ITEM 10615.8002 M - STEEL HARBORWALK HANDRAIL, TYPE A
ITEM 10615.8003 M - STEEL HARBORWALK HANDRAIL, TYPE B

DESCRIPTION:

The work shall consist of designing, furnishing, delivering and installing steel handrails in accordance with these specifications, the contract plans and/or as directed by the engineer.

The work shall include, but is not limited to the following:

1. Railing type as follows:

   Type A - Tubular steel with various top plate, side mounted posts with mesh panels in welded frames between posts for Harborwalk as indicated on drawings.

   Type B - Tubular steel with various top plate, side mounted posts for Harborwalk as indicated on the contract plans.

2. Field and shop welding.

3. Miscellaneous components.

4. Anchoring means and methods.

5. Shop applied finish coats

MATERIALS

A. Standards

The following Standards are referenced in this specification:

1. American Society for Testing & Materials (ASTM)

ASTM A-36	Structural Steel Shapes
ASTM A-123	Zinc (Hot-Dip Galvanized) coating on Iron & Steel Products
ASTM A-153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A-269	Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A-307	Specification for Carbon Steel Bolts and Studs
ASTM A-500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A-563	Carbon and Alloy Steel Nuts
ASTM A-569	Steel Carbon Hot-Rolled Sheet & Strip Commercial Quality
ASTM A-780	Practice for Repair of Damaged and Uncoated Areas of Hot Dipped Galvanized Items
ASTM A-894	Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings
ASTM A-935	Test Method for Anchorage of Permanent Metal Railing Systems and Rails for

Buildings

ASTM A-985 Test Method for Performance of Permanent Metal Railing Systems and Rails for Buildings

ASTM C633 Standard Test Method for Adhesion or Cohesive Strength for Flame Sprayed Coatings, American Society for Testing and Materials.

2. Structural Steel Painting Council (SSPC)

3. American Welding Society (AWS)

AWS D1.1 Welding Code
ANSI/AWS A533-9X Specification for Alloy Wires, Cored Wire and Ceramic Rods for Thermal Spraying, American Welding Society.

4. National Association of Architectural Metal Manufacturers (NAAMM)

5. American Institute of Steel Construction (AISC)

6. American Hot Dip Galvanizers Association (AHDGA)

7. Occupational Safety & Health Administration (OSHA)

8. Federal Specifications (FS)

FS FF-B-575 Machine Bolts
FS FF-P-645 Shop Primer
FS FF-S-92 Machine Screws
FS FF-S-325 Drilled-in Expansion
FS FF-W-84 Lock Washers
FS FF-W-92 Plain Washers

9. American Iron and Steel Institute (AISI)

10. Steel Structures Painting Council (SSPC)

SSPC-CS Guide 23.00, June 1, 1991, Coating system Guide for Thermal Spray Metallic Coating Systems;.

B. General

1. Metals shall be free from defects impairing strength, durability, or appearance, and the best commercial quality for purposes specified. Metals shall be new materials and made with structural properties to safely sustain or withstand stresses and strains to which normally subjected. Members shall be true to detail, clean and straight with curved work true to radii with

smooth finished surfaces.

2. For the fabrication of metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

C. Handrail Members and Elements

1. Welded wire infill panels shall be 3mm diameter stainless steel with 50 mm square openings. Panels to be finished with welded steel frames as indicated in the contract plans. Frames are to be zinc metallized with epoxy and urethane topcoats.

2. Vertical posts and rectangular top rails: Steel tubes as per ASTM A-36, 3.1 mm minimum wall thickness.

D. Fasteners and Anchors

1. General: Select fasteners for the type, grade and class required for the installation of miscellaneous metal items

2. Standard bolts: ASTM A-307, Grade A, regular hexagon head.

3. Lag bolts: ANSI B18.2.1, square head type.

4. Machine screws: FS FF-S-92, cadmium plated steel.

5. Plain washers: FS FF-W-92, round carbon steel.

6. Lock washers: FS FF-W-84, helical spring type carbon steel.

7. Nuts: ASTM A-563.

E. Steel plates shall conform to ASTM A-36.

F. Tubular Railings

1. Steel tubes as per ASTM A-36, 3.1 mm minimum wall thickness.

G. Welding rod and bare electrodes, selected in accordance with the AWS specification for the metal alloy to be welded.

H. Zinc Metallizing with Epoxy and Urethane Topcoats

1. Description

a. This consists of surface preparation, metallizing and painting of steel components as shown on the plans and as directed by the Engineer in accordance with these specifications. The coating system under this specification shall consist of an 85/15 Zinc aluminum thermally sprayed metallizing system, an epoxy sealer coat and a urethane top coat. The thermal spraying process consists of melting the metal described herein and then applying said metal onto a properly prepared surface by means of compressed air.

b. Zinc Metallizing material shall be an 85% Zinc, 15% Aluminum wire as specified herein.

