THE CITY OF EDMONTON
DESIGN-BUILD AGREEMENT
CAPITAL LINE SOUTH LRT EXTENSION PHASE 1

Schedule 5 – D&C Performance Requirements

Part 3: Civil

[NTD: Schedule 5 D & C Performance Requirements – all parts – will be amended July 30 2024 to reflect requirements associated with Appendix A - Affordability Opportunities Amendment Term Sheet]

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PART 3: CIVIL

SECTION 3-1 – TRACK

3-1.1 INFRASTRUCTURE DESCRIPTION

3-1.1.1 Mainline

3-1.1.1.1 Track Applications

A. Direct Fixation Track

1. Provide Direct Fixation Track at the following locations:

    a. 23 Avenue Underpass and portals;

    b. Blackmud Creek LRT Bridge; and

    c. Anthony Henday Drive LRT Bridge.

B. Tie and Ballast Track

1. Provide tie and ballast track at the following locations:

    a. Between Century Park Station and Heritage Valley North Station unless otherwise indicated above as Direct Fixation Track, including within Twin Brooks Station and Heritage Valley North Station.

C. Special Trackwork - Double Crossovers

1. Provide double crossovers at the following locations:

    a. A No. 8 double crossover at a location north of Twin Brooks Station and south of 12 Avenue NW.

    b. A No. 8 double crossover at a location north of and as close to Heritage Valley North Station as the track alignment geometry permits and south of the Llew Lawrence OMF south lead track tie-in to the northbound Mainline Track, in accordance with design requirements for Special Trackwork below.

D. Special Trackwork - Single Crossovers

1. Provide a single crossover at the following location:

    a. A No. 8 left-hand single crossover between the northbound and southbound Mainline Tracks between the north Llew Lawrence OMF lead track tie-in and the Anthony Henday Drive LRT Bridge.

3-1.1.2 Road/Pedestrian Crossings

A. Modular pre-cast concrete crossing panels must be used at the following crossings in accordance with requirements in the HFDG:

1. Road Crossings:

    a. Bus crossing south of Century Park Station (NB track on tangent and SB track on tangent/spiral)

b. Saddleback Road / 19 Avenue NW crossing (SB and NB tracks on tangent)

c. 12 Avenue NW road crossing (SB and NB tracks on tangent)

d. 9 Avenue NW road crossing (SB and NB tracks on tangent/spiral)

e. Bus access north of Heritage Valley North Station (SB and NB tracks on tangent)

2. Pedestrian Crossings:

a. both Mainline Tracks on the south side of Saddleback Road

b. both Mainline Tracks on the south side of 12 Avenue NW

c. SB track at the north end of Twin Brooks Station

d. SB track at the south end of Twin Brooks Station

e. both Mainline Tracks on the south side of 9 Avenue NW

f. both Mainline Tracks on the south side of the bus access north of the Heritage Valley North Station

g. both Mainline Tracks at the south end of the Heritage Valley North Station with provisioning for future GCWS

3-1.1.3 Trackway Delineation

3-1.1.3.1 Based on Appendix 1B in the HFDG, hard barriers for exclusion are required along the At-Grade portions of the mainline Trackway. These should consist of vehicle barriers on the Roadway side of the Trackway and pedestrian exclusion fencing on the non-roadway side of the Trackway.

3-1.1.3.2 Where the Trackway is more than 3 m away from a roadway curb, the hard barrier may transition from a vehicle barrier to pedestrian exclusion fencing.

3-1.1.4 Llew Lawrence OMF

3-1.1.4.1 Track Applications

A. Embedded Track

1. Embedded Track must be provided in the following locations:

a. Within the Llew Lawrence OMF building and for the first 5.0 m outside the building as described in Section 3-1.2.3.2D [*Shop Tracks*] and Section 3-1.2.3.2E [*Yard Tracks*] of this Schedule.

B. Tie and Ballast Track

1. Tie and ballast track should be provided for Yard Tracks within the Llew Lawrence OMF where Embedded Track is not prescribed.

3-1.1.4.2 Special Trackwork - Turnouts

A. Turnouts within the Llew Lawrence OMF yard must be designed and manufactured to AREMA standards and be appropriate for the maximum allowable speed required for the desired application.

B. Yard turnouts may be installed on either hardwood ties or concrete ties as needed to match the type of tie and ballast Yard Track installations.

C. Yard turnouts do not require parking for maintenance vehicles within 50 m.

D. Turnouts must meet the requirements of the HFDG Sections 5.3.1 – "General Requirements" and 5.3.2 "Turnouts".

3-1.1.4.3 Connection to Mainline

A. The lead tracks of the Llew Lawrence OMF connecting the yard to the Mainline Track must provide clear access for LRV consists entering or exiting service in both the NB and SB travel directions in addition to providing separate locations for accessing the yard on either end of the maintenance building and LRV storage building. The lead tracks must meet Mainline Track requirements with the exception of turnouts that must meet the requirements of Section 3-1.1.3.2 [*Special Trackwork - Turnouts*] of this Schedule.

3-1.1.4.4 Yard Crossings

A. At-Grade Crossings within the Llew Lawrence OMF yard are required when access Roadways or pedestrian walkways cross tracks of the Llew Lawrence OMF. The crossings must be located clear of turnouts and yard track equipment.

B. Roadway crossings must be controlled by crossbuck signs (including the number of tracks being crossed) and a STOP sign.

3-1.1.5 Reference Standards

A. Without limiting Section 1-1.7 [*Reference Documents*] of this Schedule, and except as otherwise specified herein, the Design-Builder must develop and implement Design standards for the track alignment, track, and all associated Infrastructure (the "Track Design Criteria") based upon the following guidance, standards and regulations, as adjusted to accommodate all on-track vehicles:

1. Edmonton High Floor LRT Design Guidelines (2022 Edition)
2. Transit Cooperative Research Program (TCRP) Report 155 Track Design Handbook for Light Rail Transit, Second Edition
3. AREMA Manual for Railway Engineering
4. AREMA Portfolio of Trackwork Plans

B. In the event of any conflict, ambiguity or inconsistency between or among the requirements of Section 3-1.1.5A of this Schedule, the requirements of the HFDG will prevail.

3-1.2 DESIGN REQUIREMENTS

3-1.2.1 Clearance

3-1.2.1.1 General

A. Minimum horizontal and vertical clearances must be provided for safe passage of trains:

1. between trains on adjacent tracks;
2. between trains and adjacent Trackway elements, vaults or pullboxes, Structures, or obstructions; and

3. between trains and overhead Infrastructure.

B. Designs must meet or exceed the minimum clearance criteria, where horizontal clearance and vertical clearance dimensions comply with the definition in the HFDG Section 3.2 – “Clearances”.

C. A minimum of 2.0 m horizontal clearance must be maintained between the nearest rail and the edge of a vault or pullbox within the Trackway.

3-1.2.1.2 Static Envelope and Dynamic Envelopes

A. The Design vehicle static envelope is the area that designates the lateral and vertical limits of the LRV while not in motion.

B. The Design vehicle static envelope is based on the dimensions of the current LRT rolling stock and forms the basis for the DVDE.

C. The DVDE is the area that designates the limits within which the LRV can move laterally and vertically while in motion on level, tangent track.

D. The DVDE must be determined in accordance with Appendix 3A Figure 3.1 and the HFDG Section 3.2.1.2 – “Design Vehicle Dynamic Envelope”.

3-1.2.1.3 Minimum Vehicle Running Clearance Envelope

A. All LRT Wayside Equipment must be placed to not conflict with the DVDE as described in the HFDG Section 3.2.1 – “Design Vehicle”. This must include Wayside Equipment at Platforms and around Other Structures and installations that could encroach into the DVDE.

B. The VRCE must be designed to be clear of all physical parts of the LRT System with exception of the Design vehicle itself by applying the following effects, clearances and tolerances to the DVDE, in compliance with the HFDG Section 3.2.2 – “Minimum Vehicle Running Clearance Envelope”:

1. effects of superelevation;

2. effects of curvature;

3. track construction and maintenance tolerances; and

4. structural clearances.

3-1.2.1.4 Minimum Vertical Clearance

A. The minimum vertical clearance distance must be governed by the OCS clearance requirement, in compliance with the HFDG Section 3.2.3 – “Minimum Vertical Clearance”.

3-1.2.1.5 Application of Clearance Criteria

A. Clearance within LRT ROW

1. The minimum distance from centreline of each track to the face of Signal masts and OCS poles must comply with the HFDG Section 3.3.1 – “Clearance within LRT ROW”.

B. Clearance to Edge of LRT ROW

1. The minimum width of the LRT ROW must comply with the HFDG Section 3.3.2 – “Clearance to Edge of LRT ROW”. Non-LRT Infrastructure or landscaping is not permitted within the LRT ROW.

Buried utilities may be permitted within the LRT ROW subject to the constraints provided in the HFDG Chapter 16 – "Utilities and Drainage".

C. Platform Clearances

1. The horizontal and vertical gap distance between the Platform edge and LRV static envelope must comply with the horizontal clearance and vertical clearances in the HFDG Section 3.3.3 - "Platform Clearances".

D. Tunnels

1. Clearance requirements in tunnels differ based on the tunneling methodology used and must be applied in accordance with the HFDG Section 3.3.4 – "Tunnels".

E. Special Clearance Situations

1. Under-Car Clearances

a. Under-car clearances must be provided in compliance with the HFDG Section 3.3.5.1 – "Under-Car Clearances".

2. Equipment and Pedestrian Safety

a. Minimum clearances between OCS contact wires and any areas accessible by the public must comply with the HFDG Section 3.3.5.2 – "Equipment and Pedestrian Safety" and Chapter 6 – "Traction Power".

3-1.2.2 Track

3-1.2.2.1 Design Basis

A. The Track Design Criteria provide all Design criteria limits (e.g., minimum and maximum) and account for all factors affecting the safe and efficient operation and Maintenance of the Infrastructure.

B. All track material, Special Trackwork and practices described herein must govern the Design of track and include the required interfacing of trackwork with other elements of the Infrastructure such as, but not limited to, Trackway, bridges, track slabs, transition slabs, electrification system, Signal System, and drainage.

C. In compliance with the HFDG Section 4.1.3 – "Optimization", the Design-Builder must perform a track alignment optimization study, as part of the Design development process, to determine the optimal track alignment to ensure the safe and efficient operation of the Infrastructure (the "Track Optimization Study"). The Track Optimization Study must be submitted to the City with the first Interim Design submission and revised and re-submitted with each of the second Interim Design and Final Design submissions for the Track Alignment as described in Schedule 4 Appendix 4D [*Project Specific Submission Requirements*]. The Design-Builder must demonstrate how the track alignment is optimized for the Infrastructure, including:

1. performance characteristics of the existing high floor LRV, including acceleration and braking capability;

2. all potential Train configurations for normal operations and emergency towing events, including LRV dimensions and bogie spacing;

3. Rail/wheel interface, including characteristics of the rail and wheel profiles for the on-track vehicles;

4. the effect of different operating speeds, up to and including the Maximum Design Speed;

5. LRT Corridor constraints, including Station locations, LRV-Platform interface, available stopping distance (including results from a stopping sight distance study), horizontal curvature, spiral transition, superelevation, grade and overlapping condition of horizontal curve with vertical curve and steep grades;

6. interfaces between the track and adjacent Structures, including HFDG requirements for lateral and overhead clearances and the effect of Special Trackwork anti-creep devices, sliding rail joints, rail lubricators and rail restraining devices in areas where differential structural movement may be anticipated;

7. the Passenger ride comfort requirements identified in the HFDG Section 2.2.17 – "Ride Quality";

8. Track Design speed in accordance with the HFDG Section 4.1.4 – "Design Speed"; and

9. Track structure limits and transition requirements.

D. The Design-Builder must optimize the track alignment in accordance with the results of the Track Optimization Study, subject to the following requirements:

1. Passengers must not be subjected to excessive acceleration, vibration, or shocks, as defined in TCRP Report 155, when the train is travelling at the Maximum Design Speed;

2. Lateral acceleration and jerk rate due to curvature of track must not exceed the following values:

   a. Tie and ballast track: 0.1 g maximum lateral acceleration;

   b. Direct Fixation Track and Embedded Track: 0.15 g maximum lateral acceleration; and

   c. the maximum jerk rate for any spiral length of Mainline Track must not exceed 0.03 g/s.

3. Design Speed

   a. The Design-Builder must meet the Maximum Design Speed for each section of the alignment up to 80 km/h and include all relevant calculations with the applicable Final Design submission.

   b. For each section of the alignment, the Design-Builder must include all relevant calculations with the applicable first Interim Design submission, second Interim Design submission, and Final Design submission for Maximum Operating Speed and Maximum Design Speed.

   c. Yard Track must have a Maximum Design Speed of 10 km/h.

4. Track Gauge

   a. All track must be standard gauge per the HFDG Section 5.1.3.3 – "Track Gauge".

5. Track Superelevation

   a. Provide track superelevation on curved sections of the alignment where required to ensure compliance with the HFDG Section 4.2.3.5 – "Superelevation" and Passenger ride comfort and operational safety requirements of the HFDG and this Schedule.

   b. Track superelevation is not permitted on any track sections that include turnouts, crossovers or diamond crossings, or within Yard Track.

E. Track Alignment

1. All track must be designed to meet the requirements of the HFDG Chapter 4 – “Track Alignment”.

F. Trackway Integration

1. Trackway systems are composed of several elements, each of which has a particular interaction with the other elements of the Infrastructure.

2. Design for Trackway must consider track systems in accordance with Section 5 [*System and Safety Assurance*] of Schedule 4 [*Design and Construction Protocols*]. In performing this Trackway Design, consideration of associated factors such as safety, Stray Current, ride comfort, noise, and vibration must not be overlooked. In addition, the relationship of Trackway Design to the Design of other elements of the Infrastructure must be recognized and accommodated early in the Design process.

3. Design for Trackway must be fully integrated and optimized with the adjacent Roadway and associated Design of other civil Infrastructure.

4. The essential elements of a Trackway system may include, but are not limited to:

   a. roadbed, drainage, and track foundation slab;

   b. loading and environmental factors;

   c. Direct Fixation Track structure or Embedded Track structure;

   d. tie and ballast track structure;

   e. rail;

   f. rail fastening systems (including elastomers if appropriate);

   g. Special Trackwork; and

   h. other track devices including switch blowers, lubricators, switch machines, bumping posts and the like.

5. Without limiting Section 3-1.1.4 [*Reference Standards*] of this Schedule, vertical and horizontal loading from the LRV must be in accordance with the HFDG Section 2.2 – “Rail Standards and Design Considerations” and Section 9.9 – “Design Loads”.

6. The Design must accommodate the space requirements for rail profile grinding and rail corrugation grinding.

7. The Design-Builder must Design and Construct the track to tie-in and be fully integrated with the Capital Line at the existing Century Park Station in accordance with this Section 3-1 [*Track*], and Section 1-1.4 [*Integration with Capital Line LRT*].

8. The rail/wheel interface Design of the Project must be fully compatible with the existing Capital Line.

9. The Design-Builder must adhere to the Capital Line rail/wheel interface and rail grinding requirements.

10. The Design-Builder must ensure that the tolerances between the track and Platforms are met and are compliant with the HFDG requirements.

11. The Trackway must be Designed and Constructed in accordance with Section 4-3.8 [*Geotechnical*] of this Schedule. In addition, the Platform and track relationship must be compliant with HFDG requirements and therefore must be resistant to frost heaving and settlement or any other differential movement condition which may be introduced between the track and Platform based upon the results of the Design-Builder's geotechnical investigation.

3-1.2.2.2 Horizontal Alignment

A. Horizontal geometric Design must meet the requirements of the HFDG Section 4.2 – "Horizontal Alignment".

B. The minimum radius of all curves on Mainline and Yard Track must be per as described in the HFDG Section 4.2.3.1 – "Circular Curves".

C. Tangent track must meet the requirements of the HFDG Section 4.2.2 – "Tangent Sections".

3-1.2.2.3 Vertical Alignment

A. Vertical geometric Design must meet the requirements of the HFDG Section 4.3 – "Vertical Alignment" with the exception of track between STA 411+600 and STA 411+800 where a maximum track gradient of 6% is permitted.

B. All changes in vertical gradient must be connected using parabolic curves. The minimum length of curve must be the greatest of the computed values from Equations 13, 14, 15a, and 16b as follows:

Design Basis	Length of vertical curve (LVC)	Equation
Minimum length permitted	60 m	Equation 13
Rate of change in grade		Equation 14
Vertical acceleration	Crest curves	Equation 15a
	Sag curves	Equation 16b

Where: A = algebraic difference in grades in percent
V = speed in km/h
K = rate of change in grade

Note:
K = 22 for horizontal tangents or curves with balanced superelevation
K = 44 for horizontal tangents or curves with unbalanced superelevation
K = 15 where speed is restricted to less than 50 km/h

C. Changes in grade are not permitted on any track sections that include turnouts, crossovers or at Station locations.

D. The elevation of the track crossing at the 900 mm diameter sewer relocation north of 23 Avenue NW must be no lower than 674.38 m to achieve the minimum 2.0 m cover from top of rail. This sewer elevation cannot be revised; therefore, the minimum elevation of the track cannot be changed.

