Appendix U – Transportation Standards Manual, City of Winnipeg, 2012 Update

DRAFT

THE CITY OF WINNIPEG

Winnipeg

TRANSPORTATION STANDARDS MANUAL

2012 Update

Table of Contents

Table of Contents i

Section 1 – Introduction 1

1.1 What's New in the Manual 2

1.2 Transportation Master Plan (TMP) 2

1.3 Complete Communities Direction Strategy 2

1.3 Active Transportation (AT) 2

1.4 Accessibility 3

1.5 Design Exceptions 3

1.6 Definitions 5

Section 2 – The Street Classification System 7

2.1 Expressway 11

2.2 Major Arterial 13

2.3 Minor Arterial 15

2.4 Industrial/Commercial Collector 16

2.5 Residential Major Collector 17

2.6 Residential Minor Collector 18

2.7 Industrial/Commercial Local 19

2.8 Residential Local 20

2.9 Public Lane 21

Section 2A – Standard Drawings for Cross Sections 23

Section 3 – Roundabout Design Standards 25

3.2 Applications of Roundabout Use in the City 25

3.3 Roundabout Geometric Design Standards 26

Section 4 – Geometric Design Standards 31

4.1 General 31

4.2 Alignment Design 31

4.3 Cross Section Elements 40

4.4 Sidewalks and Pedestrian Connectivity 53

4.5 Intersections 56

4.6 Subdivision Street Network Design 67

Section 4A – Standard Drawings for Intersections and Turnarounds 72

Section 5.0 – Roadside Safety Guidelines 74

5.1 General 74

5.2 Rigid Barriers 81

5.3 Flexible Barriers (Guardrails) 84

5.4 OHSS and Rail Warning Systems Protection 88

5.5 Curbing and Curb Transitions 89

Section 5A – Standard Drawings for Roadside Safety 92

DRAFT

Section 1 – Introduction

The 2012 Update to the *City of Winnipeg Transportation Standards Manual* was developed by the City of Winnipeg Public Works Department and is an update to the *City of Winnipeg Transportation Standards Manual, 1991*. The Transportation Standards Manual is intended to serve as a design aid for designers and planners involved in work related to or affecting the transportation network in the City of Winnipeg. The primary purpose of the Manual is to ensure that additions and/or modifications to the City of Winnipeg's transportation facilities are designed and constructed in a consistent manner from one area of the city to another and in conformance with current transportation design practices and trends in Canada.

The Manual is divided into multiple sections. Section 2 provides an overview of the Streets Classification System used in the City of Winnipeg and includes standard cross-sections for each street classification category. Section 3 focuses on Roundabouts. Section 4 focuses on street design, alignment design, standard intersections and turnarounds and recommended practices for subdivision street network design. Section 5 focuses on Roadside Safety.

All transportation facilities within City of Winnipeg rights-of-way are to be designed in accordance with the Transportation Association of Canada's *Geometric Design Guide For Canadian Roads* (TAC GDG) unless otherwise noted within this Manual. The intent of this Manual is to identify and address areas that apply to the local conditions and climate of the City of Winnipeg that differ or are not addressed in the TAC GDG. Examples include the street classification system and intersection design particulars. This manual, as well as the other City documents referenced below, shall take precedence over the TAC GDG.

It is the Engineer's responsibility to review all City by-laws, policies, standards, and guidelines and to review with the City the design criteria for the specific project prior to commencing any design work. In conjunction with this Manual, the Engineer shall utilize and integrate, where appropriate, the latest editions of the following references;

- The City of Winnipeg Pedestrian and Cycling Design Guide, pending;
- The City of Winnipeg Universal Design Policy;
- The City of Winnipeg's Accessibility Design Standards (WADS);
- The City of Winnipeg Standard Construction Specifications;
- City of Winnipeg's Tree Planting Details and Specifications Downtown Area and Regional Streets;
- TAC Canadian Guide to Neighbourhood Traffic Calming.

1.1 What's New in the Manual

There are numerous additions and revisions to the 1991 Manual, to highlight a few of the major changes:

- Provides integration and emphasizes the importance of Universal Design
- Provides increased design flexibility based on design rationale and promotes good engineering
- Provides increased compatibility with the latest edition of the TAC GDG.
- Adds major collector and expressway to the Street Classification System
- Provides clarification and additional information on various common geometric design elements to encourage more consistency, increased safety and consideration for all modes of transportation within City rights-of-way
- Introduces a Section on Roundabout Design
- Introduces a Section on Roadside Safety

1.2 Transportation Master Plan (TMP)

The TMP is the City's overarching long-term strategic planning document that sets out a vision for transportation in Winnipeg over the next two decades. The intent of the Transportation Standards Manual is to provide a delivery tool to successfully accomplish some of the TMP's relevant strategies. The TMP calls for the development of a Complete Streets Strategy, a Pedestrian Strategy and a Cycle Strategy which are all forthcoming and will influence future revisions to this Manual.

1.3 Complete Communities Direction Strategy

Complete Communities is the City's land use plan and has been adopted as a City by-law. As a City wide secondary plan, all other City by-laws, policies, guidelines, and standards must be consistent with Complete Communities.

Complete Communities describes the physical characteristics of the City and its many neighbourhoods, articulates a vision, and establishes a framework for future growth and development. It is based on the promotion of "complete communities" as inclusive, vibrant places in which to live, work, and play.

The Complete Communities Direction Strategy focuses on Winnipeg's urban structure and the spatial articulation that distinguishes different areas of Winnipeg based on their period of development and unique characteristics. It identifies areas that are expected to accommodate significant growth and change as well as areas where more moderate intensification is expected to occur.

1.3 Active Transportation (AT)

The Transportation Standards Manual does not directly address specifics to Active Transportation facility selection and standard details, however higher level information is provided where necessary to ensure compatibility with other documents. There are several new and pending documents to be released to address AT design including the City of Winnipeg Pedestrian and Cycling Facilities Design Guide and the TAC AT Design Guide.

1.4 Accessibility

The Transportation Standards Manual is intended to complement the Winnipeg Accessibility Design Standards. The Transportation Standards Manual provides additional information to that guide to facilitate the design process.

Accessibility and Universal Design integration is critical and fundamentally important to the entire design and construction process. Accessibility is an integral part of each Section in this document and is not limited to any one section.

In summary, the accessibility improvements in this update to the Transportation Standards Manual are:

- Additional information and guidance is provided for right turn channelization including design guidance for Smart Channels. Additional guidance is provided for selecting appropriate radii for right turns at intersections as well as locating the pedestrian crossing in right turn cut-offs.
- General roundabout design guidance is included such as;
    - Pedestrian crossing alignments
    - Horizontal geometry to control vehicular speeds to increase the likelihood for vehicles to yield to pedestrians
    - Use of Detectable tiles
- Widening medians for high speed/high volume roadways to provide pedestrian refuge is discussed
- Pedestrian median crossings, including the flush alternative for narrow medians, is explained
- Guidance on bullnose placement is provided
- Opportunities for sidewalks on residential streets are increased
- Additional transit stop details for collector streets are provided
- Provides guidance for the application of shared lanes on developmental major collectors and arterials
- Sidewalk planning for community connectivity to reduce trip lengths is discussed
- Additional guidance for sidewalk alignment design within the rights-of-way is included

1.5 Design Exceptions

A design exception is a documented decision to design a cross section element, intersection, or a street segment using design criteria and values that do not meet minimum values or ranges within the TAC GDG or this Manual. Design exceptions are to be performed only by the appropriate qualified Professional Engineer that will assume responsibility for that design.

Reasons for Design Exceptions

There are a variety of reasons why design exceptions should be considered and prove to aid in arriving at the optimal design solution. These reasons include;

- Environmental impacts
- Restricted right-of-way
- Preservation of historic or cultural resources
- Context sensitivities
- Costs

Design Exceptions for AT Projects

Active Transportation projects introduce a variety of needs for design exceptions. Since limited detail is provided in this document; refer to the pending AT design guide. Facility type selection is an integral part of the iterative design process as exceptions differ for each facility type that is undergoing evaluation.

Examples of Design Exceptions

Some examples are provided where design exceptions are implemented to arrive at an optimal solution.

Example A: Fort Street Reconstruction: Graham Avenue to Portage Avenue

This roadway was the first in Winnipeg to be reconstructed to include a bike lane and is constrained by the right-of-way widths and building door elevations. There is a high volume of buses as well. Lane widths for all modes had to be below the standard as the road could not be widened to maintain appropriate sidewalk/boulevard width. The road had been painted in the proposed configuration prior to the reconstruction and was demonstrated to function adequately. The proposed longitudinal joints were spaced to accommodate the proposed paint lines. Curb heights on the east side were also designed to be higher than standard; this was required to ensure the sidewalk can be constructed within tolerable cross falls. This increase curb height also had a benefit as the majority of the space was for bus loading and no parking was present.

