ITEM 634.7872--07 – TOLL BOOTH CANOPY

DESCRIPTION

Under this section, the Contractor shall furnish all labor, materials, and equipment for general construction of the Toll Booth Canopy. Work includes all accessory items of work herein described, as shown on plans, as specified, and/or directed. Submit shop drawing to include material specifications, details of fabrication, construction erection and layout drawings for all Toll Booth Canopy components.

UNIT MASONRY

Materials

1. Masonry Units:

a. Concrete Masonry Units (C.M.U.): Units shall be of modular dimensions and be steam cured, or approved equal. Exposed surfaces of units shall be comparatively smooth and of uniform texture. Exterior concrete masonry units shall be split or smooth face as indicated with texture, integral color and water-repellant admixture added during manufacture. C.M.U. and mortar color shall be as chosen by the Owner from the C.M.U. manufacturer’s standard color selection and submitted to the Owner for review and selection. Each colored sample shall be in the form of a 610mm to 813mm (2'-0" x 2'-8") mock-up of the colored C.M.U. and mortar (running bond pattern) by applying the face shell of the C.M.U. to a plywood substraight.

b. Hollow Load-Bearing Units: ASTM C90, Grade N-I or N-II, made with heavyweight aggregate for textured units and normal weight aggregate for regular faced units. Provide load-bearing units for exterior walls and interior load-bearing walls. Minimum compressive strength shall not be less than 1900 psi.

c. Hollow Non-Load-Bearing Units: ASTM C129, Type I or II, made with normal weight aggregate. Load-bearing units may be provided in lieu of non-load-bearing units.

d. Concrete Building Brick: ASTM C55, Grade S-I or S-II, except brick exposed to weather shall be Grade N-I or N-II, and made with lightweight or normal weight aggregate. Concrete brick shall match the concrete masonry units as closely as practicable in color and surface characteristics.

e. Special Shapes: Provide special shapes such as closures, header units, and jamb units as necessary to complete the work. Special shapes shall conform to the requirements for the units with which they are used.

2. Water-Repellant Admixture: Polymeric type formulated to reduce porosity and water transmission. Construct panels of masonry units and mortar which contain...
the water-repellant admixture. When tested in accordance with ASTM E72, such panels shall be flexural strength not less than 20 percent greater, and compressive strength not less than 3 percent greater, than similar panels which do not contain the admixture. When tested in accordance with ASTM E514, panels shall exhibit no water visible on back of test panel and no leaks through the panel after 24 hours, and not more than 25 percent of wall area shall be damp after 72 hours.

3 Mortar:

a. Portland Cement: ASTM C150, Type I, II, or III.

b. Hydrated Lime: ASTM C207, Type S.

c. Masonry Cement: ASTM C91, except that for masonry cement used in mortar for exterior walls, the air content of the mortar specimen shall be not more than 16 percent by volume in lieu of 22 percent. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar.

d. Sand: ASTM C144. The sand in combination with the cementitious materials shall produce a mortar of the specified color.

e. Water: Clean, potable, and free from substances which could adversely affect the mortar.

f. Mortar Types: ASTM C270, Type M for bearing walls and exterior walls, Type N or S for non-load-bearing, interior masonry; and Type S for all other masonry work; except where higher compressive strength is indicated on structural drawings. Air content shall be limited to 12 percent.

g. Pre-Mixed Mortar: ASTM C270, Type N, compressive strength of 750 psi in 28 days S, compressive strength of 1800 psi in 28 days M, compressive strength of 2500 psi in 28 days. Air content shall be limited to 12 percent.

h. Admixtures: No air-entraining admixtures, anti-freeze compounds or calcium chlorides shall be included in mortar. Where colored mortar is indicated, add pigment to obtain the color indicated. Mortar colors shall consist of inorganic compounds not to exceed 15% of the weight of the cement. Admixtures may be used in mortar to retard curing and provide up to 36 hours of workability, provided the admixture does not adversely affect bonding or compressive strength.

4. Grout: Grout for reinforced masonry shall be proportioned and mixed in accordance with ASTM C476. Fine grout (with sand aggregate) shall be used in grout spaces where minimum horizontal dimension is less than 102mm (4 inches).
Coarse grout (with pea gravel) may be used elsewhere. Samples shall be tested in accordance with applicable portions of ASTM C1019 and shall exhibit a minimum ultimate compressive strength of 2500 psi at 28 days. Do not use admixtures that contain calcium chlorides, air-entrainment or antifreeze compounds.

5. Accessories:

a. Horizontal Joint Reinforcement: Fabricate from cold drawn steel wire, ASTM A82. Wire shall be hot-dipped galvanized after fabrication in accordance with ASTM A153 (1.5 oz of zinc per square foot). Reinforcement shall be truss type with two or more longitudinal wires welded to a continuous diagonal cross wire, or ladder type with perpendicular cross wires not more than 400mm (16 inches) o.c. Provide flat sections 10 feet long, and preformed corners and tees approximately 762mm (30 inches) long. Overall width shall be approximately 50mm (2-inches) less than nominal thickness of wall.

(1) Single-Wythe: For single-wythe walls and partitions, provide two 9-gauge 4mm (0.1483-inch) longitudinal wires and 9-gauge cross wires.

For cavity walls, provide vertically adjustable ladder type consisting of two 9-gauge 4mm (0.1483-inch) longitudinal wires for the inner wythe, 9-gauge cross wires either winged loop or eye-section receivers, and 5mm (3/16-inch) wire hook type box ties or rectangular pintle ties at not more than 16 inches o.c. Pintles shall have two vertical legs. Maximum play between pintles and eyes shall be 2mm (1/16 inch). Maximum vertical misalignment between bed joints of brick and the joint reinforcement shall be 32mm (1.25 inches). Provide one tie for every 1.78 square feet of wall area 406mm (16 inches) o.c. both ways).

For veneers, provide two 9-gauge (0.1483-inch) longitudinal wires and 9-gauge cross wires.

b. Anchors and Ties: Provide approved designs of stainless steel, zinc-coated steel, or noncorrosive metal having the equivalent total strength of steel types. Zinc coat steel by the hot-dip process after fabrication to a minimum of 1.25 ounces of zinc per square foot of surface when tested in accordance with ASTM A90.

(1) Rigid Steel Anchors: Not less than 38mm (1-1/2 inches) wide, 6mm (1/4-inch) thick, and 610mm (24 inches) long with each end bent not less than 50mm (2 inches).
(2) Dovetail Flat Bar or Wire Anchors: Flat bar: corrugated sheet steel, not lighter than 16 gauge, and 22mm (7/8-inch) wide, with end turned up 6mm (1/4 inch). Wire: not lighter than 6 gauge, 22mm (7/8-inch) wide with wire looped and closed. Dovetail slots and inserts are specified in Section 03300, "Cast-in-Place Concrete".

(3) Veneer Anchors: Provide vertically adjustable wall ties with 5mm (3/16-inch) wire closed loop and clip for interlocking with horizontal joint reinforcement. Adjustable wall tie shall be suitable for fastening to wood studs. Provide one tie for every 1.78 square feet of wall area 406mm (16 inches o.c. both ways).

c. Fastenings: Build in bolts, metal wall plugs, and other metal fastenings furnished under other sections for securing furring and other items.

d. Reinforcing Bars: Vertical steel and dowel reinforcing shall be 60,000 psi and conform to ASTM A615 as specified in Section 03210.

e. Through-Wall Flashing: Provide one of the following types.

(1) Plastic Flashing: Homogeneous, waterproof, impermeable, elastomeric sheeting not less than 762mm (0.030-inch) thick. Sheet ing shall have not less than 1000 pounds per square inch tensile strength, nor more than 7 percent tension set at 50 percent elongation when tested in accordance with ASTM D412. Suitably stabilize sheeting to resist exposure without visible deterioration when tested not less than 400 hours in accordance with ASTM D822. The material, after being exposed for not less than 1/2 hour to a temperature of minus 20 degrees F, shall show no cracking or flaking when, at that temperature, it is bent 180 degrees over a 8mm (1/32-inch) diameter mandrel and then bent at the same point over the same size mandrel in the opposite direction 360 degrees and not be subject to rapid ultraviolet degradation.

(2) Reinforced Membrane Flashing: Polyester film core with a reinforcing fiberglass scrim bonded to one side. The membrane shall be impervious to moisture, flexible, and not affected by caustic alkalis. The material, after being exposed for not less than 1/2 hour to a temperature of 32 degrees F, shall show no cracking when, at that temperature, it is bent 180 degrees over a 1.59mm (1/16-inch) diameter mandrel and then bent at the same point over the same size mandrel in the opposite direction 360 degrees.

(3) Embossed Membrane Flashing: Polyester film embossed in a small hexagon pattern, impervious to moisture and resistant to corrosion. Film
shall not become brittle and shall remain flexible for thermal movements within wall.

f. Wicking for Weep Holes: Clear plastic tubes, 6mm (1/4 inch) in diameter.

g. Precast Concrete Sills: Smooth surface texture, with a 28-day compressive strength of not less than 3,000 psi. Provide reinforcing as required. Provide sills of sizes indicated, straight and true.

**Construction**

1. **Preparation:**

   a. **Protection:**

      (1) Stains: Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

      (2) Loads: Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed.

      (3) Provide temporary bracing as required to prevent damage during construction.

      (4) Polyester Embossed Film: Provide protective boards for polyester film during job installation to ensure no damage from building debris.

   b. **Surface Preparation:** Surfaces on which masonry is to be placed shall be smooth, clean, and free of foreign substances when mortar is applied.

