26.5 mm	55–90	50–80	100
9.50 mm			
4.75 mm	10–30	15–35	25–45
2.36 mm			
0.425 mm			
0.075 mm	< 10	< 10	< 10
CBR Value (Minimum)	30	25	20

Note : The material passing 425 micron (0.425 mm) sieve for all the three gradings when tested according to IS : 2720 (Pan 5) shall have liquid limit and plasticity index not more than 25 and 6 per cent respectively.

10.3 Strength of sub-base

It shall be ensured prior to actual execution that the material to be used in the sub-base satisfies the requirements of CBR and other physical requirements when compacted and finished.

When directed by the Engineer, this shall be verified by performing CBR tests in the laboratory as required on specimens remoulded at field dry density and moisture content and any other tests for the "quality" of materials, as may be necessary.

10.4 Construction Operations

10.4.1 Preparation of sub-grade : Immediately prior to the laying of sub-base, the sub-grade already finished to Clause 5 or 6 as applicable shall be prepared by removing all vegetation and other extraneous matter, lightly sprinkled with water if necessary and rolled with two passes of 80 -100 KN smooth wheeled roller.

10.4.2. Spreading and compacting: The sub-base material of grading specified in the Contract shall be spread on the prepared sub-grade with the help of a motor grader of adequate capacity, its blade having hydraulic controls suitable for initial adjustment and for maintaining the required slope and grade during the operation or other means as approved by the Engineer.

When the sub-base material consists of combination of materials mentioned in Clause 10.2.1, mixing shall be done mechanically by the mix-in-place method.

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

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

by mechanical or other approved means like disc harrows, rotavators until the layer is uniformly wet.

Immediately thereafter, rolling shall start. If the thickness of the compacted layer does not exceed 100 mm, a smooth wheeled roller of 80 to 100 KN weight may be used. For a compacted single layer upto 225 mm the compaction shall be done with the help of a vibratory roller of minimum 80 to 100 kN static weight with plain drum or pad foot-drum or heavy pneumatic tyred roller of minimum 200 to 300 kN weight having a minimum tyre pressure of 0.7 MN/m2 or equivalent capacity roller capable of achieving the required compaction. Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional cross fall and super-elevation and shall commence at the edges and progress towards the centre for portions having cross fall on both sides.

Each pass of the roller shall uniformly overlap not less than one-third of the track made in the preceding pass. During rolling, the grade and cross fall (camber) shall be checked and any high spots or depressions, which become apparent, corrected by removing or adding fresh material. The speed of the roller shall not exceed 5 km per hour.

Rolling shall be continued till the density achieved is at least 98 per cent of the maximum dry density for the material determined as per IS:2720 (Part 8). The surface of any layer of material on completion of compaction shall be well closed, free from movement under compaction equipment and from compaction planes, ridges, cracks or loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of layer and re-compacted.

10.4.3 Surface Finish and Quality Control of Work

The surface finish of construction shall conform to the requirements of Clause 902 of Quality Control of Road works Section 900 of MoRTH Specfications.

Control on the quality of materials and works shall be exercised by the Engineer in accordance with Section 900 of MoRTH specifications.

10.4.4 Arrangements for Traffic

During the period of construction, no traffic shall be allowed over the area.

10.5 Materials

Cement concrete: The cement concrete shall generally conform to specifications for ordinary concrete. The coarse aggregates shall be carefully selected, sufficiently tough and hard stone pieces broken in a manner that will provide particles of approximately cubical shape affording good interlocking. The maximum size of coarse aggregate shall be 12 mm. The fine aggregate shall consist of properly graded particles. The proportion of mix shall not be of the grade below M20 {1: 1.5: 3 (1 cement: 1.5 coarse sand: 3 stone aggregate)}. The least amount of mixing water that will produce a workable mix and will allow finishing without excessive trowelling shall be used. Generally a water cement ratio of 0.5 should suffice.

10.6 Workmanship

The sub-grade in all cases shall be formed to proper levels and slopes, well compacted and cured. The top surface shall be kept slightly rough.

The surface of the sub-grade shall be cleaned off all loose materials and moistened immediately before laying the concrete floor. The concrete paving shall be laid in alternate

bays not exceeding 6.25 sq.m (about 64 sf.ft) each. At least 48 hours shall elapse before the concreting in the adjacent bays is commenced.

The concrete shall be laid immediately after mixing. While being placed the concrete shall be vigorously sliced and spaded with suitable tools to prevent formation of voids or honey comb pockets. The concrete shall be brought to the specified levels by means of a heavy straight edge resting on the side forms and drawn ahead with a sawing motion in combination with a series of lifts and drops alternating with small lateral shifts. While concreting the adjacent bays care shall be taken to ensure that the edges of previously laid bays are not broken by careless or hard tamping.

10.7 Screeding

After poring concrete in place, it shall be compacted, in wet condition, by screed vibrator run over the steel channel shuttering pressing concrete surface matched with the top of steel channel shuttering spaced not more than 4.0 meters apart. Poker vibrators will be used to vibrate the laid concrete thoroughly with minimum 40 mm dia needles. On completion of laying of approximate 2m to 2.5m length the surface vibrator then be run over the concrete surface to achieve better overall compaction of concrete. Water cement ratio shall be just sufficient to make concrete workable. Screed shall be run at least twice to achieve well compacted & level surface.

Undulations on the concrete surface shall be rectified immediately by local patching, in wet state of concrete.

After striking off the surfaces to the required grade concrete shall be compacted with a wooden float. The blows shall be fairly heavy in the beginning but as consolidation takes place, light rapid strokes shall be given to complete the ramming.

No dry cement or mixture of dry cement and sand shall be sprinkled directly on the surface of the concrete to absorb moisture or to stiffen the mix.

After the concrete in the bays has set, the joints of the panels shall be filled with cement cream or with suitable bitumastic compound as shown on the drawings or directed by the Engineer-in-Charge.

Vertical edge of the bays shall be neatly marked on the surface of the concrete with a pointed trowel after filling the joints.

Brooming: When concrete is in final stage of plastic state, the pavement shall be given broom finish with approved steel / fibre broom. The broom shall be pulled gently over the pavement surface from edge to edge (perpendicular to centre line of the road). Brooming shall be completed before concrete passes plastic state.

Curing: Curing shall start on the next day after finishing and shall be continued for 14 days.

Curing shall not be commenced until the top layer has hardened. Covering with empty gunnies shall be avoided as the colour of the flooring is likely to be bleached due to the remanents of cement dust from the bags.

J. LANDSCAPING ENGINEERING

1.0 SCOPE

1.1 General Scope of Work

The scope of work of this package is shown on the drawings, tech. Specifications, the Planting Schedule (given at the end of this specification section) and any other instructions defined in this document.

The scope of work comprises but is not limited to the following;

Supply all of plants associated with landscape, water feature and related mechanical works, special lighting, other related structures.

1.2 Detailed Scope of Work

1.2.1 Construction

1.2.1.1 Planting for landscape, backfilling and leveling, refilling

2.0 SUBMISSIONS:

(To be provided by Contractor)

- Construction method statement
- Shop drawings
- Site organization chart
- Detail work schedule
- Site progress schedule report
- Site safety organization chart
- Site photos
- Construction records. QA/AC records
- Purchase orders, delivery orders
- As built drawings and documentation
- One CD containing soft copies of all the drawings produced

3.0 TECHNICAL SPECIFICATIONS

3.1 Garden Works

3.1.1 Scope of Work

This section includes execution of landscape (softscape) work as per the design drawings and the planting schedule included herein. It includes all labors, materials, tools, power supply, transportation, handle, follow-up care, direct or indirect works (supplementary or replacement included) indicated on the Contract drawings, which are necessary to complete all the newly planted avenue trees in all the streets ,shrubs, ground covers, accent plants(specimen plants) at the entrance ,four rain gardens behind administration buildings, shrub plantations & tree plantations at traffic island / medians ,flower beds at guard house.(.All the associated expense has been covered in the unit price of the Contract.

3.2 Planting Materials

3.2.1 Select Young Trees in Nursery Garden

3.2.1 The Contractor shall submit in writing to client the supply sources on plants and visit the nursery garden for selection young trees together with client.. If plants are not grown by the planter himself, the Contractor shall visit the original planting region in company with client for selection as the case may be. The plantings in jobsite neighborhood or in conservation zone, defined by the legislation in force, cannot be taken as the supply sources for this project. The Contractor shall submit the planting inspection record to client for approval and proceed after permission is given.

3.2.2 Inspection shall be performed on species, specification and quality. It shall be deemed as unqualified if any case is found like: wrong species, not in accordance with specification, improper visual proportion, partly withered, over weak, poor growth in the crowded garden, lots of pruning to be applied to suit the specification, root seriously damaged resulted from small root ball.

3.2.3 The arbor of trunk diameter of 5cm above (5cm included) shall be selected individually. Labels shall be lead-sealed and hung on the plant for showing the approval by the Owner. Standard plants shall be selected for those arbors (diameter below 5cm) and shrubs, and photos shall be taken as the inspection standard for planting.

3.2.4 Trees for replanting shall be inspected by client in accordance with the above-mentioned regulations.

3.2.5 The Contractor shall protect well the qualified plantings after inspection. No planting of the trees failed in inspection even if with an approved label.

3.3 Precaution for planting inspection

3.3.1 Ten trees for each kind of trees shall be ready for inspection and selection as the standard trees to be followed.

3.3.2 The plantings to be selected as the standard trees shall be in good shape and healthy conditions besides complying with the diameters and ranges specified in the Contract. The following specifications are to be satisfied or exceeded:

3.3.2.1 Arbor

Openness / Spread
- min. 3 limbs with branching height above ½ of its whole height
- upright trunk
- minor pruning
- no plant disease and insects, no wound

Cutting Layer
- upright trunk without any limb
- no broken sprout on the growing points
- over high or excessive growth (like: weak and spindling branches)

Erection:
- upright trunk
- clear cutting layer

- no excessive growth or branching
- no broken sprout

Erect tower-shape trees, such as Cypress Trees

- upright trunk
- no air or sunlight perpetration
- no over spread or excessive growth of branches
- no broken sprout

3.3.2.2 Shrubs

- min. 3 limbs, varies depending on species (different growing forms)
- upright trunk in healthy condition
- minor pruning
- limbs not on one supporting point
- no plant disease and insects, no wounds

To select plantings depending on their purpose:

- For show: 3-5 branches at lower position
- For others: 3-5 branches may at higher position

Ground covers and flowering plants

- healthy, no disease and insects
- branching varies depending on species, general 5 branches
- dense and rich branches and leaves, no spread or excessive growth resulted from lacking of growing sunlight. Ground cover suit to geographic region and characteristics.
- shade tolerance
- drought-enduring
- sufficient sunlight
- growth speed
- growth mode

Flowers

- avoid over flourishing
- aging
- protruding
- weak

3.3.2.3 Palms: classified as erect and fascicled

- upright
- trunk
- bare trunk
- no diseases and insects, healthy

3.3.3 Preparation for plantings to be selected:

- Pruning
- Cut the burlap away from the root (soil balled for bare rooted plants)
- natural growing, upright trunk, healthy
- after root cut, heel in pot to prevent any seasonal effect and increase the survive percentage
- good tree & crown shapes, no excessive growth (over-high or imbalance)

3.3.4 The Contractor shall provide the statement on plant sources, certificate for selected nursery garden and agreement to supply trees.

3.4 Inspection for Planting Construction

3.4.1 All the planting shall grow vigorously in good shape without diseases or insects (sterilization may be applied before transplanting to site if necessary). When the area of base of planting changes or roots needed to be cut, dig out the healthy and strong roots together with perennial soil ball, well wrapped, no falling over or departed during landscaping. Soil ball size to drawings.

3.4.2 During transplanting, well protection shall be carried out for roots, leaves and barks to avoid any damage or exposed directly under strong sunlight.

3.4.3 All the activities shall be finished within 2 days from digging plantings in the garden to the final transplantation.

3.5 Variety, Specification and Quality for Plants

3.5.1 Unless otherwise stated, the plant specified as one number shall be of the same species, variety, specification and color and high quality.

3.5.2 Species ranks the plants with same term both on genus and type in botanical terminology, while Variety groups the plants with same terms on genus, type or breed in botany. At the mean time, there may be many different cultivars for one Species. Same variety shall be applied in case the variety is specified. If not, plantings from species shall be selected.

3.5.3 Planting with same specification shall be of same tree height, crown width, crown thickness, trunk diameter, root ball, leaves density and so on. Dimensions shall only be taken after the pruning all the excessive branches and leaves.

- Tree Height (H): the height from treetop to ground
- Crown Width (W): average diameter of tree crowns in horizontal level
- Crown Thickness (T): tree crown thickness
- Diameter (□): the average diameter of tree trunks 1m above the ground
- Ball root (Br): soil ball around the root before the specified transplanting. The average diameter shall be taken as reference.
- Density branch (1): nos for plant branches or density for leaves

For plant group of same specification, follow the difference indicated, otherwise the height difference between the highest and lowest plants shall not be exceeds 10% of the standard one. The width of branches and leaves shall be controlled neither smaller than the specification (its difference shall be within 5%) nor bigger than the specified standard. All the above-mentioned width and height shall only measure after plant pruning.

3.5.4 High-quality plantings are free of:

- Serious diseases or insects, broken or twisted branches, fertilizer or medical hazards, aging, wound barks.
- Dry root, withered leaves and spouts resulted from long time laying after digging out
- Small ball root, broken or deflected
- Big tree in signal trunk (unless otherwise stated) with bent trunk, sparse tree crown, deflected or abnormal growth

- Too less branches for shrubs or herbs, not flourishing branches or leaves
- No turf grassroots, no original soil or its thickness is less than 2cm, fall apart or scattered, mixed with weeds

3.6 Alternatives

Alternatives can be applied after the written approval by the Owner if the Contractor has difficulty to supply the plants in accordance with the specifications, which may be from same Species with small sizes or other Species with same characteristics and sizes. Price shall be deducted after discussion for the plants from same species but in small size. No additional costs to be claimed by the Contractor for that from different species.

The Contractor shall apply, at no additional cost, alternative plants in big size from the same or different species after the permission of client.

3.7 Flowering beds

The plotting area has been indicated on the drawings. The Contractor shall submit his planting proposal regarding construction and follow-up care to client after the Contract is awarded, showing clearly the species and planting arrangement for each area. During follow-up care other than the construction period, transplantation shall be carried out at least twice to ensure there are grass flowers in bloom at one place all the time. The plantings shall cover the whole planting areas. The Contractor shall perform the activities as soon as his proposal is confirmed. No changes or additional cost, unless otherwise approved by client

3.8 Rain gardens

The plotting area has been indicated on the drawings. The Contractor shall submit his planting proposal regarding construction and follow-up care to client after the Contract is awarded, showing clearly the species and planting arrangement for each area. During follow-up care other than the construction period.

The plantings shall cover the whole planting areas. The Contractor shall perform the activities as soon as his proposal is confirmed. No changes or additional cost, unless otherwise approved by client.

4.0 SOIL, FERTILIZER, PESTICIDE, PROTECTION AND OTHERS

4.1 Soil

4.1.1 The items of "backfilling of the imported soil" specified in the drawings, if not stated otherwise, refer to the soil imported from the farmland outside the Site. The soil shall be neutral black loamy soil, or the rich soil of three quarters' loamy soil and one quarter's organic fertilizer. The imported soil can only be excavated and filled with the permission from client soil test and analysis shall be made, if necessary, at the expense of Contractor.

The backfilling soil specified in the drawing cannot contain stone, concrete, brick or other foreign matters to the detriment of root growth.

4.1.2 Judgment of Imported soil

4.1.2.1 Difference in color

Color: yellow < grey < brown < dark brown < black brown

Quality: poor-excellent
Ordinary soil + compost (vegetation type)

4.1.2.2 Soil holding quality (squeezes the soil into a ball with water, flick it to see if it holds together).
The Judgment can be made on:
- no crack (clay, poorly drained)
- 3-5 pieces (good)
- crisp (sand, no water contained)

4.2 Fertilizer

4.2.1 The type of fertilizer, applying frequency and time shall be in accordance with the drawings. If not specified in drawings or for any other reasons that Contractor needs to change the type, applying frequency and time, the change can only be made with the permission of client.

4.2.2 "Base fertilizer" is the organic fertilizer applied in the soil during planting. The organic fertilizer shall be compost, animal manure, or organic garbage compost certified by research institute.

4.2.3 "Amendment" is the fertilizer applied after the planting to promote the growth and blooming of the plants. Its type shall depend on the plants and its growth. For example, the flowering bud needs to be applied with the phosphate fertilizer, the leave sprout needs to be applied with the nitrate fertilizer.

4.3 Pesticide
During the period of construction and maintenance the pest or weed, if found, shall be removed immediately. The types and amount of pesticide or herbicide will be at the Contractor's decision. For any injury to plants, animals, or human beings caused by the wrong operation the Contractor shall be liable.

4.4 Protection measures
Protection shall be made against the destruction from animal and human and bad weather.

4.4.1 Rail shall be erected against the damage by animal and humans.

4.4.2 Firm staking or supporting rope shall be erected according to design drawing to support the seedlings. Staking shall depend on the size of young trees and the local wind. The staking shall be antiseptic treated timber made of fir, cassia tree or other timbers that are approved by client and be 5-10cm in diameter. The staking or rope can support the plant with proper size. At the contact point with the plant the timber shall be applied with soft material to avoid any injury to the trees. The appearance of staking shall be clean and proper, and can be painted black or dark green for a better appearance.

4.4.3 Straw or other measures shall be used to wrap trunk to protect against harsh weather.

4.4.4 Once the perennial soil ball is digged, burlap, rope or other packing material shall be used to wrap the ball in case the root ball will fall apart in transportation, disturbance, and transplantation. Root cutting shall be done with sharp saw. In transportation of big tree its bark and leaves cannot be injured.

4.4.5 All the protection expense is deemed to be included in the unit rates, the Contractor cannot charge for any extra expenses.

4.5 Watering

Water in the works shall be at the Contractor's decision on its sources, quality, and watering time. The water, however, cannot be the industrial wastewater, sewage water containing poisonous substances. The responsibilities of any harm to plants for the wrong operation shall be borne by the Contractor.

4.6 Others

Any application of the chemicals like evaporation inhibitor, soil chemicals by Contractor shall be permitted by client and the Contractor shall be responsible for the result.

5.0 PLANTING

Unless otherwise stated, the planting schedule shall be followed as: arbor, shrub, rain garden, ground covers, flowers..

5.1 Planting of arbor, shrub, and Rain garden

5.1.1 Application of planting hole and base fertilizer

- As per design drawing, mark the planting location at site, dig the hole after inspection by client..
- In accordance with the drawing specification the size of hole, unless otherwise specified, shall be two times than the root ball diameter. The depth shall be the number of root diameter plus 30cm.
- The debris, concrete block or any other foreign matters that will prevent the root growth shall be removed from the Site.
- For the filling work of imported soil as specified in the design drawings, the earth excavated from the hole shall be leveled if it is little amount, or removed from the Site if it is large amount for the purpose of a better drainage of the area.
- Lay compost or other appropriate mixture of organic fertilizer and soil at the bottom of the digged hole. The applied amount refers to the design drawings. If not specified, the proportion of organic fertilizer and soil shall be 1:4.

5.1.2 Transplantation

- Root Cutting shall be more than 2 months.
- Bare-root is forbidden. Root ball shall be big (diameter shall be specified).
- Over-pruning is forbidden (pruning method will depend on the trees species)
- Black cotton mesh or canvas shall be used to wrap the ball in transportation to avoid water evaporation.
- Prune the injured twig after delivery at site. Planting shall be done in 24 hours. If not, watering shall be followed to protect the plant, but cannot exceed 48 hours.
- Locate the transplantation place. Cotton or straw rope shall be used to wrap the trunk at the fixed staking for protection.
- Regular watering to trees, trunk, leaves.

- Before planting into the holes, the wrapping shall be removed if the wrapping cannot resolve into soil like straw rope, etc.
- After the planting into the holes, the wrapping or rope shall be removed 1/3 at the top.
- Soil backfill shall be imported soil or the excavated soil and to be packed for the support of trees.
- Soil backfill mould can be 2cm above the ground. The edge of the hole shall be compacted with the neighboring soil. The surface of planting hole shall be a saucer shape to retain water.

5.1.3 Staking

After the planting the staking or protection measures shall be made to support the plant.

5.1.4 Pruning

After the proper planting the Contractor shall prune the plant to reduce the water evaporation. At the expiry of maintenance period the plant shall comply with the requirement in specification.

5.1.5 Watering and fertilizing

Water the plants after planting. The Contractor shall be responsible for applying the "amendment" in the 90th day and the 150th day after the maintenance period. The fertilizer resolved in water shall be applied to the plant by watering. But attention shall be paid not to injure the plant.

5.2 Ground covers and flowers

5.2.1 Ground Leveling

5.2.1.1 As per design drawings, delineate the plot to be planted with ground covers and flowers. The planting work can be started after inspection by client.

5.2.1.2 Loosen the surface soil to 15cm depth of the ground, remove the debris, concrete, grass root, and other substances that will prevent the plant growth. Besides, keep the ground surface sloped to drain the water.

5.2.1.3 Application of "Base fertilizer"
Apply the mixture of 10cm thickness of compost and soil with the proportion of 1:4.

5.2.2 Planting

Plant the ground covers and grass flowers as per the Specification, but the spacing of plants can be negotiated with client. Without the permission of client and the quantity of the plants cannot be reduced.

5.2.3 Watering and fertilizing

Watering shall be done immediately after the planting. "Amendment" shall be applied on the 7th day after the planting, the beginning day and the 90th and 150th day of the maintenance period. The application amount shall be 0.02kg for every square meter. The fertilizer resolved in water can be applied in watering.

In the grass planting area, add 10cm thick mix soil with the proportion of organic fertilizer and imported soil as 1:4.

5.3 Rain gardens

5.3.1 Planting method

Excavating & Loosen the surface soil to 0.4M - 0.5M depth of the ground, remove the debris, concrete, grass root, and other substances that will prevent the plant growth spacing, location and other details are mentioned in the drawings.

5.3.2 The primary media in each pond consists of dug up in situ soil horizon of about 0.4m depth.

5.3.3 The dug up soil from the each circular or oval pond can be used for landscaping the rain garden provided the soil should be fertile if not garden soil with soil amendments should be used.

5.3.4 Application of "Base fertilizer" Apply the mixture of 10cm thickness of compost and soil with the proportion of 1:4.

6.0 Planting

Plant the WATER TOLERANT plants as per the Specification, but the spacing of plants can be negotiated with client. Without the permission of client and the quantity of the plants cannot be reduced.

6.1 Watering and fertilizing

Watering shall be done immediately after the planting. "Amendment" shall be applied on the 7th day after the planting, the beginning day and the 90th and 150th day of the maintenance period. The application amount shall be 0.02kg for every square meter. The fertilizer resolved in water can be applied in watering.
In the grass planting area, add 10cm thick mix soil with the proportion of organic fertilizer and imported soil as 1:4.

The gap between circular ponds/oval ponds should be filled with pebbles/in situ stones in the rain garden of thickness 6"-8" which reduces the velocity of surface runoff as well as helps obtain sediment free water entering the ponds which enhances infiltration all avoid the flow path of storm water flows.

