## SECTION 3 – CIVIL DESIGN

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## 3.1.0 GENERAL

This Design Criteria establishes the minimum standards to be used in the design of RTD bus transit facilities. This section is intended to direct the Design Engineer in the civil engineering design at all RTD bus transit facilities.

## 3.2.0 SURVEY

An ALTA survey is required for all new facilities and expansions of existing ones, unless one already exists that is less than 2 years old or it is otherwise determined by RTD that none is required (i.e., small or limited service facilities for street-side stops). RTD's minimum requirement from an ALTA Survey includes items 1-15 from Table A of the 2005 edition of ALTA/ACSM Land Title Survey, and shall include the following or additional items:

- Item #11 –Include locations horizontally and vertically for Storm Sewers (rims and inverts at manholes, inlets and outlets), Sanitary Sewers (rims and inverts at manholes), Gas Mains (potholed elevations), fiber optic lines (potholed elevations), water mains and appurtenances.
- Item #12 – Per the requirements of the local jurisdiction.
- Include any other physical planimetric features including landscaping and fences, and also topography, as stipulated, within fifty-(50) feet of the site. Topography shall include 1 foot contours and spot elevations as appropriate.
- Include easements, rights-of-way (ROW) and other jurisdictional, utility, RR or special district encumbrances.

The electronic format of the survey shall be in a matching project/world coordinate system, project base point and scale. RTD's standard vertical datum is the North American Vertical Datum of 1988 (NAVD 88) and shall be used unless written permission has been received from RTD to use another datum.

## 3.3.0 GEOTECHNICAL

### 3.3.1 Pavement Design

A geotechnical investigation and pavement designs are required for new or expanded major facilities (i.e., pnR, BRT stops and transfer station) unless a relevant report acceptable to RTD already exists for the area under consideration. Pavement designs are required for both patron vehicle and bus loadings and shall include recommendations for both Portland Cement Concrete (PCC) and Hot Bituminous Pavement (HBP). Pavement designs shall be based on the 20 year 18,000 pound equivalent single axle load (18K ESAL). Pavement designs shall be prepared in accordance with the Metropolitan Government Pavement Engineers Council (MGPEC) criteria and shall include a life cycle cost analysis.

Recommendations of "over excavating" for the subgrade preparation of surface parking areas that exceed 1 foot in depth should be avoided and alternative solutions explored. Subgrade preparation (i.e., moisture treatment, lime stabilization or other) in excess of 1 foot shall be evaluated on a case-by-case basis and alternative solutions shall be explored. In all cases the subgrade should be evaluated to determine its structural bearing capacity. Additional geotechnical investigations shall include determining "R" value, plastic/liquid limit and plasticity index (PL/LL/PI), shrink-swell potential and other applicable criteria based on site conditions.

Geotechnical investigations (including sampling frequencies) for pavement design purposes shall be conducted in accordance with MGPEC criteria.

There are three typical load carrying pavements at a facility:

- The first (heaviest load-carrying) pavement is for bus lanes and bays. To lessen pavement rolling and rutting, they shall be PCC 10-inch depth, or as recommended by a pavement design prepared by a registered Professional Engineer. All PCC pavements shall include curb and gutters that are monolithically poured and tied to the PCC pavement with dowels per RTD Standard Drawings. Pavement thicknesses less than 10" depth for bus lanes and bays shall be approved by RTD in writing.
- The second pavement type is for patron vehicle circulation or parking. It may be constructed with hot bituminous pavement (HBP) or PCC. PCC pavement is preferred, but HBP may be better for specific applications due to light reflectivity or cost considerations. The minimum circulation route pavement thickness is 8 inches, or as recommended by a pavement design prepared by a registered Professional Engineer.
- The third pavement shall be for walkway, plaza and other pedestrian areas. It shall be constructed with polypropylene fiber mesh reinforced PCC, 6-inch thick, capable of bearing maintenance and snow removal vehicles.

Concrete for PCC pavement shall be CDOT mix design class "P", 4200 psi at 28 days. CDOT mix design class "B", 3000 psi at 28 days may be used for walkways, plazas and curb and gutter with approval from RTD.