2. Shop Applied Paint Finish System

a. Sherwin Williams - Heavy Duty Epoxy/Corothane II Satin Polyurethane

b. Tnemec Inc. - Series 66 Epoxoline/Series 73 Endurashield.

c. Or equal acceptable to the Engineer

CONSTRUCTION DETAILS

I. QUALITY ASSURANCE

A. Qualifications

1. Fabricator shall be a firm who has been continuously in business for not less than five (5) years and who has had the expertise and experience in fabrication and engineering the work required for this item.

2. The installer shall be the same firm as the manufacturer of the work and shall be under the full time supervision of a foreperson during the installation.

B. Performance Criteria

1. Design, engineer, fabricate and install handrails, and railings to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems, and to comply with requirements of ASTM E-985 and E-935.

2. Deflections shall be limited to the lesser of span L/360 or 1.5 mm for total load span. Design, fabricate and install components as required for proper support and rigidity of configurations, including provisions for deflection, expansion and contraction forces. Coordinate with other trades.

3. Top rail: Capable of withstanding the following loads applied as indicated:

a. Concentrated load of 4.4 kN/m applied to any point nonconcurrently, vertically downward or horizontally or 0.73 kN/m horizontally and vertically applied simultaneously, whichever results in a more severe condition.

b. Do not assume uniform and concentrated loads act concurrently.

4. Handrails not serving as top rails: Capable of withstanding the following loads applied as indicated:

a. Concentrated load of 2.9 kN/m applied to any point nonconcurrently, vertically downward or horizontally or 0.73 kN/m horizontally and vertically applied simultaneously, whichever results in a more severe condition.

b. Do not assume uniform and concentrated loads act concurrently.

5. Infill area: Capable of withstanding a horizontal concentrated load of 2.9 kN/m applied to 0.093 m^2 at any point in the system including panels, intermediate rails, balusters, and other elements composing the infill area.

6 Thermal movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication and installation of handrails and railings to prevent buckling, opening up of joints, overstressing of components, connections and other detrimental effects. Base design calculation on actual surface temperature of materials due to both solar heat gain and nighttime sky heat loss.

7. Quality welding processes and welding operations in accordance with:

a. AWS D1.1, Structural Welding Code - Steel

b. Certify that each welder employed in unit of work of this section has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

II. SUBMITTALS

A. The Samples and Certificates listed below are required to be submitted by the Contractor to the Engineer for review. An omission of an item or items does not relieve the Contractor from this responsibility, and for compliance with the Contract Documents, of which this is a part.

SAMPLES			
Sample No.	Quantity	Size	Description
S1	5	225 mm x 225 mm	Welded connection between tube and tube members

S2	5	225 mm x 225 mm	50 mm square opening welded wire mesh with welded frame corner
S3	5	150 mm x 225 mm	Steel with finish
S4	5	225 mm x 225 mm	Steel with zinc metallizing

All samples shall be primed with welded and ground smooth connections except stainless steel.

NOTARIZED CERTIFICATES OF COMPLIANCE		
Certificate No.	Description	Standards
C1	Steel Tubes	ASTM A-500
C2	Anchors/Fasteners	As specified
C3	Welding	AWS
C4	Testing	ASTM E-894 & E-935
C5	Performance	As specified
C6	Shop Paint	As specified

B. Shop Drawings

1. Submit shop drawings to the Engineer for review in accordance with the requirements of the contract documents prior to fabrication and installation.

2. Shop drawings shall include elevations, plans, sections and details, noting gauges, materials, dimensions, anchoring devices and other attachment methods. Provide floor elevations at each level.

   a. Indicate base anchoring means and methods, sleeves, plates, side assemblies.

   b. Indicate welded and nonwelded connections.

   c. Indicate wire mesh connections to verticals.

   d. For exterior railings indicate the locations of all internal sleeved and weeped expansion/contraction joints.

   e. List all gate hardware.