2. **Workmanship:** Carry masonry up level and plumb. Furnish and use story poles or gauge rods throughout the work. Changes in coursing or bonding after the work is started will not be permitted. Do not carry one section of the walls up in advance of the others. Step back unfinished work for joining with new work. Toothing will not be permitted. Check heights of masonry with an instrument at each floor and at sills and heads of openings to maintain the level of the walls. Build in door and window frames, louvered openings, anchors, pipes, ducts, and conduits as the masonry work progresses. Fill spaces around metal door frames solidly with mortar. Handle masonry units with care to avoid chipping, cracking, and spalling of faces and edges. Drilling, cutting, fitting, and patching to accommodate the work of others shall be performed by masonry mechanics. Cut
masonry with masonry saws for exposed work. Structural steelwork, bolts, anchors, inserts, plugs, ties, lintels, and miscellaneous metalwork specified elsewhere shall be placed in position as the work progresses. Provide chases of approved dimensions for pipes and other purposes where indicated and where necessary. Inspect scaffolding regularly to ensure that it is amply strong, well braced, and securely tied in position. Do not overload scaffolding.

3. **Mortar Mixing**: Measure mortar materials in 1 cu. ft. containers to maintain control and accuracy of proportions. Do not measure materials with shovels. Mix mortar in a mechanical batch mixer for not less than 3 nor more than 5 minutes after all ingredients are in so as to produce a uniform mixture. Add water gradually as required to produce a workable consistency. Do not load mixer beyond its rated capacity. Keep mortar boxes, pans, and mixer drums clean and free of debris and dried mortar. Retemper mortar which has stiffened because of evaporation by adding water and mixing to obtain a workable consistency. Do not use or retemper mortar which has not been placed in final position within 2-1/2 hours after the initial mixing. Do not use antifreeze compounds, salts, or other substances to lower the freezing point of mortar.

   a. Mortar: Mix mortar in accordance with ASTM C270 to obtain type mortar required. Where colored mortars are required, pigments shall be prepackaged in mortar mix. When masonry cement is used, conform to printed mixing instructions of the masonry cement manufacturer.

   b. Grout: ASTM C476. Provide fine grout in grout spaces less than 50mm (2 inches) in any horizontal dimension or in which clearance between reinforcing and masonry is less than 19mm (3/4 inch). Provide coarse grout in grout spaces 50mm (2 inches) or greater in all horizontal dimensions provided the clearance between reinforcing and masonry is not less than 19mm (3/4 inch).

4. **Mortar Joints**: Uniform thickness of 10mm (3/8-inch) unless otherwise indicated. Tool exposed joints slightly concave with a round or other suitable jointer when the mortar is thumb print hard. For horizontal joints, jointers shall be at least 12 inches long for brickwork and 400mm (16 inches) long for concrete masonry. Jointers shall be slightly larger than the width of the joint so that complete contact is made along the edges of the units, compressing and sealing the surface of the joint. Strike flush joints that will not be exposed. Tool vertical joints first. Brush joints to remove all loose and excess mortar. Horizontal joints shall be level; vertical joints shall be plumb and in alignment from top to bottom of wall within a tolerance of plus or minus 13mm (1/2 inch) in 12192mm (40 feet).

5. **Tolerances**: Masonry work shall be within the following limits:

   a. Pilasters: 6mm (1/4 inch) from true line.
b. Face of Concrete Masonry Unit: 1.59mm (1/16 inch) from face of adjacent unit.

c. Variation From True Plane: 6mm (1/4 inch) in 3048mm (10 feet) and 13mm (1/2 inch) maximum in 6096mm (20 feet) or more.

d. Variation From Plumb: 1/4 inch in each story, noncumulative and 13mm (1/2 inch) maximum in two stories or more.

e. Variation From Level: 3mm (1/8 inch) in 914mm (3 feet), 6mm (1/4 inch) in 3048mm (10 feet), and 13mm (1/2-inch) maximum.

f. Variation in Wall Thickness: Plus or minus 1/4 inch.

6. **Concrete Masonry Unit Work**: Lay the first course in a full bed of mortar for the full width of the unit. Lay succeeding courses in running bond unless otherwise indicated. Form bed-joints by applying the mortar to the entire top surfaces of the inner and outer face shells. Form head joints by applying the mortar for a width of about 1 inch to the ends of the adjoining units. The mortar shall be of such thickness that it will be forced out of the joints as the units are placed in position. Where anchors, bolts, and ties occur within the cells of the units, place metal lath in the joint at the bottom of such cells, and fill the cells with mortar or grout as the work progresses. Use cut block for bonding walls, working out the coursing, butting structural steel, distributing concentrated loads, backing brick headers, and elsewhere as required. No wetting of concrete masonry units is permitted.

a. Special Concrete Masonry Unit Work: Provide special concrete masonry unit work. Select units for uniformity of size, texture, true plane, and undamaged edges and ends of exposed surfaces. Place units plumb, parallel, and with properly tooled joints of maximum 10mm (3/8-inch) thickness. Keep exposed surfaces clean and free from blemishes or defects. Lay units in the bond pattern indicated.

b. Reinforced Concrete Masonry Unit Walls: Where vertical reinforcement occurs, fill cores solid with grout. Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be filled. The cells to be grouted must be fully bedded in mortar, including the webs to prevent leakage. Remove mortar fins protruding from joints before grout is placed. Minimum clear dimensions of vertical cores shall be 50mm by 76mm (2 by 3 inches). Position reinforcing accurately as indicated before placing grout. As masonry work progresses, secure vertical reinforcing in place at vertical intervals not to exceed 160 bar diameters. Grouting shall be performed as soon as possible after placing units so shrinkage cracking at the joints is minimized and so the grout bonds with the mortar. Use puddling rod or vibrator to consolidate the grout. Minimum clear distance between masonry and vertical reinforcement shall be not less than 13mm.
Unless indicated or specified otherwise, form splices by lapping bars not less than 40 bar diameters and wire tying them together.

7. Bonding and Anchoring: Unless indicated otherwise, extend partitions from the floor to the bottom of the construction above. Structurally bond or anchor walls and partitions to each other and to concrete piers and columns. Securely anchor non-load-bearing partitions and interior walls to the construction above in a manner that provides lateral stability while permitting unrestricted deflection of construction above. Completely embed anchors in mortar joints. Partial height partitions, less than height of ceiling, should be capped with solid (not filled) masonry units.

   a. Corners of Load-Bearing Walls: Provide a true masonry bond in each course, except where indicated or specified otherwise.

   b. Intersections of Load-Bearing Walls: Provide a true masonry bond in each course, or anchor with rigid steel anchors not more than 610mm (2 feet) apart vertically, unless otherwise indicated.

   c. Intersections of Non-Load-Bearing Partitions With Other Walls or Partitions: Tie with wire mesh ties at vertical intervals of not more than 610mm (2 feet) or with masonry bonding in alternate courses, unless otherwise indicated.

   d. Masonry Walls Facing or Abutting Concrete Members: Anchor masonry to the concrete with dovetail or wire-type anchors inserted in slots or inserts built into the concrete, unless otherwise indicated. Locate anchors not more than 457mm (18 inches) o.c. vertically and not more than 610mm (24 inches) o.c. horizontally.

8. Through-Wall Flashing: Provide at the head of all masonry openings in all exterior cavity walls. Unless indicated otherwise, extend flashing from a point 6mm (1/4-inch) outside of the exterior face of walls, upward across wall cavity not less than 152mm (6 inches) and into mortar of bed joint for backing wythe. Bend down the exterior edge to form a drip. Flashing shall be terminated 19mm (3/4-inch) back from interior face of walls and turned back on itself not less than 13mm (1/2-inch). Provide flashing in lengths as long as practicable. Lap ends not less than 38mm (1-1/2 inches) for interlocking type and 4 inches for other types. Seal laps as necessary to ensure watertight construction. Provide dams at ends of flashing where masonry abuts concrete and where flashing ends within the masonry.

9. Weep Holes: Wherever through-wall flashing occurs, provide weep holes to drain the flashing to the exterior. Weep holes shall be open head joints 610mm (24 inches) o.c., clear round holes not less than 102mm (1/4 inches) in diameter and
610mm (24 inches) o.c. Wicking shall extend from the exterior face of the masonry to and approximately 50mm (2 inches) upward into the cavity.

10. **Horizontal Joint Reinforcement**: Provide reinforcement in first bed joint above foundation walls or slabs on grade, in first and second bed joints above and below openings and extending 610mm (24 inches) beyond openings each side in walls and partitions of concrete masonry units. Provide additional reinforcement at 406mm (16 inches) on center throughout entire height of walls. Provide in every course of concrete masonry unit walls of elevator shafts. Reinforcement shall be continuous except at control joints and expansion joints. Reinforcement above and below openings shall extend not less than 610mm (24 inches) beyond each side of openings. Provide reinforcement in the longest available lengths, utilizing the minimum number of splices. Overlap ends not less than 152mm (6 inches). Provide welded L-shaped assemblies and welded T-shaped assemblies to match the straight reinforcement, at corners and intersections of walls and partitions. Provide mortar cover for the wire of at least 16mm (5/8 inch) for exterior face of wall and 13mm (1/2 inch) for interior face of wall.

