

285 Toll Gantries

285.1 Gantry Types

Non-accessible gantries – See **GTR 251.4**.

The two types of non-accessible gantries are:

- Non-accessible cantilever – See **GTR 251.5**.
 - Non-accessible cantilever gantries may be installed at ramp toll sites and express lane toll sites, only where the design satisfies the span limitations identified in **GTR 250.2**, **GTR 251** and **GTR 253**, and cable distances identified in **GTR 234** can be met.
- Non-accessible span – See **GTR 251.6**.
 - Non-accessible span gantries may be installed at ramp toll sites, and express lane toll sites.

See **Exhibit 250.1-1** to identify the various elements of a non-accessible gantry.

Accessible gantries (span only) – See **GTR 251.7**.

A detailed investigation is required for the selection of the gantry type. Mainline toll gantries are assumed to be accessible gantries. A study must include justification that shall be documented in the Toll Siting Technical Memorandum (TSTM), to determine when a mainline toll site will be a non-accessible gantry. Investigation considerations should include but are not limited to existing and proposed site conditions, manufacturing limitations, maintainability, site safety, and project costs. The gantry type shall be determined during the PD&E phase in accordance with **GTR 202.2**.

The accessible gantry provides a deck (walkway) to install and maintain equipment over live traffic and allows for secured access to the deck via an elevated platform and connecting stairway accessible by maintenance vehicles such as scissor lift or bucket truck. See **Exhibit 250.1-2**, **Exhibit 250.1-3**, **Exhibit 250.1-4**, **Exhibit 250.1-5**, **Exhibit 250.1-6**, **Exhibit 250.1-7**, and **Exhibit 250.1-8** to identify the various elements of an accessible gantry.

Exhibit 285-1: Non-Accessible Gantry Elements

Exhibit 285-2: Accessible Gantry Elements

Exhibit 285-3: Accessible Gantry Swing Gate and Grating

Exhibit 285-4: Accessible Gantry Stair Platform Landing

Exhibit 285-5: Accessible Gantry J-Arm Retraction Assembly

Exhibit 285-6: Accessible Gantry Gear Box and Mounting

Exhibit 285-7: Accessible Gantry Access Stair Structure

Exhibit 285-8: Accessible Gantry Swing Gate Post

285.1.1 Gantry Design Criteria based on Toll Equipment Requirements

See **GTR 220.2** for gantry positioning requirements.

The tolling equipment positioning depends on the TEC and the roadway configuration at the gantry. See **Exhibit 250.2-1** and **Exhibit 250.2-2** for toll equipment layout and positioning over the lanes for each gantry type. See **Exhibit 250.2-3** for equipment loading.

All lanes and shoulders within the toll loop pavement area must receive toll equipment as identified in **Exhibit 250.2-1** and **Exhibit 250.2-2**.

The gantry must be designed to accommodate the TEC requirements for the following roadway configurations:

- Each interim condition
- The ultimate condition
- Each potential MOT phase required to transition from the interim to the ultimate condition

A single gantry structure design must allow the J-arms to be installed laterally along the gantry to accommodate all vendor equipment layouts for all interim and ultimate configurations.

Gantry design must take into account layout for the following:

- Horizontal and vertical supports
- Raceways and wiring
- Toll equipment clearances
- J-arm adjustments
- Equipment positioning, and separation
- Line-of-sight of illuminators, auditing cameras, Violation Enforcement System (VES) cameras, and lasers/sensors
- AVI Readers and their enclosures/cabinets
- All associated equipment mounting hardware

Cantilever Gantry must extend a minimum one foot beyond:

- Express Lane Sites: the centerline of the adjacent GUL
- All other Sites: the centerline of the far shoulder

Exhibit 285-9: TransCore Gantry Toll Equipment Layout

Exhibit 285-10: Conduent Gantry Toll Equipment Layout

Exhibit 285-11: Toll Equipment Loads

285.1.1.1 J-arm Positioning on Gantry

The approach and departure J-arm centerlines must be equidistant from the gantry centerline as per the following:

- Non-accessible gantry – 5 feet, 9 inches
- Accessible gantry – 5 feet, 9½ inches

285.1.1.2 Vertical Clearance

The following vertical clearances must be provided within the toll loop pavement area, for all interim and ultimate conditions:

- Eighteen feet, six inches (18'-6") to the bottom of the J-arm for all gantry-mounted toll equipment devices except the vehicle detection and classification system (VDAC) laser unit. The VDAC laser unit system must be twenty-four feet, six inches (24'-6") to the top of the J-arm. This clearance is the distance above the traffic lane or shoulder directly below.
- A minimum of 18 feet for any gantry structural element. This clearance is the least distance between the lowest point of any structural element (gantry or support framing) and the traffic lane or shoulder directly below.

Use the APE to set the truss elevation to ensure that the J-arm adjustability above the roadway surface as defined in **GTR 252.1.2** is not exceeded along the cross slope of the toll loop pavement area. See **GTR 220.2** for additional information.

- The truss elevation must be a constant across each gantry span.
- For a single span across both directions of travel, a single APE must be calculated using both directions of travel.
- The APE is applied separately to each direction of travel for non-accessible span gantries, when a center column is used.
- A single APE must be calculated using both directions of travel, for accessible gantries, when a center column is used and the truss elevation must be constant across both gantry spans.

285.1.1.3 Toll Equipment Operation and Maintenance

The toll equipment operation and maintenance must not be compromised by any mounting hardware or gantry element.

Non-accessible gantry elements must allow the J-arms to be located anywhere along the horizontal support pipes.