3. Clearly indicate the work to be provided by other trades and coordinate accordingly.

C. Submit product data and catalog cuts for manufactured items.

D. Submit qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

E. Submit welder AWS qualification data.

F. Engineering Calculations

1. Submit for review engineering calculations on 213 mm x 275 mm sheets which shall conform to the design criteria established herein. Calculations shall be in accordance with standard engineering practice and the procedures and methods used by this trade contractor in designing this work.

2. Each calculation sheet shall be stamped by a registered qualified engineer, licensed by the state of this project's location.

G. Test reports from independent testing laboratory evidencing compliance of handrails and railing systems with ASTM.

III. DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site ready for use and fabricated in as large sections and/or assemblies as practical. Assemblies shall be identical to the reviewed submittals.

B. Store materials under cover in a dry and clean location, off the ground. Take every precaution not to damage or mar prime coats and/or galvanizing. Remove materials which are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials at no additional cost.

IV. FABRICATION - GENERAL

A. Workmanship and finishes shall be first class in every respect and in accordance with the best practices. Employ skilled workers in the fabrication and erection of this work.

B. Securely and neatly weld and grind smooth joints or bring together with dowels, screws or countersunk rivets and dress flush. Dress surfaces smooth and free from mill marks or imperfections.

C. Cut miters accurately to assure a tight, neat fit, and weld and grind smooth and square.

D. Hold together long members built-up or drawn at end joints by concealed sleeves or similar shapes welded in place; with allowance for expansion.

E. Non-welded connections: Fabricate railing systems and handrails for interconnection of members by means of concealed mechanical fasteners and fittings unless otherwise indicated. Fabricate members and fittings to produce flush, smooth rigid hairline joints.

F. Welded construction: Fabricate handrails and railing systems for interconnection of members by concealed internal welds, which eliminate surface grinding, using fittings designed and fabricated for this purpose.

G. Form changes in direction of railing members by bending members, insertion of prefabricated elbow fittings, radius bends, or by mitering. Form simple and compound curves by bending members in jugs required; maintain profile of member throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of handrail and railing components.

H. For handrails and railing systems with non-welded connections which are exposed to exterior or to moisture from condensation or other sources, provide weep-holes or other means for evacuation of entrapped water in hollow sections of railing members.

I. Close exposed ends of all tubular and railing members using steel plugs welded and ground smooth and flush.

J. Brackets, flanges, fittings and anchors: Provide brackets, flanges, miscellaneous fittings, and anchors for connection of vertical members to other work.

1. Fabricate custom base plates and sidewall anchoring assemblies as noted.

2. Fabricate anchorage devices which are capable of withstanding loadings imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.

K. Fabricate joints that will be exposed to weather in a manner to exclude water.

L. Work shall be of the highest standard of material and workmanship, in conformity with the applicable publications of the National Association of Architectural Metal Manufacturers.

M. Welding

1. Comply with AWS for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of the exposed side. Clean exposed welded joints on all welding flux, and dress on all exposed and contact surfaces. Grind exposed welds to match adjacent contours and finish to match adjacent finish.

2. Provide fully welded assemblies, unless otherwise indicated. Use type and alloy of filler metal and electrodes as required for color match, strength and compatibility of materials being joined. Weld corners and seams continuously.

3. Exposed Connections

a. Undercut metal edges at surfaces to be welded

b. Grind exposed welds flush and dress smooth to match and blend with adjoining surfaces, so that joints will not be visible.

N. Pre-assemble items in the shop to the greatest extent possible to minimize field splicing and assembly of units at the site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

V. PIPE RAILINGS AND HANDRAILS

A. Deliver railings and handrails to the job site, ready for installation with as few joints as possible.

B. Floor Supported Posts

1. Provide internal sleeve connections at post joints with flush screw connections where shop fabricated sections are joined. All connections between vertical, horizontal and intermediate members shall be welded and ground smooth and flush in neat and workman like manner, in accordance with the reviewed submittals.

2. Where noted, provide shop welded square or round steel plates to the bottom of the posts with drilled holes for mechanical connections.

