

# CHAPTER 9

# PARKING STRUCTURES



## TABLE OF CONTENTS

<b>I. DESIGN INTENT .....</b>	<b>9-1</b>
I.A PURPOSE.....	9-1
<b>II. APPLICATION .....</b>	<b>9-2</b>
II.A GENERAL.....	9-2
II.A.1 Program and Design Guidelines .....	9-2
<b>III. SITE PLAN .....</b>	<b>9-3</b>
III.A GENERAL.....	9-3
III.A.1 Phasing and Sequencing.....	9-3
III.A.2 Pedestrian Connectivity.....	9-3
III.A.3 Landscape Plans .....	9-3
III.A.3 Storm Water Management .....	9-4
III.A.4 Environmental / Permitting.....	9-4
III.A.5 Utilities .....	9-4
III.A.6 Traffic Circulation .....	9-4
III.A.7 Erosion and Sediment Control .....	9-4
III.A.8 Fencing .....	9-4
III.A.8 Landscaping.....	9-5
<b>IV. ARCHITECTURAL .....</b>	<b>9-6</b>
IV.A FUNCTIONS OF THE BUILDING.....	9-6
IV.B ACCESSIBILITY .....	9-6
IV.B.1 Location.....	9-6
IV.B.2 Pedestrian Path .....	9-6
IV.C ELEVATORS .....	9-6
IV.D EXTERIOR APPEARANCE .....	9-6
IV.E BUILDING CODE .....	9-6
IV.F CONSTRUCTION MATERIALS.....	9-6
<b>V. PARKING.....</b>	<b>9-7</b>
V.A FUNCTIONAL DESIGN.....	9-7
V.A.1 Geometry.....	9-7
V.A.2 Ramps.....	9-7
V.A.3 Signage.....	9-8
V.B MISCELLANEOUS .....	9-8
<b>VI. STRUCTURAL.....</b>	<b>9-9</b>
VI.A GENERAL REQUIREMENTS.....	9-9
VI.B APPLICABLE CODES AND STANDARDS.....	9-9
VI.B.1 Design Loads.....	9-9
VI.B.2 Foundations.....	9-9
VI.B.3 Retaining Walls .....	9-9
VI.B.4 Structural System .....	9-9
VI.B.5 Expansion Joints .....	9-10
VI.C CONCRETE REQUIREMENTS.....	9-10
VI.C.1 Pretopped Precast Prestressed Concrete.....	9-10
VI.C.2 Slab on Grade Concrete .....	9-11
VI.C.3 Miscellaneous Requirements.....	9-11

<b>VII. MEP, FIRE PROTECTION &amp; SECURITY</b> .....	<b>9-12</b>
VII.A MECHANICAL SYSTEM .....	9-12
VII.B ELECTRICAL SYSTEM .....	9-12
VII.C PLUMBING SYSTEM .....	9-12
VII.D FIRE PROTECTION SYSTEM .....	9-12
<i>VII.D.1 Location</i> .....	9-12
VII.E SECURITY.....	9-12
<i>VII.E.1 Passive Security</i> .....	9-12
<i>VII.E.2 Active Security</i> .....	9-13
<i>VII.E.3 Materials &amp; Performance</i> .....	9-13
VII.F SIGNAGE AND WAY FINDING.....	9-14
<i>II.B.1 Location</i> .....	9-14
<b>VIII. GREEN DESIGN</b> .....	<b>9-15</b>
VIII.A SUSTAINABLE SITES (SS) .....	9-15
<i>VIII.A.1 SS Credit 8: Light Pollution Reduction</i> .....	9-15
VIII.B WATER EFFICIENCY (WE) .....	9-15
<i>VIII.B.1 WE Prerequisite 1: Water Use Reduction</i> .....	9-15
<i>VIII.B.2 WE Credit 2: Innovative Wastewater Technologies</i> .....	9-15
<i>VIII.B.3 WE Credit 3: Water Use Reduction</i> .....	9-15
VIII.B ENERGY & ATMOSPHERE (EA).....	9-15
<i>VIII.B.1 EA Credit 1: Optimize Energy Performance</i> .....	9-15
<i>VIII.B.2 EA Credit 2: On-site Renewable Energy</i> .....	9-15
<i>VIII.B.3 EA Credit 3: Enhanced Commissioning</i> .....	9-15
<i>VIII.B.4 EA Credit 4: Enhanced Refrigerant Management</i> .....	9-15
<i>VIII.B.5 EA Credit 5: Measurement and Verification</i> .....	9-15
<i>VIII.B.6 EA Credit 6: Green Power</i> .....	9-15
VIII.C MATERIALS & RESOURCES (MR) .....	9-16
<i>VIII.C.1 MR Credit 4: Recycled Content</i> .....	9-16
<i>VIII.C.2 MR Credit 5: Regional Materials</i> .....	9-16
<i>VIII.C.3 MR Credit 6: Rapidly Renewable Materials</i> .....	9-16
<i>VIII.C.4 MR Credit 7: Certified Wood</i> .....	9-16