Non-accessible gantry W-section member spacing must be as follows:

- Equipment layout conflicts: Avoid physical conflicts with Toll Equipment layout for all vendors.
- Multiple equipped lanes at span gantries: $\frac{1}{2}$ the width of the equipped lane. When equipped lane and shoulder widths under the gantry are not identical, the width of the majority of the equipped lanes and shoulders must be used.
- Single lane ramps: Gantry W-section member spacing must be 6 feet.
- Truss web angle connection plates: W-section members must not be located in the same longitudinal position with truss web angle connection plates.
- W-section members closest to the upright may deviate from the spacing described in (b) and (c) above to ensure there are no conflicts per (a) and (d) above.
- W-section members are required where needed to support all longitudinal cable trays along the gantry over equipped and non-equipped lanes.

Accessible gantry swing gate post spacing must be:

- Evenly spaced except as noted in item (c) below.
- No greater than 6 feet from centerline of post to centerline of post.
- Adjusted as necessary to avoid equipment conflicts.

There must be a 5/8-inch minimum vertical clearance between any gantry element and any gantry-mounted toll equipment in both operation and maintenance positions. See exhibits from **GTR 254.2** for toll equipment operation and maintenance positions at an accessible gantry.

Field splices must be located to avoid conflicts for all interim and ultimate conditions as follows:

- Non-accessible gantry W-section member layout
- Accessible gantry equipment retraction assembly inclusive of gate posts, gear box layout, etc.

See **GTR 254.3 (3)** for additional layout requirements for accessible gantries.

285.2 Toll Gantry Structural

285.2.1 General Structural Requirements

Gantries must be treated as sign structures when applying the requirements of the current [Standard Plans](#).

Gantries must be designed as per LRFD LTS-1 and applicable interims, and [Structures Manual, Volume 3](#) for the 700-year Extreme Event Limit State wind speed based on location.

Gantries must be designed as per LRFD LTS-1 and applicable interims, and [Structures Manual, Volume 3](#) fatigue requirements.

See exhibits from **GTR 250.2** for the toll equipment type, position, and wind areas for all TEC systems. See **GTR 250.2.3** for additional requirements.

Tolling Equipment Dead Load:

- Gantries must be designed to carry all attached items (toll equipment, toll equipment structure mounting hardware, retraction assemblies, raceways, strut channel supports, etc.):
 - The design dead load of the tolling equipment mounted on each toll equipment arm must be at least 55 pounds or the actual weight of the equipment, whichever is greater. The 55-pound allowance does not include the weight of the toll equipment support arm, J-arm, and latch mechanism or retraction assemblies.
 - Gantries must support a minimum uniform superimposed dead load of 200 pounds per linear foot across the entire structure, divided as appropriate among the superstructure chords, to account for the self-weight of the raceways, and other associated electrical items.

The horizontal truss element for each span of a two-span gantry must be designed as simply supported independent spans.

Gantry foundations must use steel reinforcing.

Signs of any type must not be attached to the gantry.

Gantries must be detailed as per the [Structures Manual](#).

All gantries must be hot-dipped galvanized. No other coatings (paint, etc.) can be applied unless approved by the District Materials Office. Written documentation (email or meeting notes documentation) of concurrence from the District Materials Office is acceptable.

Toll gantries must be designed to meet the following fabrication restrictions:

- If field welding is permitted by the CEI in accordance with the [Standard Specifications](#), the welding procedures shall be reviewed and approved by Turnpike Materials Office.
- Shop welded splices of main chords are not permitted.
- Shop welded splices of uprights are not permitted except as allowed in [Standard Plans Index 700-041](#). If splices are required, they must be detailed in the structural plans for the gantry subcomponent.

285.2.2 Gantry Superstructure

Gantries must have a multi-chord truss superstructure system for the horizontal element. The gantry truss must be horizontal and level (not parallel to the cross slope of the roadway).

The natural frequency of any element that supports the equipment must be less than 500 Hz. Equipment is defined as any electronic device that is mounted to the gantry.

Movements due to wind loads must meet the following criteria for the averaged effect on the top and bottom truss chords:

- Span gantries subject to wind speed of 30 mph:
 - Movement of any point along the chords must not exceed 1.25 inches relative to the position of any other point along the chords.
 - Rotational orientation of any point along the chords must not exceed 8 milliradians (0.47 degrees) relative to the rotational orientation of that point at rest, for all three rotational axes.
- Cantilever gantries subject to wind speeds between 25 and 45 mph:
 - Movement of any point along the chords must not exceed 2.2 inches relative to the position of any other point along the chords.
 - Rotational orientation of any point along the chords must not exceed 14 milliradians (0.80 degrees) relative to the rotational orientation of that point at rest, for all three rotational axes.

All structural elements supporting gantry-mounted electronic devices must:

- Meet all rigidity/frequency requirements indicated above for the gantry.
- Attach to the gantry with a redundant connection system.

285.2.3 Minimum Material Requirements

Include protection against galvanic corrosion when dissimilar materials are used. Dissimilar metals must be separated by inert dielectric material.

285.2.3.1 Steel

Upright and Truss Chords (Steel Pipe): API 5L X42 PSL2, 42 ksi yield or ASTM A500, Grade B (Min.).

Steel Angles, Structural Plates and Bars: ASTM A709 grade 36 or 50 (as required by design).

Bolts, Nuts, and Washers:

- High Strength Bolts: ASTM F3125, Grade A325 Type 1
- Nuts: ASTM A563 Grade DH Heavy-Hex Nuts
- Washers: ASTM F436 Type 1, one under turned element.

Anchor Bolts, Nuts, and Washers:

- Anchor Bolts: ASTM F1554, Grade 55
- Nuts: ASTM A563 Grade DH heavy-hex, 5 per bolt
- Plate Washers: ASTM F436, Type 1, 2 per bolt.

U-Bolt Assemblies:

- U-Bolts: ASTM A193
- Nuts: ASTM A194, 4 per bolt
- Washers: ASTM F436, Type 1, 2 per bolt

Galvanization: Components must meet the requirements of [Standard Specifications Section 962-11](#).