11. **Concrete Masonry Unit Lintels And Bond Beams**: Provide special units, fill cells solidly with grout, and provide not less than two No. 5 reinforcing bars, unless indicated otherwise. Reinforcing shall overlap a minimum of 40 bar diameters at splices. Concrete masonry units used for lintels and bond beams shall have exposed surfaces of the same material and texture as the adjoining masonry units. Lintels shall be straight and true and shall have at least 203mm (8 inches) of bearing at each end. Cells under lintel bearing on each side of openings shall be filled solid with grout or concrete for 2 courses. Allow lintels to set at least 6 days before shoring is removed. During mixing, add water-repellant admixture in quantity recommended by the admixture manufacturer to concrete and grout which will be used to fill lintels and bond beams in exterior walls.

12. **Control Joints**: Provide where indicated in concrete masonry-unit walls. Provide sawed type or built-in type as required. Joints shall occur directly opposite each other on both faces of the wall and shall be filled with sealant as specified in Section 07920, "Sealants", or a properly formed synthetic rubber or vinyl plastic sealing strip as indicated.

13. **Grout Placement**:

   a. Grouting is required at voids where reinforcing is provided and in below grade foundation walls. Refer to Drawings for locations.

   b. Place grout from the interior side of walls, except as approved otherwise. Protect sills, ledges, offsets, and other surfaces from grout droppings. Remove grout from such surfaces immediately. Grout shall be well mixed to prevent segregation and shall be sufficiently fluid to flow into joints and around reinforcing without leaving voids. Place grout by pumping or
pouring from buckets equipped with spouts in lifts not exceeding 1219mm (4 feet). Waiting time before subsequent pours of grout shall be thirty (30) to sixty (60) minutes, to prevent rupture of the masonry due to hydraulic pressure on the lower mortar joints and/or concrete blocks and to allow for settlement, shrinkage and absorption of excess water by the units. Keep pours at 38mm (1-1/2 inches) below the top of masonry units in top course, except at the finish course. Puddle or agitate grout thoroughly to eliminate voids. Remove masonry displaced by grouting operation and re-lay in alignment with fresh mortar.

14. **Forms and Shoring:** Construct to the shape, lines, and dimensions of members indicated and make sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry. Do not remove until members have cured.

15. **Cleaning:**
   
a. **Protection:** Protect work which may be damaged, stained, or discolored during cleaning operations.

b. **Pointing:** Upon completion of masonry work and before cleaning, cut out defective mortar joints and tuck point joints and all holes solidly with prehydrated mortar.

c. **Cleaning:** Clean exposed masonry surfaces with clear water and stiff fiber brushes and rinse with clear water. Where stains, mortar, or other soil remain, continue scrubbing with warm water and detergent. Where soil still remains clean as recommended by the masonry manufacturer. Use cleaners in accordance with the instructions and recommendations of the masonry and cleaner manufacturers. Immediately after cleaning each area, rinse thoroughly with clear water. Restore damaged, stained, and discolored work to original condition or provide new work.

**STRUCTURAL STEEL**

**Materials**

1. **Steel:**
   


c. Structural Steel Tubing: ASTM A500, Grade B.
d. Steel Pipe: ASTM A53, Grade B, Type E or S.

2. Bolts, Nuts, and Washers:

a. Structural Steel Joints:

   (1) Bolts: ASTM A325, Type 1; ASTM A490, Type 1.
   (2) Nuts: ASTM A563, Grade C and heavy hex style or as specified in the applicable ASTM bolt standard.

b. Foundation Anchorage:

   (1) Bolts: ASTM F1554, Grade 36.
   (2) Nuts: ASTM A563, Grade C, heavy hex style, except nuts under 1.5 inches may be provided in hex style.
   (3) Washers: ASTM F844.

3. Structural Steel Accessories:


b. Nonshrink Grout: Grout shall be nonmetallic such as “Embeco” as manufactured by Master Builders, “Introplast” as manufactured by Sika, or equal.

4. Painting: See Specifications for “PAINTING FINISHES.”

5. Fabrication:

a. Markings: Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations. Manufacturer's symbol and grade markings shall appear on all bolts and nuts.

b. Gas cutting may be used for concealed or minor items of work, i.e.: blocking, etc., but will not be allowed for cutting or enlarging of bolt holes. Bearing ends of columns shall be accurately milled to a plane surface perpendicular to the axis of the shaft.
**Construction**

1. **Erection:**
   
   a. Column baseplates and leveling plates shall be set level to correct elevations and temporarily supported on steel wedges or shims until the supported members have been plumbed and grouted.
   
   b. After final positioning of steel members, provide full bearing under baseplates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions. The entire bearing area under the plates shall be grouted solid.
   
   c. Templates shall be furnished as required for the accurate placement of anchor bolts and bearing plates.
   
   d. Structural steel framing shall be carried up true and plumb, and temporary bracing shall be used wherever necessary to withstand all loads to which the structure may be subjected, including erection equipment and its operation. Bracing shall be left in place as long as may be required for safety and then removed by the Contractor. As erection progresses, the work shall be securely connected to take care of all dead load, wind and erection stresses.

2. **Connections:** Except as modified in this Section, connections not detailed shall be designed in accordance with AISC Manual of Steel Construction - Load and Resistance Factor Design". Build connections into existing work. Shop connections shall be welded. All connections shall be properly designed for the moments or shears shown on the drawing, or for the standard end loads of the members to be connected as tabulated for uniform loads in the AISC Handbook. Provide for unusual end loads where necessary. All welding shall be performed with procedures and by operators recently certified in accordance with the standards of the American Welding Society. Connections shall be types shown on the Drawings and/or specified. No burning of holes for connections will be allowed. Field holes shall be drilled. Punch, sub-punch and ream, or drill bolt holes. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.
   
   a. Tightening of Shear/Bearing Connections: ASTM A307 and ASTM A325N bolts, in connections not defined as slip critical or subject to direct tension loads, shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a worker using a spud wrench, contact the
Engineer for further instructions. Bolts which may be tightened only to a snug tight condition shall be clearly identified on the drawing.

b. Tightening of Foundation Bolts: Unless otherwise directed, anchor bolts shall be set prior to concrete pouring. Do not tighten with an impact torque wrench and/or until concrete has cured minimum of 14 days.

3. **Welding**: AWS D1.1. Provide AWS D1.1 qualified welders, welding operators, and tackers.

   a. Removal of Temporary Welds, Run-Off Plates, and Backing Strips: Remove only from finished areas.

   b. Field welding will not be permitted on primed or painted steel. Contractor is responsible for properly cleaning steel before welding.

4. **Field Quality Control**: Perform field tests, and provide labor, equipment, and incidentals required for testing. The Engineer shall be notified in writing of defective welds within 7 working days of the date of weld inspection.

   a. **Welds**:

      (1) Furnish the services of AWS-certified welding inspectors for fabrication, erection, testing and verification inspections. Welding inspectors shall inspect and mark welds, including fillet weld end returns. All defective welds that have been repaired shall be retested.

      (2) Shop welds required for structural connections shall be visually inspected and approved by an independent testing laboratory. All questionable welds shall be radiographically or ultrasonically tested. If questionable welds prove defective, Contractor shall test minimum 10% or all other welds at no additional cost.

      (3) Field welds required for structural connections shall be visually inspected and approved by independent testing laboratory. All questionable welds and at least 10% of all other welds shall be tested by magnetic particle testing or ultrasonic testing.

**STEEL ROOF DECKING**

**Materials**

1. **Steel**: Deck units shall be manufactured from steel conforming to ASTM A653, Structural Quality Grade having a minimum yield of strength of 33,000 psi. Quality and properties shall conform to AISI SG671.
2. **Zinc-Coated Steel**: Provide zinc-coated steel deck and accessories conforming to ASTM A924 G90. Zinc-coated steel will require shop painting.

3. **Accessories**: Provide accessories of the same material as the deck and not lighter than 18-gauge, unless specified otherwise herein. Provide manufacturer's standard type accessories, as specified herein.
   
a. **Adjusting Plates**: Provide plates of the same gauge and configuration as the roof units. Use factory cut plates of predetermined sizes where possible.
   
b. **End Closures**: Factory fabricate of minimum 18 gauge sheet metal.
   
c. **Cover Plates**: Provide butt cover plates, underlapping sleeves; or 50mm (2-inch) wide noncombustible, pressure sensitive tape.
   
d. **Miscellaneous Accessories**: Provide cant strips, fasteners, sump pans, ridge and valley plates, and various types of plates and closures as indicated or as necessary to complete the work. Provide accessories required for a finished installation.

2. **Fabrication**: Provide decking in accordance with Steel Deck Institute-Design Manual for Composite Decks, Form Decks, and Roof Decks (SDEI-DMCDFDRD).
   
a. Decking shall have a minimum section modulus, S, of 8mm (0.318 inch) (914mm³/ft), a minimum steel thickness of 0.0474 inch, a minimum moment of inertia of 7mm (0.292 inch)×1219mm(4/ft), and a minimum depth of 1.5 inches. The deck shall be capable of resisting the seismic shear (248 PLF) and within the flexibility category: flexible. Deck units shall conform to manufacturer's published load tables. Deck shall safely support uniformly distributed live loads as indicated on drawings, plus dead loads of construction indicated and/or specified. Deflection shall not exceed 11mm (1/240) of maximum span for live loads specified.

**Construction**

1. **Inspection of Support Structure**: Prior to installation of steel roof deck and accessories, inspect the support structure to verify that the as-built structure will permit the indicated field installation of the decking system without modification.