## I. DESIGN INTENT

### I.A PURPOSE

Parking is an essential need for passengers of TRI-RAIL. Gas prices, development of surrounding areas, lease agreements, and shared parking agreements affect the amount of available parking spaces that our stations have. Based on the *2008 Tri-Rail Parking Needs and Opportunities Study* additional parking is required to increase ridership, and be able to meet future demands.

The *2008 Tri-Rail Parking Needs and Opportunities Study* projects ridership increases to the year 2025 at all currently existing Tri-Rail stations. One of the options available to provide additional parking is by constructing a parking structure. This chapter will provide general guidelines for a parking structure at a TRI-RAIL station, based on the first parking structure design from the Fort Lauderdale Airport Station.

## II. APPLICATION

### II.A GENERAL

Parking structures provide more parking for passengers of a particular station. In some cases, parking structures will also improve traffic circulation and visibility of the station. Some of the design aspects that will be included in a parking structure are as follows:

- Phasing and Sequencing
- Environmental Permitting
- Utilities
- Traffic circulation
- Stormwater management / drainage
- Erosion and Sediment Control
- Landscape and irrigation
- Architectural compatibility
- Sustainability
- Pedestrian connectivity
- Safety
- Signage

#### II.A.1 Program and Design Guidelines

A parking structure shall be planned to meet future parking demands as delineated in the *2008 Tri-Rail Parking Needs and Opportunities Study*, or its latest version.

## III. SITE PLAN

### III.A GENERAL

Site plan and associated roadway improvements (where needed) must adhere to the following standards: AASHTO, FDOT's Standard Specifications, FDOT's current memorandums, current editions of the FDOT's Roadway Plans Preparation Manual, FDOT's Flexible Pavement Design Manual, FDOT's Rigid Pavement Design Manual, FDOT's Drainage Manual, and jurisdictional municipalities' minimum design standards.

It is anticipated that proposed parking facilities will be comprised of a precast, pre-stressed concrete parking structure and will support parking capacity for vehicles, motorcycles, and bicycles.

#### III.A.1 Phasing and Sequencing

The designer shall consider the existing site, and all required site demolition. Site infrastructure currently existing in the vicinity of the structure, and which is proposed to remain shall be maintained and protected.

Site improvements shall be constructed in conjunction with the proposed improvements, which may consist of features required for tie-ins to new or existing infrastructure. These site improvements include but are not limited to connections to drive aisles, water, storm drainage, electrical, phone or other utilities, landscaping, site lighting, and site way finding signage.

#### III.A.2 Pedestrian Connectivity

The parking facility shall allow for

pedestrian connection to the existing SFRTA Tri-Rail Station through use of elevators, stair towers and ground level raised walkways. Transition areas shall be provided between the parking facility and the Tri-Rail Station, the ground level. Where a parking structure is being added to an existing station, finished floor elevations shall match the existing Tri-Rail Station elevation.

Elevator/stair tower shall be centrally located on edge of the parking facility closest to the station, in order to reduce the amount of vehicular lanes required to be crossed by pedestrians. A minimum of 2 elevators with stairs, and one additional stair tower shall be provided in the parking structure, to meet minimum life safety guidelines.