The final design elements were selected based on existing constraints, understanding the risks and tolerances, and evaluating the performance of an existing condition of the proposed design.

Example B: Corydon Avenue Westbound Reconstruction – Niagara Street to Cordova Street

This section of road was identified as a reconstruction; however, the eastbound side of the road and adjacent blocks which underwent major rehabilitation did not require the local to arterial intersection radii to be improved to current standards. This design specified radii smaller than the standard and had many benefits such as more separation and better grading of curb ramps, lower vehicular turning speed, and is consistent with the previously renewed segments. The existing radii also did not show any evidence of damage due to truck turning.

Example C: Grassie Boulevard and Molson Avenue Roundabout Construction

This project included the reconstruction of Grassie Boulevard from the roundabout to the west through a moderate curve. The road through this curve was designed using a normal crown cross section and not super-elevated. Using a normal crown for this segment had the advantage of allowing for more appropriate grades so a ditch on the south boulevard could be filled in to allow for improved drainage and a more attractive boulevard space. This design discourages higher speeds approaching the roundabout, and allows for more optimal pavement grading for the entry and exits of the roundabout.

The Design Exception Process

The FHWA's "Mitigation Strategies for Design Exceptions – July 2007" is a good reference document that established a methodology for selecting the optimal and evaluating alternative design elements that may be outside the standards or design domain.

Design exceptions are ultimately managed through good communication and effective Project Management. The Professional Engineer's authentication of the construction drawings demonstrates that the arrival to the completed design was done accordingly and is a key step in the quality control process (*Authentication of Hardcopy and Electronic Professional Documents*, APEGM, May 12, 2011).

1.6 Definitions

The following is a list of acronyms and definitions used throughout the Manual;

AASHTO – American Association of State Highway and Transportation Officials

ABB – Aluminum Balanced Barrier

ATN – Active Transportation Network – A system of streets and connections that are strategically identified as routes that may accommodate active transportation by a variety of methods.

AT – Active Transportation – Any human powered mode of transportation such as cycling, walking, skiing and skateboarding. The main emphasis is for travel for a specific purpose or to a specific destination. However, this definition does not exclude travel for purely recreational purposes.

City – Refers to the City of Winnipeg

D_s – Design Speed– The speed that is used to choose design parameters

Diamond Lane – Diamond lanes, with respect to City of Winnipeg applications, are reserved lanes for buses and bicycles.

FHWA – The Federal Highways Administration

Hard Surfacing – refers to construction with paving stones on a lean concrete base, concrete, or another approved product used in accordance with good construction practice, for boulevards, medians or islands.

MASH – Manual for Assessing Safety Hardware

MGS – Midwest Guardrail System

MJRH – Major Rehabilitation – means pavement, curb and sidewalk repairs, replacement or adjustment of drainage infrastructure, adjustment of appurtenances in the pavement and boulevards, and an asphalt overlay.

Mill and Fill – A method of asphaltic concrete pavement surface renewal with a reduced scope of work. Involves planing between 40mm and 60mm of existing asphalt; localized pavement, curb and sidewalk repairs; repair or replacement of existing inlets; adjustment of appurtenances in the pavement; and a new asphalt overlay.

MIRV – Major Incident Response Vehicle

NCHRP – The National Cooperative Highway Research Program

OHSS – Overhead sign structure

PVI – Point of Vertical Inflection

RSDG – AASHTO Roadside Design Guide 4th Edition 2011

Running Speed – The average speed a driver can attain under off-peak volume conditions.

TAC – Transportation Association of Canada

TAC GDG – Refers to the TAC 1999 Geometric Design Guide

TBO – Thin Bituminous Overlay – This is a method of pavement preservation which involves placing a thin layer of asphalt over an existing concrete pavement. It also includes minor pavement and curb repairs and renewal of curb ramps.

TL – Test Level

TMP – The Transportation Master Plan approved by City Council in 2011.

Rural – Refers to a rural right-of-way cross section that includes shoulders and channelized drainage.

Shared Lane – A designated widened curb lane that is shared by both cyclists and motorists. A bicycle and chevron pavement marking called a sharrow is typically applied to the pavement.

Smart Channel – An alternative right turn channelization geometry that deflects vehicles at a reduced angle than tradition compounded curves.

Strategic Road Network – Includes the Inner Ring Route. The streets in the Strategic Road Network are defined in the TMP.

Urban – Refers to an urban right-of-way cross section that includes curb with raised boulevards with drainage that utilizes catch basins.

WADS – The City of Winnipeg Accessibility Design Standards

ZOI – Zone of Intrusion

DRAFT

Section 2 – The Street Classification System

The Street Classification System is based on a functional hierarchy of streets in which roadways are grouped by the character of service they provide. This system of classification is derived from the functional classification system in the Transportation Association of Canada's (TAC) Geometric Design Guide for Canadian Roads.

The functional classification categories are as follows:

1. Expressway
2. Major Arterial
3. Minor Arterial
4. Industrial/Commercial Collector
5. Residential Major Collector
6. Residential Minor Collector
7. Industrial/Commercial Local
8. Residential Local
9. Public Lane

This functional classification system recognizes the street hierarchy inherent in vehicle trips: egress from the departure location using local streets, collection of traffic from the area local streets onto the collector streets, movement along the arterial streets and/or expressways, distribution of traffic back to collector streets, and finally, property access/trip termination on the destination local street or public lane.

On the following pages, each of the nine categories of functional classifications are described in terms of their function, access characteristics, typical geometric features, how transit and non-vehicular modes of transportation are generally accommodated, traffic features, typical traffic volumes and examples from the Winnipeg context. Minimum right-of-way widths are also provided at a typical mid-block section. Additional right-of-way is required for some of the cross-sections approaching an intersection due to the introduction of a raised median for channelization. The size of the sewers will also dictate whether a collector is 22.0m or 24.0m and whether a local street is 18.0m or 20.0m wide.

These functional classification categories are summarized near the end of the section in Table 2.2 – Summary of the City of Winnipeg Street Classification System followed by a cross-section of each classification.

DRAFT

Commentary

Typical access, geometric and traffic features described for each category are intended as design guidelines for new streets. There are existing streets that fall under each classification category due to their function but which may not meet the access, geometric or traffic criteria for that category. For example, in the case of minor arterials, the guidelines state that only intersections with expressways, other arterials and collectors are permitted. However, there are many existing examples of minor arterial streets in the City, which intersect with local residential streets and public lanes. Similarly, the guidelines state that residential private approaches are not permitted on collector streets in low-density residential developments. However, variations to this can be found on some existing collector streets. Although these types of variations are present on existing streets, the guidelines for each category should be followed in the case of new development and for infill developments in older areas. Rationalization of and elimination of inappropriate connections should be considered to improve traffic operations, safety and to reduce neighbourhood short cutting.

Typical traffic volumes listed for the residential categories are based on a capacity that is tolerable by the residents, rather than the actual physical design capacity of the roadway geometry. For example, in the case of local residential streets, a volume of up to 1,000 vehicles per day is listed. Typically, traffic volumes exceeding this level may not be considered acceptable to the residents on local residential streets due to safety and quality of life issues.

Frontage roads function primarily as land access and may be found adjacent to expressways, arterials or residential collectors. Where frontage roads serve low density land uses, they are to be designed to the appropriate local street standards. Where they serve higher density uses with high traffic generators, they are to be designed to the appropriate collector street standards.

In developing areas, major and minor arterials and expressways may be staged as two lane facilities initially.

The geometric design of alternative arterial or collector streets may not reflect the features and right-of-way widths described within this document, but must function fundamentally and fall under the corresponding classification category in regards to traffic volumes and access. Alternative designs must be approved by the City's Transportation Division. Examples of such streets are those within a neighbourhood or development centre such as Centre Street in Bridgwater Centre Development, the Corydon – Osborne Neighbourhood Plan, Sage Creek Boulevard or Waterfront Drive.

The expressways and arterial functional classifications overlap with the City's Regional Street System. Regional Streets are designated by Council and listed in Schedule E of the Streets By-law and the resulting network of streets is intended to move concentrated volumes of traffic between major generators throughout the City, linking communities throughout the City with each other and with the Central Business District, and providing major access routes between provincial trunk highways or important provincial roads and all sections of the City, particularly the Central Business District.