3-1.2.3 Trackwork

3-1.2.3.1 Design Basis

A. All trackwork components must be based on existing, service proven technology and have a record of performance acceptable to the City. All trackwork components must be demonstrated to be capable of withstanding the climate conditions as specified in Section 1-3.1.3 [*Edmonton Climatic Requirements*] of this Schedule. Any trackwork component that is not service proven must be submitted by the Design-Builder to the City for review.

B. Track Configuration

1. All Mainline Track will comprise two sets of nominally parallel tracks Designed for revenue service, right hand running operation with a nominal five-car LRV consist and must include provision for emergency towing.

2. The track is a structure in which the weight of the running rail, type and size of track fastener, depth of ballast and sub-ballast or foundation slab, and elastomer stiffness are all interrelated. The characteristics of the track system provided in the Design must not be changed without submitting the Change to the City for review pursuant to Schedule 2 [*Submittal Review Procedure*] and considering the impact on: public safety, track stability, track stiffness, noise and vibration, electrical insulating characteristics, track maintainability, and track life cycle cost.

3. Design of the Trackway and all other Infrastructure must meet the requirements of the HFDG.

4. The Trackway Design must address the following:

    a. Stray Current in accordance with the HFDG Chapter 13 – “Corrosion and Stray Current”; and

    b. Noise and vibration in accordance with the HFDG Section 5.1.5 – “Noise and Vibration Attenuation” and Chapter 14 – “Urban Integration”.

5. The Design-Builder must submit shop drawings and Design reports demonstrating that the products used within the Design meet noise and vibration requirements.

6. The Trackway must interface with civil structures provided to manage surface water runoff within and/or adjacent to the Trackway.

    a. The trackwork Design must accommodate this interface without compromising track strength or stability.

7. In locations where below grade Utility crossings occur, coordination with the Utility provider must be undertaken to develop Trackway solutions to protect/accommodate the Utility installation if the requirements of the HFDG Chapter 16 – “Utilities and Drainage” cannot be met.

C. Trackway General

1. Rail deflection must not exceed the allowable rail deflection as specified in the HFDG Section 5.2.1 – “Rail Deflection”.

2. Any rail break gap must not exceed the allowable rail break gap as specified in the HFDG Section 9.9.8 – “Rail-Structure Interaction Demands”, and must not be greater than 50 mm.

3. The Design-Builder must Design and Construct the Trackway based on the neutral temperature applicable to each section of the alignment.

4. The Design-Builder must Design and Construct all Trackway systems to address all the technical and interface requirements as well as the environmental conditions described in Section 1-3.1.3 [*Edmonton Climatic Requirements*] of this Schedule and:

    a. the environmental conditions related to winter conditions including resistance to the effects of road gritting;

    b. heavy salt and de-icing chemicals;

    c. cold temperatures;

    d. heavy snowfalls;

    e. icing conditions;

    f. the potential for frost heaving conditions; and

    g. the potential for damage from snow plowing.

3-1.2.3.2 Track Structure

A. Tie and Ballast Track

1. Ballast, sub-ballast and tee rail must conform with HFDG requirements.

2. Tie and ballast track must be Designed and Constructed to provide sufficient support to the LRT and meet the characteristics identified within this section. Tie and ballast track must be Designed and Constructed in accordance with the HFDG Section 5.2.2 – "Track Applications" and the following requirements:

    a. Wood Tie and Ballast Track

        i. Softwood tie and ballast track may be used for Yard Track. Wood ties are not permitted at any other location on the Project.

        ii. The rail fastening system must be Designed and Constructed in accordance with the HFDG Section 5.2.2.1 – "Wood Tie and Ballast Track" and must consist of a base plate complete with HDPE base plate pads, screw spikes, spring clips, and spring lock washers.

        iii. Spacing of wood ties must be in accordance with the HFDG.

    b. Composite Tie and Ballast Track

        i. Composite tie and ballast track must be used at the following locations:

            i.) At-Grade Crossings in conjunction with pre-cast concrete crossing panels;

            ii.) pedestrian/shared use crossings; and

            iii.) track transitions on non-embedded Mainline Track.

        ii. The rail fastening system must be Designed and Constructed in accordance with the HFDG Section 5.2.2.2 – "Composite Tie and Ballast Track" and must be comprised of a base plate compete with HDPE base plate pad, screw spikes, spring clips, and spring lock washers.

        iii. Spacing of composite ties must be in accordance with the HFDG.

c. Concrete Tie and Ballast Track

i. Concrete tie and ballast track should be used for At-Grade Mainline Track and may be permitted for use on Structures or trenched track sections, or for Yard Track.

ii. The rail fastening system for pre-cast concrete ties must be Designed and Constructed in accordance with the HFDG Section 5.2.2.3 – "Concrete Tie and Ballast Track" and must consist of supplier provided cast-in-place cast iron shoulders, spring clips, rail pads, and insulators for fastening 115 lb RE rail.

iii. Spacing of concrete ties must be in accordance with the HFDG.

B. Embedded Track

1. Embedded Track must be Designed and Constructed to provide a suitable running surface for rubber-tired traffic, meeting corrosion control requirements, providing a suitable walking surface for pedestrian crossing movements and presenting a clean and aesthetically appropriate appearance for location specific form and function.

C. Direct Fixation Track

1. Direct Fixation Track must be Designed and Constructed in accordance with the HFDG Section 5.2.2.4 – "Direct Fixation Track" and Section 5.5.2.1 – "Direct Fixation Fasteners" and the following requirements:

a. the rail fastening system must be raised above the track slab on a direct fixation support, such as a concrete plinth, to mitigate Stray Current and the potential for snow/ice and debris build-up on the rail fasteners;

b. at least 50 mm of clearance must be provided beneath the base of the rail fastener and the track slab to accommodate installation of Traction Power and signal cables across the rails without having to be trenched within the track slab/bridge deck;

c. Direct fixation support Structures must accommodate Trackway drainage requirements specified in Section 3-3.5 [*Track Drainage*] of this Schedule; and

d. the structural Design of the direct fixation support, including anchoring requirements are in accordance with Section 4-3.24 [*Direct Fixation Support*] of this Schedule.

D. Shop Tracks

1. Shop Tracks must be Designed and Constructed in accordance with the HFDG Section 5.2.2.6 – "Embedded Shop Track" and Section 5.5.1.3 – "Pocket Track, Yard Track, and Shop Track", except as specified in Section 3-1 [*Track*] and Part 7 [*Operations and Maintenance Facility*] of this Schedule.

2. Direct Fixation Track may be provided on Shop Tracks where drainage is the primary concern, and where under-vehicle access and pedestrian or non-rail equipment movements are infrequent.

a. Direct Fixation Track may be considered where pedestrian or non-rail equipment movements are frequent within an LRV Storage Area if the Design allows for easy passage of pedestrian or non-rail equipment over the rails at these locations.

3. Embedded Track must be Designed and Constructed for Shop Tracks not designated as Direct Fixation Track or Pit Track.

4. Embedded Shop Track may be constructed by embedding the rail in elastomeric grout in a trough in the shop floor concrete, or by using resilient rubber rail boots surrounded by infill concrete with the rail mounted to concrete in-floor ties.

5. All Shop Tracks in the first 5.0 m immediately inside an exterior door must slope toward the door to promote drainage and supplemental drainage must be provided at shop doorways.

E. Yard Tracks

1. Design and Construct all Yard Tracks in accordance with this Section 3-1 [*Track*] and Part 7 [*Operations and Maintenance Facility*] of this Schedule.

2. All Yard Tracks must be Embedded Track for a minimum of 5.0 m in length around north side of buildings and a minimum of 10.0 m in length around south side of buildings to provide a driveable apron.

3. Tie and ballast track may be provided for Yard Tracks within the Llew Lawrence OMF where Embedded Track is not prescribed.

F. Lead Tracks

1. Lead Tracks must be Designed and Constructed in accordance with this Section 3-1 [*Track*] and Part 7 [*Operations and Maintenance Facility*] of this Schedule.

3-1.2.3.3 Special Trackwork

A. General Requirements

1. Special Trackwork is defined as trackwork Structures, trackwork components, or fittings that are normally fabricated in whole, or in part, from regular rolled rail section. Special Trackwork may include the following components:

   a. Turnouts and crossovers

   b. Diamonds

   c. Restraining Rails

   d. Expansion or sliding rail joints

   e. Lateral restraining devices

2. All Special Trackwork must meet the requirements of the HFDG Section 5.3 – “Special Trackwork”.

3. Restraining Rails are not required for Yard Track and Shop Track which meet the minimum circular curve radius in the HFDG Section 4.2.3 – “Curved Sections”.

B. Turnout Standards and Geometry

1. All turnouts and crossovers must be Designed and Constructed to meet the requirements of the HFDG Section 5.3 – “Special Trackwork” and match the size and locations as identified on Figures 5-1A-01 to 5-1A-08 of Appendix 5-1A [*Project Description Drawings*] in Part 1 [*General*] of this Schedule. Turnouts are not permitted within the limits of an At-Grade Crossing or pedestrian crossing.

2. Any turnouts within Embedded Track sections must be Constructed using cast-in-place concrete as infill material and designed to:

   a. maintain the functionality of the switch; and

   b. not interfere with operation of the closure rail.

3. Special Trackwork used with Yard Track must be of tee rail design, based on 115 lb RE rail section.

4. All turnouts must be located on planar, tangent track. Turnouts must not be located on superelevated track.

5. All turnouts with a radius 150 m or less must be Designed with an inner restraining rail that creates a fully guarded condition throughout the turnout, and if applicable, throughout the crossover track between two turnouts.

6. All turnouts must use welded boltless manganese frogs. The frog heel joints and toe joints must be bolted rail joints.

7. Turnout guard rails must be set no more than 7 mm above the top of the running rails.

8. Hold-down bars and switch rods must be Designed to allow the two switch points to move independently.

9. Turnouts must be fully welded or connected with zero-gap bolted joints with the exception of WBM frogs, which must be connected with regular bolted joint bars.

3-1.2.3.4 Transition Zones

A. Transition Zone

1. Where two types of track construction with varying track modulus exist, a gradual change in track stiffness must be provided by introducing a transition zone between the two types.

2. The transition track must be of sufficient length to be traversed in a minimum of two seconds at the Design speed. The track stiffness must transition uniformly along its length.

3. Transition requirements are defined in the HFDG Section 5.2.3 – “Track Transitional Requirements”.

3-1.2.3.5 Crossings

A. General Requirements

1. At-Grade Crossings must match approach grades, provide positive drainage away from the crossing area, and should have the Roadways cross as close to a right angle as practicable. At-Grade Crossings must meet the requirements of the HFDG per Section 5.4 – “At-Grade Crossings”. Use of track pans must be investigated where appropriate to catch roadway grit and debris ahead of turnout switch points located adjacent to any At-Grade Crossings.

3-1.2.3.6 Track Components

A. Standard Trackwork Components

1. All standard trackwork components must conform to the requirements of the HFDG Chapter 5 – "Trackwork". Running rail must be new, of 115 lb RE rail section and must be fully head hardened having a Brinell hardness of minimum 325 BHN unless noted otherwise in the HFDG.

2. Bolted rail joints must only be used in locations where insulating joints are used, in Yard Track, or to connect WBM frogs.

3. Zero-gap joints are only permitted in Special Trackwork.

4. CWR requires rails to be joined together by welding. Rail should be welded into the longest strings practicable by means of EFB. The EFB Equipment must be programmed appropriately for the specific rail chemistry being welded.

5. Thermite welds may be used to join rail strings and for joining rails in situations where EFB welding is not practicable.

6. Wherever it is necessary to electrically isolate contiguous rails from each other to comply with track signalling or Traction Power criteria, insulated rail joints must be used.

B. Rail

1. Running Rail

   a. All running rail on Mainline Track must be a minimum of 115 lb RE CWR conforming to the standard carbon steel rail manufacturing standards of Section 3-1 [*Track*] of this Schedule and be fully compatible with the wheel profile of LRVs in service on the Capital Line.

   b. All running rail must conform to the requirements of HFDG Chapter 5.5.1 – "Running Rail".

   c. Mainline Track CWR should be properly destressed and laid in accordance with the optimum neutral rail temperature of 17°C to 24°C to minimize the destressing requirement according to the HFDG Section 5.5.1.1 – "Rails for Mainline Track".

   d. Rail used for Pocket Track and Shop Track must be CWR and Yard Track may be either CWR or bolted joint rail per the HFDG Section 5.5.1.3 – "Pocket Track, Yard Track, and Shop Track".

2. Restraining Rail

   a. Restraining rail, if required, must be Designed and Constructed as per the HFDG Section 5.3.7 – "Restraining Rails".

   b. Where deemed necessary, restraining rail must be Designed and Constructed for the rail/wheel interface characteristics and curve radius.

   c. Restraining rail may use bolted joints to avoid differences in thermal stress levels between the restraining rail and the adjacent CWR running rail. Restraining rail must be electrically bonded at joints. The ends of the restraining rail must be electrically bonded to the adjoining running rail except where track circuits are employed by the TCS.

   d. In all areas of track requiring restraining rail, ensure the restraining rail fastening assembly is compatible with the VRCE.

3. Derailment Protection

    a. Provide guard rail or another form of derailment protection within the Direct Fixation Track sections of the Trackway meeting the requirements of the HFDG Section 5.3.8 – "Guard Rails", where the Trackway is located on:

        i. any Transportation Structure having a vertical height difference between the edge of the Trackway and the immediately adjacent surface of 1.0 m or greater;

        ii. an embankment fill section having a slope steeper than 3H:1V, with a total vertical height difference between the edge of the Trackway and the bottom of the slope greater than 1.0 m;

        iii. an embankment fill section having a slope equal to, or shallower than, 3H:1V, with a total vertical height difference between the edge of the Trackway and the bottom of the slope greater than 3.0 m; and

        iv. at locations where a derailed train would potentially impact critical non-transit facilities such as high-tension power line poles.

    b. All guard rail and other derailment protection devices must be Designed and Constructed to contain the train within the Trackway in the event of derailment.

    c. Guard rail must be installed inside the running rails in Direct Fixation Track for all bridges.

    d. Where restraining rail is used at guard rail locations, guard rail must be installed only on the side having no restraining rail.

    e. The ends of guard rail must be bent into flares pointing toward the track centreline.

    f. Guard rail must be electrically isolated from the running rail.

    g. Guard rail is not required on tracks where structural lateral restraints are present which are able to contain a derailed vehicle.

C. Rail Fastening Systems

1. The Design-Builder must demonstrate that the Design meets all performance criteria for mechanical rail fasteners per the HFDG Section 5.2.2 – "Track Applications" and as specified in this Schedule.

2. Provide mechanical fasteners for all Direct Fixation Track.

3. Rail fastening systems must:

    a. hold gauge and absorb the rail forces caused by temperature fluctuation; and

    b. dampen vibrations and prevent rail creep caused by rail/wheel interaction.

4. All fasteners within Direct Fixation Track and tie and ballast track must permit lateral gauge adjustment. Direct Fixation Track must allow for vertical adjustment by use of shims.

5. Fasteners must resist corrosion and have a Design Life as defined in Section 1-3.3 [*Design and Service Life*] of this Schedule.

6. Standard spacing between Direct Fixation Track and tie and ballast track rail fasteners must accommodate the rail deflection and rail break gap in accordance with Section 3-1.2.3.1C

[*Trackway General*] of this Schedule, track design speed in accordance with Section 3-1.2.2.1D.3 [*Design Speeds*] of this Schedule and loading of all on-track vehicles.

D. Tie and Ballast

1. All concrete ties must be pretensioned monoblock concrete ties meeting the requirements of the HFDG Section 5.5.3.4 – "Concrete Ties" and Section 5.5.3.5 – "Concrete Special Trackwork Ties".

2. The Design-Builder must submit to the City, a minimum of 30 days before installation, the source(s) of ballast that will be used and the test results demonstrating that the ballast meets the requirements of the HFDG Section 5.5.4 – "Ballast".

3. The Design-Builder must submit to the City, a minimum of 14 days before installation, the source(s) of sub-ballast that will be used and the test results demonstrating that the sub-ballast meets the requirements of the HFDG Section 5.5.5 – "Sub-Ballast".

E. Elastomers and Isolating Materials

1. All LRT track Construction types must include materials and components that electrically insulate the rail from ground, absorb noise and vibration, and facilitate adjustment of track modulus.

2. Materials must be selected that are appropriate to operate in the track environment for a Design Life as defined in Section 1-3.3 [*Design and Service Life*] of this Schedule.

F. Vehicle Overrun Protection

1. Provide vehicle overrun protection at the end of the Mainline Track, and at all stub-ended Secondary Track, to prevent on-track vehicles from overrunning the end of the track as described in the HFDG Section 5.6 – "Other Trackwork Materials".

2. Determine the requirements for vehicle overrun protection based upon a Hazard Analysis which must consider, as a minimum, the following items:

   a. the distance from the normal stopping point to the end of track;

   b. the Operating Speed within in the station;

   c. the likelihood of an overrun incident, considering all plausible events leading up to the incident;

   d. the likelihood of Passengers being on board the Train at the time of an overrun incident; and

   e. other consequences of an overrun incident, including consideration of pedestrians, vehicles and property beyond the end of track.

3. The Hazard Analysis may also consider mitigations to lessen the probability or consequences of an overrun incident, including:

   a. Train Operator cab crashworthiness;

   b. operation and responsiveness of Train Operator's safety device; and

   c. application of a Train Operator awareness monitoring system.

