CHAPTER 1—GENERAL PROVISIONS

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1.1—GENERAL CRITERIA

The following shall supplement *A1.1*.

This chapter contains information and criteria related to the design of movable bridges. It sets forth the basic Louisiana Department of Transportation and Development (LADOTD) design criteria that are exceptions and/or additions to those specified in the latest edition of the *AASHTO LRFD Movable Highway Bridge Design Specifications* including all interim revisions.

Construction specifications shall be the latest edition of the *Louisiana Standard Specifications for Roads and Bridges (Standard Specifications)*. The *Standard Specifications* are subject to amendment whenever necessary by supplemental specifications and special provisions to specific contracts. In the absence of specific information in the *Standard Specifications*, follow the latest edition of the *AASHTO LRFD Bridge Construction Specifications*.

Bridges vulnerable to coastal storms shall be designed with the provisions in these Specifications herein, those given in *Part II, Volume 1 of the LADOTD Bridge Design and Evaluation Manual (BDEM)*, and those given in AASHTO *Guide Specifications for Bridges Vulnerable to Coastal Storms*. Refer to *LADOTD BDEM, Part II, Volume 1, D1.1* for the procedures to identify bridges vulnerable to coastal storms.

Refer to *LADOTD Hydraulic Manual* for the minimum freeboard requirements of structural components. For vertical lift bridges with main girders perpendicular to the travel direction, the main girders shall satisfy the minimum freeboard requirement. Finished grade for machinery shall be 1 ft. above high/high water elevation. High/High water elevations shall be obtained from the LADOTD Hydraulic Section. Final elevations used for structural components and machinery shall receive approval from the LADOTD.

The Designer shall advise the LADOTD of the optimal position, i.e. open or closed, of the bridge during major storms. This information shall be included in the Operations and Maintenance (O&M) Manual. Refer to *LADOTD Hurricane Bridge Plan*, *LADOTD Procedure for Closing Movable Bridges*, and *LADOTD Procedure for*

Re-Opening Movable Bridges Following a Natural Disaster for the emergency policy in the event of a storm.

1.2—ABBREVIATIONS, DEFINITIONS, AND COMPONENT CLASSIFICATIONS

The following shall replace the definition of concrete in *A1.2:*

Concrete—Concrete or mortar used in the structure; counterweights, including concrete balance blocks; concrete in pockets of column bases, and similar places.

The following shall supplement *A1.2*.

AASHTO SCOBS—AASHTO Subcommittee on Bridges and Structures.

Bridge Design Electrical Unit—The group of electrical engineers who work in the LADOTD Bridge Design Section and specialize in the design and plan preparation of movable bridge power and control systems.

Bridge Design Mechanical Unit—The group of mechanical engineers who work in the LADOTD Bridge Design Section and specialize in the design and plan preparation of movable bridge machinery.

High/High Water Elevation—Design elevation equal to 1 ft. above 100-year storm surge elevation.

Movable Barrier—A physical barrier, i.e. resistance gate.

Operating System—Mechanical, electrical, and hydraulic components necessary to operate the bridge.

Pontoon Bridge—Bridge type which is supported by pontoons and rotates about a vertical axis.

Removable Span—A bridge span that may be removed in order to allow passage of vessels.

Span Heavy—The condition that occurs when the span is heavier than the counterweight.

Span Light—The condition that occurs when the span is lighter than the counterweight.

Span Neutral—The condition that occurs when the span is the same weight as the counterweight.

Traffic Gate—A warning gate.

1.3—DESIGN PHILOSOPHY

1.3.3—Factors for Ductility, Redundancy, and Operation

The following shall replace the 1st, 2nd, and 3rd bullet items of *A1.3.3*.

- For all movable bridges, the importance factor η_I shall be 1.05.
- For all movable bridges, the redundancy factor, $\eta_{r,}$ shall be 1.05.
- For all movable bridges, the ductility factor, $\eta_{d,}$ shall be 1.0 where detailing conforms to the requirements of *AASHTO LRFD Bridge Design Specifications*, and *AASHTO LRFD Movable Highway Bridge Design Specifications.*

The following shall replace the last sentence of *A1.3.3*.