Maintenance work shall begin on the day the planting is finished. It shall be 1 year started from the next day of the final acceptance of the whole planting works.

6.2 Primary acceptance, final acceptance and inspection

6.2.1 Primary acceptance by client after the finishing of the whole planting and the whole works stipulated in the Contract.

6.2.2 In the maintenance period the inspection shall be made every two months. The inspection result made at the end of the maintenances period shall be taken as the reference data for the settlement of planting price. The substandard planting in the expiry inspection of maintenance period shall be deducted from the price.

6.2.3 The Contractor shall apply for the expiry inspection of maintenance period by the Owner at 4th months started from the inspection made at the end of the 8th month.

6.2.4 Primary inspection, acceptance and every check and check made in maintenance period shall be in accordance with the Contract, the pruning or mowing shall be permitted from client before inspection.

6.3 Expiry of maintenance period

6.3.1 The Contractor shall be responsible to maintain the living state of plant, including watering in dry weather, drainage in rainy season, and to prevent against any injuries caused by animals, humans, wind, pest, weed, etc. If the tree is on loose ground to stand or slanted, it shall be established upright and the firming rope should be tightened.

6.3.2 Under the following conditions the Contractor shall be liable for the rework of following at his own expenses: the top withered, the living plants cannot reach to 80% of the total area, serious pest hazard and broken limb. The above shall be replaced with new planting. The flower withering shall also be replaced under the instruction of client

6.3.3 At the expiry of maintenance period, the following requirement to be approved as the standard garden.

- All the planting shall be in accordance with the Contract
- All the planting is living, well grown, no pest hazard or withering.
- The specification of planting cannot be less than that stated in the Contract.
- Ground covers shall be well grown, no pest hazard or withering, and its coverage rate shall be more than 90%. No rain washing exists.
- The weed in the area of ground cover cannot exceed 10%, and comply with the appearance effect stated in the design drawings.

6.4 Back charge at the expiry of maintenance period
At the expiry of maintenance period, the substandard planting exceeding 10% of the total planting works shall not be charged in the lump sum for the planting works. Besides, the Contractor shall reimburse client for the expenses of the substandard part planting.

7.0 Planting Schedule

Type of plantations	Screening Trees / Avenue Trees (2m) Height
Planting Time	June 3rd week –December 1st week

Methodology	1. Excavating pits of size 0.75m x 0.75m x 0.75m filling them with supplied garden soil mixture of well rotten farmyard manure or leaf mould , red earth, river sand in appropriate ratios with folidal dust/bavistine. the spacing, location and other details as per the drawings and specifications. 2. While placing the sapling /tree in the pit the tap roots should not be folded back and fibrous roots should be spread out as they are so that the root tips are not damaged this is important for the growth of the roots . 3. Press the soil firmly with feet and make a basin around the sapling/tree. 4. Support the trees/sapling with a sturdy stake put in to the pit by the side of the tree/saplings and tied to it. 5. Protect the trees with iron mesh tree guards.
Basic maintenance	1. Water the plants for every three days in first year and later once in a week from second year. 2. Remove lateral buds and lateral braches to inhibit lateral growth till 3m height to maintain proper shape of the tree 3. Usually trees are affected with caterpillars. Spray the affected trees with neem oil extract 6ml/litre .

LIST OF AVENUE TREEES (2M) HEIGHT

S.NO	BOTANICAL NAME	COMMON NAME	TAMIL NAME
1.	*Anthocephalus kadamba*	Kadamba	Kapam
2.	*Alstonia scholaris*	Devils Tree	Palai,
3.	*Bauhinia purpurea*	Camels Foot	Mandari
4.	*Polyalthia longifolia*	False Ashok tree	Asoothi
5.	*Cordia sebestena*	Scarlet Cordia	Acchinaruvihli
6.	*Delonix regia*	Gulmohar	Mayarum
7.	*Cassia fistula*	Indian Laburnum	Konnei
8.	*Cassia javanica*		
9.	*AzadirachtaIndica*	Indian Neem Tree	Vepa
10.	*Mangifera indica*	mango	
11.	*Pongamia glabra*	Indian Beech Tree	Ponga
12.	*Tabebuia rosea*	Rosy Trumpet Tree	
13.	*Filicium decipiens*	Fern Tree	Ningal
14.	*Peltophorum ferrugineum*	Copper Pod Tree	
15.	*Melia azedarach*	Pirde Of India	malaivembu
16.	*Terminalia catappa*	Indian almond tree	nattvaduma
17.	*Spathodea campamulata lutea*	Yellow Spathodea	Patadi

S.NO	BOTANICAL NAME	COMMON NAME	TAMIL NAME
18.	*Bignonia metapotomica*		
19.	Erythrina Crista Galli		
20.	*Millingtonia hortensis*		Katte malli
21.	Plumeria alba	Temple tree white	arali
22.	Plumeria rubra	Temple tree red	arali

LIST OF ACCENT TREES

S.NO	BOTANICAL NAME	COMMON NAME
1.	*Roystonia regia (5m)*	Royal palm
2.	Wodyetia bifurcata - 4m (over all ht)	Fox tail palm
3.	*Bismarckia nobilis blue form(4m)*	
4.	*Areca catechu*	arecanut
5.	Ficus retusa	Chinese banyan tree
6.	Mimusops elengii	

SHRUBS AND GROUND COVERS

Type of plantations	Shrubs & Ground Covers/Flower beds
Planting Time	June 3rd week –December 1st week
Methodology	1. Excavating pits of size 0.30m x 0.30m x 0.30m for shrubs and 0.15m x 0.15m x 0.15m for ground covers supplied with garden soil mixture of well rotten farmyard manure or leaf mould , red earth, river sand in appropriate ratios with folidal dust. The spacing, location and other details as per the drawings and specifications. 2.While placing the shrub/ground cover in the pit the tap roots should not be folded back and fibrous roots should be spread out as they are so that the root tips are not damaged this is important for the growth of the roots .
Basic maintenance	1.Water the plants daily. 2.Prune the over growth shrubs for proper shape.

LIST OF SHRUBS & GROUNDCOVERS

S.NO	BOTANICAL NAME	COMMON NAME
1.	*Cuphea hyssopifolia hybrid purple*	Cuphea blue
2.	*Cuphea hyssopifolia hybrid white*	Cuphea white

3.	*Pisonia alba*	pisonia
4.	*Alternanthera species red (broad deep red leaf)*	Alternanthera (border)
5.	*Bixa orellana*	Annatto Tree, Lipstick Tree
6.	*Caesalpinia pulcherima red yellw orange*	Peacock Flower
7.	*Acalypha rosea*	
8.	*Tabernamontana variated nana dwarf*	
9.	*Vinca rosea*	

RAIN GARDEN

Type of plantations	Water tolerant plants
Planting Time	June 3rd week –December 1st week
Methodology	1. Excavating ponds of circular or oval surface area each of depth 0.4m-0.5m . the spacing, location and other details are mentioned in the drawings. 2. The primary media in each pond consists of dug up in situ soil horizon of about 0.4 m depth. 3. The dug up soil from the each circular or oval pond can be used for landscaping the rain garden provided the soil should be fertile if not garden soil with soil amendments should be used. 4. The gaps between circular ponds/oval ponds should be filled with in situ stones or pebbles in the rain garden which reduces the velocity of surface runoff as well as helps obtain sediment free water entering the ponds which enhances infiltration all along the flow path of strom water flows. 5. depth of the pond varies from 0.4m to 0.5m(fig 2&3)
Basic maintenance	1. Water the plants daily except rainy season . 2. Prune the over growth shrubs for proper shape of the pond.

LIST OF PLANTS FOR RAIN GARDEN

RAIN GARDEN- OPPOSITE TO PARKING

S. NO	BOTANICAL NAME	COMMON NAME	TOTAL AREA IN SQM	NO. OF PLANTS/ SQM	SPACING C/C	QNTY OF PLANTS
1.	Canna gernalis red	Canna Red Leaved	148	8	1'	1184
2.	Canna malawiensis variegata	Canna Yellow Variegated	151	8	1'	1208

S. NO	BOTANICAL NAME	COMMON NAME	TOTAL AREA IN SQM	NO. OF PLANTS/ SQM	SPACING C/C	QNTY OF PLANTS
3.	Hymenocallis littoralis (broad leaved)	Beach Spider Lily	273	8	1'	2184
4.	Pennisetum rueppeli	Red fountain grass	176	15	9"	2640
5.	Pennisetum species	Green fountain grass	165	15	9"	2475
6.	Canna x generalis lineata yellow	Canna Dwarf Yellow	19	35	6"	665
7.	Canna x generalis lineata red	Canna Red Dwarf, Indian Shot	22	35	6"	770
8.	Hymenocallis narcissiflora	Narrow Leaf Spider Lily	31	8	1'	248
9.	Hymenocallis littoralis variegata	Spider Lily Variegated	192	8	1'	192
10.	Sansevieria trifasciata laurentii,/ S. zebrina	Mother In Laws Tongue/ Snake Plant	142	15	9"	2130
11.	Euphorbia pulcherrima christmas star	Poinsettia Christmas Tree/ Tamil Magilkunni	109	8	1'	872
12.	Heliconia varities	heliconia	60	15	9"	900
13.	Ensete ventricosum	Ornamental Banana	5	-	-	1
14.	Caesalpinia pulcherima flava-yellow	Shankasur Yellow/ Tamil-Mayikonnai	6	5	15"	30
15.	Bambusa vulgaris	Golden Bamboo	6	5	15"	30
16.	Chrysalidocarpus lutecens	Areca Palm	6	5	15"	30
17.	Bismarckia nobilis green form	Bismark Palm – Green	6	-	3'	3
18.	Caesalpinia pulcherima flava-yellow-orange-red	Shankasur Yellow(10)-orange(10)-red(10)Tamil-Mayikonnai	6	5	15"	30

RAIN GARDEN-ADMINSTRATION-202

S. NO	BOTANICAL NAME	COMMON NAME	TOTAL AREA IN SQM	NO. OF PLANTS/ SQM	SPACI NG C/C	QNTY OF PLANTS
1.	Canna x generalis lineata yellow	Canna Dwarf Yellow	38.5	35	6"	1365
2.	Pandanus amaryltifolius variegatus	Pandanus	19.5	8	1'	20
3.	Canna gernalis red	Canna Red Leaved	8.5	15	9"	135
4.	Pennisetum species	Green fountain grass	55.5	15	9"	840
5.	Hymenocallis littoralis (broad leaved)	Beach Spider Lily	46	8	1'	368
6.	Pennisetum rueppeli	Red fountain grass	42	15	9"	630
7.	Heliconia varities	heliconia	30	15	9"	450
8.	Chrysalidocarpus lutecens	Areca Palm	5.5	5	15"	30

RAIN GARDEN-COUNTRY ZONE

S. NO	BOTANICAL NAME	COMMON NAME	TOTAL AREA IN SQM	NO. OF PLANTS/ SQM	SPACIN G C/C	QNTY OF PLANTS
1.	Bambusa vulgaris	Golden Bamboo	5.5	5	15"	30
2.	Euphorbia pulcherrima christmas star	Poinsettia Christmas Tree/ Tamil Magilkunni	55.5	8	1'	480
3.	Licuala grandis/Pritchardia Grandis	Prichardia Palm	5.5	-	36"	3
4.	Sansevieria trifasciata laurentii,/ S. zebrina	Mother In Laws Tongue/ Snake Plant	55.5	15	9"	900
5.	Pennisetum species	Green fountain grass	55.5	15	9"	900
6.	Hymenocallislittoralis (broad leaved)	Beach Spider Lily	55.5	8	1'	480
7.	Pennisetum rueppeli	Red fountain grass	55.5	15	9"	900
8.	Ensete ventricosum	Ornamental Banana	5.5	-	-	1
9.	Caesalpinia	Shankasur	55.5	5	15"	300

	pulcherima flava-yellow-orange-red	Yellow(10)-orange(10)-red(10)Tamil-Mayikonnai				

RAIN GARDEN-ADMINSTATION-202

S.NO	BOTANICAL NAME	COMMON NAME	TOTAL AREA IN SQM	NUMBER OF PLANTS/SQM	SPACING C/C	QNTY OF PLANTS
1.	Pennisetum species	Green fountain grass	29	15	9"	435
2.	Hymenocallis littoralis (broad leaved)	Beach Spider Lily	58	8	1'	928
3.	Pennisetum rueppeli	Red fountain grass	83	15	9"	1245

Earth Works for Avenue Trees (2m) Height Shrubs & Ground Covers/Flower beds. Rain garden	Providing top Soil Mix for Plants and Mounds 1.In the ratio of 2:1:1 of good quality red earth, river silt and manure with all pesticides, fungicides, nutrients and plant growth regulators. 2.Additives / m3 of Top soil mix 19:19:19 complex of NPK @ 1Kg/m3 3.Bavistine @ 50 gm / m3 4.Bio organic fertiliser with all Bio inoculants such as trichoderma, azorpyrillum, azatobacter, psuedomonas, 10 Kg / m3

K. HARD LANDSCAPING WORKS

1.0 GENERAL CIVIL WORKS

This specifications covers the general requirement for excavation, brick masonry, plastering, flooring, doors, windows, ventilators, wood work, water proofing, painting, plumbing and sanitary work etc., and such other related work forming a part of this job which may be required to be carried out though not specifically mentioned above. The work under this specification shall consist of furnishing of all tools, plants, labour, materials, any and everything necessary for carrying out the work.

2.0 BRICKWORK

2.1 Material – Bricks

Bricks shall be sound, hard, and homogeneous in texture, well burnt in kilns without being vitrified, table moulded, deep red, cherry or copper coloured of regular shape and size and shall have sharp and square edges and parallel of faces. The bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing unground particles and/or which absorb water more than 1/6th of their weight when soaked in water for twenty-four hours shall be rejected. The bricks shall give clean / ringing sound when struck and shall have minimum crushing strength of 50 Kg/sq.ct. Sample bricks shall be submitted to the engineer for approval. If demanded by engineer brick sample shall be got tested as per IS-3495 by Contractor at no extra cost to owner. Bricks rejected by Project Consultant shall be removed from site within 24 hours.

2.2 Mortar

The sand used shall be free from clay, shale, loam, alkali and organic matter and shall be of sound, hard, clean and durable particles. Sand shall be approved by Project Consultant. The mixed mortar shall be used within 25 minutes of mixing. Mortar left unused beyond 25 minutes shall be rejected.

2.3 Workmanship

Workmanship shall confirm to I.S. 2212.

All bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. The cement mortar for brick masonry shall be as specified in the respective item of work. Brickwork 230mm thick and over shall be laid in English bond unless otherwise specified. 115mm thick brick work shall be laid with stretchers. The thickness of joints shall be well filled with mortar with minimum thickness of 6mm and maximum depth of 12mm by raking tools daily during the progress of work when mortar is still green. The face of brickwork shall be cleaned daily and all mortar droppings removed. All brickwork shall be built tightly against columns floor slabs or other structural members. Miscellaneous inserts in masonry e.g. sleeves, wall ties, anchors conduits, structural steel, steel lintels, doors, windows shall be installed by the Contractor at no extra cost to the owner.

It shall be clearly understood that the rates quoted by the Contractor include for fixing of inserts, leaving openings, cutting chases etc.

3.0 PLASTER WORK

3.1 Material

The proportion of the mortar shall be as specified under the respective item of work. The quality of water, sand and cement shall be as per respective I. S. Code. The mortar shall be used immediately after mixing and in no case shall be allowed to stand in more than 25 minutes after mixing with water.

3.2 Workmanship

The surface to be rendered shall be washed with fresh clean water, free from all dirt, loose material, grease etc. and thoroughly wetted for 6 hours before plastering work is commenced, concrete surfaces to be rendered will however be kept dry. The wall should not be too wet but only damp at the time of plastering.

3.3 Internal Plaster

This plaster shall be laid in a single coat of 20mm thickness. The mortar shall be dashed on the prepared surface with a trowel and finished smooth by wooden floats. Interior plaster shall be carried out on jambs, lintels, sills, soffits as shown in drawing or as directed by Architect. Rate quoted shall be deemed to include plastering of all surfaces and no separate payment will be considered for any particular, surface like jambs etc.

3.4 Curing

Curing of both interior plaster shall be started as soon as the applied plaster has hardened enough so as not to be damaged. Curing shall be done by continuous applying water in a fine spray.

At places the thickness of plaster may go higher than specified thickness. In such event Contractor shall provide chicken mesh and perform plastering in layers without additional cost.

3.5 Measurement

3.6 Admixture

If directed by Project Consultant, the Contractor shall use approved water proofing / water reducing admixtures in the mortar for plaster work, in the proportion and method prescribed by the manufacturer. Payment shall be made for actual quantity of such admixtures used unless it is already covered in the rates for the work concerned.

4.0 STONE FLOORING FOR LANDSCAPING

4.1 Material

Stones should be of approved quality, hard, sound, durable and uniform in thickness as specified. Edges shall be machine cut / hand cut, machine dressed / hand dressed as specified in respective item of work. Top surface shall be pre machine polished, machine polished at site, hand polished, any other finish as specified in Schedule of Quantities. Stone slabs should meet all the required properties and test requirements as stipulated in I. S. Standard.

4.2 Workmanship

Stone should be laid on a bed of cement mortar of specified mix. Thickness of mortar bedding shall not be less than 12mm and shall not be more than 25mm. Before laying the stone slabs should be thoroughly wetted with clear water, Neat white cement should spread over the mortar bed (at the rate of 5 kg per 1 sq.meter.) over as much area as could be covered with slabs within half an hour. The slabs are then laid and gently tapped with wooden mallet till it if firmly and properly bedded. There should be no hollows left. The joints should not be more than 2mm thick. The joints should be struck smooth. The joints should run true and parallel. The floor should be kept covered with damp sand or water for a week.

Stones laid adjoining the wall shall project 12mm under the plaster / dado / skirting.

For skirting work the vertical surface shall be thoroughly cleaned and wetted. Thereafter it shall be evenly and uniformly covered with 0.5"mm thick 1:2 cement mortar. The back of

each tile to be fixed shall covered with a thin layer on neat white cement plaster pigmented to match the shade of the stone slab and tile shall then be gently tapped against the wall with a wooden mallet. The joints shall be as close as possible and the work shall be truly vertical and flush.

5.0 PAINTING

5.1 Material

Paints to be used for various terms of work should be of approved make and colour. The Contractor shall obtain Project Consultant's approval in regard to the make and colour of paint that is proposed to be used for various items of work.

5.2 Workmanship

The painting work shall be carried out as directed by the Consultant, keeping however, in view the recommendations of the manufacturer. In case of plastic emulsion paint, all uneven surfaces shall be made up by use of putty of appropriate quality, after the surface has been thoroughly cleaned of all dust, dirt and sand papered. Two coat of primer, and two/three coasts of emulsion as specified shall be applied. Workmanship shall conform to the requirement of I.S. 2395.

6.0 CERAMIC TILE WORK IN FLOORING AND DADO

6.1 Material

The tiles used shall be as specified and of approved make, size and shade. The tiles shall be of standard size without warp and straight edges, true and even in shape and size and uniform colour.

6.2 Workmanship – Flooring

Tile shall be laid on base of minimum 12mm thick cement mortar of specified mix. Neat white cement pigmented to match the shade of the tile shall be spread at the rate of 5 kg. Per 1 Square metre area over mortar before laying the tiles. The joints shall be filled with joint filling cement based compound.

6.3 Dado work

The vertical surface shall be thoroughly cleaned and wetted. Thereafter it shall be uniformly covered with about 12mm thick 1:3 cement mortar plaster for leveling purpose. The back of each tile to be fixed shall be covered with a thin layer of approved waterproof tile adhesive cement and the tile shall then be gently tapped against wall and fixed as per adhesive cement manufacturer's instructions. The joints shall be very thin, uniform, perfectly straight and truly vertical. The joints shall be filled with joint filling cement based compound specially manufactured for the purpose.

Flooring, Treads, Skirting – Dado – Risers

6.4 Material

Size, shade and colour of tiles shall be approved by Project Consultant before starting of the work.

6.5 Workmanship

Tiles shall be laid on a bed of cement mortar of specified mix. Thickness of mortar bedding shall not be less than 20mm and shall not be more than 25mm. Tiles shall be covered with white cement / and placed over mortar bed and tapped gently till it is firmly

and properly bedded. There should be no hollows left. The joints should run true and parallel. The floor should be cured for one week.

Tiles laid adjoining the wall shall project 12mm under the plaster / dado / skirting.

6.6 Skirting-dado-risers

The masonry surface shall be thoroughly cleaned and wetted. Thereafter it shall be evenly and uniformly covered with 12mm thick 1:3 cement mortar. The back of each tile shall be covered with tile adhesive cement and then the tile shall be fixed as per manufacturer's instructions. The joints shall be filled with tile joint filling coloured cement specially manufactured for the purpose.

7.0 MARBLE / GRANITE WORK

Marble / granite shall be hard, sound, dense and homogeneous in texture with crystalline texture as far as possible. It shall generally be uniform in colour and free from stains, cracks, decay and weathering.

7.1 Classification

The marble / granite blocks, slabs and tiles shall be classified broadly in the following two categories:

White Marble / granite.

Coloured Marble / granite such as Black, Green, Pink, Brown, Grey Marble / granite etc.

7.2 Approval of Sample

Before starting the work, the contractor shall get samples of marble / granite approved by the Engineer-in-Charge. Approved samples shall be kept in the custody of the Engineer-in-Charge and the marble / granite supplied and used on the work shall conform to samples with regard to soundness, colour, veining and general texture.

7.3 Sampling

In any consignment all the blocks / slabs / tiles of the same group, size and finish shall be grouped together to constitute a lot. Sample shall be selected and tested separately for each lot for determining its conformity or otherwise to the requirements of the specification. The number of blocks / slabs / tiles to be selected for the samples shall depend upon the size of the lot and shall be in accordance with the Table given below:

7.4 Sample size and Criteria for Conformity.

Number of Blocks / slabs /tiles in the lot	Number of blocks slabs / Tiles to be selected in sample	Permissible number of defectives	Sub sample size in No.
(1)	(2)	(3)	(4)
Upto 25	3	0	2
26 to 100	5	0	2
101 to 200	8	0	3
201 to 500	13	0	4
501 to 1000	20	1	5

Note: The blocks/ slabs/ tiles in the sample shall be taken at random and in order to ensure to randomness of selection, random tables may be used.

Explanation 1: All the blocks / slabs / tiles, selected in the sample, shall be examined for dimensions workmanship and general requirements.

Any block / slab / tile failing in any one or more of the above requirements shall be considered as defective. All lot shall be considered as conforming to these requirements if the number of defectives obtained is not more than permissible no. of defectives given in Col. 3 pf the Table.

Explanation 2: The lot having been found satisfactory with respect to dimensions, workmanship and general requirements shall be tested for physical properties of the marble / granite. For this purpose a sub sample of the size given in Col. 4 of table shall be selected at random.. These blocks/ slabs / tiles in the sub sample shall be tested for moisture absorption, hardness and specified gravity. The lot shall be considered having satisfied the requirements of the physical properties if none of the blocks / slabs / tiles tested for the requirements fails in any of these tests.