Additional Right-of-Way Width Requirement for Cycling Facility Accommodation

To assist in the planning of new streets, Table 2.1 – Additional Right-of-way width for various cycling treatments quantifies the amount of additional right-of-way width required to accommodate the selected cycling treatment within a particular right-of-way width. The additional right-of-way is needed to ensure adequate boulevard space is maintained for appropriate sidewalk set back to allow for snow storage, healthy tree placement, utility placement and user safety.

Table 2.1: Additional Right-of-way Width for Various Cycling Treatments

Type of Treatment	33m Right-of-Way	40m Right of Way
Shared Lane	None	None
Multi-use Pathway[2]	2.0m	2.0m
Bi-directional Bike Path[3]	3.0m	3.0m
Bike Lanes	2.0m	2.0m
Buffered Bike Lane or Cycle Track	up to 3.5m	up to 3.5m

The above information is further depicted in Figure 2.1.

[2] Multi-use Pathway selection over a separate cyclist and pedestrian facility to be based on criteria described in the pending City of Winnipeg Pedestrian and Cycling Design Guide.
[3] This additional width will accommodate a 3.0m path on one side or 1.5m one way individual paths on both sides of the road. The right-of-way will also accommodate room for a sidewalk on both sides of the road.

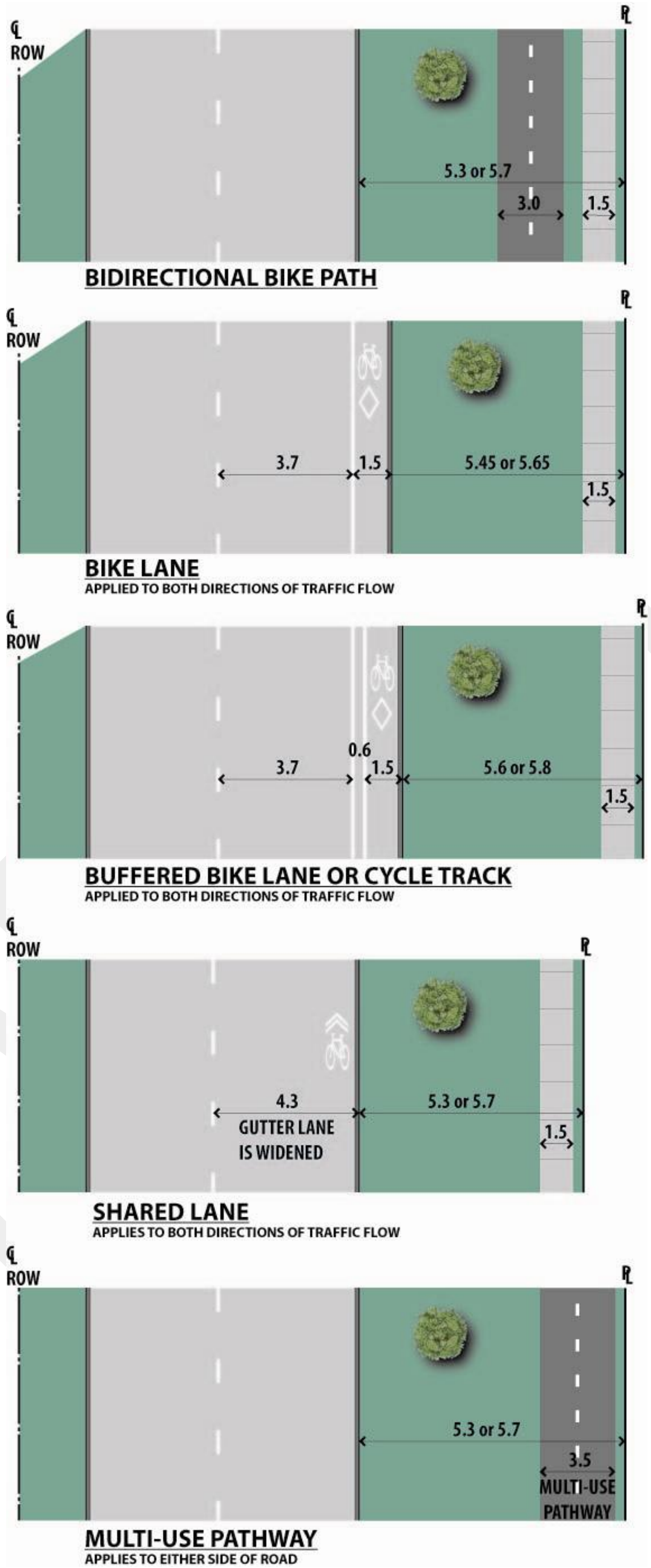


Figure 2.1 – Additional ROW Requirements for Various Cycling Treatment

2.1 Expressway

Function

Expressways accommodate large traffic volumes at higher operating speeds and under unimpeded flow conditions. They are intended to serve longer trips including intra-urban travel and trips destined to major centers of activity. All types of vehicles (passenger vehicles, trucks and buses) are accommodated. Expressways are full time truck routes.

Access

Direct access to adjacent lands is prohibited. Only arterial streets or other expressways may intersect with this type of facility.

Typical Geometric Features

At a minimum, expressways feature a four-lane divided cross-section or three lanes for a one way expressway. Rights-of-way are generally determined through a corridor study to accommodate, as required;

- a safe and recoverable roadside;
- appropriate number of lanes;
- right turn treatments;
- pedestrian facility;
- separated bike path if required or multi-use pathways;
- sound attenuation if directly adjacent to residential land use;
- median widths to accommodate future expansion, multiple left turns, and pedestrian refuge.

A minimum of two 3.7m traffic lanes are provided per direction. An outer shoulder of a minimum of 3.0m and an inner shoulder of a minimum of 1.5m is provided. An alternative to the 1.5m inner shoulder is a 120mm mountable curb with a 300mm shy distance to the face of the curb. A median with a minimum width of 12.0m is also featured. Expressways shall be designed to accommodate future expansion when specified. Auxiliary lanes will have a width of 3.5m with a 1.5m shoulder or a 120mm mountable curb.

Spiral curve transitions are to be used to develop changes in super elevation.

Traffic Features

Where large volumes of traffic are to be accommodated at high speeds, grade separated interchanges may be provided. Signalized intersections are widely spaced at least by 800m. Parallel auxiliary lanes are provided at intersections for right turn, left turn and merging. Double left turn movements are normally accommodated at intersections. Parking and stopping is prohibited. Intra-city bus routes may be featured with a limited number of stops located in bus bays or at the intersections with offset islands. Pedestrians crossing expressways are accommodated at signalized intersections and/or grade separated

DRAFT

pedestrian crossings. Pedestrian movement along the expressway is generally accommodated with an AT path or a sidewalk if warranted. Frontage roads may be featured to provide access to adjacent lands but will not connect directly with the expressway.

Typical Traffic Volumes
Greater than 15,000 vehicles per day.

Average Running Speeds
70 to 90 km/h

Examples
- Bishop Grandin Boulevard between Pembina Highway and Kenaston Boulevard
- Chief Peguis Trail between Main Street and Lagimodiere Boulevard
- Charleswood Parkway between Grant Avenue and Portage Avenue

DRAFT

2.2 Major Arterial

Function

Major arterials carry large traffic volumes (including passenger vehicles, trucks and buses) and connect large development areas including major residential areas, the central business district, regional shopping centres, large industrial and commercial areas and other major activity areas. Generally, major arterials are full time truck routes.

Access

In order to preserve capacity and enhance safety, direct access to adjacent properties is normally controlled or limited. Major arterials may intersect with expressways, other arterials and collectors.

Typical Geometric Features

Due to the variance in both the operating and design speeds and adjacent land use for major arterials throughout the City there are a variety of different cross section element options that must be carefully chosen based on the specific facility. At a minimum, all major arterials feature at least a four lane divided cross section. For lower speed urban major arterials that are not part of the Active Transportation Network, a 40.0m right-of-way is provided with 8.0m of pavement per direction (i.e. two 4.0m travel lanes per direction) with a 5.0m median. As the design speeds increase shy distances to the curb are introduced as well as a change in the curb type. Shoulders with ditch drainage may be introduced as well as an increase in median width. Additional right-of-way width may be required to accommodate sound attenuation. A corridor study similar to the design of an expressway may be warranted on higher volume and/or higher speed routes.

Traffic Features

Generally, major arterials are located along the boundary of residential areas and do not pass through these areas. Traffic signals are used to control major intersections. Left and right turn bays are normally provided at intersections and may feature double left or right turn movements. Merge lanes may be provided. Minimum intersection spacing is 400m. Pedestrian movement across major arterials is accommodated at signalized intersections and with pedestrian corridors and half-signals. Sidewalks are typically provided on both sides to accommodate pedestrian movement along the street. Parking is permitted only where and when vehicular movement and traffic safety are not negatively impacted. Parking is prohibited on high speed facilities. Major bus routes are featured. Major arterials that are part of the Active Transportation Network may accommodate cyclists by a variety of methods and is facility specific. Frontage roads may be featured to provide access to adjacent lands but generally do not connect directly with the arterial.

