# DIVISION 06

# WOOD AND PLASTIC

## SECTION 06100 - ROUGH CARPENTRY

## PART 1 - GENERAL

### 1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services for furnishing and installing the carpentry work as shown on the Drawings and specified herein.

B. The extent of rough carpentry work is shown on the Drawings and includes, but is not necessarily limited to the following:

1. Installation of wood framing, blocking and furring.

2. Plywood backing panels.

### 1.02 RELATED DOCUMENTS SPECIFIED ELSEWHERE

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

### 1.03 SUBMITTALS

A. Comply with all provisions of Section 01300, as well as the requirements listed herein.

B. Submittals Pertaining to Wood Preservative Data:

1. Carpentry: For information only, submit 2 copies of chemical treatment manufacturer's instructions for proper use of each type of treated material.

2. Pressure Treatment: For type specified, include certification by treating plant, stating chemicals and process used, net amount of salts retained and conformance with applicable standards. For water-borne preservatives, include statement that moisture content of treated materials was reduced to a maximum of 19% prior to shipment to project site.

### 1.04 QUALITY ASSURANCE

A. Installer must examine all parts of the existing structure and the conditions under which the carpentry work is to be installed, and notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow proper attachment of other work.

C. Delivery and Storage: Keep materials dry during delivery and storage. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood and provide air circulation within stacks.

D. Protect installed carpentry work from damage by work of other trades until Owner's acceptance of the work.

E. Factory-mark each piece of lumber and plywood to identify the type, grade, agency providing the inspection service, the producing mill and other qualities as specified herein.

## PART 2 - PRODUCTS

### 2.01 LUMBER

A. Lumber, Standards: For each use, comply with the "American Softwood Lumber Standard" PS 20 by the U.S. Department of commerce. Nominal sizes are shown or specified; provide actual sizes complying with the minimum size requirements of PS 20 for moisture content specified for each use.

B. Provide dressed lumber, S4S, unless otherwise shown or specified.

C. Provide seasoned lumber with 19% maximum moisture content at time of dressing and complying with dry size requirements of PS 20, unless otherwise specified.

D. Framing Lumber: Where wood framing from 2" to 5" (but not including 5") in nominal thickness, and 2" or more in nominal width is shown or scheduled; provide lumber complying with grading rules which conform to the requirements of the "National Grading Rule for Dimension Lumber" of the American Lumber Standards Committee established under PS 20. For light framing (2" to 4" thick and 2" to 4" wide), provide "Stud" grade lumber for stud framing and "Standard" grade for other light framing. Design values for framing lumber shall be as follows:

| | **Stud Grade** | **Standard Grade** |
|---|---|---|
| Extreme fiber in bending | 775 PSI | 575 PSI |
| Tension parallel to grain | 450 PSI | 350 PSI |
| Compression parallel to grain | 575 PSI | 900 PSI |
| Horizontal shear | 90 PSI | 90 PSI |
| Compression perpendicular to grain | 405 PSI | 390 PSI |
| Modulus of elasticity | 1,400,000 | 1,400,000 |

E. Boards: Where lumber less than 2" in nominal thickness and 2" or more in nominal width is shown or specified, provide boards complying with dry size requirements of PS 20, with a moisture content of 19% maximum, mark boards "S-DRY".

### 2.02 PLYWOOD

A. Standard: For each use, comply with the requirements for "Soft wood Plywood/Construction and Industrial" PS 1 by the U.S. Department of Commerce except as otherwise specified herein. Provide plywood of any PS-1 species classification group, except where particular species is shown or specified or where PS-1 limits groups for a particular grade specified.