2. **Installation**: Install steel roof deck units in accordance with approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports. Extend deck units over three or more supports. Report inaccuracies in alignment or leveling to the Engineer and make necessary
corrections before deck units are anchored permanently in place. Locate end laps over supports only, with minimum lap of 50mm (2 inches). Do not use unanchored deck units as a work or storage platform. Permanently anchor units placed by the end of each working day. Suspended ceilings, light fixtures, ducts, utilities, or other loads shall not be supported by the steel deck.

a. Anchorage Methods: After placement and alignment, and after inaccuracies have been corrected, permanently fasten steel roof deck units in place by welding, and with self-drilling screws as specified on the Drawings. Length of side and end laps of deck shall be as recommended by the steel deck manufacturer, but not less than 2 inches. Clamp or weight deck units to provide firm contact between deck units and structural supports while welding or fastening is being performed.

(1) Welding: Perform welding in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturers of the base metal alloys being used. Welds shall be made only by operators previously qualified by test prescribed in AWS to perform the type of work required. Location, size and spacing of welds shall be as indicated on the Drawings and in accordance with the Steel Deck Institute recommendations and as shown on the approved shop drawings. Clean welds immediately by chipping and wire brushing. Heavily coat welds, weld scars, cut edges, drill holes, rust spots and damaged portions of shop finish and zinc-rich primer provided by the deck supplier and approved by the Engineer.

(2) Self-Drilling Screws: Provide screws for anchoring the deck to structural supports and adjoining units as indicated on the Drawings and that are standard with the Steel Deck Institute and the manufacturer. Provide screws of a positive locking type; approved prior to installation.

b. Accessories: Install cover plates, adjusting plates, finish strips, closures and closure sheets as necessary to complete the work. Install finish strips and closure sheets so as to lap one support a minimum of 50mm (2 inches).

(1) Adjusting Plates: Provide in locations too narrow to accommodate full-size deck units and install as shown on shop drawings.

(2) End Closures: Provide end closure to close open ends of cells at parapets, end walls, eaves, and openings in roof deck.

(3) Cover Plates: Provide at end joints between adjoining non-lapping units.
c. Openings:

   (1) Openings required in deck larger than five square feet, or greater than 610mm (24 inches) in either direction or 762mm (30 inches) in diameter, shall be predetermined and provided as a part of fabrication herein.

   (2) Punching, drilling or cutting deck openings smaller than above stated for passage of pipes, ducts, or attachment of other items shall be performed in field by Contractor requiring such. Obtain approval of the Engineer for such holes or other openings larger than 152mm (6 inches) in diameter.

   (3) Steel reinforcing members indicated or require around openings through decks for roof hatches, fans, and similar projections, will be provided by others when shown on drawings. If not shown, but required, this Contractor shall provide such.

   (4) Steel reinforcing members required for auxiliary openings smaller than stated above and not indicated on drawings shall be provided by Contractor requiring opening.

3. Field Quality Control: Inspect the decking top surface for flatness after installation. The top flanges of each sheet shall be flat with concavity or convexity not to exceed 1/16-inch (1.58mm). A straight edge placed across any three contact surfaces shall leave a gap of not more than 1.58mm (1/16-inch) between the straight edge and any point of the contact surface; when gap is more than 1.58mm (1/16-inch), provide corrective measures or replacement. Reinspect the decking after performing corrective measures or replacement.

   a. Complete installation of deck and accessories shall be subject to approval by roofing Contractor and Engineer.

COLD-FORMED METAL FRAMING

Materials

1. **Studs and Joists:**

   a. Studs and Joists of 16 Gauge 1.51mm (0.0598 inch) and Heavier Galvanized steel, ASTM A653, Grade D (50,000 psi yield point), G90.

   b. Studs and Joists of 18 Gauge 1.21mm (0.0478 inch) and Lighter, Track, and Accessories (All Gauges): Galvanized steel, ASTM A653, Grade D (33,000 psi yield point), G90.

2. Paint: Ungalvanized steel, if used, shall be thoroughly cleaned, phosphate treated, and coated with rust-inhibitive primer, FS TT-P-636.

Construction

1. Fastening: Fasten framing members together by welding or by using self-drilling or self-tapping screws. Welding shall conform to AWS D1.3 welding procedure. Electrodes and screw connections shall be as required and indicated in the design calculations. Do not field weld materials lighter than 18 gauge.

2. Tracks: Provide accurately aligned runners at top and bottom of partitions. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least 76mm (3 inches) from the edge of concrete slabs.

3. Studs: Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings 610mm (2 feet) wide or larger or as indicated on the Contract Drawings. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with AISI SG671, consisting of, as a minimum, runner channel cut to fit between and welded to the studs or hot- or cold-rolled steel channels inserted through cutouts in web of each stud and secured to studs with welded clip angles. Bracing shall be not less than the following:

<table>
<thead>
<tr>
<th>Load</th>
<th>Height</th>
<th>Bracing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind load only</td>
<td>Up to 3.1m (10 feet)</td>
<td>One row at mid-height</td>
</tr>
<tr>
<td></td>
<td>Over 3.1m (10 feet)</td>
<td>Rows 5'-0&quot; o.c. maximum</td>
</tr>
<tr>
<td>Axial load</td>
<td>Up to 3.1m (10 feet)</td>
<td>Two rows at 1/3 points</td>
</tr>
<tr>
<td></td>
<td>Over 3.1m (10 feet)</td>
<td>Rows 3'-4&quot; o.c. maximum</td>
</tr>
</tbody>
</table>
ROUGH CARPENTRY

Materials

1. Lumber:
   a. Structural Lumber: Except where a specific grade is indicated or specified, any of the species and grades listed in NFP NDS that have allowable unit stresses in pounds per square inch (psi) not less than 1,200 Fb, with 1,200,000 E. Use for headers, and all other members indicated to be stress rated.
   
   b. Framing Lumber: Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing shall be one of the species listed in the table below. Minimum grade of species shall be as listed.

<table>
<thead>
<tr>
<th>Grading Rules</th>
<th>Species</th>
<th>Framing</th>
<th>Board Lumber</th>
</tr>
</thead>
<tbody>
<tr>
<td>NELMA SGRNL Standard Grading Rules</td>
<td>Balsam Fir, Eastern Hemlock - Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine Cedar</td>
<td>All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade For 2 x 4 Size, 3048mm (10 Feet) and Shorter)</td>
<td>All Species: No. 3 Common Except Standard for Eastern White and Northern Pine</td>
</tr>
</tbody>
</table>

   a. Wall Sheathing:
      (1) Plywood: C-D Grade, Exposure 1, 4-ply, and a minimum thickness of 13mm (1/2 inch).
   
   b. Roof Sheathing:
      (1) Plywood: C-D Grade, Exposure 1, 4-ply, and minimum thickness of 16mm (5/8 inch).
3. **Other Materials:**

   a. **Rough Hardware:** Unless otherwise indicated or specified, rough hardware shall be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, or concrete walls or slabs shall be zinc-coated to a level of corrosion protection recommended by the rough hardware manufacturer.

      (1) **Bolts, Nuts, Studs, and Rivets:** ANSI B18.2.1, ANSI B18.5, ANSI B18.2.2, and ASTM A687. Provide a flat washer under each bolt head and a flat and lock washers under each nut.

      (2) **Lag Screws and Lag Bolts:** ANSI B18.2.1.

      (3) **Wood Screws:** ANSI B18.6.1.

**Construction**

1. **Installation:** Conform to NFP WCD1 unless otherwise indicated or specified. Fit framing lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner. Do not splice framing members between bearing points. Reinforce all members damaged by cutting or boring by means of specially formed and approved sheet metal or bar steel shapes, or remove and provide new, as approved. Provide as necessary for the proper completion of the work all framing members not indicated or specified. Spikes, nails, and bolts shall be drawn up tight.

2. **Miscellaneous:**

   a. **Wood Blocking:** Provide proper sizes and shapes at proper locations for the installation and attachment of wood and other finish materials, fixtures, equipment, and items indicated or specified.

**TAPERED ROOF INSULATION**

**Materials**

1. **Roof Insulation:** One layer of the insulation shall be factory tapered to a slope of not less than 6mm (1/4 inch0 per foot (2.1 percent). Provide starter and filler blocks as required to provide the total thickness of insulation necessary to meet the specified slope. Mitered joints shall be factory fabricated and shall consist of two diagonally cut boards or one board shaped to provide the required slopes.
Identify each piece of tapered insulation board by color or other identity coding system, allowing the identification of different sizes of tapered material insulation board required to complete the roof insulation system. The roofing installation system shall be an approved system by the approved E.P.D.M. manufacturer in order to comply with the E.P.D.M. manufacturer's total system warranty as specified under “Elastomeric Sheet Roofing System.” Use an assembly of the following materials and descriptions unless otherwise required by the approved E.P.D.M. manufacturer:

a. Polyurethane or polyisocyanurate board: ASTM C591, Type I.

b. Insulation Thickness: Thickness at the lowest point shall be a minimum of 25mm (1”) (38 millimeters). Over steel decks, the insulation thickness shall satisfy the minimum thickness for the width of rib opening recommended in the insulation manufacturer's published literature.