In the case of the operating system, η_I, η_r, and η_d shall be taken as 1.0.

1.4—DESIGN OF BRIDGE SYSTEMS

1.4.2—Machinery Design

C1.4.2

The following shall supplement *A1.4.2*.

Mechanical systems and components for movable bridges shall utilize basic machinery (open-rack and pinion-gear drives, speed reducers, basic hydraulic systems) to drive and lock the span.

Mechanical equipment that is of such complication that it cannot be maintained by the LADOTD's maintenance personnel shall not be used unless approved by the Bridge Design Engineer Administrator.

1.4.4—Safety Design

1.4.4.1—General

The following shall replace the 1st sentence of *A1.4.4.1*.

Warning signs, hazard identification beacons, traffic signals, gates and barriers, and other safety devices shall be provided for the protection of pedestrian and vehicular traffic.

The following shall supplement *A1.4.4.1*.

Signal bells and gongs shall not be incorporated into the design of traffic gates and barriers.

1.4.4.2—Clearances

C1.4.4.2

The following shall supplement *A1.4.4.2*.

Clearance gauges shall be provided as required by the U.S. Coast Guard. Details of the gauges shall be incorporated in the design drawings.

Refer to *Coast Guard Regulation 33 CFR 118.160* for clearance gauge requirements.

1.4.4.3—Protection from Waterway Traffic

The following shall supplement *A1.4.4.3*.

Refer to *AASHTO LRFD Bridge Design Specifications, A2.3.2.2.5 and A3.14.15*, and *LADOTD BDEM, Part II, Volume 1, D2.3.2.2.5* for more information.

For navigational channels with barge or ship traffic, the piers shall be protected using dikes, dolphins, guide fenders, or by designing the piers to withstand vessel collision. For navigational channels without barge traffic, pier protection requirements shall be determined by the Bridge Design Engineer Administrator on a case-by-case basis. At a minimum, guide fenders shall be used.

1.4.4.4—Traffic Gates and Barriers

C1.4.4.4

The following shall replace the 5th sentence of the 1st paragraph of *A1.4.4.4*.

Red signal lights shall be mounted on the gates (both over and under the gate arms) and interconnected to operate with the traffic signals and any time the gates are less than fully opened.

The following shall replace the 1st sentence of the last paragraph of *A1.4.4.4.*

Momentary switches without seal-in contacts may be provided to permit the gate closure to stop upon release of the operating switch.

The following shall supplement *A1.4.4.4.*

The Designer shall consult the Bridge Design Engineer Administrator for the current design

This is a difficult design issue on which the AASHTO SCOBS T-8 committee is still working

policy governing the perpendicular design load of the movable barrier.

at this time. After a state survey was conducted, it was found that many states have different policies. It has been recommended by the LADOTD Bridge Design Section to follow the current code until this issue has been resolved.

1.4.4.6—Warning Lights, Alarms, and Traffic Signals

1.4.4.6.1—Traffic Signals and Bells

Delete the 2nd sentence of the 1st paragraph of *A1.4.4.6.1*.

Delete the 2nd paragraph of *A1.4.4.6.1*.

1.4.4.6.2—Audible Navigation Signals, Navigation Lights, Aviation Lights

The following shall replace the 2nd paragraph of *A1.4.4.6.2*.

All navigation and other light units on the movable span and on fenders shall be capable of withstanding shocks and rough treatment, and shall be fully sealed and rain-tight.

1.4.4.7—Stairways and Walkways

C1.4.4.7

The following shall replace the 4th sentence of *A1.4.4.7*.

For vertical lift bridges, all of the lifting equipment shall be installed at the platform on top of the towers and safe access to the platform shall be provided.

It is not necessary to access any intermediate position of the lifting span for service.

1.5—BALANCE AND COUNTERWEIGHTS

1.5.1—General

C1.5.1

The following shall supplement *A1.5.1*.