B. Trademark: Factory-mark each construction panel with APA trademark evidencing compliance with grade requirements.

C. Roof Sheathing: APA-rated sheathing:

1. Exposure Durability Classification: Exterior.

2. Span Rating: As required to suit rafter spacing indicated.

D. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire retardant treated-plywood panels with grade designation, APA C-D PLUGGED INT, with exterior glue, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch

## 2.03 PRESERVATIVE TREATMENT

A. Preservative Treatment by Pressure Process: AWPA C2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.

5. Wood floor plates that are installed over concrete slabs-on-grade.

## 2.04 ANCHORAGE & FASTENING DEVICES

A. Select proper type, size, material and finish for each application and comply with the following specification requirements:

1. Nails and Staples: FS FF-N-105.

2. Wood Screws: FS FF-S-111.

3. Bolts and Studs: FS FF-B-575.

4. Nuts: FS FF-N-836.

5. Washers: FS FF-W-92.

6. Lag Screws or Lag Bolts: FS FF-B-561.

7. Expansion Shields, Expansion Nails & Drive Screws Devices: FS FF-B-325.

8. Toggle Bolts: FS FF-B-5889.

9. Bar or Strap Anchors: ASTM A 107 Carbon Steel Bars.

# PART 3 - EXECUTION

## 3.01 FRAMING INSTALLATION

A. Plates: Plates shall be set level and square and anchor bolted at not more than four (4) feet on centers and not more than twelve (12) inches from each end of each piece. A minimum of three anchors shall be used for each piece. All sill plates shall be preservative treated lumber.

B. Miscellaneous:

1. Blocking shall be provided as necessary for application of wallboard, wall hung accessories and other materials or building items.

2. Wood grounds shall be provided as necessary for attachment of trim, finish, and other work. Grounds shall be run in lengths as long as practicable, butt jointed, and rigidly secured in place.

END OF SECTION

## SECTION 06600 - FIBERGLASS REINFORCED PLASTIC PRODUCTS AND FABRICATIONS

### PART 1 - GENERAL

### 1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to install the fiberglass reinforced plastic (FRP) grating, stair treads, handrail, ladders and structural members as shown on the drawings and as specified herein.

### 1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

### 1.03 QUALITY ASSURANCE

A. The material covered by these specifications shall be furnished by a reputable and qualified manufacturer of proven ability who has regularly engaged in the manufacture and installation of FRP systems.

B. Substitution of any component or modification of system shall be made only when approved by the Engineer.

C. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

D. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

### 1.04 DESIGN CRITERIA

A. The design of FRP products including connections shall be in accordance with governing building codes and standards as applicable.

B. Design of FRP live loads on grating shall not be less than 100 pounds per sq. ft. Grating deflection at the center of a simple span not to exceed 0.25 inch. Deflection in any direction shall not be more than L/180 of span for structural members. Connections shall be designed to transfer the above loads.

### 1.05 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance

Design, engineer, fabricate, and install the following FRP fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each FRP fabrication.

B. Stair Tread Performance

Capable of withstanding a uniform load of 100 lbs per sq. ft. or a concentrated load of 300 lbs on an area of 4 sq. inches located in the center of the tread, whichever produces the greater stress.

C. Platforming and Stair Platform Performance

Capable of withstanding a uniform load of 100 lbs per sq. ft.

D. Handrails Systems Performance

Capable of withstanding a concentrated load of 200 lbs applied at any point non-currently, vertically downward, or horizontally.

## 1.06 SUBMITTALS

A. Shop drawings of all FRP structural members, handrails, gratings, plate, ladders and appurtenances shall be submitted to the Engineer for approval in accordance with the requirements of Section 01300.

B. Manufacturer's catalog data showing:

1. Dimensions, spacings, and construction of grating

2. Design tables showing limits for span length and deflection under various uniform and concentrated loads

3. Materials of construction

C. Detail shop drawings showing:

1. Dimensions of grating, ladders, handrail, and structural members

2. Sectional assembly

3. Location and identification mark

4. Size and type of supporting frames required

5. Anchorage and accessory items.

D. Samples of each type of grating proposed shall be submitted for approval prior to placement of purchase orders.

## 1.07 SHIPPING AND STORAGE INSTRUCTIONS

A. All systems, sub-systems and structures shall be shop fabricated and assembled into the largest practical size suitable for transporting.

B. All materials and equipment necessary for the fabrication and installation of the grating, plate, handrails, stair treads, and structural shapes shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun. Any material which, in the opinion of the Engineer, has become damaged as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.

C. Identify and match-mark all materials, items, and fabrications for installation and field assembly.

# PART 2- PRODUCTS

## 2.01 GENERAL

A. Materials used in the manufacture of the FRP products shall be new stock of the best quality

and shall be free from all defects and imperfections that might affect the performance of the finished product.