c. Fire Safety Requirements: Tapered roof insulation shall have a maximum flame spread rating of 75 and a minimum smoke developed rating of 150, exclusive of facing, when tested in accordance with ASTM E84. Insulation listed in the UL BMD Building Materials Directory and bearing the UL label will be accepted in lieu of copies of certified test reports. Compliance with flame-spread and smoke-developed ratings will not be required if the insulation has been tested as a part of a roof construction assembly of the type used for this project and the construction is UL listed as being fire-classified or listed as Class 1 roof deck construction in the FM P7825. Insulation tested as a part of a roof construction assembly shall be provided with UL or FM labels attesting to the ratings specified herein.

d. Preformed Cants and Tapered Edge Strips: Provide the same material used for the roof insulation; or, if roof insulation material is unavailable, provide pressure-preservative treated wood, wood fiberboard, or rigid perlite board, as recommended by the roofing manufacturer.

e. Asphalt Primer: ASTM D41.

f. Low-Slope Asphalt: ASTM D312, Type I or II.

g. Steep Asphalt: ASTM D312, Type III or IV.

h. Asphalt Roof Cement: ASTM D2822, Type I.

i. Rosin-Sized Building Paper or Unsaturated Felt: A minimum of 5 pounds (2.3 kilograms) per 100 square feet (9.3 square meters).
j. Asphalt-Saturated Felts: ASTM D226, Type I.

k. Asphalt-Saturated Felt Base Sheet: ASTM D2626.

l. Nails And Fasteners: Flush-driven through discs or hexagonal plates a minimum of 1 3/8 inch (35 millimeters). Discs may be omitted when one-piece composite nails or fasteners with heads a minimum of one inch (25 millimeters) in diameter are used. Minimum withdrawal resistance of nails or approved fasteners shall be 40 pounds (178 newtons) each in the specific decks when driven, except for fasteners specified herein for steel decks.

(1) Fasteners for Steel Decks: Hardened, penetrating-type fasteners with zinc-coated or chromate finish designed to be driven through the roof deck. Fasteners shall be FM listed for Class 1 roof deck construction. The length of fasteners shall be governed by the thickness of the insulation. Holding power shall be a minimum of 120 pounds per fastener or shall withstand an uplift pressure of 90 pounds per square foot (psf) (4,310 pascals) when tested in accordance with the uplift pressure test described in the FM D/S1-28 Loss Prevention Data Sheet 1-28.

m. Discs and Plates: Steel or plastic. Discs used to secure insulation to steel decking shall be of the type and design listed in the FM for Class 1 roof deck construction or UL listed for fire-classified roof deck construction.

(1) Steel Discs or Plates: Zinc coated steel not lighter than 28-gauge and a minimum of 3 inches (76 millimeters) in diameter. The disc or plate shall be formed to prevent dishing. Do not use bell- or cup-shaped caps.

(2) Plastic Discs: High density molded thermoplastic with a smooth top surface, reinforcing ribs, and a minimum diameter of 3 inches (76 millimeters). Discs shall be designed to cause the fastener head to recess fully into the discs after driving.

n. All metal nails and fasteners and connectors, plates, disks, etc., that will be in contact with pressure preservative treated wood (P.P.T.) shall be hot-dip galvanized equal to or better than ASTM A653 Class G-185 for connectors, plates, disks, etc., and ASTM A153 for nails and fasteners.

Construction

1. Installation: Install roof insulating materials as specified herein unless specified or recommended otherwise by the E.P.D.M. manufacturer's instructions. Keep roof insulating materials dry before, during, and after installation. Keep
insulation 1/2 inch (13 millimeters) clear of vertical surfaces penetrating and projecting from the roof surface.

a. Surface Inspection: Surfaces receiving insulation shall be clean, smooth, and dry.

b. Surface Preparation: Correct all deficiencies in roof deck surfaces including those at roof drains and outlets prior to the start of work. Examine steel decks to ensure that panels are properly secured to structural members and to each other and that surfaces of top flanges are flat or slightly convex and are without stiffening grooves.

c. Asphalt Temperature: When installing the insulation, apply the asphalt when the temperature of the asphalt is within 25 degrees F (14 degrees C) of the EVT. Do not heat the asphalt to the FP. Do not heat asphalt above the FBT for longer than 4 consecutive hours. Use thermometers to check temperatures during heating and application. Have the kettle attended constantly during the heating process to ensure that specified temperatures are maintained.

d. Wood Nailers: Pressure-preservative treated wood nailers for securing insulation are specified in "Rough Carpentry. Verify prior to the installation of insulation that the nailers are the same thickness as the insulation and have been provided at eaves, edges, curbs, walls, and roof openings for securing cant strips, gravel stops, gutters, and flashing flanges.

e. Insulation: Install insulation directly to roof deck surface using mechanical fasteners. Lay insulation so that end joints of each course are staggered with those of the adjoining courses. When using multiple layers of insulation, the joints of each succeeding layer shall be parallel and staggered in both directions with respect to the layer below. Firmly embed each succeeding layer of insulation in a solid steep asphalt mopping; mop only sufficient area to provide complete embedment of one board at a time. Each piece of insulation shall be walked-in prior to the installation of succeeding pieces of insulation.

(1) Insulation on Steel Deck: Secure insulation to the deck with self-drilling, self-tapping fasteners. Engage fasteners by driving them through the insulation and screwing them into the top flange of the steel deck. Insulation joints, parallel to the ribs of the deck, shall occur on solid bearing surfaces only, not over open ribs. When multiple layers of insulation are used, mop in the second layer and all succeeding layers as specified herein for mopping layers of insulation in place. Space fasteners as recommended in FM D/S1-28.
f. Cant Strips: Where indicated, provide cant strips at intersections of the roof with walls, parapets, and curbs extending above the roof. The face of cant strips shall have an incline of 45 degrees, the minimum face dimension shall be 5 1/2 inches (140 millimeters), and the minimum thickness shall be 1 1/2 inches (38 millimeters). Cant strips shall bear on the wood nailers and fit flush against vertical surfaces. Where possible, nail cant strips to adjoining surfaces. Where cant strips are installed against nonnailable materials, install the cant strips in a heavy mopping of steep asphalt or set the cant strips in asphalt roof cement.

g. Tapered Edge Strips: Where indicated, provide edge strips in the right angle formed by the junction of the roof and wood nailing strips that extend above the level of the roof. Edge strips shall be tapered from the top of the wood nailing strips to approximately 1/8 inch (3 millimeters) at a slope of one to 38mm (1-1/2 inches) per foot (8.4 to 13 percent). Install edge strips flush against vertical surfaces of wood nailing strips. Where possible, nail edge strips to adjoining surfaces. Where installed against non-nailable materials, install edge strips in a heavy mopping of steep asphalt or set the edge strips in asphalt roof cement.

2. Protection of Applied Insulation: Completely cover each day's installation of insulation with finished roofing specified in “Elastomeric Sheet Roofing System.” Do not permit phased construction. Protect the open ends of each day's work with temporary water cutoffs; remove the cutoffs when work is resumed. Protect open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints until permanent roofing and flashing are applied. Do not permit storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces. Provide smooth, clean board or plank walkways, runways, or platforms near roof structural supports, as necessary, to distribute weight to conform to a maximum 20 pounds-per-square-foot construction live load limit.

PREFORMED METAL SOFFIT LINER AND FASCIA PANEL

Materials

1. Soffit Liner and Fascia Panel:

   a. Panels shall be type having a cross sectional profile and depth as indicated on the Contract Drawings. Form sheets from steel conforming to ASTM A446, Structural Grade A with a galvanized coating conforming to ASTM A526, Coating Class G-90. Sheets shall be not lighter than 26 U.S. Standard Gauge at the soffit liner and 24 U.S. Standard Gauge at the fascia panel.
b. Finish Coating System: Factory-applied, polyvinylidene difluoride (PVF₂) as indicated, total dry film thickness of 1.0 mil, available in a minimum of eight manufacturer's standard colors. Provide a finish coating system on both faces. Color of exterior face shall be selected by Owner. Color of interior face shall be manufacturer's standard.

(1) Canopy Soffit Liner and Fascia Panel: Exposed face to receive a polyvinylidene difluoride (PVF₂) finish.

c. Accessories: Sheet metal flashings, trim, moldings, closure strips, low profile ridge unit, and other similar sheet metal accessories used in conjunction with preformed metal panels shall be made of the same material, finish and color as used for the panels, except that such accessories which will be concealed after installation, may be provided without the finish if they are aluminum- or zinc-coated steel. Thickness of the metal shall be not less than that used for the panels. Molded closure strips shall be closed-cell or solid-cell synthetic rubber, neoprene, or polyvinyl chloride premolded to match the configurations of the preformed metal panels.

(1) Closure Strips: Formed of approved compressed rubber, synthetic rubber, bituminous impregnated materials, or metal of the same respective type as the roof and wall panels, and as standard with the manufacturer. Molded closure strips shall be free of open voids and shall not absorb or retain water. Form closure strips to match the corrugations or configurations of the roofing or siding used. Provide closure strips where indicated and where necessary to ensure weathertight construction.

(2) Joint Sealing Material: Seal side and end laps with Type II, Class B ribbon form sealant conforming to FS TT-C-1796, except that bituminous type materials shall not be used. Minimum sizes of ribbons shall be 24mm by 13mm or 4.8mm by 6mm (3/32 by 1/2 inch or 3/16 by 1/4 inch) for rectangular areas and 6mm (1/4 inch) diameter for circular areas. Seal joints at doors, windows, accessories, and flashings.

d. Fasteners: Fasteners for attaching panels to structural supports and to adjoining panels shall be as approved and in accordance with the manufacturer's recommendations. Unless specified otherwise, the fasteners shall be self-drilling screws. Design the fastening system to withstand the design loads indicated. Fasteners shall be Series 305 stainless steel or aluminum. Fasteners, with the exception of those having integral hexagonal washer heads and those having aluminum drive caps, shall have composite metal and neoprene washers. Fasteners having integral hexagonal washer heads and fasteners having aluminum drive
caps shall have polychloroprene washers. Heads of screws or bolts exposed on exterior face of factory-finished panel shall be nylon headed to match color of panel.