285.2.3.2 Aluminum

Components must meet the requirements of [Standard Specifications Section 965](#).

Bars, Plates, Stiffeners, Backing Ring, Shims, Shapes must be Alloy 6061-T6.

285.2.3.3 Stainless Steel

Plates: Type 304L per ASTM A240

Structural Shapes and U-bolt Assemblies: Type 316L per ASTM A276

Stainless Steel Screws, Bolts, Washers and Nuts: Grade 18-8, unless otherwise noted.

285.2.4 Non-Accessible Gantries

Non-accessible gantries must be a tri-chord truss as shown in [Exhibit 251.4-1](#).

A channel assembly must be used to support the vertical conduit routing along the upright for gantry power, data, and AVI cables. See [Exhibit 251.4-2](#) and [Exhibit 251.4-3](#).

Bent plates must be used to connect the vertical and horizontal W-Section members as shown in [Exhibit 251.5-2](#).

Exhibit 285-12: Non-Accessible Gantry Typical Section

Exhibit 285-13: Cantilever Plan and Upright Structural Details for Conduit Support

Exhibit 285-14: Span Upright Structural Details for Conduit Support

285.2.5 Non-Accessible Cantilever Gantry Structural Requirements

Structural configuration of cantilever gantries must be based on the [Standard Plans Index 700-040](#), Cantilever Sign Structure, except for the offsets between the centerline of upright and centerline of truss chords and the location of the back chord gusset plates closest to the upright as shown in [Exhibit 251.4-1](#) and [Exhibit 251.4-2](#). These modifications provide space for longitudinal cable trays as described in **GTR 255.5.2**, and ensure there is no conflict between the upright and web members.

Cantilever gantries must have three (3) truss chords with a single upright in a cantilever configuration.

Cantilever truss span lengths must be 30, 36, 42, or 48 feet.

Toll equipment layout and horizontal support pipe requirements may control the cantilever span length by increasing to the next allowable span length. See **GTR 250.2** and **GTR 253** and item (3) above.

When a chord splice is required and permitted by the [Standard Plans](#), an alternate splice connection detail (bolted flange connection), similar to the connection shown [Standard Plans Index 700-041](#), Span Sign Structure must be provided. No other type of splice connections for the truss chords are permitted.

The gantry must be designed for one future sign panel, 12 feet wide by 10 feet high, centered over the combined travel lanes. Other future signs (as defined in **Volume 3** of the [Structures Manual](#),) need not be considered. The gantry design must always account for the toll equipment simultaneously with load cases with and without the future sign panel to produce the worst-case loading effect.

Toll equipment support elements including but not limited to horizontal support pipe, J-arms and mounting hardware must not extend beyond the end of the longest truss chord.

The upright must be filled with concrete for the full height. Upright handholes are not required.

Provide an angle along the upright to mitigate the effects of vortex shedding as shown in [Exhibit 251.5-3](#).

Use [Exhibit 251.5-1](#) to confirm compliance with strength and fatigue requirements for the site-specific cantilever gantry conditions. If compliance cannot be demonstrated, then a non-accessible span gantry is required.

The structural element requirements noted below provide compliance with vibration, rotation, natural frequency and other dynamic effects. Use [Exhibit 251.5-1](#) and [Exhibit 251.4-2](#) for the structural element requirements as follows:

- The upright height (A) is a site-specific dimension, not to exceed 24 feet.
- The remaining element sizes and dimensions must not be changed and must be as shown in the Table of Variables in [Exhibit 251.5-1](#) and [Exhibit 251.4-2](#).
- Calculate the back rake (G) for the site-specific conditions.

Exhibit 285-15: Table of Structure Variables

Exhibit 285-16: Non Accessible Gantry Bent Plate Detail

Exhibit 285-17: Cantilever Median Upright Structural Details for Conduit Support

285.2.6 Non-Accessible Span Gantry Structural Requirements

Structural configuration of non-accessible span gantries must be based on the [Standard Plans, Index 700-041](#), Span Sign Structure.

When a chord splice is required, and permitted by the [Standard Plans](#), an alternate splice connection detail (bolted flange connection), as shown in [Standard Plans, Index 700-041](#), must be provided. No other type of splice connections for the truss chords are permitted.

Truss depth must meet the span-to-depth requirements for DMS structures as specified in the [Structures Manual, Volume 3](#).

Maximum span length and truss depth must be as specified for sign structures in the **FDM 261.1**.

The gantry must be designed for one future sign, 12 feet wide by 10 feet high, centered over the combined travel lanes in each direction of travel. Other future signs (as defined in the [Structures Manual, Volume 3](#)) need not be considered. The gantry design must always account for the toll equipment simultaneously with load cases with and without the future sign panel to produce the worst-case loading effect.

Gantry panel layout must be adjusted to accommodate W-section member spacing as described in **GTR 250.2.3(3)(b)**.

285.2.7 Accessible Span Gantry Structural Requirements

The accessible gantry is a trapezoidal quad-chord truss supported on two (2) uprights as a span configuration. See [Exhibit 251.7-1](#).

The site-specific structural items that can be changed include: foundation size, length and reinforcement, upright height, and thickness (not diameter) of structural elements.

The accessible gantry design must allow the J-arm retraction assembly system elements to be located anywhere along the horizontal support members.

Configuration of truss chord splice must be in accordance with [Exhibit 251.7-22](#).

Gantry must be designed for future signs, 12 feet wide by 10 feet high, one on each upright at the height of the truss. Other future signs (as defined in the [Structures Manual, Volume 3](#)) need not be considered. The gantry design must always account for the toll equipment simultaneously with load cases with and without the future sign panel to produce the worst-case loading effect.

