusion welding quality)

14 ISO 12944- International standard on corrosion protection of Steel structures by protective paint systems – Classification -C4

Corrosion classes

The corrosion classes below describe - with examples - under which conditions treatments for iron and metal are providing sufficient corrosion protection.

ISO 12944	Impact	Interior	Exterior
C1	Very low	Heated buildings with clean air, such as offices, shops, schools, hotels, etc.	None
C2	Low	Buildings not heated, where condensation may occur, such as warehouses and sports halls.	Atmosphere with low pollution. For example in the country.
C3	Middle	Buildings for production with high atmospheric humidity and some air pollution such as food manufacturers, breweries, dairies and laundries.	Urban and industrial areas, moderate sulphur dioxide pollution. Coastal areas with low salt content.
C4	High	Chemical manufacturers, swimming baths and ship- and boatyards by the sea.	Industrial areas and coastal areas with moderate salt impact.
C5-I	Very high - Industry	Buildings or areas with almost permanent condensation and with high pollution.	Industrial areas with high humidity and aggressive atmosphere.
C5-M	Very high	Buildings or areas with almost permanent condensation and with high pollution.	Coast and offshore areas with high salt content.

3.0 STRUCTURAL SYSTEM

The space has primarily Mezzanine floor, RCC wall & column system. The foundation system is as per the soil consultant's report & recommendations

Note: The above structural configuration gives overall view of the structural system for the building.
However, for detailed column sizes, slab thickness, and other structural details.
Please refer individual floors structural layouts.

4.0 LOADS

Following loads are considered while designing the structural elements apart from the dead loads as per codal norms.

Dead Loads

1	Floor finish (Typical)	:	100 mm thick in CC/ TILING.
2	Self-weight of RCC	:	25 kn/cum (As per IS: 875 part-1)
3	Self-weight of PCC	:	24 kn/cum (As per IS: 875 part-1)

4	Fly ash/ Laterite /Red Brick	:	19.2 - 21.0 KN/M3
5	Concrete Blocks	:	24.0 KN/M3
6	Partitions	:	1.0 KN/M3
7	External finishes	:	1.75 kn / Rmt
8	Soil - Dry	:	18 kn/Cum (As per IS: 875 part-1)
9	Soil - Moist	:	20 kn/Cum (As per IS: 875 part-1)
10	Toilets(Sunken) Filling load	:	3.0 kn/sqm (300mm sunk)
11	AHU/Electrical room	:	7.5 kn/sqm
12	Escalator	:	82KN on each node

Live loads:

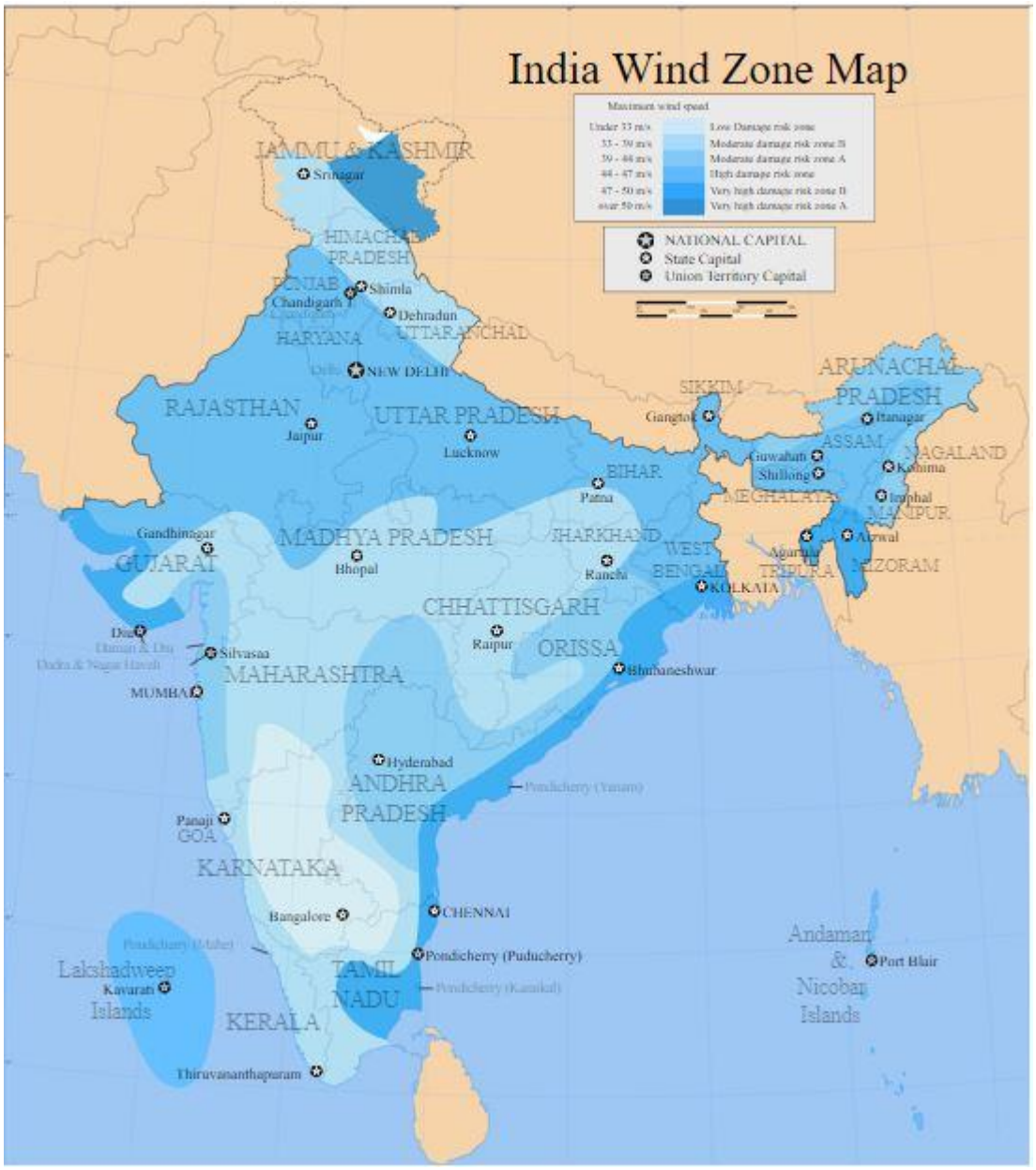
	Floor loading as per NBC	Live Load in KN/sqm.
A	Office Space , Retail Shops, Lounges, Food courts	5
B	Staircase , Corridor , utilities ,Balconies	5
C	Cafeterias, Kitchen	3
D	Toilets	2
E	Terrace (Accessible)	1.5
H	AHU, Electrical Room	3
I	Lift Machine Room	15

Wind load:

Basic wind speed: 39 MPS as per the last cyclone data.
K1 – as per IS: 875, 2015, Part 3.
K2 – as per IS: 875, 2015, Part 3.
K3 – as per IS: 875, 2015, Part 3.
K4 – as per IS: 875, 2015, Part 3.

Maximum wind speed

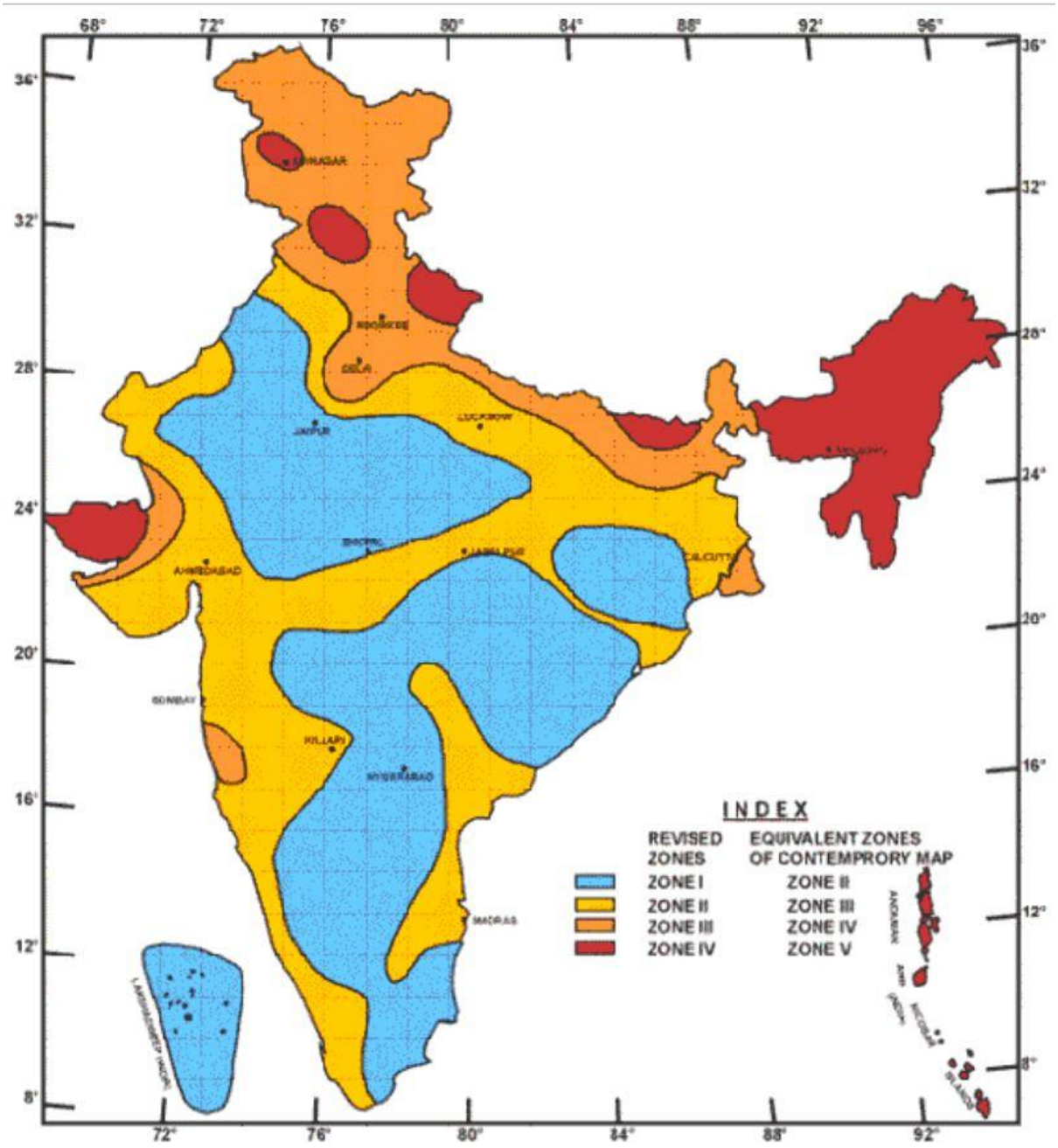
Under 33 m/s	Low Damage risk zone
33 - 39 m/s	Moderate damage risk zone B
39 - 44 m/s	Moderate damage risk zone A
44 - 47 m/s	High damage risk zone
47 - 50 m/s	Very high damage risk zone B
over 50 m/s	Very high damage risk zone A



Seismic Load:

Considered As per Code

Zone	:	III
Zone factor	:	0.16
Importance factor	:	1.5
Response reduction Factor	:	5.0



INDIA SEISMIC MAP

Footings:

Strip Footings are designed as per Soil Consultants report.

We are placing the footings above the existing foundation system considering SBC 30T/Sq m

Roofing:

Steel Structure (PEB/Conventional) supported on RCC columns.

Landscape Loads if any

Landscape load is considered actual as per the final pre-defined architectural locations.

5.0 STRUCTURAL MATERIAL

Concrete

All structural concrete shall have cube crushing strength varying from M25 to M50 N/sq.mm.

At 28 days as detailed below considering standard deviation.

25 + 4 = 29 N/mm^2 for M25 grade concrete

30 + 5 = 35 N/mm^2 for M30 grade concrete

35 + 5 = 40 N/mm^2 for M35 grade concrete

40 + 5 = 45 N/mm^2 for M40 grade concrete

45 + 5 = 50 N/mm^2 for M45 grade concrete

50 + 5 = 55 N/mm^2 for M50 grade concrete

60 + 5 = 65 N/mm^2 for M60 grade concrete

Plain cement concrete shall have cube crushing strength of 10N.sq.mm. (M10) at 28 days.

Fly ash blended cement is used in view of green building concept.

Micro concreting (adding micro silica) of similar grade for retrofitting works.

Reinforcement steel

All reinforcement shall confirm to IS 1786 – 1985 having minimum yield strength of 500 Grade.

Structural steel

All structural steel shall confirm to IS: 226-1975 with minimum yield strength requirements of 250/315 Mpa

6.0 ANALYSIS

The structural analysis will be carried out by finite element method using the commercially available software STADD/ETABS for the load combinations as per standards. The designs of the RCC elements are made using the limit state method with appropriate load factors as per IS: 456-2002.

7.0 LOAD COMBINATIONS For RCC Structures (Major)

Combinations:

7.1 Tower analysis

S.L.No	Load Combination Name	Detail
1	DCon 1	1.5(DL+SDL)
2	DCon 2	1.5(DL+SDL+LL+NLL)
3	DCon 3	1.2(DL+SDL+LL+NLL+WX)
4	DCon 4	1.2(DL+SDL+LL+NLL-WX)
5	DCon 5	1.2(DL+SDL+LL+NLL+WY)
6	DCon 6	1.2(DL+SDL+LL+NLL-WY)
7	DCon 7	1.5(DL+SDL+WX)
8	DCon 8	1.5(DL+SDL-WX)
9	DCon 9	1.5(DL+SDL+WY)
10	DCon 10	1.5(DL+SDL-WY)
11	DCon 11	0.9(DL+SDL)+1.5(WX)
12	DCon 12	0.9(DL+SDL)-1.5(WX)
13	DCon 13	0.9(DL+SDL)+1.5(WY)
14	DCon 14	0.9(DL+SDL)-1.5(WY)
15	DCon 15	1.2(DL+SDL+LL+NLL+EQX)
16	DCon 16	1.2(DL+SDL+LL+NLL-EQX)
17	DCon 17	1.2(DL+SDL+LL+NLL+EQY)

18	DCon 18	1.2(DL+SDL+LL+NLL-EQY)
19	DCon 19	1.5(DL+SDL+EQX)
20	DCon 20	1.5(DL+SDL-EQX)
21	DCon 21	1.5(DL+SDL+EQY)
22	DCon 22	1.5(DL+SDL-EQY)
23	DCon 23	0.9(DL+SDL)+1.5(EQX)
24	DCon 24	0.9(DL+SDL)-1.5(EQX)
25	DCon 25	0.9(DL+SDL)+1.5(EQY)
26	DCon 26	0.9(DL+SDL)-1.5(EQY)
27	DCon 27	1.2(DL+SDL+LL+NLL+SPECX)
28	DCon 28	1.2(DL+SDL+LL+NLL+SPECY)
29	DCon 29	1.5(DL+SDL+SPECX)
30	DCon 30	1.5(DL+SDL+SPECY)
31	DCon 31	0.9(DL+SDL)+1.5(SPECX)
32	DCon 32	0.9(DL+SDL)+1.5(SPECY)
33	DWall 1	1.5(DL+SDL)
34	DWall 2	1.5(DL+SDL+LL+NLL)
35	DWall 3	1.2(DL+SDL+LL+NLL+WX)
36	DWall 4	1.2(DL+SDL+LL+NLL-WX)
37	DWall 5	1.2(DL+SDL+LL+NLL+WY)
38	DWall 6	1.2(DL+SDL+LL+NLL-WY)
39	DWall 7	1.5(DL+SDL+WX)
40	DWall 8	1.5(DL+SDL-WX)
41	DWall 9	1.5(DL+SDL+WY)
42	DWall 10	1.5(DL+SDL-WY)
43	DWall 11	0.9(DL+SDL)+1.5(WX)
44	DWall 12	0.9(DL+SDL)-1.5(WX)
45	DWall 13	0.9(DL+SDL)+1.5(WY)
46	DWall 14	0.9(DL+SDL)-1.5(WY)
47	DWall 15	1.2(DL+SDL+LL+NLL+EQX)
48	DWall 16	1.2(DL+SDL+LL+NLL-EQX)

49	DWall 17	1.2(DL+SDL+LL+NLL+EQY)
50	DWall 18	1.2(DL+SDL+LL+NLL-EQY)
51	DWall 19	1.5(DL+SDL+EQX)
52	DWall 20	1.5(DL+SDL-EQX)
53	DWall 21	1.5(DL+SDL+EQY)
54	DWall 22	1.5(DL+SDL-EQY)
55	DWall 23	0.9(DL+SDL)+1.5(EQX)
56	DWall 24	0.9(DL+SDL)-1.5(EQX)
57	DWall 25	0.9(DL+SDL)+1.5(EQY)
58	DWall 26	0.9(DL+SDL)-1.5(EQY)
59	DWall 27	1.2(DL+SDL+LL+NLL+SPECX)
60	DWall 28	1.2(DL+SDL+LL+NLL+SPECY)
61	DWall 29	1.5(DL+SDL+SPECX)
62	DWall 30	1.5(DL+SDL+SPECY)
63	DWall 31	0.9(DL+SDL)+1.5(SPECX)
64	DWall 32	0.9(DL+SDL)+1.5(SPECY)

Sx – Response Spectrum / Time history function in X direction
Sy – Response Spectrum / Time history function in Y direction

7.2 Foundation analysis

Sl. No.	Load Combination Name	Detail
1	1.0 (DL+LL)	DL+SDL+LL
2	1.0 (DL+WLX)	DL+SDL+WX
3	1.0 (DL-WLX)	DL+SDL-WX
4	1.0 (DL+WLY)	DL+SDL+WY
5	1.0 (DL-WLY)	DL+SDL-WY
6	1.0(DL)+0.8(LL+WLX)	DL+SDL+0.8(LL+NLL+WLX)
7	1.0(DL)+0.8(LL-WLX)	DL+SDL+0.8(LL+NLL-WLX)
8	1.0(DL)+0.8(LL+WLY)	DL+SDL+0.8(LL+NLL+WLY)
9	1.0(DL)+0.8(LL-WLY)	DL+SDL+0.8(LL+NLL-WLY)
10	1.0(DL+SPECX)	DL+SDL+SPECX

11	1.0(DL-SPECX)	DL+SDL-SPECX
12	1.0(DL+SPECY)	DL+SDL+SPECY
13	1.0(DL-SPECY)	DL+SDL-SPECY
14	1.0(DL)+0.8(LL+SPECX)	DL+SDL+0.8(LL+NLL+SPECX)
15	1.0(DL)+0.8(LL-SPECX)	DL+SDL+0.8(LL+NLL-SPECX)
16	1.0(DL)+0.8(LL+SPECY)	DL+SDL+0.8(LL+NLL+SPECY)
17	1.0(DL)+0.8(LL-SPECY)	DL+SDL+0.8(LL+NLL-SPECY)

8.0 DESIGN OF ELEMENTS

Designs of RCC Elements are as per IS 456: 2000 and structural steel members are made using elastic method as per IS: 800 with relevant allowable stresses.