(1) Screws: Not less than No. 14 diameter self-tapping type or self-drilling and self-tapping type.

(2) Powder-Actuated Fasteners: Provide fasteners of the type to be used with powder-actuated tools, and with a shank diameter of adequate size to support loads imposed. Shank length of fasteners shall be not less than 13mm (1/2 inch) for fastening panels to steel and not less than one inch for fastening panels to concrete. Fasteners for securing wall panels shall have threaded studs suitable for attaching approved color-coated nuts or caps.

Construction

1. Installation: In accordance with the manufacturer's approved installation instructions, except as specified otherwise. Liner and panels shall be in full and firm contact with supports and with each other at side and end laps. Where liner or panels are cut in the field, or where any of the factory-applied coatings are damaged in handling or installation, they shall, after the necessary repairs have been made with material of the same type and color as the finish coating, be approved before installation. Seal completely all cut ends and edges, including those at openings through the liner or panels. Correct defects in the materials. Remove defective materials which cannot be corrected and provide non-defective materials. Provide molded closure strips where indicated and whenever liner or panels terminate with open ends after installation.

a. Fascia Panels: Apply panels with the configurations in a vertical position. Provide panels in full fascia heights from base to top of fascia with no horizontal joints. Seal side and end laps with joint sealing material. Flash seal at the base, at the top, and around openings. Place closure strips, flashing, and sealing material to achieve complete weathertightness. Minimum side laps shall be one configuration.

b. Soffit Liner: Apply panels with the configurations parallel to the direction of traffic. Provide full length sections of soffit liner at each soffit liner bay as shown on the Contract Drawings. Adjacent bays of soffit liner shall terminate at a continuous (1)-piece closure strip to fully conceal ends of abutting soffit liner. Closure strip shall be capable of fully supporting soffit liner ends to limit liner deflection to 11mm (1/240) of the unsupported liner length. Place closure strips, flashing, and sealing material to achieve complete weathertightness. Minimum side lap shall be one configuration.
c. Flashings: Flashings and related closures and accessories in connection with the preformed metal liner and panels shall be provided where indicated and as necessary to provide a watertight installation. Details of installation which are not indicated shall be in accordance with the panel manufacturer's printed instructions and details or approved shop drawings. Installation shall allow for expansion and contraction of flashing.

d. Fasteners: Fastener spacings shall be in accordance with the manufacturer's recommendations. Install fasteners in valleys or crowns as recommended by the manufacturer of the liner or panel being used. Install fasteners in straight lines within a tolerance of 13mm (1/2 inch) in the length of a bay. Drive exposed, penetrating-type fasteners normal to the surface and to a uniform depth to seat washers with gaskets and drive so as not to damage factory-applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered in valleys or crowns, as applicable. After drilling, remove metal filings and burrs from holes prior to installing fasteners, gaskets, and washers. Torque used in installing fasteners shall not exceed that recommended by the manufacturer. Remove liners and panels damaged by over torqued fastenings, and provide new liners and panels.

ELASTOMERIC SHEET ROOFING SYSTEM

Materials

1. Elastomeric Sheet: RMA IPR1. Ethylene Propylene Diene Monomer (EPDM), white on black, 1.52mm (0.060-inch) thick, unreinforced, for fully adhered application. Width and length of sheet shall be as recommended by the EPDM manufacturer.

2. Adhesive: As recommended by the EPDM manufacturer's printed data.

3. Splicing Cement, Splicing Tape, Splicing Cleaner, and Sealant: As recommended by the EPDM manufacturer's printed data.

4. Fire Safety: The roof membrane only shall have UL 790 Class A classification.

5. Pipe Flashings: One piece premolded elastomeric boot type, with stainless steel clamping ring as recommended by the EPDM manufacturer’s printed data.

6. Warranties: Furnish the EPDM manufacturer’s standard weathertightness and extended wind speed total system warranty for the elastomeric sheet roofing system. The warranty shall run directly to the Owner. In no event shall the warranty period be less than 20 years from the date of the Owner’s acceptance of the work. The warranties shall provide that if within the warranty period the elastomeric sheet roofing system becomes non-watertight, splits, tears, or
separates at the seams because of defective materials and workmanship, or winds up to 72 miles per hour, the repair or replacement of defective materials and correction of defective workmanship shall be the responsibility of the elastomeric sheet manufacturer with no dollar limit.

7. **Qualification of Applicator:** The total roofing system applicator shall be approved by the elastomeric sheet roofing system manufacturer.

**Construction**

1. **Preparation:** Examine substrates to which the roofing materials are to be applied to ensure that their condition is satisfactory for its application. Do not permit voids greater than 1/4 inch (6 millimeters) wide in the substrate. Install wood blocking at perimeters and penetrations as required. Substrates for roofing materials shall be dry and free of oil, dirt, grease, sharp edges, and debris. Base metal flashings shall be washed with solvents until thoroughly clean or replace in kind with new metal flashings. Inspect substrates, and correct defects before application of elastomeric sheets.

2. **Special Precautions:**
   
a. Do not dilute coatings or sealants unless specifically recommended by the materials manufacturer's printed application instructions. Do not thin liquid materials with cleaners used for cleaning elastomeric sheet.
   
b. Keep all liquids in airtight containers, and keep containers closed except when removing materials.
   
c. Use liquid components, including adhesives, within their shelf life period. Store adhesives at 60 to 80 degrees F (15 to 26 degrees C) for at least 24 hours prior to use. Avoid excessive adhesive application and adhesive spills, as they can be destructive to some elastomeric sheets and insulations; follow adhesive manufacturer's printed application instructions.
   
d. Do not allow contact between various materials through mixing of remains, dual use of mixing, transporting, or application equipment. Do not use equipment containing the remains of previous materials.
   
e. Require workmen and others who walk on the EPDM to wear clean, soft-soled shoes to avoid damage to roofing materials.
   
f. Do not use equipment with sharp edges which could puncture the EPDM sheet.
3. **Environmental Conditions:** Do not install EPDM sheet roofing during high winds or inclement weather, or when there is ice, frost, moisture, or visible dampness on the substrate surface. Unless recommended otherwise by the EPDM sheet manufacturer, do not install EPDM sheet when air temperature is below 10 degrees F (-12 degrees C) or within 5 degrees F (3 degrees C) of the dewpoint. When the air temperature is 40 degrees F (4 degrees C) or colder, use adhesives within 4 hours following exposure.

4. **Work Sequence:** Arrange work to prevent use of newly constructed roofing for storage, walking surface, or equipment movement. If access is necessary, provide temporary walkways, platforms, or runways to protect new roofing surfaces and flashings from mechanical damage.

5. **Application:** Apply EPDM sheet roofing in accordance with the EPDM sheet manufacturer's application instructions and the following requirements. The complete roof system shall be designed to resist a Factory Mutual 1-90 wind uplift pressure.

   a. **EPDM Sheet Roofing:** Unroll prefabricated EPDM sheet roofing in position without stretching membrane. Lap sheets a minimum of 3 inches (75 millimeters). Inspect for holes. Remove sections of EPDM sheet roofing that are creased or damaged, and allow sheets to relax at least 30 minutes before seaming.

   (1) **Fully Adhered Application:** Apply adhesive evenly and continuously to substrate and underside of sheets at rates recommended by EPDM sheet manufacturer's printed application instructions. Allow adhesive to dry to consistency prescribed by manufacturer before adhering sheets to the substrate. Roll each sheet into adhesive to avoid wrinkles; broom or roll to remove air pockets and "fishmouths" and to ensure full, continuous bonding of sheet to substrate. Clean both mating surfaces at splice area, apply adhesive, lap adjoining sheets, and seal seams according to instructions of EPDM sheet manufacturer.

   (2) **Perimeter Fastening:** Mechanically secure the EPDM sheet to nailers at roof perimeter and penetrations with specified fasteners. Space fasteners a maximum of 8 inches (203 millimeters) on centers, except as recommended otherwise by the elastomeric sheet manufacturer's printed data. Strip flash over the fasteners with a fully adhered layer of flashing material of the type recommended by the EPDM sheet manufacturer's printed data.

   (a) **Temporary Work:** Install temporary cutoffs around incomplete edges of roofing assembly at the end of each day's work and when work must be postponed due to
inclement weather. (Temporary cutoffs provide protection against moisture infiltration and absorption.) Straighten the insulation line using pieces of insulation loosely laid, and seal the elastomeric sheet membrane to the deck. Remove the temporary seals completely when work resumes. Provide temporary ballast on the roofing as necessary to prevent wind damage to the EPDM sheet.

b. **Flashings:** Install flashing as roofing sheets are installed in accordance with standard installation detail drawings of the EPDM sheet manufacturer. Where standard installation detail drawings are not furnished, install in accordance with NRCA Roofing and Waterproofing Manual construction details. Completely adhere flashing sheets in place.

