283 Toll Equipment Buildings

283.1 Toll Equipment Building Design

283.1.1 General Requirements

(1) The term “building” refers to the TEB.

(2) Design of buildings and building sites (not including RTC sites) including all plans, specifications, and other contract documents must comply with the latest adopted edition and supplements of the FBC at the time of permitting. Under no circumstances must the requirements be reduced because of code changes that occur during design.

283.2 Toll Equipment Building Architectural

283.2.1 General Requirements

TEBs must be designed as follows:

(1) Provide a building that is a six-sided pre-engineered precast concrete box structure.

(2) The building must be 21 feet long by 12 feet, 6 inches (12′-6″) wide measured from exterior faces.

(3) A new interior fire extinguisher and bracket must be provided in all new buildings.

(4) See ***FDM 283.2.6*** for additional architectural requirements related to the prefabricated building.

283.2.2 Toll Equipment Building Structural Design

TEB structural design must include:

(1) The design layout of the TEB including overall building size, form, and locations and sizes of all penetrations.

(2) Requirements for the TEB manufacturer to develop signed and sealed shop drawings and calculations for a complete TEB design.

(3) The foundation design for the TEB.

283.2.2.1 Hurricane Wind Requirements

(1) The design must comply with Risk Category IV buildings per ***FBC***, ***Section 1620*** "High Velocity Zones - Wind Loads" for Miami-Dade County, regardless of project location.

(2) See ***FDM 282.2.1*** for additional wind design requirements.

283.2.2.2 Live Load

(1) The minimum roof load must be 65 pounds per square foot (PSF).

(2) The minimum floor load must be 125 PSF.

283.2.3 Foundation Slab

(1) Geotechnical investigation for the TEB foundation must be in accordance with ***Geotechnical Design Manual (GDM)***, ***Section 3.2.8***.

(2) Design calculations for bearing capacity and settlement analyses for TEB foundation design must be provided.

(3) The floor penetration locations must be designed as shown in ***Exhibit 283-2***.

(4) A monolithic slab with a turned down edge designed for the allowable bearing conditions must be provided at each precast concrete building and for the wind load criterion specified above.

(5) Set the precast concrete building in a notch-troweled grout or mortar bed with a minimum thickness of ¼ inch over the entire foundation slab surface to create a uniform bearing between the precast concrete floor slab and the foundation slab.

(6) Provide a notch troweled mortar bed (minimum ¼ inch) over the entire cast-in-place foundation surface prior to setting the precast building in plaza.

(7) The foundation reinforcement layout must be designed to accommodate tolling and electrical conduit stub-up locations.

(8) The foundation design must include provisions for the concrete encased electrode conductor as required in ***FDM 283.3.13*** and shown in ***Exhibit 283-2***.

(9) Steel plate connections must be provided to tie the precast concrete building to the foundation slab. See ***Exhibit 283-2*** for additional requirements.

283.2.4 Toll Equipment Building Roof

The TEB roof system must be designed per the following:

(1) Styrene-Butadiene-Styrene (SBS) modified bitumen roof system and associated items must have State of Florida or Miami-Dade County product control Notice of Acceptance (NOA) and comply with requirements for high velocity hurricane zone Miami-Dade County regardless of location.

(2) The side of the building closest to and parallel to the roadway must be the high roof side of the building. The roof must slope to the side of the building furthest from the roadway.

(3) The high roof side and the two ends of the building must have parapets topped with a prefinished fluoropolymer coating metal coping system.

(4) R-19 minimum (aged value) tapered roof insulation must be provided. Roofing base and flashing material must be extended over top of parapet.

(5) Two roof penetrations must be provided for lightning protection at opposite corners of the roof 24 inches from the exterior faces.

(6) The roof parapet must be detailed in accordance with ***Exhibit 283-1***.

(7) A continuous gutter along the low roof side of the building with downspouts on each end must be provided. The gutter assembly must be secured with anchors sized and spaced to withstand the design wind loads. See ***Exhibit 283-1*** for additional criteria.