C. Plug exposed ends of tubular railings and weld and grind smooth.

VI. SHOP APPLIED FINISH PAINT COAT SYSTEMS

A. General

1. Complete cutting, fitting, forming, drilling and grinding of metal work prior to cleaning, finishing, surface treatment and application of finishes. All weld and torch cuts and blisters must be ground smooth

2. Comply with NAAM “Metal Finishes Manual” for recommendations and designations of finishes, except as otherwise shown or specified.

3. Color and gloss to be selected by the Engineer

B. Quality Assurance

1. Application

- All work specified above shall be done at one facility.
- All work shall be done at a facility certified by the Department of Defense as specified

in DOD-2138-A/1992 standard specifications.
- Applicator shall be certified in accordance with DOD-2138-A/1992.
- Written proof of certification shall be submitted before any work commences.

2. Mock-Up

- Prior to commencement of the work, the specified system shall be applied to a representative piece or section of the structure, in the same manner in which it will be applied during production work.
- The sample shall be submitted to the Engineer for approval of color, texture and overall suitability.
- Work shall not commence until written approval of the mock-up has been received from the Engineer.

C. Construction Method

1. The Engineer shall require that the Contractor demonstrate proven ability and competence in the application of the metallizing and topcoat materials, in conformance with the specifications herein and with the manufacturer's printed instructions.

D. Submittals

1. Product Data: Submit manufacturer's technical information including installation instructions, product description, and product test data conforming to the products specified. Test data may be submitted in printed form on the manufacturer's standard printed material, however, if requested Contractor shall submit specific performance test information as certified by independent laboratory analysis.

E. Performance Criteria: The system shall meet or exceed the following:

1. Adhesion of Zinc/Aluminum metallizing: An average of 4826 kPa, per ASTM D4541

2. Adhesion of Series 66/73 over Zinc/Aluminum metallizing: rating of 5 out of 5 Per ASTM D 3359 after system had been exposed to 10 freeze thaw cycles (1 cycle = 4 hours 100% humidity, 16 hours in freezer, 4 hours in 60 degree Celsius oven).

3. Corrosion resistance of Zinc Aluminum metallizing: 0% rust at scribe after 16 months exterior exposure. A rating of 10 out of 10 (no rusting at scribe) after 4 years natural exposure.

4. Corrosion resistance of Zinc Aluminum metallizing with 1 coat Series 66 and 1 coat Series 73: A rating of 10 out of 10 (no rusting at scribe) after 1500 hours salt fog (Prohesion Method). ASTM D-1654

F. Pre-Work Inspection

1. Metallizing/Coating applicator shall examine surfaces to be coated and report any conditions that would adversely affect the appearance or performance of the coating system and which cannot be put into an acceptable condition by the specified surface preparation.

G. Application

1. Apply materials at specified film thicknesses by method recommended by the manufacturer.

2. Application of paint shall be in accordance with SSPC, Paint Application Specifications for Steel and Manufacturerís instructions.

3. Allow each coat to dry thoroughly before recoating.

4. Finish coats shall be smooth, uniform in color and free of runs, dry spray, overspray, blisters and wrinkles.

5. Temperature and humidity conditions shall be in accordance with manufacturer's instructions

6. Surface preparation: SSPC - SP10 Near White Metal Blasting, with a 3 - 4 mils anchor pattern.

7. First Coat: Zinc/Aluminum metallizing at 4.0 - 6.0 mils minimum dry film thickness.

8. Polyurethane finish coat: Spray-applied 3.0 - 5.0 mils minimum dry film thickness.

9. It is intended that this entire coatings system be applied in the shop. Provisions shall be made for proper handling at all stages of the painting, shipping, storing at job site and erecting, that will protect finished surfaces from damage or soiling.

10. Surface preparation for steel shall be in accordance with Steel Structures Painting Council SP-6 Commercial Blast Cleaning. Prior to blasting or wheel abrading, oil and grease shall be removed, welds shall be ground smooth and all splatter removed. Sharp cut edges shall be uniformly relieved by grinding or filling to form a slight radius sufficient to permit proper wrap of the coatings.

11. Care shall be exercised to maintain clean surfaces. All dust and residue thoroughly removed just prior to painting. Apply primer coat on the same day, to each area, that cleaning is performed, and before rust-bloom occurs.

12. Application shall be by spray. Spray each coat with care, to thoroughly clean surfaces in a smooth, uniform, unbroken film free of runs and sags; with dry film thicknesses maintained on edges and corners.