Hot bituminous pavement shall be in accordance with the MGPEC Pavement Design Standards and Construction Specifications. Generally, hot bituminous pavement grading "SX" should be used for the top lift of pavement and grading "S" for the lower lifts. The Design Engineer shall include a completed MGPEC Form 9 as part of the Technical Specifications for specifying hot bituminous pavement.

As allowed by local jurisdictions and directed by RTD, temporary parking lots may be paved with gravel, crusher fines or recycled materials. They shall be

stabilized with a minimum 6-inch thick layer of compacted recycled asphalt. Temporary facilities may be excluded from the requirement of a geotechnical report and pavement design with approval from RTD.

All pavement subgrade shall be treated with a soil sterilant to inhibit future vegetative growth.

### 3.3.2 Soils and Foundation Investigations and Pavement Designs

A Professional Engineer shall prepare a foundation report for all pavements, structures and retaining walls, and gather appropriate information for a stable design, which, in addition to field work, shall include a review of preliminary structure plans, previous foundation reports, as-built plans and historic subsurface conditions information for the proposed structure area. The prior information review shall focus the analysis towards areas of concern before starting fieldwork.

A bore-hole plan approved by RTD shall be established on a site plan layout and shall be relative to proposed foundation, pavement or excavation locations. A drill crew shall collect undisturbed soil samples for laboratory testing and perform appropriate in-situ soil tests.

An engineer or geologist working under the direction and supervision of a registered Professional Engineer shall collect soil samples, perform in-situ and other manual field tests and observations, compile the results, document and record the data, and provide the necessary information to develop the project boring log and final geotechnical report. The report shall include geotechnical design recommendations based on the collected data. The report shall be signed and sealed by the registered Professional Engineer.

After completing the test borings log, the registered Professional Engineer shall analyze geotechnical surface and subsurface information, prepare a geotechnical report, as discussed above, and submit a signed and sealed copy to RTD, which shall include the recommended foundation type, and all pertinent geological foundation design parameters.

The report, at a minimum, shall include:

- Site conditions (current and historic)
- Geologic conditions
- Site investigations
- Subsurface conditions
- Recommendations
- Limitations
- Surficial geology
- Surficial geology map legend
- Plan location of exploratory bore holes

- Bore-hole logs with depth and geologic stratigraphy
- Legends and notes of exploratory borings
- Ground water potential, depth and possible fluctuations
- Summary of laboratory test results
- Soil corrosiveness potential test results
- Sulfide content
- Swell compression test results
- Gradation test results (sieve analysis)
- R value
- Liquid and Plastic Limits (LL and PL)
- Plasticity Index (PI)
- Moisture density relationships (dry density and optimum moisture content)
- AASHTO T-99, T-180 (modified and standard proctor applications)
- Dewatering requirements and recommendations
- Monitoring requirements and recommendations
- Potential utility conflicts
- Pavement Designs
- Other items as determined for the specific site conditions

## 3.4.0 DRAINAGE, EROSION CONTROL AND WATER QUALITY

### 3.4.1 General

Drainage design shall be in accordance with the design standards and technical criteria of the local jurisdictional agency. Whenever the work is located within CDOT right-of-way, CDOT standards as specified in the CDOT Drainage Design Manual shall be followed. Where local jurisdictions have no codes or standards, the design standards and technical criteria provided in the Urban Drainage and Flood Control District's (UDFCD) Urban Storm Drainage Criteria Manual (USDCM) and the CDOT Drainage Design Manual shall be used.

Storm water control and conveyance system design shall not impact adjacent properties upstream or downstream of RTD facilities beyond historic and legal allowances without consent and documented approval from adjacent property owners and governing jurisdictions.

Work within regulatory floodplains shall meet the requirements of the local jurisdiction and FEMA.

### 3.4.2 Hydrologic Criteria

Stormwater design flows shall be determined using methods specified by the design standards and technical criteria of the local jurisdiction. If no methods

are specified, flows shall be determined using the Rational Method or the Colorado Urban Hydrograph Procedure and the Urban Drainage Storm Water Management Model as described in the USDCM, as applicable.