B. All materials shall be of the kind and quality specified, and where the quality is not specified, it shall be the best of the respective kinds and suitable for the purpose intended.

C. All FRP products noted in 1.01 shall be manufactured using a pultruded process utilizing either an isophthalic polyester or a vinyl ester resin with flame retardant and ultra-violet (UV) inhibitor additives. A synthetic surface veil shall be the outermost layer covering the exterior surface. The FRP shapes shall achieve a flame spread of 25 or less in accordance with ASTM test method E84. (Isophthalic polyester resin is available without flame retardant and UV inhibitor additives.)

D. After fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating to prevent intrusion of moisture.

E. FRP products exposed to weather shall contain an ultraviolet inhibitor and shall additionally receive one mil thick 1J.V. coating to shield from ultra-violet light if specified or requested.

F. All exposed surfaces shall be smooth and true to form.

G. Manufacturers:

1. Morrision Molded Fiber Glass Company (MMFG)
2. Fibergrate

## 2.02 GRATINGS AND TREADS

A. General

1. Grating shall be shipped from the manufacturer, palletized and banded with exposed edges protected by cardboard to prevent damage in shipment.

2. Each piece shall be clearly marked showing manufacturer's applicable drawing number.

B. Design

1. The panels shall be 1-1/2" deep and sustain a deflection of no more than 0.25 inches under a uniform distributed load of 100 psf for the span lengths shown on the plans.

2. The bearing bars shall be joined into panels by passing continuous length fiberglass pultruded cross rods through the web of each bearing bars. The pultruded cross rod assembly shall consist of two cross rod spacers that have notches cut into them at 1-1/2" inches on center to fit the distance between the web of each bearing bar. A continuous fiberglass pultruded bar shaped section shall be wedged between the two cross rod spacers mechanically locking the notches in the cross rod spacers to the web of the bearing bars. Chemical bonding shall be achieved between the cross rod spacers and the bearing web and between the bar shaped wedge and the two cross rod spacers locking the entire panel together to give a panel that resists twist and prevents internal movement of the bearing bars.

3. The top surface of all panels shall have a nonskid grit affixed to the surface by a baked epoxy resin followed by a top coat of baked epoxy resin.

4. Panels shall be fabricated to the sizes shown on the drawings.

5. Hold down clamps shall be type 316L stainless steel. A minimum of 4 each per panel.

6. Color shall be gray (OSHA safety gray)

7. All bearing bars that are to be exposed to UV shall be coated (optional) with polyurethane coating of a minimum thickness of I mil if desired.

C. Fabrication

1. The FRP grating and stair treads shall be fabricated from bearing bars and cross rod manufactured by the pultrusion process. The glass fiber reinforcement for the bearing bars shall be a core of continuous glass strand rovings wrapped with continuous strand glass mat. A synthetic surface veil shall be the outermost layer covering the exterior surfaces.

2. Fiberglass Grating and Stair Treads

   a. Fiberglass grating and stair treads shall be made from a premium grade chemical resistant, fire retardant isophthalic polyester or fire retardant vinyl ester resin system with antimony trioxide added to meet the flame rating of 25 or less in accordance with ASTM E-84 testing and meet the self-extinguishing requirements of ASTM D-635. U. V. inhibitors are added to the resin.

3. Grating with Plate

   a. Grating shall be the same as described above in this section.

   b. Plate shall be manufactured using a premium grade polyester or vinyl ester resin with fire retardant additive to meet Class I flame rating of 25 or less as tested by ASTM E-84 and meet the self-extinguishing requirements of ASTM D-635. All plate shall contain a U. V. inhibitor.

   c. Plate will be epoxy bonded to the grating, and a non-skid grit will be affixed to the top surface of the assembly by a baked epoxy resin, followed by a top coat of baked epoxy resin.

4. All cut and machined edges, holes and abrasions shall be sealed with a resin compatible with the resin matrix used in the bearing bars and cross rods.

5. All panels shall be fabricated to the sizes shown on the approved shop drawing.

## 2.03 STRUCTURAL SHAPES

A. Structural shapes shall be made from a premium grade polyester or vinyl ester resin with fire retardant additives to meet Class 1 flame rating of ASTM E-84 and meet the self-extinguishing requirements of ASTM D-635. All structural shapes shall contain a U.V. inhibitor.