For vertical lift bridges, it is preferred for the span to be "span heavy" in the down position and "span neutral" in the up position. This condition normally occurs for spans that lift less than 80 ft. and have no balance chains. For spans that lift more than 80 ft., balance chains may be required, on a case-by-case basis, to prevent the span from becoming "span light" in the up position.

The following shall supplement *AC1.5.1*.

Experience has shown that for large vertical lift bridges, more than 2,700 lb. of downward vertical reaction per corner is required to get the span to seat reliably.

For bascule span bridges, it is preferred for the span to be "span heavy" in the down position and "span neutral" in the up position. This requires careful design of the counterweight and the counterweight block compartments; such that the center of gravity of the bascule span may be adjusted to the proper location on the channel side of the pivot point after construction of the span is complete.

For vertical lift bridges, assume a downward reaction per corner of 0.5 percent of the total span weight.

1.5.2—Counterweight Details

C1.5.2

Delete the 2nd sentence of the last paragraph of *A1.5.2*.

The following shall supplement *A1.5.2*.

Counterweight pockets shall be properly drained beyond the roadway and walkway.

Covers over counterweights are not preferred due to maintenance and access issues.

Counterweight block details shall be as shown in Appendix–Counterweight Balance Block Example Design at the end of this Chapter.

1.5.3—Counterweight Concrete

C1.5.3

The following shall replace the 3rd sentence of the 1st paragraph of *A1.5.3*.

The maximum weight of heavy concrete shall be 180 pcf.

Experience has shown that it is difficult to develop a heavy concrete mix with a unit weight greater than 180 pcf that remains homogeneous when poured.

1.5.4—Counterweight Pits and Pit Pumps

The following shall replace *A1.5.4*.

For bascule spans, the counterweight pits shall be located above the design high water level and shall be gravity drained.

1.6—MACHINERY AND OPERATOR'S HOUSES

The following shall supplement *A1.6.*

Before beginning the design and layout of the operator's house, the Consultant shall request,

from Bridge Design Mechanical Unit, a set of preferred operator's house plans.

These plans will provide the latest general design and sheet layout which the LADOTD requires for all movable bridges. These requested plans should contain the type of construction and all of the necessary specifications and details that meet the requirements of the LADOTD, including all of the necessary building, HVAC, and plumbing codes.

The operator's house shall be located to ensure accessibility after a storm event.

Movable bridges opened on an "on-call basis" may not be required to have an operator's house. Under this condition, the bridge shall use a lockable control station. The location and construction of the control station shall be approved by the Bridge Design Engineer Administrator.

All paint colors, interior furniture, fixtures, cabinets ceiling type and other features shall be provided to the Consultant by the LADOTD Bridge Design Section.

Wind load and storm surge shall be included in the design by using the current International Building Code (IBC) and hydraulic data for that region. The design criteria shall be submitted to the Bridge Design Engineer Administrator for approval before the Consultant proceeds with the design work.

1.6.1—Machinery House

C1.6.1

The following shall supplement *A1.6.1*.

The operator's house and machinery house shall be combined into a single, two-story building, with the exception of the machinery house, which encloses the tower drive machinery of a vertical lift bridge or the span drive machinery of a rolling lift bascule bridge. The top floor shall serve as the operator's house and shall contain the control desk, a bathroom, an air-conditioning unit, a desk, and a kitchenette. All windows shall be storefront with tempered and laminated glass designed for wind loads and missile impacts in accordance with the IBC. The bottom floor shall serve as the machinery house and shall contain an electrical switchboard, an air compressor for the air horn, a standby generator with an automatic transfer switch (if required), and miscellaneous electrical panels.

In some cases, where a minimal operator's house is used, it is acceptable to have a free-standing machinery house used to house the standby generator, tools and spare parts.

If the generator louver dampers are to be motorized, the Architectural Design drawings shall provide a damper motor with at least one single-pole double-throw (SPDT) switch which is activated when the louvers are fully open. This damper motor information is located in *D8.3.9.3*.

When using generators, the machinery room must be properly ventilated. It is preferred to use motor-driven dampers which open when the generator is running and close when the generator is off. This allows the generator room to maintain climate control for the switchboard.