7.5 Marble / granite Work in Floor, Jambs, Steps and other Plain Work

Dressing and Rubbing

Every marble / granite stone shall be cut to the required size and shape, chisel dressed on all beds and joints, so as to be free from any waviness and to give truly vertical, horizontal, radian or circular joints as required. The exposed faces and sides of stones forming joints upto 6mm. from the face shall be fine tooled such that a straight edge laid along the face of the stone is in contact with every point on it. These surfaces shall then be rubbed smooth. All visible angles and edges shall be true, square and free from chipping. Beyond the depth of 6mm from face, the joints shall be dressed with a slight splay so that the thickness of joint increases, in an inverted 'V' shape so as to give good mortar bond between two stones. The inverted portion of the joints shall be filled with bedding mortar and face 6mm portion with pointing mortar. The surfaces of the stones coming in contact with backing need not be chisel dressed.

A sample of dressed and rubbed stone shall be prepared for approval and it shall be kept on worksite after being approved by the Engineer in-charge.

7.6 Mortar

The Mortar used for jointing shall be as specified.

7.7 Laying: All marble / granite stones shall be wetted before placing in position. These shall then be floated on mortar and bedded properly in position with wooden mallets without the use of chips or under pinning of any sort. The walls and pillars shall be carried up truly in plumb or battered as shown in the drawings. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical.

When necessary jib crane or other mechanical appliances shall be used to hoist the heavy pieces of stones and place these in to correct positions, care being taken that the corners of the stone are not damaged. Stone shall be covered with gunny bags, before putting chain or rope is passed over it, and it shall be handled carefully. No piece which has been damaged shall be used in work. The matching of grains shall be carried out as direct by the Engineer in-charge.

7.8 Curing The work shall be kept constantly moist on all faces for a period of at least seven days.

7.9 Finishing After the marble / granite work is cured, it shall be rubbed with carborandum stone of different grades No. 60, 120 and 320 in succession, so as to give a plane true and

highly smooth surface. It shall then be cleaned with a solution of oxalic acid, washed and finished clean.

7.10 Protection Green work shall be protected from rain by suitable coverings. The work shall also be suitably protected from damage during construction.

7.11 Scaffolding Double scaffolding having two sets of vertical supports shall be provided where necessary. The supports shall be sound and strong, tied together by horizontal pieces over which the scaffolding plank shall be fixed.

7.14 Use of Finished Marble / granite Slabs and Tiles

In case such finished tiles are used, these shall be measured and paid for separately under different head of the schedule of quantities.

8.0 WALL LINING / VENEER WORK

Unless and otherwise specified in the nomenclature of the item, the marble slabs used for wall lining / veneer work shall conform to dimensions as shown on the drawings.

8.1 Dressing: Dressing shall be same as specified in earlier para except that the back shall not be dressed, but left rough cut, in order to ensure a good grip with the hearting of backing. The dressed slabs shall be of the thickness as specified with permissible tolerance. The tolerance in wall lining when straight edge of 3m length is placed should not be more than 2mm.

8.2 Laying: The stone shall be wetted before laying. They shall then be fixed with mortar in position without the use of chips or under pinning of any sort. Care shall be taken to match the grains of veneer work as directed by the Engineer-in-Charge. For purpose of matching the grains, the marble slabs shall be selected judiciously having uniform pattern of veins/ streaks. Preferably the slabs shall be those got out of the same block from the quarry. The area to be veneered shall be reproduced on the ground and the marble slabs laid in position and arranged in the manner to give the desired matching of grains. Any adjustment needed for achieving the best results shall be then carried out by replacing or interchanging the particular slabs. Special care shall be taken to achieve the continuity of grains between the two slabs one above the other along the horizontal joints. This shall then be got approved by the Engineer-in-Charge and each marble slabs numbered properly and the same number shall be marked on a separate drawing as well as on the surface to be actually veneered, so as to ensure the fixing of the particular slabs in the correct location.

For the facing of the columns also the same procedure as mentioned above shall be followed. Where so desired, the adjoining stones shall be secured to each other by means of copper pins 75m long and 6mm diameter or as specified. Further the stones shall be secured to the backing by means of clamps. The material for clamps shall have high resistance to corrosion under condition of dampness and against the chemical action of mortar or concrete in which clamps are usually embedded.

Clamps shall be of 25 x 6 mm and 30 cm long in case of backing of stone masonry walls and brick masonry walls thicker than 230mm. In case of backing with brick masonry walls 230 mm or less thick or RCC members clamps shall be of 25 x 6mm and length as per requirement made out of gun metal or any other metal specified. Generally the outer length of clamp in half brick work backing shall be 115 mm and in one brick work backing it shall be 150mm. Clamps shall be spaced not more 60 cm apart horizontally.

The adjoining stones shall be secured to each other by means of gun metal clamps or copper pins of the specified size. Clamps may be attached to its sides or top and bottom.

The actual number of clamps and their sections, however, shall be as per requirements of design to carry the loads.

Where clamps are used to hold the unit in position only, the facings shall be provided with a continuous support on which the stones rest at the ground level and other storey levels, the support being in the form of project from or recess into the concrete floor slab, or a beam between the columns or a metal angle attached to the floor slab or beams. These supports shall preferably be at vertical intervals not more than 3.5 m apart and also over the heads of all openings. Such supports shall also be provided where there is transition from thin facing below to thick facing above.

Alternatively clamps may be used to hold the units in position and in addition to support the units thus transferring the weight of the units to the backing. Such clamps should be properly designed as per IS : 4101 (Part 1). The clamps may be of copper alloyed with zinc, tin, nickel, lead or stainless steel. The pins, clamps and dowels shall be laid in cement mortar 1:2 (1 cement : 2 fine sand) and their samples got approved by the Engineer-in-Charge and kept at site. All joints shall be full of mortar. Special care shall be taken to see that groundings for veneer work are full of mortar. If any hollow groundings are detected by tapping the face stones, these shall be taken out and re-laid. The thickness of the face joints shall be uniform, straight and as fine as possible, not more than 1.5mm and in the face joint, the top 6mm depth shall be filled with mortar specified for the pointing.

8.3 Mortar: The mortar used for jointing slabs shall be as specified.

8.4 Curing, Finishing, Protection and Scaffolding.: It shall be as specified in earlier Para.

L. ALUMINIUM WINDOWS, VENTILATORS, COMPOSITE

Scope of work :

The scope of work in the tender item includes fabrication supply and installation of anodized matt finished aluminium windows, ventilators, composite units, glazing etc. strictly in accordance with these specifications and relevant detailed approved shop drawings.

General :

The contractor shall submit six copies of shop drawings covering all types. Details of work as generally shown in Architectural drawing and envisaged under these specifications before manufacture. The drawing shall show all dimensions, details of construction, installation, fixtures and relation to adjoining and related work. No fabrication work shall be undertaken prior to the approval of the shop drawings from the Engineer-in-charge. The tenderer shall intimate at the time of tendering, the types of sections he proposes to use on the works.

Materials :

The aluminium alloy used in the manufacture for extruded window section shall correspond to IS 733- 1966 (or any further revision thereof). Extruded sections shall conform to IS designation HE9-WP and Hollow sections shall conform to IS Designation HV9-WP. The frame work, stiles, mullions, beadings, transoms, hinges, peg stays, handles etc. shall be structurally suitable to withstand all the load, the members have to sustain. Conter sunk screws, nuts, bolts, washers, rivets and other miscellaneous fastening devices shall be of approved cadmium plated or stainless steel as specified in the approved drawings.

Fabrication :

The frames shall be manufactured square and flat. The corners of the frames shall be fabricated to true right angles. All the fixed, sliding, openable frames shall be constructed from sections which have been cut to length, mitred and mechanically jointed or welded at

the corners. Where hollow sections are used with welded joints, argon are welding or flash butt welding shall be employed (Gas welding or brazing not to be done). Sub-dividing bars of units shall be tennoned an riveted into the frames. Water bar in aluminium section shall be provided. The dimensions shown in the drawings are overall heights and widths to the outside of frames of aluminium windows. The side hung shutters shall have projected friction type hinges of aluminium alloy. Concealed projected hinges having structural stability and of good quality will also be considered only after the inspection of the sample submitted by the tenderer. The necessary peg stays, handles, windows fasteners etc. shall be of aluminium. The handle shall be mounted on a handle plate riveted to the opening frame.

The peg stays shall be 300mm. long or as required complete with peg and locking bracket and shall have holes for keeping the shutters open in three different positions. No field fabrication of frames is permitted. The complete fabricated assembly shall be anodized in approved satin finish with minimum film thickness of 0.015 mm. for the entire surface. A thick layer of clear transparent lacquer based on methacrylate or cellulose butyrate shall be applied on the finished sections for the aluminium windows etc. by the supplier to protect the surface from wet cement, lime, dirt, dust etc. during the installation. This lacquer coating shall be removed after installation is complete, if approved by the Engineer-incharge and all sections of the windows shall be protected by the Engineer-in-charge and all sections of the windows shall be protected by P.V.C. film covering.

Hardware :

All cut outs, recesses, mortising or milling and operation required for fixing the hardware shall be accurately made reinforced with packing plate as required to ensure adequate strength of the connection. All the hardware, accessories shall be of best approved type and of anodized finish same as for the frame and other sections. All hardware shall be

free from defects which may affect the appearance and serviceability. All hardware shall be fixed after obtaining the prior approval of the Engineer-in-charge. Approved samples of hardware shall be kept in the custody of Engineer-in-charge.

Fixing :

The window frames shall be accurately fixed in the brick masonry or R.C.C. work.

The fixing of the frame shall be done with cadmium plated brass counter sunk screws driven on the teak wood rough grounds if required or fixed tot eh walls with holdfasts. All aluminium windows shall be fixed in position as per IS 1081-1960 (or any revision thereof):Code of practice for fixing and glazing of aluminium windows. All joints between metal and masonry / rough ground wooden frame shall be fully caulked and mastic or polysulphide compound in order to ensure water tight joints. Joints shall be neatly painted with matching cement an excess materials shall be removed. Hardware shall be fixed in workman like manner all as directed by the Engineer-in-charge.

Samples :

The sample of different windows shall be submitted to the Engineer-in-charge for approval.

Glazing :

The glazing shall be of Indian make plain sheet / frosted figured glass of special selected quality and size as mentioned in item description and drawings shall be of M/s Triveni / Saint Gobain / I.A.G./ Modi / approved make

The specifications specified herein before shall hold good as far as applicable Glazing will be paid on square metre basis.

Guarantee :All materials and workmanship in above work shall be guaranteed for a period of one year (unless otherwise specified) from the date of handling over.

Unqualified performance

guarantee for smooth operations of the windows, doors, wall spans and precautionary measures against leakages etc. shall be furnished by the contractor on stamped paper. If so specified, in schedule of quantities. Any defect found during the guarantee period shall be replaced / made good to the original conditions/positions entirely at the cost of the contractor.

Testing:

All windows shall be tested for water tightness. Any leakage found during testing shall be rectified by the contractor without extra charge.

M. M.S. GRILLS/RAILING

1.0 GENERAL

The contractor shall submit 6 copies of shop drawings shall show all dimension, details of construction, installation relating to the adjoining work.

2.0 MATERIALS:

All structural steel shall conform to IS 226-1963 sections for grills and shall be free from loose mill scales, rusts, pitting or any other defects affecting its strength and durability.

3.0 FABRICATION:

The grills shall be fabricated to the design and pattern shown in the drawings. All joints shall be made in best workman like manner with slotting and welding as required to the specified size and shape. The edge of the M.S. flats shall be suitably mitred before welding to get the desired shape.

The joints shall be filled to remove excess stay after welding screws, nuts, washers, bolts, rivets and any other miscellaneous fastenings devices shall be of steel and shall be provided by the contractor Manufactured M.S. Grills then be fixed in between the posts, balusters, M.S. frame work etc. to correct alignment. Any undulations, bends etc. found shall be rectified by the contractor at his own cost. The complete assembly of rill / railing so fixed shall be firm and there shall not be any lateral movements.

4.0 SAMPLES:

Samples of grill and railings shall be submitted for approval of the Engineer-in-charge and to be got approved before taking up for mass fabrication.

Installation: The approved grills shall be fixed in position where specified and shown in drawings including in masonry walls, teakwood frames, hand railings etc. Any damages to

walls, frames etc. caused during fixing the grills shall be made good by grouting with cement mortar/packing /repairing properly at the contractors cost.

5.0 PAINTING:

Painting shall be done as per the specification specified under painting.

Finishing / Painting/Polishing for railing: Teak wood hand rail shall be polished with wax polish / French polish / melamine with two or more coats over one coat of wood/primer or painted with two coats of synthetic enamel paint / flat oil paint of approved make and shade over one coat of approved primer. M.S. grills, balusters, etc. also to be painted as per specifications specified under Painting/ Polishing.

N. ACCESS FLOORING

1.0 GENERAL:

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Gravity-held panels on bolted stringer understructure.

B. Related Sections:
1. Section for Reinforced Cement Concrete for concrete floor sealer.
2. Sections for computer room air-conditioning units.
3. Electrical Specifications for connection to grounding of access flooring understructure.

1.3 PERFORMANCE REQUIREMENTS

A. Performance Requirements, General: Provide access flooring systems that comply with the following requirements:
1. Access flooring systems are proprietary portable systems composed of modular floor panels on elevated supports (understructures) forming accessible underfloor cavities (air spaces) to accommodate electrical and mechanical services.
2. Access flooring systems comply with performance requirements specified as determined by testing manufacturers' current standard products representing those indicated for this Project.

B. Structural Performance per CISCA A/F: Provide access flooring systems capable of supporting the following loads, within limits and under conditions indicated, as demonstrated by testing according to the referenced procedures in Ceilings and Interior Systems Construction Association's (CISCA) "Recommended Test Procedures for Access Floors." This publication and its procedures are referenced elsewhere in this Section as CISCA A/F.
1. Concentrated-Load Performance: Capability of floor panels, including those with cutouts, to support concentrated design loads of the following magnitude, with a top-surface deflection under load and a permanent set not to exceed, respectively, 0.10 and 0.010 inch, according to CISCA A/F Section I.
a. 1250 lbf.
2. Ultimate-Load Performance: Capability of access flooring systems to support a minimum ultimate concentrated load equal to the value obtained by multiplying the specified concentrated floor panel design load by the factor indicated below, without

failing, according to CISCA A/F Section II. Failure is defined as the point at which the access flooring system will not take any additional load.
a. Factor: 2.

3. Rolling-Load Performance: Capability of access flooring system to withstand rolling loads of the following magnitude applied to panels, with a combination of local and overall deformation not to exceed 0.040 inch after exposure to rolling load over CISCA A/F path A or B, whichever path produces the greatest top-surface deformation, according to CISCA A/F Section III.
   a. CISCA A/F Wheel 1 rolling load: 1000 lbf.; 10 passes
   b. CISCA A/F Wheel 2 rolling load: 800 lbf.; 10,000 passes
4. Stringer Concentrated-Load Performance: Capability of stringers, without panels in place, to support a concentrated load of 200 lbf at center of span with a permanent set not to exceed 0.010 inch, as determined per CISCA A/F Section IV.
5. Pedestal Axial-Load Performance: Capability of pedestal assemblies, without panels or other supports in place, to withstand the following axial load per pedestal, according to CISCA A/F Section V.
   a. 5000 lbf.
6. Pedestal Overturning-Moment Performance: Capability of pedestal assemblies, without panels or other supports in place, to withstand the following overturning moment per pedestal, according to CISCA A/F Section VI.
   a. 1000 lbf x inches.

C. Floor Panel Impact-Load Performance: Capability of access flooring system to withstand the following impact load when dropped from 36 inches onto a 1-sq. in. area located anywhere on panel, without failing. Failure is defined as the point at which the access flooring system will not take any additional load.

1. 150 lbf.

D. Static-Conductive Floor Covering Resistance: Not less than 25,000 ohms, nor more than 1 megohm, as determined by testing identical products according to the method for conductive flooring specified in Chapter 12 of NFPA 99 but modified to place 1 electrode on floor surface and to attach the other electrode to understructure.

E. Panel to Understructure Resistance: Not more than 10 ohms.

1.4 SUBMITTALS

A. Product Data for each type of access flooring specified.

B. Shop Drawings showing complete layout of access flooring based on field-verified dimensions; include dimensional relationships to adjoining work and installation tolerances. Include details, with descriptive notes indicating materials, finishes, fasteners, typical and special edge conditions, accessories, understructure, and other data to permit a full evaluation of entire access flooring system.

C. Samples for initial selection in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each type of floor covering and exposed finish indicated.

D. Samples for verification in full-size units of each type of floor covering and exposed finish indicated.
   1. In addition, submit one complete full-size floor panel, pedestal, and understructure unit for each type of access flooring system required.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who is approved by the access flooring manufacturer for installing the types of access flooring indicated for this Project.

B. Single-Source Responsibility: Obtain access flooring from one source and by a single manufacturer.

C. NFPA Standard: Provide access flooring complying with NFPA 75 requirements for raised flooring.

D. Provide floor panels that are clearly and permanently marked on their underside with the panel type and concentrated-load rating.

E. Mockups: Prior to installing access flooring, construct mockups for each type of panel and understructure required to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using products indicated for final access flooring installation.

1. Locate mockups on-site, in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Construction Manager one week in advance of the dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before start of final unit of Work.
4. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   a. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

F. Preinstallation Conference: Conduct conference at Project site

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver access flooring components in original, unopened packages, clearly labeled with manufacturer's name and item description.

B. Handle and store packages containing access flooring in a manner which avoids overloading building structure.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of access flooring until installation area is enclosed and has an ambient temperature of between 40 and 90 deg F and a relative humidity of not more than 70 percent.

B. Field Measurements: Check actual locations of walls and other construction to which access flooring must fit by accurate field measurements before preparing Shop Drawings; show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with preparing Shop Drawings for access flooring without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.8 COORDINATING AND SCHEDULING

A. Coordination of Work: Coordinate location of mechanical and electrical work in underfloor cavity to prevent interference with access flooring pedestals.

B. Mark pedestal locations with a grid of size indicated below on concrete subfloor so that mechanical and electrical work can proceed without interfering with pedestals.

1. 120 by 120 inches.

C. Do not proceed with installation of access flooring until after Substantial Completion of other construction within affected spaces.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
   1. Field Panels and Understructure: Furnish quantity of standard field panels and understructure components equal to 2 percent of amount installed.

PRODUCTS

1.10 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide access flooring by one of the following or an system with matching or better specifications:
   1. Systems with Cementitious-Filled Formed-Steel Panels:
      a. Maxcess Technologies, Inc.; RWC 200
      b. Tate Access Floors, Inc.; Concore SF 1250

1.11 FLOOR PANELS

A. Provide modular field panels complying with the following requirements that one person, using a portable lifting device, can interchange with other field panels without disturbing adjacent panels or understructure and that are free of exposed-metal edges with floor covering in place.
   1. Nominal Panel Size: 24 by 24 inches.
   2. Fabrication Tolerances: Fabricate panels to the following tolerances with squareness tolerances expressed as the difference between diagonal measurements from corner to corner.
      a. Size and Squareness: Plus or minus 0.015 inch of required size, with a squareness tolerance of plus or minus 0.015 inch, unless tolerances are otherwise indicated for a specific panel type.
      b. Flatness: Plus or minus 0.020 inch, measured on a diagonal on top of panel.
   3. Panel Attachment to Understructure: By gravity.

B. Cementitious-Filled Formed-Steel Panels: Cementitious-filled panels fabricated with die-cut flat top sheet and die-formed and stiffened bottom pan formed from cold-rolled steel sheet and joined together by resistance welding to form an enclosed assembly, with metal surfaces protected against corrosion by manufacturer's standard factory-applied finish.

1.12 FLOOR PANEL COVERING

A. Provide floor panels prepared to receive carpet tile where access flooring is scheduled for carpet tile.

B. Provide factory-applied floor coverings laminated by the access flooring manufacturer to tops of floor panels other than carpet tile applications.

C. Colors and Patterns: Provide floor covering materials in colors and patterns as indicated below:
   1. Provide Architect's selections made from manufacturer's full range of colors and patterns.

D. Conductive Plastic Laminate: NEMA LD 3, High-Wear Type, of grade indicated below, fabricated in one piece to cover each panel face within perimeter plastic edging or with integral trim serving as edging, and with static decay of 5000 to 0 V in less than 0.5 seconds per FED-STD-101C/4046 at 15 percent relative humidity.
   1. Grade: HW 62.

E. Edging: Manufacturer's standard form of edge trim. For applied edge trim, use method standard with manufacturer to attach edge trim to perimeter of each panel. Provide size and profile of applied edge trim that fits floor covering selected.

1.13 UNDERSTRUCTURE

A. Pedestals: Assembly consisting of base, column with provisions for height adjustment, and head (cap); made of steel.
   1. Base: Square base with not less than 16 sq. in. of bearing area.
   2. Provide vibration-proof leveling mechanism for making and holding fine adjustments in height over a range of not less than 2 inches. Include means of locking leveling mechanism at a selected height that requires deliberate action to change height setting and prevents vibratory displacement.
   3. Provide units of sufficient height to achieve underfloor clearance indicated.
   4. Head: Designed to support understructure system indicated.
   5. Postinstalled Expansion Anchors: Where required to comply with performance requirements, provide expansion anchors for bolting pedestal bases to subfloor that have the capability to sustain, without failure, a load equal to 5 times that specified under Part 1 Article "Performance Requirements."

B. Stringer Systems: Modular steel stringer systems made to interlock with pedestal heads and form a grid pattern placing stringers under each edge of each floor panel and a pedestal under each corner of each floor panel. Protect steel components with manufacturer's standard galvanized or corrosion-resistant paint finish.
   1. Bolted Stringers: System of main and cross stringers connected to pedestals with threaded fasteners accessible from above.
      a. Provide continuous gasket at contact surfaces between panel and stringers to deaden sound, to seal off underfloor cavity from above, and to maintain panel alignment and position.

C. Lateral Bracing: Provide manufacturer's recommended lateral diagonal bracing bolted to pedestals and bolted to floor with post-installed expansion anchors.

1.14 ACCESSORIES

A. Colors and Finishes: For exposed accessories available in more than one standard color or finish, provide color or finish complying with the following requirements:
   1. Match Architect's sample.
   2. Match color or finish indicated by referencing manufacturer's standard designations for these characteristics.
   3. Provide Architect's selections made from manufacturer's full range of available colors and finishes.

B. Cutouts: Provide cutouts in floor panels for cable penetrations and service outlets. Comply with requirements indicated for size, shape, number, and location. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with standard performance requirements.
   1. Trim edge of cutouts with manufacturer's standard plastic molding.
   2. Fit cutouts with manufacturer's standard grommets in sizes indicated or, where size of cutouts exceed maximum grommet size available, trim edge of cutouts with manufacturer's standard plastic molding having tapered top flange.
      a. Furnish removable covers for grommets.
   3. Provide foam-rubber pads for sealing annular space formed in cutouts by cables and trim edge of cutout with molding having flange and ledge for capturing and supporting pads.