#### III.A.3 Landscape Plans

All planting and irrigation plans are to be prepared in accordance to design standards and practices of AHJ.

The planting and irrigation plans shall include at least three (3) levels of planting that step up to the proposed parking structure on the face or faces that are most visible to the public. These three planting levels are as follows:

- i. Minimum 4' feet wide of ground cover;
- ii. Minimum 4' wide by minimum 36" height shrub mass at time of planting;
- iii. Minimum 4' wide by 60" height shrub/small tree at time of planting.

A landscape foundation surrounding the parking structure may require clusters of palms or trees, as per requirements of the AHJ. A tree removal and mitigation plan, might also be required prior to the start of any demolition.

The planting and irrigation plans shall be designed for watering restrictions enforced

by SFWMD for the various drought conditions.

### III.A.3 Storm Water Management

All Storm Water Management design methodology and associated plans will have to meet the requirements described in the South Florida Water Management District (SFWMD) Environmental Resource Permit Information Manual Volume IV for compliance and completeness.

The storm water drainage design and construction shall be complete as required to remove or modify the existing surface water management system and to provide the additional improvements required to meet the water quality and water quantity requirements of the permitting and approval agencies.

In cases where a parking structure is adjacent to an existing Tri-Rail station, surface water management system must be designed for the proposed improvements and to maintain the same level of service for drainage from the existing station.

### III.A.4 Environmental / Permitting

Construction approval/permitting will be required through AHJ. As a requirement to the storm water management permit, a Storm Water Pollution Protection Plan (SWPPP) will be required for the site.

### III.A.5 Utilities

A water main extension may be required to provide adequate fire protection for the parking structure. The water main extension shall be in general accordance with applicable American Water Works Association (AWWA) standards.

Electrical, site lighting, and phone service shall be provided for the proposed structure. If a proposed parking structure is adjacent to an existing Tri-Rail station,

electrical, site lighting, and phone service shall be maintained in operation and protected during construction.

### III.A.6 Traffic Circulation

The level of traffic circulation must be maintained or improved with the addition of the parking structure. Bus lanes with bus bays, kiss-n-ride, and taxi lanes shall be maintained separated on the lower level of the structure, or around the exterior of the structure.

Passenger drop-off / pick-up areas shall be eight feet minimum in width, and shall meet all ADA requirements to accommodate wheelchair lifts, and accessible loading areas.

It is preferable that a concrete divider is used to protect and to guide patrons to the designated cross walks. Width of the concrete barrier shall be taken into consideration to ensure sidewalk has eight feet minimum clearance.

Parking and revenue control systems shall be incorporated to be easily installed in the future.

### III.A.7 Erosion and Sediment Control

A National Pollutant Discharge Elimination System (NPDES) Permit shall be obtained prior to construction of the structure, as required by the Florida Department of Environmental Protection (FDEP), and shall be installed and maintained according to minimum standards and specifications of the Florida Stormwater, Erosion and Sedimentation Control Inspector's Manual, July 2008.

### III.A.8 Fencing

- i. **Permanent:** Permanent fencing or concrete barriers may be required as indicated in the site plan for back-up generators, pedestrian protection, access, and guidance to cross-walks.

- Permanent fencing must match the materials and characteristics as required by the applicable jurisdiction, and the surrounding development.
- ii. **Temporary:** Temporary construction fencing must be installed in conjunction with construction of the site improvements, maintenance of traffic, and access to the Station.

### III.A.8 Landscaping

Landscape consisting of shrubs and trees shall be provided to screening along the exterior walls of the parking garage. Landscaping materials and design shall meet the requirement of the municipality having jurisdiction, and shall complement the existing landscaping in the surrounding property.

The type of irrigation system and specifications shall be compatible with or replace the existing irrigation system on site. Existing trees or palms to remain shall be protected with a 5' tall construction fence, creating a min. 8' x 8' square around the tree or palm during construction.



## IV. ARCHITECTURAL

### IV.A FUNCTIONS OF THE BUILDING

- i. Parking of automobiles and small, handicap-accessible vans. Facility shall serve as both long and short term patron parking.
- ii. Support rooms for electrical equipment, telecommunications, security equipment, and general storage.
- iii. Parking control booths and/or revenue collection station.