Access Elements – Gantry design must include a deck (upper platform) to maintain equipment over live traffic. This allows for secured access to the deck via a lower platform

and connecting stairway accessible by maintenance vehicles such as a scissor lift or bucket truck. See [Exhibit 251.7-2](#) for additional requirements.

See exhibits below for required accessible gantry elements:

- Truss Connections – [Exhibit 251.7-3](#), [Exhibit 251.7-4](#)
- Lower Chord Connection – [Exhibit 251.7-5](#)
- Upper Chord Connection – [Exhibit 251.7-6](#)
- Upright Structural Details for Wireway Support – [Exhibit 251.7-7](#)
- Lower Grating – [Exhibit 251.7-8](#)
- Upper Grating – [Exhibit 251.7-9](#)
- Stairs and Platforms – [Exhibit 251.7-10](#), [Exhibit 251.7-11](#), [Exhibit 251.7-12](#), [Exhibit 251.7-13](#)
- Swing Gates and Latches – [Exhibit 251.7-14](#), [Exhibit 251.7-15](#), [Exhibit 251.7-16](#), [Exhibit 251.7-17](#)
- Platform Panels – [Exhibit 251.7-18](#), [Exhibit 251.7-19](#)
- Fall Restraint System – [Exhibit 251.7-20](#)
- Reinforced Opening in Channels for Cable Tray Pass Thru - [Exhibit 251.7-21](#)
- Camber and Splice Details - [Exhibit 251.7-22](#)

Exhibit 285-18: Accessible Gantry Typical Section

Exhibit 285-19: Accessible Gantry Deck and Access Stairway

Exhibit 285-20: Truss Connection Details (1 of 2)

Exhibit 285-21: Truss Connection Details (2 of 2)

Exhibit 285-22: Lower Chord Connection

Exhibit 285-23: Upper Chord Connection

Exhibit 285-24: Upright Structural Details for Wireway Support

Exhibit 285-25: Lower Grating Detail

Exhibit 285-26: Upper Grating Detail

Exhibit 285-27: Stair and Platforms

Exhibit 285-28: Stair Column Details

Exhibit 285-29: Platform Details

Exhibit 285-30: Upper Stair Landing Detail

Exhibit 285-31: Swing Gate (1 of 2)

Exhibit 285-32: Swing Gate (2 of 2)

Exhibit 285-33: Swing Gate Latch (1 of 2)

Exhibit 285-34: Swing Gate Latch (2 of 2)

Exhibit 285-35: Upper Platform End Panels

Exhibit 285-36: Upper Platform Panels

Exhibit 285-37: Fall Restraint System Details

Exhibit 285-38: Reinforced Opening in Channels for Cable Tray Pass Thru

Exhibit 285-39: Camber Splice Details

285.2.8 Foundation Systems

Gantries must be supported by a deep foundation system. Shallow foundation systems are not permitted.

Geotechnical investigations for gantry foundations must be in accordance with **GTR 280.3**.

Design drilled shafts and driven piles per the requirements of [Soils and Foundations Handbook](#).

Driven Piles:

- At least one test pile per gantry must be dynamically monitored with a Pile Driving Analyzer (PDA) or Embedded Data Collector (EDC) and following [Standard Specifications, Section 455](#).
- All preformed pile holes installed in rock must be grouted following [Standard Specifications, Section 455](#), to restore lateral stability of the foundation, unless the rock is modeled as non-cohesive soil in design and sand backfill is used following the Specification requirements.

Drilled Shafts – Thermal integrity (TITDS) tests are required at every drilled shaft. The TITDS tests will be performed by FDOT.

Modification for Non-Conventional Projects:

Replace the above sentence with the following:

Thermal integrity (TITDS) tests are required at every drilled shaft. The TITDS tests will be performed by the Design-Build Team. The signed and sealed report must be included in the Foundation Certification Package.

Do not use micropiles or auger cast piles.

285.2.8.1 Foundation Length

After foundation length is determined based on design analyses add:

- Four (4) feet to the required foundation length when subsurface soil or rock is modeled as non-cohesive material.
- Six (6) feet to the required foundation length when any soil or rock is modeled as cohesive material in design.

Design of the drilled shaft must include reduction of skin friction in limestone associated with the use of temporary casing.

285.3 Toll Equipment J-Arms

285.3.1 General Requirements

J-arms must be in accordance with [Exhibit 252.1-1](#).

285.3.1.1 J-Arm Attachment Hardware

The J-arms must be mounted to the horizontal support pipes (non-accessible gantries) or to the support arms (accessible gantries) as follows:

- Non-accessible gantry J-arm attachment hardware must be in accordance with **Exhibit 252.1-2**, **Exhibit 253.2-1**, **Exhibit 253.2-2**, and **Exhibit 253.2-3**.
- Accessible gantry J-arm attachment hardware must be in accordance with **Exhibit 252.1-2**, **Exhibit 254.2-5**, **Exhibit 254.2-6**, **Exhibit 254.2-7**, and **Exhibit 254.2-8**.
- Telescoping brackets or supports are not allowed.
- All hardware connections must be designed to prohibit loosening over time.
- See **GTR 251** for rigidity and vibration requirements.

285.3.1.2 J-Arm Point of Attachment

The point of attachment of the J-arm must be in the longest straight section of the J-arm. See [Exhibit 251.4-1](#), [Exhibit 252.1-1](#), and [Exhibit 254.2-5](#).

All J-arms must accommodate 26 inches of vertical adjustability (13 inches up/down) from the reference point (neutral position of the J-arm). See [Exhibit 252.1-1](#) for the reference point on the J-arm.

Horizontal adjustability limits with respect to the J-arms must be within the limits identified in [Exhibit 252.1-3](#) and [Exhibit 252.1-4](#). For all other toll equipment, the centerline of J-arm coincides with the centerline of the toll equipment.