C. Service Outlets: Standard UL-listed and -labeled assemblies, for recessed mounting flush with top of floor panels, for power, communication, and signal services, and complying with the following requirements:
   1. Structural Performance: Cover capable of supporting a 1000-lbf concentrated load.

2. Cover and Box Type: Hinged polycarbonate cover with opening for passage of cables when cover is closed and including frame and steel box or formed-steel plate for mounting electrical receptacles.
3. Location: Locate outlets in center of panel quadrant.
4. Receptacles and Wiring: Equip each service outlet with power receptacles to comply with requirements indicated below.
   a. Type of Receptacle: Heavy-duty duplex, 2-pole, 3-wire grounding, 20 A, 125 V, NEMA configuration 5-20R, unless otherwise indicated.
   b. Number of Receptacles for Outlet: 4.
   c. Wiring Method: Power-in connectors, built into outlet housing, of type to fit power-in and power-out connectors of branch circuit cables supplied with building electrical system.

D. Die-Cast Aluminum Floor Grates: Standard load-bearing die-cast aluminum grates complying with the following requirements:
   1. Air-Distribution Characteristics of Units without Dampers: 56% free area.
   2. Structural Performance: Capable of supporting a 1000-lbf concentrated load.

E. Panel Lifting Device: Manufacturer's standard portable lifting device of type and number required for lifting panels with floor covering provided.
   1. Provide 4 lifting devices of each type required.

F. Perimeter Support: Where indicated, provide manufacturer's standard method for supporting panel edge and form transition between access flooring and adjoining floor covering at same level as access flooring.

EXECUTION

1.15 PREPARATION

A. Locate each pedestal, complete any necessary subfloor preparation, and vacuum clean the subfloor to remove dust, dirt, and construction debris before beginning installation.

1.16 INSTALLATION

A. Install access flooring system and accessories under supervision of the access flooring manufacturer's authorized representative to produce a rigid, firm installation that complies with performance requirements and is free of vibration, rocking, rattles, and squeaks.

B. Attach pedestals to subfloor by postinstalled expansion anchors.

C. Lay out floor panel installation to keep the number of cut panels at the floor perimeter to a minimum. Scribe perimeter panels to provide a close fit with adjoining construction with no voids greater than 1/8 inch where panels abut vertical surfaces.

   1. To prevent dusting, seal cut edges with sealer recommended by panel manufacturer:

   2. Connect grounding strips embedded in static-conductive floor covering to connector clips attached to pedestals at the intervals needed to comply with performance requirements for electrical resistance of floor covering.

D. Secure stringers to pedestal heads according to the access flooring manufacturer's instructions.

E. Clean dust, dirt, and construction debris caused by floor installation, including vacuuming the subfloor area, as installation of floor panel's proceeds.

F. Cut and trim access flooring and perform other dirt-or-debris-producing operations as remotely as possible from installation area and to prevent contamination of subfloor under access flooring already installed.

G. Level installed access flooring to within 0.10 inch of true level over the entire access flooring area and within 0.062 inch in any 10-foot distance.

1.17 ADJUSTING, CLEANING, AND PROTECTION

A. After completing installation, vacuum clean access flooring and cover with continuous sheets of reinforced paper or plastic. Maintain protective covering until the time of Substantial Completion.

B. Replace access flooring panels that are stained, scratched, otherwise damaged, or not complying with specified requirements.

O. THEORETICAL, STANDARD REQUIREMENT OF CEMENT FOR VARIOUS ITEMS OF WORK FOR GUIDANCE OF CONTRACTOR.

Sl. No.	Brief description of item	Unit	Qty. of cement in bags
1	Cement Concrete 1:5:10	Cum	2.60
2	Cement Concrete 1:4:8	Cum	3.40
3	Cement Concrete 1:3:6	Cum.	4.40 *
4	Cement Concrete 1:2:4	Cum	6.40 *
5	Reinforced Cement Concrete1:2:4	Cum.	6.40 *
6	Reinforced Cement Concrete:1:1½:3	Cum.	8.00 *
7	Reinforced Cement Concrete 1:1:2	Cum.	12.20 *

Note : For controlled concrete items like M-10, M-15, M-20, M-25 etc. the Consumption of cement will have to be assessed by the Engineer-in-charge on the basis of design mixes approved for individual work.

8	Brick Masonry in C.M. 1:4	Cum.	1.90
9	Brick Masonry in C.M. 1:6	Cum.	1.25
10	Half brick masonry in C.M. 1:4 with RCC 1:2:4 stiffeners	Sqm.	0.27
11	Half brick masonry in 1:4	Sqm.	1.21
12	a. R.R. Masonry in C.M. 1:6	Cum.	1.65
	b. C.R. Masonry in C.M. 1:6	Cum.	1.56
13	IPS Flooring (C.C. 1:2:4, Finished smooth)		
	a. 30 mm thick	Sqm	0.23
	b. 40 mm thick (smooth / broom finish)	Sqm.	0.30
	c. 50 mm thick	Sqm.	0.36
	(+) 20 mm thick skirting /dado in cm. 1:3	Sqm.	0.30
14	Hardonate flooring – 50 mm thick (C.C. 1:2:4, finished smooth)	Sqm.	0.41
15	Kota Stone :		

Sl. No.	Brief description of item	Unit	Qty. of cement in bags
	a. Flooring (with lime mortar bedding pointed with matching cement slurry)	Sqm.	0.13
	b. Skirting with 20mm thick C.M. 1:3 backing	Sqm.	0.27
	c. Coping Sqm. 0.13 16 Terrazzo Tile :		
	a. Flooring (with lime mortar bedding and pointed with cement slurry)	Sqm.	0.18
	b. Skirting with 20 mm thick C.M. 1:3	Sqm.	0.28
	c. Treads, hydraulically pressed with C.M. 1:3 bedding	Sqm	0.37
	d. Treads in one piece	Sqm	0.28
	e. Risers, hydraulically pressed with C.M. 1:3 backing	Sqm.	0.28
	f. Risers in one piece	Sqm.	0.23
	a. Flooring 40 mm thick (28 mm C.C. 1:2:4 + 12mm with marble chips & powder)	Sqm.	0.26
	b. Skirting, 20mm thick (12mm C.M. 1:3 + 8 mm marble chips with cement & marble powder)	Sqm.	0.25
	White glazed tile flooring and dado over 20mm C.M. 1:3 bedding	Sqm.	0.31
	Cement tile :		
	a. Flooring (Lime mortar bedding)	Sqm.	0.18
	b. Skirting with 20 mm thick C.M. 1:3	Sqm.	0.28
20	Plaster skirting, 20 mm thick in C.M. 1:3	Sqm.	0.30
21	Cuddapah stone kitchen platform over 20mm thick C.M. 1:4	Sqm	0.30
22	Cuddapah stone window sill over 20mm thick C.M. 1:4	Sqm.	0.27
23	Fixing hold fasts in cement concrete 1:3:6 of size 300 X 100 X 150mm for door & windows	100 nos.	2.20
24	Cement plaster in C.M. 1:4 / 1:5 with neeru finish		
A.	Cement mortar 1:4		
a.	12 mm thick	Sqm.	0.1
b.	15 mm thick	Sqm	0.13
c.	20 mm thick	Sqm.	0.1
B.	Cement mortar 1:5		
a.	12 mm thick	Sqm.	0.09
b.	15 mm thick	Sqm.	0.11
c.	20 mm thick Sqm. 0.14 25 Cement plaster in C.M. 1:4 in two coats with neat cement punning		
a.	12 mm thick 10 mm + 5 mm (for ceiling)	Sqm.	0.18
b.	15 mm thick 15 mm + 5 mm (for internal walls)	Sqm.	0.22
25 .	Cement plaster in C.M. 1:4, 20 mm thick rough finish (for external brick / concrete surfaces)	Sqm	0.17

Sl. No.	Brief description of item	Unit	Qty. of cement in bags
26.	Sand faced plaster, 20 mm thick (12 mm C.M. 1:4 + 8mm C.M. 1:3)	Sqm.	0.21
27.	Rough cast plaster, 25mm thick (12 mm C.M. 1:4 + 13mm C.M. 1:3)	Sqm.	0.27
28 .	(+) 10 mm wide & 18 mm thick plain or moulded cement mortar band in CM 1:4	100 RM	0.152
29 .	Cement plaster in C.M. 1:3 with water proofing compound finished smooth with neat cement		
	a. 12 mm thick	Sqm.	0.19
	b. 20 mm thick	Sqm	0.27
30 .	Cement pointing in C.M. 1:3		
	a. Ruled pointing (groove pointing)	Sqm.	0.02
	b. Raised & cut pointing	Sqm.	0.04
31.	Cement based waterproofing work		
	a. Terrace type average 115mm thick	Sqm.	0.45
	b. Basement type (Box type)	sqm .	0.70
	c. Basement type (surface)	Sqm.	0.60
	d. In sunken floor of toilets, chajjas, parapets	Sqm	0.30
	e. Brickbat coba in toilets, extra in roof terrace	Cum.	3.00
	f. O.H. water tanks	Sqm.	0.50
	g. Expansion joints	RM	0.50
32.	Damp proof course in CC 1:2:4		
	a. 25 mm thick	Sqm.	0.16
	b. 38 mm thick	Sqm.	0.24
33.	Laying R.C.C. spun pipes in C.M. 1:1 / 1:2		
	A. 100 mm dia	10 m	0.1
	B. 150 mm dia	10 m	0.12
	C. 250 mm dia	10 m	0.18
	D. 300 mm dia	10 m	0.22
	E. 450 mm dia	10 m	0.48
	F. 600 mm dia	10 m	0.64
34.	Cement mortar 1:4 screed		

Sl. No.	Brief description of item	Unit	Qty. of cement in bags
	a. 20 mm thick	Sqm.	0 .30
	b. 50 mm thick	Sqm.	0.60
35	Chain link fencing / barbed wire fencing C.C. 1:3:4 pockets of 45 X 450 X 600 mm		
	a. Angle iron posts	m	0.21
	b. Cement concrete 1:2:4 posts	m	0.37
36	Kerb stone in CC 1:3:6 of size 125 X 375 mm	m	0.21
37	Shahabad stone paving, pointed in C.M. 1:3 15 X 10 mm groove	Sqm .	0.02
38	Pointing & grouting stone pitching in CM 1:3	Sqm.	0.14

P. METAL CLADDING

1.0 GENERAL

1.1 WORK INCLUDED

A. This Section specifies the requirements necessary to furnish and install the metal cladding systems.

1.2 RELATED WORK

A. This Section shall be used in conjunction with, but not necessarily limited to, the other relevant specifications, the Drawings and the Contract Documents to establish the total requirements for the metal cladding.

B. CAUTION: Using this Section without including the above-listed items will result in omission of basic requirements

C. In accordance with the General Conditions of Contract, the aforesaid documents shall be taken as mutually explanatory, and any ambiguities or discrepancies shall be resolved by the Purchaser, who shall then instruct the Contractor thereon. In the event of conflict regarding the metal cladding requirements between this Section and any other document, the more stringent requirement shall apply unless specifically instructed by the Purchaser in writing otherwise.

1.3 DESIGN CRITERIA

A. The work in this Section shall include the design, supply, installation, completion and maintenance of all metal cladding systems.

B. The work in this Section shall include all accessories, parapet cappings, end cappings, soffit trims, reveal linings, jamb linings, sills, and the like, which may not be expressly indicated on the drawings, but which are necessary to provide a total

metal cladding systems package, which interfaces in a complete manner with the adjacent building surfaces.

C. The proposed cladding systems shall include all required sealant systems, fixing systems, anchorage systems, and framing systems.

D. The Contractor shall provide all additional structural support systems, which are required for the proposed cladding systems, but not already provided under a separate contract, in the building structural works.

E. A set of "Only For Reference" structural works drawings form part of the Contract Documents. The Contractor will be deemed to have acquainted himself with the contents of these drawings and shall include in his tender any costs in respect to additional structural support systems which are not shown on these drawings, but which are required for the proposed cladding systems.

F. No consideration will be granted to any misinterpretation or unforeseen difficulties for which provision has not been made in the tender and this will in no way relieve the Contractor from the full execution of the Contract.

G. The Contractor shall note that the structural columns of the building superstructure, provided under a separate contract, are constructed of both cast in-situ and pre-cast concrete, with no provision for cast-in components for the anchorage systems of the proposed cladding systems.

H. Any cast-in anchorage components, which are required, shall be provided by and placed in position by the Contractor, ready for casting of concrete. Provide shop drawings of proposed anchorage systems.

H. The proposed cladding systems shall be so designed to meet or exceed the specified performances required for the prevailing local weather conditions. All fixings and joints shall be designed to provide for the expected thermal expansion and contraction, and to accommodate structural movement. The cladding systems shall be designed for air and water tightness, and moisture disposal.

J. The entire metal cladding systems shall be designed, constructed and installed to bond to the lightning protection systems as specified in Clause 1.12 Bonding of Cladding to Lightning Protection System.

1.4 QUALITY ASSURANCE

A. The metal cladding shall comply with Authorities' requirements and regulations in force in Tamil Nadu and shall guarantee durability with particular attention to the following critical factors:
- Effects of atmospheric corrosion typical to the area.
- Avoid contact between dissimilar metals to avoid electrolytic corrosion.

1.5 WARRANTY

A. Provide a two (2) year warranty under the provisions of Conditions of Contract.

B. The Contractor and the Specialist Sub-Contractor shall jointly provide a two (2) year warranty for the completed works on its performance against any defects and failure as a cladding system, in particular to its prevention of corrosion.

1.6 ORDERING AND DELIVERY

A. The Contractor shall be responsible for timely ordering, scheduling, delivery, receiving, protection and installation of all materials necessary for completion of the Contract work, on site or in transit.

B. The Contractor shall be responsible for all carriage freight, insurance, damage, breakage, duties, customs, clearance, etc.

C. All materials to be used shall be new and unused. Proof of ordering and delivery including shipping documents may be required to be given by the Contractor on demand at the discretion of the Purchaser.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Protect prefinished aluminum surfaces. Do not use adhesive papers or sprayed coatings, which bond when exposed to sunlight or weather.

C. The Contractor shall replace any defective, damaged, or broken cladding system components at his own expense and shall leave the systems clean and perfect on completion.

1.8 SUBMITTALS

A. Provide the following with the bid:
1. Product Data
2. Proposed Work Programme
3. Method Statement

B. The Contractor shall submit with his bid design recommendations including relevant information and physical properties of the selected elements. Notwithstanding the acceptance of the design recommendations by the Purchaser, the Contractor shall remain solely responsible for the adequacy of all the works and shall make good any damages arising from any inadequate design or provision.

C. Shop Drawings: Submit shop drawings for fabrication and installation of cladding units and accessories. Include schedules, plans, elevations and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joints, trims, and other information to determine compliance with specified requirements.

Shop drawings shall give all pertinent information of construction method proposed, together with all required dimensions for proper fitting and connection with other work and materials, together with all special conditions as may be required to complete the installation.

Indicate system and component dimensions, framed opening requirements and tolerances, anchorage and fasteners, anticipated deflection under load, affected related work, and field welding required. Include components within assembly, weep drainage network, and expansion and contraction joint locations and details. Submit preliminary data with the bid. After preliminary submission, all shop drawings shall be computer generated, Autocad-14 files. Shop drawings, product data, and samples shall be submitted to the Purchaser for review and approval, before ordering materials and commencing fabrication.

D. Product Data: Submit manufacturer's specifications including finishes and materials; certified test data, where applicable; and installation instructions; for required products. Provide framing member structural and physical characteristics, dimensional limitations, special installation requirements. Provide data on components within assembly, anchorage and fasteners, sheets and panels, sealant systems and drainage systems. Data sheets shall fully describe properties of materials, processes and finishes.

E. Proposed Work Programme: The Contractor shall prepare and submit a detailed programme of all phases of the work, including but not limited to the design, submissions, testing, ordering, fabrication, transportation, installation and after care, for the completion of the whole works to the Purchaser following award. Submit a preliminary work programme with the bid.

F. Method Statement for Site Installation and Quality Control: The Contractor shall prepare and submit a detailed step by step method statement for approval. Submit a preliminary method statement with the bid. The method statement shall include:

1. Setting out.
2. Transportation of cladding and framing.
3. Structural surface preparation if necessary.
4. Installation of fixings, such as drilling, installation of shims, angle, plate, anchors and bolts, inclusive of testing (pull out test) of anchor
5. Installation of cladding and framing.
6. Method of replacement of damaged units, framing, etc, if necessary.

G. Samples: The Contractor shall submit the following to the Purchaser for approval.

1. Samples of profiled metal sheet cladding.
2. Samples of aluminum flat panel cladding.
3. Samples of edge and corner details for cladding units.
4. Samples of support frame systems.
5. Samples of fixing and anchoring systems.
6. Samples of sealant systems.
7. Submit samples not less than 300 x 300mm in size illustrating finishes and materials.
8. Samples of coating for color.

H. Certificates: Submit manufacturer's certification, and other independent certification where applicable, that products meet or exceed specified requirements.

I. Test Reports: Submit substantiating engineering data, test results of previous tests by independent laboratory of the systems which purport to meet performance criteria, and other supportive data

J. Manufacturer's Instructions: Indicate special installation procedures.

K. Professional Engineer's Certificate: The design, fabrication and installation of the cladding systems shall be certified by the Contractor's Professional Engineer as safe, and in compliance with the regulations and requirements of the Authorities.

L. As-Built Drawings: During construction, the Contractor shall keep accurate records of the contract works, "as-built", on Autocad-14 construction drawings and details. This information shall be supplied to the Purchaser on Autocad-14 files, and shall form the basis of an "as-built" record of the construction of the building.

M. Prior to the issue of the Final Acceptance Certificate, the Contractor shall hand over to the Purchaser transparencies and Autocad-14 files of all as-built drawings, all Professional Engineer's certificates, and all other documents related to the Contract work, which will be required for the application for Temporary Occupation Permit.

1.9 SEQUENCING

A. Coordinate work under provisions of Conditions of Contract.

B. Coordinate work with installation of structural works, masonry works, waterproofing and roofing works, door / roller shutter works, and other cladding systems works.

1.10 MOCK-UPS AND SAMPLES

A. The Contractor shall install mock-ups of the typical metal cladding systems in conjunction with the other systems as and when directed by the Purchaser for his review and approval. These mock-ups are to ensure proper installation and coordination. Once accepted these mock-ups will be used as acceptance yardsticks for all production units.

B. Provide mock-ups of system components as part of the exterior wall mock-ups. Assemble to illustrate component assembly including cladding materials, weep drainage system, moisture disposal, attachments, anchors, and perimeter sealant.

C. Samples of components, fixtures, etc, shall, where required, be submitted to the Purchaser for review and approval before commencement of work.

D. The Contractor shall replace or modify such mock-ups and samples if deemed necessary by the Purchaser, and such final mock-ups and samples shall be used as the basis of installation work. However, any agreement by the Purchaser to such mock-ups and samples does not exonerate the Contractor from any responsibility under the terms and conditions of the Contract.

E. Delays caused by late installation of mock-ups or submission of samples, or delays caused by modifications of mock-ups / samples due to repeated errors, will under no circumstances be construed as reasons for extension of the Contract Period.

F. If the Contractor requires early review and approval of any mock-up / sample to avoid delay in the delivery or installation of the works, he shall advise the Purchaser to such effect when submitting them.

G. The Contractor shall be responsible for any claims arising out of errors / omissions in samples and mock-ups.

H. The Contractor shall obtain and pay for permits required for the work.

1.11 VERIFICATION AND PERFORMANCE TESTING

A. General

1. The Contractor will be required to verify that the work of this section meets the specified design criteria as well as all other conditions of this specification, through submission of shop drawings, calculations, data sheets, samples and test results.

2. Structural calculations, engineering data, and test data, shall be provided by a registered Professional Engineer, acceptable to the Purchaser.

3. Testing by independent testing laboratory or review of data by the Purchaser shall not avoid or reduce the Contractor's responsibility for performance of the work, nor relieve the Contractor of his responsibility to verify for himself that the work conforms to the intent of the Contract documents.

4. Data sheets shall fully describe properties of materials, processes, and finishes.

B. Performance Testing

1. After approval of structural calculations and shop drawings of the installation, the Contractor shall fabricate and erect test units of sizes and configurations acceptable to the Purchaser for testing.

2. Prior to fabrication of the test units, submit shop drawings of the test units and the test programmes for the Purchaser's approval.

3. Fabrication of test units and testing shall be carried out expeditiously and concluded in such time as not to delay fabrication and erection schedule.

4. The Contractor shall be responsible for all costs in connection with the performance testing.

5. If the test units fail to meet the performance requirements of this specification during testing, the Contractor shall make the necessary corrections to the test unit, and shall have the test unit re-tested until it passes the tests. The cost of corrections to the test unit, and of re-testing, shall be paid by the Contractor at no cost to the Purchaser.

6. The test programme shall require meeting the structural criteria at design load and at 1.5 overload (1.5 times the design load) at which no failure shall occur. The Contractor shall propose method of testing.

1.12 BONDING OF CLADDING TO LIGHTNING PROTECTION SYSTEM

A. The entire metal cladding systems shall be designed, constructed and installed so that all metal parts are electrically continuous. Sampling tests shall be carried out on site to verify the electrical continuity.

B. Earthing bosses shall be provided behind the cladding and curtain wall panels / frames. Each earthing boss shall basically consist of an "ear" piece of the same material as the cladding and shall have a hole of 10mm diameter to permit connection of 25mm x 3mm bonding aluminum tapes. The Contractor shall provide earthing boss "ears" as shown in the Lightning Protection System Drawings. The bonding of the aluminum tapes and connection of the tapes to the earthing bosses will be provided / undertaken by the C43 contractor under a separate contract. A set of Lightning Protection System Drawings form part of the Contract Documents.

C. At areas where the top of the cladding wraps round the parapet walls, 25mm x 3mm aluminum tapes will have to be mounted on the top of these claddings. To avoid puncturing the cladding, the Contractor is to supply and install saddles at every 600mmm along the top of the cladding. The details of the saddle are as shown in the Lightning Protection System Drawings.

D. The Contractor shall coordinate with the C43 contractor to ascertain the exact positions of the earthing bosses to suit the lightning protection system

2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. To the extent that products of the following manufacturers meet or exceed specified requirements, the following are acceptable:

1 For Main Wall Cladding System:

Lloyd
Kirby
Metecno

2 For Canopies and Sun Shades above doors and windows

Aluminium Panel
Alucobond
Durobond

B. Products of manufacturer's other than the above-listed will be considered for acceptance providing they meet the specified criteria and that the substitution requests are made in accordance with the Conditions of Contract.

2.2 TECHNICAL SPECIFICATIONS & INSTALLATION METAL WALL CLADDING SYSTEM

2.2.1 Supplying and Fixing Pre-Fabricated Rockwool Sandwich Panels For Walls Comprising Of

A. **Exterior sheet** : Profiled sheets with 1000 mm cover width, 35 mm crest height at 333 mm centres, made out of 0.5 mm TCT, 300 Mpa – yield stress, Galvalume

Steel, 150 gsm Zinc – Aluminium alloy (as per ASTM : A 792) coating with 20 microns polyster coating.