4. Where the probability and consequences of an overrun incident can be demonstrated to be low, as accepted by the City, acting reasonably, non-energy absorbing devices may be considered;

otherwise, energy absorbing devices must be provided meeting the requirements of the HFDG Section 5.6.7 – “Friction End Stops”.

G. Switch Blower and Heat Tracing Requirements

1. Provide a system to keep all switches and associated closure rails clear of snow and ice at all times.

    a. Cold-air switch blowers must be used for all Direct Fixation Track or tie and ballast track.

2. Where switch blowers are used, they must be housed within noise reduction enclosures as required to comply with the requirements of the HFDG Section 5.6.2 S - “Switch Blowers”.

H. Track Drainage System

1. All track, including Mainline Track, Secondary Track, Shop Track and Yard Track must comply with the applicable requirements of Section 3-3.7.4 [*Stormwater Management – Specific Facilities*] of this Schedule.

2. Shop Track must comply with Part 7 [*Operations and Maintenance Facility*] of this Schedule.

3-1.2.3.7 Trackwork Assets

A. General

1. All other track materials needed to furnish the track Design in addition to the major track components previously described must adhere to the HFDG Section 5.6 – “Other Trackwork Materials”.

2. Other track materials generally include the following:

    a. switch machines

    b. switch blowers

    c. switch point detectors

    d. hold-down bars

    e. roller plates

    f. switch point protectors

    g. friction end stops

    h. wheel stops

    i. rail lubricators

    j. lateral track bracing for Stations

    k. rail anchors

3. Rail lubricators are not required for Yard Track regardless of curve radius.

3-1.3 CONSTRUCTION SPECIFICATIONS

3-1.3.1 Track

A. Track refers to all regular trackwork in the Project as described in Section 3-1 [*Track*] of this Schedule.

B. Quality management, assurance, control, and overall execution for trackwork must adhere to guidelines and procedures described in Schedule 9 *[Quality Management*].

C. Trackwork Tolerances

1. Alignment Tolerances

    a. The tracks must be located within 6 mm of the horizontal alignment shown on the Design Data and marked in the concrete slab at 3.0 m intervals.

    b. The finished elevation of the tracks must be within 6 mm of the vertical alignment shown on the Design Data.

    c. Variations in horizontal alignment should not occur at a rate greater than 3 mm in 9.0 m on tangents and not greater than 3 mm from the designated mid-ordinate on a 20 m chord on curves.

    d. Variations in vertical alignment should not occur at a rate greater than 3 mm in 9.0 m.

2. Gauge

    a. The track gauge is the distance between the gauge sides of the rail heads on a line at right angles to the centreline of the track and measured 16 mm below the top of the rail.

    b. Gauge of all LRT track, tangent and curved, must be 1435 mm +3/-1 mm.

    c. Variations in track gauge should not occur at a rate greater than 3 mm in 9.0 m.

    d. The Design-Builder's track gauge should be subject to periodic verification by the City to assure its accuracy. Such checks, or the lack of them, will in no way relieve the Design-Builder of its responsibility for the accuracy of the work.

3. Cross Level

    a. Cross level is the difference in elevation, of the top of rail at points directly opposite each other on a line at right angles to the centreline of the track.

    b. On tangent track, cross level should not exceed 2 mm. On curved track, the cross level should not vary more than 2 mm from the specified superelevation.

    c. Variations in cross level should not occur at a rate greater than 2 mm in 9.0 m.

4. Summary of Track Construction Tolerances

    a. All track or trackwork related components for the Project should be installed by the Design-Builder to within the allowable Construction deviations as listed in the summary table. Track gauge, cross level, superelevation, and alignment deviations are acceptable if the rate of change is within the tolerance limits specified.

Table 3-1.3.1-1 Track Horizontal and Vertical Alignment Tolerances

		Horizontal Track Alignment	Horizontal Track Alignment	Vertical Track Alignment	Vertical Track Alignment
Gauge Deviation	Cross Level Deviation	Total Deviation	Middle Ordinate in 20 m chord	Total Deviation	Middle Ordinate in 20 m chord
+ 3 mm - 1 mm	+ 2 mm - 2 mm	+ 6 mm - 6 mm	+ 3 mm - 3mm	+ 6 mm - 6 mm	+ 3 mm - 3mm

Notes:

Total deviation is measured between the theoretical or best fit and actual alignments at every fastener location. During Construction, the best-fit alignment will account for changes to the theoretical alignment based on the survey of actual field conditions.

5. The allowable rate of variation for Mainline Track should be as follows:

   a. Horizontal: rate of change should not exceed 3 mm per 9.0 m measured in increments of 3.0 m.

   b. Vertical: rate of change should not exceed 3 mm per 9.0 m measured in increments of 3.0 m.

   c. Gauge: rate of change should not exceed 3 mm per 9.0 m measured in increments of 3.0 m.

   d. Cross level: rate of change should not exceed 2 mm per 9.0 m measured in increments of 3.0 m.

6. Measurements and Reporting of Trackwork Tolerances

   a. The Design-Builder must provide qualified personnel and suitable equipment to properly check the accuracy of the Infrastructure and must provide to the City, the results of all measurements showing conformity, or lack of conformity, to the tolerances set out in this Section.

   b. Such measurements, and the results thereof, will be subject to periodic checking by the City. Such checks, or the lack of them, will in no way relieve the Design-Builder of its responsibility for the accuracy of the work.

   c. The auditing and monitoring by the City of the operation of on-track vehicles over any trackwork Constructed by the Design-Builder does not constitute a waiver of the requirements for measurement and reporting of trackwork tolerances, and/or requirements for conformity to those trackwork tolerances.

   d. Such measurements should be taken at locations and /or frequencies as set out herein:

      i. Measurements for conformity to alignment tolerance should be taken at the alignment control points shown on the Drawings and at intervals of 3.0 m.

      ii. Measurements for conformity to track gauge tolerances should be taken at all welds and at intervals of 3.0 m.

      iii. Measurements for conformity to cross level should be taken at all rail welds and rail joints and at intervals of 3.0 m.

iv. Measurements for conformity to tolerances should be taken at such additional locations as the City may from time to time direct and/or at such additional locations as are necessary to ensure compliance with the requirements of this section.

v. Measurements for conformity to tolerances may be made with suitable devices, which provide continuous measurement and recording of track geometry that are acceptable to the City. The Design-Builder must remain responsible for the measurements taken continuously or at finite points.

e. While not necessarily limited thereto, the reports to be submitted by the Design-Builder to the City showing conformity with specified tolerances, should:

i. be titled “Reports of Conformity to Trackwork Tolerances”;

ii. bear a date which should be the date the report is prepared;

iii. show the date or dates when measurements were taken;

iv. be reported separately by each track, so that measurements for different tracks are not intermingled;

v. show the name and designation of the track to which the measurements apply;

vi. show the chainage of each point where measurements are made at finite points, or show the chainage at intervals not exceeding 3.0 m where measurements are made continuously;

vii. show the Design grades and the As-Built variations from Design grades and Design centreline;

viii. show the Design and As-Built gauge and superelevation and variation of As-Built from Design for gauge and superelevation; and

ix. be provided to the City within 3 working days of the date the measurements were taken.

f. The trackwork tolerance report must be provided to the City on the completion of turnover of each separate section of trackwork.

3-1.3.2 Special Trackwork

A. Parameters of Special Trackwork

1. Track gauge in Special Trackwork must be 1.435 m measured on the gauge line at a point 16 mm below the top of running rail.

2. The radius of the gauge corner in the wheel contact area for all Special Trackwork components must be 9.5 mm. Any deviation from this Design parameter must be approved by the City.

3. Switch points adjoining the curved closure rail must be curved to the same radius as the closure rail.

4. Flangeway clearance between guard rail and running rail must be 45 mm measured on the gauge line at a point 16 mm below the top of running rail.

B. Tolerance in Manufactured Components or Assemblies

1. All tolerances specified herein are not cumulative.

2. Track gauge is 1435 mm +3/-1 mm.
3. Warp from the vertical and/or horizontal plane of the rail section +/-3 mm in 5.0 m.
4. Deviation in the horizontal alignment from the centreline of tangent rail:
    a. Measured from the mid-ordinate on a 10 m chord +/-1.5 mm.
    b. Rate of change 1 mm in 3.0 m.
5. Rate of change in vertical displacement +/-3 mm in 9.0 m.
6. Tolerances on turnout components
    a. Frogs

i.	length of frog	+0/-5 mm
ii.	flatness over machined surfaces	+0/-1 mm
iii.	maximum deviation of squareness at field welded ends	3 mm
iv.	spread at the heel and toe	+/- 1 mm
v.	straightness of running rail throughout frog	+1/-0 mm
vi.	gauge	+0/-3 mm

    b. Machining of frogs: all surfaces should match with no protrusions, sharp edges or sharp comers.
    c. Flangeway for frogs:
        i. Depth 45 mm +3/-1 mm
        ii. Width: 47 mm +/-1.5 mm
    d. Switch points length +0/-5 mm.
    e. Height deviation from Design dimensions: +1/-0 mm.
    f. Planed section of switch point contact area to the undercut section of stock rail +0.5/-0 mm.
    g. Maximum deviation of squareness at field welded ends 3 mm.
    h. Centre to centre of connecting rod bracket holes +/-1 mm.
    i. Diameter of connecting rod bracket holes +0.5/-0 mm.
    j. Lateral supports for switch points +0.5/-0 mm.
    k. Switch points must be continuously supported over the planed portion of the switch point rail.
    l. Bottom and leading edges of the switch point supported by sliding baseplates must be smooth and free from all sharp edges, burrs, corrosion, rust, or other defects which would hinder a smooth throwing movement.

m. The supplier must dry lubricate the sliding surface of the switch point rail base to eliminate any corrosion or rust build-up during storage and shipping.

n. Closure rails: Deviation of curved running rail from specified radius 1 mm in 3.0 m.

o. Stock rails: Minimum undercut length for the turnout should be determined by the Supplier.

p. Alignment of switch point running edges: Straight running rail over total length +1/-0 mm.

q. Curved running rail over total length +/-1.5 mm.

r. Flangeway for Guard Rail:

    i. Depth: 45 mm +3/-1 mm

    ii. Width: 47 mm +/-1.5 mm

s. Insulated Joints:

    i. Diameter of bolt hole to match joint bar hole +1.5/-0 mm

    ii. Centre to centre spacing to joint bar hole spacing +0/-2 mm

t. Switch Point Sliding Baseplates and Roller Plates:

    i. Diameter of bolt hole: 26 mm +2/-0 mm

u. Top siding surface must be machined smooth, with no visible indications of surface irregularities caused by manufacturing procedures.

v. The supplier must dry lubricate the sliding surface of the baseplates to eliminate any corrosion or rust build-up during storage and shipping.

w. Roller plates: vertical adjustment +6.5/-.5 mm.

SECTION 3-2 - ROADWAYS/SIDEWALKS/SHARED USE PATHS

3-2.1 INFRASTRUCTURE DESCRIPTION

A. The following section provides the details for the Construction of the transportation surface works within the Road ROW, outside of the Trackway, Station locations and the Llew Lawrence OMF as well as two access roads within the TUC. This Infrastructure generally includes:

1. Construction and rehabilitation of the road cross-section of 111 Street NW, between Anthony Henday Drive and Century Park Station as follows:

    a. 111 Street NW, Anthony Henday Drive to Blackmud Creek Bridge – Construction with the alignment shifting to the east, with reduced lane widths and an additional southbound lane, and intersection modifications at 9 Avenue NW and 12 Avenue NW.

    b. 111 Street NW, Blackmud Creek Bridge to 23 Avenue NW – Construction of the southbound travel lanes, with additional southbound lane, northbound lanes to remain, with an additional northbound lane provided at the intersection of 111 Street and 19 Avenue NW, with rehabilitation of existing northbound lanes. Construction of intersection modifications at 19 Avenue NW (Saddleback Road) and the William Lutsky YMCA access.

    c. 111 Street NW, 23 Avenue NW to Century Park Station – Construction of intersection modifications, access modifications and roadway realignment. Widening construction required along the east and west edges of the Roadway.

2. Removal and replacement of sidewalks as required, generally at intersections through the corridor, including curb ramps.

3. Removal and replacement of SUPs and connections. SUP works exist over the length of the 111 Street corridor on the west side, including the Blackmud Creek crossing. Minor SUP connections on the east side of the corridor.

4. Replacement, expansion and new construction of bus stops along the corridor.

5. Removal and reinstatement of the curbs through the corridor as required, based on road realignment and intersection modifications.

6. Removal, reconstruction and new construction of traffic islands at intersections.

7. Intersection enhancements at sidewalk and SUP crossing including colour and tactile elements.

8. Construction of a 4.8 m gravel access road with maintenance vehicle parking areas, from a concrete commercial crossing on the west side of 111 Street south of 9 Avenue NW, along the east side of the LRT Trackway to the north end of the Anthony Henday Drive LRT Bridge, fulfills access requirements as described in the HFDG Section 17.4 – “Emergency and Maintenance Vehicle Access”.

9. Construction of a 4.5 m paved access road located immediately adjacent to the south boundary of the TUC from the northeast side of the Llew Lawrence OMF site to the TPSS located in the TUC near the MacEwan SWMF.

10. Other related works including minor paving and curb construction to match to existing, spot concrete repairs (e.g., curbs, commercial crossings, sidewalks, islands) and minor pavement rehabilitation within and adjacent to the LRT Corridor.

11. Construction of a 4.8 m gravel access road with turnaround, from the north Llew Lawrence OMF access, along the south side of the LRT Trackway to the southbound turnout of the mainline single crossover located in the TUC.

3-2.2 REFERENCE STANDARDS

3-2.2.1 List of Codes and Standards

A. Without limiting Section 1-2.2 [*Codes and Standards*] of this Schedule and except as otherwise specified herein, the Roadways, sidewalks, SUP, and all associated Infrastructure must comply with the requirements of the following codes, standards and regulations:

1. City of Edmonton Design and Construction Standards 2021 Edition, March 26, 2021, available on the City's website
2. City of Edmonton Manual of Temporary Traffic Control, February 7, 2022, available on the City's website
3. City of Edmonton Access Management Guidelines, 2021-11-29, available on the City's website
4. City of Edmonton Access Design Guide
5. Transportation Association of Canada "Geometric Design Guide for Canadian Roads"
6. TAC "Manual of Uniform Traffic Control Devices for Canada"
7. Alberta Transportation Roadside Design Guide
8. Alberta Transportation Highway Geometric Design Guide
9. TAC "Bikeway Traffic Control Guidelines for Canada"
10. TAC "Pedestrian Crossing Control Guide"
11. American Association of State Highway and Transportation Officials (AASHTO) "A Policy on Geometric Design of Highways and Streets"

B. In the event of any conflict, ambiguity, or inconsistency between or among the requirements of the above listed codes, standards and regulations, the requirements generally apply in the order listed, subject to applicability as listed in Section 3-2.2.1-A [*Reference Standards*] of this Schedule.

C. The Roadways, sidewalks, SUPs and all associated Roadways Infrastructure within the TUC must comply with the following codes, standards and regulations, except as otherwise specified in Part 4, Section 4-2 [*Reference Documents*] of this Schedule.

1. Alberta Transportation Standard Specifications for Highway Construction
2. Alberta Transportation Highway Geometric Design Guide
3. Alberta Transportation Roadside Design Guide
4. Alberta Transportation Standard Specifications for Bridge Construction
5. Alberta Transportation Bridge Structures Design Criteria

3-2.3 DESIGN REQUIREMENTS

3-2.3.1 Safety Audit

A. Roadway Safety Audits must be carried out in accordance with Section 5.9 [*Road Safety Audits*] of Schedule 4.

3-2.3.2 Mainline

3-2.3.2.1 Design Speeds

A. Design all Roadways in accordance with the Roadways posted speeds and classifications specified in Tables 3-2.3.2.1 [*Roadways Posted Speed (Main Alignment)*] and 3-2.3.2.2 [*Roadways Posted Speed (Cross Streets)*] of this Schedule.

Table 3-2.3.2.1 Roadways Posted Speed (Main Alignment)

	Roadway	Roadways Posted Speed	Roadway Classification
1	111 Street NW, Anthony Henday Drive to 23 Avenue NW	60 km/h	Arterial, transit route
2	127 Street SW, Ellerslie Road to Llew Lawrence OMF Access	40 km/h	Collector

Table 3-2.3.2.2 Roadways Posted Speed (Cross Streets)

	Roadway	Roadways Posted Speed	Roadway Classification
1	23 Avenue NW	60 km/h	Arterial, transit route
2	Saddleback Rd NW/ 19 Avenue NW	40 km/h	Collector, transit route
3	12 Avenue NW	40 km/h	Collector, transit route
4	9 Avenue NW	40 km/h	Collector, transit route
5	Anthony Henday Drive	100 km/h	Freeway
6	Ellerslie Transit Access Rd (Kiss and Ride)	40 km/h	Collector, transit route
7	Ellerslie Rd SW	60 km/h	Collector, transit route

B. Design for Roadway and associated civil Design must be fully integrated and optimized with the adjacent Trackway.

3-2.3.3 Geometric Design

3-2.3.3.1 General

A. All Roadways, including existing Roadways that are modified or reconstructed, but not including Roadways within the TUC, must comply with the standard requirements as specified in Section 3-2.2 [*Reference Standards*] of this Schedule.

B. Cross Fall

1. The cross fall of all Roadways must be a minimum 0.020 m/m.

2. The cross fall of all sidewalks and SUP must be as prescribed in the DC&S except:

    a. the maximum crossfall of monolithic sidewalks and SUP must be 0.035 m/m.