B. Manufactured by the pultrusion process.

Structural FRP members composition shall consist of a glass fiber reinforced polyester or vinyl ester resin matrix, approximately 50% resin to glass ratio. A synthetic surface veil shall be the outermost layer covering the exterior surfaces. Continuous glass strand rovings shall be used internally for longitudinal strength. Continuous strand glass mats shall be used internally for transverse strength.

C. The following minimum mechanical properties shall apply:

**Table 1 – Fiberglass Pultruded Material Properties**
**Minimum Ultimate Coupon Properties (UN)**

| Material Properties | ASTM Test Method | PSI (Mpa) |
|---|---|---|
| **Pultruded Fiberglass Structural Shapes** | | |
| Ultimate tensile stress in longitudinal direction | D638 | 30,000 (207) |
| Ultimate compressive stress in longitudinal direction | D695 | 30,000 (207) |
| Ultimate flexural stress in longitudinal direction | D790 | 30,000 (207) |
| Ultimate short beam shear in longitudinal direction | D2344 | 4,500 (31) |
| Ultimate tensile stress in transverse direction | D638 | 7,000 (48) |
| Ultimate compressive stress in transverse direction | D695 | 15,000 (103) |
| Ultimate flexural stress in transverse direction | D790 | 10,000 (69) |
| Density (lb/in.$^3$ (kg/mm$^3$) | D792 | .060-.070 (0.00166-00194) |
| Water absorption (24-h immersion) | D570 | 0.60 Max, % by Weight |
| Barcol Hardness | D2583 | 45 |
| Coefficient of thermal 10$^-$6 in/in/°C | D696 | 8 |
| Expansion,LW10$^{-6}$ in/in/°F | _____ | 4.4 |
| Thermal conductivity BTU-in/FT$^2$/hr/°F | C177 | 4 |
| **Flame Retardant Properties** | | |
| Flame resistance | FTMS 406-2023 | 55/30 lgn.burn.sec. |
| Flammability test | D 635 | Self Extinguishing |
| Surface burning characteristics | E 84 | 25 maximum |
| Flammability class | UL 94 | VO |
| Temperature index | UL94 | 130°C |

## 2.04 HANDRAILS

A. Design:

1. The FRP handrail system shall be designed to meet the configuration and loading requirements of OSHA 1910.23, with a minimum factor of safety on loading of 2.0.

B. Material:

1. The rails and posts shall be 2"'x2"x.156" square tube manufactured by the pultrusion process. The kickplate shall be 4"xl/2" (corrugated) x .125" thick pultruded fiberglass shape. The parts may be coated with an industrial grade polyurethane paint for additional U.V. protection and wear resistance. The pultruded parts shall be made with a fire retardant resin which meets the ASTM E-84 test for a flame spread of 25 or less. The resin matrix shall be {polyester} or {vinyl ester} and shall contain a UV inhibitor. The color shall be {OSHA safety yellow} or {gray}.

2. The pultruded parts shall meeting the following minimum mechanical properties:

| Properties | Test Method | Values |
|---|---|---|
| Tensile Stress | ASTM D638 | 30,000 psi |
| Tensile Modulus | ASTM D638 | $2.5 \times 10^6$ psi |
| Compressive Stress | ASTM D695 | 30,000 psi |
| Compressive Modulus | ASTM D695 | $2.5 \times 10^6$ psi |
| Flexural Stress | ASTM D790 | 30,000 psi |
| Flexural Modulus | ASTM D790 | $1.6 \times 10^6$ psi |
| Shear Stress | ASTM D2344 | 4,500 psi |
| Density | ASTM D792 | .060 - .070 lbs/in$^3$ |
| 24 Hr. Water Absorption | ASTM D570 | 0.6% max |
| Coef. of Thermal Expansion | ASTM D696 | $4.4 \times 10^{-6}$ in/in°F |
| Flexural Stress | Full Section | 36,000 psi |
| Flexural Modulus | Full Section | $3.7 \times 10^6$ psi |

C. Fabrication Handrail System:

1. The fiberglass handrail system shall be fabricated into finished sections by fabricating and joining together the pultruded square tube using molded or pultruded components; epoxy bonded and connected as shown in the fabrication details. Where required by OSHA, fiberglass kickplate shall be attached to the handrail posts with nylon rivets. Handrail sections shall be fabricated to the size shown on the approved fabrication drawings and shall be piece marked with a waterproof tag.