Exhibit 285-40: J-Arm Detail

Exhibit 285-41: J-Arm Attachment Hardware

Exhibit 285-42: Toll Equipment Adjustability (1 of 2)

Exhibit 285-43: Toll Equipment Adjustability (2 of 2)

285.4 Horizontal Support Pipes for Non-Accessible Gantries

285.4.1 General Requirements

Horizontal support pipes must be provided for attaching J-arms to the structural W-section of the gantry. See [Exhibit 252.1-2](#), [Exhibit 253.2-1](#), [Exhibit 253.2-2](#), and [Exhibit 253.2-3](#) for assembly details.

The horizontal support pipes must be staggered to allow the J-arms to be on the same centerline offset, as required in **GTR 250.2.1**.

The W-section members' location must not conflict with the J-arms' position required for toll equipment installation. There must be a minimum of 7 1/2 inches between the centerline of the W-section and the centerline of the J-arm, resulting in a minimum of 1 inch of lateral clearance between any J-arm attachment hardware and the W-section supporting the horizontal support pipes as shown in [Exhibit 253.2-3](#).

285.4.2 Horizontal Support Pipes

Horizontal support pipes must span between each set of adjacent W-section members over equipped lanes and shoulders.

Horizontal support pipes must be provided to hold all J-arms. There must be horizontal pipes on both the approach and departure sides of the gantry above equipped lanes and shoulders.

All horizontal support pipes will be 6'-6" long except when cantilevered as described in (8) below. Horizontal support pipes must be identical in diameter, wall thickness and material for each gantry.

Each horizontal support pipe must hold a maximum of three (3) J-arms.

Horizontal support pipes must have an outside diameter of 4.5 inches and must be attached to the structural members (W-section) by pipe saddles and U-bolts. See [Exhibit 251.4-1](#).

Horizontal support pipes must extend a minimum of 3 inches beyond the pipe saddle U-bolt assembly that secures the horizontal pipes to the W-section members. The extension must not conflict with J-arm mounting installation.

All horizontal support pipes must be level.

Only on 42-foot and 48-foot cantilever gantry spans, horizontal support pipes can be cantilevered beyond the last W-section member for supporting equipment on the cantilevered portion. These cantilevered horizontal support pipes must not extend beyond the end of the longest chord.

For horizontal support pipes cantilevered from the gantry, J-arm mounting hardware must be a minimum of 3 inches inside the unsupported edge of the horizontal support pipe.

Exhibit 285-44: Horizontal Support Pipe Attachment (1 of 3)

Exhibit 285-45: Horizontal Support Pipe Attachment (2 of 3)

Exhibit 285-46: Horizontal Support Pipe Attachment (3 of 3)

285.5 Equipment Retraction Assembly for Accessible Gantries

The equipment retraction assembly includes the gear box, support arm, J-arm and associated hardware. The retraction assembly system allows the toll equipment to be retracted to the deck (walkway) where it can be serviced over live traffic by trained technicians.

285.5.1 General

One equipment retraction assembly must be provided for each J-arm as shown in the exhibits included in this subsection.

The number and positioning of gear boxes and support arms must be determined from the equipment layout.

The equipment retraction assembly must fully retract each equipped J-arm individually without requiring other equipped J-arms to be retracted.

285.5.2 Support Arm Assembly

The support arm assemblies must retract the J-arm mounted tolling equipment devices to the gantry walkway, as shown in [Exhibit 254.2-1](#), [Exhibit 254.2-2](#), [Exhibit 254.2-3](#), and [Exhibit 254.2-4](#).

The support arms ("support arm") must be as shown in [Exhibit 254.2-5](#), [Exhibit 254.2-6](#), [Exhibit 254.2-7](#), and [Exhibit 254.2-8](#). Each support arm must be attached to a single gear box.

Where toll equipment layout results in the latch plate conflicting with the latch bar brace:

- Offset the support arm assembly per the adjustability as shown in [Exhibit 252.1-3](#) and [Exhibit 252.1-4](#).
- Where toll equipment is not adjustable, an alternate latch plate must be designed to avoid the conflict with the latch bar brace.

Stop plates must be used to restrict the movement of the support arms as they swing into the maintenance position over the walkway. Type and mounting position of stop plates will vary for each piece of toll equipment. See [Exhibit 254.2-1](#), [Exhibit 254.2-2](#), [Exhibit 254.2-3](#), [Exhibit 254.2-4](#), and [Exhibit 254.2-10](#) for stop plate types and mounting.

Exhibit 285-47: Equipment Retraction Assembly Rotation (1 of 4)

Exhibit 285-48: Equipment Retraction Assembly Rotation (2 of 4)

Exhibit 285-49: Equipment Retraction Assembly Rotation (3 of 4)

Exhibit 285-50: Equipment Retraction Assembly Rotation (4 of 4)

Exhibit 285-51: Equipment Retraction Support Arm (1 of 2)

Exhibit 285-52: Equipment Retraction Support Arm (2 of 2)

Exhibit 285-53: Equipment Retraction Assembly Details (1 of 2)

Exhibit 285-54: Equipment Retraction Assembly Details (2 of 2)

Exhibit 285-55: Latch Bar Assembly

Exhibit 285-56: Stop Plate Types and Details

285.5.3 Gear Boxes

The gear boxes must be provided in accordance with the [Exhibit 254.3-1](#) and [Exhibit 254.3-2](#).

- Swing gate posts must be removable so that they can be repositioned along the kick plate to adjust the position of swing gates for interim to ultimate configurations to accommodate gear box attachment system flexibility. See [Exhibit 254.3-3](#).
- Gear boxes must be oriented such that fixed gantry elements (gantry top chord field splices, swing gate support posts, other gear boxes, latch bar brace supports, etc.) do not prevent or impair retraction of the toll equipment.
- For each interim and ultimate layout:
 - (a) Each TEC equipment layout must have the same quantity of left gearboxes.
 - (b) Each TEC equipment layout must have the same quantity of right gearboxes.