All bus transit facilities, including parking lots and roadway improvements shall be designed in accordance with the design storm frequencies as specified by the technical criteria of the local jurisdiction. If design storm frequencies are not specified, the minor storm system shall be designed for the 5-year storm and the major storm system shall be designed for the 100-year storm. CDOT criteria use only the 100-year storm for major highway crossings. Storm water design shall not impact adjacent properties upstream or downstream of RTD facilities. Drainage design shall consider flows from adjacent properties and shall be designed to accept historic flows from upstream areas. Where stormwater flows from upstream properties cross RTD facilities, the emergency overflow pathway through RTD facilities shall be evaluated and accounted for in site design. Storm sewers, culverts and inlets shall be designed to convey the typical 5-year minor design storm event, unless the local jurisdiction or unusual conditions require larger conveyance elements.

### 3.4.3 Hydraulic Criteria

All storm sewer, hydraulic structures and appurtenances shall be designed in accordance with the design standards and technical criteria of the local jurisdiction as modified by this design manual.

Stormwater shall be conveyed in a system that includes curb and gutter and storm sewer. Stormwater flows in gutter located adjacent to designated pedestrian walkways shall be minimized. The depth of flow in curb and gutter in the minor storm shall be a maximum of 6 inches to prevent inundation and damage to landscaped areas and other adjacent improvements.

### 3.4.4 Storm Sewer

Storm sewer shall be constructed with Class III reinforced concrete pipe (RCP). Where conditions will provide inadequate cover material or excessive structural loading is expected, the class of pipe shall be evaluated and upgraded, if required. Storm sewer crossing LRT shall be Class V RCP.

Pipe material other than concrete, including polyethylene, polyvinyl chloride (PVC) or ductile iron, shall not be used without prior approval from RTD. Area drains within landscaped areas may be constructed with polyethylene or PVC, if they do not cross beneath or drain paved areas and if they do not connect to concrete pipe upstream.

### 3.4.5 Inlets

Type R inlets, as modified by RTD Standard Drawings, shall be used to collect stormwater from curbed areas in accordance with local jurisdictional requirements. Other types of inlets, including Type 13, Type C, slotted-veined grates and combination inlets, shall not be used without prior approval from RTD. Inlets shall be designed to accept design flows with no more than 6 inches of ponding over the inlet in the minor storm. The design ponding depth over inlets in the major storm shall not exceed 9 inches. Inlets shall be placed in sump conditions. The use of on-grade inlets shall be avoided. In public right-of-way, published jurisdictional standards shall take precedence.

Inlet grates in pedestrian areas shall be heel-proof and non-slip, and shall meet all requirements of the ADAAG.

Any structures that vary from agency or RTD standards, including manholes, junction boxes, inlets, vaults or other structures shall require prior approval by RTD.

### 3.4.6 Detention Facilities

Detention facilities shall be provided as required by the local jurisdiction, and shall be designed in accordance with the design standards and technical criteria of the local jurisdiction and Urban Drainage and Flood Control District (UDFCD). Rip-rap, cobbles or other similarly rocky material used for landscaping, erosion control or storm drainage management shall be designed to prevent vandalism. This may include the use of grout, top-soil cover, large or heavy stones, which preclude manual lifting or other agreed upon alternatives. RTD approval shall be obtained prior to specifying these materials. Detention ponding for the 10-year frequency storm shall not extend into parking or other paved areas. Detention ponding may extend into parking areas to a depth of 9 inches in a 100-year storm event, if allowed by the design standards and technical criteria of the local jurisdiction. Detention ponding shall not extend into designated pedestrian routes. Underground detention shall not be used unless approved by RTD and the local jurisdiction. Detention pond outlet structures shall be designed in accordance with RTD Standard Drawings.

### 3.4.7 Permanent Water Quality Facilities

Permanent water quality facilities shall be provided unless the site is served by regional water quality facilities with adequate capacity for the proposed construction. Water quality facilities shall be integrated into the detention pond. Facilities shall be designed in accordance with the design standards of the USDCM Volume 3. They shall not be designed to have a permanent pool of water.