D. For Side Mount:

1. Post shall be constructed with a square pultruded bottom plug. Length shall be sufficient to extend a minimum of one inch beyond the uppermost bolt hole to prevent cursing of post tubing. Bolt holes shall provide clearance of 1/16 inch for 1/2 inch diameter bolts/studs. Holes shall be on longitudinal center line of post, 1 inch from bottom of post (minimum) and not less than 3 inches apart on center. Posts shall be fastened with stainless steel anchor bolts or studs, 1/2 inch diameter extending no less than 2-1/4 inches into the concrete, or into a minimum thickness of 1/4 inch structural steel or pultruded fiberglass.

2. Post locations shall be no greater than 24 inches, nor less than 9 inches from horizontal or vertical change in handrail direction. Post centers shall be no greater than 72 inches apart on any straight run of rail or 48 inches apart on any inclined rail section.

E. Other Attachment Methods:

1. Base mount, embedded, and removable are also types of mounting procedures for handrail. Contact approved fabricator for detailed information on these connection types.

F. Installation of Handrail Sections:

1. The fabricated handrail sections shall be supplied complete with fittings by the FRP manufacturer. The components used to joint fabricated sections together may be shipped loose, to be exposed and riveted together in the filed by the Contractor, per the manufacturer's recommendations.

2. The fabricated handrail sections shall be installed as shown on the approved shop drawings. The handrail sections shall be accurately located, erected plumb and level. The sections shall be fastened to the structure as shown on the approved shop drawing.

G. Approved Fabricators:

1. Morrison Molded Fiber Glass Company (MMFG)

a. AFC Division (Chatfield, MN)
b. Bristol Division (Bristol, VA)

## 2.05 LADDERS AND CAGES

A. Ladders and cages shall be made from (select either Isophthalic-Polyester or Vinylester) resin.

B. All ladder and cage components shall be flame retardant per ASTM E-84 Class 1.

C. Ladder rails shall be 2 x 2 x 1/4 square tube. Ladder rungs shall be 1 inch diameter solid round.

D. Ladders and cages are to be safety yellow.

E. Ladder rungs are to penetrate inside wall of ladder rail tube and be countersunk into outside wall of ladder rail tube, providing support for the ladder rung in 4 places. This connection is to be fully bonded and with epoxy adhesives and pinned to prevent rung rotation.

F. Ladder rungs to have slip-resistant quartz epoxy grit surface.

G. Ladder stand-off brackets are to be FRP and are to be installed at a maximum of 6'-0 on center. Ladder base mount brackets are to be FRP. All bolts are to be 316 stainless steel.

H. Ladder cages, if required per OSHA, shall be fabricated from FRP Hoops and Straps. FRP Hoops are to be 3 x 1/4 preformed FRP. Hoop spacing shall be a max. of 4'-0 on center. FRP Straps are to be 2 x 1/4 FRP and are to be spaced at 9" on center. Hoops and Straps are to be bonded with epoxy adhesives and riveted with 316 stainless steel rivets.

I. Approved Fabricators:

1. Ladder and cages shall be manufactured by Seasafe Inc., Lafayette LA.

## 2.06 FALL PREVENTION DEVICES

A. All ladders shall be equipped with Saf-T-Climb fall prevention device, Manufactured by Air Space Devices, Inc., Paramount, California, or equal.

B. All ladders and safety devices shall meet OSHA regulations

# PART 3 - EXECUTION

## 3.01 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

## 3.02 INSTALLATION, GENERAL

A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, and other connectors as required.

B. Cutting, fitting, and placement: Perform cutting, drilling, and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

## 3.03 ALL FRP INSTALLATION

A. All field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.

B. Install items specified as indicated and in accordance with manufacturer's instructions.

## 3.04 INSPECTION AND TESTING

A. The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.

B. All labor, power, materials, equipment, and appurtenances required for testing shall be furnished by the Contractor at no cost to the Owner.

END OF SECTION