C. Lane Width

1. Roadway lane widths must be the actual finished pavement dimensions measured between pavement markings or between pavement marking and face-of-curb, as applicable.

D. Shy-Way Width

1. The shy-way between the face-of-curb or vehicular travel lane and any vertical obstruction must be 1.25 m.

E. Median Width

1. The minimum width of any raised median must be 1.20 m from face-of-curb to face-of-curb.

2. Painted medians must not be greater than 1.20 m in width.

F. Curb and Gutter

1. Curbs and gutters adjacent to the Trackway must comply with drawing #5023 in the D&CS, except:

   a. where there is a marked pedestrian crosswalk across the tracks. In these locations, the Design must allow for the Trackway to be flush with the Roadway to allow the Barrier-Free passage of pedestrians; and

   b. as specified in Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule.

2. All other curbs and gutters throughout the Lands must comply with Drawing #5000 in the D&CS, except as specified in Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule.

3. All curbs and gutters must be new construction.

4. At intersections, the curbs and gutters adjacent to the Trackway must continue through the intersection, except:

   a. at intersections where there are legal vehicular turning movements or through movements across the Trackway; and

   b. at pedestrian crosswalks, as referenced in this Section 3-2.3.3.1F [*Curb and Gutter*] of this Schedule.

   c. curbs, medians and Trackway must be constructed such that the Trackway will be accessible by Emergency Service vehicles from the adjacent road lane(s) at all locations where there is Embedded Track except where obstructed by a Platform.

G. Slopes

1. Slopes located adjacent to Roadways, sidewalks and SUP must not be steeper than 3.5H:1V, except:

   a. on 111 Street NW between 19 Avenue NW/Saddleback Road and 12 Avenue NW (Blackmud Creek Area), the side slopes must be graded to match existing;

   b. through the TUC, slopes must meet the requirements of the Alberta Transportation Standard Specifications for Highway Construction and the Alberta Transportation Standard Specifications for Bridge Construction;

c. the sideslopes of bridge approach fills can be sloped at 3H:1V in accordance with Section 4-3.8.4.A of this Schedule, provided that the target slope factors of safety are met and that any vegetation planted on the sideslopes do not require maintenance.

2. In areas where these slopes cannot be achieved, retaining walls must be Constructed in accordance with Section 2-10.5 [*Retaining Walls*] of this Schedule in order to meet the requirements of Section 3-2.3.3.1G [*Slopes*] of this Schedule.

H. Width of Ditch

1. The minimum width of any ditch bottom must be 1.0 m.

I. Horizontal Clearances

1. All horizontal clearances must comply with the requirements specified in Section 3-2.2 [*Reference Standards*] of this Schedule.

J. Intersections

1. Intersection Design must comply with the D&CS. Intersections must be Designed to the classification of each incoming Roadway, as defined in Tables 3-2.3.2.1 [*Roadways Posted Speed (Main Alignment)*] and 3-2.3.2.2 [*Roadways Posted Speed (Cross Streets)*] of this Schedule and in the City's Transportation System Bylaw, 15101.

2. For each section of Roadway, the SSD, as defined in the TAC Geometric Design Guide for Canadian Roads, must meet or exceed the upper limit for the Design speed of the applicable Roadway Section.

K. Shared Use Paths

1. All SUPs must be 3.0 m in width and separated from the Roadway by a boulevard, except as specified in Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule. A 0.5 m clearance is required from vertical obstructions (e.g., fencing, barriers, posts) and a 1.0 m clearance is required to the Trackway, except from 9 Avenue SW to 10 m north of the north Twin Brooks Station ramp access where a 0.5 m clearance is permitted.

2. Where a curbline (monolithic) SUP (no boulevard) is specified in Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule, it must be a minimum 3.5 m in width, measured from the back of curb.

3. All SUPs must allow a clear path of travel, free of obstructions. Connecting curb ramps must also be free of obstructions.

4. At intersections of SUPs to SUPs and/or to Sidewalks, provide additional scoring or patterning within the intersection to differentiate the intersection from the travel zone.

5. Boulevard SUP (SUP that are separated from the Roadway by a boulevard) must be detoured behind bus pads to create the required clear space as set out in Section 4000 of D&CS, except as specified in Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule.

6. Due to topographic constraints, the SUP on the west side of 111 St NW that connects to the trail on the north side of Blackmud Creek is not required to be designed to a slope of 5% or less. This SUP should have a slope of no greater than 8% wherever possible, and no greater than an absolute maximum of 10% at any point.

L. Sidewalks

1. All sidewalks must be a minimum 1.8 m in width and separated from the Roadway by a boulevard, except as specified in Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule.

2. Where a curbline (monolithic or monowalk) sidewalk is specified in Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule, it must be a minimum 2.3 m in width measured from the back of curb.

3. All sidewalks must allow a clear path of travel, free of obstructions. Connecting curb ramps must also be free of obstructions.

4. Boulevard sidewalks (that are separated from the Roadway by a boulevard) must be detoured behind bus pads to create the required clear space as set out in Section 4000 of D&CS, except as specified in Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule.

M. Turnarounds

1. Design all turnarounds to comply with Drawing #3040 in the D&CS, except as specified in Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule.

N. Grading

1. All grading tie-in elevations for private properties must be at or below existing ground elevations at property line.

O. Streetscape

1. A streetscape includes all elements that constitute the cross-section of a street within the right-of-way, including landscaping, boulevards, Roadways, medians, side, and SUP.

2. The Design of the streetscape along the LRT Corridor must provide an integrated pedestrian focused environment that provides a high level of safety, sense of place and landmarks that contribute to wayfinding and an enjoyable all-season experience for every corridor user.

P. Sustainable Urban Integration and Landscape

1. The Design-Builder must meet the SUI and Landscape requirements as described in Part 2 [*Sustainable Urban Integration and Landscape Architecture*] of this Schedule.

2. Amenity Nodes:

   a. The Design-Builder must:

      i. Provide five concrete pads for pedestrian Amenity Nodes at the locations shown in the Project Description Drawings in Appendix 5-1A [Project Description Drawings]; and

      ii. Design the concrete pads as follows:

         i.) Additional scoring or patterning on the concrete pad to differentiate the Amenity Node from the adjacent sidewalk/SUP must be provided.

         ii.) Provide one bench, one waste receptacle, and one bicycle rack at each Amenity Node.

iii.) Integrate each Amenity Node into the adjacent landscape, highlight the node with landscape planting and meet the Design intent of the associated Character Zone as described in Section 2-9 [*Landscape Architecture*] of this Schedule.

iv.) The Design-Builder may add Amenity Nodes at their discretion to further enhance SUI for the LRT Corridor.

Q. Pedestrian Priority Zones

1. PPZ are delineated areas along the LRT Corridor where safe and comfortable pedestrian movement is intended to be prioritized and enhanced within the corridor.

   a. The Design-Builder must provide a PPZ at the locations, and with the extents, as listed below and as described in Section 2-3 [*Character Zones*]:

      i. Four pedestrian crossings at the intersection of 23 Ave and 111 St NW;

      ii. The west side of 111 St at the intersection of 19 Ave / Saddleback Rd NW;

      iii. The west side of 111 St at the intersection of 12 Ave NW; and

      iv. The west side of 111 St at the intersection of 9 Ave NW.

   b. Within each PPZ, the Design-Builder must provide:

      i. Continuity of surface finish from the Platform to the pedestrian crossings;

      ii. Continuity of surface finish from the sidewalk to the pedestrian crossings;

      iii. Continuity of safety fencing adjacent to and within the PPZ;

      iv. A concrete connection from the SUP to pedestrian crossing;

      v. Modular precast concrete panels as specified in Part 3 [*Civil*], Section 3-1.1.2 to strongly distinguish the crossings visually from the Trackway;

      vi. A landscape Design that meets the Design intent as described in Section 2-9.5.6 [*Pedestrian Priority Zone Landscape Design*]; and

      vii. Visual, auditory and tactile cues as described in the HFDG.

3-2.3.4 Pavement Design

A. New Construction

1. The minimum pavement structures for the following Roadways must be as specified in Table 3-2.3.4-1 [*Minimum Pavement Structures (Main Alignment)*], Table 3-2.3.4-2 [*Minimum Pavement Structures (Ancillary Locations)*] and Table 3-2.3.4-3 [*Minimum Pavement Structures (Alleys and Turnarounds)*].

Table 3-2.3.4-1 Minimum Pavement Structures (Main Alignment)

Roadway	Segment	10 mm-HT Asphalt (mm)	20 mm-B Asphalt (mm)	3-20 mm Granular Base (mm)	Cement Stabilized Subgrade (mm)
111 Street NW, Anthony Henday Drive to 23 Avenue NW	23 Avenue NW to Anthony Henday Drive LRT Bridge	50	250	300	150
127 Street SW, Ellerslie Road to Llew Lawrence OMF Accesses	Anthony Henday Drive LRT Bridge to Ellerslie Road	50	175	300	150

Table 3-2.3.4-2 Minimum Pavement Structures (Ancillary Locations)

Roadway	Segment	10 mm-HT Asphalt (mm)	20 mm-B Asphalt (mm)	3-20 mm Granular Base (mm)	Cement Stabilized Subgrade (mm)
Llew Lawrence OMF North Access Road	From 127 Street SW	50	175	300	150
Llew Lawrence OMF South Access Road and Parking Areas	From 127 Street SW	50	75	300	150

Table 3-2.3.4-3 Minimum Pavement Structures (Alleys and Turnarounds)

Roadway	Required Pavement Structure
Other Residential Alleys	100 mm 10 mm-LT; 175 mm 3-20 mm Granular Base Course centre and 250 mm 3-20 mm Granular Base Course edge; 150 mm Cement Stabilized Subgrade or geogrid
Other Residential Turnarounds	100 mm 10 mm-LT; 250mm 3-20 mm Granular Base Course; 150 mm Cement Stabilized Subgrade or geogrid
Other Commercial Alleys	50 mm 10 mm-HT; 175 mm 20 mm-B; 300 mm 3-20 mm Granular Base Course centre and 375 mm 3-20 mm Granular Base Course edge; 150 mm Cement Stabilized Subgrade or geogrid
Other Commercial Turnarounds	50 mm 10 mm-HT; 75 mm 20 mm-B; 300 mm 3-20 mm Granular Base Course centre and 375 mm 3-20 mm Granular Base Course edge; 150 mm Cement Stabilized Subgrade or geogrid

2. All Roadways, alleys, parking lots, and service roads not listed in in Table 3-4.2.3.1 [*Minimum Pavement Structures (Main Alignment)*], Table 3-4.2.3.2 [*Minimum Pavement Structures (Ancillary Locations)*] and Table 3-4.2.3.3 [*Minimum Pavement Structures (Alleys and Turnarounds)*] must be Constructed of asphalt, in accordance with the D&CS, to match existing pavement structure.

3. All sections of Roadway listed in Table 3-2.3.4-2 [*Minimum Pavement Structures (Ancillary Locations)*] must be fully reconstructed as required to tie into the existing Roadway in accordance with this Section 3-2.3.4 [*Pavement Design*] of this Schedule unless specified otherwise.

4. Removal of existing pavement structure for new Roadway construction must be such that the edge of any pavement structure that is to be retained must be along the lane lines of the future traffic lanes.

5. Final stage paving for Roadways parallel to the Trackway must be completed from lip of gutter to lip of gutter for the length of each Roadway segment from cross street to cross street as a minimum, including any existing pavement structure that remains and must not be completed for a minimum of 365 days from the time base paving is completed. Prefill may be required prior to final stage paving.

6. For final stage paving for Roadways that cross the Trackway, mill and overlay to the full width of any lane or lanes impacted or adjacent to work on that Roadway.

7. All Roadways within the Construction Limits as shown in Appendix 5-1A [*Project Description Drawings*] that are not new Roadway construction, with the exception of the traffic lanes on the 111 Street Roadway Bridge, will require pavement milling and a 50 mm asphalt overlay. Milling and overlay of traffic lanes on the 111 Street Roadway Bridge that are not impacted by Construction is not required. Existing concrete bus lanes north of 23 Avenue NW may remain in place, however new concrete pavement required due to curb reconstruction must be structurally connected to the existing concrete pavement.

8. Pavement structures for SUP and sidewalks must comply with the following:

    a. the relevant requirements of the D&CS;

    b. where SUP or sidewalks will be utilized as an access for Maintenance or Emergency Services vehicles as specified in Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule, the concrete or asphalt pavement structure must be Designed to accommodate such use;

    c. all boulevard SUP must be Constructed of asphalt, in accordance with the D&CS;

    d. all curb line (monolithic) SUP must be Constructed of concrete, in accordance with the D&CS; and

    e. all sidewalks must be Constructed of concrete, in accordance with the D&CS.

9. All bus stop amenity pads must be Constructed of concrete in accordance with the D&CS.

10. The minimum pavement structures for the on-street bus pads required by Section 3-2.3.5 [*Bus Stops*] of this Schedule must be as specified on Drawing #4250 of the D&CS.

11. All alley, residential, commercial, and industrial crossings must be concrete, in accordance with the D&CS.

12. For any Roadway where there is a mix of partial depth pavement removal, full depth pavement removal and mill and overlay, ensure the transition between existing and new pavement structure provides consistency between the performance of the existing and new pavement through the full section.

13. Where new curb and gutter ties into existing curb and gutter, any transition in the curb height must occur over a distance of 10H:1V. Lip of gutter tie-ins must be Designed to match.

14. Except as specified in Table 3-4.2.3.1 [*Minimum Pavement Structures (Main Alignment)*], Table 3-4.2.3.2 [*Minimum Pavement Structures (Ancillary Locations)*] and Table 3-4.2.3.3 [*Minimum Pavement Structures (Alleys and Turnarounds)*], where new Roadway ties into existing Roadway, the new pavement structure must match the existing pavement structure and must not impede sub-surface drainage.

3-2.3.5 Bus Stops

A. Provide bus stops, bus lay-bys and amenity pads at the locations specified in Table 3-2.6 [*Bus Stop Requirements*].

B. Bus stops must comply with the D&CS.

C. Bus lay-bys must be Designed to accommodate articulated bus, as defined in Figure 3-3.2.3-2 [*City of Edmonton Articulated Bus Profile*] of this Schedule, entering, exiting, and stopping parallel to the curb face, except as otherwise specified in Table 3-2.6 [*Bus Stop Requirements*].

1. An additional 1.2 m must be added to the front overhang shown in Figure 3-3.2.3-2 [*City of Edmonton Articulated Bus Profile*] of this Schedule, to allow for an extended bike rack.

2. The width of the buses shown in Figure 3-3.2.3-1 [*City of Edmonton Bus Profile*], 3-3.2.3-2 [*City of Edmonton Articulated Bus Profile*] and Figure 3-3.2.3-3 [*City of Edmonton Electric Bus Profile*] of this Schedule must be increased to 3.15 m to include the wing mirrors.

D. The City will design, supply and install all bus shelters, bus stop signs, benches, litter receptacles and other furniture associated with the new bus stops. Notify the City in writing, not less than 17 Business Days and not more than 25 Business Days prior to a bus stop amenity pad being complete and ready for opening, in accordance with Section 1-1.3 [*City Works*] of this Schedule. The number of bus stops opening in any week must not exceed five.

E. Replacement bus service stops are required to allow Passengers to access replacement buses when the LRT cannot operate due to an emergency or scheduled Maintenance. Provide a replacement bus service stop in each direction at each Station, except:

1. at Heritage Valley North Station in the northbound direction.

F. Each replacement bus service stop must be located within line of sight of the Platform it is replacing and be located along the mainline Roadway within 100 m of the Platform. Bus stops listed in Table 3-2.6 [*Bus Stop Requirements*] may be used as replacement bus service stops if they meet the sightline and distance requirements of the D&CS. If no regular bus stop is available, the replacement bus service bus may be located on a section of Roadway where there is only one lane of traffic in that direction. Provide a hard surfaced, accessible connection between each replacement bus service stop and the Platform it is replacing.

G. Where a replacement bus service stop is not located at a regular bus stop, provide the following at each replacement bus service stop:

1. a 17 m length straight faced curb to comply with drawing #5020 in the D&CS;

2. a 17 m long concrete pad behind the curb joining the curb with the adjacent boulevard sidewalk or SUP. If the adjacent sidewalk or SUP is curbline (monolithic) sidewalk or SUP, then no concrete pad is required; and

3. to facilitate access to the bus doors, no physical obstructions are permitted in the following locations along the 17 m contingency bus service bus stop, measured from the head of the bus stop:

a. 0 m to 1.5 m for the front doors;

b. 4.5 m to 8.5 m for the rear doors; and

c. 11.5 m to 14 m for the rear doors (articulated bus).