Water quality facilities requiring special maintenance provisions (including facilities constructed with underground vaults) shall not be used unless approved by RTD.

### 3.4.8 Erosion Control

Facility design shall include provisions for erosion control Best Management Practices (BMPs) during construction. BMPs shall be designed in accordance with the design standards and technical criteria of the local jurisdiction. The use of rip-rap or cobbles shall be in accordance with part 3.4.6 of this Manual. If the local jurisdiction does not specify erosion control design standards, guidelines or criteria, then BMPs shall be used in accordance with the USDCM Volume 3.

## 3.5.0 UTILITIES

### 3.5.1 Water Service

The size of the water service taps and meters shall be determined by the demand for both irrigation and domestic uses on site. The cost of the water and sewer taps and post-construction service rates shall be analyzed, and the most economical combination of domestic and irrigation water taps, and sanitary sewer service taps shall be purchased for the site from the local utility district. In some cases, it may be more economical to purchase a separate irrigation tap.

Water service shall be provided to the Drivers Relief Station (DRS) building. The service line shall be constructed in accordance with local criteria. If local criteria do not specify service line requirements, service lines shall be constructed with ¾ inch Type K copper. If a DRS is located more than 50-feet from the water main line, the water service line shall be analyzed for head losses using the American Water Works Association manual Sizing Water Service Lines and Meters (M22). The size of the service line shall be increased as required after the water meter without increasing the tap size.

Generally facility development will not require the construction of utility main lines. If the construction of utility mains is required, utilities main lines shall be constructed in accordance with the standards and criteria of the local utility district. All water mains and service lines shall be buried to a minimum 4.5 foot depth. Excessive burial depths shall be avoided.

Where community water service is not available to the site, a domestic well may be constructed. The design of water well facilities, if required, shall be coordinated with RTD on a case-by-case basis. State permitting and adjudication requirements shall be coordinated with the State Engineer's Office, and the Colorado Department of Public Health and Environment, as required.

If a 1 inch or larger water tap is required for irrigation or other purposes, consideration should be given to installing a 1 inch water service line into the DRS for the purpose of using a tank-less toilet. However, if no other need besides a tank-less toilet exists for a 1 inch waterline tap, a ¾ inch tap and a regular tank toilet shall be used. Utility trench backfill shall adhere to street compaction and materials requirements as defined by local jurisdiction criteria.

### 3.5.2 Sanitary Sewer

Sanitary sewer service shall be provided to the DRS. Service lines shall be constructed in accordance with the design standards of the local utility district. Where local criteria do not specify service line requirements, service lines shall be constructed with 4 inch schedule 40 PVC. Service lines shall be installed with a minimum of 4.5 feet of compacted cover below the ground surface, and shall be installed at a minimum slope of 2% between the DRS and the utility main line, unless topographic constraints require a reduced slope and as approved by RTD.

Generally, facility development will not require the construction of utility main lines. If utility mains are required, they shall be designed and constructed in accordance with the local utility district standards and criteria. Utility trench backfill shall adhere to street compaction and materials requirements as defined by local jurisdiction criteria.

If community sanitary sewer service is not available, alternate waste disposal facilities (self contained DRS) may be constructed. The design of alternate facilities shall be coordinated with RTD, the Colorado Department of Public Health and Environment, Tri-County Health Department, local County Health Departments and local jurisdiction as required.

### 3.5.3 Electrical

Site electrical service shall be constructed in accordance with Section 9 of this Manual. The designer shall coordinate with the electrical service provider to install any conduits or utility sleeves that may be required in order to provide service to the site.

### 3.5.4 Telephone and Communication Services

The local service provider in coordination with RTD shall provide telephone service at all major facilities. Smaller street stops are excluded, unless otherwise warranted. The Design Engineer shall coordinate with the local service provider to locate utility sleeves or conduits to provide service to the site.