Exhibit 285-57: Gear Box Details (1 of 3)

Exhibit 285-58: Gear Box Details (2 of 3)

Exhibit 285-59: Gear Box Details (3 of 3)

285.5.4 Gear Box Attachment System

The gear box attachment system to the gantry must allow a minimum 6-inch lateral clearance between the centerline of the gear box input shaft and the centerline of the nearest swing gate post.

The horizontal support member for the support of gear boxes that spans between swing gate posts must be as long as possible, up to 12 feet in length. The angles that connect these horizontal supports must only attach at swing gate posts and on each side of upper chord field splices. See [Exhibit 254.3-3](#) for additional details.

285.6 Gantry Electrical

285.6.1 General Requirements

Equipment and raceway placement must avoid conflicts with access to all site elements.

285.6.2 Cable Tray

The AVI section of the cable tray must be used for the antenna RF cables.

The data section of the cable tray must be used for data and composite cables rated less than 50V.

The power section of the cable tray must be used for 120V power cabling.

Bond cable trays and metal conduits with grounding bushings and a #10 AWG, minimum bare copper equipment grounding conductor.

The AVI data cable may be routed through either the AVI section or the data section of the cable tray.

See **GTR 255.5** for non accessible gantry cable tray requirements.

See **GTR 255.6** for accessible gantry cable tray requirements.

285.6.3 Wire Troughs

Wire troughs must not be located between the gantry column and the roadside barrier.

All wire troughs must be mounted on galvanized strut channel supports such that the bottom of the enclosure is 4 feet above the concrete slab or sidewalk below, as shown in [Exhibit 255.3-1](#), except for the AVI wire trough on the AVI reader ground-mounted frame.

Drain fittings must be provided at the bottom of the wire trough as shown in [Exhibit 255.3-1](#). The drain fittings must maintain the NEMA 3R rating of the wire troughs.

The data and power conduits/wireways must terminate in their respective wire troughs.

The AVI conduits/wireways from the gantry must either terminate into the AVI wire trough or at the AVI reader ground-mounted frame.

Raceways terminating into wire troughs from non-accessible gantries must be in accordance with **GTR 255.5.1**.

Raceways terminating into wire troughs from accessible gantries must be in accordance with **GTR 255.6.4**.

For TEB Sites: See **GTR 242.14 (6)** for conduit termination requirements from the wire troughs to the TEB.

For RTC Sites: See **GTR 232.11 (5)** for conduit termination requirements from the wire troughs to the RTC and OCC.

285.6.3.1 Toll Equipment Building Sites

Non-accessible gantry wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 24-inch L.

Accessible gantry power wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 24-inch L.

Accessible gantry data/AVI wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 96-inch L.

285.6.3.2 Roadside Tolling Cabinet (RTC) Sites

Non-accessible gantry power and AVI wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 24-inch L.

Single movement sites: Non-accessible gantry data wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 24-inch L.

Dual movement sites: Non-accessible gantry data wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 36-inch L.

Exhibit 285-60: Wire Trough

285.6.4 Lightning Protection

Two grounding studs (lugs) must be installed at the base of each gantry upright for connecting to the lightning protection system.

All ground mounted metallic enclosures, supports, and equipment must be connected to an underground lightning protection system conductor at the base of the gantry foundations by lightning protection bonding conductors.

See [Exhibit 255.4-1](#) for bonding and grounding of uprights, stair columns and wire troughs.

Exhibit 285-61: Gantry Upright Lightning Protection Detail

285.6.5 Non-Accessible Gantry

Conduit, cable tray, AVI reader ground-mounted frames, AVI reader placement in TEBs, AVI reader mounting system on the gantry, lightning protection, duct banks, directional bores, loop pull boxes, and TEB penetrations must be provided as described herein for the connection of the gantry and roadside tolling equipment to the TEB or RTC.

285.6.5.1 Conduit

Vertical conduit from the horizontally mounted cable tray must be located on the gantry upright and terminated into wire troughs at the base of the gantry, except for median cantilever gantries as described in **GTR 255.5.8**.

Conduits must not terminate into the top of the wire trough.

See [Exhibit 251.4-2](#), [Exhibit 251.4-3](#), [Exhibit 255.5-1](#), and [Exhibit 255.5-2](#) for conduit layout and support requirements.

Exhibit 285-62: Span Upright Conduit Layout

Exhibit 285-63: Cantilever Upright Conduit Layout

285.6.5.2 Longitudinal Cable Trays

Provide 5-inch high aluminum ladder type cable tray with dividers to separate AVI, data, and power cabling.

Cable tray must be no less than 9" wide and no greater than 24" wide.

AVI, data, and power sections of the cable tray must be at least 8" wide.

Provide waterfall fittings as needed for all cables that transition out of the longitudinal cable trays as shown in [Exhibit 255.5-1](#), [Exhibit 255.5-2](#), and [Exhibit 255.5-3](#).

Extend the longitudinal cable tray to within 12" of the end of the upright cable tray below. Longitudinal cable tray must not extend beyond the nearest end of the upright cable tray below.

Cable tray must be supported by strut channel frame as shown in [Exhibit 255.5-1](#) and [Exhibit 255.5-2](#). Strut channel must be secured to the gantry structure with beam clamps as shown in [Exhibit 255.5-3](#).

285.6.5.3 Equipment Cable Tray

Equipment cable tray must be provided to support all cabling between the longitudinal cable tray and the equipment on the J-arms. A galvanized threaded rod assembly for field installation of galvanized strut channel to W-section members must be provided at NEC required spacing. These mechanically fastened assemblies must have galvanized self-locking nuts with washers installed above and below the W-members as shown in [Exhibit 255.5-3](#).