### IV.B ACCESSIBILITY

#### IV.B.1 Location

Accessible parking shall be located throughout the parking facility. The parking functional design must meet the code required quantity, size, and clearances of normal and van accessible spaces.

Van Accessible stalls shall be grouped together and located on the ground level due to the higher structural clearance already required for bus circulation, as well as closer proximity to the Tri-Rail Station.

#### IV.B.2 Pedestrian Path

Care should be taken to ensure that all accessible routes are provided to allow direct and accessible movement between the parking facility and the egress exit.

The pedestrian path of travel from these accessible parking spaces to the Tri-Rail Station shall be accessible and shall include walkways, stairs and elevators. Also, accessible paths of travel shall not pass behind any parking stall.

### IV.C ELEVATORS

For elevator guidelines, please refer to Chapter 7 – Conveying Systems.

### IV.D EXTERIOR APPEARANCE

The parking facility must be designed in accordance with the corresponding municipality codes. The architectural plans including elevations must be designed to be architecturally compatible with the existing SFRTA Tri-Rail Station structures and the surrounding area and must be approved by SFRTA.

Due to the massive size of a parking facility, the exterior appearance should be visually attractive and complementary to the surrounding SFRTA facilities and site areas. A structure that is exciting, interesting, efficient, durable, and safe is the desired outcome.

### IV.E BUILDING CODE

The proposed parking facility shall be designed in accordance with the latest edition of the Florida Building Code, all applicable referenced codes, and all other AHJ. In the event of a discrepancy between code regulated minimum standards, as well as the standards presented herein, the more stringent shall apply.

### IV.F CONSTRUCTION MATERIALS

All hand rails, guardrails, hand rail connections, or other exposed steel will be stainless steel.

Façade will be constructed of precast concrete panels with architectural features that are compatible with the surrounding development.

## V. PARKING

### V.A FUNCTIONAL DESIGN

#### V.A.1 Geometry

- i. The ingress / egress and internal circulation within the parking facility must be supported by a substantiated analysis prepared by the Parking Consultant acceptable to SFRTA.
- ii. Surface parking must accommodate a single bay of 90-degree parking, full vehicle access throughout the site, as well as allow for bus and vehicular circulation drop-off and pick-up lanes.
- iii. Vehicles shall navigate the parking structure via two-way drive aisles along the length and two-way drive aisles on the ends. Parking stalls along the length shall be 90-degree stalls, and are 9'-0" wide (perpendicular to stalls) by 18'-0" long.
- iv. Parking stalls on the ends shall be 90-degree stalls with dimensions of 9'-0" wide by 18'-0" long. At end bays, a striped buffer no smaller than 2'-0" shall be provided between the last parking stall and the drive aisle.
- v. Handicap stalls are 12'-0" wide by 18'-0" long with the code required access aisle and appropriate signage.
- vi. A minimum of 16'-2" vertical clearance is required between surface parking level and the next elevated parking level to allow bus circulation for pick-up and drop-off. Van accessible parking shall be located on ground level P1.
- vii. A minimum of 8'-4" vertical clearance is required between the second parking

level and all other levels above for handicap spaces and vehicular access routes. A review of federal ADA and local accessibility regulations is required.

- viii. All floor surfaces shall be positively sloped for drainage. The floor cross slope, measured from the high point to the drain, shall be within the range of 1-1/4% (minimum) to 2% (maximum). Care should be taken in a precast system to take into account the camber of double tee beams. In addition to camber, warping stresses of the double tees should also be reviewed carefully. Drains shall not be located such that they straddle two adjacent double tee beams.
- ix. Care shall be taken to ensure that columns, pipe guards, and risers do not significantly encroach into the parking spaces. Should a design condition result in a vertical element (column or precast wall) located within the parking module, the minimum space width shall be increased by 10" to account for increased maneuverability difficulty.
- x. To avoid potential tripping hazards and injury claims, wheel stops in front of parking stalls should be minimized throughout the parking facility. Use wheel stops only as required by the AHJ.