283.2.5 Exterior Equipment

(1) New fire extinguisher and bracket must be provided near the generator and fuel storage tank area.

  (a) The fire extinguisher must be in an area hidden from general public view.

  (b) An appropriate weather resistant enclosure must be provided with mounting hardware, and signage.

(2) Fire extinguisher and electrical meter must not be located over building reveals.

283.2.6 Pre-Engineered Precast Concrete Toll Equipment Buildings

(1) All exposed concrete floors in interior spaces must be coated with a clear coat sealer to reduce concrete dust.

(2) All block outs must be designed to accommodate tolling and electrical conduit stub-up locations. See ***Exhibit 283-2*** for additional layout and size criteria.

(3) All wall penetrations through the TEB must be coordinated with the electrical devices for which they serve. See ***Exhibit 283-3*** for additional layout criteria.

(4) Vertical and horizontal reveals must be provided on the exterior of all building walls. See ***Exhibit 283-3*** and ***Exhibit 283-4*** for additional requirements.

(5) Door and Frame:

(a) Exterior door frame and door must have State of Florida or Miami-Dade County product control NOA and comply with requirements for high velocity hurricane zones in Miami-Dade County requirements regardless of location.

(b) The TEBs must have one door made of steel with a steel frame cast in the wall. All door and conduit openings must be suitably protected and sealed to prevent the ingress of water, moisture, dust, and wind driven rain.

(c) The TEB door must swing open at least 170 degrees and be unobstructed to provide access for maintenance technicians and tolling equipment.

(d) Door jamb guards, kick plates, and other items must be provided as shown in ***Exhibit 283-5***.

(6) Interior Walls and Ceilings:

(a) See ***Exhibit 283-1*** for basis of design.

(b) Interior wall and ceiling system (not inclusive of the precast concrete) must not exceed 2⅛ inches in thickness.

(c) Design of the insulation system must satisfy the Florida Building Code – Energy Conservation.

(d) Design the wall and ceiling systems with the capacity to support TEB wall and ceiling mounted equipment.

(e) Calculations must be provided for the type, size, length, and minimum embedment depth of fasteners required to support all wall mounted equipment without compromising the precast wall.

(f) Design the wall and ceiling with a painted or equivalent surface finish.

(g) Design the wall to include resilient base.

(7) Exterior and interior color schedule must be as follows:

(a) Exterior walls, door, and AC pipe chases: Federal Standard 595 No. 17886.

(b) Exterior metal coping, gutter, and downspout: Brown – Federal Standard No. 20062.

(c) Interior walls, interior door frame, interior door: White Federal Standard 595 No. 17925.

(d) Interior ceiling: White Federal Standard 595 No. 17925.

283.2.7 Equipment Support Frames

283.2.7.1 Toll Equipment Support Frame

A raised aluminum cabinet support frame must be provided to support the TEC provided tolling equipment in each TEB. The raised aluminum cabinet support frames must meet the following requirements:

(1) Raised aluminum cabinet support frames must be 159 inches long x 36 inches wide x 8 inches high.

(2) The frame area where the cabinets sit must be a minimum 2.5 inches wide or as required to allow for all cabinets to be properly placed over the frame.

(3) The frame must have two (2) aluminum cross ribs. The cross ribs must be 4 inches wide and provide a minimum of 4 inches clear between the finish floor and cross rib bottom. See ***Exhibit 283-6*** for additional requirements.

283.2.7.2 Condensing Units Support Frame

(1) Provide stainless steel angle equipment support frame shop welded. Coordinate exact size and clearance requirements with the specified condensing unit.

(2) See ***Exhibit 283-7*** for frame design intent.

283.3 Toll Equipment Building Electrical

This section applies to all TEBs (new or existing) unless noted otherwise.