Table 3-2.3.5-1 Bus Stop Requirements

Bus Stop Street	Direction	Location	Shown on Part 1, Appendix 5-1A, Figure #	Lay-by Required	Bus Stop Pad (In-Street) Length	Amenity Pad Required	Notes
111 Street NW	Southbound	South of 111 Street NW and 23 Avenue NW Intersection	13002	No	24 m	12 m x 4 m in front of SUP along curb. Additional 3.0 m to connect to SUP.	New bus stop to replace the existing stop in similar location.
111 Street NW	Northbound	North of YMCA access	13003	N/A	N/A	N/A	Existing bus stop; Existing bus pad.
111 Street NW	Northbound	Between Sobeys Heritage and YMCA Service access	13003	N/A	N/A	N/A	Existing bus stop.
111 Street NW	Southbound	South of YMCA access	13003	No	24 m	12 m x 4 m in front of SUP along curb. Additionally, 2.0 m to connect.	New bus stop to replace the existing stop in similar location
111 Street NW	Northbound	Between 7- Eleven access and 19 Avenue NW	13004	N/A	N/A	N/A	Existing bus stop; Existing bus pad
111 Street NW	Southbound	South of the 111 Street NW and 19 Avenue NW Intersection	13004	No	24 m	12 m x 4 m between Roadway and track.	New bus stop to replace the existing stop in similar location
111 Street NW	Northbound	North of 111 Street NW and 12 Avenue NW Intersection	13006	No	24 m	12 m x 4 m attached at end of sidewalk.	New bus stop to replace the existing stop in similar location
111 Street NW	Southbound	South of 111 Street NW and 12 Avenue NW Intersection	13006	No	24 m	12 m x 4 m in between Roadway and track.	New bus stop to replace existing stop in similar location
111 Street NW	Northbound	North of 111 Street NW and 9 Avenue NW Intersection	13007	No	21 m	9 m x 3 m attached at end of sidewalk.	New bus stop to replace the existing stop in similar location

Bus Stop Street	Direction	Location	Shown on Part 1, Appendix 5-1A, Figure #	Lay-by Required	Bus Stop Pad (In-Street) Length	Amenity Pad Required	Notes
111 Street NW	Southbound	South of 111 Street NW and 9 Avenue NW Intersection	13007	No	21 m	9 m x 4 m in between Roadway and track.	New bus stop to replace the existing bus stop which is ~125 m north of the new location
9 Avenue NW	Eastbound	East of 111 Street NW and 9 Avenue NW Intersection	13007	No	21 m	9 m x 3 m in front of sidewalk.	New bus stop to replace the existing stop in similar location
9 Avenue NW	Eastbound	West of 111 Street NW and 9 Avenue NW Intersection	13007	No	21 m	9 m x 3 m in front of sidewalk.	New bus stop to replace the existing stop in similar location
23 Avenue NW	Westbound	West of 111 Street NW and 23 Avenue NW Intersection	13011	No	24 m	17 m x 4.5 m in front of sidewalk.	New bus stop to replace the existing stop in similar location
23 Avenue NW	Westbound	East of 111 Street NW and 23 Avenue NW Intersection	13012	No	24 m	12 m x 2 m in front of sidewalk with attachment.	New bus stop to replace the existing stop in similar location

3-2.3.6 Bicycle Parking

A. At a minimum, provide the number of bicycle racks specified in Table 3-2.3.6-1 [*Bicycle Racks Required at Each Station*].

Table 3-2.3.6-1 Bicycle Racks Required at Each Station

Station	Number of Bicycle Racks
Twin Brooks Station	20
Heritage Valley North Station	60

B. Bicycle racks at Twin Brooks Station must be located within 50 m of a Platform Access Point and may be clustered in groups.

C. Provide Covered Bicycle Racks for a minimum of 60 bicycles, within 70 m walking distance of the east or west ramp at the end of the Heritage Valley North Station. The bicycle racks must either be grouped all together or in a maximum of three smaller groups. The Covered Bicycle Racks must be located within the Heritage Valley North Station/Heritage Valley Park and Ride Transit Facility.

D. Any existing bicycle racks removed to accommodate the Construction must be replaced with racks of an equal or better Design or must be stored by the Design-Builder and reinstalled within the same street block, to accommodate the same number of bicycles.

E. Bicycle racks must be provided at Amenity Nodes as specified in Section 2-3 [*Character Zones*] of this Schedule.

3-2.3.7 Signing, Delineation and Pavement Markings

A. Signage

1. Provide all Roadway, pedestrian, and bicycle signage required to guide, regulate, and control traffic and reinstate all existing information signage within the Lands in accordance with the requirements of Manual On Uniform Traffic Control Devices published by the Transportation Association of Canada (MUTCD (Canada)), except as follows:

    a. the City will supply all “regulatory”, “warning” and “information” signs as defined in MUTCD (Canada) in accordance with the Accepted Final Designs provided by the Design-Builder except for the overhead sign structure on the west side of 111 Street NW south of 9 Avenue NW;

    b. the City will install all “regulatory”, “warning” and “information” signs as defined in MUTCD (Canada) in accordance with the Accepted Final Designs provided by the Design-Builder, including “regulatory” and “traffic control” signs to be mounted on Traffic Signal poles or arms except for the overhead sign structure on the west side of 111 Street NW south of 9 Avenue NW. Provide the City with sufficient notice that the Roadway or SUP will be complete and ready for opening, in accordance with Section 1-1.3 [*City Works*] of this Schedule; and

    c. the need for relocation or protection of the overhead sign structure on the west side of 111 Street NW south of 9 Avenue NW must be assessed based on the Alberta Transportation and Economic Corridors (ATEC) Roadside Design Guide, and if relocation is required must comply with Section 15 “Overhead Sign Structures” of the ATEC “Bridge Structures Design Criteria”.

2. Provide all other active and static Roadways signage required for operation of the Capital Line South LRT Extension.

3. Maintain all existing or temporary “regulatory” and “traffic control” signage until permanent signage is installed.

B. Delineation Markers

1. Where delineation markers are required, they must comply with the requirements of MUTCD (Canada).

C. Pavement Markings

1. Provide all Roadway, pedestrian, and bicycle pavement markings required to guide, regulate and control traffic within the Lands in accordance with the requirements of D&CS, Volume 8 – Pavement Markings, 2022 and the TAC manuals referred to in Section 3-2.2 [*Reference Standards*] of this Schedule, except:

    a. The City will supply and install all permanent pavement markings in accordance with the Accepted Final Designs provided by the Design-Builder. Provide the City with sufficient notice that the Roadway will be complete and ready for public use, in accordance with Section 1-1.3 [*City Works*] of this Schedule.

2. All existing and temporary pavement markings must be maintained until permanent pavement markings are installed.

3-2.3.7.2 Sustainable Urban Integration

A. Part 2 [*Sustainable Urban Integration and Landscape Architecture*] provides the overarching requirements for SUI. SUI goals and objectives outlined in Section 2-1.3 [*SUI Goals and Objectives*] must be met. Additional component specific SUI requirements have been incorporated into this Part.

3-2.4 CONSTRUCTION SPECIFICATIONS

3-2.4.1 Road Appurtenances

A. Provide all road appurtenances required by the Road Safety Audits, including traffic barriers, pedestrian barriers, and protective netting, or an alternate which has been Accepted by the City.

B. Where median or roadside barriers are required, such barriers, including end treatments, must be Designed in accordance with the Alberta Transportation Roadside Design Guide and comply with Alberta Transportation Standard Specifications for Highway Construction.

3-2.4.2 Restoration of Infrastructure

A. Where Existing Infrastructure is impacted by Construction, restore or reconstruct all such Infrastructure, including all Roadways, sidewalks, driveways, SUP, curbs and gutters, medians, traffic islands, storm drain systems, Utilities, signs, markings, Street Lighting, streetscape and landscaping.

B. Where elevation or grading of Existing Infrastructure, including sidewalks, driveways and other accesses, is impacted by Construction, restore existing conditions so that the new Infrastructure matches the existing grades at the boundary of the City Lands. Where final grading does not permit the restoration of existing sidewalks and driveways to within 10 mm of the existing grade without introduction of a step(s), transitions must be provided using a ramp NBCAE requirements, without adversely affecting the grades and drainage within the adjacent land. Where access to property outside the Lands is required in order to complete such tie-ins, the Design-Builder must obtain temporary access easements and remedial Construction agreements to allow access in accordance with Schedule 4 [*Design and Construction Protocols*] of the Agreement and Section 3-2.3.3.1G [*Slopes*] of this Schedule.

3-2.4.3 Area Specific Requirements

3-2.4.3.1 General

A. The lane assignments, lane direction and vehicle turning movement requirements along the length of the LRT Corridor must be as shown on Figures 5-1A-01 to 5-1A-08 of Appendix 5-1A [*Project Description Drawings*] in Part 1 [*General*] of this Schedule.

B. The minimum, maximum and recommended lane widths must be as set out in the D&CS.

C. Turning bay lengths at intersections must be as shown on Figures 5-1A-01 to 5-1A-08 of Appendix 5-1A [*Project Description Drawings*] in Part 1 [*General*] of this Schedule.

D. Signalized intersections will be provided in the locations listed in Part 6 [*Systems*] of this Schedule.

E. Left turns will be prohibited at all intersections except in those locations shown on Figures 5-1A-01 to 5-1A-08 of Appendix 5-1A [*Project Description Drawings*] in Part 1 [*General*] of this Schedule.

F. In any intersections where traffic running parallel to the Trackway is permitted to make a left or right turning movement across the Trackway, a separate left turn or right turn bay must be provided for that turning movement.

G. Provide crosswalks on all sides of signalized intersections except as otherwise specified in this Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule.

H. Provide “mid-block” crosswalks in the locations listed in Part 6 [*Systems*] of this Schedule.

I. All crosswalks which cross the track must be controlled by pedestrian Signals as detailed in Part 6 [*Systems*] of this Schedule.

J. Multiple stage crosswalks, where the crossing of opposite directions of Roadway or the crossing of the Roadway and track are on separate Traffic Signal phases, must have a horizontal stagger between crosswalks for each stage. The stagger must be a minimum offset of the crosswalk width plus 1.0 m.

K. Provide curb ramps at all crosswalks. The width of the ramp must equal the width of the adjacent walk or SUP.

L. All sidewalks, SUP and Roadways Constructed as part of the Project must provide a seamless transition into the applicable Existing Infrastructure.

M. Where a sidewalk, SUP or Roadway is provided parallel to an existing parking lot and abuts the existing parking lot, provide a curb at the edge of the City Lands. Where the distance between the edge of sidewalk or SUP and the edge of the City Lands is less than 0.5 m, a hard surface must be provided in accordance with the applicable Character Zone. Where the distance between the edge of sidewalk or SUP and the edge of the City Lands is greater than 0.5 m, a grassed surface must be provided.

N. Where an existing SUP or sidewalk has been realigned as part of the Construction, all private walk connections from all residences, businesses, and other facilities adjacent to the SUP or sidewalk must be re-established without negative impacts on Existing Infrastructure.

O. Except as otherwise specified in this Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule, re-establish all SUP and sidewalks that are impacted by the Construction in accordance with D&CS, but to the same geometrical standard as the applicable existing SUP and sidewalks.

P. Where SUP are leading to a sidewalk or plaza area, there must be clear visual cues of the different uses through delineation, pavement material types and signage.

Q. Preserve all vehicular and pedestrian accesses between a Roadway and land adjacent to that Roadway, including accesses to existing alleys, private driveways, and commercial properties except as otherwise specified in this Section 3-2.4.3 [*Area Specific Requirements*] or as shown in Appendix 5-3A [*Access Closure Drawings*] of this Schedule.

R. Coordinate the Access Closure in accordance with Appendix 5-1A [*Project Description Drawings*] in Part 1 [*General*] of this Schedule.

1. For the Access Closure, the Design-Builder may block vehicular access with physical means no earlier than the bylaw effective date as listed in Table 3-2.11-1 [*Access Closure Bylaw Effective Date*] except as otherwise specified in this Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule.

Table 3-2.11-1 Access Closure Bylaw Effective Date

Closure Group	Description	Bylaw Effective Date
Commercial Access	ESSO Service Station access removal (111 Street NW)	January 21, 2025

2. For the Access Closure, provide the City 6 months advance notice prior to the physical closure of the access except as otherwise specified in this Section 3-2.4.3 [*Area Specific Requirements*] of this Schedule.

S. On-street parking facilities including parking lanes, DATS parking, Maintenance vehicle parking and Kiss and Rides, must in general be in the locations shown on Figures 5-1A-1 to 5-1A-08 of Appendix 5-1A [*Project Description Drawings*] in Part 1 [*General*] of this Schedule.

T. In consultation with the City, provide a safe location at each Station for a Maintenance vehicle to park without impeding traffic or pedestrian movement or LRT operations.

3-2.4.3.2 127 Street SW (Ellerslie Road to Llew Lawrence OMF Access)

A. 127 Street SW (Ellerslie Road to Llew Lawrence OMF Access) must be as shown on Figures 5-1A-07 to 5-1A-08 of Appendix 5-1A [*Project Description Drawings*] in Part 1 [*General*] of this Schedule.

B. Roadway access from 127 Street SW must be provided to both the east and west security gates to the Llew Lawrence OMF.

C. A 3.0 m SUP connection from the Heritage Valley Transit Centre must be provided to the pedestrian access gate at the SW corner of the OMF site.

D. The concrete sidewalk on the west side of 127 Street NW must be extended to tie into the SUP at the SE corner of the expanded SWMF.

E. All existing Roadways and sidewalks must be retained between Anthony Henday Drive and the Heritage Valley North Station/Heritage Valley Transit Center.

F. Road Closures, Access Closures and Connection Removals along 127 Street SW (Existing Anthony Henday LRT Drive Bridge to South Project Limit) must be as shown on Figures 5-1A-01 to 5-1A-08 of Appendix 5-1A [*Project Description Drawings*] in Part 1 [*General*] of this Schedule.

3-2.4.3.3 111 Street NW (North Project Limit to Existing Anthony Henday Roadway Bridge)

A. 111 Street NW (North Project Limit to existing Anthony Henday Roadway bridge) must be as shown on Appendix 5-1A [*Project Description Drawings*] in Part 1 [*General*] of this Schedule.

B. Existing number of travel lanes as well as pedestrian and cycling facilities must be retained between the north Project limits and the existing Anthony Henday Roadway bridge with the exception of the following sections:

1. Widening of 111 Street NW southbound to three lanes (currently two lanes) between 23 Avenue NW and 9 Avenue NW
2. Widening of 111 Street northbound to three lanes (currently two lanes) between 19 Avenue NW (Saddleback Road) and 23 Avenue NW
3. Provision for double left turn lanes in all directions at the intersection of 23 Avenue NW and 111 Street NW
4. Revised geometry at 23 Avenue NW to minimize the length of the 23 Avenue Underpass
5. Provision of an at- grade crossing at the south end of the Century Park Station for Emergency or temporary operational use
6. Continued provision of a Shared Use Path for 111 Street NW through the corridor
7. Improved connections to the Shared Use Path at Blackmud Creek
8. Intersection channelization and operational improvements at 19 Avenue NW, 12 Avenue NW and 9 Avenue NW
9. Revised pedestrian crossings at 23 Avenue NW, 19 Avenue NW, 12 Avenue NW and 9 Avenue NW
10. Provision for a Traffic Signal at the Kinsmen Arena/YMCA access (111 Street NW at approximately 20 Avenue NW), including a crosswalk and access to a southbound bus stop for pedestrians
11. Maintenance access and parking along the corridor as required

C. The minimum, maximum and recommended lane widths within the TUC are set out in the Alberta Transportation Highway Geometric Design Guide. Where new Roadway ties into existing Roadway with lane widths that exceed the Design widths, a suitable transition must be included.

D. Provide SUP and sidewalks as specified in Table 3-2.4.3-1 The minimum SUP width is 3.0 m with an additional 0.5 m clearance from vertical obstacles (poles, fencing, barriers, etc.) and a 1.0 m clearance from any track right-of-way fence or barrier. It is recognized that within the constrained right-of-way from 9 Avenue NW to 10 m north of the north ramp access to the Twin Brooks Station these minimums may not be achievable, and in this area the minimum clearance to the trackway may be reduced to 0.5 m to assist in optimization of functionality and safety.

E. Provide temporary access to the lift station and oil and grit separator located in the northeast corner of the intersection of 23 Avenue and 111 Street NW while the detour is operational. Maintenance crews must be allowed access to the lift station throughout construction, this can be achieved through lane closures. Restore the entire paved lift station access and commercial crossing to tie into the new curb line on 111 Street NW. The final design must allow a hydrovac truck to park adjacent to the access hatch. Match the pavement for Residential Turnarounds in Table 3-2.3.4-3 Minimum Pavement Requirements. Design and Construct concrete truck access to the oil and grit separator.

Ensure that hydrovac trucks can pull off 23 Avenue NW and park parallel to the oil and grit separator such that the truck is no greater than 4 m from the access hatch. The Design-Builder must obtain necessary City approvals for the final lift station and oil and grit separator access locations.

F. Road Closures, Access Closures and Connection Removals along 111 Street NW (must be as shown on Appendix 5-3A [*Access and Road Closure Drawings*] of this Schedule.

G. Provide a padlockable swing gate(s) across the full width of the new access to the south TUC in accordance with Drawing CB-6-2.12M2 [*Class 'B' Fence*] of the Alberta Transportation Highway Geometric Design Guide.