The bottom floor shall also have a back porch that contains the A/C condensing unit and the sewage treatment plant (if required). The elevation of the bottom floor shall be located above the high/high water level. In the case where the operator's house is located adjacent to a levee, the bottom floor of the operator's house shall be located above the top of the levee.

High/High water level is a design elevation equal to 1 ft. above the 100-year storm surge elevation.

1.7—SPECIAL REQUIREMENTS FOR CONTRACTOR-SUPPLIED INFORMATION & EQUIPMENT

1.7.1—Drawings and Diagrams

1.7.1.1—Drawings

The following shall supplement *A1.7.1.1*.

The Contractor is required to check physical requirements and the electrical circuit requirements of electrical equipment.

Refer to the most current edition of *Louisiana*

Standard Specifications for Roads and Bridges for information on shop drawings.

1.7.1.2—Wiring Diagrams, Operator Instructions, Electrical and Mechanical Data Booklets, and Lubrication Charts

The following shall supplement *A1.7.1.2.*

The Designer shall provide movable bridge operating instructions in the contract documents.

See Appendices "Bridge Operation Manual" and "Electrical Operation and Maintenance Manual" at the end of this Chapter.

1.7.2—Tools, Maintenance, and Training

C1.7.2

The following shall supplement *AC1.7.2.*

Successful completion is defined by completion of a project upon written approval from LADOTD.

The following shall supplement *A1.7.2.*

After successful completion of O&M Manual, the Contractor shall be required to provide on-site training.

1.8—DEFECTS AND WARRANTIES

The following shall supplement *A1.8.*

Refer to the latest edition of the *Louisiana Standard Specifications for Roads and Bridges* for Contractor guarantee requirements.

1.9—ACCESS FOR MAINTENANCE

The following shall supplement *A1.9.*

Maintenance access shall comply with OSHA regulations and the NEC.

REFERENCES

AASHTO Guide Specifications for Bridges Vulnerable to Coastal Storms, Latest Edition, American Association of State Highway and Transportation Officials, Washington D.C.

AASHTO LRFD Bridge Construction Specifications, Latest Edition, American Association of State Highway and Transportation Officials, Washington D.C.

AASHTO LRFD Bridge Design Specifications, Latest Edition, American Association of State Highway and Transportation Officials, Washington D.C.

AASHTO LRFD Movable Highway Bridge Design Specifications, Latest Edition, American Association of State Highway and Transportation Officials, Washington D.C.

AASHTO Standard Specifications for Movable Highway Bridges, 5th Edition, MHB 5, American Association of State Highway and Transportation Officials, Washington D.C., 1988.

Code of Federal Regulations-Title 33, Latest Edition, US Government Printing Office

LADOTD Hurricane Bridge Plan, LADOTD Bridge Design Section, State of Louisiana Department of Transportation and Development, Baton Rouge, LA

LADOTD Hydraulics Manual, Latest Edition, State of Louisiana Department of Transportation and Development, Baton Rouge, LA

LADOTD Procedure for Closing Movable Bridges, LADOTD Bridge Design Section, State of Louisiana Department of Transportation and Development, Baton Rouge, LA

LADOTD Procedure for Re-Opening Movable Bridges Following a Natural Disaster, LADOTD Bridge Design Section, State of Louisiana Department of Transportation and Development, Baton Rouge, LA

Louisiana Standard Specifications for Roads and Bridges, Latest Edition, State of Louisiana Department of Transportation and Development, Baton Rouge, LA

Applicable Codes and Standards:

IBC—International Building Code

NEC—National Electric Code

OHSA—Occupational Safety and Health Standards

APPENDIX—Bridge Operation and Maintenance Manual

The following shall supplement the 2nd sentence of *A1.7.1.2*.