9.0 WATER PROOFING

Water proofing wherever required adopt membrane type 2mm thick

PHE INDEX

1. SCOPE

The scope of Public Health Engineering Services though not limited can be classified as follows: -

- Domestic & Flushing water supply system.
- Soil & Waste water drainage system.
- R O Plant.
- Sewage Treatment Plant.
- Rain/storm water management system
- Solid waste management.

2. CODES & STANDARDS

1. APPLICABLE CODES AND STANDARDS

The installation shall conform in all respects to the following standards in general:

IS 778	:	Specification for gunmetal gate, globe and check valves for water.
IS5329 – 1983	:	Code of practice for sanitary pipe work above ground for buildings
IS 12251 – 1987	:	Code of practice for drainage of building basements
IS 800	:	Structural Steel Works
IS 2064 – 1973	:	Code of practice for selection, installation and maintenance of sanitary appliances
IS 13592 – 1992	:	Specification for unplasticized PVC pipes for soil and waste discharge system inside building including ventilation and rainwater.
IS 2527 – 1984	:	Code of practice for fixing rainwater gutters and down pipes for roof drainage.

IS 12235 (Parts 1 to 11)	:	Methods of test for unplasticized PVC pipes for portable water Supplies
IS 1703 – 1977	:	Specification for ball valves (Horizontal plunger type)including floats for water supply purposes
IS 1172 - 1983	:	Code of basic requirements for water supply, drainage & sanitation (revised).
IS 2064 – 1973	:	Code of practice for selection, installation and maintenance of sanitary appliances
IS 2065 - 1983	:	Code of practice for water supply to buildings
IS 4515	:	Specification for unplasticized PVC pipe fittings
IS 4985 - 1988	:	Specification for unplasticized PVC pipes for potable water supplies (second revision)

Note:

1. All IS Codes Latest year of Publication/ Revision to be considered.
2. National building Code for Water Supply, drainage and Sanitation - Part IX Plumbing services - Section 1 and Section 2 & Special Publication-35.
3. UPCI Code also can be considered for the system implementation. The installation shall also be in conformity with the bylaws and requirements of the local authority so far as these become applicable to the installation. Wherever this specification calls for, a higher standard of materials and/or workmanship than those required by any of the above regulations and standards, then this specification shall take precedence over the said regulations and standards.

   Wherever the specifications and drawings require something that may conflict with the regulations, the regulations shall govern. This shall be confirmed from Client/PMC/Consultants before execution.

3. DOMESTIC & FLUSHING WATER SUPPLY SYSTEM

3.1 SOURCE AND WATER REQUIREMENT

In assessing the water requirements, due consideration shall be given to the local needs of people, habits and climatic conditions. Plumbing fixtures, devices and appurtenances shall be supplied with water in sufficient volume and at adequate pressures.

Since the project is being planned for mixed occupancy, population requirement and water consumption as per NBC 2016 as follows:

Sl. No.	Type of Building	Population Requirement	Water Consumption as per NBC 2016	
			Domestic per day (Liters per head)	Flushing per day (Liters per head)
1	Terminal	0.65 Sqm/Person	40	30
2	Retail	6 (Sqm/Person)		
(a)	Staff	10% Fixed	25	20
(b)	Visitors	90% Floating / Vistiors	5	10
3	Food court	1.8 Sqm/Person	25	10
4	Office	10 Sqm/Person	25	20

Offices shall be provided with potable water in the amounts and at pressure specified as per IS / National Building. The main source of water is municipal/tanker/bore well. The water collected from sources shall be stored in a centralized UG sump.

ANNEXURE 1:

Water Demand Calculation for Terminal Building:

DESCRIPTION	AREA IN SFT	AREA IN SQM	No of People	Domestic Water Req @	Flushing Water Req @	Total
Terminal Building International						
GROUND FLOOR	65639	6098				
Terminal Building International Arravial	8557	795				
Staff (10% on Total Population)			52	2067	1550	3617
Visitors (90% on Total Population)			465	2325	4651	6976
Terminal Building International Departure	10775	1001				
Staff (10% on Total Population)			65	2603	1952	4555
Visitors (90% on Total Population)			586	2928	5856	8784
	Terminal Building Domestic					
Terminal Building Domestic Arravial						
Staff (10% on Total Population)			86	3427	2570	5997
Visitors (90% on Total Population)			771	3855	7710	11565
Terminal Building Domestic Departure						
Staff (10% on Total Population)			90	3585	2689	6274
Visitors (90% on Total Population)			807	4034	8067	12101
	Public Common Space					
Grand Lobby, Booking Counter, Café & Food Kiosks, Terminal Office Entry, Restaurants	17276	1605	200	8000	6000	14000

FIRST FLOOR						
Terminal Building International Departure	11108	1032				
Staff (10% on Total Population)			67	2683	2012	4696
Visitors (90% on Total Population)			604	3019	6037	9056
Terminal Building Domestic Departure	5834	542				
Staff (10% on Total Population)			35	1409	1057	2466
Visitors (90% on Total Population)			317	1585	3171	4756
	Public Common Space					
Grand Lobby, Booking Counter, Café & Food Kiosks, Terminal Office Entry, Restaurants	11259	1046	200	8000	6000	14000
Office (10 m2/person as per NBC 2016)	12422	1154	116	2900	2320	5220
TOTAL			**4460**	**52420**	**61643**	**114063**

Total per day Water Requirement in liters. (Domestic+Flushing)	**114063**	Liters
Total per day Water Requirement in Cum. (Domestic+Flushing)	**114**	Cum
Raw water Sump capacity (1 day storage) in Cum	**52**	Cum
Treated water Sump capacity (1 day storage) in Cum	**52**	Cum
Fire water Sump capacity in Cum	**200**	Cum
Rain water Sump capacity in Cum	**149**	Cum
Water Curtain Sump capacity in Cum	**17**	Cum
STP Capacity @ 90% Diversity Factor Cum	**103**	Cum

NOTES:

1. We arrived number of persons as per NBC 2016 part 9.
2. Water Requirements for mixed occupancy are considered as per NBC part 9
3. UG Sump & OHT capacities are arrived based on NBC norms.
4. STP capacity arrived based on CHPEEO Norms.

Water Demand Calculation for Ancillary Building:

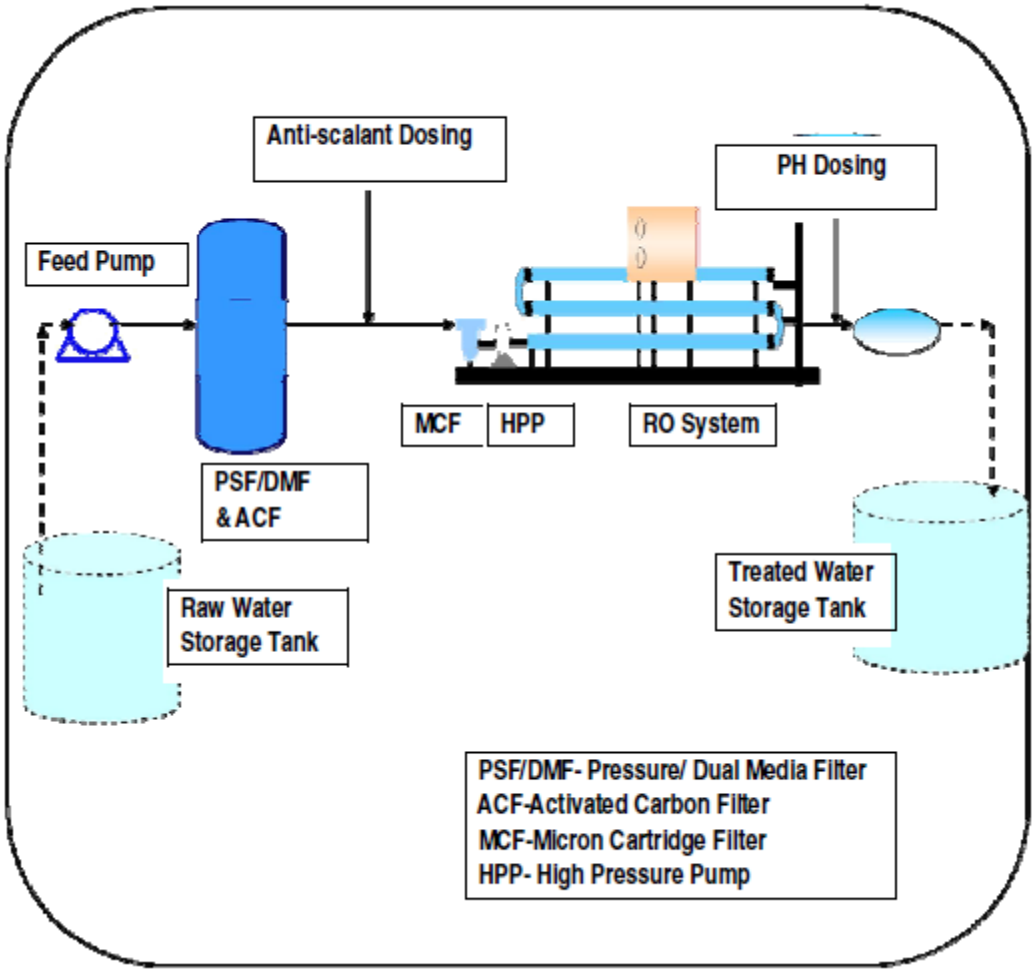
TITLE:	WATER DEMAND CLACULATION				Date	16.08.2019
DESCRIPTION	**AREA IN SFT**	**AREA IN SQM**	**No of People @ Mixed Occupancy**	**Domestic Water Req @**	**Flushing Water Req @**	**Total**
Ancillary Building						
GROUND FLOOR	28621	2659				
Retail (6 m2/person as per NBC 2016)						
Staff (10% on Total Population)	2862	266	45	1125	900	2025
Visitors (90% on Total Population)	25759	2393	399	1995	3990	5985
FIRST FLOOR	11691	1086				
Office (10 m2/person as per NBC 2016)			109	2725	2180	4905
TOTAL			**553**	**5845**	**7070**	**12915**
Total per day Water Requirement in liters. (Domestic+Flushing)					**12915**	Liters
Total per day Water Requirement in Cum. (Domestic+Flushing)					**13**	Cum
Raw water Sump capacity (1 day storage) in Cum					**6**	Cum
Treated water Sump capacity (1 day storage) in Cum					**6**	Cum
Fire water Sump capacity in Cum					**50**	Cum
Rain water Sump capacity in Cum					**60**	Cum
Water Curtain Sump capacity in Cum					**9**	Cum
STP Capacity @ 90% Diversity Factor Cum					**12**	Cum

NOTES:
1. We arrived number of persons as per NBC 2016 part 9.
2. Water Requirements for mixed occupancy are considered as per NBC part 9
3. UG Sump & OHT capacities are arrived based on NBC norms.
4. STP capacity arrived based on CHPEEO Norms.

STP CAPACITY TOTAL : 115 KLD

WATER TREATMENT SYSTEM

The quality of water supplied shall be in accordance with the requirements specified in IS: 10500-2012- Drinking Water Specifications. As per the results found in water test report **RO (Reverse Osmosis)** system is proposed for the treatment of water.



3.2 STORAGE

The Building shall have **UG Sump** for **Terminal and Ancillary Building** to 1.0 day domestic water requirement. This storage is further divided in two compartments of raw water for 1 day & treated water for 1 day storage. Water from fire static water sump shall overflow into raw water sump & treated through a sequence of operations in the RO plant and after treatment the water will be stored in the filter water sump. The water from filter water sump is supplied to the building by Hydro Pneumatic System. The treated water from Sewerage Treatment Plant is supplied to the building by Hydro Pneumatic System.

The storage details for Terminal and Ancillary Buildings are as follows:-

UG Sump details:

Sl. No	Description	Sump Capacity in Liters	Sump Capacity in Liters Cum/day
1	Fire Water	250000	250
2	Raw Water	126978	127
3	Filter Water	126978	127
4	Rain Water Sump	208733	209
5	Water Curtain Sump	25830	26

Over Head Tank details:

Sl. No	Description	OHT Capacity in Cum/day
1	Fire water OHT – Terminal Building	20
2	Fire water OHT – Ancillary Building	5

3.3 DISTRIBUTION SYSTEM

A. Domestic Water Distribution:

The distribution of water supply to the building is worked out in the following sequence.

- As discussed above building shall have UG sumps to meet Domestic requirement as well as Fire static storage.
- Depending on the water analysis report, water shall be treated to required standards & collected in treated water sump.
- From treated water sump, water will be pumped to the buildings through Hydro pneumatic system.
- Pressure reducing valves shall be introduced based on the height and distance of the buildings from storage tank to reach required pressure.

B. **Flushing Water Distribution:**

The distribution of flushing water supply to the building is worked out in the following sequence.

- From STP treated water sump, water will be pumped to the buildings through Hydro pneumatic system.
- Pressure reducing valves shall be introduced based on the height and distance of the buildings from storage tank to reach required pressure.

3.4 MATERIAL SPECIFICATION

Domestic water distribution pipes and fittings are CPVC as per IS:15778.CPVC pipes and fittings shall be SDR 11 for diameter less than 50mm and schedule 40/80 for 65mm and above diameters. Flushing water distribution pipes and fittings are CPVC schedule 40 confirming to ASTM D 1785 for pipes and fittings confirming to ASTM D 2466. Valves 50mm diameter and below shall be brass type ball valve and valves 65mm diameter and above shall be double flanged type cast iron butterfly valves.

Sl. No	Description	Material Considered
1	External Works Water Supply Line- Tapping from Municipal Line to UG Sumps	UPVC as per IS:15778
2	Internal DWS Works – Inside Toilet, Shafts, PRM, Basement Ceiling & Terrace	CPVC as per IS:15778
3	Internal FWS Works – Inside Toilet, Shafts, PRM, Basement Ceiling & Terrace	CPVC

4. SOIL & WASTE WATER DRAINAGE SYSTEM

4.1 INTRODUCTION

Domestic drainage has been designed as two pipe system as per IS codes and standards. Vertical stacks from toilets, pantry/kitchen etc., has been taken separately .Vent pipe is provided for soil stack (soil venting) as well as waste pipes, which is extended above terrace level. The minimum diameter of the vertical soil stack is 110mm. All fixtures and appliances are fully trapped to prevent back flow of foul gases and odour into the toilets. The soil and waste stack are connected to the main header which is running below the basement ceiling with adequate slope to achieve the smooth flow (self cleaning velocity) in the system and finally connected to the centralized sewage treatment plant.

4.2 BASIS OF DESIGN

The system of sizing pipes is based on fixture units as follows:

Water Closet (tank)	:	2 Units
Kitchen Sink	:	2 Units
Wash Basin	:	1.5 Units
Urinal	:	3 Units

4.3 MATERIAL SPECIFICATION

Best quality sanitary fixtures and chromium plated fitting shall be used. The Client/Architect shall select the model numbers. Each toilet shall be provided with European water closets with health faucets/ablution tap, washbasins with pillar cock, urinals with sensor operated flushing system. Standard accessories like toilet paper holders, towel rings, liquid soap dispenser and mirror shall be provided.

Drainage pipes shall be PVC for soil and waste water drainage application.

5. SEWAGE TREATMENT PLANT (STP)

SBR (Sequential Batch Reactor) technology

SBR technology treats sewage in batches. The aeration and clarification takes place in a single reactor, hence space required for the plant is lesser.

Source : **Domestic.**

Inlet raw water parameters : BOD_5 – 300 – 350 mg/ltr.
COD – 500 - 600 mg/ltr.
TSS – 100-150 mg/ltr.
pH – 6.5 – 8.0

Outlet Treated water parameters : BOD_5 < 10 mg/ltr.
COD < 60 mg/ltr.
TSS < 10 mg/ltr.
pH – 6.5 – 8.0
E-coli – NIL
TURBIDITY < 2NTU
RES-CHLORINE>1MG/L

The treated water from STP, should meet state pollution control board norms, which will be fit for re-use for gardening and flushing purposes.

DESIGN BASIS

a) The treated water should be fit for re-use for gardening / flushing water requirement.
b) The treated water should fit not only from the view point of re-use for the purposes mentioned above, but also should be hygienically safe, so that people's health is least affected due to contact with treated water or by its spray and consequent biological aerosol.

c) The treated water should be such that its continuous use even for very long periods does not make the soil "SEWAGE SICK", nor will it affect the other processes.

d) The treated garden water, with a BOD_5 of less than 10 mg/ltr, and TSS of less than 10 mg/ltr. Should be clear, free from any odour and its re-use should not create fly nuisance.

e) The proposed STP should be economical in terms of initial capital cost and operating cost and at the same time versatile enough to deliver the desired output in terms of quality parameters on continuous basis. Further the plant should be easily operatable by semi-skilled personnel.

f) Replacements, if any, at a later date, should be easily available locally and at short notice period.

g) The technology proposed should be time tested and must be under use already elsewhere for similar applications, particularly in tropical environments.

h) The structures for STP should be compact in size / layout and be impervious and water tight to avoid drifting of odour and ground water pollution.

i) The Plant should meet state pollution control board norms in all respects for urban re-use.

j) The plant should be expandable in modular form.

k) The STP should have built-in flexibility to handle variations in flows / characteristics, with or without simple modifications in process and without incurring major additional expenses.