Table 3-2.4.3-1 111 Street NW and Connecting Streets (North Project Limit to Existing Anthony Henday Drive LRT Bridge) SUP/Sidewalk Requirements

Road	From	To	Side	Sidewalk/SUP Width	Notes
111 Street NW	North Project boundary	23 Avenue NW	East	2.5 m monowalk	To tie into existing s/w and curb.
111 Street NW	North Project boundary	23 Avenue NW	West	3.0 m SUP	To tie into existing 2.5 m SUP.
111 Street NW	23 Avenue NW	Saddleback Rd/ 19 Avenue NW	East	2.1 - 2.4 m sidewalk	Existing.
111 Street NW	23 Avenue NW	Saddleback Rd/ 19 Avenue NW	West	3.0 m SUP	To connect into 1.8 m monowalk along Saddleback Road.
23 Avenue NW	Corner of 111 Street NW	~170 m west of 111 Street NW	North	1.8 m sidewalk	To connect from corner to existing sidewalk.
23 Avenue NW	Corner of 111 Street NW	~35 m east of 111 Street NW	North	3.0 m sidewalk	Existing.
23 Avenue NW	Corner of 111 Street NW	~25 m east 111 Street NW	South	2.5 m sidewalk	To tie into existing 2.3 m sidewalk.
Saddleback Rd	Corner of 111 Street NW	~25 m west of 111 Street NW	North	1.8 m monowalk	To tie 3.0 m SUP along 111 Street NW into existing 1.5 m monowalk.
Saddleback Rd	Corner of 111 Street NW	~25 m west of 111 Street NW	South	1.8 m monowalk	To tie into 5.0 m SUP along 111 Street NW.
111 Street NW	Saddleback Rd/ 19 Avenue NW	Blackmud Creek LRT Bridge North End	East	~ 3.0 m SUP	Existing (ends prior to Blackmud Creek).
111 Street NW	Saddleback Rd/ 19 Avenue NW	Blackmud Creek LRT Bridge North End	West	5.0 to 3.0 m SUP	13 m x 3 m maintenance parking pad located at transition from 5.0 m to 3.0 m SUP.
111 Street NW	Blackmud Creek LRT Bridge North End	Blackmud Creek LRT Bridge South End	West	4.2 m SUP on bridge; 3.0 m below	Existing Sidewalk to be relocated to new LRT bridge; additional SUP for area within vicinity to Blackmud Creek.
111 Street NW	Blackmud Creek LRT Bridge South End	12 Avenue NW	West	3.0 m SUP	To connect to 4.2 m SUP over Blackmud Creek LRT Bridge.
12 Avenue NW	Corner of 111 Street NW	~28 m east of 111 Street NW	North	1.8 m sidewalk	To connect from corner to existing SUP.
12 Avenue NW	Corner of 111 Street NW	~19 m east of 111 Street NW	South	1.8 m sidewalk	To connect from corner to existing SUP.
12 Avenue NW	Corner of 111Street NW	~21 m west of 111Street NW	North	1.8 m sidewalk	To connect from corner to existing sidewalk.

Road	From	To	Side	Sidewalk/SUP Width	Notes
12 Avenue NW	Corner of 111 Street NW	~36 m west of 111 Street NW	South	1.8 m sidewalk	To connect from corner to existing sidewalk.
111 Street NW	12 Avenue NW	9 Avenue NW	West	3.0 m SUP	15 m x 3 m maintenance parking pad located at transition from 4.2 m to 3.0 m SUP.
9 Avenue NW	Corner of 111 Street NW	~37 m east of 111 Street NW	North	1.8 m sidewalk	To connect from corner to existing sidewalk.
9 Avenue NW	Corner of 111 Street NW	~21 m east of 111 Street NW	South	1.5 m sidewalk	To connect from corner to existing sidewalk.
111 Street NW	9 Avenue NW	Existing Anthony Henday Drive Bridge	East	3.0 m SUP	Tie into existing trail.
111 Street NW	9 Avenue NW	~5 m south of 9 Avenue NW	West	1.5 m sidewalk	Connecting into new bus pad.
111 Street NW	9 Avenue NW	Existing Anthony Henday Drive Bridge	East	3.0 m SUP	

3-2.4.3.4 Llew Lawrence OMF Site

A. Access roads to and within the Llew Lawrence OMF Site must be in accordance with the requirements of Part 7 [*Operations and Maintenance Facility*] of this Schedule and:

1. The Design vehicles for the access roads to and within the Llew Lawrence OMF Site will be a WB-21 as defined in TAC Geometric Design Guide for Canadian Roads and a City of Edmonton Waste Collection Truck as defined in the D&CS.

2. The minimum pavement structure for the access roads for the Llew Lawrence OMF Site must be as specified for the access road with truck traffic in Table 3-4.3.11 [*Minimum Pavement Structures*] of this Schedule.

3. Access roads to and within the Llew Lawrence OMF Site must be Constructed in accordance with Section 3-2.3.3 [*Geometric Design*] of this Schedule.

4. SUP within the Llew Lawrence OMF Site must be Constructed in accordance with Section 3-2.3.3 [*Geometric Design*] of this Schedule.

B. Parking for the Llew Lawrence OMF Site must be in accordance with the requirements of Part 7 [*Operations and Maintenance Facility*] of this Schedule:

1. Parking layouts must meet the requirements of City's Zoning Bylaw, 12800 (Clauses 54.2 and 54.4).

2. The minimum pavement structure for the parking facilities for the Llew Lawrence OMF Site must be as specified for the asphalt parking area in Table 3-2.3.4-2 [*Minimum Pavement*] of this Schedule.

3-2.4.3.5 Safety

A. Provide the least intrusive means necessary, as specified in this Section 3-2.4.3.5.D to provide public safety based on the Safety and Security Certification Program.

B. Where separations and barriers are provided, they must be consistent with an open, integrated, and SUI-compliant Design.

C. All posts of fences or barriers must be vertical.

D. Permitted types of safety cues, separations and barriers and their application are as described in the HFDG.

SECTION 3-3 – STORMWATER MANAGEMENT

3-3.1 INFRASTRUCTURE DESCRIPTION

A. This Section 3-3 [*Stormwater Management*] sets out the requirements for the Stormwater Management System, including the installation of new and modification or removal of existing Stormwater Management Infrastructure required to manage stormwater and other flows within and from the Lands.

3-3.2 23 AVENUE UNDERPASS DRAINAGE

A. Municipal Infrastructure required to receive the stormwater runoff from the 23 Avenue Underpass is under construction with a completion date forecasted for November 2024. Work that will be completed includes a 1200 mm reinforced concrete pipe installed under the low point of the underpass that will be the receiving pipe for the underpass drainage. This 1200 mm pipe will drain by gravity to a new lift station, which will then pump the stormwater via a force main to the existing storm line on 23 Avenue NW, east of the underpass. The system includes a pipe storage system that will accommodate the 1:100 year rainfall event stormwater runoff volumes. IFC drawings will be included in the Disclosed Data for information only.

B. Refer to the Design Brief Memorandum, City of Edmonton, Capital Line South, 23 Avenue NW Drainage Early Works issued by Associated Engineering, July 2022 and the Capital Line South, Early Works Design Drawings, Issued for Construction by Associated Engineering, October 17, 2022, included for reference in the Disclosed Data for details on Existing Infrastructure that will support underpass drainage.

C. The scope of work for the Design-Builder will include all track and Structure drainage features related to the underpass including perimeter drains, catch basins, cleanouts, connection to the existing 1200 mm pipe and required flood monitoring and controls within the Structure. The scope of work includes required alarms and communication with the LRT Building Management System (BMS).

D. The scope of work for the Design-Builder includes required surface and roadway grading Design to ensure that the catchment areas contributing to the underpass are minimized.

E. The Design-Builder will not be permitted to use the lift station for dewatering activities during construction. It will be the responsibility of the Design-Builder to obtain approval from Public Utility Company for the use of any portion of the storm system upstream of the lift station including the inlet manhole, oil and grit separator and 1200mm pipe for dewatering activities during construction of the underpass. Approval for these purposes cannot be guaranteed.

3-3.3 ROADWAY DRAINAGE

A. The Design-Builder must provide Major and Minor Drainage systems including surface grading, catch basins, catch basin leads, mainline pipe, manholes, ditches, and swales.

B. Minor system roadway drainage will connect to the existing piped storm mains running the length of 111 Street NW. Drainage within the TUC will be via a network of ditches and swales connecting to the existing surface drainage features.

3-3.4 LLEW LAWRENCE OMF AND HERITAGE VALLEY PARK AND RIDE SWMF

A. Design and Construct the Major and Minor Drainage systems within the Llew Lawrence OMF to drain stormwater runoff to the expanded Heritage Valley Park and Ride SWMF.

B. Design and Construct the required expansion to the Heritage Valley Park and Ride SWMF to accommodate increased runoff from the Llew Lawrence OMF including realignment of the storm

outfall and the SUP within the SWMF. Reconfigure the SWMF footprint to accommodate the revised pond inlet location.

C. Prepare submissions for review and approval by detailing the modifications to the SWMF including storage calculations and details on the impact to the existing downstream system including the MacEwan SWMF and facilities within the TUC.

3-3.5 TRACK DRAINAGE

A. A tie and ballast track system shall be installed in most of the track areas except at the 23 Avenue Underpass, Blackmud Creek LRT Bridge, and Anthony Henday Drive LRT Bridge areas. Perforated subdrains must be installed for the portions of the tie and ballast track areas from the existing Century Park Station to a high point located south of the 111 Street NW and 9 Avenue NW intersection. The subdrain system may tie-in to the existing Minor Drainage system at suitable locations with approval from EPCOR Water Services Inc. (Drainage Services).

B. Ditches may be constructed for drainage of the portions of the tie and ballast track from the high point identified above to the proposed Heritage Valley North Station. The ditch system may tie-in to the existing surface drainage system beside Anthony Henday Drive with the approval of Alberta Transportation. Runoff from the mainline track adjacent to the Llew Lawrence OMF may be conveyed to the expanded Heritage Valley Park and Ride SWMF instead of the existing surface drainage system beside Anthony Henday Drive. The Design-Builder will be responsible for obtaining the required approvals for their proposed ditch drainage system within the TUC. The City is anticipating that a surface drainage system will meet the requirements for approval. If a surface drainage system is not approved by Alberta Transportation, an alternate piped system would be considered a Change in accordance with Schedule 13 [*Changes*].

C. On Blackmud Creek LRT Bridge, runoff must be collected at the lowest point on the proposed bridge and then be conveyed to the existing Minor Drainage system through the proposed storm sewers. The scope of work for track drainage works will include:

1. Design and Construct a subdrain system complete with cleanouts and backflow preventers that may tie-in to the Minor Drainage system.

2. Design and Construct a surficial drainage system including ditches, culverts and associated erosion control measures that may tie-in to the existing overland drainage system.

3. Design and Construct catch basins, grit traps and storm sewers for the proposed Blackmud Creek LRT Bridge that may tie-in to the existing Minor Drainage system.

3-3.6 REFERENCE STANDARDS

A. Without limiting Section 1-2 [*Reference Documents*] of this Schedule, and except as otherwise specified herein, the Stormwater Management System and all associated Infrastructure must comply with the following codes, standards and regulations:

1. City of Edmonton High Floor LRT Design Guidelines (March 2022)

2. Design and Construction Standards, Volume 3: Drainage, Vol. 3-02 Stormwater Management and Design Manual (February 2022)

3. *EPCOR Drainage Services Bylaw* (City's Bylaw, 18100) (February 2020)

4. City's *Drainage Bylaw*, 18093 (January 2021)

5. City of Edmonton Erosion and Sedimentation Control Field Manual (January 2005), available on the City's website

6. The following clause discussing minimum Quality standards in Section 6.0 of the Municipal Policies and Procedures Manual, Alberta Environment (April 2001): “Stormwater management techniques to improve water quality must be included to effect a minimum of 85% removal of sediments of particle size 75 microns or greater”.

7. City of Edmonton Low Impact Development Construction, Inspection & Maintenance Guide, Edition 1.0 (May 2016), available on the City’s website

8. The Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, Part 5: Stormwater Management Guidelines (Alberta Environment and Parks) (March 2013)

9. EPCOR Water and Sewer Connections Guidelines (July 2021)

B. In the event of any conflict, ambiguity or inconsistency between or among the requirements of the above listed codes, standards and regulations, the more stringent requirements will apply.

3-3.7 DESIGN REQUIREMENTS

3-3.7.1 General

A. Design and Construct the Stormwater Management System to accommodate the following Design storm events: 1:2 year, 1:5 year, 1:25 year and 1:100 year rainfall events, each as defined in the D&CS, Volume 3: Drainage, Vol. 3-02 Stormwater Management and Design Manual (February 2022).

B. The Stormwater Management System must be Designed in accordance with the goals and principles set out in the following City of Edmonton documents:

1. City of Edmonton Stormwater Quality Control Strategy and Action Plan (June 2008). Available on the City’s website.

2. City of Edmonton Total Loadings Plan (June 2009). Available on the City’s website.

3. EPCOR’s Stormwater Integrated Resources Plan. Available online.

C. Provide Minor Drainage systems to carry stormwater runoff for events up to and including the 1:5-year rainfall event.

D. Provide Major Drainage systems to carry stormwater runoff in excess of the capacity of the Minor Drainage systems, for events up to and including the 1:100 year rainfall event.

E. Design and Construct the Stormwater Management System to:

1. meet the SUI objectives and requirements of this Project;

2. maximize the use of Existing Infrastructure; and

3. protect downstream Stormwater Management Systems and the Environment.

F. Design and Construct the Stormwater Management System to provide:

1. runoff quantity control (for all events up to and including the 1:100 year rainfall event);

2. runoff quality treatment, in accordance with Section 3-3.7.1.1 [*Water Quality Treatment*] of this Schedule; and

3. spill containment, in accordance with Section 3-3.3.7.1.1 [*Water Quality Treatment*] of this Schedule.

G. Design and Construct the Stormwater Management System such that drainage from the City Lands does not adversely impact adjacent properties or the surrounding Environment, including properties, Roadways, sidewalks and SUPs.

H. Design and Construct the Stormwater Management System to not:

1. increase runoff peak flows to the existing Stormwater Management Systems or the Environment;

2. increase surface ponding depths or create additional risk of flooding on adjacent properties;

3. adversely impact runoff Quality; or

4. increase the risk of spilled materials discharging to receiving systems.

I. With the exception of the 23 Avenue Underpass, the Stormwater Management System must be a gravity system. Pumping of stormwater runoff is prohibited for all catchment areas not directly contributing to the 23 Avenue Underpass.

J. Provide trash guard systems, including grates over inlets, to intercept trash and other materials that may reduce the conveyance capacity of any existing Stormwater Management System.

K. Direct all stormwater discharge from the City Lands to locations that will not impact pedestrians or cyclists, private properties or result in erosion. Provide erosion control measures at discharge sites susceptible to erosion, including all sites without hard surfaces.

3-3.7.1.1 Water Quality Treatment

A. Design and Construct the Stormwater Management System such that discharge will not contain substances that may be deleterious to the Environment. Discharge from the Stormwater Management System into the existing Stormwater Management Systems must comply with the water Quality requirements set out in the documents referenced in Section 6-4.1.1 [*Applicable Codes, Standards, Regulations, and Guidelines*] of this Schedule.

B. Provide a multi-barrier approach to stormwater Quality treatment to ensure Site discharge water Quality complies with the water Quality requirements of this Section 3-3.7.1.1 [*Water Quality Treatment*] of this Schedule, including infiltrating LID measures.

C. Design and Construct water Quality treatment measures to provide ease of access for regular monitoring and Maintenance activities.

D. Provide grit management at all stormwater inlets.

E. Submit a spill containment strategy which must:

1. identify, describe, quantify and estimate the likelihood of occurrence of the types of spills that have potential to occur throughout the Project during its Construction and future operations;

2. describe the spill containment capacities of the various proposed Stormwater Management System elements and their capacity to contain collected materials during storm events up to and including the 1:100 year rainfall event; and

3. propose any additional measures that may be required to contain spills at any location throughout the Project.

3-3.7.2 Minor Drainage

3-3.7.2.1 General

A. Direct all stormwater runoff from the City Lands and the designated catchment area(s) to the Minor Drainage system for events up to and including the 1:5 year rainfall event.

3-3.7.2.2 Peak Flow Mitigation

A. Design and Construct the Minor Drainage systems such that peak runoff discharges from the City Lands to the existing Minor Drainage systems during the 1:5 year rainfall event do not exceed the pre-development rates.

B. Design and Construct the Major Drainage systems such that peak runoff discharges from the City Lands to the existing Minor Drainage systems during the 1:100 year rainfall event do not exceed the 1:100 year pre-development rates.

3-3.7.2.3 Peak Flow Reduction Measures

A. Provide peak flow reduction measures to satisfy criteria mentioned in Section 3-3.7.2.2 [*Peak Flow Mitigation*].

B. Structural Soil Cells should be used for peak flow reduction wherever practicable to align with the City's LID principles.

C. Where Structural Soil Cells are used as peak flow reduction measures, they must be Designed and Constructed to:

1. comply with the D&CS, Volume 3: Drainage, Vol. 3-02 Stormwater Management and Design Manual (February 2022), City of Edmonton Low Impact Development Best Management Practices Design Guide and the City of Edmonton Low Impact Development Construction, Inspection & Maintenance Guide with LID soils and landscape requirements provided in the HFDG taking precedence;

2. use a soil mix engineered to provide a 0.2 void ratio for water movement, and adequate water retention features to retain water for use by trees and other plantings; and

3. provide a 150 mm void space between the top of the soils and the top of the Structural Soil Cells to maximize the distribution of inflows through the soils, as a means of minimizing short-circuiting.

D. In the event of any conflict, ambiguity or inconsistency between or among the requirements of Section 3-3.7.2.3 [*Peak Flow Reduction Measures*] of this Schedule, the most stringent requirements must prevail as determined by the City.