A minimum of one public pay phone, as coordinated with the local service provider, shall be provided. Phones shall be placed in a well lit portion of the

passenger plaza waiting area, preferably adjacent to the main pedestrian pathways. Construction sequencing and phasing typically require the contractor to install only the phone conduit and respective pull cord, "mule" rope or tape.

Emergency telephones shall be installed as outlined in Section 12 of this Manual.

Video surveillance and associated equipment, conduits, duct-banks, pull boxes and appurtenances shall be installed as outlined in Section 12 of this Manual.

Communications service to the DRS shall be coordinated with the local service provider to include a minimum 24-pair phone cable. See Section 7 for DRS communications service design criteria. See Section 4 for the irrigation systems communications (remote monitoring) requirements.

## 3.6.0 SITE FURNISHINGS

Site furnishings (benches, trash receptacles, newspaper racks, etc.) shall be specified and installed in accordance with Section 4 of this Manual and RTD Standard Drawings. The designer shall coordinate with local jurisdictions to assure that both local and RTD design criteria are met.

## 3.7.0 SITE LAYOUT

While each facility project has its own unique set of design objectives and constraints and must be looked at on a case-by-case basis, there are certain design parameters that should be adhered to in order to achieve a proper design that is consistent with RTD requirements.

### 3.7.1 Access and Circulation

Bus, pedestrian and private vehicle access onto and through the site should be separated. There should be at least two separate and distinct points of private vehicle ingress and full movement egress that are separate from the bus and pedestrian movements. If this is not feasible, the Design Engineer shall coordinate site access with RTD. The exits and entrances should be located on different streets; however, if site conditions require that they be located on the same street, refer to the local jurisdictions design standards for the minimum separation and further coordinate with RTD. Circulation aisles shall be considered for park-n-Rides (pnRs) in excess of 200 spaces and should be located at the periphery of the parking area to minimize pedestrian and vehicle conflicts. One-way circulation or parking aisles are discouraged.

### 3.7.2 Grading

Local topography shall influence the grading of a site. To ensure functionality of the site, the following grading parameters shall apply. A 1.5 to 2.0% grade is the most desirable for bus lanes. The allowable grade for parking stalls, circulation and access aisles shall be 1.0% (min.) and 5.0% (max.) Mountainous terrain grades for circulation aisles may utilize a maximum 8% grade. Bus access grades shall not exceed 4%. The parking stalls and access aisles for ADA accessible parking shall not exceed a 2% grade.

Horizontal and vertical control and grading shall be shown, measured and designed to curb and gutter flow lines rather than to the top back of curb or any other design feature. Spot elevations shall be shown at all significant surface locations such as plaza areas, walkways, stairs, curb returns, drive cuts, surface drainage features, exposed pipe inverts, swales, pans, gutters, structural elements, finished floor, top and bottom of walls, slopes, and all locations that are designed with minimum or maximum grades, major or minor elevation changes, and areas that are crowded with many graphic elements, numerous lines, tight contours and a variety of functional features.

All travel way (pedestrian or vehicular) slopes shall include gradient percents shown on the drawings. All non-travel way natural, landscaped, cut, fill or existing slopes shall include horizontal to vertical (H:V) grade ratios shown on the drawings. Both travel and non-travel slopes shall include directional arrows showing "+" (up-slopes) and "--" (down-slopes) relative to stationing, as applicable. Emphasis shall be placed on all access locations, curb returns, drive lanes, walkways, bike-ped paths, ramps, landscaped areas, drainage swales, side-slopes, ridges and all features with grades that are less than or greater than the limits of 1% to 3%.

In general, grading for landscape areas should not exceed a slope of 3:1 (H:V) and shall be used only to minimize retaining walls or to maximize adjacent non-landscaped areas. The preferred maximum cut, fill, natural or landscaped slope is 4:1 (H:V). See Section 4, Urban Design and Architectural Elements, for additional criteria about grading in landscape areas.

Parking aisles should be aligned parallel to the primary direction of pedestrian flow. When the topography of the land or site conditions require grades in the facility to exceed 3%, consideration should be given to aligning parking stalls perpendicular to the grade of the lot.