Typical Traffic Volumes

Greater than 20,000 vehicles per day.

Average Running Speeds

50 to 80 km/hour

Examples

- Pembina Highway between Corydon Avenue and Dalhousie Drive
- Main Street between Broadway and Chief Peguis Trail
- Henderson Highway between Hespeller Avenue and Chief Peguis Trail
- St. Mary's Road between Fermor Avenue and Bishop Grandin Boulevard
- Kenaston Boulevard between Academy Road and Taylor Avenue
- Lagimodiere Boulevard between Chief Peguis Trail and Fermor Avenue
- Portage Avenue between Sturgron Road and Main Street
- Fermor Avenue between St. Mary's Road and Lagimodiere Boulevard

DRAFT

2.3 Minor Arterial

Function

Minor arterials carry slightly lower traffic volumes than major arterials and augment the major arterial system by connecting residential, employment, shopping and recreational areas. Minor arterials typically serve trips of a shorter length than major arterials and have slightly lower operating speeds. Minor arterials may be designated as full time or part time truck routes.

Access

Direct access to minor arterials is usually permitted except for low density residential developments. Minor arterials connect with expressways, other arterials and collectors.

Typical Geometric Features

Typically, minor arterials have a four-lane cross-section. For minor arterials that are not part of the Active Transportation Network a 33.0m right-of-way is typically provided with two 4.0m travel lanes per direction and a 5.5m centre median. Minor arterials may also have shoulders with ditch drainage in a widened right-of-way.

Traffic Features

Traffic signals are used to control intersections. Minimum intersection spacing is 200m. Pedestrian movement across minor arterials is accommodated at intersections. Sidewalks are provided on both sides. Parking is permitted only where and when vehicular movement and traffic safety are not negatively impacted. Major or local bus routes may be featured. Minor Arterials that are part of the Active Transportation Network may accommodate cyclists by a variety of methods and is facility specific. Frontage roads may be featured to provide access to adjacent lands.

Typical Traffic Volumes

Up to 25,000 vehicles per day.

Average Running Speeds

40 to 70 km/h

Examples

- Leila Avenue between McPhillips and Sinclair Street
- Taylor Avenue between Kenaston Boulevard and Pembina Highway
- Warde Avenue between St. Mary’s Road and St. Anne’s Road
- Dakota Street between Meadowood Drive and Warde Avenue

DRAFT

2.4 Industrial/Commercial Collector

Function

The primary function of industrial/commercial collector streets is to collect and distribute traffic between local industrial/commercial streets and arterial streets. The secondary function of these streets is to provide land access to industrial and commercial areas. Passenger vehicles, large trucks and buses are accommodated.

Access

Direct access to fronting properties is permitted subject to traffic and design conditions. Industrial/commercial collectors may intersect with arterials, other industrial/commercial collectors and local industrial/commercial streets.

Typical Geometric Features

Typically, a four lane divided cross section is featured. A 33.0m right-of-way is provided with two 4.0m travel lanes per direction and a 5.5m median. Alternatively, a two lane undivided 10.0m pavement can be used with a 22.0m right-of-way with channelization at the intersections.

Traffic Features

Because industrial/commercial collectors feature lower operating speeds than arterials, closer intersection spacing is permissible (a minimum of 60m). Local industrial/commercial streets are generally stop controlled where they intersect with industrial/commercial collector streets. Where approximately equal traffic volumes from each direction approach the intersection of one or more industrial/commercial collector streets, all-way stop control is normally utilized except where signal control is warranted. Parking is permitted only where and during times when traffic mobility and safety are not negatively impacted. Pedestrian corridors are utilized where warranted. Generally, sidewalks are featured on at least one side of the street. Local bus routes may be featured. Cyclists are generally accommodated within the pavement area.

Typical Traffic Volumes

Up to 20,000 vehicles per day.

Average Running Speeds

30 to 60 km/h

Examples

- Murray Park Road between Saulteau Crescent and Sturgeon Road
- Meadowood Drive between St. Mary's Road and Dakota
- Scurfield Boulevard between Kenaston Boulevard and Waverley Street
- Inksbrook Drive between Inkster Boulvard and Brookside Boulevard

2.5 Residential Major Collector

Function

The primary function of residential collector streets is to collect and distribute traffic between local residential streets and arterial streets. The secondary function of these streets is to provide land access in residential areas. Passenger vehicles, delivery trucks and buses are accommodated. All bus routes in new residential areas should be developed to residential collector standards at a minimum.

Access

Direct access to adjacent properties is permitted only for commercial and multi-family developments subject to traffic and design conditions. Private approaches are not permitted for low-density residential developments fronting residential collectors. In these cases, a back lane or frontage road is required for direct property access. Residential collector streets may intersect with arterials, other collectors and local residential streets.

Typical Geometric Features

Residential major collectors are usually four lane divided streets and typically feature a 33.0m right-of-way and two 4.0m travel lanes per direction with a 5.5m median.

Traffic Features

Lower operating speeds allow closer intersection spacing than for arterials (minimum intersection spacing is 60m). Local residential streets are normally stop controlled where they intersect with residential collector streets. Where approximately equal traffic volumes from each direction approach the intersection of one or more residential collector streets, all-way stop control may be utilized except where a roundabout is warranted. During peak hours parking may be prohibited to accommodate increased traffic volumes. Traffic control for pedestrians is accommodated by pedestrian corridors or signed and marked crosswalks where warranted. Sidewalks are featured on both sides to accommodate pedestrians along the street. Local bus routes may be featured. Cyclists are generally accommodated within the pavement area.

Typical Traffic Volumes

5,000 To 12,000 vehicles per day.

Average Running Speeds

30 to 60 km/h

Examples

- Boulevard De La Seigneurie between Bishop Grandin Boulevard and Island Lakes Drive
- Scurfield Boulevard between Kenaston Boulevard and Columbia Drive
- Buchanon Boulevard between Portage Avenue and Hamilton Avenue

DRAFT

2.6 Residential Minor Collector

Function

The primary function of residential collector streets is to collect and distribute traffic between local residential streets and arterial streets. The secondary function of these streets is to provide land access in residential areas. Passenger vehicles, delivery trucks and buses are accommodated. All bus routes in new residential areas should be developed to residential collector standards at a minimum.

Access

Direct access to adjacent properties is allowed for commercial and multi-family developments subject to traffic and design conditions. Private approaches are not permitted for low-density residential developments fronting residential collectors. In these cases, a public lane or frontage road is required for direct property access. Residential collector streets may intersect with arterials, other collectors and local residential streets.

Typical Geometric Features

Residential minor collectors are two lane undivided streets that have at least a 22.0m right-of-way and a 10.0m roadway.

Traffic Features

Lower operating speeds allow closer intersection spacing than for arterials (minimum intersection spacing is 60m). Local residential streets are generally stop controlled where they intersect with residential collector streets. Where approximately equal traffic volumes from each direction approach the intersection of one or more residential collector streets, all-way stop control may be utilized except where a roundabout is warranted. Near intersections, residential collector streets may be transitioned to a median divided cross-section. Parking is restricted to one side of the street except during peak hours when parking may be prohibited to accommodate increased traffic volumes. Traffic control for pedestrians is accommodated by pedestrian corridors or signed and marked crosswalks where warranted. Sidewalks are usually featured on both sides. Local bus routes may be featured. Cyclists are accommodated within the pavement area.

Typical Traffic Volumes

Up to 5,000 vehicles per day.

Average Running Speeds

30 to 60 km/h

Examples

- River Grove Drive between Ridgecrest Avenue and Red River Boulevard
- John Forsyth between Aldgate Road and Dakota Street

DRAFT

2.7 Industrial/Commercial Local

Function

Local industrial/commercial streets provide direct access to properties in industrial and commercial areas. Most traffic on a local industrial/commercial street has an origin or destination along the length of the street. This type of street is not intended to carry traffic between two streets of a higher classification. Generally, passenger vehicles and trucks are accommodated.

Access

Direct access is provided to all fronting properties on a local industrial/commercial street. This type of street may intersect with other local industrial/commercials, industrial/commercial collectors and arterials but not with expressways.

Typical Geometric Features

A local industrial/commercial street generally has a two lane undivided cross section. However, near intersections with industrial/commercial collectors or arterials, the street may be transitioned to a median divided cross section. At least a 22.0m right-of-way is featured with a 10.0m roadway.