TREATMENT SCHEME

Primary Treatment:

The raw sewage will be received at the inlet of the bar screen to trap any floating particles and debris. The effluent overflows to the collection cum equalization tank. Equalization tank will be fitted with coarse bubble aeration system for homogenizing

the sewage and also to keep it fresh during storage. This Sewage is then transferred to a downstream Sequencing batch reactor by sewage transfer pump.

Secondary Treatment:

Like other biological effluent treatment processes the Sequencing Batch Reactor, works by developing mixed culture of bacteria (biomass) which is effective for removal of BOD, COD and nutrients commonly found in sewage. The SBR is a fill and draw, non steady state of activated sludge process in which one or more reactor basins are filled with waste water during a discrete time period and then operated on batch mode. In a single reactor basin the SBR accomplishes anoxic mixing, aeration and settling in a timed sequence.

A single cycle for each reactor consists of five discrete period of FILL, REACT, SETTLE, DECANT and IDLE. The nitrification and denitrification is easily achieved.

Tertiary Treatment:

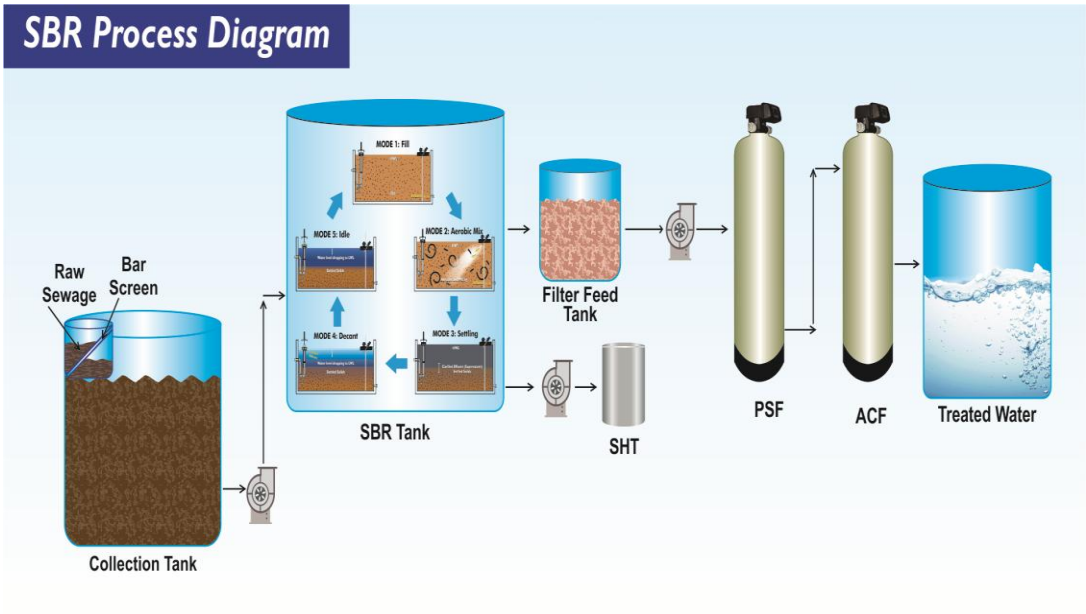
The treated water from the SBR is overflowed into a the Prefiltration tank /Decant Tank, from where it is fed for tertiary treatment using a Pressure Sand Filter – for removal of suspended solids, and Activated Carbon Filter – for removal of residual color and odour.

Finally the treated water is disinfected using hypo chloride solution (Chlorine) using a metering pump to regulate the dosage of chlorine. **(Vendor has to suggest and design suitable treatment units based on the treated water quality.)**

The treated water is then fit for use in Gardening, Feeding HVAC as well toilet flush.

Sludge Handling:

The excess Sludge from the aeration tank will be taken out at regular intervals either to a sludge holding tank and dewatered through filter press, or the sludge is pumped to sludge drying beds for dewatering.



END USE

The end product, which is the treated effluent water, will be used for flushing (EWC & UR), landscaping.

PROPOSED GOA CRUISE TERMINAL (Terminal Building)			
S.NO	**Description**	**Capacity**	**Units**
1	STP Capacity	115	Cum
2	STP Treated Water Sump Capacity	105	Cum
3	STP Treated Water Used for Flushing	69	Cum
4	STP Treated Water Used for Gardening (Area is 41059.46 Sqm. Per sqm 6 lts used)	246	Cum
5	STP excess water	0	Cum

6. RAIN /STORM WATER MANAGEMENT

6.1 CONCEPT

All vertical down takes are designed for an intensity of 100mm/hr. (For 15min. Storm). Minimum dia of vertical down take shall be 160/200mm. However rain water pipe of suitable diameter has been proposed. These vertical rain water pipes from terrace floor will discharge the rainwater to header pipe running along ground surface & finally connected to the rain water sump with 15min capacity which is located at the basement and excess water shall pump to the external networks which are leading to the municipal network.

The site run - off shall be routed through the network of external storm water drain with recharge pits. And excess water will be diverted to external storm drain either by gravity or pumping.

Terrace rain water is collected in rain water sump of capacity 209 cum for terminal and ancillary buildings which is to be reused for domestic purpose.

7. SOLID WASTE MANAGEMENT

Quantity of solid waste generation is estimated as tabulated below. The waste suitable for recycling shall be handed over to the recyclers and rest of the waste shall be handed over to the municipal waste collection vehicles. In house treatment of organic waste is recommended considering that the output (manure) can be utilized within the project due to availability of landscape area or can be sold to third parties.

For Terminal and Office Buildings:

PROJECT:	PROPOSED GOA CRUISE TERMINAL		
TITLE:	SOLID WASTE CALCULATION @ Mixed Occupancy		
1	Total No. of Persons	5013	Nos
2	Solid Waste Generation per person per day in kg/day	0.20	Kg/Day
3	Total Solid Waste Generation in kg/day	1003	Kg/Day
	Organic Waste		
4	Assume 40% of waste would be Organic therefore Organic waste in Kg/day (Modular Package unit)	401	Kg/Day
	Inorganic Waste		
5	Assume 60% of waste would be Inorganic therefore Inorganic waste in Kg/day	602	Kg/Day

Notes:

1. Arrived number of persons as NBC 2016.
2. Solid waste capacity arrived based on CPHEEO Norms
3. Solid Waste Generation per person per day is 0.20 kg/day
4. As per CPHEEO on Solid Waste Pg. no 49 assumed 40% of the Waste would be organic therefore Organic waste in Kg/Day
5. Organic waste will be treated in OWC.
6. In-organic waste will be handled over to re-cyclers.

ELECTRICAL INDEX

1. SCOPE

- Scope is only to design warm shell facility, same has been considered. The following information outlines the salient features of the electrical works. As per the Goa electricity department tariff regulations states that for load above 1000KVA the source supply should be 33KV, proposing 33kV System.
- Main Grid Power Supply is envisaged at 33 kV.
- 33kV HT Power Distribution by Ring main loops.
- Consider all HT Panels as SF6 insulated compact VCB
- The transformer and DG sizing is made considering all commercial, retail and utility loads.
- 33kV/11KV Power Transformer provided as per GED(Goa Electricity department norms) at outdoor and 11kv/433 Volts Transformers at Utility block shall be considered with oil type, with ON-Load Tap Changer (OLTC) to correct +/- 10% voltage variations through 17 steps @1.25%of HT supply of 33 KV& RTCC Panel.
- Stand-by DG Sets are provided with Room acoustic enclosures, 415V, LT, DG Sets with stack of 30 metres as per CPCB norms
- Change over from EB to DG & Vice versa through DG SYNCH PANEL or Electrical & Mechanical interlocking sets by using ATS.
- Main Distribution Panel - Grid Power and Back-up power shall be distributed through Main LT Panel. The main LT Panel shall be installed in Main Electrical Room situated preferably at basement-1 level/Ground floor of the building.
- Main LT Panel shall be designed with various outgoing supply feeders considering the general requirements of the building.
- Sub Distribution Panels shall be provided as per requirement.
- Earthing –i) Dedicate earthing has to provide as per IS 3043-1987.

2. DESIGN STANDARDS AND ASSUMPTIONS

2.1 Design Assumptions

- Light Pollution Density for all the areas including office are considered as per latest ECBC norms.
- LED Energy efficient lamps are considered

Power supply connection from EB authority	• For 33kV supply, GOA Electricity Board will provide common feeder up to 5 MVA Load. • Since the overall demand is Less than 5 MVA, developer should take of 33 kV common connection from the Electricity board authority.
HT Metering to the developer	• HT tariff meter : for all loads • HT Check meter
Generator back-up	100% backup
Method of DG source changeover	Automatic
Transformers	2 No 33/11KV Power transformer according to the load and 1 No. of 11KV/433V 1250KVA and 1 No.of 11KV/433V 1000KVA Oil type Distribution Transformers considered.
DG yard / room	LT DG Sets located in Utility block with acoustic enclosure
UPS	UPS for 10% common area emergency lighting, Baggage Carousel, check in Counters, Security Screening, Baggage Screening all systems with 90min backup BMS & ELV equipment is provided with 30 min backup.
External lighting	Designed to suit landscape including Building Facade lighting.
Earthing	Mandatory earthing shall be as per IS 3043-1987. Standard with sleeves & tray provision to reach electrical shaft.
Building lightning protection	Grounding & Building Lightning protection system.

POWER SUPPLY REGULATIONS

- The peak demand and services voltage at which power supply is made available if Drawn from a common feeder services more than on installation:
- Peak Demand – up to 1500 KVA- 11 KV 3 Phase 3 Wire's
- Peak Demand – up to 1501 & 5000 KVA- 33 KV 3 Phase 3 Wire's
- Peak Demand – up to 5001 KVA & above - 132 KV 3 Phase 3 Wire's
- The peak demand and services voltage at which power supply is made available if an Independence dedicated feeder is available from the substation is as under
- Peak Demand – up to 2500 KVA- 11 KV 3 Phase 3 Wire's
- Peak Demand – up to 2501 & 10000 KVA- 33 KV 3 Phase 3 Wire's
- Peak Demand – up to 10000 KVA & above - 132 KV 3 Phase 3 Wire's

2.2 Design Standards

The design shall be based on the following Standards and Guidelines

a) Indian Standard Specifications

b) Goa Electricity Department Supply Authority Rules and Regulations

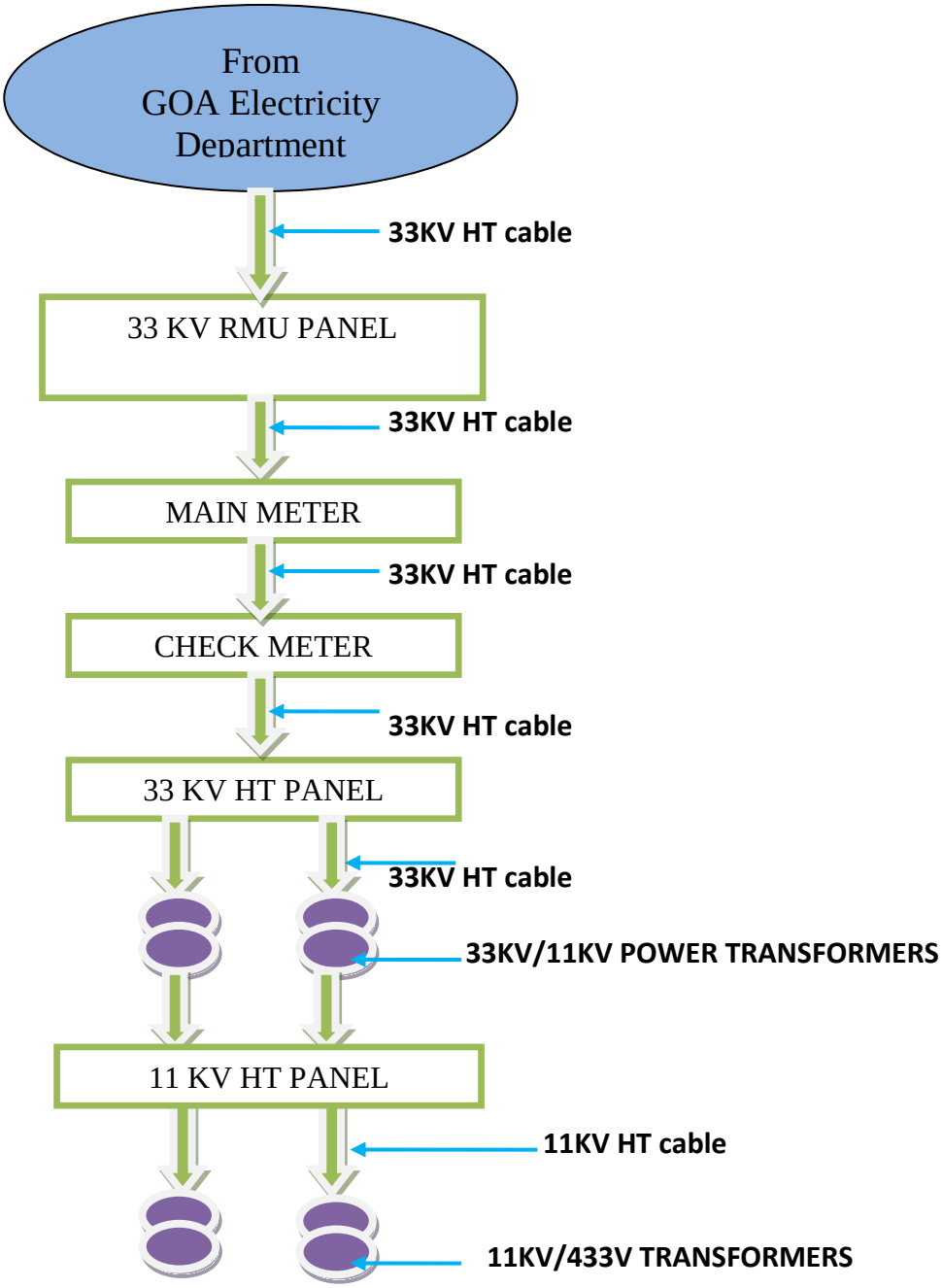
c) National Building Code of India

d) Other Statutory Regulations.

2.3Electrical Design Scope Matrix

Electrical scope matrix for the building is as mentioned below.

HT Source of Supply:



33KV/11KV Power Transformers shall be considered standby. 1No. of 11KV/433V 1250 KVA and 1No.s of 11KV/433V 1000 KVA shall be considered as working.

3.0 Equipment Configuration:

The incoming HV Supply shall be stepped down to 433 V through suitable rated distribution transformers. The type of distribution transformers shall be used with On Load Tap Changer (OLTC) arrangement. Major equipment, energy meters and switchgear shall be integrated with BMS

- The transformer output as L T supply of 3 Ph, 4 wires 433 V, 50 Hz shall be connected to L T Kiosk and further taken to Main LT Panel through bus ducts as per the site conditions.

4.0 TRANSFORMERS:

1 No. of 11KV/433V 1250 KVA and 1 No. of 11KV/433V 1000 KVA shall be considered as working.

Transformer shall be level 3 with IS 1180 suitable for operation in an ambient up to 50Deg.C

Transformers of the proper ratings and design shall be selected to safety the minimum efficiency at 50% and full rating as mentioned in the below table. In addition the Transformer shall be selected such that it minimizes the total cost of its initial cost in addition to the present value of the cost its total lost energy while serving its estimated loads during its respective life span.

Load Breakup:

TERMINAL BUILDING GROUND FLOOR			
LIGHTING			
DESCRIPTION	**AREA PER FLOOR IN SFT**	**No. of FLOORS**	**Lighting In VA**
(1.5VA/sft)			
International Arrival & Departure, Domestic Arrival & Departure, Food Court, Lobby	65638	1	98457
Total Load in VA			98457
TOTAL LOAD IN KVA			**98**
POWER			
DESCRIPTION	**AREA PER FLOOR IN SFT**	**No. of FLOORS**	**Power in VA**
(2 VA/sft)			
International Arrival & Departure, Domestic Arrival & Departure, Food Court, Lobby	65638	1	131276
Total Load in VA			131276
TOTAL LOAD IN KVA			**131**
HVAC			
DESCRIPTION	**AREA PER FLOOR IN SFT**	**No. of FLOORS**	**AC in VA**
(9VA/sft)			
International Arrival & Departure, Domestic Arrival & Departure, Food Court, Lobby	65638	1	590742
Total Load in VA			590742
TOTAL LOAD IN KVA			**591**

TERMINAL BUILDING FIRST FLOOR			
LIGHTING			
DESCRIPTION	**AREA PER FLOOR IN SFT**	**No. of FLOORS**	**Lighting In VA**
(1.5VA/sft)			
Premium Lounges, Office Space, Foodcourt	40628	1	60942
Total Load in VA			60942

TOTAL LOAD IN KVA			61
POWER			
DESCRIPTION	**AREA PER FLOOR IN SFT**	**No. of FLOORS**	**Power in VA**
(2VA/sft)			
Premium Lounges, Office Space, Foodcourt	40628	1	81256
Total Load in VA			81256
TOTAL LOAD IN KVA			**81**
HVAC			
DESCRIPTION	**AREA PER FLOOR IN SFT**	**No. of FLOORS**	**AC in VA**
(9VA/sft)			
Premium Lounges, Office Space, Foodcourt	40628	1	365652
Total Load in VA			365652
TOTAL LOAD IN KVA			**366**

ANCILLARY BUILDING			
LIGHTING			
DESCRIPTION	**AREA PER FLOOR IN SFT**	**No. of FLOORS**	**Lighting In VA**
(1.5VA/sft)			
Ground Floor	28621	1	42932
First Floor	11691	1	17537
Total Load in VA			60468
TOTAL LOAD IN KVA			**60**
POWER			
DESCRIPTION	**AREA PER FLOOR IN SFT**	**No. of FLOORS**	**Power in VA**
(2VA/sft)			
Ground Floor	28621	1	57242
First Floor	11691	1	23382
Total Load in VA			80624
TOTAL LOAD IN KVA			**81**

HVAC			
DESCRIPTION	**AREA PER FLOOR IN SFT**	**No. of FLOORS**	**AC in VA**
RETAIL (9VA/sft)			
Ground Floor	28621	1	257589
First Floor	11691	1	105219
Total Load in VA			362808
TOTAL LOAD IN KVA			**363**