Passenger boarding zones are defined as the area directly adjacent to the bus bay where passengers queue for buses. Passenger boarding zones shall be located on a defined accessible route of travel, which should be the shortest possible route to the ADA accessible parking spaces. The grades

within the passenger boarding zones and the ADA accessible parking spaces should have a minimum slope of 1.0% and may not exceed 2.0% in any direction. Accessible routes shall include ramps and handrails as required by ADA and ADAAG.

Passenger boarding zones are usually located adjacent to plaza areas, which are relatively broad areas that accommodate pedestrian pass thru and passenger waiting sites, often with shelters. Plaza areas shall be relatively flat and, excluding the passenger boarding zones, shall not exceed a 1.0% minimum and 2.0% maximum allowable grade in any direction. A pnR design should have grades that do not exceed 2.0% in any direction for the passenger boarding zones, plaza areas and the defined accessible route of travel. The grades of the bus bay, the adjacent passenger boarding zones and plaza areas need to be reviewed in conjunction with each other to assure that a situation has not been created that interferes with use of the wheel chair lifts on the buses. The walking distance from the plaza area to the most distant parking stall should not exceed 1000 feet and shall not exceed 1500 feet without RTD approval.

### 3.7.3 Islands

A raised island, typically 10 feet (may be reduced if other constraints prevail) wide (FL to FL), should be placed at the ends of each parking row to provide adequate sight distance, aesthetic appearance and meet jurisdictional requirements. The use of painted islands in lieu of a raised island with curb and gutter is discouraged and requires RTD approval. However, if a painted island is used, the width should not exceed 4 feet in order to discourage its use as a parking space.

### 3.7.4 Parking Stalls

Standard parking stall dimensions are 9 feet wide by 18 feet deep. RTD does not normally use compact parking stalls at surface lots, however if site constraints require reduce depths, and the parking spaces are adjacent and perpendicular to a curb, and sufficient depth is available behind the curb, the stall depth can be reduced by 2 feet to 16 feet. If this configuration is used, a 2 foot paved platform behind the curb shall be included to lessen landscape maintenance restrictions. The curb head height for a 16 feet deep parking stall shall not exceed 6 inches. Reduced depth parking stalls are only allowable when permitted by the local jurisdiction and approved by RTD.

Parking stall widths may be reduced to 8.5 feet within a parking structure and shall include double striping. The length of parking stalls within a structure shall be 18 feet. Double striping shall include two 4 inch wide stripes placed 12" on center on both sides. Standard striping may be used within parking structures with approval from RTD.

See Section 5 for bicycle parking criteria.

### 3.7.5 ADA Accessible Parking

ADA accessible parking and access shall conform to the ADAAG.

### 3.7.6 Motorcycle Parking

The number of spaces that should be dedicated for motorcycle parking is unique to each location and shall be determined by demographics and the size of the facility. During conceptual design, a ratio of motorcycle parking to automobile parking shall be 1 to 50 respectively.

See the RTD Standard Drawings for the layout of motorcycle parking. Motorcycle parking can damage asphalt pavement, therefore concrete pavement shall be used for motorcycle parking spaces.

### 3.7.7 Kiss-n-Ride (short-term parking)

The use of kiss-n-rides should be considered for all pnR facilities. Their parking stalls should face and be located near bus loading zones or rail platforms. Locate kiss-n-ride parking stalls near the ADA parking area. The number of kiss-n-ride spaces is unique to each location, as determined by area demographics and ridership and will be as directed by RTD.

Signage indicating that the stall shall be used only as a kiss-n-Ride or a sign limiting the time, typically 15 minutes should be used.

### 3.7.8 Bus Bays and Saw Tooth Geometry

The standard parallel dimensions for bus loading bays are nominally 12 feet by 50 feet for 45 feet long buses, and 12 feet by 70 feet for an articulated bus. The standard access taper is 7:1, and egress taper is 4:1. Refer to RTD Standard Drawings for additional geometric layout information.

### 3.7.9 Internal Lane and Aisle Criteria

Orthogonal parking is the preferred geometry for stalls, curbs and circulation lanes.