283.3.1 General Requirements

(1) The TEB electrical components layout and interconnections must be provided as shown in ***Exhibit 283-8***, ***Exhibit 283-9***, ***Exhibit 283-10***, ***Exhibit 283-11***, ***Exhibit 283-12***, and ***Exhibit 283-13***, except as modified by ***FDM 283.3.5***, ***FDM 283.3.7***, and ***(2)*** below.

(2) One toll equipment space is required for each tolling movement up to maximum of 6 equipped lanes and shoulders per tolling movement.

(3) All cables and conductors must be installed in raceways.

(4) All wall-mounted wiring devices must be provided in accordance with ***Exhibit 283-14***.

(5) Power cables from the critical power panel(s) must route to the power side of the ceiling mounted cable tray. See ***Exhibit 283-16*** for additional requirements.

283.3.2 Toll Equipment Building Lighting

(1) An interior lighting system must be provided consisting of at least six pendant mounted light fixtures to maintain average lighting levels of 40 foot-candles.

(2) Light fixtures must be installed at 96 inches above finished floor to the bottom of the fixture.

(3) See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Lighting Fixtures, Lamps, and Ballasts for TEB Sites*** for additional requirements.

(4) Lights must be provided on the exterior of all four walls of the TEB.

(5) See ***Exhibit 283-15*** for additional requirements for interior and exterior lighting.

283.3.3 Critical Power Receptacles

(1) Dedicated 20A twist-lock receptacles and associated circuits must be provided from the critical power panel(s) and mounted to the power side of the cable tray above the toll equipment and toll communications cabinet.

(2) See ***Exhibit 283-16*** for critical power receptacle layout requirements except as modified by ***FDM 283.3.5***, ***FDM 283.3.7***, and ***FDM 283.3.1 (2)***.

(3) See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Wiring Devices for TEB Sites*** for additional requirements.

283.3.4 Electrical Power Panels

(1) One new main distribution panel (MDP) must be provided for all TEBs. New MDPs must be rated 400 amps, 120/240 volts, and comply with the requirements in ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Panelboards for TEB Sites***.

(2) One new emergency distribution panel (EDP) must be provided, rated 400 amps, 120/240 volts, along with associated components for all TEBs. The EDP must

comply with the requirements in ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Panelboards for TEB Sites***.

(a) The indoor and outdoor lighting, fuel tank monitor, UPS, UPS bypass, AC units, generator battery charger, and generator engine jacket heater, and security system devices, must be fed by panel EDP.

(b) The electrical loads used in load calculations must be rated full load of the equipment.

283.3.5 Critical Power Panels

(1) Critical power panels and panel breakers must be as specified in ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Toll Equipment Critical Power Panelboard for TEB Sites***.

(2) One critical power panel must be provided for TEBs supporting a single tolling equipment enclosure and two critical power panels for TEBs supporting two to four tolling equipment enclosures.

(3) The critical power panel must be rated for 100A, 42 circuits, 120/240V, 1-phase, 3-wire.

(4) The critical power panel must only serve the following systems: tolling and communications.

(5) The following dedicated circuits must be provided from Panel C1 if only one critical panel is provided:

(a) 2 circuits for PDU-A

(b) 2 circuits for PDU-B

(c) 2 circuits for WAN Switch

(d) 8 circuits for each instance of toll equipment

(e) 1 circuit for TELCO, if required

(6) The following dedicated circuits must be provided if two critical panels are provided:

(a) 1 circuit from panel C1 and 1 circuit from panel C2 for PDU-A

(b) 1 circuit from panel C1 and 1 circuit from panel C2 for PDU-B

(c) 1 circuit from panel C1 and 1 circuit from panel C2 for WAN switch

(d) 4 circuits from panel C1 and 4 circuits from panel C2 for each instance of toll equipment

(e) 1 circuit from panel C1 for TELCO, if required

283.3.6 SCADA System

(1) One SCADA control panel must be provided for each TEB.

(2) The SCADA control panel must meet the requirements of ***Toll Facility TSP Library***, TEB Package, TSP Section for ***SCADA System for TEB Sites***.