Traffic Features

Traffic control at intersections is normally provided by means of stop signs except where signal control is warranted. Minimum intersection spacing is 60m. Parking is restricted to one side except during peak hours when parking may be prohibited to accommodate increased traffic flow. Pedestrian corridors may be provided where pedestrian volumes warrant. Sidewalks are usually featured on at least one side. Bus routes are not usually featured. Cyclists are accommodated within the pavement area.

Typical Traffic Volumes

Up to 5,000 vehicles per day.

Average Running Speeds

20 to 50 km/h

Examples

- Paquin Road between De Baets Drive and Beghin Drive
- Saulteaux Crescent between Moray Street and Murray Park Drive
- Fennell Street between Seel Avenue and McGillivary Boulevard
- Hutchings Street between Church Avenue and Sheppard Street

DRAFT

2.8 Residential Local

Function

Local residential streets provide direct access to properties in residential areas. This type of street is not intended to carry high volumes of traffic or to carry traffic between neighbourhoods or between two streets of a higher classification. Generally, vehicles traveling on a local residential street have an origin or destination along the length of the street. Passenger vehicles and delivery trucks are accommodated.

Access

Direct access is provided to all fronting properties on a local residential unless a public lane is present. This type of street may intersect with other local residentials, various collectors but not with arterials or expressways.

Typical Geometric Features

Local residentials have a two lane undivided cross section and feature at least an 18.0m right-of-way with a 7.5m roadway.

Traffic Features

Stop signs provide traffic control at an intersection of two local residential streets and at intersection with a collector. Intersections of local residentials with streets of another classification are normally stop sign controlled except where signal control is warranted. Minimum intersection spacing is 60m. Sidewalks may be provided where pedestrian volumes or needs are warranted. Parking is restricted to one side of the street. Trucks are not permitted except for local service or deliveries. Bus routes are not usually featured. Cyclists are accommodated within the pavement area.

Typical Traffic Volumes

Up to 1,000 vehicles per day.

Average Running Speeds

20 to 50 km/h

Examples

- Quincy Bay
- Vineland Crescent
- Poitras Place
- Paulley Drive
- Gemini Avenue
- Polson Avenue
- McBeth Grove

DRAFT

2.9 Public Lane

Function

Public lanes provide direct access to abutting properties. They are normally provided at the rear of properties fronting on collector or arterial streets to provide access in lieu of private approaches on the fronting street. It is intended that vehicles traveling on a public lane have an origin or destination along the length of the lane. Public lanes are not intended to carry through traffic.

Access

Direct access is provided to all properties abutting a public lane. Public lanes connect to other public lanes and to local streets. In some cases, public lanes may connect to collectors. However, this is not preferred. Public lanes should not intersect with arterial streets or expressways.

Typical Geometric Features

Residential public lanes typically feature a 6.25m right-of-way with a 5.0m curbless roadway. Industrial/commercial and multi-family residential public lanes typically feature a 7.25m right-of-way with a 6.0m curbless roadway.

Traffic Features

Intersections of public lanes with other public lanes and intersections of public lanes with streets do not require traffic control signs. Parking is not permitted in public lanes. Public lanes in residential areas carry mainly passenger and collection vehicles. Trucks are not permitted except for local service and deliveries.

Typical Traffic Volumes

Up to 350 vehicles per day for residential public lanes.

Up to 650 vehicles per day for industrial/commercial public lanes.

Average Running Speeds

20 to 30 km/h

DRAFT

Table 2.2: Summary of the City of Winnipeg Streets Classification System Categories

	Public Lanes		Locals		Collectors		Arterials		Expressways
	Residential	**Indust/Com**	**Residential**	**Indust/Com**	**Residential Min/Major**	**Indust/Com**	**Minor**	**Major**	
Function	Land access primary function, traffic movement secondary function		Land access primary function, traffic movement secondary function		Traffic movement and land access of equal importance		Traffic movement is primary function, some controlled access is permitted		Optimum mobility, no access permitted
Typical Traffic Volumes (veh/day)	< 350	< 650	< 1,000	< 5,000	< 5,000/ < 12,000	< 20,000	< 25,000	> 20,000	> 15,000
Average Running Speeds (km/h)	20 – 30		20 – 50		30 – 60		40 – 70	50 – 80	70 – 90
Desirable Connections	Public lanes, locals		Locals, collectors		Locals, collectors, arterials		Collectors, arterials, expressways		Arterials, expressways
Minimum Intersection Spacing (metres)	As required		60.0		60.0		200.0	400.0	800.0
Typical Right-of-way Width (metres)	6.25	7.25	≥ 18.0	≥ 22.0	22.0/33.0	22.0/33.0	33.0	≥ 40.0	≥ 80.0
Typical Pavement Width (metres)	5.0	6.0	7.5	10.0	10 / 16	16.0	16.0	≥ 16.0	≥ 16.0
Drawing Numbers	M-8	M-8	M-1,M-14P10 M-2	M-3, M-4	M-3, M-4, M-6	M-6	M-6	M-7	M-13

Section 2A – Standard Drawings for Cross Sections

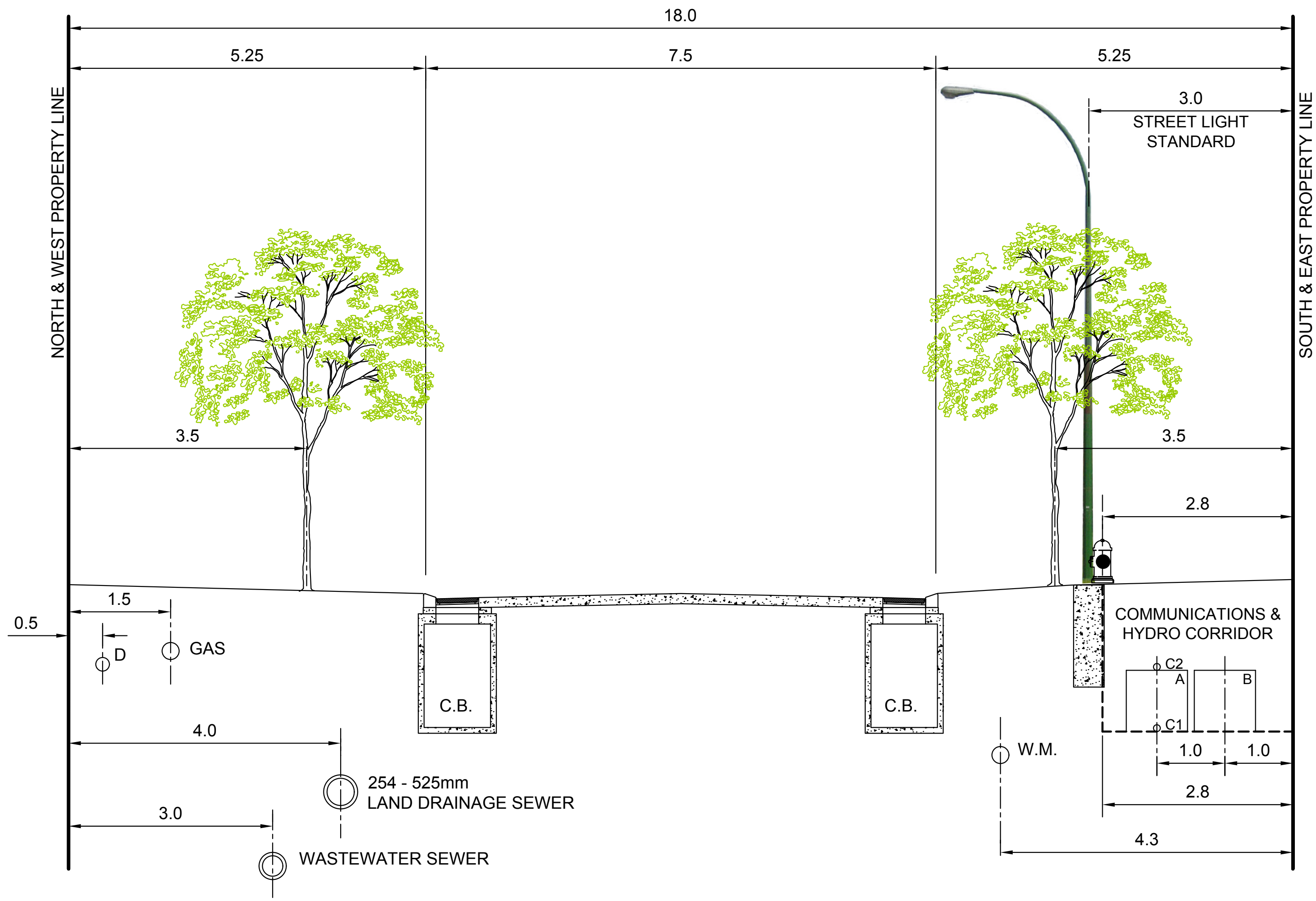
Associated with each streets category in the City of Winnipeg Street Classification System is a standard cross section which illustrates the location within the right-of-way of standard underground and above ground services. The following is a list of the various cross sections.