#### V.A.2 Ramps

External express ramp are preferred, and shall be the only mechanism for vehicles to move between floors. Express ramping shall not exceed a maximum slope of 14% and must include transition slopes equal to ½ of the main ramp slope and be at least 12' long at each end of the ramp.

Express ramps must be designed to minimize dangerous encounters between vehicles and pedestrians.

**V.A.3 Signage**

Site signage shall be incorporated and installed, according to the proposed construction phasing, to help direct patrons, and shall be in accordance with Chapter 8 – Station Signage, as well as TRI-RAIL’s Internal Signage and Graphics Manual.

**V.B MISCELLANEOUS**

- i. Provide steel bumper guards at all electrical conduits, plumbing risers, and fire protection risers within the strike zone of a vehicle.
- ii. Provide concrete-filled steel pipe bollards to protect utility rooms.

## VI. STRUCTURAL

### VI.A GENERAL REQUIREMENTS

The parking structure is to be designed for a 50-year design life. This is accomplished by considering long-term durability at each level of design. Parking structures that reflect attention to detail generally require less maintenance and repair during their design life, resulting in lower costs of operation, fewer disruptions in service, and a more aesthetically pleasing building.

### VI.B APPLICABLE CODES AND STANDARDS

Final design shall comply with the latest edition of the Florida Building Code and all applicable referenced codes. In addition, the following criteria should be met as a minimum:

- i. ACI 301 – “Specification for Structural Concrete for Buildings”
- ii. ACI 318 – “Building Code Requirements for Structural Concrete”
- iii. ACI 362 – “Guide for the Design of Durable Parking Structures”
- iv. ASCE 7 – “Minimum Design Loads for Buildings and Other Structures”

#### VI.B.1 Design Loads

Structural design loads shall be in accordance with the latest edition of the Florida Building code and all applicable referenced codes. These referenced codes include, but are not limited to the American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures (ASCE-7) and American Concrete Institute

Building Code Requirements for Structural Concrete (ACI-318).

#### VI.B.2 Foundations

Foundation alternatives shall be based on the field subsurface exploration results obtained from a geotechnical investigation. Based on the existing soil conditions, anticipated column axial loads, and code mandated lateral wind loads, both shallow foundations and deep foundations may be considered for design.

#### VI.B.3 Retaining Walls

Cast-in-place concrete cantilever retaining walls may be necessary to retain the soil around the ground level of the parking facility. These walls shall be structurally isolated from the parking facility superstructure.

Waterproofing behind all retaining walls is required to prevent moisture intrusion through the concrete walls. Sheet or cold-applied waterproofing membranes are acceptable for the cast-in-place cantilever retaining walls. In an effort to promote positive water drainage, granular backfill shall be placed directly behind the retaining walls in addition to providing subdrains along the wall base. Also, filter fabric shall be installed between the granular backfill and the existing soils.

#### VI.B.4 Structural System

Parking structures shall be constructed of precast, pre-stressed concrete including, but not limited to, double tees, inverted tee beams, spandrel panels, and columns.

Long-span construction is preferred to minimize vehicular conflicts, sight line constraints, and increase the parking efficiency. Pre-topped is preferred over field-topped for durability, quality of surface finish, and speed of construction.

In addition, the following structural design items shall be included in design of the

parking structure:

- i. Anticipate that the ground level surface will be subjected to both vehicular traffic as well as bus traffic. Bus travel lanes and passenger loading bays shall feature heavy duty pavement design, or concrete with a minimum thickness of 7 inches with the necessary reinforcement. Vehicular travel lanes and passenger loading bays shall feature standard roadway pavement design. Parking areas on the ground level shall be concrete slab-on-grade with a minimum of 5-in thickness. The slab-on-grade shall be thickened along all edges, slab-on-grade transitions in slope and to elevated structure, as well as beneath non-load bearing CMU walls and partitions if not supported on isolated strip footings.
- ii. All horizontal concrete slab surfaces shall be finished with a medium broom finish to provide a non-slip surface throughout.
- iii. Concrete masonry units shall act as partition walls for the accessory rooms located throughout the parking deck. These walls are not load-bearing for gravity or lateral loads.
- iv. Exterior vehicular restraint shall be accomplished through use of solid precast concrete structural spandrels. A minimum spandrel height of 30-inches, measured from top of precast double tee, is required to satisfy vehicular restraint requirements. Barrier cable or galvanized handrail may be required above the top of spandrel, up to 42-inches measured above top of precast double tee, to meet pedestrian fall protection requirements.