(3) The SCADA system must connect to the toll site assets as shown in ***Exhibit 283-17***, ***Exhibit 283-18***, and ***Exhibit 283-19*** as applicable. See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***SCADA System for TEB Sites*** for additional requirements.

(4) For electrical power to the SCADA panel refer to ***FDM 283.3.5.***

283.3.7 Uninterruptible Power Supply (UPS)

(1) One UPS must be provided for TEBs supporting a single tolling instance and two UPSs for TEBs supporting two to four tolling instances.

(2) UPS must be sized for the total connected critical power panel load. UPSs must be 15 KVA at a minimum.

(3) One ¾-in conduit must be provided from each UPS communications port card area to the pendant mounted cable tray.

(4) Refer to ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Static Uninterruptible Power Supplies for TEB Sites*** for additional UPS requirements.

283.3.8 UPS Maintenance By-Pass Switches (BPS)

(1) A wall mounted external manual maintenance BPS must be provided for each new UPS.

(2) The BPS must be fed by two separate power sources (two separate breakers, two separate feeders, and two separate conduits) from the appropriate power panel.

(3) The feeders must not be spliced or routed through any disconnects prior to terminating in the BPS.

(4) Other devices or equipment must not be located directly under the BPS.

(5) The BPS must not cause a power outage to the critical power panel when it is put in either by-pass mode and/or UPS mode.

(6) See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Static Uninterruptible Power Supplies for TEB Sites*** for additional requirements.

(7) See ***Exhibit 283-20*** and ***Exhibit 283-21*** for additional details and requirements.

283.3.9 Cable Trays

(1) Pendant mounted ladder type cable trays must be provided to accommodate data and power cables.

(2) The cable tray length must be as follows:

(a) At minimum, the “main core” of the cable tray must run the entire length of the largest dimension (length or width) of the room.

(b) For any buildings requiring wall penetrations, the cable tray must span between the wall penetration points and the main core of the cable tray.

(c) The cable tray must be located above the toll equipment spaces and also the communications cabinet inside the TEB.

(3) Transition fittings, attachments, and supports must be provided for all conduits terminating in the cable tray.

(4) Bond the cable tray and each metal conduit with grounding bushings and a #10 AWG, minimum bare copper equipment grounding conductor that originates from the critical power panel(s) in the TEB.

(5) See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Cable Trays for TEB Sites*** for additional requirements.

283.3.10 Surge Protection Devices (SPDs)

(1) SPDs must be provided for all conductive cabling that originates outside the TEB walls and terminates within the building.

(2) See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Surge Protective Devices for TEB Sites*** for additional requirements.

283.3.11 Emergency Power Off (EPO) Stations

(1) EPO stations must be provided.

(2) See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Emergency Generator for TEB Sites*** for additional requirements.

(3) See ***Exhibit 283-22*** for additional requirements.

283.3.12 Access Control System

(1) Access control and security system devices and wiring must be provided. See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Door Hardware and Access Control System for TEB Sites*** for additional requirements.

(2) All necessary conduit, junction boxes, fittings, connections, and miscellaneous hardware must be provided for power and data cabling required for the access control system.

(3) See ***Exhibit 283-23*** for additional requirements.

283.3.13 Grounding and Bonding

(1) See ***Exhibit 283-24*** and ***Exhibit 283-25*** for grounding and bonding requirements.

(2) See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Grounding and Bonding for Electrical Systems for TEB Sites*** for additional requirements.

283.3.14 Electrical Raceways from Site to New TEBs

(1) Vertical raceways that originate from the gantry must terminate as described in ***FDM 284.3.5.1*** and ***284.3.6.4.***

(2) Working space 1 is the area between the toll equipment spaces 1 and 3. Working space 2 is the area between toll equipment spaces 2 and 4. See ***Exhibit 283-9***.

(3) Loop pull box raceways must be routed to the stub up, under the appropriate working spaces in the TEB.