FERRY TERMINAL BUILDING			
LIGHTING			
DESCRIPTION	**AREA PER FLOOR IN SFT**	**No. of FLOORS**	**Lighting In VA**
(1.5VA/sft)			
Ground Floor	12240	1	18360
First Floor	7804	1	11706
Total Load in watts			30066
TOTAL LOAD IN KW			**30**

POWER			
DESCRIPTION	**AREA PER FLOOR IN SFT**	**No. of FLOORS**	**Power in VA**
(2VA/sft)			
Ground Floor	12240	1	24480
First Floor	7804	1	15608
Total Load in VA			40088
TOTAL LOAD IN KVA			**40**

HVAC			
DESCRIPTION	**Total TR**	**KVA/TR**	**AC in KVA**
For Ground floor & 1st floor	20	2.25	45
TOTAL LOAD IN KVA			**45**

UPS LOAD	
TERMINAL BUILDING	
DESCRIPTION	**Load in KVA**
LIGHTING(10%)	16

POWER (SYSTEM SOC BACKUP)	21
BMS systems	20
BAGGAGE CAROUSEL	32.00
CHECK-IN COUNTERS	45.00
SECURITY SCREENING	50.00
BAGGAGE SCREENING	10.00
TOTAL	194.19
ANCILLARY BUILDING	
DESCRIPTION	**Load in KVA**
LIGHTING(10%)	6
FERRY TERMINAL BUILDING	
DESCRIPTION	**Load in KVA**
LIGHTING(10%)	3

TRANSFORMER LOAD CALCULATIONS:

PROJECT	**INTERNATIONAL AND DOMESTIC CRUISE TERMINAL AND ALLIED FACILITIES AT MORMUGAO PORT, GOA**			
TITLE	**ELECTRICAL TRANSFORMER LOAD CALCULATIONS**			
S.No.	**DESCRIPTION**	**LOAD IN KVA**	**DIVERSITY FACTOR**	**TOTAL LOAD IN KVA**
1	LIGHTING LOAD	249.93	0.75	187.45
2	POWER LOAD	333.24	0.75	249.93
3	UPS LOAD	203.25	0.75	152.43
4	AC LOAD	1364.20	0.75	1023.15
5	BAGGAGE CAROUSEL,CHECK-IN COUNTER, SECURITY SCREENING, BAGGAGE SCREENING, ESCALATORS	157.00	0.75	117.75
6	PUMPS LOAD	40.00	0.50	20.00
7	FIRE FIGHTING LOAD	237.50		
8	LIFT LOAD	60.00	0.75	45.00
9	ESCALATOR LOAD	60.00	0.75	45.00
10	STP	35.00	0.75	26.25
11	EXTERNAL & LANDSCAPING LIGHTING	10.00	0.50	5.00
12	MISCELLANEOUS LOAD	15.00	0.60	9.00
	TOTAL LOAD IN KVA			**1880.97**
	GROUP DIVERSITY FACTOR			**0.9**
	TOTAL LOAD IN KVA AFTER DIVERSITY FACTOR			**1692.87**

	SELECTED TRANSFORMER WITH 80% LOADING	**2116.09**
	PROPOSED TRANSFORMER	**1X1000KVA and 1X1250KVA**

Note: Obtaining authority permissions is part of contractor scope. Actual government fee will be paid by MPT at actuals/submission of government fee.

Measurement and Reporting of Transformer Losses

All measurement of losses shall be carried out by using calibrated digital meters of class 0.5 or better accuracy and certified by the manufacturer. All transformers of capacity of 500kVA and above would be equipped with additional metering class current transformers (CTs) and potential transformers (PTs) additional to requirements of Utilities so that periodic loss monitoring study may be carried out.

ELECTRIC MOTORS

1. All permanently wired poly phase motors of 0.375kW or more serving the building and expected to operate more than 1,500 hours per year and all permanently wired poly phase motor of 50kW or more serving the building and expected to operate more than 500 hours per year shall have a minimum acceptable nominal full load motor efficiency not less than IS 12615 for energy efficient motors.
2. Motor horsepower ratings shall not exceed 20 % of the calculated maximum load being served.
3. Motor nameplates shall list the nominal full-load motor efficiencies and the full- load power factor.
4. Certificates shall be obtained and kept on record indicating the motor efficiency.

Services exceeding 1000kVA (Proposed commercial building is 2000 kVA) shall have permanently installed metering to record demand (kVA), energy (kWh), and total power factor. The metering shall also display current (in each phase and the neutral), voltage (between phases and between each phase and neutral), and Total Harmonic Distortion (THD) as a percentage of total current

POWER FACTOR

All electricity supplies exceeding 100 A, 3 phases shall maintain their power factor between 0.95 lag and unity at the point of connection.

POWER DISTRIBUTION IN BUILDINGS

The Power cabling shall be adequately sized as to maintain the power distribution losses not to exceed 1% of the total power usage. Record of design calculation for the losses shall be maintained.

5.0 DIESEL GENERATOR SYSTEM

- 100 % Grid Power as primary source shall be provided. Grid power at high voltage (HV) level shall be taken from local company. The HV level may be 33kV.Power shall be tapped from point of supply defined by Supply Company. Underground cables/bus ducts shall be used to tap the power which shall be adequately marked on ground and in drawings to track for maintenance. The necessary associated switchgears and cables shall be installed from point of supply to Supply Company HV Room / Electrical Service yard as per the guidelines of Supply Company. Supply Company HV Room / Electrical Service Yard for the building shall be situated in building premises. Equipment in the service yard is mainly Ring Main Unit (RMU), Metering Kiosk, H V Switchgears, and Transformers, cables, earthing and associated civil works.

Power Backup

- Power back-up shall be provided through 100 % capacity Standby Diesel Generator (DG) sets. The DGs shall be equipped with suitable day tank. DGs shall be provided.
- In case of mains power failure, DG set shall start and run in auto mode. Power supply changeover shall take place at main LT panel level through Auto Transfer Switch (ATS).Voltage drop in the electrical system shall be limited to 5% at the farthest point. DG set along with fuel tanks, energy meter, ATS, Sync panel and switch gear shall be integrated with IBMS for remote monitoring and control.
- 1No.of 1250kVA and 1No.of 1000kVA 415V LT DG set shall be placed in Utility block.
- For DG set above 1000KVA the minimum stack height should be 30Mts or 3Mts above the building whichever is higher as per CPCB norms.

DG LOAD CALCULATIONS:

PROJECT	INTERNATIONAL AND DOMESTIC CRUISE TERMINAL AND ALLIED FACILITIES AT MORMUGAO PORT, GOA			
TITLE	ELECTRICAL GENERATOR LOAD CALCULATIONS			
S.No.	DESCRIPTION	LOAD IN KVA	DIVERSITY FACTOR	TOTAL LOAD IN KVA
1	LIGHTING LOAD	249.93	0.75	187.45
2	POWER LOAD	333.24	0.75	249.93
3	UPS LOAD	203.25	0.75	152.43
4	AC LOAD	1364.20	0.75	1023.15
5	BAGGAGE CAROUSEL,CHECK-IN COUNTER, SECURITY SCREENING, BAGGAGE SCREENING, ESCALATORS	157.00	0.75	117.75
6	PUMPS LOAD	40.00	0.50	20.00
7	FIRE FIGHTING LOAD	237.50		
8	LIFT LOAD	60.00	0.75	45.00
9	ESCALATOR LOAD	60.00	0.75	45.00
10	STP	35.00	0.75	26.25
11	EXTERNAL & LANDSCAPING LIGHTING	10.00	0.50	5.00
12	MISCELLANEOUS LOAD	15.00	0.60	9.00
	TOTAL LOAD IN KVA			**1880.97**
	GROUP DIVERSITY FACTOR			**0.9**
	TOTAL LOAD IN KVA AFTER DIVERSITY FACTOR			**1692.87**
	SELECTED GENERATOR WITH 80% LOADING			**2116.09**
	PROPOSED GENERATOR			**1X1000KVA and 1X1250KVA**

LT POWER DISTRIBUTION:

- Considered Utility block for spatial requirements including of transformers, DG sets, capacitor banks, Main LT Panel and other required panels.
- Main LT panel shall be air insulated, indoor type with draw out type ACBs & fixed type MCCBs. The bus bars rated above 100A shall be of electrolytic grade

aluminium. The lower ratings shall be with copper cables.

- Sub main Panels shall be located in Ground floors electrical rooms for Terminal Building, Ancillary building & Ferry Terminal building
- Bus bars shall be designed for a current density of 0.8Amps/sq.mm for Aluminium bus bars and current density of 1.2Amps/sq.mm for Copper bus bars.
- A continuous earth bus of Aluminium bus shall be provided.
- The entire system shall be fuse less.
- Metering shall be with electronic digital type which is capable of displaying all electrical parameters and shall have communication capability.
- Over current, short circuit and earth fault protections shall be provided for all incoming circuits in the main panel & sub panels.
- The main switch board shall have requisite number of feeders including one spare feeder of each rating.
- Separate outgoing feeders shall be provided to cover ACCP, Chillers, fire pump, external lighting, rising mains, utility loads and spares.
- All Panels inside the building shall have top entry & outdoor panels shall have bottom entry.
- Main panels, Sub panels shall be form **3B** construction and both side extendable type.
- All the Wiring shall be FRLS type and minimum size of the wire is 2.5 Sq mm
- All the external conduits should be of GI only.

A. VOLTAGE DROPS

The maximum voltage drops in various sections of the electrical system shall be within the limits stated in the table below.

S.No.	SYSTEM ELEMENT	MAX. PERMISSIBLE
1	Maximum voltage Drop(Vd) allowed from Main PCC to Individual Panel	≤ 12V

2	% voltage Drop(%) allowed from Main PCC to Individual panel	≤ 3%
3	Total % cumulative voltage drop (%) is allowed from Main PCC panel to up to the Equipment	≤ 5%

DISTRIBUTION:

- From the building sub main panels outgoing feeders of suitable rating for Ground floor to 1st floor cables shall be considered with required panels
- Distribution from Main LT Switchboard up to chillers, primary & secondary pumps kept will be through XLPE Al. cables up to the Indoor panel kept near the chillers plant.
- Suitable Inverters with 90 minutes backup for shall be provided.

Metering Concept:

- Main 33 kV HT metering for the whole building loads will happen at the 33 kV HT Main meter and Check meter.(Note : The 33KV 3way RMU panel and 3way consumer HT panel are in Contractor scope.)
- LT meters will be provided at the following feeders.
  - Main LT Panel Incomers for Grid Power and DG Power.
  - Dual (DG and Grid Power) Meters for Chillers feeders in Main LT panel.
  - Dual (DG and Grid Power) Meters for Utility and common area load feeders in Main LT panel.
- The following loads shall be metered by separate energy meters.
  - Exterior lighting power consumption.
  - UPS Power consumption.
  - HVAC Pumps power consumption.
  - AHUs / FCUs power consumption.
- All utilities like Pumps, WTP, STP; Etc (all different utility systems available in the

Project) shall be metered separately.

- All meters shall be with Port Provision (RS 485) for data logging.

SAFETY FEATURES

- For all lighting and small power panels 30mA sensitivity earth leakage circuit breakers will be installed for protection against electrocution.
- Live parts of all equipments in panels and Distribution boards shall be shrouded.
- HT cable to transformer shall be properly protected using MS pipe or suitable size cable tray duly clamped/Cable trench.
- Laying of cables in trenches shall be as per IS1255-1983.
- Cables shall be protected with sand cushioning and moulded bricks.
- Cable trays shall be hot dip galvanized with minimum 2 mm thickness – weld less and ready to install.- prefabricated.
- Copper strips laid for neutral shall be laid in heat shrinkable PVC sleeves.
- Route markers shall be provided for HT cables.
- RCCBs – wherever provided shall be suitable for isolation, with distinguished trip and off indications.
- RCCBs shall be of Si type with 30 mA
- MCBs used for Lighting and small power shall be Curve C – 10 kA.
- MCBs used for UPS distribution shall be of Curve D – 10 KA

ELECTRICAL ROOM

6.0 EARTHING:

- All earthing shall be in conformity with IS: 3043-1987.
- The system shall be TNS with four wire supply system (R, Y, B, N and. E). All noncurrent carrying metal parts of electrical installation and all metal conduits trunking, cable sheaths, switchgear, distribution panels, light fittings, transformer yard fencings shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system.
- The earthing system shall be a stand-alone type not connected to the building reinforcing bars with the exception of reinforcing in the floor and walls of the substation enclosure which should be electrically separate from the remainder of the building.
- It shall be well clear that building lightning protection shall not be connected to the earth bar of any switchboard.
- Dedicated earthing shall be provided for LV, Electronic BMS, IT, Telecom, AV, Data enter equipment for owners common area panels only.
- Adequate quantity of professional new-age modular earth pits made of composite material shall be used with sufficient slag in the cable length for use of clamp meters.
- All fuel tanks (DG & Diesel Fire Pumps) shall be adequately earthed.
- Maintenance free earthing shall be considered

Sizing of Earthing Conductors:

- Sizing of earth conductor for Substation, HV equipment and Main LV panels etc. Shall be based on actual fault current calculated.
- Earthing grid near substation station and earthing grids for other building shall be connected together at ground floor for equipotential bonding and to minimize overall resistance of earthing path.
- Earthing grids of electronic \ IT equipment shall be separate and shall not be
- Connected to general earthing grids with prior consent from user. Electronic \ IT equipment earthing grids for various buildings can be interconnected for

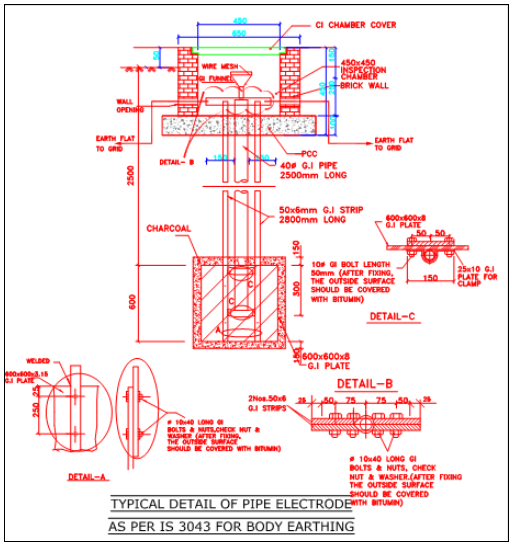
equipotential bonding and to minimize overall resistance of earthing path.

- Copper \ GI conductor shall be used for general body earthing as mentioned in the schedule of quantities. Copper GI conductors shall be used for earthing wires/strips running underground.
- Area for adequate numbers of earth electrodes meeting statutory requirements shall be provided.

Earthing Conductors

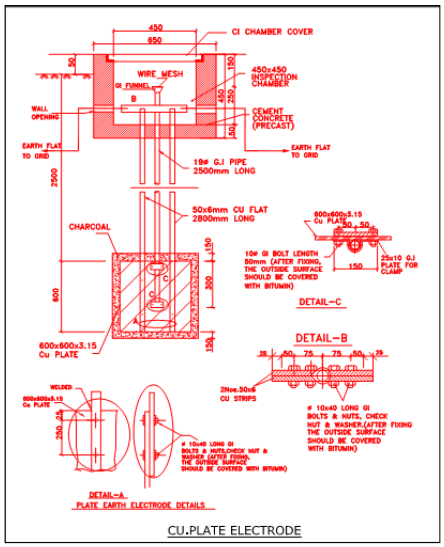
- Earthing Copper conductors shall be used for DG sets and transformer neutral grounding.
- GI conductor shall be used for general body earthing.

EQUIPMENT BODY EARTHING



TYPICAL DETAIL OF PIPE ELECTRODE
AS PER IS 3043 FOR BODY EARTHING

EQUIPMENT NEUTRAL EARTHING



CU.PLATE ELECTRODE

7.0 LIGHTING

- For continuous improvement of Projects energy performance, it is suggested to have separate Lighting DB and Power DB along with separate meters from the main board itself.

- Illumination levels for all the below mentioned areas shall be as per NEC.

- Complete street and external area lighting shall be supplied and installed by Client.

- Lighting for common areas and toilets will be with surface / recess mounted LED down lighters / Decorative light fixtures.

- Emergency lighting shall be provided in building common area as in lift lobby, staircases and parking areas at strategic locations.

- The facility is proposed with Emergency source of lighting using UPS systems / Inverter for feeding common area lighting i.e, elevator lobbies, alternate landings in staircase, basement car park, service area, corridors, common toilets etc., loads..The wiring carried out for emergency lighting is terminated to a separate MCB distribution board.

- Lighting has been designed for the whole building with LEDs. Lighting Lux levels are as per NBC 2016 code.

- Indigenous LED light fixtures available in local markets shall be provided for common area, internal lighting and external lighting. Apart from wattage rating and lux levels factors like quality of optics - throw and dispersion of light and thermal management and switching endurance for life shall be considered while making choice of LEDs. Care must be taken to ensure that illuminance – Colour Temperature combination is within “Pleasing” area of Kruith of curves.

- External lighting shall be done as per the design given by the landscape architects. The power distribution shall be done through armoured cables & an outdoor feeder pillar / external lighting DB shall be provided with 24Hrs timer for automatic switching on/off the lights during night & day time and with provision for Manual on/off, through an Auto/Manual selector switch and Push Buttons.

- Lighting scheme will be designed to suit landscape layout as prepared by Landscape Architects. Building lighting will be done using LED light fixtures. Cabling for all the light fixtures will be executed using multi-core PVC armoured cable.

- **Exterior Building Grounds Lighting**

  Lighting for exterior building grounds luminaries which operate at greater than 100W shall contain lamps having minimum efficacy of 60lm/W unless the luminaries is controlled by a motion sensor

8.0 LIGHTNING PROTECTION SYSTEM

- The Building premises will be protected against lightning through Conventional type Lightning protection System GI strips Run outside the columns shall be used as down conductor and galvanized GI strips interconnecting grounding electrodes and the air terminal rods. This design will ensure effective grounding of lightning discharges.
- Basic Grounding System and Protection against Lightning and Excess Voltages.
- The basic grounding resistance shall not exceed 1 Ohm. The protection against lightning shall be in accordance to As per IEC 62561 -2 table 1/ IEC 62305-3 (GI material for down conductor)
- It is proposed to provide lightning protection system by advanced techniques which allow optimum performance, flexibility of design, as well as overall cost effective installation.
- Advance lightning protection system comprises of Air terminals, down conductors, support system as required, event counters and finally the grounding system.
- The air terminal is mounted on the highest point of the building (Generally the lift machine room / head room top which will be the highest point). The terminal is connected to down conductor and low impedance grounding system such a way as to provide a totally integrated system.
- The down conductor provide low impedance path from air terminal to ground system so that lightning current can be safely conducted to earth.
- The advance lightning protection system will have only one down conductor which will be dropping down to the ground level as against 'n' number of down conductors as required in case of a conventional protection system.
- Hybrid lightning protection system has provided because of the Architectural elements.