B **Core Insulation Material :** High density Rockwool of 100 kg/cu.m density converted to lamellar in 80 mm thick and bonded to steel sheets with industrial Grade adhesive.

C. **Interior sheet :** Plain sheet with slight ribs, with 1000 mm cover width, made out of 0.5 mm TCT, 300 Mpa – yield stress, Bare Galvalume steel, 150 gsm Zinc-Aluminium alloy (as per ASTM : A 792) coating with 20 microns polyester coating.

D. Panel shall be supplied in 1 m width and in single length upto 12 m without any joints depending on site requirements.

E. **Fixing:** Panel shall have tongue and groove joint with concealed fixing system and shall be fixed on to the support system with self drilling and self tapping fasteners as per manufacturer's specification.

2.2.2 Supplying & Fixing Site Fabricated Double Skin Insulated Cladding Comprising Of

A **Exterior sheet** : Profile sheet 1000 mm cover width, 28 + 2 mm crest height at 195 centres made out of 0.6 TCT, 550 MPa – yield stress, Galvalume Steel, 150 gsm Zinc-Aluminium Alloy (as per ASTM : A 792) coating and with 20 microns of Polyster coating.

B **Vapour Barrier** : Providing and fixing SIL / Polynum Refective Vapour Barrier of Supreme Industries Ltd,./ Polyon Barkai Industries between exterior sheet & Insulation.

C **Core Insulation Material** : Bonded Rockwool slabs of 64 Kg/cu.m density in 100 mm thickness encased in Black Polythene sheet.

D **Interior sheet** : Profile sheet 1000 mm cover width, 28 + 2 mm crest height at 195 centres made out of 0.6 TCT, 550 MPa – yield stress, Galvalume Steel, 150 gsm Zinc-Aluminium Alloy (as per ASTM : A 792) coating and with 20 microns of Polyster coating.

E **Fixing procedure** : The internal sheets shall be fixed to the purlins with self drilling self tapping fasteners, Z Sub-girts shall be 50 x 100x 50 and made out of 1.6 mm Galvanised steel sheet shall be provided at purlin locations and collinear to the purlin.

F. The insulation material shall be then laid between the Z sub-girts as exterior sheet shall then be fixed to Z Sub-girts with self drilling self tapping screws.

G. The wall cladding shall be complete with necessary flashings and wherever necessary

2.2.3 Supplying & Fixing Partitions with Pre-Fabricated Rockwool Insulated Panels comprising of

A. **Exterior sheet** : Plain sheets with micro ribs, made out of 0.5 mm TCT, 300 MPa – yield stress, Galvalume Steel, 150 gsm Zinc-Aluminium Alloy (as per ASTM : A 792) coating and with 20 microns of Polyster coating over 5 microns primer.

B **Core Insulation Material** : High Density Lamellar Rockwool having 100 Kg/cu.m density in 80 mm thick.

C **Interior sheet** : Plain sheets with slight ribs, made out of 0.5 mm TCT, 300 MPa – yield stress, Galvalume Steel, 150 gsm Zinc-Aluminium Alloy (as per ASTM : A 792) coating and with 20 microns of Polyster coating over 5 microns primer.

D Panels shall be supplied in 1000 mm width and in single length upto 12 m without any joints depending on site requirements and shall be laid vertically.

E **Fixing procedure** : Panels shall have tongue and groove joint with concealed fixing system and shall be fixed on to the support system with self drilling and self taping fasteners as per manufacturer's specification.

2.2.4 Supplying And Fixing Single Skin Partitions Comprising Of

A. **Partition sheet** : Profile sheet 1000 mm cover width, 28 + 2 mm crest height at 195 centres made out of 0.6 TCT, 550 MPa – yield stress, Galvalume Steel, 150 gsm Zinc-Aluminium Alloy (as per ASTM : A 792) coating and with 20 microns of Polyster coating.

B. **Fixing procedure** : The partition sheets shall be fixed to the support structure with self drilling self tapping at crest locations with required overlaps and partitions shall be complete with all necessary flashings wherever necessary.

2.2.5 Accessories

A **Cappings, Flashings and Trims** : Cappings, Flashings and Trims shall be made out of 0.7 mm TCT, 550 Mpa – yield stress, Galvalume Steel, 150 gsm, Zinc-Aluminium Alloy (as per ASTM : A 792) coating and with 20 microns of Polyster coating.

B Cappings, Flashings and Trims may be formed to required shape and profile based on shop drawings in 2.5 m lengths of profile of external / internal sheet except where metal crapped foam fillers are used.

C **Fixing** : Cappings, Flashings and Trims shall be screwed to the external / internal sheeting with colour matched nylon head self drilling stitching fasteners at max. 500 mm centres along the length of the capping / flashing shall be installed at 90°C to the material being fastened.

D All longitudinal joints in cappings and flashings shall be overlapped a minimum of 50 mm and sealed with a continuous run of sealant.

2.2.6 Fixing Accessories :

A **Fastners**

12 – 14 x 90 Galvanised head self drilling screws with integral washers shall be used for fastening Pre-fabricated sandwich Panels for Wall Cladding.

12 – 14 x 55 Galvanised head self drilling screws with integral washers shall be used for Partition Sheets and fastening Double Skin Insulated Cladding.

10 -16 x 16 hexagonal head stitch fasteners shall be provided on side laps at 900 mm centers maximum.

The fasteners shall generally confirm to ASTM A 3566 and shall be Hilti / Corroshield make.

B **Profiled Foam Fillers** :

Profiled foam fillers shall be provided wherever required to close the voids between cappings and the troughs of the external sheet so as to provide a weather tight exterior. These shall be made out of closed cell Polyethylene Foam die cut in profile to match external sheeting.

C Gutters, down-spouts and down-takes:

Gutters shall be provided wherever shown on the drawings, Gutters shall be fabricated and brake-formed from 3.15 mm Cold Rolled Steel conforming to IS 513.

For reinforcing gutters 38mm x 38mm x 3 mm angle shall be provided at 1000 mm c/c and support bottom of gutters to structural steel at 1000 mm c/c. longitudinal joints in gutter shall be continuously welded. The gutter surfaces shall be cleaned, and provided with 2 mm thick FRP coating.

The mouth of each downtake pipe in the gutter shall be provide with a weldmesh screen with mesh size of 6 mm x 6 mm.

D Down spouts:

Down spouts will be either 200 mm dia or 300 mm dia UPVC pipes, as indicated in the drawings. Pipes shall have joints sealed and shall be laid plumb or to horizontal slope as indicated in drawings. Pipes shall be clamped to the columns / cladding runners by means M S clamps bent to shape and fixed by colour matched self drilling screws.

E Roof Openings:

Roof Openings with curbs shall be located at the place of openings. Wherever such framed openings are to be provided, the contractor shall provide flashing around such framed openings or curbs.

Flashings around such openings shall be formed of same material as flashings. The flashing shall normally be with a flat sheet of size adequate to overlap the roof sheeting all around the opening by at least 200 mm. This flat sheet flashing shall be sealed to roof sheeting at transverse laps with foam fillers and at side laps with continuous runs of sealant.

Where required, curbs shall be fabricated from 14 G (2 mm) pre painted steel and flashed around the opening. All curbs shall be min. 300 mm high and shall feature a 50 mm wide MS angle flange around the top of the curb and a sloped drainage surround. Contractor shall furnish details of curb construction for approval prior to commencement of work. All structural loads will be supported by structural framing in roof by others.

Such framed openings may be provided-while the roof sheeting is being installed or subsequent to the roof sheeting installation

2.3 TECHNICAL SPECIFICATIONS AND INSTALLATION ALUMINIUM PANEL CLADDING SYSTEM FOR CANOPIES AND SUN SHADES

Description of the work: The aluminum composite cladding panels shall be fixed securely to the aluminum extrusion supports. The fixing shall allow for building tolerance

adjustment. Where reinforcement of the panel is required, extruded aluminum profiles of suitable cross-section and strength shall bonded to the reverse side of the panel. Application of the bonding systems shall be strictly in accordance with the manufacturer's specification. No cladding element shall sustain permanent deformation or failure under loading equivalent 1.5 times of design wind pressure (positive and negative) specified. Deflection of any aluminum frame shall not exceed 1/500 of the clear span. All component parts shall be installed level, true to line with uniform joints and reveals.

Maximum deviation for vertical member: 3mm max. in an 5.2m run.

Maximum deviation for horizontal member: 3mm max. in an 8.5m run.

Maximum deviation form true alignment between the abutting member shall not exceed 1.0mm.

The tolerance of the width of the joints between two panels shall be maximum ± 2mm.

3.0 EXECUTION

3.1 See execution notes under various products and items listed under 2.2 above

3.2 SITE INSPECTION

The Contractor is to examine and satisfy himself of other related-trades site conditions under which, the metal cladding is to be installed. Do not proceed until unsatisfactory conditions have been rectified. The Contractor shall compensate the owner any additional cost due to above reason.

All parts of the works done on site will be subject to inspection and shall be completed to the satisfaction of the Purchaser. The Contractor shall provide all facilities and assistance for inspection during the progress of the site works and until the completion of the contract.

Q. SPECIFICATIONS FOR FAÇADE ALUMINIUM AND GLAZING WORKS

1.0 SCOPE OF WORK:

The scope of work under this sub-head includes structural analysis and design, preparation of shop drawings, setting out, fabrication, supply, installation, aligning, fixing and protection of the Fixed Glazing butt to butt joint, patch fitted door, Aluminum Composite Panel Cladding, Conventional curtain wall with butt flat & Cap, Skylight, Sunshade Louvers, Suspended Spider Glazing etc. it also includes guarantee for the works under this sub head as described above, for the system, materials and performance requirements for a period of 10 years form the date of completion of the work.

The work under this section includes cost of all inputs of labour, materials including wastages, hardware and accessories, transport & packaging, access equipments such as cranes or cradles, scaffolding etc., other enabling temporary structures and services and all other incidental charges, if any, not specifically mentioned here, but as required for complete design, engineering, fabrication, assembling delivery, anchorage, installation, protection of Fixed Glazing butt to butt joint, patch fitted door, Aluminum Composite Panel

Cladding, Conventional curtain wall with butt flat & Cap, Skylight, Aluminium Louvers, Suspended Spider Glazing etc water tight and complete all in accordance with the true intent and meaning of the specifications and the drawings taken together regardless of whether the same may or may not be particularly shown on the drawings and / or described in the specifications, provided that the same can be reasonably inferred there from. All items as mentioned in the above scope of work shall be structurally and mechanically designed to achieve the architectural elevations as well as performance parameters specified herein. Anchorage shall include all supporting brackets and anchor fasteners, as required to rigidly secure the structural framing to the RCC/ Masonry / Structural steel members of the building.

Fixed Glazing butt to butt joint, patch fitted door, Aluminum Composite Panel Cladding, Conventional curtain wall with butt flat & Cap, Skylight, Sunshade Louvers, Suspended Spider Glazing etc described hereafter shall include but will not necessarily be limited to the following:

a. Frames, fixed vision panels, spandrels, openable panels, as indicated in the drawings inclusive of all accessories and fittings. The scope of work also includes replacement of any defective and / or broken glass panes [single or insulated Glazed Units (IGUs) (breakage not attributable to vandalism or accident), evident due to condensation or dirt between the lites, failure of seal and damage to internal glass panes, staining, damage to the coating etc., for a period of 10 years from the date of completion of work for which nothing extra shall be payable. The decision of Engineer-in –Charge as regards for reason for breakage of glass shall be final and binding on the contractor.

b. Glass wool insulation panel fire stop (barrier) –cum –smoke seals, splice plates, connectors, sleeves, anti-buckling clips etc.

c. Access panels and inspection of lightening protection and test clamps including ironmongery and accessories to all the open able panels of curtain glazing, structurally glazed aluminum windows and doors etc.

d. Doors and vents where indicated.

e. Structural, weather and other silicone sealants within and all round the perimeter of all the work under this sub head for fabricating IGUs, holding the glass to the aluminum and glass to glass and to provide water tightness to the Fixed Glazing butt to butt joint, perforated metal sheet cladding, patch fitted door, Glas Canopy, Sandstone Cladding, Aluminum Composite Panel Cladding, conventional Curtain wall with butt flat & cap, skylight, Sunshade Louvers etc.

f. Ozone resistant EPDM/ silicone gaskets, trims, shims, setting blocks, double sided spacer tape, spacer blocks, weathering strips etc.

g. All caulking, sealing and flashings including sealing at junctions with the building members.

h. All brackets, anchor fasteners, screws, inserts, nuts, bolts & washers, and attachments required for complete installation and fixing to the RCC, Masonry and / or the structural steel members of the building.

i. All accessories, fasteners, screws, nuts and bolts, toggles, rivets etc. and other items implied in the drawings and the specifications through are not specifically indicated or mentioned here

j. Isolation of all dissimilar metal surfaces as well as moving surfaces by use of suitable separators.

k. Electrolytic & Bimetallic isolation Different metals that are in direct contact and at risk of electrolytic and bimetallic corrosion shall be isolated form one another to prevent electrical connectivity and interment corrosion between the metals.

l. Aluminium composite panel Cladding and trimmers etc. as per the drawings.

m. Engineering proposals, design, drawings and architectural data.

n. Shop drawings, engineering data and structural calculations (analysis & design) of all systems including aluminium structural framing, fasteners, sealants etc.

o. Scheduling and monitoring of the work.

p. Cost of all samples of the individual components mock-ups at site, field tests for individual materials/ components and the curtain wall system as a whole, as specified.

q. Coordination with work of other agencies / contractors employed on site.

r. Protection, during storage and construction until handing over the building for occupation, of Fixed Glazing butt to butt joint, perforated metal sheet cladding, patch fitted door, glass canopy, sandstone Cladding, Aluminium composite panel cladding, conventional Curtain wall with butt flat & cap, skylight, sunshade louvers etc.

s. All final exterior and interior cleaning of the Fixed Glazing butt to butt joint, perforated metal sheet cladding, patch fitted door, glass Canopy, Sandstone Cladding, Aluminium Composite panel cladding, Conventional Curtain wall with butt flat & Cap, Skylight, Sunshade Louvers etc before handing over the building for occupation to the satisfaction of the client.

t. Hoisting, staging, scaffolding and temporary enabling structural work/ services, cranes and cradles etc,

u. All the loading, unloading cartage, insurance and other incidental charges of any kind on account of transporting material to site / factory shipment etc., all complete as required for the execution of the work.

v. Specified tests, of necessary records, reports, logbook etc. including all certifications and documentation from the contractor/ curtain wall fabricator / specialist agency / manufacturer / suppliers/ processors etc. as specified.

w. Maintenance manuals. Design and performance guarantees in the enclosed formats.

x. Construction monitoring for regular quality control and technical inspection to ensure the work conforms to the approved shop drawings and details (including any modifications made after initial/ mock up testing) and acceptable standards of quality including monitoring the progress of the work.

2.0 STANDARDS

2.1 RELEVANT CODES AND STANDARDS

The Contractor shall, as a minimum, comply with all the relevant regulations and with the current edition of the relevant Standards and Codes. Where conflicts arise between this specification and the code or standard listed below the more stringent requirement shall apply.

Materials and workmanship shall, in general, comply with the latest editions of the following standards as a minimum. The following standards are applicable to the design of the works covered by this specification. This is not an exclusive list and additional standards shall be referenced where required to meet the contract intent, Indian standards shall also be referred as appropriate.

ANSI Z97.1	Safety glazing material used in Buildings
ASTM C 1036	Specification for float glass
ASTM C 1048	Specification for Heat – treated Float Glass
ASTM E 774	Specification for sealed insulating Glass Units
ASTM C 864	Specification for compression Seal Gaskets
ASTM C 1115	Specification for Silicone Rubber Gaskets
ASTM C 920	Specification for Sealants
ASTM C 509	Specification for sealing material
CPSC 16 CFR 1001	Specification for safety glass
GTA Specification No. 89-1-6	Specification for environment durability for heat strengthened spandrel Glass with Applied opacifiers.
BS EN12150 BS EN14179 BS EN12600	Specification for toughened safety glass(Shatter proof) Heat-soak test Pendulum test
BSCP 118	Structural use of Aluminium

2.2 International Standards

In general, the Contractor shall follow either of the latest Indian/ international standards issued by BIS, ASTM, SAA, AAMA, BSS, ISO, & SSIR. The contractor shall state reasons for adopting particular standards / codes. Nothing in this clause shall relieve the contractor of his obligations to provide high standard of quality and workmanship as required.

2.3 Submittal of Codes

All relevant codes proposed to be followed for design, materials, installation and testing etc. shall be procured by the contractor and submitted to the Engineer –in –charge within 2 months of the issue of letter for commencement of work failing which these shall be purchased by the Engineer-in-charge and cost shall be recovered from the contractor.

2.4 Building Regulations

Design of the Fixed Glazing butt to butt joint, perforated metal sheet cladding, Patch fitted door, Glass Canopy, Sandstone Cladding, Aluminium Composite panel Cladding, conventional Curtain wall with butt flat and skylight , toughened safety glass(Shatter

proof), sunshade louvers etc shall comply with all Government codes and regulations. The design for dead loads, wind loads, seismic loads, and other loads, shall comply with the requirements of the relevant National Building Code and Indian standard code / international standards, unless specified otherwise.

2.5 Structural Adequacy

- Installation:- Erect panel ,plumb. level and true. Panel shall be erected as per the approved shop drawings if required.
- Specialized Contractors are required to do this kind of job

Any façade system is to be structurally adequate to resist the loads that it will experience over its structural design life. These are considered to be the following:

2.6 Dead Loads

All Systems Are To Support And Transfer Their Own Self Weight And Other Associated Dead Loads To The Main Building Structure. The Contractor Will Be Required To Identify, Design, Co-Ordinate And Supply All Necessary Sub Frames And Secondary Structure

2.7 Live loads

Sunshades with a dimension greater then 600mm:	0.50kp
Canopy and skylights with access only for maintenance:	0.75kpa
Accidental human point load on sunshade and fins:	075kn in any direction
Horizontal barrier loads for walls to all occupied spaces: Above Floor Finish Level	0.36kn/m @ +1m

Large panels forming horizontal surface should be designed for multiple concentrated loads of 2.25 kN concentrated at any critical location.

Component	Material & Grade	Comments and other requirements
Glass	Following should be considered in the absence of any specific glass types noted during tender. Use Annealed –generally Use Head Strengthened (HS), if required to resist thermal stress, impact loads and comply regulations. Use Toughened, it HS is not adequate for strength and impact loads. Use Laminated, if required for safety	All toughened glass to be 100% head soaked. Base float glass (uncoated) to be any one of the following glass manufacturers • Asahi • Glaverbel • Guardian • Saint Gobain • Pilkington High performance coated glass to be any one of the following 1. Glaverbel 2. Saint Gobain 3. Pilkington 4. Viracon All glasses should be sourced form one single source. Glass type and thickness should satisfy respective standards and special conditions as mentioned in the tender.
Toughened safetyglass(Shatter proof)	Thermally toughened safety glass which has increased resistance to mechanical and thermal stresses than conventional annealed glasse.if the glass breaks; it fragments safely into small pieces with dulled edge.	High performance safety glass to be any one of the following 1. Glaverbel 2. Saint Gobain 3. Pilkington All glasses should be sourced form one single source. Glass type and thickness should satisfy respective standards and special conditions as mentioned in the tender.
Laminated glass	PVB laminated	Use PVB from saflex or Dupont Resin laminated shall to be acceptable as an alternate to PVB. Contractor should seek approval to use resin laminated glass.
Vision glass for curtain walls	Double glazing for typical areas single glazing for glass screens Thickness to suit strength	Must satisfy performance requirements toughened glass to be used for fire access panels and laminated inner lite adjacent to floors. Comply with local statutory requirements.

Spandrel Glass for curtain walls	Single glass –Heat strengthened thickness of glass to suit strength	Contractor to check for strength.
Glass for windows	Single glass- clear HS Thickness of glass to suit strength	
Framing Extrusions	Aluminium grade 6063 T5 or T6 min wall thickness 2.5 mm(struct) 1.5mm (non-struct). For coating refer to specification.	Use of thinner walls acceptable if supported by calculation and demonstration of extrusion quality. Contractor should seek prior approval to select Aluminium extruder. The proposed extruder shall only be acceptable upon review by consultants.
Spandrel air seal (back pan)	Alumiium (Minimum thickness 1.6mm) or zicalume (minimum thickness 1.2mm)	Thickness to be verified by calculation thickness should be adequate to achieve flat and consistent paint finish.
Alum panels (vertical and part of sunshades)	4 mm min. solid aluminium or composite panel fire rated with metallic finish.	Acceptable Aluminium composite panel brands: alplic, alucobond and Reynobond to be fire resistance (FR) grade PVDF coated

2.8 Wind Loads

The façade is to be designed in accordance with the minimum design pressures as per Indian Standard is 875 and appropriate pressure coefficients to be taken from the codes of practice. Basic wind speed is 47 m/s with terrain category 2, in any case the design with pressure shall not be less than 1.8kpa (including Factor of safety).

Dynamic response to wind effects and associated loads, deflections and vibrations are to be considered for all elements of the façade.

2.9 Maintenance Loads

All trafficable areas including parapet copings shall make allowance for maintenance loadings this will include person loadings, point loads and indirect loads form abseiling ropes.

2.10 Building Maintenance Unit (BMU) Loads

BMU restraint Points: 1.50 kN (in any direction)
BMU impact loads: in accordance with requirements of the equipment supplier.

2.11 Movement Related Loads

Any forces resulting from support structure movements, thermal effects, etc to be accommodated.

2.12 Verification Methods

Acceptable evidence of adequacy may be provided by:

- Calculation
- Testing / demonstration – small prototypes, mock-ups and in-situ testing

Where the calculation will not be adequate to demonstrate the strength then façade contractor should carry out testing as instructed by consultant.