(4) All conduits must be stubbed up through the building floor slab and cut to 1 inch above the building finished floor elevation with a cable ground bushing installed at both ends of all metallic conduits.

(5) See ***Exhibit 283-26*** for the conduit stub-ups below the toll equipment support frame for each working space inside the TEB.

(6) Conduits from each wire trough must terminate as follows:

(a) CCTV: For each direction of travel served by the wire trough, two 2-in conduits must be routed to the wire trough below the wall mounted toll communications cabinet. See ***Exhibit 285-1***.

(b) AVI reader conduits routed as follows:

i. AVI Reader Mounted in the Building: Two 4-in rigid conduits must be routed from the bottom of the AVI reader wire trough and stub up

under the wall mounted AVI reader backplane. See ***Exhibit 283-13***.

ii. AVI Readers Ground Mounted Frame: Two 4-in rigid conduits must be routed from the bottom of the upright and terminate at the AVI reader frame. See ***Exhibit 282-40***.

iii. AVI Readers Mounted on the Gantry: For each direction of travel served by the wire trough, two 4-in rigid conduits must be routed from the bottom of the AVI reader wire trough and stub up in the appropriate working spaces in the TEB. For additional information see ***Exhibit 283-6*** and ***Exhibit 283-26***.

(c) Data not associated with CCTV must be routed to stub-up under the appropriate working space in the TEB. For additional information, see ***Exhibit 283-6*** and ***Exhibit 283-26***.

(d) Power must be routed to stub up under the appropriate working space in the TEB except as stated in (e) below. For additional information, see ***Exhibit 283-6*** and ***Exhibit 283-26***.

(e) Power to the receptacles and lighting on the gantry must be routed to stub up under the EDP in the TEB.

(7) The underground cable routing for AVI readers that are located on a ground-mounted frame, must be as follows:

(a) Two 4-in conduits per direction of movement must be routed to the toll equipment working spaces.

(b) See ***FDM 284.3.5.6*** for additional requirements.

(8) Generator underground cable routing must be as follows:

(a) Conduits sized by the EOR for the generator power feeders must be routed to the ATS.

(b) One 1-in conduit must be routed to the ATS for generator control wiring and EPO wiring.

(c) Two 1-in conduits to SCADA wireway.

(d) One 1-in conduit to EDP for engine jacket heater circuit.

(e) One 1-in conduit to the battery charging unit for the generator battery circuit.

(9) Fuel tank monitor underground cable routing must be as follows:

(a) One 3/4-in conduit to SCADA wireway.

(b) One 3/4-in conduit to EDP for fuel tank monitor circuit.

(10) See ***FDM 284.3.5.8*** and ***284.3.5.9*** for cantilever gantry conduit routing requirements.

283.3.15 Electrical Raceways from Site to Existing TEBs

The Turnpike Toll Systems can elect to re-use an existing building to house the new tolling system provided by the TEC.

Coordination must take place with Turnpike Tolls Design on the termination point of the conduits incoming from the gantry and roadside during the gantry and site design.

Written documentation (email or meeting notes documentation) of concurrence from the Turnpike Tolls Design Administrator or designee is acceptable.

(1) The wall penetrations for raceways at existing buildings must be from wall-mounted enclosures as follows:

(a) The enclosures must be mounted to the exterior side of the wall at the ceiling level such that cabling transitions to the ceiling mounted cable trays in the interior of the building.

(b) The enclosures must be stainless steel NEMA 4X. The enclosures must be attached to the wall with stainless steel galvanized strut channel supports and labeled “Data” or “Power” depending on the conduits it serves.

(c) The enclosures and associated conduits must be painted to match the adjacent surfaces.

(d) The number of conduit penetrations must match the number of incoming conduits from the gantry and roadside.

(e) The conduit penetration design must maintain the structural integrity of the wall.

(f) The seal around each conduit penetration must provide a waterproof and dust proof wall penetration. The conduit penetrations and enclosures must be constructed to prevent dirt intrusion and water intrusion from rain, and hose-down water test. See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Cutting and Patching for TEB Sites*** for additional requirements.