9.0 UPS SYSTEM

- UPS for 10% common area emergency lighting, Baggage Carousel, check in Counters, Security Screening and Baggage Screening all systems with 90min backup BMS & ELV equipment is provided with 30 min backup.
- Centralised UPS system shall be provided for Terminal building and Ancillary building separately.

10.0 SOLAR SYSTEM:

On Grid Solar PV plant shall be provided at Ancillary block terrace level and International Cruise and Domestic cruise Terminal block 's terrace level . Provision for the structural loadings /etc is considered and supply & installation is separate package Built ,Install & Profit share basis .

Required Rooftop Area for Solar PV Modules installation for the proposed Solar PV Plant Capacity as per the requirements. Provision for solar power shall be integrated to main PCC panel.

LIST OF APPROVED MAKES AND AGENCIES

..\20200101 List of Approved Makes.xls

LIST OF APPROVED MAKES							
S.NO.	MATERIAL	MAKE					
		1	2	3	4	5	6
A.		HT Equipment					
1	HT Breakers	Schneider (HVX/EVOLIS)	ABB (Unigear/HPA)	Siemens (8DJ20/3AH3)	L&T		
2	Load Break Switches HT	Schneider	ABB	Siemens	L&T		
3	Oil Immersed Transformers	Volt-amp	ABB	Schneider	Siemens	KIRLOSKAR	
4	Cast Resin Transformers	United Insulation	Volt-amp	Kirloskar	Schneider THRIHAL		
5	HT panels	SIEMENS	SCHNEIDER	ABB			
6	HT Cables	Polycab	KEI	Kenter Cable	Apar Cables	Gloster	
7	HT Cable Jointing Kits	Raychem	Mahindra				
8	HT Metering Kiosk	Huphen					
9	HT Metering Cubicles	As per the Design approved by Goa state Electricity Department.					
10	Ring Main Unit	ABB	Siemens				
B.		LT Equipment					
1	Air Circuit Breakers	L&T U Power	ABB (E Max)	Siemens (SENTRON 3WL) Series	Schneider Masterpact (NW)	Legrand	
2	Load Break Switch/ Switch Fuse Units	L&T (FN/FNX SDF)	Schneider FUPACT	Siemens (3KL/3KT/3KA)	Havells(KOMPACT)	Socomec	
3	Distribution Boards	Legrand	ABB (Classic)	Schneider (ACTI9)	L&T		
4	Energy Meters	L&T	Enercon	Secure i	Schnider		
5	MCCB/ MPCB	Schneider Compact NSX	ABB (T Max XT)	Siemens (SENTRON 3VL)	L&T (d sine)		
6	MCB/ RCBO/ RCCB	Legrand	L&T	ABB (S series)	Schneider ACTI9		
7	Modular Switches, Sockets & Accessories	Crabtree	Legrand (Arteor)	L&T	Anchor/ Panasonic		
8	Contactors	Schneider (TESYS)	ABB	L&T (MNX)	Havells (Powerline)	Legrand	
9	Capacitors	L&T	Epcos	ABB	Schneider (Varplus)	Subodhan	Legrand
10	Solenoid Operated Auto Transfer Switches	Asco Series	Socomec	VITZRO Tech			
11	ACCL Three Phase	Elmeasure	Hager	L&T			
12	ACCL Single Phase	Elmeasure	L&T	Hager			
13	Sandwiched Bus-ducts	Legrand (Zucchini)	EAE	L&T	Siemens		
14	LT Cables	Polycab	Finolex	KEI	Havells	Kenter	
15	LT Glands & Lugs	Dowells	Comet	Globex	Lotus		
16	LT Wires	Universal	Polycab	Finolex	Havells	Anchor/Panasonic	
17	ELV Cables	Caliplast	Kenter	ITL			
18	FRLS PVC Conduits & Accessories	Universal	VIP	Polycab	Anchor/ Panasonic		
19	Lighting Fixtures	Wipro	Bajaj	JAQUAR	Philips	Crompton Greaves	Havells
20	Lightening Arrestors	Dehn	OBO BETTERMANN				
21	Surge Arrestors	Dehn	Schneider	Siemens	ABB	OBO BETTERMANN	Legrand
22	Maintenance Free Earthing Electrodes	Eltech	JEF	Dehn			
23	GI Cable Trays / Raceways	Profab	Legrand	OBO	patni		
24	Wiremesh Cable Trays	Legrand	OBO				
25	Arc flash sensing Relay system	Schneider (Easergy)	ABB (REA)				
C.		HT/ LT Accessories					
1	Protection Relays	Schneider/ Areva(VIP/MICOM)	Alsthom	Siemens	ABB	L & T	
2	Indicating Meters	Rishab	Secure	L&T	HPL	Schneider	
3	Push Buttons/ Selector Switches	Siemens	ABB	KEC	L&T	Schneider XB5	
4	Indicating Lamps	Technic	Siemens	ABB	KEC	L&T	Schneider XB7
5	HT Current Transformers/ Potential Transformers	Jyoti	AE	Raychem	Kappa	Schneider	
6	LT Current Transformers	Rishab	AE				
7	Safety Accessories	Dehn	OBO				
8	Connectors	Elmex	Connectwell	Tosha			
9	APFC Relay	Epcos	Siemens	L&T	Crompton Greaves	Sycon	Beluk
10	UPS	Socomec	Emerson	Schneider	Eaton	Delta	
11	Industrial Socket Outlets	L&T	Merlin Gerin	Siemens	MDS.		
12	Weather proof Switches & Sockets	Clipsal	Hensel	HPL	Scame.		
D.		LV Equipment					
1	Telephone Cables	Polycab	Finolex	RPG	Universal		
2	Cat 6 cable	Legrand	Finolex	Molex	Lapp		
3	Tag block with boxes	Krone	ITL				
E.		DG Equipment					
1	Engine	Cummins	Caterpillar	Perkins	MTU	Kirloskar	
2	Alternator	Stamford	LeroySomer	Kirloskar	Crompton Greaves		
3	Synchronising Controller	Wood Word	DEIF	Comap			

CODES AND STANDARDS:

Reference of the Indian Standards being followed:-

1.1. WIRING SYSTEM:

IS	732	Code of practice for electrical wiring installation (System voltage not exceeding 650 V).
IS	1646	Code of practice for fire safety of buildings (General Electrical installation).
IS	2667	Fittings for rigid steel conduits for electrical wiring.
IS	3480	Flexible steel conduits for Electrical wiring.
IS	3837	Accessories for rigid steel conduit for electrical wiring.
IS	694	PVC insulated cables.
IS	9537 Pt 3	Rigid - non-metallic conduits for electrical wiring.
IS	9537 Pt 5	Flexible (Pliable) non-metallic conduits for electrical installation.
IS	1293	3 Pin plugs and sockets.
IS	8130	Specifications for conduits for electrical installation.
IS	3854	Switches for domestic purpose.
IS	3415	Fittings for rigid non-metallic conduits.
IS	4648	Guide for electrical layout in residential building.
IS	9537	Conduits for electrical installation.
IS	302	General and safety requirements for household and similar electrical appliances.
IS	3043	Code of practice for earthing.
IS	5216	Guide for safety procedures and practices in electrical work.
		Indian Electricity Act and Rules.
		Regulations for the electrical equipment in buildings issued by the Bombay Regional
		Council of Insurance association of India.

1.2. EARTHING SYSTEM:

IS	3043	IS 3043 - Code of practice for earthing.
IEEE	80:86	IEEE - 80:86.
IEEE	142:92	IEEE - 142:92

1.3. HT CABLES:

IS	692-1973	Paper insulated sheathed cables.
IS	8130-1976	Conductors for insulated electric cables and flexible cords.
IS	3975-1979	Mild Steel wires, strips and tapes for armoring of Cables.
IS	3961-1967	Recommended current rating for cables.
IS	1255-1967	Code of Practice for installation and Maintenance of paper insulated power Cables (upto and including 33 KV).
IS	7098-1973 Part II	XLPE Cables.

1.4. TRANSFORMERS AND ACCESSORIES:

IS	335	Insulating oil
IS	1271	Thermal evaluation and Classification of electrical insulation
IS	2026	Power transformers
IS	2099	Bushing for Alternative voltages above 1000 V
IS	2705	Current transformers
IS	3347	Dimensions for porcelain Transformer Bushings
IS	3637	Gas operated relays
IS	6600	Guide for loading of oil immersed transformers.
IS	3639	Fittings and accessories for power transformers.
IS	4201	Application guide for CTs
IS	8478	Application guide for ON-load tap changers
IS	8468	On-load tap changers (Amendment 1)
IS	13947	LV switchgear and control gear - Part 1 General rules
IEEE	32	Neutral Grounding Devices- Standard Requirements, Terminology and Test Procedure

1.5. LIGHT FITTINGS AND ACCESSORIES:

IS	16101	General Lighting - LEDs and LED modules – Terms and Definitions
IS	16102(Part 1)	Self- Ballasted LED Lamps for General Lighting Services Part 1 Safety Requirements

IS	16102(Part 2)	Self-Ballasted LED Lamps for General Lighting Services Part 2 Performance Requirements
IS	16103(Part 1)	Led Modules for General Lighting Part 1Safety Requirements
IS	16103(Part 2)	Led Modules for General Lighting Part 2 Performance Requirements
IS	16107(Part 1)	Luminaires Performance Part 1 General Requirements
IS	16107	Luminaires Performance Part 2 Particular Requirements Section 1 LED Luminaire

NOTE: Followed the Indian Standard codes of practice for all the materials. If not specified anywhere, please follow Indian Standard codes of practice for installations.

FIRE FIGHTING INDEX

1. CODES AND STANDARDS

Fire protection system shall be designed and installed as per the following codes and standards

NBC 2016 : National building code, part IV

IS 2189:1999 : Installation & maintenance of fire detection and alarm System

IS 15105:2002 : Design and installation of fixed automatic sprinkler fire extinguishing system

IS 13039:1991 : Yard hydrant system

IS 3844:1989 : Internal hydrant system

IS 1239 / IS 3589 : Specification for Pipes should be MS heavy grade

IS 5290:1993 : Specifications for hydrant landing valves

IS 15683:2006 : ABC powder type extinguishers

IS 9457:1980 : Safety colours and safety signs

IS 12349:1988 : Fire protection – safety sign and

Local fire authority requirements

BUILDING DETAILS

Following are the building details

Type of building: As per NBC 2016

- Terminal building premise is classified as assembly buildings Group – D
- Office premise is classified as business buildings Group – E
- Retail premise is classified as mercantile buildings Group – F

  In case of mixed occupancy, in so far as fire protection is concerned, all the occupancies/the entire building shall be governed by the most restrictive provisions of the Code among those applicable for individual occupancies. The provisions for life safety given in the Code for individual occupancy shall, however, apply to the respective occupancies. Exits in such mixed occupancy shall be arranged so as to ensure that means of egress is not decreased in the direction of egress travel.

OCCUPANT LOAD

As per NBC 2016, Table 3 Occupant load as follows:

Sl. No.	Type of Building	Population Requirement
1	Terminal	0.65 Sqm / Person
2	Shopping and Retail	6 Sqm / Person
(a)	Staff	10% Fixed
(b)	Visitors	90% Floating / Visitors
3	Offices (including canteen)	10 Sqm / Person
4	Food court / Restaurant	1.8 Sqm / Person

TRAVEL DISTANCE

Exits shall be located that the travel distance on the floor from any portion of the floor shall not exceed 30meters for non – sprinklered buildings and for fully sprinklered buildings; it shall be increased by 50 % (15 meters) i.e., 45 meters.

This building need to be sprinklered and travel distance shall be 45 meters from any portion of the floor to the exits.

STAIRCASES

Staircases shall be either internal or external type. Staircases shall be located such that occupant shall not travel more than 45 meters to reach an exit and clear width of stairs shall be minimum 1500mm wide. Minimum width of tread shall be 300 mm. The maximum height of rise shall be 150mm.

All staircases shall be fitted with self-closing type fire rated doors. No. of staircase shall depend on the travel distance and occupant load calculation, as per NBC 10mm width of staircase is required per person.

PRESSURISATION OF STAIRCASES

As far as possible staircases shall be constructed as a self-contained unit and in such a way that one of its wall shall be external wall of the building.

- Also staircase should have natural ventilation by means of windows / louvers on the external wall of the staircase.
- If it is not possible to locate the staircases at external wall of the building, or if it is not possible to achieve natural ventilation, staircases have to be pressurized for positive pressure as per NBC, to avoid entry of smoke / toxic gases in to stairwells.

FIRE TENDER PATH

Fire tender movement path of minimum 11.0 meters shall be provide all-round the building, and turning radius shall be minimum 14 .0m to be maintained.

2. SYSTEMS PROPOSED

The Fire protection system shall be designed and installed as per National Building Code of India (NBC), part IV and local fire authorities. As per NBC part IV, Following are the systems proposed;

- Centralized fire water tank and fire pump room equipment
- Landing hydrants & first aid hose reel along with wet risers on all floors with necessary accessories
- Automatic Sprinklers system
- Addressable analogue type fire detection and alarm system for entire building (Except parking areas)
- Manually Operated Electronic Fire alarm
- Two ways talk back system
- Fire extinguishers and Signage's
- Yard Hydrants

3. FIRE WATER STORAGE TANKS

The tank capacities are proposed as per NBC 2016:

Underground Tanks:

Sl.No	Description	Remarks
1	Underground tank capacity (Cum)	250 Cum (Sprinkler & Hydrant)
2	Water Curtain Sump	26 Cum

Overhead Tanks:

Sl.no	Description	Remarks
1	Fire Water OHT - Terminal Building	20 Cum
2	Fire Water OHT - Ancillary Building	5 Cum

4. FIRE WATER PUMPS

The pumping facility forms the heart of the fire protection system. The pumps are basically used to increase the velocity and the quantity of water required to fight fires. Pump head shall be designed to meet minimum pressure requirement at remotest hydrant.

The following are the pumps proposed:

Terminal Building:

Sl. no	Description	Capacity	Remarks
1	1 No. of Electrical motor driven main pump for hydrant system	2280LPM	Location near UG Sump
2	1 No. of Electrical motor driven main pump for sprinkler system	2280LPM	
3	1 No. of Diesel engines driven common standby pump	2280LPM	
4	1 No. of Electrical motor driven Jockey pump for hydrant system	180 LPM	
5	1 No. of Electrical motor driven Jockey pump for sprinkler system / Water Curtain system	180 LPM	

Ancillary Building:

Sl. no	Description	Capacity	Remarks
1	1 No. of Electrical motor driven main pump for hydrant & sprinkler system	1620 LPM	Location near UG Sump
2	1 No. of Diesel engines driven common standby pump	1620 LPM	
3	1 No. of Electrical motor driven Jockey pump for hydrant, sprinkler/ Water Curtain system	180 LPM	

A common compartmentalized control panel for all pumps has been envisaged and located at pump room. Panel is designed to operate pumps automatically on pressure loss basis with timers, contactors, indicators etc. Necessary provisions shall be made in the panel to link the system to BMS. The power supply to the panel shall be from two sources i.e., raw (electric city board) power and Diesel generator power.

5. FIRE HYDRANT SYSTEM

5.1 INTERNAL HYDRANT SYSTEM

The fire hydrant system is the most effective, efficient and ultimate means of extinguishing very large fires, which can prove to be devastating. The main advantage of fighting fires with fire hydrant system is its accessibility and penetration capability, since fires can be fought from a very large distance and to a very high reachability.

The hydrant network is pressurized with water at a definite pressure and is maintained in readiness for any eventuality. Once the hydrant valve is manually opened during fire, the fall in pressure in the pipe line is sensed by the pressure switches activating the pumps, thereby ensuring continuous supply of water and pressure at the outlets (Hydrant Points).

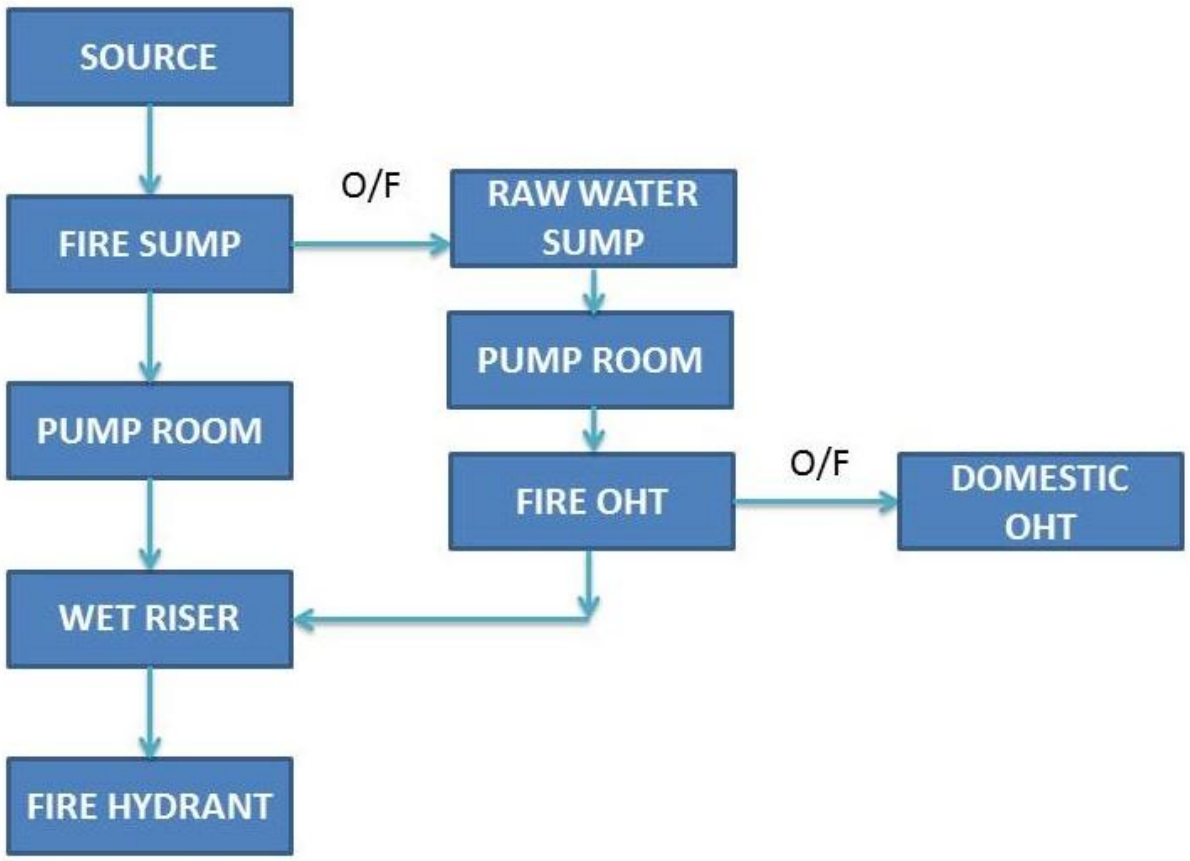
- The wet riser cum down comer system piping shall be G.I pipe class B as per IS 1239.
- Minimum pressure of 3.5 kg/cm2 will be ensured at the remotest hydrant point.