#### VI.B.5 Expansion Joints

An expansion joint shall be provided to alleviate distress due to volumetric

changes. Expansion joints shall also be used to isolate stair towers and express ramps from the main structure. Total movement of these joints shall include, at minimum, wind movements, thermal movements, shrinkage, elastic shortening and creep, and shall be carefully evaluated in sizing the joint openings. The expansion joint material must be able to function appropriately under these anticipated movements.

A raised wash on both sides of the expansion joint shall be provided, to promote positive drainage away from the expansion joint seal system. In addition, the expansion joint shall be located at the drainage high point so that water does not collect or cross the joint under typical drainage scenarios.

A minimum 5 year joint warranty shall be provided.

### VI.C CONCRETE REQUIREMENTS

Durability requirements of ACI 362, "Guide for the Design of Durable Parking Structures" shall be followed based on the requirements of Coastal Chloride Zone I (CC-1) for precast, pre-stressed concrete – pretopped.

#### VI.C.1 Pretopped Precast Prestressed Concrete

- i. Requirements of ACI 301, "Specification for Structural Concrete for Buildings" shall be followed.
- ii. Careful consideration shall be given to concrete cover requirements of the current edition of the Florida Building Code, ACI 362, and ACI 318.
- iii. Minimum compressive strength shall be 5,500-psi.
- iv. A maximum water-to-cementitious material of 0.40 is required.

- v. Air entrained concrete (6.5% +/- 1.5%) shall be used for all concrete above grade.
- vi. Use a minimum of 10% and a maximum of 25% fly-ash in the cementitious material for added durability and sustainability.
- vii. Maximum chloride ion content for total mix shall not exceed 0.06% for horizontal construction and 0.15% for vertical construction.
- viii. Use concrete admixtures, such as corrosion inhibitors, to enhance durability.
- ix. Field tests of fresh concrete shall include: Sampling –ASTM C172, Slump – ASTM C173, Making and Curing Test Specimens – ASTM C31, Air Content – ASTM C231 or ASTM C173, and Unit Weight – ASTM C138.
- x. All connections between double tee flanges and adjacent double tee flanges, spandrel panels, wall panels, and inverted tee girders shall be stainless steel.

#### VI.C.2 Slab on Grade Concrete

- Minimum compressive strength shall be 4,500-psi.
- A maximum water-to-cementitious material of 0.45 or less is required.
- Air entrained concrete (6.5% +/- 1.5%) shall be used.

#### VI.C.3 Miscellaneous Requirements

At a minimum, traffic bearing membranes (traffic coatings) shall be applied to concrete surfaces directly over any rooms or occupied space. Membranes shall be specifically applicable to vehicular and pedestrian traffic, have a minimum of 60 dry mills, and provide a slip resistive surface. Membranes shall extend a minimum of 2-ft past the extents of the room footprint. In addition, all vertical terminations shall be a

minimum of 6" up the wall or curb face.

A penetrating silane sealer is recommended for all horizontal surfaces (including the vehicular ramps) in the parking structure. The penetrating silane sealer shall be a minimum of 100% solids with 400 g/L or less of VOCs and not result in any film on the concrete surfaces.

Joint sealants shall be placed between precast elements including the flanges of double tees. Therefore, joint sealants shall be traffic grade sealants specifically suited for exposure to weather, vehicular traffic, and pedestrian traffic.

Use stainless steel for miscellaneous connections and exposed metals. Avoid combinations of dissimilar metals in any connection, joint or member.

Provide elevator pit ladders.

Galvanized 7-wire steel strand barrier cable may be used to resist pedestrian loading at the top of spandrel panels if needed.

Sleeves through structural members and handrails shall be appropriately detailed and sealed to prevent deterioration. Embeds and lifting points for precast members shall be patched and protected following installation.