6. **Roof Drain Test:** After the roofing system is complete but prior to Owner’s acceptance of the roofing, perform the following test of roof drains and adjacent roofing for water tightness. Plug roof drains, and fill drains with water for 24 hours. To ensure some drainage from the roof, do not test all drains at the same time. Measure water levels at the beginning and end of the 24-hour period. If precipitation occurs during the test period, repeat the test. If the water level falls, remove water, thoroughly dry and inspect the installation, and repair or replace roofing at the drain. Repeat the test until there is no water leakage.

7. **Information Card:** Provide a typewritten card, laminated in plastic and framed in a weather-tight frame, or a photo-engraved 0.032-inch (0.8-millimeter) thick aluminum card for each roof. This card shall be a minimum size of 8-1/2 by 11 inches (216 millimeters by 279 millimeters) and contain information listed in the attached Form 1. Install the card near access to the roof or where directed. Furnish framed card and a duplicate card to the Owner and Engineer.
FORM 1
ELASTOMERIC SHEET ROOFING SYSTEM COMPONENTS

1. Building & Location:
2. Deck Type:
3. Slope of Deck:
4. Insulation Type & Thickness:
5. Insulation Manufacturer:
6. Sheet Elastomeric Roofing Description:
   Manufacturer (Name, address, & phone no.):
   Type:
   Method of attachment:
7. Statement of Compliance or Exception:
8. Date Roof Completed:
9. Warranty Period:
10. Roofing Contractor (Name & Address):

Contractor's Signature ____________________________ Date: ____________
Inspector's Signature ____________________________ Date: ____________

FLASHING AND SHEET METAL

Materials

1. Materials: Furnish sheet metal items in 2438mm to 3048mm (8 to 10-foot) lengths. Single pieces less than 2438mm (8 feet) long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Provide accessories and other items essential to complete the sheet metal installation. These accessories shall be made of the same materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage or thickness shown. Sheet metal items shall have mill finish unless specified otherwise.
ITEM 634.7872--07 – TOLL BOOTH CANOPY

a. Exposed Sheet Metal Items: Shall be of the same material. The following items shall be considered as exposed sheet metal: gutters, including hangers; downspouts; drip edge; and related accessories.

b. Aluminum Alloy Sheet and Plate: ASTM B209, form alloy, and temper appropriate for use.

   (1) Alclad: When fabricated of aluminum, the following items shall be fabricated of Alclad 3003, Alclad 3004, Alclad 3005, clad on one side, unless otherwise indicated.

      (a) Gutters, downspouts, and hangers
      (b) Drip edge

   (2) Finish: Exposed exterior sheet metal items of aluminum shall have a baked-on, factory-applied color coating applied after metal substrates have been cleaned and pretreated. Finish coating dry-film thickness shall be 0.8 mils, and color shall be as chosen by Owner.


e. Fasteners: Use the same metal or a metal compatible with the item fastened. Use stainless steel fasteners to fasten dissimilar materials.

f. Drip Edge: Fabricated from not less than 0.6mm (.024 inch) thick aluminum, 1-inch face. Color shall be as chosen by Owner.

**Construction**

1. **Installation**:

   a. Requirements: Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications, conform to the applicable requirements of SMACNA ASMM, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight.

   b. Workmanship: Make lines, arrises, and angles sharp and true. Free exposed surfaces from visible wave, warp, and buckle, and tool marks. Fold back exposed edges neatly to form a 13mm (1/2-inch) hem on the
concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

c. Nailing: Confine nailing or flashing to one edge only. Space nails evenly not over 76mm (3 inches) on centers and approximately 13mm (1/2 inch) from edge unless otherwise specified or indicated.

d. Base and Counterflashing: Except where indicated or specified otherwise, extend vertically up 152mm (6 inches) above roof deck, extend down vertical surfaces over upturned vertical leg of base flashings not less than 76mm (3 inches). Where stepped counterflashings are required, they may be installed in short lengths or may be of the preformed one-piece type. Provide end laps in counterflashings not less than 76mm (3 inches) and make it weathertight with plastic cement. Do not make lengths of metal counterflashings exceed 3048mm (10 feet). Form the flashings to the required shapes before installation.

e. Gutters: Field fabricate seamless gutters from not less than 0.8mm (.032 inch) thick aluminum to size and shape specified on the Contract Drawings. Provide gutters complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation. Aluminum gutters shall be joined with riveted sealed joints. Adjust gutters to slope uniformly to outlets as specified on the Contract Drawings. Fabricate fastenings from metals compatible with the gutters.

f. Downspouts: Types, shapes and sizes as indicated on the Contract Drawings. Provide complete operating system including elbows, offsets, and sealants. Provide downspouts in continuous unjointed lengths between all end fittings (elbows, offsets, etc.) and downspout inlets and outlets. Provide end joints to telescope not less than 13mm (1/2 inch) and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than one inch away from vertical supports. Fasten downspouts to the supports at top, bottom, and at an intermediate point not to exceed 1524mm (5 feet) on centers with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the downspouts. Provide downspouts transitioning into P.V.C. pipe boot.

g. Metal Drip Edge: Provide a metal drip, designed to allow water run-off to drip free of underlying construction, at fascia. Extend up from the bottom edge of the fascia not more than 76mm (3 inches) and secure with compatible nails spaced not more than 254mm (10 inches) on center along upper edge.
SEALANTS

Materials

1. **Sealants**: Provide sealant that has been tested and found suitable for the substrates to which it will be applied.

   a. **Exterior Sealant**: For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Location(s) of sealant shall be as follows:

      Location

      (1) Joints and recesses formed where steel framing adjoin masonry or concrete.

      (2) Voids where items pass through the fascia.

      (3) Metal-to-metal joints where sealant is indicated or specified.

2. **Primer For Sealant**: Provide a non-staining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

3. **Bond Breakers**: Provide the type and consistency recommended by the sealant manufacturer for the particular application.

4. **Backstops**: Provide glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Backstop material shall be compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

5. **Cleaning Solvents**: Provide type(s) recommended by the sealant manufacturer.

6. **Color**: Sealants exposed to view shall match the color of adjacent finished surfaces.

Construction

1. **Surface Preparation**: Surfaces shall be clean, dry to the touch, and free from dirt, frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. When resealing an existing joint, remove existing calk or sealant prior to applying new sealant.
a. Steel Surfaces: Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

b. Aluminum or Bronze Surfaces: Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. For removing protective coatings and final cleaning, use nonstaining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

2. Sealant Preparation: Do not add liquids, solvents, or powders to the sealant. Mix multi-component elastomeric sealants in accordance with manufacturer's instructions.

3. Application:

a. Joint Width-To-Depth Ratios:

(1) Acceptable Ratios:

<table>
<thead>
<tr>
<th>Joint Width</th>
<th>Joint Depth Minimum</th>
<th>Joint Depth Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>For metal, glass, or other nonporous surfaces:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6mm (¼”) (minimum)</td>
<td>6mm (¼”)</td>
<td>6mm (¼”)</td>
</tr>
<tr>
<td>Over 6mm (¼”)</td>
<td>13mm (½) of width</td>
<td>Equal to width</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Over 6mm to 13mm (¼” to ½”)</th>
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</thead>
<tbody>
<tr>
<td>13mm (½”) width</td>
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</table>

<table>
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<tr>
<th>Over 13mm to 50mm (½” to 2”)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13mm (½”)</td>
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</table>

<table>
<thead>
<tr>
<th>Over 50mm (2”)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(As recommended by sealant manufacturer)</td>
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</table>

(2) Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding shall not be required on metal surfaces.

b. Backstops: Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

(1) Where indicated.
(2) Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios".

c. Primer: Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

d. Bond Breaker: Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

e. Sealants: Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and cannot be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Sealant shall be uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified.

4. Protection And Cleaning:

a. Protection: Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

b. Final Cleaning: Upon completion of sealant application, remove remaining smears and stains, and leave the work in a clean and neat condition.

(1) Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry, and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hours then remove by wire brushing or sanding.

(2) Metal and Other Nonporous Surfaces: Remove excess sealant with a solvent-moistened cloth.
PAINTING AND FINISHING

Materials

1. Product Data: Manufacturer’s product literature for actual materials. Submit material manufacturer’s printed directions and recommendations for environmental conditions, surface preparation, priming, mixing, reduction, spreading rate, application, and storage, as applicable for each material.

2. Materials selected for each system type shall be products of a single manufacturer.

3. Container Labels: Include manufacturer’s name, trade name of product, kind of material, color name and number, manufacturer’s identifying number and date of manufacture, formula analysis in percent by weight, Federal Specification number (if applicable, surface preparation, reducing and application instructions, and on containers other than primers, include manufacturer’s recommended primer.

4. The Contractor shall provide Material Safety Data sheets to the Engineer for all materials used at the job site. The Contractor shall also supply the Engineer with the manufacturer’s current technical data for the paint furnished.

5. Deliver materials to the site in original, unopened containers bearing manufacturer’s printed label.

6. Material for the full prime and second coats shall be a lead and chromate free water based polymer coating that bonds with tight rust and aged coatings, Type: “Noxyde,” as manufactured by Mathys Waterproofing of Belgium and distributed in the USA by Advanced Coating Technology (ACT/Martco) of Elmsford, NY.

7. Material for full finish coat shall be a one part, water based acrylic coating, containing 26% resin emulsions and free of internal or external plasticized polyvinyl acetate, Type: “Pegacryl,” as manufactured by Mathys Waterproofing of Belgium and distributed in the USA by Advanced Coating Technology (ACT/Martco) of Elmsford, NY.