All wet risers with landing valves on all floors near each staircase. Each landing Hydrant comprising of the following:

- Double headed hydrant valve.
- 2 x 15Mts. of fire hoses.
- Stainless Steel Branch Pipe with nozzle.
- Hose reel with 40 Mts. Length and 25mm dia Rubber hose and nozzle.

All wet risers are interconnected with terrace level water tank though Booster pumps to increase the pressure in case of emergency.

Block Diagram



a. YARD HYDRANT SYSTEM

For fighting fires from outside the building at strategic locations on perimeter of the building, double headed yard (external) hydrants have been proposed and 30 meters is the distance between two hydrants. The yard hydrants are provided with hose cabinet in which 2 x 15Mts. fire

hoses, branch pipe and nozzle are stored. The hydrant valve distance should not exceed 2m to 15m from building line.

Also there is a four way inlet type fire brigade connection with isolation valves to feed water directly to system and as well as 2 way type fire brigade connection to fill fire water tank.

6. AUTOMATIC SPRINKLER SYSTEM

Automatic sprinkler system is considered to be the most effective and economical way to apply water from fixed systems. It is designed to act upon a fire at a pre-determined temperature by measure of water spray. It could either extinguish the fire or control its spread. The extinguishing mechanism of sprinkler water spray includes combustible materials to prevent further fire spread and displacement of combustible vapour and oxygen by steam. The sensitivity of a sprinkler glass bulb varies and is identified by different colour.

Sprinklers have been designed with sprinkler riser, piping network, sprinkler control valve, floor control valves, sprinkler alarm valve etc, complete. All sprinklers are 68 deg and for kitchen 91 to 93 deg temperature rating and pendent-recessed type in all parking areas, office areas and side wall sprinklers for ramp areas and fresh air cut outs in basements. For kitchen (for cooking area), it is recommended as 93 deg. The sprinkler system is fed by independent pump, the delivery header of the pumps is designed in such a way and it is possible to feed water from the hydrant pump to Sprinkler system in emergency. The sprinkler mains at each floor level consisting with Flow switch which will transfer audio / visual indications to Fire alarm panel in case of water flow in the pipes.

Tapping is taken from the riser to connect all sprinklers at all floor level, currently the system & piping is designed for both level of sprinkler (i.e., pendent sprinklers, upright sprinklers) above and below false ceiling.

Sprinkler pipes of G.I pipe B class shall be based on IS 1239.

Sprinkler system not considered for electrical rooms, DG room and if any other electrical related areas.

Two level sprinkler systems will be considered for entrance lobby and lift lobby areas, if the false ceiling height is more than 800 mm.

7. ADDRESSABLE FIRE DETECTION AND ALARM SYSTEM

Addressable analogue type fire detection and alarm system shall be provided in all the floors (except parking areas) of the building as per National Building Code.

The Fire detection and alarm system shall be consisting with the following;

- Analogue Addressable Fire detection & alarm control panel and shall be located in entrance lobby (ground floor)
- Multi sensor type Smoke detectors for entire building (Except parking areas)
- Manual pull stations (break glass type)
- Electronic Hooters cum strobes
- Heat detectors considered for DG room
- Multi sensor type Smoke detectors considered for pump room, main electrical room, STP, storage rooms, AHU rooms and common other utility areas
- Duct detectors are considered in AHU rooms
- Conduits / wiring
- The integration with various systems like AHU, exhaust & emergency fans shall be done through the hard wiring further it is proposed to extend the fire alarm panel signals/indications to BMS control system for monitoring.

It is essential that when a fire breakout, it is detected as soon as possible. The earlier actions are taken, the greater possibility of minimizing damage and loss in terms of human lives and property. This includes an early warning, initiation of protection systems for safety of occupants and fire brigades and for the control of fire.

Fire detectors are essentially sensing units located at strategic locations to detect one or more of the three characteristics of a fire, smoke, heat or flame. Choice of the type of detectors for particular premises depends on the type of fire hazard present and the conditions prevailing in and around the premises. In some cases it may be useful to combine different types of detectors for early detection of fire.

Manual call points and hooters are installed at strategic location to enable easy access and audibility. In the event of fire, the occupant who is rushing through the staircase can operate the manual call point. On operation of the manual call point the control panel, which is located in the centralized location, being monitored around the clock, initiates an alarm through the electronic hooters (External sounders), while registering the affected zone.

The system shall be designed such that each loop shall limited to only 85% of its total capacity at initial installation.

All tenant fire alarm panels should be integrated with base building fire alarm panel. Same provision will be done in base builder panel.

8. PUBLIC ADDRESS SYSTEM

A public address system with a two ways conversation facility comprises speakers located at various strategic locations on different floors connected to a floor selector-switching console. The floor selector-switching console is interconnected to an amplifier of suitable wattage and a microphone. The console amplifier and microphone are installed close to the fire alarm control panel. In the event of actuation of any detector or manual call point & music on a particular floor, the fire marshal or security personnel can select the public address speaker on the affected floor by operating the particular floor switch on the switching console.

9. PORTABLE FIRE EXTINGUISHERS

The number and location of portable fire extinguishers are depends on the size and use of the building. There are different types of Extinguishers for special fires, such as carbon-di-oxide, ABC powder and Foam type etc.

Different types of Fire extinguishers have different characters and therefore, an appropriate type of Fire Extinguisher is required to be used.

Portable fire extinguishers are provided at locations mentioned below,

- ABC powder type fire extinguisher of capacity 6 kilograms fitted with gun metal cap, high pressure carbon-dioxide cartridge, with suitable mounting brackets conforming to IS: 15683:2006 all stair case areas, main switch board room, transformer, generator room, lifts and parking areas.
- Carbon dioxide type fire extinguishers of capacity 4.5 kilograms fitted with valve, discharge horn, conforming to IS: 15683:2006, located in electrical panel room and lift machine room.
- AFFF foam type fire extinguishers of 9 lts. Capacity fitted with all accessories shall be provided at D.G. Rooms and Firewater pump house.

Portable fire extinguishers are provided at locations mentioned below:

S.No.	Extinguisher	Capacity	Quantity	Location
1	Dry Chemical Powder	10 Kg	1	For every 8 cars in parking area
2	CO2	2 Kg	1	Entrance to each main switchboard room, Corridors, Staircase & lift lobbies
3	Dry Chemical Powder	5 Kg	2	EB transformer yard
4	Dry Chemical Powder	10 Kg	1	Generator room
5	CO2	2 Kg	1	Lift machine room
6	Water type gas cartridge	9 Litres	1	Each staircase landing for every floor

10. SIGNAGE

The descriptive photo luminescent safety signage in different sizes / graphics / colours / texts can be made according to the standard for the following fire equipment's / accessories / areas.

Fire hose reel, Lifts, Fire extinguishers, Emergency exits, Analogue addressable Main fire alarm panel & Sprinkler control valves & MCP's etc.

Photo luminescent safety signage plays a vital safety role in risk-prone areas and panic causing situation. When the source of light suddenly goes off, photo luminescent materials glow settles to a near continuous intensity.

Signages that are proposed are as follows.

- Fire Order Board
- Fire Exit Signage
- Floor Identification markers
- Signage near Elevators/ lifts
- Fire Extinguisher identification

11. WATER CURTAIN SYSTEM

The water curtain fire control system is designed to prevent the fire from propagating into adjacent cars and area in case of a fire incident. The system will encapsulate the fire between the water curtain sections in order to make the evaluation of people who may be trapped inside.

The present system is designed as a fire controlling system where the curtains will effectively stop the fire from propagation. The physics in this respect and the task is to create an effective water wall fire barrier. When hot smoke and air is reaching the fire curtain, the ambient temperature in this area will be significantly reduced as a function of rapid heat exchange/heat absorption. Water Curtain fire protection system, consisting of plurality of nozzles are forming a water barrier.

Considered 750 sqm each fire compartmentation as per the NBC 2016

Considered building with type-2 construction as per NBC guidelines for fire rating.

Sprinklers in a water curtain shall be suitably designed to provide a discharge of at least 35 LPM for every linear meter of openings (intended to be protected) and it shall be ensured that each sprinkler discharges at least 61.5 LPM at 1.4 bar pressure depending upon spacing between nozzles which shall not exceed 2.5M.

HVAC - INDEX

ABBREVIATIONS & NOTATIONS :

Ht	: Height
L	: Length
W	: Width
D	: Depth
M	: Meters
MM	: Milli Meters
CM	: Centi Meters
SFT	: Square Feet
SQM	: Square Meters
Wt	: Weight
Kg	: Kilo Grams
CD	: Contract Demand with Electrical supply authority
W	: Watts
KW	: Kilowatts
KVA	: Kilovolt amps
HP	: Horse Power
KV	: Kilo Volts
V	: Voltage
A	: Amps
KA	: Kilo amps
T	: Temperature in Deg .C
RH	: Relative Humidity
CFM	: Cubic Feet per Minute
LPM	: Liters per Minute
CMH	: Cubic Meters per Hour
Ltr	: Liters
KL	: Kilo Liters
GI	: Galvanized Iron
Cu	: Copper
Al	: Aluminum
PAS	: Public Address System

AIRCONDITIONING SYSTEMS

STANDARDS & CODES

1. NBC 2005 : National Building Code of India.
2. ASHARE : American society of Heating and Refrigeration Engineers.
3. ASHRAE 62.1-2007 : Ventilation for acceptable indoor quality.
4. ASHRAE 90.1-2007 : Energy standards for building.
5. IGBC : Indian green building council

ASHRAE Handbooks

a. ASHRAE Handbook 2006 : Refrigeration.

b. ASHRAE Handbook 2007 : Applications.

c. ASHRAE Handbook 2008 : System and Applications.

d. ASHRAE Handbook 2009 : Fundamentals.

STANDARDS & CODES FOR MATERIALS (Item of Work)

1) Ducting Fabrication : SMACNA
2) Galvanized Sheets : IS-277-1977
3) Glass Wool : IS-8183
4) Resin Bonded Glass Wool : IS-8183
5) Expanded Polystyrene : IS-4671
6) 3 Phase Induction Motor : IS-325
7) Starters Sheets : IS-8555
8) Specific requirement for Direct switching of Motors : IS-4064(Part II)

9) Inspection and Testing : IS-732(Part III)

10) PVC insulated electric cables : IS-1554

11) HRC cartridge fuse links : IS-2208

12) Aluminum Sheets : IS-737

13) Mild Steel Pipe : IS-1239/3589

14) Steel Pipe Flange : IS-6392

15) Horizontal Centrifugal Pump : IS-1620

16) VALVES

a) Gate, Globe and Check valve : IS-778

b) Butterfly valve of 50mm & above: IS-780, IS-2906

c) Balancing valve : IS-778

d) Non-return valve : IS-5312

17) Color Code for identification of Pipes: IS-5312

18) Borden type pressure gauges : IS-3624

BASIS OF DESIGN:

SITE	:	GOA CRUISE TERMINAL AND ANCILLIARY BUILDING.
PROJECT LOCATION	:	GOA.
REQUIREMENT	:	YEAR ROUND CONTROL OF TEMPERATURE & RELATIVE HUMIDITY
AREA	:	AS PER DRAWING.
HEIGHT	:	AS PER DRWING.
FRESH AIR	:	30% More than ASHRAE 62.1.2010.

INTRODUCTION

The work comprises of HVAC Engineering Services associated with Retail building comprising of–at GOA.

HVAC service is designed

Total Site Area : 13.4 acres.

The Project Comprises : Sea Port, Retails & Offices.

Heights of the buildings : 25 meters.

GENERAL

The purpose of air-conditioning and mechanical ventilation systems is to create a comfortable and safe environment for the occupant as well as providing effective heat removal from M&E equipment. Maintaining good indoor air quality in terms of temperature, humidity, air movement, air filtration and contaminant controls will be a prime concern. Parallel to this, the ACMV installation should not create undue noise and vibration to the premises. Special attention will thus be given to noise and vibration control to ACMV equipment and sensitive areas. Generally, air-conditioning will be provided for offices, ground floor main lobby, and lift lobby. Mechanical ventilation will be provided for lift lobbies, toilets, staircases and plant rooms.

1. BASIS OF DESIGN:

1.11	Site location.	:	GOA
1.21	Geographic location.	:	15.50° N, 73.83° E
1.31	Altitude.	:	06 meter

1.2 Outdoor Conditions As per ISHRAE Standard

The outdoor design conditions for various months have been considered as follows:

Summer:	34.8°C DB	27.5 °C WB
Monsoon:	33.9°C DB	21.6 °C WB
Winter:	30.7°C DB	26.8 °C WB

1.3 INDOOR DESIGN CONDITIONS:

Indoor design conditions for comfort Air-Conditioning spaces shall be as follows:

Retail Area& Office area

DB: 23 ± 1°C / RH: Not exceeding 60 %(however, there is no direct control on RH).

1.31 Areas Design RH

Lift lobby: 23 ± 1 ^{o}C -55%
Office Space: 23 ± 1 ^{o}C -55%
Anchor Shops: 23 ± 1 ^{o}C -55%

1.32 People Load

Occupancy: 60 square feet per person on Office area.
Occupancy: 100 square feet per person on Lift lobby and corridors.
Occupancy: 25 square feet per person on Anchor Shops.

1.33. Heat Load

Lighting load (W/sqft)- 0.8
Equipment load (W/Sqft) - 2.5
Occupancy (Sqft / Person on AC carpet area) – 60(OFFICE AREA)
Occupancy (Sqft / Person on AC carpet area) – 25(ANCHOR SHOP)

1.34. Outside Air

Outside air is considered as per ASHRAE 62.1.2010 i.e.
Office/Anchor Shop - 5 CFM per person + 0.06 CFM per Sq ft.
Cafeteria – 7.5 CFM per person + 0.18 CFM per Sq ft.
Additional 30% of outside air has been considered for LEED certification.

All the air handling shall be equipped with pre filter (MERV 8) of efficiency 90% down to 10 Microns by Gravimetric test and Space provision for Bag filter (MERV 13) shall be given in the Air handling unit casing.

1.4 NOISE LEVEL DESIGN CRITERIA

Sound and vibration control is required for both equipment and duct system, as well as in the selection of diffusers and grilles. The design of the air conditioning system shall be as under:-

Retail Area	-	NC 35 to 45
Office Area	-	NC 35 to 45

1.5 REFERENCE STANDARDS

- Relevant BIS Standards.
- ASHRAE Standards.
- ASHRAE Hand book.
  - O Systems & Equipment 2004
  - O Refrigeration 2002
  - O Fundamental 2005
  - O Application 2003

·Duct construction standards as per relevant BIS Codes and SMACNA.

·Indoor Air Quality as per ASHRAE 62.1-2010.

·National Building Code of India 2005.

System Description:

Centralized AIR Cooled Chiller has been proposed for the Terminal Building.

The proposed Chiller will be **DUAL COMPRESSOR SCREW CHILLER**. The high side equipment, Chillers, Primary and Variable Secondary Pumps, Secondary Pump VFD Panel, Closed loop Expansion Tank with automatic pressurization unit, Pot Strainer, automatic tube cleaning system for chillers, **CHW Temp IN/OUT - 12.22 / 6.67**, **Refrigerant** consider for chiller- **R134a/R407C** and all the Equipment shall be located in Service Yard/Utility building and the Chilled water is circulated to the terminal building area through **PPR-C pipes** through Shafts provided. The **AIR cooled Chillers** selected shall be suitable for GOA (Panaji) ambient conditions. Noise levels considered for chiller: **80 dba** at 1 meter. All the motors for the HVAC equipment shall be energy efficient. The Chiller plant shall be provided with a Chiller Plant Manager which shall be able to monitor and control all the equipment in the Chillers Plant Room. Chillers shall be located in **N configuration** shall have to be followed for Chillers and **N+1 configuration** for Pumps. This chiller should have a provision for **BACNET protocol**.

 # 320 TR x 1nos (1W) Air cooled dual compressor screw chillers proposed.

The Chilled water headers to be provided with isolation valves and balancing valves at each vertical. The Chilled water pipes shall be provided with nitrile rubber insulation. Automatic Air vents at the top and drain valves shall be provided for the Chilled water piping.

VERTICAL PUMP

VERTICAL SPLIT COUPLED INLINE pumps with Factory mounted on a common base with electric motor for recirculation of water for the central air conditioning system. All pumps shall be aligned properly as required and complete with mechanical seal. The pump motor shall be suitable for 415 + 10% volts, 50 cycles/second, 3-phase power supply Pump, design parameters with VFD. The Secondary and Primary pumps are proposed with VFD of **768 USPM head of 70ft**. VARIABLE SPEED PUMPING SYSTEM consisting of one number adjustable frequency drive (AFD) with each secondary pump with by-pass starter, dedicated one number microprocessor based pump controller duly downloaded with parallel pumping software for each zone and minimum 2 Nos. Sensor / Transmitters. The entire system along with secondary pumps as described above must be sourced preferably from single manufacturer only. The system shall be complete in all respects and suitable for secondary chilled water pumps.