3.0 MATERIALS AND MINIMUM REQUIREMENTS

In addition to meeting the performance standards the following minimum material properties are required

Sealants	Silicone	Acceptable suppliers: dow corning, GE silicones Structural sealants must be clearly identified and suitable material used .
Backing Roads	Open cell	Closed cell accepted upon review of glazing method
Glazing Tapes	Breathable spacer tape	Double sided tape from Norton or 3m
Insulation	50 mm glass fibre insulation min. weight 60 kg/m^3	
Fire Proof	Glass fibre insulation Min. Weight 70 kg/m^3	
Stainless steel elements	Grade 316 linished finish with passivation	Large SS elements to be isolated from aluminium and mild steel frames
Fixings	External (visible) stainless steel grade 316 Inside of air seal: hot-dipped Galvanised steel	
Screws & Bolts	Non-visible: Stainless steel gr 304 Visible grade 3160	
Pop Rivets	Stainless steel with stainless steel mandrel. Stainless steel grade 316 or higher	Aluminium rivets with SS madrels may be accepted providing the design allows for redundancy.
Concrete inserts/ cast –in	Hot –dipped galvanized steel.	
Anchor bolts	Stainless steel for building external (visible or non-visible area) Hot dip galvanized or electro galvanized for internal space i.e. inside airseal	Acceptable brands are fischer or hilti

Brackets (internal space, invisible) Brackets (visible)	Aluminium extrusions or hot dip galvanized mild steel with intermediate coat- Epoxy MIO 125 micom. Stainless steel (Gr. 316)	Systems and corrosion protection to consider finished and construction environment
Flashings	0.8mm (min.) aluinium sheet anodized or chromate	Thickness verified for wind loads
Sub- frames/ support frames (invisible) Panel Fixing brackets	Mild steel gr.43/50 Hot dip galvanized (min75um) in exposed conditions or in contact with envelope. Aluminium 6061 –T6 extrusions SS Gr. 316	Structural steel specifications apply concealed elements. Finish for exposed steelwork to be determined. Min 3.0 mm thk – anodized or chromate Min 1.5 mm thick
Cladding Support frame (runners)	Aluminimum extrusion 6063 – T5 or SS Gr. 316	Min 3.0 mm thk- Hollow sections to be sealed
Backing wall waterproofing	Water resistant render or flexible membrane system	Full submissions, sample and testing to be conducted
Hardwares (handle, stay arms etc.)	Stainless steel	Acceptable brands are Alutec, Giesse, Sobinco and securistyle

4.0 CURTAIN WALL CONTRACTOR'S QUALIFICATIONS:

Work of this section shall be performed by one contractor, who is regularly engaged in the engineering, fabricating, finishing and installation of curtain walls including glazing and sealing of glass, comparable to work on this project. The contractor shall demonstrate to the satisfaction of Architect and Client that he has successfully performed comparable projects over the previous five years.
Subcontracting any part of the work is specifically prohibited, except for that which may be approved by the architect/ Client in writing prior to award of the contract. If approval is granted to subcontract installation and / or glazing, approval is contingent upon the supervision of his subcontractor (s) by the same full time supervisor who coordinates and supervises mock-up work and installation at the project.

5.0 PERFORMANCE GUARNTEE

5.1 The contractor shall be solely responsible for the design including shop drawings and performance of the installed Fixed Glazing butt to butt joint, perforated metal sheet cladding, patch fitted door , glass canopy, sandstone cladding, aluminium composite panel cladding, conventional curtain wall butt flat & cap, skylight, sunshade Louvers etc. the installations shall be guaranteed by the contractor during the guarantee period for materials used, workmanship, water tightness (wherever specified) structural design, performance requirements and other requirements as given in the specifications. The contractor shall submit in the enclosed format a written guarantee for the same for period of 10 years form the date of completion of the work. In addition, the contractor shall obtain and submit to the engineer-in-charge a similar back- to back guarantee for same duration

from the specialist agency engaged by them.

5.1 The design , fabrication, supply and installation of the fixed glazing butt to butt joint, perforated metal sheet cladding, patch fitted door, glass Canopy, sandstone cladding, aluminum composite panel cladding, conventional curtain wall but flat & cap, skylight, sunshade louvers etc. shall be to the best of national / international standards and shall be guaranteed to take the dead loads, wind and seismic loads, storms, air pollution, thermal stresses, building movements and the consequent deflection without compromising the performance characteristics. It shall be water tight wherever specified and prevent ingress of water / moisture, pollutants etc. further, the individual members of the structural framing shall not deflect beyond permissible limits as specified.

5.2 In addition, guarantee for 10 years for all the material used and their performances shall be submitted by the contractor. Besides the contractor shall obtain and submit similar back to back guarantees form the specialist agency and also from the manufacturers / suppliers / processors, as applicable, of various materials to the tune that they conform to the specifications and other criteria as specified herein for:

5.3 Glass (single or IGUs, Ceramic frit glass) substrate, coatings, assembly of IGUs etc.

5.4 Sealants- usage as per requirement of structural design and functional requirements, compatibility with different substrates and sealants, bite size, quality assurance during sealing of IGUs and fixing glass to glass and glass to the aluminium frame, etc.

5.5 EPDM/ silicone gasket –for ozone resistance and other properties as specified etc.

5.6 Aluminium material quality, tem penning requirements, suitability of aluminium grade and anodizing etc.

5.7 Anchor fasteners – suitability and strength requirements as per manufacturers' specifications etc.

5.8 Aluminium composite panel cladding- material quality and PVDF coating etc.

5.9 The contractor shall also submit guarantee in the enclosed format for replacement of glass during the guarantee period of 10 years form the date of completion of work. All the guarantees shall be submitted before final payment is released after the date of the completion of work and shall not in any way limit any other rights, which the engineer-in –charge may have under the contract.

6.0 CONTRACTOR'S RESPONSIBILITY FOR DESIGN

a. Architectural drawings and specifications only indicate the required basic dimensions, profiles and performance criteria..
b. The contractor shall design the Fixed Glazing butt to butt joint, perforated metal sheet cladding, patch fitted door, glass canopy, sandstone cladding, aluminium composite panel cladding, conventional curtain wall with butt flat and cap, skylight, sunshade louvers etc. as per the parameters specified and submit the same for the approval of the Engineer –in –charge if required, the contractor shall re-design the system based on the directions of the Engineers-in-charge and / or based on the outcome of the mock up test(s) in the laboratory . Nothing extra shall be payable on these accounts.

c. The contractor may, at his own cost, have the option of minor modifications and addition of details and profiles subject to the approval of the Engineer -in –charge provided the architectural concept and performance requirements are achieved.
d. The acceptance by the contractor, of any modifications(s) suggested by the Engineer-in –charge, shall to relieve the contractor form his sole responsibility for the structural design and performance.
e. The contractor shall be solely and fully responsible for proper structural analysis and design for various load cases and their combination, fabrication, supply and installation and its satisfactory performance. This shall include design and proper sizing of all sections, meeting structural and architectural requirements. The anchor assemblies shall meet the performance and design requirements including installation of all inserts, clips, bracing and framework, as required for the proper anchorage to the structure, unless otherwise specified.
f. The approval of the structural design and shop drawings by the Engineer-in –charge shall not relieve the contractor from his responsibility for the structural design.
g. In the end, the contractor shall be solely and fully responsible for design of the Fixed Glazing butt to butt joint, perforated metal sheet cladding, patch fitted door, Glass Canopy, Sandstone Cladding, Aluminium composite panel cladding, conventional curtain wall with butt flat & cap, skylight , sunshade Louvers etc. including providing and installing a stable, safe and completely water tight (wherever specified) Fixed glazing butt to butt joint, perforated metal sheet cladding, patch fitted door, Glass Canopy, Sandstone cladding, Aluminium composite panel cladding conventional curtain wall with butt flat & cap, skylight , sunshade louvers etc pergola with sun-Breaker Louvers etc. which shall perform to the required standards during the guarantee period of 10 years from the date of completion of work . The contractor shall indemnify the Department against all claims, of whatsoever nature, due to defective designing and / or non- performance during the 10 years guarantee period. The provisions of this clause shall not in any way limit the rights of the Engineer-in- charge to take action under other clauses of the contract agreement .

7.0 SHOP DRAWINGS

7.1 Submittals

Within seven days after the issue of letter for commencement of works / letter of intent (LOI), the contractor shall prepare and submit preliminary shop drawings by incorporating necessary modifications to the architectural drawings and within seven days thereafter should submit four (4) copies of all shop drawings to the Engineers- in- charge for review and final approval. Based on the review of the preliminary shop drawings, the Fabricator to order all necessary raw materials such as extrusions, glass, Aluminium Composite panel etc.

The review of the shop drawings by the Engineer-in –charge shall be limited to their conformity to the architectural and structural design concept & specification. However the approval of the shop drawings by the Engineers –in –charge shall not relieve the contractor from any of his responsibilities and requirements as specified herein.
No fabrication shall be taken up until the shop drawings and all other related submittals, documentation, certification, samples and the mock-up for that work have been reviewed and approved by the Engineers –in charge.

On approval by the Engineer-in –charge, the contractor shall submit four (4) sets of the approved shop drawings to the Engineer –in –charge within two (2) weeks thereafter. After the completion of work, two (2) sets and two (2) CD's each of the as built drawings incorporating final approved shop drawings incorporating all the approved modifications, if

any, as per the site requirements, shall be submitted to the Engineer-in-charge within fifteen days from the date of completion of work.

7.2 Scope of Shop Drawings

Shop drawings shall incorporate scaled and dimensioned plans, elevations, section and complete size details for all the woks including site survey as carried out.
The shop drawings shall indicated the required dimensional profiles and modules, function design and performance standards and in general cover all dimensional and details required fabricating and installing the curtain wall at site.

The contractor shall verify and co-ordinate the shop drawings with all applicable and inter-related trades; drawings and specifications.

All dimensions/ modules, etc, shall be field checked and the drawings shall be modified, if required based on actual measurements at site.

Details shall show and specify all metal sections, types of finishes, areas to be sealed and sealant materials gaskets, applicable construction materials including fasteners and welds, all anchorage assemblies and components, fabrication and reaction tolerances for the work.

All details shall be subject to the approval of the Engineer-in-charge, after incorporating all the modifications as suggested by the Engineer-in-charge or otherwise.

All dimensions / modules, etc, shall be field checked and the drawing shall be modified, if required, based on actual measurements at site.
Details shall show and specify all metal sections, types of finishes, areas to be sealed and sealant materials, gaskets, applicable construction materials including fasteners and welds, all anchorage assemblies and components, fabrication and erection tolerances for the work.

All details shall be subject to the approval of the Engineer-in-change, after incorporating all the modifications as suggested by the Engineer-in-change or otherwise.

7.3 Section Profiles

Profile adjustments, if required as per the site conditions may be allowed by the Engineer-in-change subject to meeting the architectural / performance requirements. However, this shall be carried out only with the approval of the Engineer-in-charge Provided that the general design and intent of the drawings and specifications are also maintained. Also, if any new / non-standard aluminium extruded section is required as per the site requirement and /or the architectural drawings for the structural, functional and / or aesthetic reasons, the contractor shall procure the same from the approved manufacturers for the aluminium sections, even if it entails preparing new die, etc. Nothing extra shall be payable to the contractor on this account.

8.0 STRUCTURAL DESIGN AND CALCULATIONS

A The contractor / specialist agency shall employ a competent curtain wall design engineer to design the system and its components for Fixed Glazing butt to butt joint, Perforated mental sheet cladding, Patch fitted door, Glass Canopy, Sandstone Cladding, Aluminium Composite Panel Cladding, Conventional curtain wall with butt flat & Cap, Skylight, Sunshade Louvers etc. The design engineer shall have fich past

experience of successfully designing and detailing of similar system installed for at least three prestigious projects during last five calendar years.

B During the design stage, the contractor shall interact actively with the Engineer-in-charge, concerning all aspects of design and detailing and shall obtain the relevant information on architectural and structural design parameters concerning the structure, probable deflections and other building movements etc.

C The design shall account for all design considerations, codal provisions, possible loads & building movements as well as the movements within and relative movements etc. The Contractor shall obtain the approval of the Engineer-in-charge for the provisions made in his design in this regard.

D The Contractor shall submit his detailed structural analysis and design calculations for the system and cach of its typical and non-typical components along with the shop drawing for the approval of the Engineer-in-charge. Also, the contractor shall guarantee that his design ensures the structural stability, safety, integrity and required performances against all natural forces, superimposed loads, building movements and environmental effects, as specified and as called for under various codal provisions. The contractor shall also get the structural design checked and the shop drawing vetted from the Principals of the curtain wall system.

E The Contractor shall modify his design as required by the Engineer-in-charge for meeting the various provisions as specified and resubmit the same for the approval till the design is finally approved. Nothing extra shall be payable on this account.

F The Grade of R.C.C. in the building structure is as specified in DESIGN DATA. The Contractor shall design anchorages (capacity and numbers of the anchor fasteners) for this grade of concrete.

G The contractor shall submit for record only the glass manufacturer's wind pressure analysis and thermal analysis showing that the specified maximum deflection and probabilities of breakage are not exceeded.

9.0 DOCUMENTATION AND CERTIFICATION

The contractor shall obtain and submit to the Engineer-in-charge the manufacture's certificate for compliance of the various parameters for the various components to be used in the work (under this sub head) as per the manufacturer's specifications. A copy of the manufacturer's test report, for each lot of material procured and supplied for the work shall also be obtained from the respective manufacturers and submitted to the Engineer-in-charge for the record.

9.1 Glass and Glazing Documentation

a. Before taking up the work, the glass manufacturer / processor shall submit written certification for the review of the Engineer-in-charge and record, stating that all glass (properties as specified such as U value, shading coefficient, light transmission, light reflection (internal as well as external), solar factor, relative heat gain etc.) and glazing requirements (including heat strengthening / toughening, fabrication of IGUs including sealants etc.) as per the shop drawings are recommended by them for use related to their specific applications and design parameters and that they are in conformity with the specifications.

b. Tests shall be carried out for glass, including properties after processing, for each lot supplied, by the glass manufacturer / processor in his factory / laboratory or any other accredited international laboratory at his own cost and the copies of the test results shall be obtained by the contractor and submitted to the Engineer-in-charge for the record.

9.2 Sealant Documentation

a. All sealant applications must be clearly designated on shop drawings. Before taking up the work, a master sealant schedule shall be prepared and submitted to the Engineer-in-charge specifying materials, special instructions and application procedures.

b. The sealant manufacturer shall certify that all sealant requirements as detailed and specified on the shop drawings have been reviewed and approved for use related to their specific applications and / or design intent, compatibility to adjacent materials and in conformity with specifications including size of the structural silicone bite for tensile and shear requirements and for silicone sealant and its compatibility with adjacent materials shall also be certified by the sealant manufacturer. The sealant manufacturer shall also certify against streaking of the silicone. The contractor shall obtain certificate from the sealant manufacturer for the performance requirements of the sealant during the 10 years guarantee period from the date of completion of work and submit the same to the Engineer-in-charge for records.

c. The sealant manufacturer shall certify that the Contractor / specialist agency / curtain wall fabricator / glass processor has followed all application and quality assurance procedures recommended by them for fabrication and installation of panels including cleaning, curing sealant storage, application at a controlled temperature and clean dust free environment as per the relevant specifications. The sealant manufacturer shall also carryout field and laboratory tests on the samples of the sealants being used and collected from the factory / workshop of the Contractor / specialist agency / glass processor like butterfly test and snap-time tests on pump start –up, peel and pull adhesion tests by deglazing, compatibility test, water immersion test, UV chamber test, weather meter test, etc., as specified and submit the copies of the test reports to the Engineer-in—charge for records.

d. The deglazing tests for sealant adhesion on the working glazed panels shall be performed by the sealant manufacturer / supplier who shall certify the test results and the quality assurance of the same.

e. The contractor shall maintain a log book indicating the details of glass panel number, batch number of silicone sealants and the solvents including its shelf life and the name of the operator who fabricated the particular panel which shall be reviewed periodically and countersigned by the sealant manufacturer who shall also carry out deglazing test on the working panels, as specified and prepare deglazing summary report. The logbook and the deglazing summary report, duly authenticated by the sealant manufacturer, shall handed over to the Engineer-in-charge, for record, after the completion of the work. This logbook and the deglazing reports shall also be available for the review by the Engineer-in-charge during the execution of the work.

9.2 Aluminum Composite Panel Cladding Documentation

Before taking up the work, the Aluminum Composite Panel manufacturer shall submi9t written certification for the review of the Engineer-in-charge and record, stating all the quality parameters and other characteristics for the material for the use related to their

specific application and design parameter and that, they are in conformity with the specifications. The test shall be carried out for the PCDF / lumiflon-based fluoropolymer resin coating to the Aluminum Composite Panel Cladding material, for each lot supplied, by the manufacturer in his factory / laboratory or any other accredited international laboratory at his own cost and the copies of the test results shall be obtained by the contractor and submitted to the Engineer-in-charge for the record.

9.2.1 Quality Control Documentation

a. The contractor shall submit the methodology and quality assurance statement for in-plant and job site quality control procedures for the review and approval of the Engineer-in-charge before taking up the work to ensure the design integrity and performance of the curtain wall with Fixed Glazing butt to butt joint, Perforated matel sheet cladding, Patch fitted door, Glass canopy, Sandstone Cladding, Aluminum Composite Panel Cladding, Conventional curtain wall with butt flat & Cap, Skylight, Sunshade Louvers etc.

b. Documentation shall include schedules, details and / or schematic explanatory sketches cross-referenced to the shop drawings, data sheets, etc., all as required to assess methods and materials and to ensure that both the fabrication and quality assurance procedures.

c. The Engineer-in-charge or his authorized representatives may, time to time, visit the plant / workshop / factory to inspect material, fabrication and quality assurance procedures.

i) The in-plant quality control procedures shall include but not be limited to the following items:

- Material : Visual inspection and other field tests.
- Fabrication : Tolerances, Joinery, Sleeves, screws, cleats, etc.
- Finish Match : Approved finished and controls required for matching the exposed surfaces.
- Assembly : Welds, fasteners, sealants, gaskets, separators, setting blocks,
- Glazing, structural silicone bite.
- Protection : Handling, protection, shipping

ii) The job site quality control procedures shall include, but not necessarily be limited to the following items:

- Anchorage : Lines, grades and related tolerances.
- Installation : Setting-out, tolerances, finish match, connections, Sleeves, flashing, welds, fasteners, sealants, bolt Tensioning.
- Sealing : As recommended by the respective manufacturer.
- Storage : As recommended by the respective manufacturer(s) / processor(s).
- Protection & Cleaning : As recommended by the respective material manufacturer(s) / processor(s).

10.0 SAMPLES AND MOCK-UP AT SITE

10.1 Submittals

The samples of the following materials together with detailed technical data / catalogues shall be submitted in triplicate for review of the Engineer-in-charge and approval along with the shop drawings. Any omission of an item or items which require the compliance of the contractor shall not relieve him from responsibility.

a) Aluminum Composite Panel : Each type and thickness 600 mm x 600 mm

b) Aluminum extrusions: Each section: 500mm long

c) Glass : each type 600mm x 600mm.

Gaskets, separators, glass setting blocks, double sided spacer tape, backer rods etc: Each section or unit, 300mm long or unit.

Brackets of each type (material), anchor fasteners and connecting devices: Each type and size.

Finish samples: After approval of the final finish coating, the Engineer-in-charge shall be provided with three (3) approved samples.

Window and door ironmongery and accessories, as applicable.

Finished flashing samples.

Finished samples of shadow boxes, fire stop (barrier)-cum smoke seals

Structural and weather silicone sealant

In addition to the above, the contractor shall also submit one sample of the assembly of various components forming a typical fixing detail of curtain glazing, composite panel Cladding, structurally glazed aluminum window.

10.2 Mock-up at site

Before the fabrication and site installation is taken up and within Seven (7) days after the approval of shop drawings by the Engineer-in-charge, the Contractor shall prepare mock-ups of the proposed curtain wall and fix it on the building. The width of the mock up for curtain glazing (including one openable panel) shall be not less than three typical adjoining wall panels / units. The height of the mock up test sample of curtain glazing shall be not less than 1 storey high and must contain full height modules. The mock up shall also incorporate all types of in fill panels, fire stop / barrier-cum-smoke seal, flashings, shadowbox, bracketry, hardware and fixtures etc. A typical mock up shall also be put up for the aluminum windows including fittings and the other hardwares. The mock ups shall be essentially put up at site for final approval of all materials and installation details by the Engineer-in-charge. The mock up shall not form part of the work and shall not be paid for separately. It shall be dismantled and taken away by the contractor at this own cost, with the prior permission of the Engineer-in-charge. Nothing extra shall be payable on this account.

10.3 Maintenance Manual

After the completion of the work, the contractor shall submit two (2) copies each, of detailed procedures for the periodic inspection, maintenance and cleaning of all the Fixed Glazing butt to butt joint, Perforated metal sheet cladding, Patch fitted door, Glass Canopy, Sandstone cladding, Aluminum Composite Panel Cladding, Conventional

Curtain wall with butt flat & Cap, Skylight, Sunshade Louvers etc to the Engineer-in-charge.

11.0 WORK SCHEDULE

Immediately after award of work, the Contractor shall submit the final programmed micro work schedule/Bar chart for the completion of whole of the work under this sub-head Fixed Glazing butt joint, Perforated metal sheet cladding, Patch fitted door, Glass Canopy, Sandstone Cladding, Aluminum Composite Panel Cladding, Conventional Curtain wall with butt flat & Cap, Skylight, Sunshade Louvers etc including submittals, mock up test at site as well as in the approved laboratory (optional), approvals, fabrication, supply of materials at site & installation etc.

12.0 STORAGE, PROTECTION AND PROGRAMME

a. The contractor shall submit a schedule of procedure for inspection during installation so as to control and assure quality on the job site.

b. The Contractor shall submit a detailed method statement for the protection of the surface of the Fixed Glazing butt to butt joint, Perforated metal sheet cladding, Patch fitted door, Glass Canopy, Sandstone Cladding, Aluminum Composite Panel Cladding, Conventional Curtain wall with butt flat & Cap, Skylight, Sunshade Louvers etc during delivery and erection, with description as to when the protection can be removed. The protection paper shall not be kept for more than 45 days and shall be replaced with the fresh protection paper. Further, it shall not have acid content, which in any manner may affect the substrate.

c. The Contractor shall submit fortnightly reports on supplying, fabrication and installation as directed by the Engineer-in-charge.

d. Delivery and Storage of Materials: All materials delivered to site shall be stored in allocated spaces where the stored materials shall not get exposed to rainwater moisture or damage, and shall permit easy access to and handling of the materials. Materials shall be stored neatly and properly stacked.

   i. Factory made Aluminum composite panel Cladding / glazing units and / or their components shall be transported, handled and stored in a manner to preclude damage of any nature.

   II. Accessory materials, required for erection at the site shall be delivered in labeled containers by the Manufacturer / supplier.

   III. All units or components, which are cracked, bent, chipped, scratched or otherwise defective and unsuitable for installation shall be removed and replaced by the contractor. Nothing extra shall be Payable on this account.

R. METAL ROOFING

1.0 PART 1 – GENERAL

1.1 WORK INCLUDED

This Section specifies the requirements necessary for the supply and installation of the metal roofing system including rain water gutter.

1.2 RELATED WORK

This Section shall be used in conjunction with, but not necessarily limited to, the other relevant specifications, the Drawings and the Contract Documents to establish the total requirements for the metal decking.

CAUTION: Using this Section without including the above mention will result in omission of basic requirements.

In accordance with the General Conditions of Contract, the aforesaid documents shall be taken as mutually explanatory, and any ambiguities or discrepancies shall be resolved by the Purchaser, who shall then instruct the Contractor thereon. In the event of conflict regarding the metal decking requirements between this Section and any other document, the more stringent requirement shall apply unless specifically instructed by the Purchaser in writing otherwise.

1.3 DESIGN CRITERIA

The metal roofing system shall be in accordance to architectural requirement. The system shall be so designed to meet the specified performances for the prevailing local weather conditions and local Authority requirements.

1.4 QUALITY ASSURANCE

Materials used in the works shall be of best qualities and kinds specified herein and equal to approve sample. Delivery shall be made sufficiently in advance to enable samples to be taken and tested if required. No materials shall be used until and unless approved by the Purchaser/ Architect. Materials not approved shall be immediately removed from the work site at the Contractor's expense.