Provide sleeves through all precast beams and double tee stems that span the parking structure at ¼ points for future conduit installation. Provide a single sleeve through all precast inverted tee girders.

Provide a sealant on the ceiling of the ground level so that smog accumulated due to vehicular running engines, can easily be cleaned off.

## VII. MEP, FIRE PROTECTION & SECURITY

### VII.A MECHANICAL SYSTEM

Packaged terminal HVAC equipment shall be provided for specialized spaces within the proposed parking facility which require cooling; electric heaters shall be provided for spaces that require heating only; and exhaust fans and louver systems shall be provided for ventilation as required.

### VII.B ELECTRICAL SYSTEM

Provide infrastructure as appropriate to match power service for the parking facility.

All electrical conduits should be exposed, due to durability and maintenance benefits.

Provide one (1) GFCI electrical outlet (20-amps, 120-volts) in each stair tower at each floor landing, one (1) in the elevator pit, and one (1) in the elevator control closet.

All lighting shall be designed to the IESNA recommended illumination levels for parking facilities.

Parking facility interior perimeter lighting and stair tower lighting shall be placed on a separate circuit, with photovoltaic controls at each floor to accommodate powering down lights during daylight operations.

For more specifications on lighting requirements, please refer to Chapter 6 – Electrical Systems, and Chapter 10 – Green Design.

### VII.C PLUMBING SYSTEM

Drain heads should be large with large net free areas. The use of sediment traps in

drains should be considered, where practical, to help prevent disruption.

Proposed horizontal plumbing lines shall not decrease the vertical head room design of the parking facility.

All vertical utility lines, including risers, shall be protected by a steel pipe guard designed to resist vehicular bumper contact. Install bumper guards within the strike zone of a vehicle.

Parking facility drains shall be tied to the stormwater system. Provide all needed water quality treatment (e.g. oil separation, sand filtration) and water quantity treatment measures as required.

Wash down hose connections with manual drain down system shall be provided.

### VII.D FIRE PROTECTION SYSTEM

#### VII.D.1 Location

Install dry standpipe system for fire protection in conformance with local fire code regulations.

- i. Provide a 3'-0" wide access aisle to every standpipe connection.
- ii. The location of Siamese connection shall be coordinated with the local fire code official.
- iii. Provide fire extinguishers, evenly dispersed throughout each parking level, and located such that they can be easily accessed.
- iv. Provide fire and smoke detectors at all elevator lobbies in conformance with local fire code regulations.

### VII.E SECURITY

#### VII.E.1 Passive Security

Provide the following passive security measures:

- i. Glasped backed elevators and open stair towers to allow clear visibility from the inside out and from the outside in.
- ii. Maximize openness around the perimeter of the parking deck to accommodate increased natural light.
- iii. Minimize interior solid structural walls or corners which might be perceived as unsecure areas.
- iv. Incorporate a facility lighting system that is well distributed, has a high color rendition index and high color temperature.



**FIGURE 9.1 GLASS BACK ELEVATOR TOWER**

#### VII.E.2 Active Security

Provide the following active security measures:

- i. It is anticipated that a minimum of six (6) CCTV cameras will be provided at a future date on the ground level. Spare conduit shall be provided between the camera locations and the camera control / security room. Final placement of cameras will be evaluated and directed by SFRTA during the design phase.
- ii. It is anticipated that future cameras will be strategically located to monitor the following locations:
  - a. One (1) camera positioned to monitor the base of the express ramp (for revenue control equipment).
  - b. One (1) camera positioned to monitor activity near the main stair and elevator lobby(ies).
  - c. Four (4) cameras positioned to monitor full range vehicular movements located in the central drive aisle(s).
- iii. It is anticipated that a minimum of four (4) CCTV cameras, at each parking level, will be provided to monitor the upper level parking activity. Spare conduit shall be provided between the camera locations and the camera control / security room.
- iv. It is anticipated that these cameras will be strategically located such that one (1) camera is placed near each building corner to monitor both vehicular traffic and pedestrian movements. Final placement of cameras will be evaluated and directed by SFRTA.
- v. "Blue light" security phones shall be anticipated. A minimum of three (3) security phones will be required per floor. There shall be a one inch conduit between phone locations and telecom room and power as directed by SFRTA.