Construction

1. Color Schedule:
   a. New Canopy Columns – By Owner.
   b. New Canopy Downspouts/Brackests – By Owner.
   c. New Canopy Framing (not exposed to view) – black.
2. Examine surfaces for conditions that will adversely affect execution, performance or quality of the work. Do not proceed with the coating application until conditions are suitable.

3. Protection:
   a. Prior to surface preparation and painting, cover or otherwise protect adjacent surfaces, equipment or structures.
   b. Cover Toll Booths involved with reinforced polyethylene sheeting taped securely closed as directed.

4. Schedule, Procedures, Preparation:
   a. At least five working days prior to the start of work, the Contractor shall provide the Engineer with a painting schedule fully delineating a schedule of operations and one copy of the paint manufacturer’s current technical data for the paint furnished. In addition, the Contractor shall provide the Engineer with a written statement from the paint supplier identifying recoat requirements. Instructions, suggestions, and precautions contained in the data sheets shall be followed. If the manufacturer’s technical data contradicts the provisions of these specifications, the Engineer will be notified by the Contractor and the Engineer will issue a determination of the procedures to follow. The schedule shall be in accordance with these specifications and the manufacturer’s application and recoat recommendations.

   b. No changes to the coating schedule or system will be permitted without the express written approval of the Engineer.

   c. Surface Preparation: All steel surfaces shall be cleaned by rinsing with potable hot water at high pressure (82°C, 20 MPa) for removal of loose paint, debris and surface contaminants. Subsequently, loose rust and loose mill scale shall be removed from the steel surfaces by hand tool cleaning in accordance with SSPC-SP2.

   d. Mixed Coatings: All coatings shall be thoroughly mixed prior to application. Mechanical mixers shall be used to thoroughly disperse any settled pigment or solids. Hand mixing or boxing shall not be allowed.

   e. Thinning: No thinning of coatings shall be allowed unless all of the following are met:

      (1) recommended by the manufacturer
      (2) done in strict compliance with the manufacturer’s instructions
      (3) approved by the Engineer
(4) mixed in the presence of the Engineer or Inspector

Unauthorized thinning shall result in rejection, and the coating shall be removed and the surface repainted in conformance with the specifications and to the satisfaction of the Engineer, at the Contractor’s expense.

f. Coating Application Methods: All coatings shall be applied in a neat and workmanlike manner. Coatings shall be applied uniformly and shall be free of runs, sags, drips, ridges or other defects. Paint may be applied by brushes, rollers, spray, or a combination of these methods as specified in the contract documents or as approved by the Engineer.

Hand Brushing: The coating, when applied with brushes, shall be so manipulated by the brush as to produce a uniform even coating. When applying a coating to a previously coated surface, strokes should be made perpendicular to those of the receiving surface to insure adequate anchorage. Brushes shall be of good quality and the length of the exposed bristle shall be equal to or greater than the width of the brush.

On those areas which are inaccessible to brushes, the coating shall be applied by the use of rollers, spray equipment, daubers, or sheepskins, as approved by the Engineer.

Spraying: Spray equipment shall be capable of applying paint in a fine even spray so as to produce a uniform film. Spray equipment shall be as recommended by the coating manufacturer.

Spray coating shall be done by experienced and qualified painters. Painters shall apply material in a manner that promotes uniform coverage and prevents discontinuity of the applied coating film. The spray gun shall be moved uniformly across and perpendicular to the receiving surface. The insure a uniform coating, each spray pass should lap the other by 50%. Any sags, drips, air holes or film defects shall be immediately corrected by hand brushing.

g. Termination of Coating Operations: The Engineer is empowered to terminate coating operations, temporarily or permanently, if the Engineer determines that any of the following conditions exist.

1. Satisfactory results are not being obtained.

2. The measured dry film thickness is not within the required range.

3. Areas not specifically designated to be coated are likely to be or are being affected by the application method.
(4) The application method is causing to public or private property.

h. Pre-Prime Fog Coat (shop applied): Before applying the primer to the specified film thickness, a thin fog coat primer diluted 33% shall be applied by spray to all surfaces.

i. Finish Coat (field applied): After application of the full prime and second coat, all new canopy columns shall receive one finish coat of satin gloss acrylic enamel finish.

j. The coating of metal surfaces shall include, but not be limited to the following:

(1) The proper preparation of all surfaces.

(2) The application, protection and curing of the coatings.

(3) The protection from spatter or spillage of pedestrian, vehicular or other traffic upon, beneath or adjacent to the coated surfaces.

(4) The protection against disfigurement of all structures as well as highway appurtenances. Disfigurement may be caused by abrading, scoring, spattering, over spraying, splashing, and smirching of coatings or cleaning materials.

(5) The prevention of spillage of any pollutants into any waterway or body of water.

(6) The supplying of all equipment, tools, tackle, scaffolding, labor and materials necessary to complete the entire work.

k. All coatings shall be applied without runs, sags or other objectionable properties necessary to complete the entire work.

The total film thickness of all coating applications shall be as indicated below:

<table>
<thead>
<tr>
<th>Coating Type</th>
<th>Material</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-prime Fog Coat</td>
<td>Noxyde</td>
<td>2 mils dry</td>
</tr>
<tr>
<td>Full Primer Coat</td>
<td>Noxyde</td>
<td>7-9 mils dry</td>
</tr>
<tr>
<td>Full Second Coat</td>
<td>Noxyde</td>
<td>7-9 mils dry</td>
</tr>
<tr>
<td>Full Finish Coat</td>
<td>Pegacryl</td>
<td>6-8 mils wet</td>
</tr>
</tbody>
</table>

The mil thickness specified above shall be achieved prior to acceptance of the work, regardless of the number of applications required.
The prime coat, second coat and finish coat shall be a different color from each other. The color of the prime coat shall contrast with the underlying substrate and/or previously applied paints. The color range between subsequent coats shall be as approved by the Engineer prior to ordering the material. The coating colors shall be such that they can be completely hidden by a single application at the minimum specified dry film thickness. Field tinting shall not be allowed.

1. Schedule:

(1) All Prime Coat (all canopy framing and downspouts/brackets): Shall be applied to dry surfaces that have been cleaned and pre-primed in accordance with this specification. If previously cleaned surfaces are left to stand 24 hours before application of the primer, they shall be re-rinsed with water before application of the primer.

(2) Field Applied

(a) Second Coat (all canopy framing and downspouts/brackets): The second coat of paint shall be applied to the receiving surfaces in conformance with the manufacturer’s recommended schedule for recoating.

(b) Finish Coat (canopy columns and downspouts/brackets only): The finish coat shall be applied to the receiving surfaces in conformance with the manufacturer’s recommendations.

m. After installation of new steel, all areas where paint has become damaged or deteriorated shall be thoroughly cleaned and “touched-up” or recoated with the appropriate number of coats as directed by and to the satisfaction of the Engineer.

RAIN LEADER PIPING

Materials

1. Rain Leader Piping: Provide Cast-Iron Hubless Pipe and Fittings in conformance with CISPI 301 with CISPI 310 coupling joints; fittings shall be long radius type.

2. Cleanouts: ANSI A112.36.2M; provide threaded bronze or thermoplastic cleanout plugs.

3. Pipe Hangers and Supports: Provide MSS SP-58 and MSS SP-69, Type 1 or 6, of the adjustable type, except as modified herein or indicated otherwise. Attachments to steel W or S beams shall be with Type 21, 28, 29, or 30 clamps.
Attachments to steel angles and channels (with web vertical) shall be with Type 20 clamp with a beam clamp channel adaptor. Attachments to steel channel web (horizontal) shall be with drilled hole on center line and double nut and washer. Attachments to concrete shall be with Type 18 insert or a drilled hole with expansion anchor. Attachments to wood shall be as indicated. Hanger rods and attachments shall be full size of the hanger threaded diameter. Provide Type 40 insulation protection shields for insulated piping. Provide steel support rods. Provide nonmetallic, hair felt, or plastic piping isolators between copper tubing and the hangers.

Construction

1. Installation: Installation of plumbing systems including fixtures, equipment, materials and workmanship shall be in accordance with the New York State Plumbing Code, except as modified herein.
   a. Pipe Supports (Hangers): Provide supports, clamps and guides as specified herein and as shown on the plans.
      (1) Maximum spacing between supports:
         a. Vertical Piping: Support metal piping at each floor, but at not more than 3048mm (10-foot) intervals.
         b. Horizontal Piping: Support cast-iron piping at 1524mm (5-foot) intervals, except for pipe exceeding 1524mm (5-foot) length, provide supports at intervals equal to the pipe length but not exceeding 3048mm (10 feet).

2. Field Testing: Before final acceptance of the work, test each system as in service to demonstrate compliance with the contract requirements. Perform the following tests in addition to the tests specified in the New York State Plumbing Code, except as modified herein. Correct all defects in the work provided by the Contractor, and repeat the tests until the work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for the tests.
   a. DWV Piping: Before the installation of fixtures, cap the ends of each system, fill the piping with water to the roof, and allow to stand until a thorough inspection has been made. If the system is tested in sections, each opening shall be plugged and each section tested with not less than a 3048mm (10-foot) head of water.
METHOD OF MEASUREMENT

The TOLL BOOTH CANOPY work will be measured on a lump sum basis.

BASIS OF PAYMENT

The lump sum price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the TOLL BOOTH CANOPY work. Monthly payments will be made in proportion to the amount of work done as determined by the Engineer.