The Contractor is to examine and satisfy himself of other related-trades condition on site under which, the metal roof is to be installed. Do not proceed until unsatisfactory conditions have been rectified. The Contractor shall be responsible for any additional cost incurred and compensate the owner due to above reason.

1.5 WARRANTY

1.6

a) The Contractor shall provide a warranty for the completed work against any defects of materials and workmanship, which comprise a water-tightness for the roof.

b) Warranty shall be for a period of 20 years and shall begin following Date of Substantial Completion of the project.

c) Warranty shall include all labour and material necessary to complete required activities and repairs, including joint scaling, penetration seals, bolts, and anchoring and grounding details.

1.6 SUBMITTALS

1.6.1 SAMPLES

The contractor shall submit the following to the Purchaser / Architect for approval before any work in this trade commences on site:

a) Sample of Metal Roofing System panel system;

b) Sample of fixing system elements.
(In compliance with the rules and requirements of the local authorities and to comply with FM guidelines for I-90 wind uplift).

1.6.2 SHOP DRAWINGS

The Contractor is to submit a design recommendation to the Purchaser/ Architect with the preliminary shop drawings showing fabrication and installation of the works including relevant information about the selected elements.

The shop drawings shall provide details including cuts, connections, and holes. The drawings shall show the size, length and type of each member, details for accessories, and method of assembly.

The Contractor shall submit to the Purchaser/ Architect with the final shop drawings for approval. Once approved, the typical installation details shall be fabricated strictly in accordance with the shop drawings.

After preliminary submission, all shop drawings shall be computer generated, AutoCad-2007 file.

During construction, the Contractor shall keep accurate records of the contract works, "as built", on AutoCad-2007 construction drawings and details.

Prior to the issue of the Final Acceptance Certificate, the Contractor shall hand over to the Purchaser transparencies and AutoCad-2007 files of all as-built drawings, all Professional Engineer's certificates, and all other documents related to the Contract work, which will be required for the application for Temporary Occupation Permit.

1.6.3 PROFESSIONAL ENGINEER'S CERTIFICATE:

The design, fabrication and installation of the metal roof system shall be certified by the Contractor's Professional Engineer are safe and the systems are in comply with the manufacturer's requirements and the rules and requirements of the local authorities.

1.6.4 QUALITY ASSURANCE DOCUMENT

Materials used in the works shall be of best qualities and kinds specified herein and equal to approve sample. Delivery shall be made sufficiently in advance to enable samples to be taken and tested if required. No materials shall be used until and unless approved by Purchaser/ Architect. Materials not approved shall be immediately removed from the work site at the Contractor's expense.

Materials shall be transported, handled and stored on site or elsewhere in such a manner as to prevent damage, deterioration or contamination all to the satisfaction of the Purchaser/ Architect. The Purchaser/ Architect reserve the right to inspect any materials to be used on the works at any time and at any place of storage.

Unless otherwise specified or otherwise agreed by the Purchaser/ Architect, materials shall comply with the appropriate Standards, In compliance with the rules and requirements of the local authorities and to comply to FM guidelines for I-90 wind uplift with preference for materials of local manufacture. Where the requirements of the relevant standards are in conflict with this Specification then this Specification shall take precedence accordingly.

1.6.5 DELIVERY AND WORK SCHEDULE

The contractor shall submit a proposed delivery and installation work schedule for approval.

2.0 PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 METAL ROOFS

The metal roof has to comply with the authorities requirements in force in Tamil Nadu and has to be durable with particular attention to the following critical factors:

- Effects of atmospheric corrosion typical to the area.
- Electrolytic corrosion where dissimilar metals are used in contact.

a) The metal roof shall comprise of components that result in a "Klip Lock" type Metal Roofing System with insulation and complete with all accessories and installed at centres in accordance with the manufacturer's instructions.

b) The metal roof material shall be 0.60 mm (BMT) in Hi Tensile (min tensile strength 550 Mpa) with a standard Z275 underside galvanised coating in accordance with ASTM A 525 G90 and Polyester Powder Coated on top side.

c) Contractor to provide a direct twenty (20) year's guarantee against any failure of the roofs system in particular water-leakage.

2.2 METAL ROOFING

2.2.1 Supply and Fixing Single Skin Insulated Roofing System Complete Comprising Of

PROFILED STEEL ROOFING SHEETS

The Hi Tensile steel "Klip Lock" roof panel is designed for quick installation and easy handling. It is Hi Tensile galvanised steel sheet and is lightweight, trapezoidal ribbed. It has bold, widely spaced ribs and is available in long length, governed only by local transport considerations. The Contractor shall check whether the design for the roof and comply with the Manufacturer's specification before the actual installation of the structure.

The Contractor's Professional Engineer shall provide the metal roof structural plans and fastening details, supported by design calculations accordingly. The design shall satisfy the Performance Requirements for its intended use and that include withstanding wind load, Air and weather tightness. The Contractor's Professional Engineer shall submit a **Certificate of Supervision** not later than two (2) weeks after completion of the works, stating that he has carried out such supervision works and is fully satisfied that the works have been constructed with such structural plans and fastening details.

The accessories such as capping, fascia capping, valley gutter, longitudinal and transverse parapet flashing cap flashing and corner moulds and others shall be shown in the drawings where applicable.

EXTERIOR SHEET: Kliplock Sheets of 500 mm cover width with 47 mm crest height at 250 mm centres and made out of 300 Mpa - yield stress, 0.6 mm TCT Galvalume Steel, 150 gsm Zinc – Aluminium alloy (as per ASTM : A 792) coating with 20 microns polyester coating.

CORE INSULATION MATERIAL: Bonded Rockwool Blankets as per IS : 8183 100 mm thickness (in 2 layers) with Aluminium Foil on one side and with flaps for over lapping at the joint locations.

VAPOUR BARRIER: Providing and fixing SIL / Polynum refective Vapour Barrier of Supreme Industries Ltd,. / Polyon Barkai Industries between exterior sheet & Insulation.

WELD MESH: Galvanised weld mesh of Size: 75 mm x 75 mm x 2 mm (120 gsm / Sqm Zinc coating mass) provided over the purlins.

FIXING PROCEDURE: The kliplock sheet shall be fixed to the purlins with special clips made out of 1.6 mm thick GI Steel with 120 gsm Zinc coating. The clips shall be fixed to the purlins with 10 – 16 x 25 mm self drilling wafer head fasteners as per manufacturer's specification and drawing.

The Kliplock sheets shall be site rolled and shall be in single length from roof ridge to eve or eve to ridge. Kliplock sheets shall be provided with suitable end closures made out of Closed cell polyethylene foam at the ridge locations. The insulated Roofing shall be complete with all accessories like ridge cappings, flashings at eve locations and barge locations and wherever necessary.

HANDLING AND STORAGE: To preserve the surface, handling should only be carried out using clean, dry, gloves. Do not slide sheets over rough surfaces or each other. Packs of the claddings in all finishes must be kept dry in transit, and stored clear off the ground under cover to prevent water and / or condensation being trapped between adjacent surfaces.

2.2.2 Supply & Fixing Of Pre-Fabricated Rockwool Sandwich Panels For Roofing Comprising Of

A Interior sheet : Plain sheets with slight ribs, with 1000 mm cover width, made out of 0.5 mm TCT, 300 Mpa – yield stress, Galvalume Steel with150 gsm Zinc – Aluminium alloy (as per ASTM : A 792) coating with 20 microns polyester coating.

B Core Insulation Material : High density Rockwool 100 kg/cu.m density converted to Lamellar in 80 mm thick and bonded to steel sheets with Industrial Grade Adhesive.

C Exterior sheet : profiled sheets with 1000 mm cover width, 35 mm crest height at 333 mm centre, made out of 0.5 mm TCT, 300 Mpa – yield strength, Galvalume Steel, 150 gsm Zinc-Aluminium alloy (as per ASTM : A 792) coating with 20 microns polyester coating.

D Panel shall be supplied in 1 m width and in single length upto 12 m without any joints depending on site requirements.

E Fixing Procedure : The panel shall be fixed on to the purlins with self drilling fasteners and with necessary overlap as per manufacturer's specification. The Insulated Roofing shall be complete with all accessories like capping, flashings wherever necessary

2.2.3 Accessories

A Cappings, Flashings and Trims: Cappings, Flashings and Trims shall be made out of 0.7 mm TCT, 550 Mpa – yield stress, Galvalume Steel, 150 gsm, Zinc-Aluminium Alloy (as per ASTM : A 792) coating and with 20 microns of Polyster coating.

Cappings, Flashings and Trims may be formed to required shape and profile based on shop drawings in 2.5 m lengths of profile of external / internal sheet except where metal crapped foam fillers are used.

Fixing: Cappings, Flashings and Trims shall be screwed to the external / internal sheeting with colour matched nylon head self drilling stitching fasteners at max. 500 mm centres along the length of the capping / flashing shall be installed at 90°C to the material being fastened.

All longitudinal joints in cappings and flashings shall be overlapped a minimum of 50 mm and sealed with a continuous run of sealant.

B Fixing Accessories:

12 – 14 x 125 Galvanised head self drilling screws with integral washers shall be used for fastening Pre-fabricated Sandwich Panels for Roofing.

12 – 14 x 90 Galvanised head self drilling screws with integral washers shall be used for fastening Pre-fabricated sandwich Panels for Wall Cladding.

12 – 14 x 55 Galvanised head self drilling screws with integral washers shall be used for Partition Sheets and fastening Double Skin Insulated Cladding.

10 -16 x 16 hexagonal head stitch fasteners shall be provided on side laps at 900 mm centers maximum.

The fasteners shall generally confirm to ASTM A 3566 and shall be Hilti / Corroshield make.

C Profiled Foam Fillers:

Profiled foam fillers shall be provided wherever required to close the voids between cappings and the troughs of the external sheet so as to provide a weather tight exterior. These shall be made out of closed cell Polyethylene Foam die cut in profile to match external sheeting.

D Gutters, down-spouts and down-takes:

Gutters shall be provided wherever shown on the drawings, Gutters shall be fabricated and brake-formed from 3.15 mm Cold Rolled Steel conforming to IS 513.

For reinforcing gutters 38mm x 38mm x 3 mm angle shall be provided at 1000 mm c/c and support bottom of gutters to structural steel at 1000 mm c/c. longitudinal joints in gutter shall be continuously welded. The gutter surfaces shall be cleaned, and provided with 2 mm thick FRP coating. The mouth of each downtake pipe in the gutter shall be provide with a weldmesh screen with mesh size of 6 mm x 6 mm.

E Down spouts:

Down spouts will be either 200 mm dia or 300 mm dia UPVC pipes, as indicated in the drawings. Pipes shall have joints sealed and shall be laid plumb or to horizontal slope as indicated in drawings. Pipes shall be clamped to the columns / cladding runners by means M S clamps bent to shape and fixed by colour matched self drilling screws.

F Roof Openings:

Roof Openings with curbs shall be located at the place of openings. Wherever such framed openings are to be provided, the contractor shall provide flashing around such framed openings or curbs. Flashings around such openings shall be formed of same material as flashings. The flashing shall normally be with a flat sheet of size adequate to overlap the roof sheeting all around the opening by at least 200 mm. This flat sheet flashing shall be sealed to roof sheeting at transverse laps with foam fillers and at side laps with continuous runs of sealant.

Where required, curbs shall be fabricated from 14 G (2 mm) pre painted steel and flashed around the opening. All curbs shall be min. 300 mm high and shall feature a 50 mm wide MS angle flange around the top of the curb and a sloped drainage surround. Contractor shall furnish details of curb construction for approval prior to commencement of work. All structural loads will be supported by structural framing in roof by others. Such framed openings may be provided-while the roof sheeting is being installed or subsequent to the roof sheeting installation.

3.0 PART 3 -- EXECUTION

3.1 INSTALLATION

3.1.1 INSPECTION & PREPARATION

Verify all field coordination and examine the substrates before start of installation. Beginning of installation means acceptance of the existing conditions. Do not install roofing sheets that are observed to be warped, bowed, deformed or damaged to such extent as to impair strength or appearance.

3.1.2 FASTENING METHOD

See in item 2.2 above. The panels shall be fixed to the purlin supports with a minimum of 4 fasteners per panel (i.e.: one fastener at every alternative valley). All stainless steel self tapping fasteners shall attach with EPDM washer for metal deck fastening. All sheeting shall be fixed in a workman like manner, leaving the job clean. All debris (nuts, screws, cuttings, filings etc.) shall be cleaned off daily.
The Contractor shall be responsible for supplying the following information to the Purchaser / Architect and obtain his approval prior to commencing work.

a) Detail to scale showing all relevant information in connection with roof sheeting such

as falls, sumps, expansion joints, pipe penetration roofs, etc.

It shall be the responsibility of the Contractor to inspect all roof construction prior to the laying of roofing including checking work by others connected with roof coverings such as cover flashing, etc. All labour employed on roofing shall be skilled roofing labour. A section of roof shall be laid as prototype for final approval of the Purchaser/Architect of materials and method of fixing before the main work is put in hand. This shall involve showing all detailed fixings as required for the whole of the roofing.

3.1.3 END LAPS

Should the end laps occur and necessary to use two or more shorter sheet to provide full length coverage, the locking ribs of the "Klip Lock" Hi Tensile steel Roofing System shall have sufficiently flexibility to enable it to be end lapped.

3.2 TESTS

The Purchaser / Architect reserves the right to take samples of roofing materials or accessories delivered or used at the work and subjects them to chemical or physical tests to determine if they have comply with specifications. If they do not comply, the materials shall be rejected and any materials that have been built shall be taken out and removed from the site immediately. Any replacement of proper materials in compliance with the specification shall at Contractor's expense.

3.3 GUARANTEE OF WATERTIGHTNESS

The Contractor shall lodge with the Purchaser / Architect a 20-years guarantee against any defects in the workmanship, quality of materials, installation, water- tightness or deterioration in the works. Under this guarantee, the Contractor will be required to make good any defects and will be responsible for any consequential loss directly attributable to any leakage during the warranty period.

If, in the opinion of the Contractor, the foregoing Specifications are insufficient for him to give the Guarantee then he shall allow for upgrading as he shall deem necessary to enable him to do so guarantee.

3.4 CLEANING

On completion, clean down all roofs, including underside of metal decking, remove all debris, loose nails, mortar droppings, paint drips, clean out gutters and outlets and test all roofing and down pipes and leave the whole roofing and rainwater disposal system clean and water-tight to the complete satisfaction of the Purchaser / Architect.

Ensure that metallic particles are swept off sheet surfaces immediately following any cutting, drilling.

S. LOUVERS

PART 1 -- GENERAL

1.1 WORK INCLUDED

This Section specifies the requirements necessary to supply and install metal wall louvers, complete with frames, sealant, bird and insect screens, and blank-out panels.

1.2 RELATED WORK

A. This Section shall be used in conjunction with, but not necessarily limited to, the other relevant specifications, the Drawings, the Schedules, and the Contract Documents to establish the total requirements for metal louvers.

B. CAUTION: Using this Section without including the above-listed items will result in omission of basic requirements.

C. In accordance with the General Conditions of Contract, the aforesaid documents shall be taken as mutually explanatory, and any ambiguities or discrepancies shall be resolved by the Purchaser, who shall then instruct the Contractor thereon. In the event of conflict regarding metal louver requirements between this Section and any other document, the more stringent requirement shall apply unless specifically instructed by the Purchaser in writing otherwise.

1.3 DESIGN CRITERIA

A. General

Install louvers to permit passage of air at required velocity, without blade vibration or noise, without exceeding the maximum permissible static pressure loss. The Contractor shall provide written support material with respect to system performance with respect to, airflow performance, rain defense performance, and structural loading under design conditions of the building. Comply with AMCA and BSRIA test requirements.

B. References

1. AMCA 500 (Air Movement Control Association) – Test Method for Louvers, Dampers, and Shutters.
2. BSRIA (Building Services and Research Information Association) – Test Method for Determining Louver Effectiveness.

C. Airflow Design Requirements

1. Maximum Permissible Pressure Drop: 50 Pa at 2.5 m/s face velocity

D. Rain Defense Performance Requirements

The Contractor shall submit certified test data to the requirements contained in the 4th edition of HEVAC Technical Specification - Laboratory testing of weather louvers when subjected to simulated rain, based on a 1m x 1m unit tested at rain fall rate of 75mm/hr and with wind directed at louver face of velocity of 13m/s.

Test data will show the following:

1. Single-Bank Louvers: The louver system shall achieve a 'C' rating providing proof of a rain performance effectiveness of between 80.0% to 94.9% for airflow velocity between 0 m/s to 3 m/s (ventilation rate of 0 to 3 m3/s/m2) and a maximum allowed penetration of simulated rain of 15.0 litre/hr/m2.

2. Double-Bank Louvers: The louver system shall achieve a 'B' rating providing proof of a rain performance effectiveness of between 95.0% to 98.9% for airflow velocity between 0 m/s to 3 m/s (ventilation rate of 0 to 3 m3/s/m2) and a maximum allowed penetration of simulated rain of 3.75 litre/hr/m2.

E. Structural Requirements

1. Wind Load Requirements: In accordance with requirements of applicable building code.

F. Appearance Requirements

1. Louvers shall match in appearance, configuration, profile and elevation with the louvers in the approved samples.

G. The Contractor shall provide factory pre-assembled louver units, and take into consideration the necessity of fixing the louver units to the sub-surface structure from outside the wall.

H. Where louvers are operable, they shall be equipped with a fixed frame.

I. Where louver doors are incorporated in louver units, they shall be concealed frame louver doors.

J. The work in this Section shall include the design, supply, installation, completion and maintenance of all metal louver systems, including metal louvers used as wall/screen cladding systems.

K. The work in this Section shall include all accessories, parapet cappings, end cappings, soffit trims, reveal linings, jamb linings, sills, and the like, which may not be expressly indicated on the drawings, but which are necessary to provide a total wall/screen cladding systems package, which interfaces in a complete manner with the adjacent building surfaces.

L. The proposed wall/screen cladding systems shall include all required sealant systems, fixing systems, anchorage systems, and framing systems.

M. The Contractor shall provide all additional structural support systems, which are required for the proposed wall/screen cladding systems, but not already provided under a separate contract, in the building structural works.

N. A set of "Only For Reference" structural works drawings form part of the Contract Documents. The Contractor will be deemed to have acquainted himself with the contents of these drawings and shall include in his tender any costs in respect to additional structural support systems which are not shown on these drawings, but which are required for the proposed wall/screen cladding systems. No consideration will be granted to any misinterpretation or unforeseen difficulties for which provision has not been made in the tender and this will in no way relieve the Contractor from the full execution of the Contract.

O. The Contractor shall note that the structural columns of the building superstructure are constructed of concrete, with no provision for cast-in components for the anchorage systems of the proposed wall/screen cladding systems. Some structural beams are of post-tensioned concrete construction, requiring special coordination of the cladding anchorage systems.

P. Any cast-in anchorage components, which are required, shall be provided by and placed in position by the Contractor, ready for casting of concrete. Provide shop drawings of proposed anchorage systems.

1.4 QUALITY ASSURANCE

Performance Requirements: Where louvers are indicated to comply with specific performance requirements, provide units whose performance ratings have been determined in compliance with Air Movement and Control Association (AMCA) Standard 500.

AMCA Certification: Where indicated, provide louvers with AMCA Certified Ratings Seal evidencing that product complies with above requirements.

Field Measurements: Verify size, location and placement of louver units prior to fabrication, wherever possible

Shop Assembly: Coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units. Pre-assemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

All the elements shall be determined with due consideration to the India Standard Codes of Practice.

The Contractor is responsible for the calculation of the maximum admissible panel span.

The manufacturer of the louvers shall be a company with minimum 10 years experience in supply and installation of AMCA-certified and BSRIA-certified louvers. All aluminum alloy components shall comply with BS 1470.

1.5 SUBMITTALS

A. Provide the following with the bid:

1. Product Data
2. Proposed Work Programme
3. Method Statement

B. Preliminary Shop Drawings: The Contractor shall submit with his bid design recommendations with preliminary shop drawings showing fabrication and installation of the works including relevant information and physical properties of the selected elements.

Notwithstanding the acceptance of the design recommendation by the Purchaser, the Contractor shall remain solely responsible for the adequacy of all the works and shall make good any damages arising from any inadequate design or provision.

C. Product Data: Submit manufacturer's specifications; certified test data, where applicable; and installation instructions for required products, including finishes and materials.

D. Samples: Submit samples not less than 300 x 300mm in size illustrating finishes and materials, and colour of exterior and interior surfaces.

E. Manufacturer's certificate: Submit manufacturer's certification that products meet or exceed specified requirements.

F. Shop Drawings: Submit shop drawings for fabrication and erection of louver units and accessories. Include plans, elevations and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joints, trims and other information to determine compliance with specified requirements.

After preliminary submission, all shop drawings shall be computer generated, on Autocad-2008 files. Shop drawings, product data, and samples shall be submitted to the Purchaser for review and approval, before ordering materials and commencing fabrication.

G. Proposed Work Programme: Submit a work programme for approval by the Purchaser.

H. Method Statement for Site Installation and Quality Control: The Contractor shall prepare and submit a detailed step by step method statement for approval. Submit a preliminary method statement with the bid.

1.6 SEQUENCING

A. Coordinate work under provisions of Conditions of Contract.

B. Coordinate work with mechanical ductwork.

C. Coordinate work with installation of masonry works flashings.

1.7 WARRANTY

A. Provide a two (2) year warranty under the provisions of Conditions of Contract.

B. The Contractor and the Specialist Sub-Contractor shall jointly provide a two (2) year warranty for the completed works on its performance against any defects and failure. Include warranty coverage on PVdF Kynar 500 finish.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Not used

2.2 MATERIALS

A. Aluminium Extrusions: ANSI /ASTM B221 alloy 6063-T5, or BS 1474 6063-T6. Extrusions shall be not less than 0.081 inches (2.06 mm) thick.

B. Aluminum shall have stoved polyester powder coat finish.

C. Fastenings: Stainless steel philips flat head machine screws.

D. Anchors and Inserts: Stainless steel anchors and inserts for exterior installations.

E. Bituminous Paint: SSPC Paint 12 (cold-applied asphalt mastic).

2.3 METAL FINISHES

A. General:

1. Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. The colours of the louvers shall be Ultramarine Blue, RAL colour code no. and Silver Metallic, RP 25 Alucobond colour code no. as specified in the finishes schedules. The Contractor shall submit samples of the coloured louver types for the Purchaser's approval.

2. Apply finishes in factory after products are assembled.

3. Protect finishes on exposed surfaces with protective covering, prior to shipment.

4. Remove scratches and blemishes from exposed surfaces which will be visible after completing finishing process.

B. Preparatory Work:

1. Grind welds flush and smooth.

2. Polish exposed weld marks to match the approved sample.

4. Use pretreatment complying with FS TT-C-490 to remove grease, oil, dirt and other foreign matter.

C. High-Performance Coating: AA-C12C42R1x (cleaned with inhibitive chemicals, conversion coated with an acid-chromate-fluoride-phosphate treatment and painted with fluorocarbon coating specified below).

1. Fluorocarbon Coating: Inhibitive thermo-cured primer, 0.2 mil (0.05 mm) minimum dry film thickness, and thermo-cured fluorocarbon coating containing "Kynar 500" resin, 1.0 mil (0.25 mm) minimum dry film thickness.