The format of the movable bridge operation and maintenance manual shall be as described in the latest edition of the *Louisiana Standard Specifications for Roads and Bridges.*

The Operation and Maintenance Manuals (booklets) for a movable bridge mechanical system shall contain the following at a minimum:

Mechanical Operation and Maintenance Manual

- **Title Sheet**
- **Front Matter**
  - Table of Contents
  - List of Figures, Illustrations
  - Safety Precautions
- **Parts Lists**
  - Approved Catalogue Cut Sheets
  - Approved Shop Drawings/As-Built Drawings
  - Machinery Paint System
  - Copies of all Commercially Manufactured Equipment Warranties
- **List of Special Tools**
- **Warning Notes**
- **Warranties**
- **Contract Plans**
  - Including all original mechanical contract plan sheets and change order sheets.
- **As Built Drawings**
  - Containing all As-Built Drawings which have been signed and dated by the Project Engineer

Bridge Operation Manual

- **Title Sheet**
- **Front Matter**
  - Table of Contents
  - List of Figures, Illustrations
  - Safety Precautions
- **Theory of Operation**
  - Illustrations and Diagrams
- **Installation and Maintenance Instructions**

A. Pre-Setup Adjustments
   1. Span Brakes
   2. Plugging Switches
   3. Limit Switches
   4. Span Air Buffers

5. Span Balance

B. Setup Procedure

1. Balancing Span and Counterweights
2. Span Brake Torque Calibration/Test
3. Seating Force/Span Air Buffer Adjustment
4. Span Brake Settings
5. Span Fully Raised Limit Switch Adjustment
6. Span Nearly Lowered Limit Switch Adjustment
7. Span Nearly Seated Limit Switch Adjustment

- **Span Operation Under Normal Conditions**
- **Span Operation Under all Possible Fault Conditions**
- **Troubleshooting Guide**

APPENDIX—Electrical Operation and Maintenance Manual

Operation and Maintenance Manuals for a movable bridge electrical system.

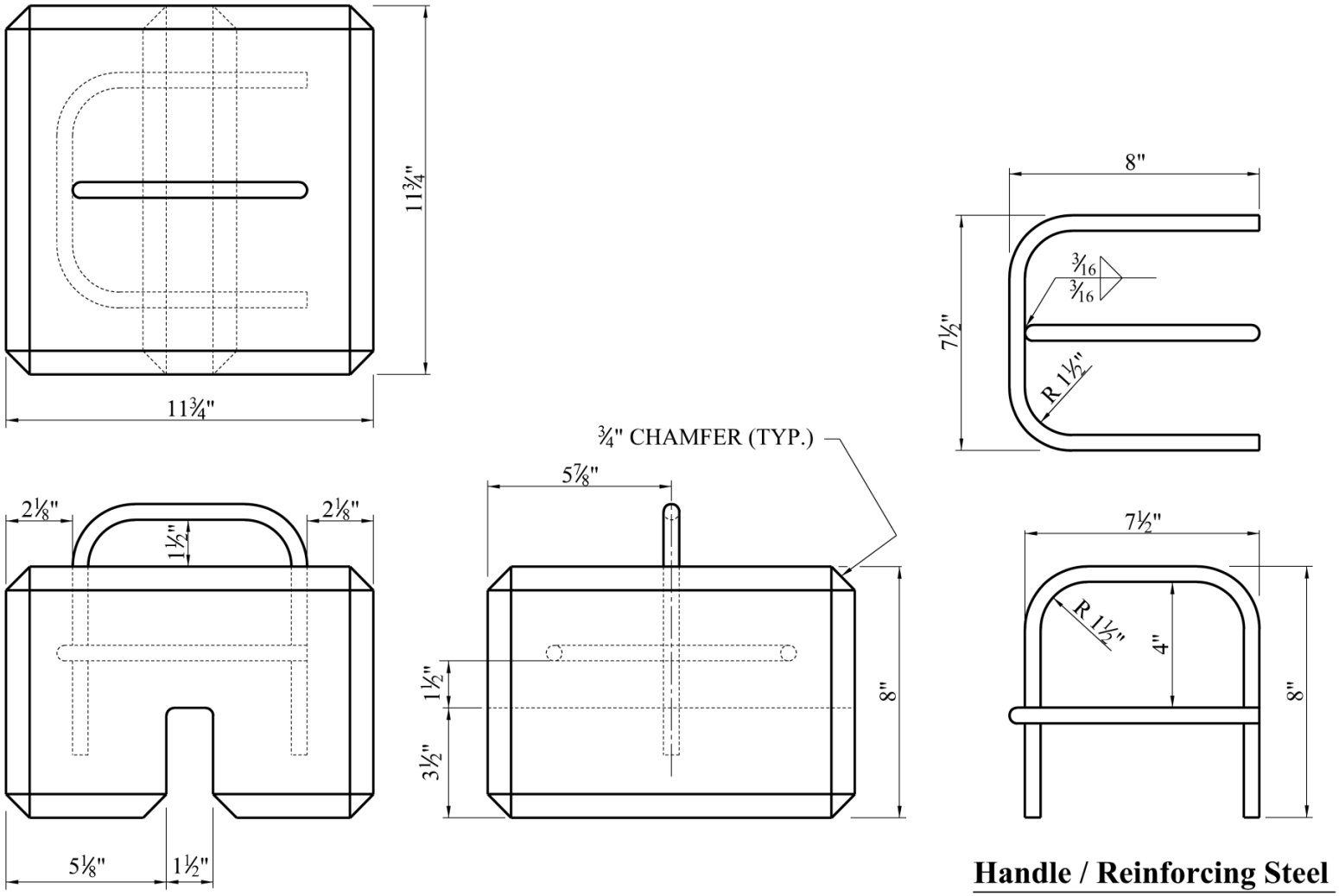
The general format for a typical swing span is as follows:

- **Front Matter**
  - Table of Contents
  - List of Figures, Illustrations
  - Safety Precautions
- **Theory of Operation**
  - Illustrations and Diagrams
  - Control Circuit Operation
    - Traffic Signal Controls
    - Traffic Gate Circuit
    - Traffic Barrier Circuit
    - Safety Interlock Relay
    - Electric Motors
    - Span Control System
    - Span Adjustments
- **Operational Features**
  - Operating Bridge from Remote Station
  - Disabling the Control Circuit from the Remote Station
  - Operating the Navigational Horn Without Electrical Power
  - Stopping the Bridge in an Emergency
  - Stopping the Bridge Before Fully Open
  - What to Do When the Span Stops Short of Fully Closed
  - Controlling the Lights
  - Low Oil Warning Light (for Hydraulically Operated Bridges)
- **Using the Bypass Switches**
  - Bypass Signal Interlock to Gate Control (A)
  - Bypass Span Locks/Lifts Limit Switches to Gate Control (B)
  - Bypass Barrier Limit Switches to Gate Control (C)
  - Bypass Gate Limit Switches to Barrier Control (D)
  - Bypass Signal Interlock to SI Control (E)
  - Bypass Barrier Limit Switches to Lifts/Locks (F)
  - Bypass Span Fully Closed Limit Switch to Lift/Lock Control (G)
  - Bypass Pump Neutral Limit Switch to Span Pump Control (H)
  - Bypass Lift(s) Limit Switches to Span Pump Control (I)
  - Bypass Span Limit Switches to Span Pump Control (J)
  - Disable Automatic Neutral Control (K)
  - Spare (L)

- **One Year Warranty From Contractor**
- **Parts Lists**
  - 100 Items
    - Index
    - Catalogue Cut Sheets
    - Approved Drawings
  - 200 Items
    - Index
    - Catalogue Cut Sheets
    - Approved Drawings
  - 300 Items
    - Index
    - Catalogue Cut Sheets
    - Approved Drawings
  - Full Set of Electrical As-Built Drawings
- **List of Special Tools**
- **Warning Notes**
- **Megger Readings**
- **Electric Motor Test Results (If Required)**

See *D8.1.1* for more information on Electrical Operation and Maintenance Manuals.

APPENDIX—Counterweight Balance Block Example Design



Balance Block Detail

CONCRETE DENSITY RANGE: 140 - 147 LBS. PER CU. FT.
WEIGHT RANGE: 83 - 87 LBS.

Handle / Reinforcing Steel

#4 DEFORMED REINFORCING STEEL
(STAINLESS STEEL)
ASTM A955, TYPE 316LN