Table 2.3: Standard Cross Sections

Drawing Number[1]	Title
M-1	Residential Local Street – 18m ROW
M-14P10	Residential Local Street 4 Party 10
M-2	Residential Local Street – 20m ROW
M-3	Residential Collector Street – 22m ROW
M-4	Residential Collector Street – 24m ROW
M-6	Minor Arterial Street – 33m ROW
M-7	Major Arterial Street – 40m ROW
M-8	Public Lanes
M-10	Residential Cul-de-sac[2]
M-13	Expressway

1. Drawing numbers are not continuous as those numbers not displayed are archived and/or redundant.
2. Although not a classification type, cul-de-sacs are depicted to show utility placement.

DRAFT

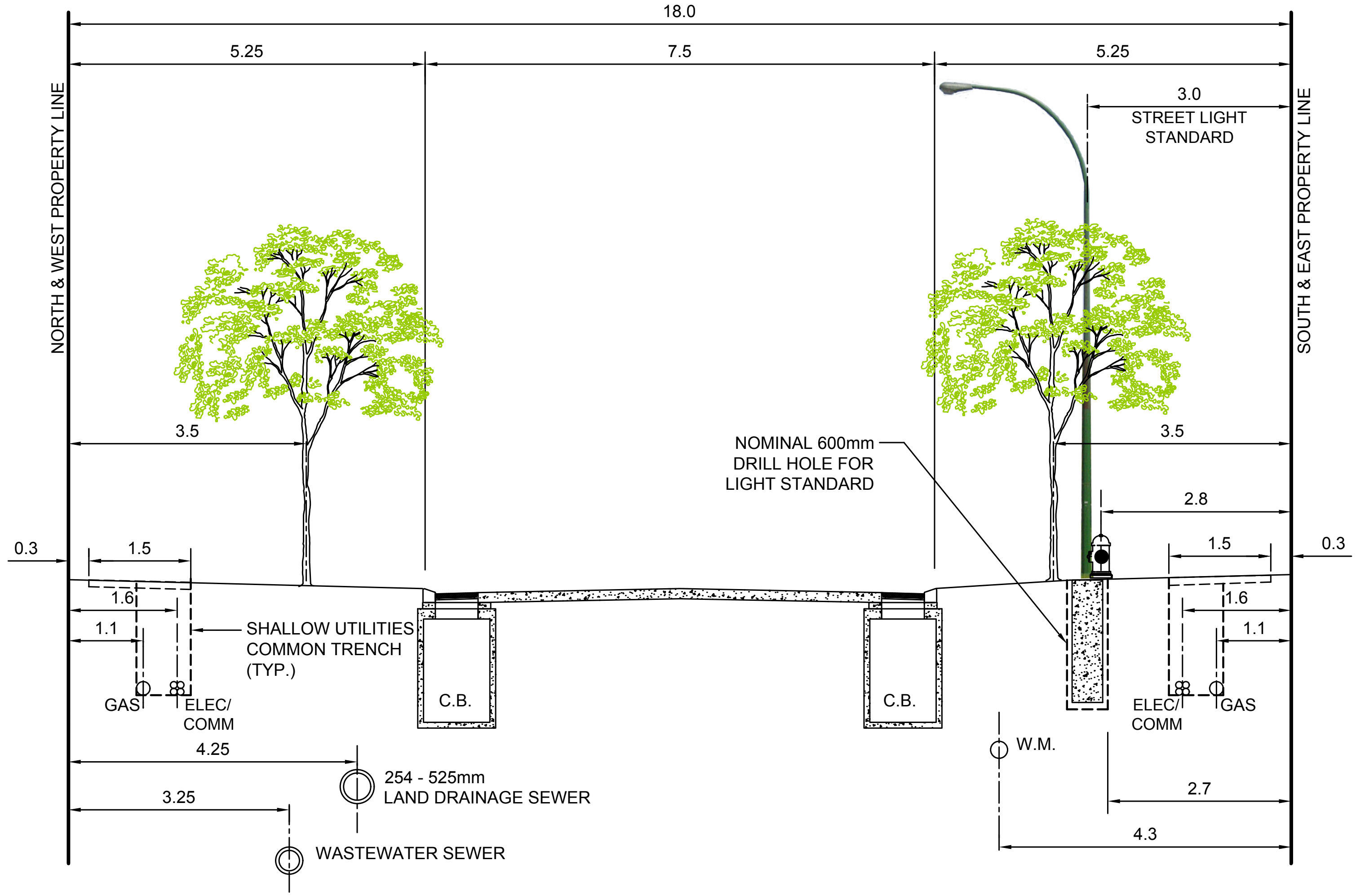


NOTES:

1. 2.8m SPACE ALLOTMENT FOR HYDRO AND COMMUNICATIONS CORRIDORS ARE FOR MANHOLE INSTALLATION ONLY. OTHER UTILITIES INSTALLED WITHIN THE CORRIDOR WILL BE SO CONSTRUCTED TO AVOID CONTACT WITH THE MANHOLE.
2. ORDER OF CONSTRUCTION WITHIN THE COMMUNICATIONS & HYDRO CORRIDOR:
   A. FIRST DUCTLINE INSTALLATION
   B: SECOND DUCTLINE INSTALLATION
   C1 & C2 - ORDER OF DIRECT CABLE BURIAL INCLUDING STREET LIGHTING CABLE.
3. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL AT "D"
4. L.D.S. LARGER THAN 525mm IN DIAMETER, DEPICTED ON DRAWING M-2

DRAFT

Winnipeg — THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	18m RESIDENTIAL LOCAL STREET	STANDARD LOCATIONS FOR UTILITY STRUCTURES
DRAWN BY: AP DATE: 2012-04-25	SCALE: 1:100	APPROVED BY: DATE	DRAWING NO. M-1



NOTES:

1. 2.8m SPACE ALLOTMENT FOR HYDRO AND COMMUNICATIONS CORRIDORS ARE FOR MANHOLE INSTALLATION ONLY. OTHER UTILITIES INSTALLED WITHIN THE CORRIDOR WILL BE SO CONSTRUCTED TO AVOID CONTACT WITH THE MANHOLE.
2. ORDER OF CONSTRUCTION WITHIN THE COMMUNICATIONS & HYDRO CORRIDOR:

A. FIRST DUCTLINE INSTALLATION

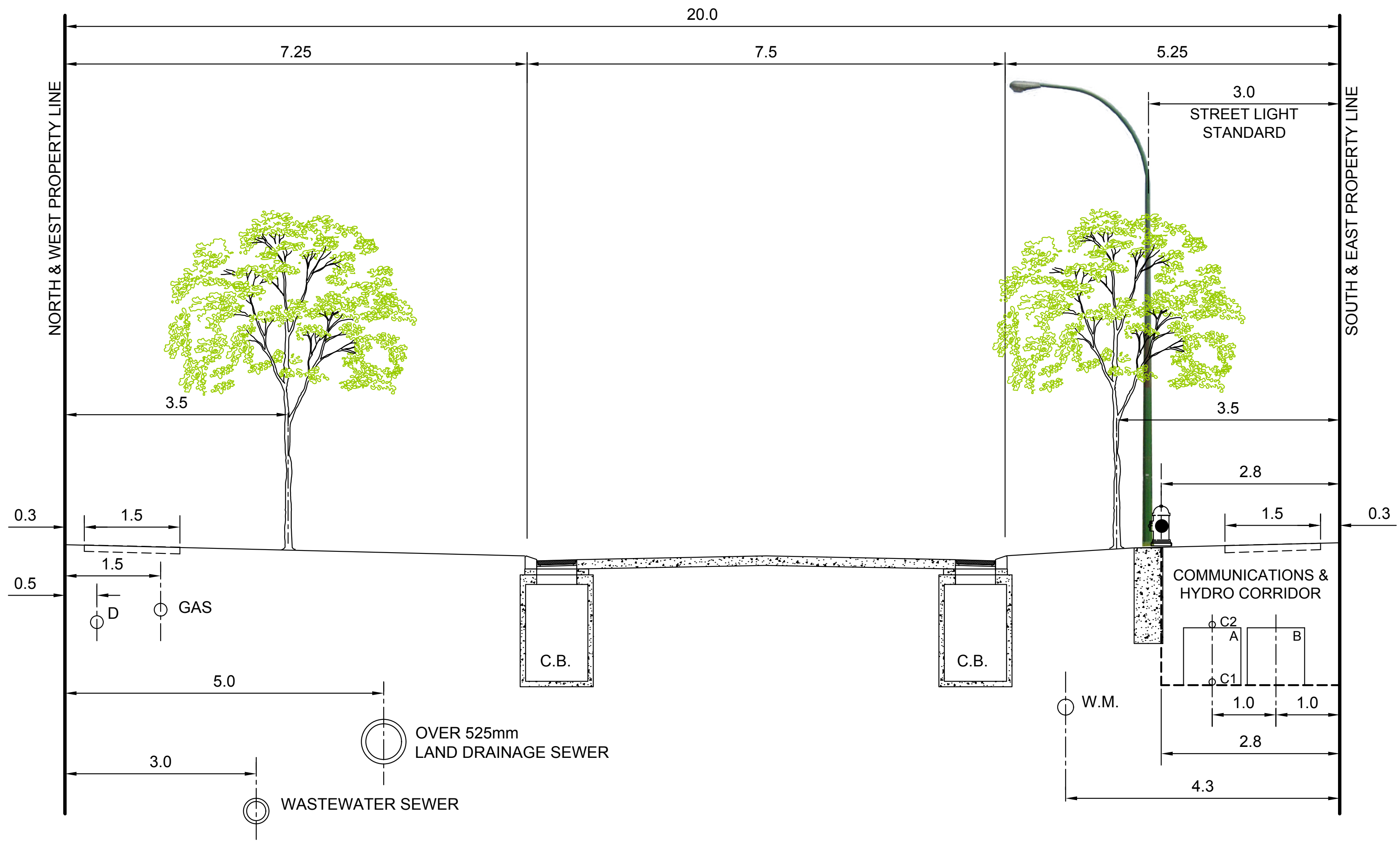
A: SECOND DUCTLINE INSTALLATION

C1 & C2 - ORDER OF DIRECT CABLE BURIAL INCLUDING STREET LIGHTING CABLE.

3. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL AT "D"
4. L.D.S. LARGER THAN 525mm IN DIAMETER, DEPICTED ON DRAWING M-2
5. SIDEWALK LOCATIONS ARE SHOWN IF REQUIRED.

DRAFT

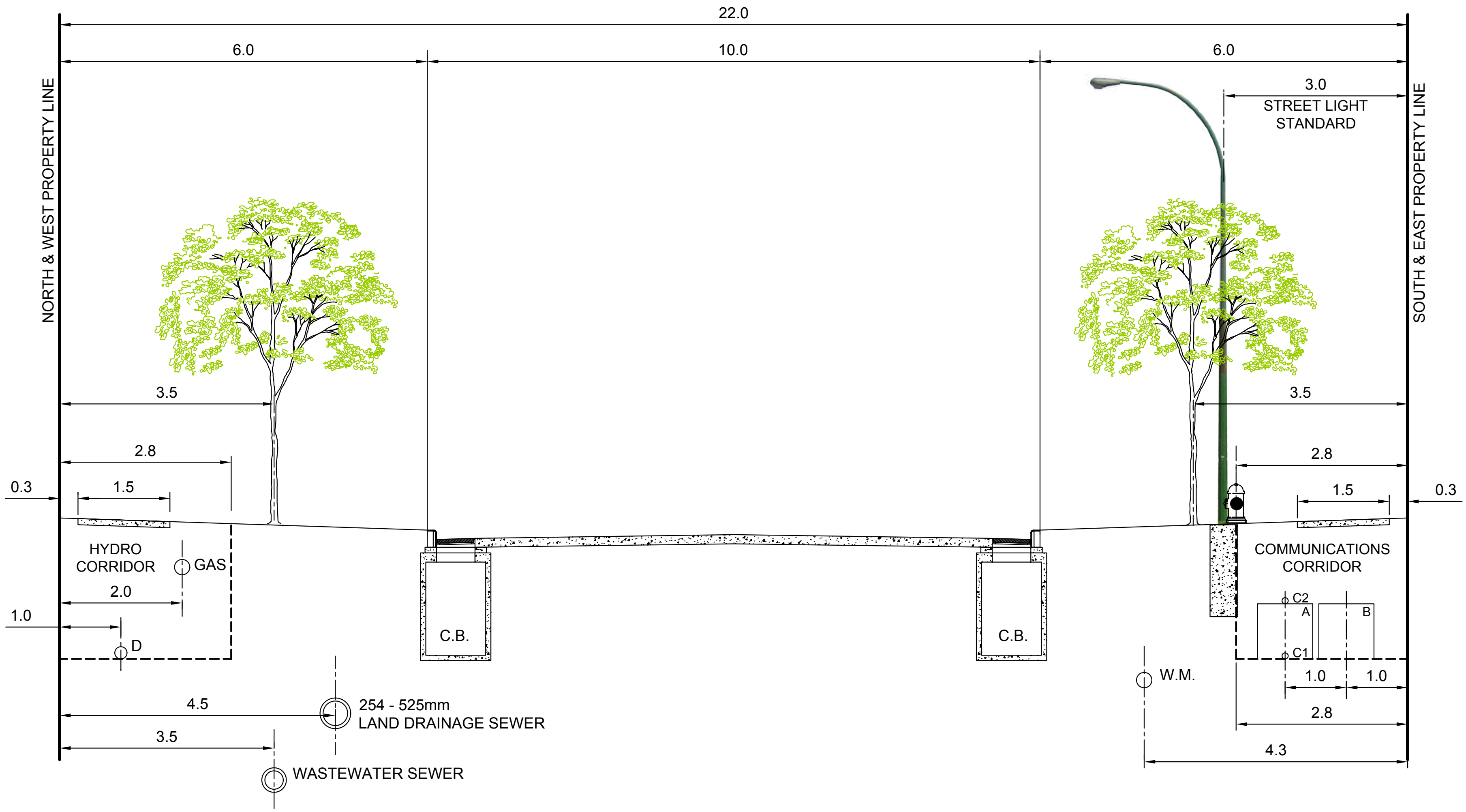
Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	18m RESIDENTIAL LOCAL STREET	STANDARD LOCATIONS FOR UTILITY STRUCTURES
DRAWN BY: AP DATE: 2012-04-25 SCALE: 1:100	APPROVED BY: DATE	DRAWING NO. M-1-4P10



NOTES:
1. 2.8m SPACE ALLOTMENT FOR HYDRO AND COMMUNICATIONS CORRIDORS ARE FOR MANHOLE INSTALLATION ONLY. OTHER UTILITIES INSTALLED WITHIN THE CORRIDOR WILL BE SO CONSTRUCTED TO AVOID CONTACT WITH THE MANHOLE.
2. ORDER OF CONSTRUCTION WITHIN THE COMMUNICATIONS & HYDRO CORRIDOR:
A. FIRST DUCTLINE INSTALLATION
A: SECOND DUCTLINE INSTALLATION
C1 & C2 - ORDER OF DIRECT CABLE BURIAL INCLUDING STREET LIGHTING CABLE.
3. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL AT "D"
4. L.D.S. LARGER THAN 525mm IN DIAMETER, DEPICTED ON DRAWING M-2
5. SIDEWALK LOCATIONS ARE SHOWN IF REQUIRED.

DRAFT

Winnipeg — THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION		20m RESIDENTIAL LOCAL STREET	STANDARD LOCATIONS FOR UTILITY STRUCTURES
DRAWN BY: AP DATE: 2012-04-25	SCALE: 1:100	APPROVED BY: DATE	DRAWING NO. M-2