E. Structural Soil Cells and any Utility Infrastructure contained within them must comply with the City's ULA requirements set out in the ULA Process.

3-3.7.3 Major Drainage

3-3.7.3.1 General

A. Direct all stormwater runoff from the City Lands and the designated catchment area(s) to the Major Drainage system for events up to and including the 1:100 year rainfall event.

3-3.7.3.2 Flood Mitigation of Trackway

A. Design and Construct the Major Drainage system along the Trackway such that:

1. ponding and overland flow within the Trackway does not exceed the top of rail for any type of Track, other than Embedded Track, during events up to and including the 1:100 year rainfall event;

2. ponding and overland flow within the Trackway does not exceed the top of rail for Embedded Track during events up to and including the 1:5 year rainfall event;

3. ponding and overland flow within the Trackway of Embedded Track for all locations along the LRT Corridor during design events up to and including the 1:100 year rainfall event, does not exceed the lesser of:

   a. 100 mm, or

   b. the maximum depth of water through which the LRV can pass without damage.

4. ponding and overland flow does not occur at any point of safety or Emergency egress pathway (each as described in NFPA 130) along Elevated Guideways for events up to and including the 1:100 year rainfall event.

3-3.7.3.3 Overland Flow Control

A. Design and Construct the Stormwater Management System such that peak runoff discharges and discharge volumes from the City Lands to the Environment during events up to and including the 1:100 year rainfall event do not exceed the pre-development rates or volumes.

B. Design and Construct the Stormwater Management System to not alter or disrupt existing overland flow patterns from areas external to the City Lands that flow onto, across and off of the City Lands that will consist of Embedded Track or Direct Fixation Track sections, unless otherwise specified herein or required to comply with Section 3-3.7.3.2 [*Flood Mitigation of Trackway*] of this Schedule. Wherever existing overland flow patterns from areas external to the City Lands are altered or disrupted, such flow volumes must be controlled by the Stormwater Management System for events up to and including the 1:100 year rainfall event.

C. Existing overland flow patterns from areas external to the City Lands that flow across the City Lands that will contain tie and ballast track sections must be prevented from entering the tie and ballast track sections by being intercepted, controlled and redirected away from the tie and ballast track sections by the Stormwater Management System for events up to and including the 1:100 year rainfall event.

D. Peak runoff discharges from the City Lands for events greater than the 1:5 year rainfall event can overflow the Minor Drainage system and runoff the City Lands onto the adjacent existing Major Drainage systems or to natural Environments with adequate erosion control, subject to Section 3-3.7.3.4 [*Flood Mitigation of Properties*] of this Schedule.

3-3.7.3.4 Flood Mitigation of Properties

A. Design and Construct the Stormwater Management System so there is no increase in ponding within the City Lands that may extend onto adjacent properties during the 1:100 year rainfall event.

3-3.7.4 Stormwater Management – Specific Facilities

3-3.7.4.1 Track Drainage

A. The Stormwater Management System must include Minor Drainage and Major Drainage systems as required to comply with the flood mitigation requirements of Section 3-3.7.3.2 [*Flood Mitigation of Trackway*] of this Schedule.

B. Provide Trackway drain inlets upstream of all crosswalks to prevent ponding or overland flows across crosswalks for events up to and including the 1:100 year rainfall event.

C. Discharges from the Minor Drainage systems for tie and ballast track sections to the City's existing Minor Drainage systems must comply with the requirements of Section 3-3.7.2.2 [*Peak Flow Mitigation*] of this Schedule.

D. Design and Construct Direct Fixation Track to be raised on direct fixation supports with at least 50 mm of clearance above the Track Slab. Openings below the track and between the direct fixation support must be at a minimum 50 mm in height and a minimum of 300 mm in length, spaced at a maximum of 2500 mm intervals along the track alignment in order to provide ample capacity to pass runoff expected from events up to and including the 1:100 year rainfall event between the track and slab, with a minimum risk of blockage.

E. The minimum inside pipe diameter for track drainage inlets must be 250 mm and have a minimum grade of 1.0%.

F. The ditches beside the tie and ballast track are to be sized for the 1:25 year rainfall event. The 25-year design water levels on the ditches are to be at a minimum 0.3 m below the top of Subgrade elevation of the tie and ballast tracks.

G. The seepage velocities of the stormwater runoff through the ballast and sub-ballast layers are to be less than 0.6 m/s to prevent migration of particles through these layers.

H. The subdrain system and associated clean outs to convey surface runoff from the tie and ballast track areas are to be designed per City of Edmonton High Floor LRT Design Guidelines (March 2022).

3-3.7.4.2 23 Avenue Underpass

A. Design and Construct the Stormwater Management System in accordance with the Capital Line South 23 Avenue NW Drainage Early Works Design Brief Memorandum (Associated Engineering, 2022). Specifically, assessment is required such that:

1. the existing depressions along 111 Street NW north of 23 Avenue NW east and west of the proposed 23 Avenue Underpass approach are limited to a maximum depth of 0.35 m during the 1:100 year rainfall event. Mitigate any impacts to ponding depths created by the proposed 23 Avenue Underpass approach retaining walls. Optimize catch basin inlet capacities.

2. the existing overland flow path crossing 111 Street NW north of 23 Avenue NW from west to east at the Century Park entrance is eliminated.

3. no runoff flows from 111 Street NW will drain into the proposed 23 Avenue Underpass approach.

B. Design and Construct the Stormwater Management System for the 23 Avenue Underpass to convey flows from events up to and including the 1:100 year rainfall event, to discharge into the 1200 mm diameter conveyance pipe installed by others under the low point of the underpass.

3-3.7.4.3 Llew Lawrence OMF

A. Design and Construct the Stormwater Management Systems within the Llew Lawrence OMF to drain stormwater runoff from the Llew Lawrence OMF for events up to and including the 1:100 year rainfall event, to discharge into the expanded Heritage Valley Park and Ride SWMF. The catchment area may include portions of the mainline track adjacent to the Llew Lawrence OMF and within the TUC.

B. Design and Construct the Llew Lawrence OMF Minor Drainage System to discharge by gravity to the expanded Heritage Valley Park and Ride SWMF.

C. Design and Construct the Llew Lawrence OMF Major Drainage system:

1. to route flow south, overland to the expanded SWMF, for events up to and including the 1:100 year rainfall event;

2. such that the maximum depth of any overland flow or ponding within the Llew Lawrence OMF site does not exceed 350 mm for any event up to and including the 1:100 year rainfall event; and

3. such that surface ponding does not occur on pedestrian or driving areas within the Llew Lawrence OMF site for events up to and including the 1:5 year rainfall event.

D. Provide a multi-barrier approach to stormwater Quality treatment and stormwater LID measures employing natural treatment processes to ensure site discharge water complies with the water Quality treatment requirements of Section 3-3.7.1.1 [*Water Quality Treatment*] of this Schedule.

3-3.7.4.4 Heritage Valley Park and Ride SWMF

A. Design and Construct the expansion to the Heritage Valley Park and Ride SWMF:

1. to provide additional pond capacity to accommodate Minor and Major Drainage System runoff from the Llew Lawrence OMF site for any event up to and including the 1:100 year rainfall event;

2. such that the pond discharge into the existing outlet pipe does not pose an adverse effect to the existing MacEwan SWMF with increases to the HWL exceeding 0.01 m for any event up to and including the 1:100 year rainfall event;

3. that incorporates the findings and recommendations in the Capital Line South Extension (Century Park to Ellerslie Road) Owner's Engineer, Geotechnical Investigation – Stormwater Management Facility (SWMF) prepared by Capital Line Partners, November 2022.

4. Design and Construct a new pond outlet pipe:

a. such that the new pond outlet pipe connects to the existing pond outlet pipe within the Llew Lawrence OMF site limits;

b. such that the new pond outlet pipe does not conflict with the new Llew Lawrence OMF building footprint;

c. such that the horizontal distance between the new pond inlet and outlet locations is maximized; and

d. such that no Minor Drainage system connections are made directly to this pipe.

B. Design and Construct a SUP to accommodate the pond expansion and restore connectivity around the pond in accordance with requirements in Section 3-2.3.3.1K [*Shared Use Paths*] in this Schedule.

3-3.7.4.5 Building Structures

A. Design and Construct Building Structure rooftops to direct runoff from all events up to and including the 1:5 year rainfall event into gutters and drained through downspouts.

B. Design and Construct Building Structure rooftop downspouts to discharge:

1. onto adjacent absorptive Landscaped Areas for all events up to and including the 1:2 year rainfall event, with energy dissipation provided to prevent erosion of the Landscaped Areas, and with excess runoff above the 1:2 year runoff to bypass the absorptive Landscaped Areas;

2. directly into the local Minor Drainage systems where absorptive Landscaped Areas are not available, and where the Minor Drainage system is located in the vicinity of the downspout; or

3. onto surface areas not designated for regular pedestrian use (e.g., Roadway gutters), where absorptive Landscaped Areas or Minor Drainage systems are not available, and in a manner that does not negatively impact the public, private property or cause erosion.

C. Where downspouts discharge directly onto surface areas susceptible to erosion (non-hard surface areas), provide energy dissipation measures sufficient to prevent erosion.

D. Design and Construct rooftop drainage systems to control melting snow or ice from falling onto adjacent pedestrian or cyclist areas.

3-3.7.4.6 Bridges

A. Design and Construct the decks of bridges such that:

1. stormwater runoff, for events up to and including the 1:100 year rainfall event, is conveyed in gutters and swales along the decks and routed to inlets spaced at intervals no greater than 120 m, with inlet flows directed to ground level through deck drains at support piers; and

2. stormwater runoff, for events up to and including the 1:100 year rainfall event, does not spill over the sides of the decks and does not impact future operations. In addition to deck drains, deck runoff up to the 1:100 year rainfall event may be routed along the surface of the deck to the adjacent Roadway Minor Drainage and Major Drainage systems.

B. Design and Construct Bridge deck drains to discharge:

1. in accordance with the SUI requirements as noted in Section 2-9 [*Landscape Architecture*] of this Schedule;

2. onto adjacent absorptive Landscaped Areas for all events up to and including the 1:2 year rainfall event, with energy dissipation provided to prevent erosion of the Landscaped Areas, and with excess runoff above the 1:2 year runoff to bypass the absorptive Landscaped Areas;

3. into the local Minor Drainage systems where absorptive Landscaped Areas are not available, and where the Minor Drainage system is located in the vicinity of the downspout; or

4. onto surface areas not designated for regular pedestrian use or vehicular traffic (e.g., Roadway gutters), where absorptive Landscaped Areas or Minor Drainage systems are not available, and in a manner that does not impact the public, vehicular traffic, private property or cause erosion.

C. Provide energy dissipation measures sufficient to prevent erosion wherever deck drains discharge directly onto surface areas susceptible to erosion (non-hard surface areas).

D. Provide grit management through grit traps located at either of the following locations:

1. on the deck immediately below the inlets; or

2. at the ground level outlets of the deck drains provided the deck drains are Designed with sufficient slope to ensure conveyance of grit to ground level.

E. Refer to Part 2 [*Sustainable Urban Integration*] for requirements of passive irrigation systems in the Ultimate Limit State.

F. Design and Construct swale systems down the embankments of the Anthony Henday Drive LRT Bridge to convey Major Drainage runoff into the TUC corridor below, in a manner that dissipates energy and prevents erosion, if that is the route of the Major Drainage flows.

3-3.8 CONSTRUCTION SPECIFICATIONS

3-3.8.1 New Sewer Infrastructure

3-3.8.1.1 General

A. All new sewer Infrastructure must comply with the D&CS, Volume 3: Drainage, Vol. 3-02 Stormwater Management and Design Manual (February 2022).

B. New sewer Infrastructure must be located such that City and applicable Utility Company's standard clearance criteria with other Infrastructure is achieved, and such that new sewer installations are coordinated with installation of other Utility Infrastructure.

C. All new sewers must be located outside the LRT ROW in accordance with the HFDG.

D. All new Minor Drainage systems located in combined sewer service areas must discharge into the existing municipal storm sewer system where a storm system is available. All new sewer Infrastructure must be furnished using new materials only. Re-use of materials is not permitted.

3-3.8.1.2 Supplemental Drainage Standards

A. The following requirements supplement the D&CS, Volume 3: Drainage, Vol. 3-02 Stormwater Management and Design Manual (February 2022).

1. Supplemental to Section 14.5 Location of Drainage Inlets:

    a. drainage inlets must not be placed on mainline sewers; and

    b. drainage inlets must not be placed at locations where they are prone to damage by vehicular traffic or other street Maintenance equipment, including within the wheel paths of vehicular traffic.

2. Supplemental to Section 19.2.3 General Sewer Materials Requirements:

    a. All storm sewers greater than 1200 mm diameter must be concrete pipe in accordance with Canadian Standards Association (CSA) A257.2 made with Type HS high sulphate resistant Portland cement, with flexible rubber gasket joints to CSA A257.3.

    b. All storm sewers 1200 mm diameter or less must be PVC (PSM Type) SDR35 conforming to CSA B182.2, American Society of Testing Materials (ASTM) D3034, and ASTM F679 standards with minimum stiffness of 320 kPa. Sealing gaskets must meet requirements of CSA B182.2 and ASTM F477 and withstand up to 345 kPa hydrostatic pressure.

    c. The approved pipe materials for trenchless Construction sections are fiber reinforced polymer pipes (Hobas or Flowtite) and concrete pipes with PVC or HDPE liner.

        i. All pipes must be Designed to support the worst-case combinations of externally and internally imposed loads including but not limited to earth, traffic, hydrostatic and pipe jacking force, etc., with minimum factor of safety of two and have a minimum Design Life of 100 years.

        ii. The mechanical strength of the pipe must be adequate to resist any tensile or bending stresses anticipated to be imposed upon the pipe during the installation process.

iii. The total external pressure on the pipe must include an allowance for AASHTO HS25 concentrated live load, CSA S6CL800 load. If the pipe crosses under the LRT track, minimum live load surcharge must be calculated based on the worst combination of LRT live load, truck load, earth load, etc. for the portion of the pipe affected by that loading.

iv. All material specifications, relevant manufacturers' documents and Design Drawings, authenticated by a Professional Engineer must be submitted to the City by the Design-Builder.

3. Supplemental to Section 19.5.3 Location of Manholes:

   a. manholes are to be located to allow for operation and Maintenance access; and

   b. manholes are not to be located in locations that prohibit access such as behind walls or Structures or within planting beds.

4. Supplemental to Section 19.7.2 Catch Basin Lead Arrangement:

   a. catch basins may connect to a manhole or catch basin manhole but catch basin manholes must connect to a manhole - long chains of catch basin-to-catch basin manhole-to-catch basin manhole are not permitted;

   b. catch basin leads must not be placed in parallel or below the curb and gutter; and

   c. catch basin leads must be located within the Roadway - installations below sidewalks are not permitted.

5. Supplemental to Section 21.2 Engineering Drawing Requirements, the Design-Builder must submit plan-profile drawings for all sections of mainline sewer installations.

6. Supplemental to Section 02958 Leakage Testing of Sewers:

   a. Leakage testing is not required for sewer installations that include the connection of existing services. Leakage testing is required for all sewer installations where no existing services are connected to the mainline sewer.

B. Construction with Live Sewer Flow and Flow Bypass:

1. Working with live sewers is required for this Project. Flow bypass or diversion is required when installing or connecting the existing pipes to the new pipes/manholes and/or replacing existing manholes.

2. The Design-Builder is responsible for the Design, installation and operation of temporary flow bypass systems during construction. The Design-Builder must submit flow bypass plans Designed and authenticated by a Professional Engineer to the City for acceptance prior to implementation.

3. Bypass plans and Designs must be in accordance with D&CS Volume 3: Drainage, and the City's Drainage Bylaws.

C. Non-Standard Drainage Products:

1. Standard City of Edmonton drainage products must be used unless approved by the City. It is the Design-Builder's responsibility to submit all product information to the City for product approval.

SECTION 3-4 – STREET LIGHTING

3-4.1 INFRASTRUCTURE DESCRIPTION

3-4.1.1 Scope

A. Lighting requirements for the illumination of roadways, sidewalks, SUPs, and the Trackway are presented in this section. Lighting of Stations, UCs, and TPSS buildings, including adjacent access and parking areas, is described in Part 5 - Facilities of this Schedule. Lighting of the Llew Lawrence OMF, including access roadways, parking areas, and overall Site lighting is described in Part 7 – Operations and Maintenance Facility of this Schedule.

3-4.2 REFERENCE STANDARDS

A. Without limiting Section 1-2 [*Reference Documents*] of this Schedule and except as otherwise specified herein, the Street Lighting design must comply with the requirements of the following codes, standards and regulations:

1. City of Edmonton High Floor LRT Design Guidelines
2. City of Edmonton Road and Walkway Lighting Design Standards
3. City of Edmonton Road and Walkway Lighting Construction and Material Standards
4. City's *Light Efficient Community Policy* (C576)
5. Transportation Association of Canada Guide for the Design of Roadway Lighting
6. Illuminating Engineering Society of North America (IESNA) RP-8-22 Roadway Lighting

3-4.3 DESIGN REQUIREMENTS

A. Without limiting the requirements of Section 3-4.1.1 [*Scope*], this Section 3-4.3 [*Design Requirements*] sets out additional requirements for the Street Lighting of specific areas.