#### VIII.E.3 Materials & Performance

- i. Sign surface materials shall be UV- and graffiti-resistant, and shall require minimal maintenance beyond periodic cleaning; such cleaning shall not require proprietary cleaning solutions or methods.
- ii. Signs shall be designed and installed to withstand heavy (100 mph+) wind loads, and to discourage tampering.



Sign components shall be assembled and mounted using tamper-proof fasteners.

## VII.F SIGNAGE AND WAY FINDING

Signage shall be installed in accordance with the conventions described in TRI-RAIL's Internal Signage and Graphics Manual, Chapter 8 of these guidelines, and the following:

### II.B.1 Location

Signs shall not be located in a manner which obstructs building fenestrations or distinctive architectural features.

- i. **Visibility:** Signs shall be installed in locations which maximize their visibility, and which are free of encroachment by advertising panels, station structural elements, landscaping and other vegetation, and the like.
- ii. **Placement Priority:** Station identification, destination, directional, exit, and regulatory signs shall have priority in placement over information and advertising signs.

## VIII. GREEN DESIGN

The following LEED prerequisites and credits apply to this Chapter. These criteria shall be implemented on each project as applicable, and as far as the budget allows. Criteria to meet each prerequisite and credit shall be in accordance to the latest version of LEED New Construction and Major Renovations

### VIII.A SUSTAINABLE SITES (SS)

#### VIII.A.1 SS Credit 8: Light Pollution Reduction

The intent of this credit is to minimize light trespass from the building and site.

### VIII.B WATER EFFICIENCY (WE)

#### VIII.B.1 WE Prerequisite 1: Water Use Reduction

The intent of this prerequisite is to reduce water demand of the facilities by 20% when compared to a baseline, not including irrigation.

#### VIII.B.2 WE Credit 2: Innovative Wastewater Technologies

The intent of this credit is to reduce wastewater generation by reducing potable water demand of the facilities 50%, or treat 50% of the wastewater on site.

#### VIII.B.3 WE Credit 3: Water Use Reduction

The intent of this credit is to reduce water demand of the facilities beyond the 20% required in WE Prerequisite 1.

### VIII.B ENERGY & ATMOSPHERE (EA)

#### VIII.B.1 EA Credit 1: Optimize Energy Performance

The intent of this credit is to increase energy efficiency performance.

#### VIII.B.2 EA Credit 2: On-site Renewable Energy

The intent of this credit is to encourage use of renewable sources of energy for consumption of the stations and ancillary structures.

#### VIII.B.3 EA Credit 3: Enhanced Commissioning

The purposed of this credit is to promote early commissioning in the design phase, and have additional activities after performance verification.

#### VIII.B.4 EA Credit 4: Enhanced Refrigerant Management

The intent of this credit is to support early compliance of not using refrigerants.

#### VIII.B.5 EA Credit 5: Measurement and Verification

The intent of this credit is to encourage ongoing accountability of the structure's energy consumption.

#### VIII.B.6 EA Credit 6: Green Power

The intent of this credit is to encourage the development and use a grid-source, renewable energy technology to provide a minimum of 35% of the station and ancillary structures' energy demand for a minimum of 2 years.

## VIII.C MATERIALS & RESOURCES (MR)

### VIII.C.1 MR Credit 4: Recycled Content

The intent of this credit is to incorporate the requirement to use recycled materials, or the recycled material content in the design and specifications.

### VIII.C.2 MR Credit 5: Regional Materials

The intent of this credit is to encourage and increase the use of local materials by reducing impacts due to transportation.

### VIII.C.3 MR Credit 6: Rapidly Renewable Materials

The intent of this credit is to encourage the use of rapidly renewable materials, such as bamboo, cotton, linoleum, and cork.

### VIII.C.4 MR Credit 7: Certified Wood

The intent of this credit is to encourage environmentally responsible forest management, by utilizing certified wood.

**END OF CHAPTER**