(2) The conduits must be sloped away from the building interior such that water originating from the outside or from condensation does not make its way inside of the building.

(3) All wireways, wire troughs, enclosures, conduit, chases, pull boxes, and cable trays must be terminated and supported using the appropriate hardware and fittings in accordance with ***FDM 280.11.1*** and the NEC.

283.4 Toll Equipment Building Lightning Protection

283.4.1 General Requirements

(1) A lightning protection system must be provided for all new toll sites and associated toll site infrastructure.

(2) Each TEB lightning protection system must be connected to the applicable site elements identified in ***FDM 282.4.1***.

(3) See ***FDM 282.4.2*** for lightning protection separation distance requirements.

(4) Lightning protection conduit penetrating the exterior wall must not be exposed. See ***Exhibit 283-27*** and ***Exhibit 283-28*** for additional criteria.

(5) See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Lightning Protection for TEB Sites*** for additional requirements.

283.5 Toll Equipment Building Mechanical

283.5.1 General Requirements

(1) Fuel tank and fuel oil piping must be provided to support the emergency generator.

(2) Two ductless split AC systems with wall mounted air handling units (AHUs) and outdoor condensing units (CUs) with inverter-driven twin rotary compressors and CUs with seacoast protection must be provided for each TEB. See ***Exhibit 283-29*** for additional requirements.

(3) Outdoor condensing units must be wall mounted in accordance with ***FDM 283.2.7.2***.

283.5.2 Air Conditioning (AC) System

(1) The AC system must be sized to account for all design factors including TEB size, equipment normal operation, temperature and humidity requirements, heat loads, etc.

(2) Each unit must be sized for 100% of the building load and be redundant to the other unit. Coordination must take place with Turnpike Tolls Design if the cooling capacity of a single unit is insufficient to satisfy 100% of the building load.

(3) Cooling load calculations must account for 100% of the building load, including electrical equipment, ultimate tolling equipment, and the building envelope. Each

AC system's cooling capacity must maintain 75ºF with 50% relative humidity when the outside air temperature is at design conditions.

(4) Building minimum and maximum operating parameters: A single AC unit must maintain the interior temperature of the building between 73 degrees (dry bulb) Fahrenheit, and 77 degrees (dry bulb) Fahrenheit, and maintain the humidity in the building of not more than 55%.

(5) The AC system must be equipped with a remote controller for the dual unit control system and thermostat, to periodically and automatically switch between the primary and secondary units. See ***Toll Facility TSP Library***, TEB Package, TSP Sections for ***Ductless Split System AC for TEB Sites*** and ***Dual Air Conditioner Control System and Sequence of Operations for TEB Sites*** for additional requirements.

(6) The sensible heat gain calculations must take into account the following:

(a) The heat output of each tolling equipment space and toll communications cabinet must be included in the calculation at a rate of 1.0kW.

(b) Refer to ***FDM 283.3*** for the number of tolling equipment spaces per TEB.

(c) See ***Exhibit 283-29*** for additional requirements for AC infrastructure.

283.5.3 Condensate Piping and Dry Well

(1) Dry well for AC condensate must be provided.

(2) See ***Exhibit 283-30*** for additional requirements.

(3) See ***Toll Facility TSP Library***, TEB Package, TSP Section for ***Piping and Specialties for TEB Sites***.

283.5.4 Fuel Storage Tanks and Fuel Oil Piping

(1) See ***Exhibit 283-31*** and ***Exhibit 283-32*** for fuel oil piping routing and accessories.

(2) See ***Exhibit 282-19*** for fuel tank hold-down details.

(3) See ***Toll Facility TSP Library***, TEB Package, TSP Sections for ***Concrete Protected Above-Ground Fuel Storage Tank for TEB Sites*** and ***Fuel Oil Piping*** for TEB Sites for additional requirements.