2.4 FABRICATION

A. Fabricate units rigid, neat in appearance, to true alignment, free from defects, warp or buckle. Dress exposed welds for smooth flush appearance.

B. Finished louver shall be free of exposed horizontal and vertical intermediate mullions. Provide mitered corners on louvers.

C. Provide continuous blade type louvers.

D. Joint frame members to one another and to fixed louver blades by welding. Maintain equal blade spacing to produce uniform appearance.

E. Blades shall be equally spaced at 2" (51mm) o.c.

F. Provide custom extruded aluminum sill to duplicate the spacing of top blade to head section. Profile and finish to match the approved louver sample.

G. Provide sill extensions and loose sills in metal and finish matching louvers.

H. Powder coated blade metal louvers and frames of aluminum alloy complying with BS 1470.

I. Proper brackets made of extruded aluminum shall be provided to ensure installation of the louvers.

J. Fasteners and anchors of aluminum or stainless steel type.

2.5 LOUVERED DOGHOUSE

A. Roof: 12 gauge (2.75 mm) 3003-H14 Aluminum sheet with condensation barrier on underside.

B. Unless otherwise specified, provide same louver profile in the penthouse as specified elsewhere, in matching metal and finish.

C. Posts: Aluminum support angles, of size as required to support penthouse.

2.6 LOUVER SCREENS

A. Fabricate screen frames in metal and finish matching louver units to which secured. Frames shall consist of U-shaped metal for permanently securing screen mesh.

B. Use bird screen of 1/2inch (12.7 mm) sq. mesh, 0.063 inch (1.6 mm) aluminum wire.

C. Locate screens on inside face of louvers, unless otherwise indicated. Secure screens to louver frames with machine screws, spaced at each corner and in between at 12" (300mm) o.c.

2.7 ACCESSORIES

A. Flashings: Of same material as louver frame. Thickness as required to avoid warping, buckling and "oil canning"; minimum 0.081" (2.06 mm) thick.

B. Sealants: Type as specified in Division 7.

C. Fasteners: Manufacturer's standard, compatible with items.

D. Blank-Out Sheeting on Interior of Louver: Metal, finish and colour matching louver and frame.

2.8 MANUFACTURED LOUVERS

The louver types shall be single, double and triple bank louvers. All louvers, mullions, frames, blades, braces, and associated components shall be manufactured to give the required rigidity and strength stipulated by AMCA and BSRIA.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine conditions, verify that prepared openings and flashings are ready to receive work, and that opening dimensions are as indicated on the shop drawings.

B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Coordinate setting out drawings, templates, instructions and directions for installation of anchors, which are to be embedded in, or attached to, concrete, masonry or steel construction.

3.3 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture is shed from flashings and to ensure diversion of moisture to exterior.

D. Install insect screening to interior of louvers as indicated on louvers schedule.

E. Install perimeter sealant and backing rod.

F. Where indicated, prepare louvers to receive ductwork attachment.

G. Where louvers are fixed over a backing wall, the surface behind shall be painted black by the Contractor.

H. Locate and place louver units plumb, level and in proper alignment with adjacent work.

I. Use concealed anchors wherever possible. Provide stainless steel washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

J. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers.

K. Repair finishes damaged by cutting, welding, soldering and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items to shop, make required alterations, and refinish entire unit, or provide new units.

L. Protect galvanized and non-ferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry or dissimilar metals. Wherever possible, the design of the installation shall avoid dissimilar metals being placed in contact with, or in close proximity of, each other.

M. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

N. Clean surfaces and components.

O. Refer to Division 7 sections for sealants in connection with installation of louvers.

3.4 CLEANING

At completion, clean surfaces and components to remove foreign substances.

T. TOILET COMPARTMENTS AND CUBICLES

PART 1 - GENERAL

1.1 WORK INCLUDED

A) This Section details works, which shall be carried out by the Interior Works Sub-Contractor, hereinafter referred to as the Contractor, in this Section. The Interior Works Sub-Contract is hereinafter referred to as the Contract, in this Section.

B) This Section specifies the requirements necessary to furnish and install the partition walls and accessories of the toilet cubicles.

1.2 RELATED WORK

A) This Section shall be used in conjunction with, but not necessarily limited to, the other relevant specifications, the Drawings, the Room Finishes Schedule, and the Contract Documents to establish the total requirements for compartments and cubicles in toilets.

B) CAUTION: Use of this Section without including the above - listed items will result in omission of basic requirements.

C) In accordance with the General Conditions of Contract, the aforesaid documents shall be taken as mutually explanatory, and any ambiguities or discrepancies shall be resolved by the Purchaser, who shall then instruct the Contractor thereon. In the event of conflict regarding compartments and cubicles requirements between this Section and any other document, the more stringent requirement shall apply unless specifically instructed by the Purchaser in writing otherwise.

1.3 DESIGN CRITERIA

A) The partition walls and doors of the cubicle toilets shall be sandwich construction made from 3mm high-pressure laminated decorative panels, with CFC free polyurethane foam core or Phenolic core board.

B) Doors and all exposed edges of the laminate to be chamfered.

C) Fully framed in extruded anodized aluminium E6/EU1with perimeter head stabilising section and continuous side fixing channels.

1.4 QUALITY ASSURANCE

A) The partition walls and doors of the toilet cubicles shall be of approved manufacturer. The integral laminate contracts dimensionally at low humidity and expands at high humidity: therefore enlarged holes for the stay-bolts and adequate spaces on the joints will have to be calculated at the time of project engineering and the cost of this will be borne by the Contractor.

B) Manufacturer Qualifications: company specializing in plastic laminate toilet cubicles with 5 years' minimum documented experience.

C) Installer Qualifications: company with 5 years' minimum documented experience and approved by manufacturer.

1.5 WARRANTY

The Contractor and the Specialist Sub-contractor shall jointly provide a two (2) years warranty for the completed works on its performance against any defects and failure.

1.6 SUBMITTALS

A) Product Data - Submit manufacturer's technical data for materials, fabrication, finishing, fastenings, hardware, and installation details.

B) Shop Drawings - Submit shop drawings indicating elevations of partitions, thickness of material, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, hardware, fittings, mountings and other related items and installation details.

C) Samples - Submit samples of materials to be used, and colours and patterns selected for verification.

D) Proposed Work Schedule.

1.7 MOCKUPS

Provide a field sample of 1 partition wall complete with the partition door, urinal divider with all accessories for approval. Locate where directed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A) Formica, century ply, green lam/ply, kitpy

B) Others approved equivalent manufacturers meets the standards and specifications will be evaluated by the owner.

2.2 MATERIALS

A) Toilet cubicles shall be floor mounted, and made of 15mm thick solid compact laminate board with rough matt finish on both sides, complete with extruded anodized aluminium E6/EU1 or powder coated aluminium round profile framing. The panels shall be water, scratch and impact resistant. Accessories shall be made of Nylon.

B) The system shall be constructed of pilasters fixed with 45mm diameter extruded aluminium profile on both edges. The vertical profile shall have a rebated edge that supports the door and a rubber strip to cushion the door closing.

C) Adjustable leg (partition columns) shall be of 40mm diameter stainless steel with nylon sleeve and collar, slotted into the vertical profile and secured firmly to the floor with stainless steel screws and plug. It shall be covered with a nylon rosette after fixing.

D) Top portion of the pilasters shall be slotted with a 45mm x 86mm extruded aluminium head-rail with rounded corner. The head-rail shall run the total length of the cubicle front with fixing point at the pilaster vertical profiles for rigidity and stability.

E) Revolving doors, flush fitting shall be 600 mm wide (unless otherwise specified) and complete with the following accessories:

1) Nylon spring hinges or Stainless steel hinges (3 nos. per door)

2) Nylon pull Door knob handle on both sides of door

3) Nylon lock fitting with vacant/engaged sign Indicator lockset with emergency opening

4) Coat hook

F) Toilet cubicles shall have a continuous dividing partition without joint.

G) The total height of the toilet cubicles shall be 2150mm high inclusive of a 150mm from floor clearance.

H) Color of the toilet cubicles shall be selected by the Purchaser/Owner, and the entire installation work shall be carried out by the Specialist.

I) Color Scheme: To be selected from the standard range.

J) The solid compact laminate shall comply with the following physical properties:

Physical Property	Test Method	Test Results
Gross density	DIN 53479	1430 kg/m^3
Thickness tolerance	DIN 16926	+0.50 mm
Thickness swelling (24 hr at 20+1°C)	EN 317	0.07%
Flexural strength	BS 2782	> 120 N/mm^2
Tensile strength • Machining direction • Cross direction	BS 2780	> 130 N/mm^2 > 90 N/mm^2
Resistance to surface wear (Taber Abrasion Test)	BS 2782	> 500 cycles（周）
Resistance to impact	EN 438-2	> 40 N
Resistance to scratching	EN 438-2	> 4 N
Resistance to colour change in Xenon arc light	EN 438-2	> Blue wool standard No. 6

K) The solid compact laminate shall comply with the following physical properties:

Physical Property	Test Method	Test Results
Resistance to immersion in boiling water (100°C for 2 hrs) • increase in weight • increase in thickness	EN 438-2	0.44% 0.28%
Resistance to dry heat (180°C)	EN 438-2	No visible change
Resistance to cigarette burns	EN 438-2	No visible change
Resistance to steam (1 hr)	EN 438-2	No visible change
Coefficient of thermal conduction	DIN 52612	0.3 W/mK
Surface hardness • Micro-Vickers	Mitutoyo MVK-G1 Hardness tester 100 gf load	60

2.3 ACCESSORIES

- Coat hooks: Hewi No. 520.501 or equivalent
- Paper holder: Hewi No. 450 or equivalent
- Toilet brush: Hewi No. 475.2.171 or equivalent
- Door stopper
- Anti-trap protection: soft PVC finger guard fitted on the hinges side

PART 3 – EXECUTION

3.1 EXAMINATION

A) Before covering wall and ceiling framing with finish materials, examine framing to ensure that backing plates and structural framing have been installed in such position as to receive all attachment screws.

B) Verify spacing of plumbing fixtures to ensure compatibility with installation of compartments.

C) Do not start the work of this section until all deficiencies have been corrected.

3.2 INSTALLATION

Install toilet compartments as shown on the shop drawings and in accordance with the manufacturer's specifications and printed installation instructions. Install toilet compartments and doors in a rigid and substantial manner, straight and plumb, with horizontal lines level.

Secure pilasters to supporting members and level, plumb and tighten the installation with leveling nuts and washers.
Secure panels and doors to pilasters so that exterior faces are flush. Secure panels to walls, with 2 stirrup brackets located near the top and bottom of each panel, or with one continuous bracket from top to bottom. At concrete or masonry walls, fasten brackets with screws and expansion anchors. At light gauged steel-framed walls, fasten brackets with toggle bolts into metal studs or backing plates fastened directly to the studs. At wood framed walls, fasten brackets with wood screws into wood studs or blocking fastened directly to the studs.

3.3 ADJUSTING AND CLEANING

Hardware Adjustment - After installation, carefully adjust hardware for proper operation. Set hinges on in-swing doors to hold open approximately 30 degrees from the closed position when unlatched. Set hinges on out-swinging doors to return to the fully closed position. Adjust doors so that bottoms of doors are level with the bottoms of the pilasters when the doors are in the closed position.

Cleaning - Clean compartments and doors upon completion and leave free from imperfections.

3.4 INSPECTION

A) The installation shall be subject to inspection and shall be completed to the satisfaction of the Purchaser, failing which the works shall be rectified at the Contractor's expense.

U. TOILET ACCESSORIES

PART 1 - GENERAL

1.1) WORK INCLUDED

A) This Section details works, which shall be carried out by the Interior Works Sub - Contractor, hereinafter referred to as the Contractor, in this Section. The Interior Works Sub - Contract is hereinafter referred to as the Contract, in this Section.

B) This Section specifies the requirements necessary to furnish and install the following:

1) Toilet and washroom accessories.

2) Attachment hardware inclusive Hand dryer – Hand Paper holder.

3) Provisions for handicapped toilets (i.e. grab bars).

1.2) RELATED WORK

A) This Section shall be used in conjunction with, but not limited to, the other relevant specifications, drawings and Contract Documents to establish the total requirements.

B) CAUTION: Use of this Section without including all of the above-listed items will result in omission of basic requirements.

C) In accordance with the General Conditions of Contract, the aforesaid documents shall be taken as mutually explanatory, and any ambiguities or discrepancies shall be resolved by the Purchaser, who shall then instruct the Contractor thereon. In the event of conflict regarding requirements between this Section and any other document, the more stringent requirement shall apply unless specifically instructed by the Purchaser in writing otherwise.

1.3) REGULATORY REQUIREMENTS

A) Conform to National Standards and Codes of Practice (India) for installing work.

B) Positioning of provisions for handicapped toilets shall conform to Authorities' regulations and requirements.

1.4) QUALITY ASSURANCE

A) Manufacturer Qualifications: Company specializing in toilet accessories with 5 years' minimum documented experience.

B) Installer Qualifications: Company with 5 years' minimum documented experience and approved by manufacturer.

C) The installation shall be subject to inspection and shall be completed to the satisfaction of the Purchaser, failing which the works shall be rectified at the Contractor's expense.

D) Installed toilet and washroom accessories for handicapped shall comply with Authorities' requirements.

1.5) WARRANTY

A) The Contractor and the Supplier shall jointly provide a 2 (two) years warranty covering the performance of the material and installation against any defects and failure.

B) The guarantee shall cover the cost for damages, which include the cost of finishing materials and labor required replacing the entire defective installation, should the installation be proven defective.

1.6) DELIVERY, STORAGE, AND HANDLING

A) The Contractor shall be responsible for timely delivery, storage, protection and installation of all materials necessary for completion of the works.

B) Deliver materials to project site in manufacturer's original packaging, clearly identified as to type and location.

1.7) SEQUENCE AND SCHEDULING

A) Coordinate the work of this Section with the placement of internal wall, tiling, toilet partitions, etc. to receive anchor attachments.

1.8) SUBMITTALS

A) Provide the following in addition to the standard requirements:
1) Product data on accessories describing size, finish, details of function and attachment methods.

2) Two samples of each component illustrating color and finish.

1.9) MOCK UPS

A) Provide field samples when requested, illustrating installed accessories.

B) Locate where directed.

C) Accepted sample may not remain as part of the work.

PART 2 - PRODUCTS

2.1) MATERIALS

A) Products quality for accessories shall conform to the following:

1) Sheet Steel: ASTM A366.

2) Stainless Steel Sheet: ASTM A167, Type 304.

3) Tubing: ASTM A269, stainless steel, Type SS316.

4) Adhesive: two-component epoxy type, waterproof.

5) Fasteners, Screws, and Bolts: stainless steel.

2.2) FABRICATION

A) Weld and grind smooth joints of fabricated components.

B) Form exposed surfaces from single sheet of stock, free of joints.

C) Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

D) Paint back of components where contact is made with building finishes to prevent electrolysis.

E) Shop-assemble components and package complete with anchors and fittings.

F) Provide steel anchor plates, adapters, and anchor components for installation.

G) Hot-dip galvanizes exposed and painted ferrous metal and fastening devices.

2.3) FACTORY FINISHING

A) Galvanizing: ASTM A123 to 45g/m2 (1.25 ounce per square yard) or other equivalent standard.

B) Shop-Primed Ferrous Metals: Pre-treat and clean; spray apply one coat primer and bake.

C) Enamel: Pre-treat to clean condition; apply one coat primer, and minimum two coats epoxy electrostatic baked enamel.

D) Chrome/Nickel Plating: ASTM B456, Type SC 2 satin and/or polished finish as required.

E) Stainless Steel: No. 4 satin luster and polished finish as required.

2.4) KEYING

A) Supply 3 keys for each accessory to Owner where applicable.

B) Master-key all accessories where applicable.

PART 3 - EXECUTION

3.1) EXAMINATION

A) Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings.

B) Beginning of installation means acceptance of existing conditions.

3.2) PREPARATION

A) Deliver inserts and rough-in frames to site at appropriate time for installation.

B) Provide templates and rough-in measurements as required.

C) Verify exact location of accessories for installation.

3.3) INSTALLATION

A) Install fixtures, accessories, and items in accordance with manufacturer's instructions.

B) Install plumb and level, securely and rigidly anchored to substrate.

3.4) ADJUSTING AND CLEANING

A) Remove all protective masking and clean surfaces, leaving them free of soil and imperfections.

B) Fill all units final acceptance with necessary supplies just prior to of building.

C) Deliver to Owner all keys or other devices required to service units.

3.5) PROTECTION

A) The Contractor is to ensure that all completed toilet accessories are fully protected until full completion of construction.

V. LOCKERS

PART 1 – GENERAL

1.1 WORK INCLUDED

This Section specifies the requirements necessary to furnish and install the following: Lockers

1.1 RELATED WORK

This Section shall be used in conjunction with, but not limited to, the other relevant specifications, drawings & Contract Documents to establish the total requirements.

CAUTION: Use of this Section without including all of the above-listed items will result in omission of basic requirements.

In accordance with the General Conditions of Contract, the aforesaid documents shall be taken as mutually explanatory, and any ambiguities or discrepancies shall be resolved by the Architect, who shall then instruct the Contractor thereon. In the event of conflict regarding requirements between this Section and any other document, the more stringent requirement shall apply unless specifically instructed by the Architect in writing otherwise.

1.2 QUALITY ASSURANCE

Manufacturer Qualifications: Company which has been in the business for at least 10 years and which has successfully produced products of a scope similar to this project.

Installer Qualifications: Company which is approved by manufacturer and which has successfully installed products of a scope similar to this project.

The installation will be subject to inspection and shall be completed to the satisfaction of the Purchaser. In case the requirements are not followed. The Purchaser can request the works to be amended up to complete satisfaction at Contractor's expenses.

The materials use shall be of the type and standard acceptable by the local authorities. The materials and the installation shall comply with the relevant local standards and code of practice.

1.3 WARRANTY

The Contractor and Supplier shall provide a one (1) year warranty on work of this Section for its performance against any defects and failure.

1.4 DELIVERY, HANDLING, AND STORAGE

Deliver products in manufacturer's original, unopened, protective wrapping with original, legible label intact.

Protect against damage and discoloration.

1.5 SUBMITTALS

Provide the following within 2 weeks of Contract award:

- Product data describing product type, size, configuration, layout, accessories, and finish color when applicable.
- Samples - Submit samples of materials to be used; colour and pattern selected for verification.
- Shop Drawings - Submit shop drawings indicating fastenings, details of construction, hardware, and other related items and installation details.
- Proposed Work Programme.

PART 2 – PRODUCTS

1.6 MANUFACTURER

- Godrej.
- Manufacturers that can meet the requirements specified will be considered.

1.7 MATERIALS

B) Materials used shall meet the following or other equivalent standards.

A. Aluminum – ASTM B 221, alloy 6063-T5 for extrusions; ASTM B 209, alloy 6061-T6, sheet and plate. Protect aluminum surfaces in contact with cementitious materials with zinc chromate primer or chromate conversion coating.

B. Stainless Steel – SS 316 with hairline finish, unless indicated otherwise, for plates, sheet and strips.

C. Structural Steel Shapes – ASTM36

D. Steel Plates – ASTM A283 Grade C

E. Scratch Resistance Plastic Laminate for counter and cabinet – The plastic laminate shall be of the type and standard acceptable by the Purchaser/Architect. Preferred laminates are Formica / Greenlam / Ventura / approved equivalent manufacturers.

PART 3 -- EXECUTION

1.8 INSPECTION

- Verify adequacy of backing and support framing and property, prepared, sized, and located.
- Verify that surfaces and openings are ready to receive work and field measurements are as shown on shop drawings.
- Beginning of installation means acceptance of existing conditions.

1.9 PREPARATION

- Protect other materials against damage and discoloration caused by work of this Section.

1.10 INSTALLATION

General:
Follow manufacturer's instructions and reviewed shop drawings.
Secure specialties plumb, level, square, and true as applicable.

1.11 ADJUSTING AND CLEANING

- Adjust the specialties to function correctly and satisfactorily at the time of substantial completion and during warranty period.
- Remove debris from project site upon work completion or sooner, if directed.
- Including work of other sections, clean, repair and touch up, or replace when directed products which have been soiled, discolored, or damaged by work of this Section.
- Leave installation clean and free of defects on completion.

W. CEILING SURFACES

PART 1 - GENERAL

1.1) RELATED WORK

A) This Section shall be used in conjunction with the other relevant specifications, the Drawings and Contract Documents to establish the total requirement for the installation of the ceiling works.

B) CAUTION: Use of this Section without including the above mentioned will result in omission of basic requirements.

1.2) DESIGN CRITERIA

A) The location and the type of ceiling panels and the location of the lighting points are shown in the architectural drawings.

B) The work in this Section shall include all accessories, control joints, end trims, which may not be expressly indicated on the drawings, but which are necessary to provide a total ceiling systems package, which interfaces in a complete manner with the adjacent construction.

1.3) QUALITY ASSURANCE

A) The installed ceiling shall have a sound transmission class of minimum STC40 for areas specified to have acoustic ceilings. The ceiling shall be free of any asbestos and shall be unaffected by moisture.

B) The installer shall be a company specializing in applying the work of this Section with a minimum of 5 years' documented experience and approved by the manufacturer.

1.4) WARRANTY

A) The Contractor and the Specialist Sub-contractor shall jointly provide a two (2) years warranty for the completed works on its performance against any defects and failure.

B) The guarantee shall cover the cost for damages, which include the cost of finishing materials and labor required replacing the entire defective installation.

1.5) SUBMITTALS

A) Provide the following with bid:

(i) Manufacturer's Data: installation literature for all ceiling systems and materials.

(ii) Certificates: copy of Certificate of License issued to system installer by manufacturer.

(iii) Submit evidence that the materials and systems have been tested, and that the fire rated systems have been approved by the Authorities. Submit environmentally friendly approval for suspended ceiling material.

B) The contractor shall submit the following to the Purchaser for approval before any work in this trade commences on site:

(i) Samples of ceiling panels, fixing systems of appropriate size and types of sound insulation and thermal insulation shall be submitted to the Purchaser for review and approval, before ordering materials.

(ii) Shop drawings: The Contractor shall submit typical installation details for the ceiling systems for Purchaser approval. The shop drawings shall provide complete details of the system. Shop drawings shall be drawn using AutoCad-2008 and soft copies made available upon request without charge.

(iii) Installation schedule: The Contractor shall submit proposed delivery and work installation programmed for approval.

(iv) As built drawings: During construction, the Contractor shall keep accurate records of the contract works, "as built", on AutoCad-2008 construction drawings and details. Prior to the issue of the final acceptance certificate, the Contractor shall hand over to the Purchaser transparencies and AutoCad-2008 files of all as-built drawings, and all other documents related to the Contract work, which will be required for the application for the occupation permit.

1.6) MOCK UPS

A) Provide field sample panels of specified systems, minimum 2 meter long by 2 meter wide, showing ceiling panels and suspension systems.

B) Locate where directed.

C) The accepted samples shall not remain as part of the completed permanent works.