Equipment cable trays must span along the entire W-section within 12 inches from the centerline of the approach and departure J-arms, except as stated below.

In accordance with **GTR 250.2.3**, VCARs must open for maintenance without conflict. When installation of the equipment cable tray as described in item (2) above results in impacts to VCAR maintainability, equipment cable tray must terminate 42 inches from the centerline of the applicable J-arm.

285.6.5.4 Upright Cable Tray

An upright cable tray must be provided as a termination point for the vertical conduit installed on the uprights and support cables transitioning to the longitudinal cable trays located on the gantry truss as shown in [Exhibit 255.5-1](#) and [Exhibit 255.5-2](#).

Weatherproof blind end covers must be provided on ends of the cable tray.

A factory cable tray with a pitched cover must be provided over the vertical conduit terminations to prevent water intrusion. Extend the cover from the end of the cable tray to at least 18 inches beyond the conduit terminations.

Vertical conduit terminations into the cable trays must be provided with manufacturer supplied fittings.

Vertical conduit installed on the uprights must extend 1 inch above the bottom of the cable tray.

Cable tray must be supported by strut channel frame as shown in [Exhibit 255.5-1](#) and [Exhibit 255.5-2](#). Strut channel must be secured to the gantry structure with beam clamps as shown in [Exhibit 255.5-3](#).

Exhibit 285-64: Toll Equipment Cable Tray

285.6.5.5 AVI Reader Placement in Toll Equipment Building

For toll sites with only one critical power panel and where the cable distances allow, the AVI readers must be wall-mounted inside the associated TEB as shown in [Exhibit 242.1-6](#).

See **GTR 242.14** for additional requirements on AVI cable routing for AVI reader placement in the building.

285.6.5.6 AVI Reader Ground-Mounted Frames

AVI reader ground-mounted frames must be used:

- At TEB sites when AVI Reader placement in TEBs cannot meet the requirements of **GTR 255.5.5**.
- At RTC and TEB sites when antenna to AVI reader cable distance requirements identified in **GTR 234.3 (1)** can be met.

See [Exhibit 232.5-2](#) for AVI reader ground-mounted frames.

See **GTR 242.14** and **GTR 232.11** for additional requirements on AVI cable routing.

285.6.5.7 AVI Reader Gantry-Mounted Frame

If the AVI readers cannot be placed inside the TEB or on AVI reader ground-mounted frames, mount the AVI readers over a shoulder on the gantry:

- Use the inside shoulder for EL-only toll sites.
- Use the outside shoulder for all other toll sites.
- Mount AVI readers on the departure side where possible.

Provide galvanized strut channels on the non-accessible gantry truss for the TEC to vertically mount each TEC-provided AVI reader fiberglass NEMA 4 enclosure as shown in [Exhibit 255.5-4](#).

TEC equipment enclosure, AVI reader fiberglass enclosures, and associated elements must not be in conflict with any gantry elements supporting interim and ultimate lanes.

See **GTR 242.14** and **GTR 232.11** for additional requirements on AVI cable routing.

Exhibit 285-65: AVI Reader in Non-Accessible Gantry Mounting Detail

285.6.5.8 Cantilever Gantry Mounted on Median Barrier

Each vertical conduit from the horizontally mounted cable tray must terminate in a vertically-mounted handhole (pencil pull box). The conduit and pencil pull box supports must be designed such that they do not conflict with the gantry upright stiffener plates. See [Exhibit 255.5-5](#) for additional requirements.

Cantilever gantries must be designed according to the requirements for typical non-accessible span gantries with the following exceptions:

- The 3-inch power and data conduits routing below the median must be located a minimum of 5 feet away from the 1-inch roadway pavement loop conduits.
- Conduits on the upright consists of three 3-inch RGS conduits for data and one 3-inch RGS conduit for power extending from the upright cable tray above.
- When the toll loop pavement area is located on the same side as the TEB, data and power conduits must route to separate pull boxes for cantilever data, and cantilever power, located in the median barrier as shown in [Exhibit 232.1-13](#).
- When the toll loop pavement area is located on the opposite side from the TEB, data and power conduits must route directly to separate pull boxes for cantilever data, and cantilever power, located adjacent to the TEB. See [Exhibit 232.1-4](#) for dual movement example.
- When the RTC site serves a single movement median cantilever gantry, data and power conduits must route to the OCC as shown in [Exhibit 231.1-7](#) and [Exhibit 231.1-13](#).
- When the RTC site serves dual movement median cantilever gantries, the data and power conduits must route to the OCC associated with each gantry as shown in [Exhibit 232.1-6](#) and [Exhibit 232.1-10](#).

A non-accessible span gantry may be considered to satisfy cable distance requirements from **GTR 234**.

285.6.5.9 Cantilever Gantry Mounted Behind Concrete Barrier

Cantilever gantries electrical must be designed according to the requirements for typical non-accessible span gantries when the cantilever gantry is mounted behind the concrete barrier.

Exhibit 285-66: Cantilever Gantry Upright Conduit Layout

285.6.6 Accessible Gantry

285.6.6.1 General Requirements

The following elements must be provided as part of the accessible gantry electrical layout:

-
- Maintenance receptacles
- Cable trays
- TEC equipment enclosure and AVI reader mounting assemblies
- Wireways and associated strut channel supports
- Lighting control
- Lighting for platform and stairway

See [Exhibit 255.6-1](#) for details of the electrical infrastructure of the accessible gantry.

The 120 VAC branch circuits serving power outlets, lighting, or equipment on the gantry must be installed in the power section of the cable tray from panel EDP.