As required by limited space, angled (e.g. 45 degrees) parking will be considered on a case-by-case basis in coordination with RTD during the concept design phase. When angled parking is used, aisle direction and width shall be one-way and 15 feet (for 45 degree parking), respectively.

The following acceptable and desirable drive lane widths and curb return FL radii shall apply to two-way drive lanes/aisles:

- Parking Aisle
  - width – 24 feet minimum
  - radius – 2 feet minimum, 5 feet desirable

- Circulation Aisle
  - width – 24 feet minimum, 30 feet desirable
  - radius – 15 feet minimum

- Bus lane
  - width – 30 feet minimum
  - radius – 35 feet minimum
  - Turn lane – 30 feet minimum (inner)
  - Turn lane – 55 feet minimum (outer)
  - Turnaround – 65 feet minimum (outer)

### 3.7.10 Plaza Layout

The layout of the plaza areas shall be coordinated with local jurisdictions to assure that both local and RTD design criteria are met. Refer to Section 4, Urban Design, Architectural Landscape Elements.

## 3.8.0 ACCESSIBILITY STANDARDS

Specific attention shall be given to the most recent version of the Americans with Disabilities Act (ADA), the ADA Accessibility Guidelines for Building and Facilities (ADAAG), the ADA Accessibility Guidelines for Transportation Vehicles and to any supplements that may be issued. Their applicability is noted in several sections of this Manual where apparent or appropriate significance apply. ADA adherence is required for all areas of this Manual, regardless of explicit, implied or lack of reference herein.

## 3.9.0 ROADWAY IMPROVEMENTS

### 3.9.1 General

Based on the requirements of the local jurisdictional authority or site traffic analysis findings, adjacent street improvements shall be designed to accommodate additional traffic accessing proposed bus transit facilities. Such improvements may include turn lanes or a traffic signal, for example. Since these improvements are most likely to be on public right of way, they shall be designed in close coordination with the local jurisdiction.

### 3.9.2 Street Improvements

Unless otherwise specified, all road and street design shall be in accordance with the current specifications and design guidelines of the local jurisdictions. For those cases where the local jurisdictions have no design guidelines, the most current versions of the Colorado Department of Transportation (CDOT) Design Guide, and/or the Policy on Geometric Design of Highways and Streets by the American Association of State Highway and Transportation Officials (AASHTO) shall be used and coordinated with RTD design staff.

### 3.9.3 Traffic Signals and Control Devices

Traffic signals and control devices shall be designed in accordance with local jurisdiction criteria and the Manual on Uniform Traffic Control Devices (MUTCD). The design shall be based on a traffic study and coordinated with the local jurisdiction to ensure compatibility with adjacent traffic signals and traffic patterns. The power source for the signal shall be coordinated with the local utility provider and jurisdiction. When possible, existing easements should be utilized for location of the power service. New easements should be avoided where feasible.

## 3.10.0 SNOW STORAGE AREAS

The Design Engineer shall consider snow removal procedures, maneuvering requirements, and storage for walkways, plazas, roads, drives and parking lots. Designated snow storage areas shall be provided at all RTD bus transit facilities and shall be located within or directly adjacent to areas requiring snow removal. Snow storage areas shall be sized to equal 10% of the areas requiring snow removal, which is based on a design storm of 6 inches and a pile height of 5 feet, excluding consolidation of snow. For larger storms, snow storage will be coordinated with RTD.

Snow storage areas shall be located down gradient and in the vicinity of storm water collection and conveyance features such as curb and gutter, inlets, curb cuts, swales, detention ponds and broad grassy landscaped areas. Locate storage areas to protect structures, roadways, parking lots, walkways or plazas from snow melt runoff. The

Design Engineer shall coordinate the location of snow storage areas with landscaping design so that landscaping is not damaged during snow removal and storage.

Designated snow storage areas shall not impact parking, bus bays, pedestrian traffic or vehicular circulation. Parking areas for snow storage shall be considered on a case by case basis and used only upon receiving written RTD approval.