Ceiling Suspended Unit: Fan, Aluminum filter, Filter box, 3 speed motor, 6 row deep cooling Coil, ball valve, strainer, flexible connection, air vent, with auxiliary extended insulated stainless steel sandwiched drain pan, thermostat (with heat / cool change over switch),with necessary accessories remote and sensor. For all the Lift Lobby Corridors **Ceiling Suspended Unit (CSU)** is planned, as it is easy to install and operate with working conditions.

Air Handling Unit: For GRAND ATRIUM **VERTICAL FLOOR MOUNTED AHU** is planned with Plenum box and Drum jet nozzle. Double skin construction draw thru type **VERTICAL AIR HANDLING UNITS** with 50 mm thick Sandwiched PUF insulation, 0.6mm thick precoated GI outer skin, 0.6mm thick plain GI inner skin, mixing box, RA & FA dampers, **MERV 8 filters**, 6 row deep water coil of copper tube & aluminum fins with Hydraufillic coating, Backward Curved Fan and spring isolators, Limit switches, Emergency Light, Guard for inspection door. The coil size shall be selected for a

maximum face velocity of 2.5m/s. Motor shall be inbuilt **Variable Frequency Drive** and for 415±10% volts, 50 cycles/second, 3 phase AC supply.

Chill Water Cassette Ac: For Duty Shop chill water cassette ac is planned. CASSETTE AC with Fan, Alumininum filter, Filter box, 3 speed motor, 3 row deep cooling Coil, 2 way on/off valve, ball valve with & without strainer, flexible connection, air vent, with auxiliary extended insulated stainless steel sandwiched drain pan, thermostat.

Chill Water Hiwall Split Ac: For office area chill water Hiwall Split ac is planned with Fan, Alumininum filter, Filter box, 3 speed motor, 3 row deep cooling Coil, 2 way on/off valve, ball valve with & without strainer, flexible connection, air vent, with auxiliary extended insulated stainless steel sandwiched drain pan, thermostat.

1.6 Design parameter for duct design shall be:

Maximum flow velocity for Supply Air	:	1500FPM
Maximum flow velocity for Return Air	:	1000FPM
Maximum friction for Supply Air	:	0.1inch of water
Maximum friction for Return Air	:	0.08inch of water
Maximum Velocity at Supply Air Outlet	:	500FPM

1.7. **Assumptions:**

a.	Double Pane glass pane with Aluminum frame	U = 0.44 BTU/Hr. sqft. Deg.F.(to be confirmed by client)
		Shading Co-efficient = 0.25.(to be confirmed by client)
b.	Wall 'U' value – External	0.34 BTU / Hr.sqft.deg.F.
c	Occupancy.	25 Sft Carpet area / person(Anchor Shop) 60 Sft Carpet area/ person (Offices).
d	Lighting	0.7W / Sqft on Retail Area & 0.5W/ Sqft on Common Areas.
e	Equipment	2W/Sqft on AC Area for Retail areas and 1W/Sqft on AC Area for common areas.
f	Roof 'U' value.	0.063 BTU / Hr.sqft.deg.F. **(Over deck insulation under developer scope)**

PPR-C:-

Polypropylene Random Copolymer. PPR-C is approved for the production of pipes and fittings according to DIN 8078 & DIN 16962 standards. Its physical and chemical properties are well suited to the transfer of potable water and in the heating sector.

Special features of PPR-C:-

- Anti Corrosive & Chemical Resistant
- Withstand high pressure, Low pressure drop
- Withstanding high temperature
- Hygienic Harmless
- Low noise & thermal conductivity
- Non toxic
- Low Flammability
- Resistant to Stray electric current.

System Description:

The GOA SEA PORT Project (ANCILLIARY BUILDING) is proposed to have VRF/VRV System of Air Conditioning.

- VRV/VRF type of Air Conditioning shall be provided for all the areas mentioned in the section “Basis of Design”.
- The VRF/VRV system shall be inverter-based system with R410A or suitable refrigerant. The system shall be sized taking in to account the de ration in to account for both the refrigerant piping and ambient conditions. The Unit shall deliver the desired capacity at GOA(Panaji) ambient conditions. The Outdoor Units for VRV/VRF Units shall be located in such a way that the units are easily accessible and no bypass of hot discharge air from the ODUs to the inlet of the ODU is possible. The outdoor units shall be located on RCC/PCC base with vibration isolators. The ODU selected shall be of modular construction and shall have high (COP 3.7).
- The copper piping insulation shall be 13/19 mm thick Nitrile rubber as per manufacturer’s recommendations and shall be covered with glass cloth protection.
- The indoor units shall be provided with cordless remote for temperature setting and operation with sequential operation controller wherever single room has multiple units.
- Indoor units shall be selected meeting the requirements of both the tonnage and air flow as per cooling load calculations. Type and number of Indoor Units shall be subject approval of Client.
- The IDU/ODU selection shall take in to account of the diversified nature of operation of the Site.
- UPVC Drain pipe shall be provided for all other rooms. Drain pipe shall be sloped suitable to avoid clogging and leaking and shall be run up to the nearest drain pipe. Drain piping insulation shall be 6/9 mm thick Nitrile rubber covered with glass cloth protection. The thickness of drain pipe shall be as per manufacturer’s recommendation.

TOTAL AREA

Project Name :-M/S GOA CRUISE TERMINAL				
SL.NO	**AREA NAME**	**AREA IN SMT**	**AREA IN SFT**	**AC IN TR**
1	GROUND FLOOR	5222.5	56194.1	261.75
2	FIRST FLOOR	2973.0	31989.5	144.5
	GRAND TOTAL	**8195.5**	**88183.6**	**406.3**
			AIR COOLED CHILLER	325

AIR CONDITIONING LOAD DETAILS –

Project Name :- M/S GOA CRUISE TERMINAL										
	GROUND FLOOR									
SL.NO	AREA NAME	AREA IN SMT	AREA IN SFT	HEIGHT	Occupancy	OUTSIDE AIR CFM/ SFT	OUTSIDE AIR CFM/ PERSON	OUTSIDE AIR TOTAL CFM	Required TR	SFT/TR
1	FOOD COURT	281	3024	16.4	50	181.4	252.0	563.4	12.5	241.9
2	LOBBY 1	23	247	16.4	2	14.8	12.4	35.4	1.0	247.5
3	VIP LOUNGE	133	1431	16.4	14	85.9	71.6	204.6	6.3	229.0
4	DOMESTIC ARRIVAL	544	5853	16.4	234	351.2	1170.7	1978.5	26.0	225.1
5	SHOP 1	25	269	16.4	3	16.1	15.8	41.6	1.0	269.0
6	SHOP 2	14	151	16.4	2	9.0	8.9	23.3	1.0	150.6
7	SHOP 3	14	151	16.4	2	9.0	8.9	23.3	1.0	150.6
8	SHOP 4	23	247	16.4	3	14.8	14.6	38.2	1.0	247.5
9	SHOP 5	14	151	16.4	2	9.0	8.9	23.3	1.0	150.6
10	SHOP 6	14	151	16.4	2	9.0	8.9	23.3	1.0	150.6
11	SHOP 7	23	247	16.4	3	14.8	14.6	38.2	1.0	247.5
12	SHOP 8	14	151	16.4	2	9.0	8.9	23.3	1.0	150.6
13	SHOP 9	14	151	16.4	2	9.0	8.9	23.3	1.0	150.6
14	SHOP 10	23	247	16.4	3	14.8	14.6	38.2	1.0	247.5
15	SHOP 11	14	151	16.4	2	9.0	8.9	23.3	1.0	150.6
16	SHOP 12	14	151	16.4	2	9.0	8.9	23.3	1.0	150.6
17	SHOP 13	23	247	16.4	3	14.8	14.6	38.2	1.0	247.5
18	SHOP 14	14	151	16.4	2	9.0	8.9	23.3	1.0	150.6
19	SHOP 15	14	151	16.4	2	9.0	8.9	23.3	1.0	150.6
20	SHOP 16	23	247	16.4	3	14.8	14.6	38.2	1.0	247.5
21	SHOP 17	55	592	16.4	7	35.5	34.8	91.4	2.5	236.7
22	SECURITY	37	398	16.4	5	23.9	23.4	61.5	1.5	265.4
23	LOBBY 2	54	581	16.4	6	34.9	29.1	83.1	2.5	232.4
24	WAITING+CHECK IN	584	6284	32.8	180	377.0	897.7	1657.1	28.0	224.4
25	E-SECURITY SCREENING	156	1679	16.4	67	100.7	335.7	567.4	7.0	239.8
26	DOMESTIC DEPATURE	404	4347	16.4	174	260.8	869.4	1469.3	20.0	217.4
27	STAFF ROOM	30	323	16.4	3	19.4	16.1	46.2	1.5	215.2
28	SECURITY OFFICE	13	140	16.4	1	8.4	7.0	20.0	1.0	139.9
29	GRAND LOBBY	956	10287	49.2	129	617.2	642.9	1638.1	46.0	223.6
30	BAGGAGE SCREENING + SELF CHECK IN	56.5	608	32.8	24	36.5	121.6	205.5	3.0	202.6
31	INTERNATIONAL DEPATURE	322	3465	32.8	139	207.9	692.9	1171.1	15.0	231.0
32	E-SECURITY SCREENING	116	1248	32.8	50	74.9	249.6	421.9	5.5	226.9
33	OFFICES	14	151	32.8	6	9.0	30.1	50.9	1.0	150.6
34	CUSTOM OFFICERS CABIN	10	108	32.8	3	6.5	15.4	28.4	1.0	107.6
35	LUGGAGE HANDLING ROOM	20	215	32.8	2	12.9	10.0	29.8	1.0	215.2
36	LOST BAGGAGE COUNTER	10	108	32.8	1	6.5	5.4	15.4	1.0	107.6
37	CUSTOM OFFICERS CABIN	10	108	32.8	3	6.5	15.4	28.4	1.0	107.6
38	CUSTOM OFFICERS CABIN	10	108	32.8	2	6.5	10.0	21.4	1.0	107.6
39	OFFICES	14	151	32.8	2	9.0	9.4	24.0	1.0	150.6
40	MONITORING OFFICE	16	172	32.8	7	10.3	34.4	58.2	1.0	172.2
41	SECURITY OFFICE	10	108	32.8	4	6.5	21.5	36.4	1.0	107.6
42	DUTY FREE SHOP	10	108	32.8	4	6.5	21.5	36.4	1.0	107.6
43	DUTY FREE SHOP	10	108	32.8	4	6.5	21.5	36.4	1.0	107.6
44	DUTY FREE SHOP	10	108	32.8	4	6.5	21.5	36.4	1.0	107.6
45	IMMIGRATION	307	3303	32.8	132	198.2	660.7	1116.5	15.0	220.2
46	WAITING AREA	80	861	32.8	2	51.6	10.0	80.1	4.0	215.2
47	INTERNATIONAL ARRIVAL	184	1980	32.8	79	118.8	396.0	669.2	10.0	198.0
48	INTERNATIONAL ARRIVAL EXIT	70	753	32.8	22	45.2	107.6	198.6	3.5	215.2
49	INTL. ARRIVAL LOUNGE	155	1668	32.8	67	100.1	333.6	563.7	8.0	208.5
50	INTL. DEPARTURE LOUNGE	194	2087	32.8	83	125.2	417.5	705.6	10.0	208.7
51	CAFÉ 1	11	118	32.8	3	7.1	15.0	28.7	1.0	118.4
52	CAFÉ 2	11	118	32.8	3	7.1	15.0	28.7	1.0	118.4
53	CAFÉ 3	11	118	32.8	3	7.1	15.0	28.7	1.0	118.4
54	CAFÉ 4	11	118	32.8	3	7.1	15.0	28.7	1.0	118.4
		5222.5	56194.1						261.8	

	FIRST FLOOR											
		AREA IN	AREA IN			OUTSIDE AIR			Inside Conditions		Required	SFT
SL.NO	AREA NAME	SMT	SFT	HEIGHT	Occupancy	CFM/ SFT	CFM/ PERSON	TOTAL CFM	TEMP	RH %	TR	TR
1	FOOD COURT	414	4455	16.4	127	267.3	636.4	1174.8	22+/-1	55.0	20.0	222.7
2	PRIORITY CLUB	522	5617	16.4	160	337.0	802.4	1481.2	22+/-1	55.0	25.0	224.7
3	LOBBY ORRIDOR	162	1743	16.4	17	104.6	87.2	249.3	22+/-1	55.0	8.0	217.9
4	OFFICES	454	4885	16.4	49	293.1	244.3	698.6	22+/-1	55.0	22.0	222.0
5	OFFICES	130	1399	16.4	56	83.9	279.8	472.8	22+/-1	55.0	6.5	215.2
6	PREMMIUM LOUNGE 1	430	4627	16.4	93	277.6	462.7	962.4	22+/-1	55.0	21.0	220.3
7	PREMMIUM LOUNGE 2	720	7747	16.4	155	464.8	774.7	1611.4	22+/-1	55.0	35.0	221.3
8	DUTY FREE STORE	53	570	16.4	6	34.2	28.5	81.6	22+/-1	55.0	2.5	228.1
9	DUTY FREE STORE	35	377	16.4	4	22.6	18.8	53.9	22+/-1	55.0	2.0	188.3
10	DUTY FREE STORE	53	570	16.4	6	34.2	28.5	81.6	22+/-1	55.0	2.5	228.1
		2973.0	31989.5								144.5	
		8195.5	88183.6								406.3	

Project Name :- M/S GOA ANCILLIARY BUILDING				
SL.NO	AREA NAME	AREA IN	AREA IN	AC IN
		SMT	SFT	TR
1	GROUND FLOOR	864.0	9296.6	49.8
2	FIRST FLOOR	2330.0	25070.8	128.8
	GRAND TOTAL	3194.0	34367.4	178.6

Project Name :- M/S GOA ANCILLIARY BUILDING										
	GROUND FLOOR									
	AREA NAME	AREA IN	AREA IN	HEIGHT FT	Occupancy	OUTSIDE AIR			Required	SFT
SL.NO		SMT	SFT			CFM/ SFT	CFM/ PERSON	TOTAL CFM	TR	TR
1	MARKET HALL - 1	419	4508	17.7	129	270.5	644.1	1188.9	24.8	182
2	MARKET HALL - 2	445	4788	17.7	137	287.3	684.0	1262.7	25.0	192
		864.0	9296.6						49.8	
	FIRST FLOOR									
	AREA NAME	AREA IN	AREA IN	HEIGHT	Occupancy	OUTSIDE AIR			Required	SFT
SL.NO		SMT	SFT			CFM/ SFT	CFM/ PERSON	TOTAL CFM	TR	TR
1	OFFICE 1	80	861	13.6	34	51.6	172.2	291.0	4.6	187
2	OFFICE 2	67	721	13.6	29	43.3	144.2	243.7	4.0	180
3	OFFICE 3	65	699	13.6	28	42.0	139.9	236.4	4.0	175
4	OFFICE 4	35	377	13.6	15	22.6	75.3	127.3	2.0	188
5	OFFICE 5	35	377	13.6	15	22.6	75.3	127.3	2.0	188
6	OFFICE 6	35	377	13.6	15	22.6	75.3	127.3	2.0	188
7	OFFICE 7	35	377	13.6	15	22.6	75.3	127.3	2.0	188
8	OFFICE 8	35	377	13.6	15	22.6	75.3	127.3	2.0	188
9	OFFICE 9	70	753	13.6	30	45.2	150.6	254.6	4.0	188
10	OFFICE 10	35	377	13.6	15	22.6	75.3	127.3	2.0	188
11	OFFICE 11	35	377	13.6	15	22.6	75.3	127.3	2.0	188
12	OFFICE 12	35	377	13.6	15	22.6	75.3	127.3	2.0	188
13	OFFICE 13	71	764	13.6	31	45.8	152.8	258.2	4.0	191
14	OFFICE 14	52	560	13.6	22	33.6	111.9	189.1	3.2	175
15	CORRIDOR	206	2217	13.6	22	133.0	110.8	317.0	10.0	222
16	STREET	335	3605	31.3	36	216.3	180.2	515.5	16.0	225
17	LOBBY + CORRIDOR	280	3013	31.3	30	180.8	150.6	430.8	17.0	177
18	MARKET HALL - 3	435	4681	31.3	134	280.8	668.7	1234.3	24.0	195
19	MARKET HALL - 4	217	2335	31.3	67	140.1	333.6	615.8	12.0	195
20	LOBBY 1	172	1851	31.3	19	111.0	92.5	264.7	10.0	185
		2330.0	25070.8						128.8	
		3194.0	34367.4						178.6	

POWER LOAD DETAILS:

Project Name :- M/S GOA CRUISE TERMINAL								
	GROUND FLOOR							
	AREA NAME	TYPE OF	AC	AC QTY	TOTAL	AC		TOTAL
SL.NO		AC	TR		TR	KW	QTY	KW
1	FOOD COURT	CSU	6.3	1	6.3	2.5	1	2.5
			6.3	1	6.3	2.5	1	2.5
2	LOBBY 1	FCU	1.0	1	1.0	0.4	1	0.4
3	VIP LOUNGE	CSU	6.3	1	6.3	2.5	1	2.5
4	DOMESTIC ARRIVAL	AHU	26.0	1	26.0	10.4	1	10.4
5	SHOP 1	FCU	1.0	1	1.0	0.4	1	0.4
6	SHOP 2	FCU	1.0	1	1.0	0.4	1	0.4
7	SHOP 3	FCU	1.0	1	1.0	0.4	1	0.4
8	SHOP 4	FCU	1.0	1	1.0	0.4	1	0.4
9	SHOP 5	FCU	1.0	1	1.0	0.4	1	0.4
10	SHOP 6	FCU	1.0	1	1.0	0.4	1	0.4
11	SHOP 7	FCU	1.0	1	1.0	0.4	1	0.4
12	SHOP 8	FCU	1.0	1	1.0	0.4	1	0.4
13	SHOP 9	FCU	1.0	1	1.0	0.4	1	0.4
14	SHOP 10	FCU	1.0	1	1.0	0.4	1	0.4
15	SHOP 11	FCU	1.0	1	1.0	0.4	1	0.4
16	SHOP 12	FCU	1.0	1	1.0	0.4	1	0.4
17	SHOP 13	FCU	1.0	1	1.0	0.4	1	0.4
18	SHOP 14	FCU	1.0	1	1.0	0.4	1	0.4
19	SHOP 15	FCU	1.0	1	1.0	0.4	1	0.4
20	SHOP 16	FCU	1.0	1	1.0	0.4	1	0.4
21	SHOP 17	FCU	2.5	1	2.5	1	1	1
22	SECURITY	FCU	1.5	1	1.5	0.6	1	0.6
23	LOBBY 2	FCU	2.5	1	2.5	1	1	1
24	WAITING+CHECK IN	AHU	35.0	1	35.0	14	1	14
25	E-SECURITY SCREENING				0.0	0		0
26	DOMESTIC DEPATURE	AHU	10.0	1	10.0	4	1	4
27		AHU	11.5	1	11.5	4.6	1	4.6
28	STAFF ROOM				0.0	0		0
29	SECURITY OFFICE	FCU	1.0	1	1.0	0.4	1	0.4
30	GRAND LOBBY	AHU	11.5	1	11.5	4.6	1	4.6
31		AHU	11.5	1	11.5	4.6	1	4.6
32		AHU	11.5	1	11.5	4.6	1	4.6
33		AHU	11.5	1	11.5	4.6	1	4.6
34	BAGGAGE SCREENING + SELF CHECK IN	FCU	3.0	1	3.0	1.2	1	1.2
35	OFFICES	FCU	1.0	1	1.0	0.4	1	0.4
36	CUSTOM OFFICERS CABIN	FCU	1.0	1	1.0	0.4	1	0.4
37	LUGGAGE HANDLING ROOM	FCU	1.0	1	1.0	0.4	1	0.4
38	LOST BAGGAGE COUNTER	FCU	1.0	1	1.0	0.4	1	0.4
39	CUSTOM OFFICERS CABIN	FCU	1.0	1	1.0	0.4	1	0.4
40	CUSTOM OFFICERS CABIN	FCU	1.0	1	1.0	0.4	1	0.4
41	OFFICES	FCU	1.0	1	1.0	0.4	1	0.4
42	MONITORING OFFICE	FCU	1.0	1	1.0	0.4	1	0.4
43	SECURITY OFFICE	FCU	1.0	1	1.0	0.4	1	0.4
44	DUTY FREE SHOP	FCU	1.0	1	1.0	0.4	1	0.4
45	DUTY FREE SHOP	FCU	1.0	1	1.0	0.4	1	0.4
46	DUTY FREE SHOP	FCU	1.0	1	1.0	0.4	1	0.4
47	INTERNATIONAL DEPATURE							
48	E-SECURITY SCREENING	AHU	28.0	1	28.0	11.2	1	11.2
49	IMMIGRATION							
50								
51	WAITING AREA	AHU	21.5	1	21.5	8.6	1	8.6
52	INTERNATIONAL ARRIVAL							
53	INTERNATIONAL ARRIVAL EXIT	CSU	3.5	1	3.5	1.4	1	1.4
54	INTL. ARRIVAL LOUNGE	AHU	18.0	1	18	7.2	1	7.2
55	INTL. DEPARTURE LOUNGE							
56	CAFÉ 1	FCU	1.0	1	1.0	0.4	1	0.4
57	CAFÉ 2	FCU	1.0	1	1.0	0.4	1	0.4
58	CAFÉ 3	FCU	1.0	1	1.0	0.4	1	0.4
59	CAFÉ 4	FCU	1.0	1	1.0	0.4	1	0.4
					261.8			104.7
	FIRST FLOOR							
	AREA NAME	TYPE OF	AC	AC QTY	TOTAL	AC		TOTAL
SL.NO		AC	TR		TR	KW	QTY	KW
1	FOOD COURT	CSU	10.0	1	10	4	1	4
		CSU	10.0	1	10	4	1	4
2	PRIORITY CLUB	CSU	8.0	1	8	3.2	1	3.2
		CSU	8.0	1	8	3.2	1	3.2
		CSU	8.0	1	8	3.2	1	3.2
3	LOBBY CORRIDOR	CSU	8.0	1	8	3.2	1	3.2
4	OFFICES	CSU	11.0	1	11	4.4	1	4.4
		CSU	11.0	1	11	4.4	1	4.4
5	OFFICES	CSU	6.5	1	6.5	2.6	1	2.6
6	PREMMIUM LOUNGE 1	AHU	21.0	1	21	8.4	1	8.4
7	PREMMIUM LOUNGE 2	AHU	35.0	1	35	14	1	14
8	DUTY FREE STORE	FCU	2.5	1	2.5	1	1	1
9	DUTY FREE STORE	FCU	2.0	1	2	0.8	1	0.8
10	DUTY FREE STORE	FCU	2.5	1	2.5	1	1	1
					143.5			57.4
				TOTAL TR =	405.3		TOTAL KW =	162.1

Project Name :- M/S GOA, ANCILLIARY BUILDING.		
	AREA NAME	TOTAL
SL.NO		KW
1	GROUND FLOOR IDU POWER	6.7
2	FIRST FLOOR IDU POWER	7.6
3	GROUND FLOOR ODU POWER	83.2
4	FIRST FLOOR ODU POWER	89.6
		187.1

Project Name :- M/S GOA, ANCILLIARY BUILDING.								
	GROUND FLOOR							
	AREA NAME	TYPE OF	AC	AC QTY	TOTAL	AC		TOTAL
SL.NO		AC	TR		TR	KW	QTY	KW
1	MARKET HALL 1	CASS	2.3	2	4.6	0.11	2	0.22
		CASS	2.0	6	12.0	0.11	6	0.66
		CASS	3.2	1	3.2	0.163	1	0.163
		CSU	5.0	1	5.0	0.67	1	0.67
2	MARKET HALL 2	CASS	2.0	10	20	0.11	10	1.1
		CSU	5.0	1	5.0	0.67	1	0.67
3	MARKET HALL 3	CSU	8.0	3	24.0	0.7	3	2.1
4	MARKET HALL 4	CSU	4.0	1	4	0.4	1	0.4
		CSU	8.0	1	8.0	0.7	1	0.7
					85.8			6.7
	FIRST FLOOR							
	AREA NAME	TYPE OF	AHU	AHU QTY	TOTAL	AHU		TOTAL
SL.NO		AC	TR		TR	KW	QTY	KW
1	OFFICE 1	CASS	2.3	2	4.6	0.11	2	0.22
2	OFFICE 2	CASS	2.0	2	4.0	0.11	2	0.22
3	OFFICE 3	CASS	2.0	2	4.0	0.11	2	0.22
4	OFFICE 4	CASS	2.0	1	2.0	0.11	1	0.11
5	OFFICE 5	CASS	2.0	1	2.0	0.11	1	0.11
6	OFFICE 6	CASS	2.0	1	2.0	0.11	1	0.11
7	OFFICE 7	CASS	2.0	1	2.0	0.11	1	0.11
8	OFFICE 8	CASS	2.0	1	2.0	0.11	1	0.11
9	OFFICE 9	CASS	2.0	2	4.0	0.11	2	0.22
10	OFFICE 10	CASS	2.0	1	2.0	0.11	1	0.11
11	OFFICE 11	CASS	2.0	1	2.0	0.11	1	0.11
12	OFFICE 12	CASS	2.0	1	2.0	0.11	1	0.11
13	OFFICE 13	CASS	2.0	2	4.0	0.11	2	0.22
14	OFFICE 14	CASS	3.2	1	3.2	0.163	1	0.163
15	CORRIDOR	CSU	5.0	2	10.0	0.67	2	1.34
16	LOBBY	CSU	5.0	2	10.0	0.67	2	1.34
17	CORRIDOR+ LOBBY	CSU	5.0	1	5.0	0.67	2	1.34
18		CSU	6.0	2	12.0	0.7	2	1.4
18	STREET	CSU	8.0	2	16.0	0.7	2	1.4
					92.8			9.0

WATER FLOW GPM PER FLOOR DETAIL:

GREEN BUILDING FEATURES ADOPTED IN THE PROJECT:

e. FUNDAMENTAL REFRIGERANT MANAGEMENT**:** Reduce ozone depletion. Aim for zero use of CFC based refrigerants in the HVAC&R equipment's. The refrigerant selected for the HVAC&R application for the building to minimize or eliminate the emission of compounds that contribute to ozone depletion and global warming. The base building HVAC&R equipment shall have only CFC& HCFC free refrigerant, i.e.**R134A / R407C / R410A / R123.**

f. EA 1: FUNDAMENTAL COMMISSIONING OF THE BUILDING ENERGY SYSTEMS: The project team shall appoint a dedicated commissioning team, who are not involved in design & do not belong to any of the firms involved in design of the project, as a commissioning authority. Proposed commissioning team having hands on experience in commissioning electro-mechanical system typically installed in commercial / office buildings shall be involved. Experience of the commissioning team proposed for the project shall meet LEED guide lines stipulated in reference guide version 2.0.

g. EQ CREDIT 7: Thermal comfort: Provide a comfortable thermal environment that supports the productivity and well-being of building occupants; the designed hvac system will be meeting the requirements of Ashrae standard 55 – 2010.

h. MANDATORY OUTDOOR AIR REQUIREMENT: 5 cfm per person + 0.06 cfm/Sq.ft meeting Ashrae standards.

h. ENHANCED VENTILATION : 30% additional fresh air over and above Ashrae standards

5. DETAILS ON LOW SIDE WORKS

FOLLOWING ARE THE LOW SIDE DETAILS FOR THE ABOVE HVAC WORKS:

- Sheet metal ducting shall be factory fabricated and shall be as per SMACNA Standards.

2. Extruded Aluminum powder coated Grilles / Diffusers shall be utilized for both supply air and return air diffusers.
3. Factory fabricated insulated flexible ducts to be used for inter connection of the supply air duct and the diffuser / grille.
4. The flexible ducts used to tap supply air shall be of high quality thermally insulated duct. The thickness of the insulation shall be 25 mm thick and the density shall be not less than of 16 kg / cum. The inner core of the flexible duct shall be of PVC / tough aluminum material bonded with stainless steel spirally reinforced wire. The outer jacket is made out of very tough spirally reinforced multiple layer aluminum laminated construction.
5. Supply air ducts shall be treated thermally and acoustically for re-ducting the noise levels through the initial ducts from the unit and to reduce the. For the same fiber glass wool or nitrile rubber can be used.

Table 5-2: Ductwork Insulation (m^2 - ^0C/ W):

Duct Location	Required Insulation [a] Supply Ducts	Return Ducts
Exterior	R-1.4	R-0.6
Ventilated Attic	R-1.4	R-0.6
Unventilated Attic without Roof Insulation	R-1.4	R-0.6
Unventilated Attic with Roof Insulation	R-0.6	No Requirement
Unconditioned Space [b]	R-0.6	No Requirement
Indirectly conditioned Space [c]	No Requirement	No Requirement
Buried	R-0.6	No Requirement

[a] Insulation R-value is measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 24 ^{o} C (75 ^{o} F) at the installed thickness.

[b] Includes crawlspaces both ventilated and non ventilated.

[C] Include return air plenums with or without exposed roofs above.

TOILET VENTILATION

All toilets have been considered with exhaust system which will be ventilated at a rate of 18 ACPH. For **Toilets within the core,** Centralized exhaust fans are located at terrace catering to each floor through riser duct through shafts. Constant Air flow regulators are planned at each floor level branches for proper balancing. Toilet exhaust fans shall be designed to meet minimum criteria as N/2 X 2 Nos.

Toilets close to peripheral walls; localized exhaust system is planned with ducted inline fans mounted at ceiling level. Exhaust shall be thrown out at the same level through louvers located on peripheral walls.

M/s GOA CRUISE TERMINAL									
ilet Ventilation									
(GROUND FLOOR)									
	LEFT SIDE								
		Area	Area	Height	ACPH	capacity			
Gents Toilet		SMT	SFT	Ft		CFM	NOS	TOTAL CFM	
1	TOILET	14.2	152.8	11.97	18	549	2	1097	1100
2	TOILET	1.5	16.1	11.97	18	58	2	116	120
3	TOILET	1.5	16.1	11.97	18	58	2	116	120
4	TOILET	1.5	16.1	11.97	18	58	2	116	120
						TOTAL CFM			1460
		Area	Area	Height	ACPH				
Ladies Toilet		SMT	SFT	Ft			NOS	TOTAL CFM	
1	TOILET	8.1	87.2	11.97	15	261	2	522	520
2	TOILET	1.63	17.5	11.97	18	63	2	126	130
3	TOILET	1.63	17.5	11.97	18	63	2	126	130
4	TOILET	1.63	17.5	11.97	18	63	2	126	130
5	TOILET	1.63	17.5	11.97	18	63	2	126	130
						TOTAL CFM			1040
1	JC	1.57	16.9	11.97	18	61	2	121	130
						TOTAL CFM			2630

	RIGHT SIDE								
		Area	Area	Height	ACPH	capacity			
Gents Toilet		SMT	SFT	Ft		CFM			
1	TOILET	15.84	170.4	11.97	18	612			600
2	TOILET	1.58	17.0	11.97	18	61			60
3	TOILET	1.58	17.0	11.97	18	61			60
4	TOILET	1.58	17.0	11.97	18	61			60
						TOTAL CFM			780
		Area	Area	Height	ACPH				
Ladies Toilet		SMT	SFT	Ft					
1	TOILET	7.1	76.4	11.97	15	229			230
2	TOILET	1.5	16.1	11.97	18	58			60
3	TOILET	1.5	16.1	11.97	18	58			60
4	TOILET	1.5	16.1	11.97	18	58			60
5	TOILET	1.5	16.1	11.97	18	58			60
						TOTAL CFM			470
		Area	Area	Height	ACPH	capacity			
Gents Toilet		SMT	SFT	Ft		CFM			
1	TOILET	20	215.2	11.97	18	773			770
2	TOILET	1.5	16.1	11.97	18	58			60
3	TOILET	1.5	16.1	11.97	18	58			60
4	TOILET	1.5	16.1	11.97	18	58			60
5	TOILET	1.5	16.1	11.97	18	58			60
						TOTAL CFM			1010
		Area	Area	Height	ACPH				
Ladies Toilet		SMT	SFT	Ft					
1	TOILET	9.78	105.2	11.97	15	315			320
2	TOILET	1.94	20.9	11.97	18	75			75
3	TOILET	1.94	20.9	11.97	18	75			75
4	TOILET	1.94	20.9	11.97	18	75			75
5	TOILET	1.94	20.9	11.97	18	75			75
						TOTAL CFM			620
1	STAFF TOI	19.9	214.1	11.97	18	769			770
						TOTAL CFM			3650

RIGHT SIDE DOWN									
		Area	Area	Height	ACPH	capacity			
Gents Toilet		SMT	SFT	Ft		CFM			
1	TOILET	17.4	187.2	11.97	18	672			670
2	TOILET	1.5	16.1	11.97	18	58			60
3	TOILET	1.5	16.1	11.97	18	58			60
4	TOILET	1.5	16.1	11.97	18	58			60
5	TOILET	1.5	16.1	11.97	18	58			60
						TOTAL CFM			910
		Area	Area	Height	ACPH				
Ladies Toilet		SMT	SFT	Ft					
1	TOILET	15.5	166.8	11.97	15	499			500
2	TOILET	1.5	16.1	11.97	18	58			60
3	TOILET	1.5	16.1	11.97	18	58			60
4	TOILET	1.5	16.1	11.97	18	58			60
5	TOILET	1.5	16.1	11.97	18	58			60
						TOTAL CFM			740
1	PH	5.4	58.1	11.97	18	209			200
						TOTAL CFM			1850

RIGHT SIDE CORNER									
		Area	Area	Height	ACPH	capacity			
Gents Toilet		SMT	SFT	Ft		CFM			
1	TOILET	24.9	267.9	11.97	18	962			970
2	TOILET	1.5	16.1	11.97	18	58			60
3	TOILET	1.5	16.1	11.97	18	58			60
4	TOILET	1.5	16.1	11.97	18	58			60
						TOTAL CFM			1150
		Area	Area	Height	ACPH				
Ladies Toilet		SMT	SFT	Ft					
1	TOILET	17	182.9	11.97	15	547			550
2	TOILET	1.78	19.2	11.97	18	69			70
3	TOILET	1.78	19.2	11.97	18	69			70
4	TOILET	1.78	19.2	11.97	18	69			70
5	TOILET	1.78	19.2	11.97	18	69			70
6	TOILET	1.78	19.2	11.97	18	69			70
						TOTAL CFM			900
1	PH	6.4	68.9	11.97	18	247			250
						TOTAL CFM			2300

STP VENTILATION:

Forced exhaust system at 30 ACPH is planned and 85% fresh air is provided to keep the area under negative pressure. Exhaust fans are located in terrace or required location as per the site while fresh air fans are planned within STP as ceiling mounted and fresh air intake from the cut-out provided at podium level.

PUMP ROOM VENTILATION:

Forced exhaust system at 15 ACPH is planned and 85% fresh air is provided to keep the area under negative pressure. Exhaust fans are located in basement ceiling, while fresh air shall be planned with louvers provided facing basement area.

DG VENTILATION:

DG fresh air is considered at a rate of 60 cfm/kva. Necessary cutout @ 500 fpm is planned in ceiling/wall. Hot air chamber is considered for DG radiator exhaust.

ELECTRICAL ROOM VENTILATION:

Forced exhaust system at 15 ACPH is planned and fresh air is planned through louvers provided on peripheral wall or duct system as per the site.

6. BUILDING MANAGEMENT SYSTEM

PROPOSED SYSTEM

The main objective of the Building Automation System is to carry out control of HVAC systems and monitor the Electrical Services, Pumping equipment, water storage and Fire pumps in order to reduce the running and energy costs and to improve the quality of information on Air conditioning, Electrical and other allied systems in the building.

COCHIN PORT TRUST

Civil Engineering Department

E-Tender No. T15/T-1946/2021-C

Construction of International and Domestic Cruise Terminal and Other Allied Facilities at Mormugao Port Trust

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