13. For field welded connections the coating system shall be held back for field touch-up using the same primer and finish coat.

14. Manufacturer's recommendations for handling, thinning, applying and re-coat intervals shall be followed. No work shall be performed when temperature and humidity conditions are outside the limitations stated by the coating manufacturer.

15. A pre-production conference shall be arranged by the Contractor with the Engineer, the Village of Greenport Architect, the fabricator and a representative of the paint manufacturer in attendance, to discuss all details relevant to performing the work in accord with the requirements.

VII. EXAMINATION

A. Study the Contract drawings and specifications with regard to the work as shown and required under this Section so as to insure its completeness.

B. Examine surfaces and conditions to which this work is to be attached and notify the Engineer if conditions or surfaces exist which are detrimental to the proper and expeditious installation of the work. Starting on the work shall imply acceptance of the surfaces and conditions to perform the work as specified.

C. Verify dimensions taken at the job site affecting the work. Bring field dimensions which are at variance, to the attention of the Engineer. Obtain decision regarding corrective measures before the start of installation.

D. Cooperate in the coordination and scheduling of the work of this item with the work of other items so as not to delay job progress.

VIII. INSTALLATION -GENERAL

A. The finished work shall be strong and rigid, neat in appearance and free from defects, with members clean cut, straight and true. Work shall be properly laid out and spaced between terminals, so that there is no cutoff or other uncertain finish or ending.

B. Perform shimming using non-ferrous and non-corrosive metal or fiber shim stock; do not use compressible material subject to deterioration.

C. Work shall be accurately located, erected plumb and level or as required at the designed lines and elevations, and in true planes. In all cases, positioning of members shall be carefully checked to produce continuity of line and design.

1. Level shall mean 3mm in 3 m.

D. Where recesses, pockets holes or other provisions are required to be made in the work by

other trades, provide templates and/or setting drawings to assure that they will be properly formed and located. Furnish such information sufficiently in advance to avoid delay in the construction progress.

E. Field Welding

1. Perform welding using qualified welders and equipment using procedures complying with the applicable current standards, specifications and codes of the American Welding Society. Welds shall be continuous except where spot- welding operation.

F. Securing to Other Work

1. Provide anchors, bolts and other connecting means and methods for securing work in place and for anchoring to adjacent construction.

2. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at intervals indicated, but not less that required by design loading.

3. Vertical post connections

   a. Where noted anchor vertical members to encountered floor surface using welded-on steel plate floor flanges and two (2) expansion bolts with internal edge inserts. Use lock washers. Installed work shall be rigid, plumb and secure at proper locations.

   b. For side anchorages to wood use stainless steel screw bolts.

4. Nonwelded connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic filler cement colored to match finish of handrails and railing systems.

5. Welded connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact or use fittings designed for this purpose.

6. Expansion joints: provide expansion joints at locations indicated or, if not indicated, at intervals not to exceed 12 m. Provide slip-joint internal sleeve extending 50 mm beyond joint on either side; fasten internal sleeve securely to one side, locate joint within 150 mm of post.

G. Installation Tolerances

1. Set posts plumb within a tolerance of 6 mm in 3.6 m.

2. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 6 mm in 3.6 m.

H. For handrails and railing systems that are exposed to exterior or to moisture from condensation or other sources, provide weepholes or other means for evacuation of entrapped water in hollow sections of railing members.

I. The installed work shall be accurately installed, properly spaced out, between runs. Vertical members shall be plum, surfaces shall be uniform without dents, gouges, bends or distortions. Finished work shall be strong, rigid and secure, neat in appearance and free from defects.

IX. ADJUSTING AND CLEANING

A. Protect installed work using adequate and suitable means during and after installation until accepted.

B. Repair, remove and/or replace surfaces and materials which become marred, scratched, bent or damaged in any way.

C. Touch-up painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

METHOD OF MEASUREMENT

The quantity paid for under this item shall be the number of linear meters of handrailing, measured along the top of the railing from center of end post to center of end post, furnished and installed in accordance with the contract plans, specifications and/or as ordered by the Engineer.

BASIS OF PAYMENT

The unit price bid per linear meter shall include the cost of all labor, materials and equipment necessary to complete the work including design, delivery and storage, preparation of shop drawings and mock ups.