3-4.3.1 Roadways, Sidewalks and SUP

A. Except as otherwise specified in this Schedule, provide new lighting along all Roadways, sidewalks, plazas/concourses, and SUPs, in accordance with the D&CS and the TAC Guide for the Design of Roadway Lighting.

B. Lighting must comply with the City's *Light Efficient Community Policy* (C576), including the corresponding City Procedure.

C. Lighting systems for all Roadways, sidewalks, bridges and SUPs within the TUC must comply with the Alberta Transportation Highway Lighting Guide.

D. If the lighting Design proposes that luminaires are to be mounted on traffic signal poles, the Design-Builder must assess traffic signal pole locations following design of the traffic signal assets by the City to confirm suitability and that lighting requirements are met.

E. Luminaires may not be mounted on OCS poles unless there is no practicable alternative, and only upon approval by the City.

F. SUP lighting along 111 Street NW must be designed with a focus on Crime Prevention Through Environmental Design (CPTED) principles, as the SUP will be constrained by fences on both sides of

its length between intersections. The Design-Builder should consider the following measures to enhance both perceived and objective safety in these constrained corridors:

1. Increased lighting levels greater than design minimums, if practicable without inducing excessive light spill into adjacent properties.

2. More frequent luminaires to minimize areas of relative darkness between more brightly lit areas.

3. Pedestrian height lighting, either standard 4.9 m poles or lower height poles with two spare poles provided to the City for future replacement.

G. Decorative Street Lighting elements may be incorporated into the lighting design to enhance SUI. If non-standard lighting materials or colours are used, additional Spare Parts must be provided to the City.

H. Lighting of the SUP into the Blackmud Creek River Valley and under the new and existing bridges is not required.

I. Lighting of the access road from 111 Street to the north approach of AHD LRT Bridge is not required.

3-4.3.2 LRT Trackway

A. Lighting requirements for the Trackway, including on bridges and in the 23 Avenue Underpass are defined in the HFDG.

B. The Design-Builder may evaluate if roadway lighting provides sufficient illumination to an adjacent Trackway to minimize the total number of lighting fixtures in the corridor and enhance SUI.

C. Where practicable, lighting of the Trackway on bridges should be incorporated into the bridge Structures at or near railing level on both sides to:

1. Improve light distribution for Train Operators

2. Minimize shadows

3. Enhance SUI by eliminating poles

D. The Design of SUP lighting along 111 Street NW must consider that the SUP will be constrained by fences on both sides of its length between intersections. The Design-Builder should consider the following to enhance both perceived and objective safety in these constrained corridors:

1. Enhanced lighting levels over design minimums, if practicable without inducing excessive light spill into adjacent properties

2. More frequent luminaires to minimize areas of relative darkness between more brightly lit areas

3. Pedestrian height lighting

E. Decorative lighting (e.g., poles, luminaires) may be incorporated into the lighting design to enhance SUI. If non-standard lighting materials or colours are used, additional Spare Parts must be provided.

SECTION 3-5 – LRT CORRIDOR UTILITIES

3-5.1 INFRASTRUCTURE DESCRIPTION

3-5.1.1 Scope

A. This Section 3-5 [*LRT Corridor Utilities*] sets out the technical requirements for all temporary and permanent Utility Work. Refer to Schedule 28 [*Project Approvals and Utility Matters*] for the administrative protocols to be followed in coordinating, undertaking, and completing Utility Work.

B. The Design-Builder must confirm the location of, protect and avoid interruption of all existing Utility Infrastructure and existing Utility Service Connections that may be affected by the Project Work, unless approved in writing by the applicable Utility Company or the City as the property owner, as applicable, and in compliance with any conditions imposed in the applicable approval.

3-5.2 REFERENCE STANDARDS

A. Without limiting Section 1-2 [*Reference Documents*] of this Schedule and except as otherwise specified herein, the Utility Work and all associated Infrastructure must comply with the following codes, standards and regulations:

1. The latest version of all codes, standards, and regulations applicable to Utility Work;

2. codes and standards identified in the applicable Utility Agreements, copies of which are included in the Disclosed Data;

3. City of Edmonton Design and Construction Standards;

4. CSA 662; and

5. City of Edmonton High Floor LRT Design Guidelines.

B. Materials incorporated into the Utility Work must be approved by the relevant Utility Company prior to installation.

3-5.3 DESIGN REQUIREMENTS

3-5.3.1 Design and Construction Principles

A. The Design-Builder must coordinate with each applicable Public Utility Company and obtain the necessary new Utility Service Connections for operation and Maintenance of the Infrastructure. The Design-Builder must also confirm equipment compatibility and interoperability in compliance with each applicable Public Utility Company's connection requirements.

B. The Design-Builder must comply with the Stray Current Mitigation Program and coordinate with the Utility Companies to protect the Utility Infrastructure from corrosion impacts. Public Utility Companies will be responsible for Design and Construction of corrosion protection for their own Public Utility Infrastructure. The Design-Builder will be responsible for Design and Construction of corrosion protection for Pipeline Infrastructure.

C. The Design-Builder must not impede the flow in existing water services, sewers, drains and water courses encountered in conjunction with the Construction. Effluent from drains must not flow into an open trench. Interruption of power or telecommunication services must not be permitted without written approval of the customer and Public Utility Company providing the specific service, as applicable.

D. The Infrastructure must be Designed and Constructed such that it does not impede the future replacement or repair of Utility Infrastructure.

E. A minimum of 1.0 m vertical separation must be maintained between any soil disturbance or the Infrastructure, and Pipeline Infrastructure, unless the applicable Pipeline Agreement specifically identifies a different clearance requirement.

F. Utility Best Practices must be employed, including field investigations to inform Designs.

G. As EPCOR Water Services Inc. maintains exclusive jurisdiction over water Infrastructure to Construct or alter all municipal water Infrastructure within existing road right-of-way, the Design-Builder must ensure sufficient advance notification and details regarding impacts to existing or new water Infrastructure are provided to EPCOR Water Services Inc. for them to perform their work.

3-5.3.2 Sewer Relocations

A. The sewer relocation criteria below are relevant to both storm and sanitary sewer Infrastructure.

3-5.3.2.1 Relocation Criteria

A. Relocate all existing sewer Infrastructure and appurtenances (including manholes and catch basins), that may impede the Construction of the LRT.

B. Without limiting Section 3-5.3.2.2A of this Schedule, relocate sewer Infrastructure in accordance with the HFDG Chapter 16 – "Utilities and Drainage" and as follows:

1. existing sewer Infrastructure located below proposed catenary poles, with less than 10 m cover (depth from existing ground to top of pipe), must be relocated to outside the LRT Zone of Influence;

2. existing sewer pipe Infrastructure (i.e., sewer mains, catch basin leads, and services) within the LRT Corridor being extended to new sewer Infrastructure crossing the LRT ROW with less than 7.0 m cover must be removed and replaced with new sewer pipe. Sewer services must be replaced from the sewer main to property line.

C. The 23 Avenue Storm Sewer Relocation will be completed by the City.

3-5.3.2.2 Abandonment

A. Portions of any existing sewer Infrastructure that are abandoned or will be abandoned must be removed if the abandoned sewer Infrastructure is within the LRT ROW.

B. All other portions of existing sewer Infrastructure that are relocated must be abandoned in-situ by confirming that the infrastructure has been disconnected from operating Infrastructure and abandoned in accordance with Section 02535 3.13 Abandonment of Sewers of the D&CS, Volume 3: Drainage.

3-5.3.2.3 Relocation Standards

A. All sewer Infrastructure that is relocated must be replaced with equivalent sizes/carrying capacities as the infrastructure that is replaced, and with equivalent type of sewer (e.g., storm with storm etc.).

B. Notwithstanding Section 3-5.3.2.3.A of this Schedule, all sewer Infrastructure that is relocated must be replaced with the following minimum pipe sizes:

1. locations where an existing sanitary sewer is to be relocated, a minimum pipe diameter of 250 mm is required for the relocated pipe regardless of the downstream sewer diameter; and

2. locations where an existing storm sewer is to be relocated, a minimum pipe diameter of 300 mm is required for the relocated pipe regardless of the downstream sewer diameter.

C. All new sewer Infrastructure must comply with the D&CS, Volume 3: Drainage, and the separation requirements identified in Section 3-5.3.2.1 [*Relocation Criteria*] of this Schedule.

D. For all relocated sewers:

1. Relocated sewer Infrastructure must be located such that City and applicable Utility Company's standard clearance criteria with other infrastructure is achieved, and that relocations are coordinated with relocations of other Utility Infrastructure.

2. Where catch basins are relocated, they must be relocated to an adjacent Roadway in accordance with the D&CS, Volume 3: Drainage and the Roadways must be graded to provide Positive Drainage of the Roadway drainage system and all other areas contributing to the catch basins.

3. At locations where a new storm sewer has recently been relocated by Public Utility Company in preparation for LRT construction, with upstream sewers and sewer services reconnected to the new sewer but with catch basins remaining connected to the original sewer, the Design-Builder must:

a. connect all catch basins to manholes on the recently relocated storm sewer;

b. ensure no other sources of flow can contribute to the original storm sewer; and

c. abandon the original storm sewer.

3-5.3.2.4 Extension

A. The existing 250 mm sanitary sewer stub on the bus access roadway north of the Heritage Valley North Station west of manhole S203 must be extended to the west side of the Trackway using a cased crossing as per the requirements of the HFDG and the D&CS.

B. A plug must be installed at the new stub west of the Trackway and in manhole S203 to prevent debris inflow into the pipe.

3-5.3.3 Services

3-5.3.3.1 General

A. Where Sewer Service Connections or water Utility Service Connections are being installed, relocated, adjusted or replaced, servicing records must be updated using the WASS data entry forms. The Design-Builder must coordinate with wass.applications@epcor.com to obtain a WASS application for any impacted service connections.

3-5.3.3.2 Existing Services

A. The existing services within the Project area may be determined through the WASS department of EPCOR Water Services Inc., through the following contact email: wass.drainage@epcor.com.

3-5.3.3.3 LRT Stations

A. Storm, sanitary and water service connections to Stations, if required, must meet the requirements for service connections in the D&CS, Volume 3: Drainage.

3-5.3.3.4 Utility Complexes / Traction Power Substations

A. Storm, sanitary and water service connections to UCs and TPSS, if required, must meet the requirements for service connections in the D&CS, Volume 3: Drainage.

B. Any UC or TPSS located on Lands with existing storm and sanitary sewer services that the Design-Builder plans to utilize to service the UC or TPSS will require a service inspection and assessment of condition by Public Utility Company. Upgrading of services to current standards by the Design-Builder may be required.

C. If an existing service is deemed unsuitable or not permitted to be re-used, the Design-Builder will be responsible for the Design and Construction of the service connections and must meet the requirements for service connections in the D&CS, Volume 3: Drainage. If existing sewers service will not be re-used:

   1. Sewer services must be abandoned by the Design-Builder from the sewer main or manhole within the LRT Corridor leading to the titled property or as agreed to with WASS.

   2. Sewer service abandonments may be requested by the Design-Builder in writing through WASS. The Design-Builder will be responsible for plugging the sewer services to prevent infiltration and sedimentation from entering the sewer system with plug locations to be determined by WASS.

D. For all UCs requiring services, the Design-Builder must develop and submit Site mechanical and grading plans within property lines for review and approval by WASS.

3-5.4 CONSTRUCTION SPECIFICATIONS

3-5.4.1 Design-Builder Utility Work

3-5.4.1.1 General

A. For Utility Work to be undertaken by the Design-Builder:

   1. obtain all required Project Approvals, including rights of entry or access agreements;

   2. liaise, arrange, and coordinate with Utility Companies, Governmental Authorities, and other interested parties in connection with Utility Work;

   3. observe and comply with any instructions or directions including meeting advance notification requirements, as listed in the Disclosed Data, relating to Utility Work issued by the Utility Company or any Authority Having Jurisdiction over the Utility Infrastructure including:

      a. secured access to Utility Infrastructure;

      b. operation of Utility Infrastructure;

      c. monitoring/inspection by a Utility Company; and

      d. protection of Utility Infrastructure; including the Design, installation and removal of temporary supports as required to protect Utility Infrastructure where a Utility Company would permit temporary exposure of Utility Infrastructure.

   4. secure, or cause to be secured, entry into or execution of all relevant Construction or other agreements required in connection with Utility Work;

   5. secure and protect Utility Work from deleterious material intrusion;

6. give such notices as required by the relevant Utility Company and pre-arrange for Utility Company inspections/monitoring of investigations or Construction activities as required;

7. identify, Design, coordinate, and Construct any Utility Work and any upgrades to existing Utility Infrastructure that may be required to service the Infrastructure; and

8. identify, Design, coordinate, construct, and remove any temporary Utility Infrastructure that may be required to accommodate the Design or Construction of the Infrastructure.

B. The Design-Builder must develop, implement and maintain a system for retaining and tracking Design submissions, applications, agreements, correspondence, Quality Control and Quality Assurance documentation with respect to all Design-Builder Utility Work. The system must be capable of being accessed remotely by the City.

C. The Design-Builder must map all Utility Infrastructure in accordance with CSA S250-11 CAD base files, drawing submissions, and Designs depicting mapping information and must be maintained, shared and submitted in accordance with type of submission being made or information being shared, for the Pre-ULA and ULA Processes. All Utility Work and Pipeline Work drawings must comply with the City cadastral convention as set out in Section 1 [*Drafting Guidelines and Instructions*] of Appendix 4E [*Project Drawing Standards*] of Schedule 4 [*Design and Construction Protocols*] and must differentiate between the status of Utility Infrastructure, including “abandoned” and “inactive”. Where the standard scale of drawings employed is insufficient to accurately distinguish between Utility facilities the next larger standard scale must be employed.

3-5.4.1.2 Tie-ins and Utility Crossings

A. The Design-Builder must not undertake tie-ins to operational mains unless expressly approved in writing by the applicable Public Utility Company:

1. Water – EPCOR Water Services Inc.

2. Power – EPCOR Distribution & Transmission (D&T)

3. Gas – ATCO Gas

4. Telecommunications – applicable service Public Utility Company or department of the City of Edmonton

B. Track, road and pedestrian crossings of Pipeline Infrastructure must be in accordance with CSA 662. Notwithstanding CSA 662, the Design-Builder is permitted to apply a crossing angle of 25 degrees or more for the crossing of the LRT track with the Trans Mountain pipeline.

3-5.4.1.3 Utility Trenches

A. The Design-Builder must backfill Utility trenches in accordance with the applicable Utility Company specifications or guidelines, and the trench and backfill specifications in the D&CS.

B. Final Roadway restoration must be in accordance with Section 3-2 [*Roadways/Sidewalks/Shared Use Paths*] of this Schedule and the D&CS.

C. The Design-Builder must Design, install, and remove any required temporary support Structures where exposing Utility Infrastructure to the satisfaction of the applicable Utility Company, including authenticated designs.

3-5.4.1.4 Utility Service Connections

A. The Design-Builder must investigate to confirm all existing Utility Service Connections, identify and mitigate conflicts.

B. The Design-Builder will be responsible for all alterations required to modify or replace existing Utility Service Connections, including any Infrastructure required to support the connection, arising from modifications required to accommodate the Infrastructure, regardless of who performs the work.

C. Where new Utility Service Connections are required for operation and Maintenance of the Infrastructure, the Design-Builder must make the service application as well as coordinate and complete the Construction, including performing any field investigations and identifying all conflicts with the Construction.

D. All new Utility Service Connections must be installed underground and within the Lands.

3-5.4.2 Access to and Protection, Abandonment and Removal of Utility Infrastructure

A. The Design-Builder must not access Utility Infrastructure except with the prior consent of the applicable Utility Company.

B. If Utility Infrastructure is deemed redundant by a Utility Company, the Design-Builder may abandon or remove it as specifically approved by the Utility Company in accordance with agreed upon limits and terms. Approved abandonment or removal work must be undertaken by the Design-Builder.

C. Existing Utility Infrastructure may contain Hazardous Substances. The Design-Builder must identify and properly dispose of redundant Utility Infrastructure materials encountered in compliance with Schedule 10 [*Environmental Performance Requirements*].

3-5.4.3 Utility Infrastructure Repairs

A. Where the Design-Builder encounters, as part of the Project Work, existing Utility Infrastructure in poor condition, the Design-Builder must notify the Utility Company verbally and in writing and afford the Utility Company an opportunity to investigate. The Utility Company will be afforded such time and access to make repairs as can be reasonably accommodated within the Construction Schedule.

B. Where replacement of Utility Infrastructure that is found to be in poor condition forms part of the Project Work, the Design-Builder must complete repairs to the Utility Infrastructure to a location agreed upon with the applicable Utility Company, extending no further than the next logical connection point that would afford the Utility Company the ability to undertake future repairs without affecting Construction Schedule or the operations by others.

3-5.4.4 Pipeline Crossing Records

A. At each location where Utility Work or other Project Work is adjacent to or on Pipeline Company property, the Design-Builder must keep a pipeline crossing record which must contain the following:

1. name and phone number of the Pipeline Company field representative; special provisions of the Pipeline Agreement;

2. records of:

    a. calls to the Pipeline Company field representative;

    b. Pipeline Company field representative visits – time, date, comments, and signature;

    c. The City visits – time, date, comments, and signature; and

d. The Design-Builder's superintendent's comments or observations related to work on or adjacent to Pipeline Company property.

3. commencement and completion dates of Utility Work or other Project Work on or adjacent to Pipeline Company property.

Appendix 5-3A: Access Closure Drawings