Transverse cable trays must be provided connecting the power outlets, lighting and toll equipment conductors to the power cable tray on the gantry as shown in [Exhibit 255.6-3](#).

A minimum of one (1) maintenance receptacle must be provided per direction of travel. Additional receptacles are required along the gantry at maximum longitudinal spacing of 100 feet.

- See [Exhibit 255.6-3](#) for the two types of receptacle mounting details.
- Cables above the upper grating must be installed in conduits with CGB fittings for cable strain relief.

Lighting fixtures must not be mounted on moveable swing gates or associated swing gate posts.

Lighting and associated infrastructure must not impede the swing gates' operational requirements that allow toll equipment to be rotated to the maintenance position.

Exhibit 285-67: Accessible Gantry Electrical Plan

285.6.6.2 Cable Trays

The following cable trays must be provided along the entire horizontal section(s) of the gantry as shown in [Exhibit 255.6-2](#):

- A minimum of two (2) 24-inch wide aluminum ladder type cable trays for data/AVI.
- A minimum of two (2) 6-inch wide aluminum ladder type cable trays for power.

Cables installed in cable trays must be UL or other NRTL listed and rated as “Tray Cable (TC) Rated”.

The data/AVI cable trays must be used to route data cabling for tolling cameras, illuminators, TEC equipment, AVI cables, and antenna RF cables.

Six-inch wide channel type transverse power cable trays must be used to route 120 VAC power cabling for TEC equipment, maintenance receptacles, gantry lighting, and gantry walkway lighting. See [Exhibit 255.6-3](#) for additional requirements.

Exhibit 285-68: Accessible Gantry Cable Tray Layout

Exhibit 285-69: Accessible Gantry Transverse Cable Tray

285.6.6.3 AVI Reader Accessible Gantry-Mounted Frame

The positioning of each AVI reader fiberglass enclosure and TEC equipment enclosure on the accessible gantry and the adjacent light fixtures, receptacles, switches, etc. must be as shown in [Exhibit 255.6-4](#), and [Exhibit 255.6-6](#).

AVI reader fiberglass enclosures, TEC equipment enclosure, associated elements, strut channel, and mounting plates must not be located on the moveable swing gates or where swing gate elements would conflict with AVI reader enclosure access and associated light fixtures.

AVI reader and TEC equipment enclosure mounting locations must not interfere with future toll equipment arm assemblies for existing or future lanes.

A galvanized strut channel must be provided on the accessible gantry maintenance walkway at AVI reader and TEC equipment enclosure mounting locations as shown in [Exhibit 255.6-4](#). The element is used by the TEC to vertically mount each TEC-provided AVI reader fiberglass NEMA 4 enclosure and TEC equipment enclosure to the accessible gantry structure.

Exhibit 285-70: Accessible Gantry AVI Reader Enclosure Layout

285.6.6.4 Wireway Transition to Wire Troughs

The horizontal cable tray sections along the gantry truss must terminate in a minimum of seven (7) 6-inch x 6-inch fiberglass wireways dual rated NEMA 12/3R.

The fiberglass wireways must run horizontally on the truss prior to descending the gantry upright as shown in [Exhibit 255.6-6](#) and [Exhibit 255.6-8](#).

The horizontal ends of the wireways must be protected from stormwater intrusion as shown in [Exhibit 255.6-6](#) and [Exhibit 255.6-7](#).

The wireways must descend on the column located on the TEB side of the roadway and terminate in their respective NEMA 3R wire troughs as shown in [Exhibit 255.6-5](#) and [Exhibit 255.6-8](#). Wireways must not terminate into the top of the wire trough.

Drain fittings must be provided at the bottom vertical to horizontal transition prior to wire trough termination as shown in [Exhibit 255.6-8](#). The drain fitting must maintain the NEMA 12/3R rating of the wireways.

All wireways must be routed and supported with galvanized strut channels as they descend the gantry upright as shown in [Exhibit 255.6-8](#).

Exhibit 285-71: Accessible Gantry Typical Wire Trough Layout

Exhibit 285-72: Accessible Gantry Typical Electrical Layout

Exhibit 285-73: Accessible Gantry Typical Wireway to Cable Tray Detail

Exhibit 285-74: Accessible Gantry Upright Electrical Wireway Detail

285.6.6.5 Lighting for Platform and Stairway

LED rope light must be used along the entire length of the accessible gantry platform around the full perimeter as shown in [Exhibit 255.6-1](#) and [Exhibit 255.6-6](#). See [Exhibit 255.6-9](#) for rope lighting mounting details.

AVI reader area lighting must be provided on either side of the AVI reader mounting assembly as shown in [Exhibit 255.6-4](#).

Stair and platform luminaire must be the same as specified for the TEB exterior walls without the photocell accessory. This fixture must be affixed to the stair rail and the non-moveable portion of the swing gate structural system as shown in [Exhibit 255.6-10](#).

Timer switches must be provided at the lower platform and upper platform to independently control the lighting for the stairs, AVI reader area lighting, and rope lighting. See [Exhibit 255.6-1](#), [Exhibit 255.6-6](#), and [Exhibit 255.6-10](#) for timer switch locations.

Exhibit 285-75: Accessible Gantry Rope Light Mounting Details

Exhibit 285-76: Accessible Gantry Stair and Platform Lighting

285.6.7 CCTV System

See **GTR 232.9** for site-wide CCTV requirements.

See [Exhibit 232.9-1](#) and [Exhibit 232.9-2](#) for location of gantry mounted CCTV cameras.

Location of accessible gantry mounted CCTV cameras 7, 8, 9, and 10 must be coordinated to avoid conflicts with gate operations and J-arm retraction systems. See [Exhibit 232.9-1](#) for quantity and layout of boxes to support the CCTV cameras.

Exhibit 285-77: CCTV Camera Gantry Backbox Mounting Details