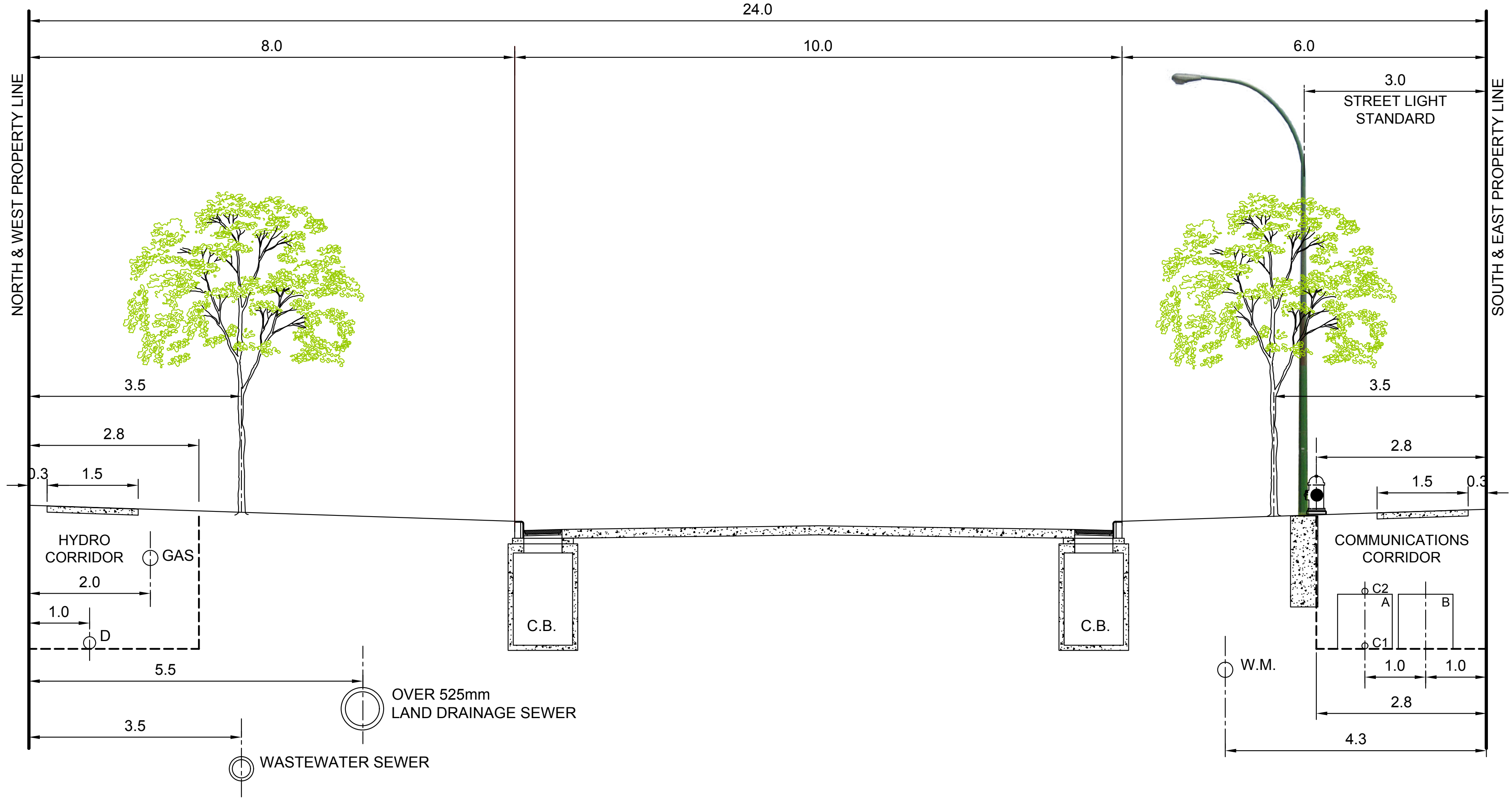


NOTES:

1. 2.8m SPACE ALLOTMENT FOR HYDRO AND COMMUNICATIONS CORRIDORS ARE FOR MANHOLE INSTALLATION ONLY. OTHER UTILITIES INSTALLED WITHIN THE CORRIDOR WILL BE SO CONSTRUCTED TO AVOID CONTACT WITH THE MANHOLE.
2. ORDER OF CONSTRUCTION WITHIN THE COMMUNICATIONS & HYDRO CORRIDOR:
   A. FIRST DUCTLINE INSTALLATION
   B: SECOND DUCTLINE INSTALLATION
   C1 & C2 - ORDER OF DIRECT CABLE BURIAL INCLUDING STREET LIGHTING CABLE.
3. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL AT "D"
4. L.D.S. LARGER THAN 525mm IN DIAMETER, DEPICTED ON DRAWING M-2

DRAFT

Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	22m LOCAL INDUSTRIAL OR RESIDENTIAL COLLECTOR STREET	STANDARD LOCATIONS FOR UTILITY STRUCTURES
DRAWN BY: AP DATE: 2012-04-25 / SCALE: 1:100	APPROVED BY: / DATE	DRAWING NO. M-3

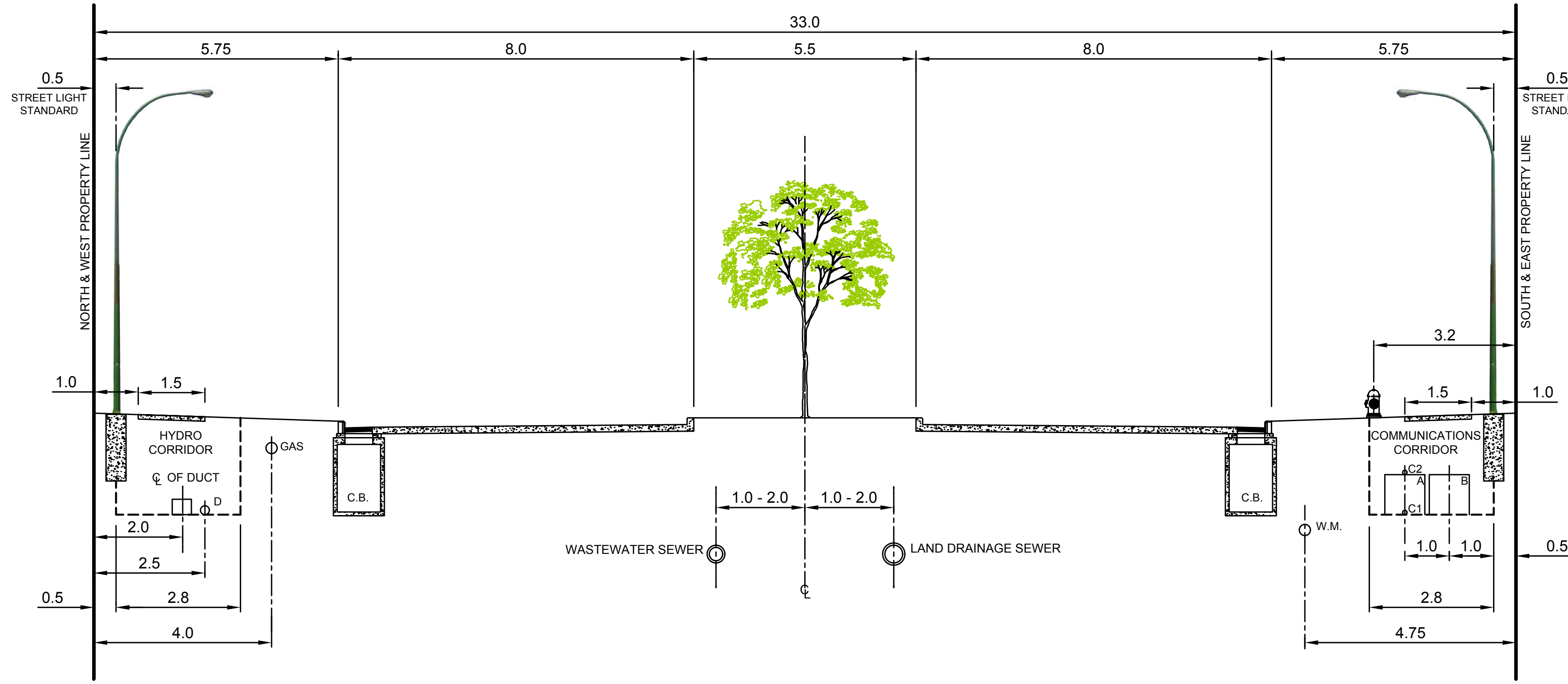


NOTES:

1. 2.8m SPACE ALLOTMENT FOR HYDRO AND COMMUNICATIONS CORRIDORS ARE FOR MANHOLE INSTALLATION ONLY. OTHER UTILITIES INSTALLED WITHIN THE CORRIDOR WILL BE SO CONSTRUCTED TO AVOID CONTACT WITH THE MANHOLE.
2. ORDER OF CONSTRUCTION WITHIN THE COMMUNICATIONS & HYDRO CORRIDOR:
   A. FIRST DUCTLINE INSTALLATION
   B: SECOND DUCTLINE INSTALLATION
   C1 & C2 - ORDER OF DIRECT CABLE BURIAL INCLUDING STREET LIGHTING CABLE.
3. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL AT "D"
4. L.D.S. LARGER THAN 525mm IN DIAMETER, DEPICTED ON DRAWING M-2

DRAFT

Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	24m LOCAL INDUSTRIAL OR RESIDENTIAL COLLECTOR STREET	STANDARD LOCATIONS FOR UTILITY STRUCTURES
DRAWN BY: AP DATE: 2012-04-25 — SCALE: 1:100	APPROVED BY: DATE	DRAWING NO. M-4

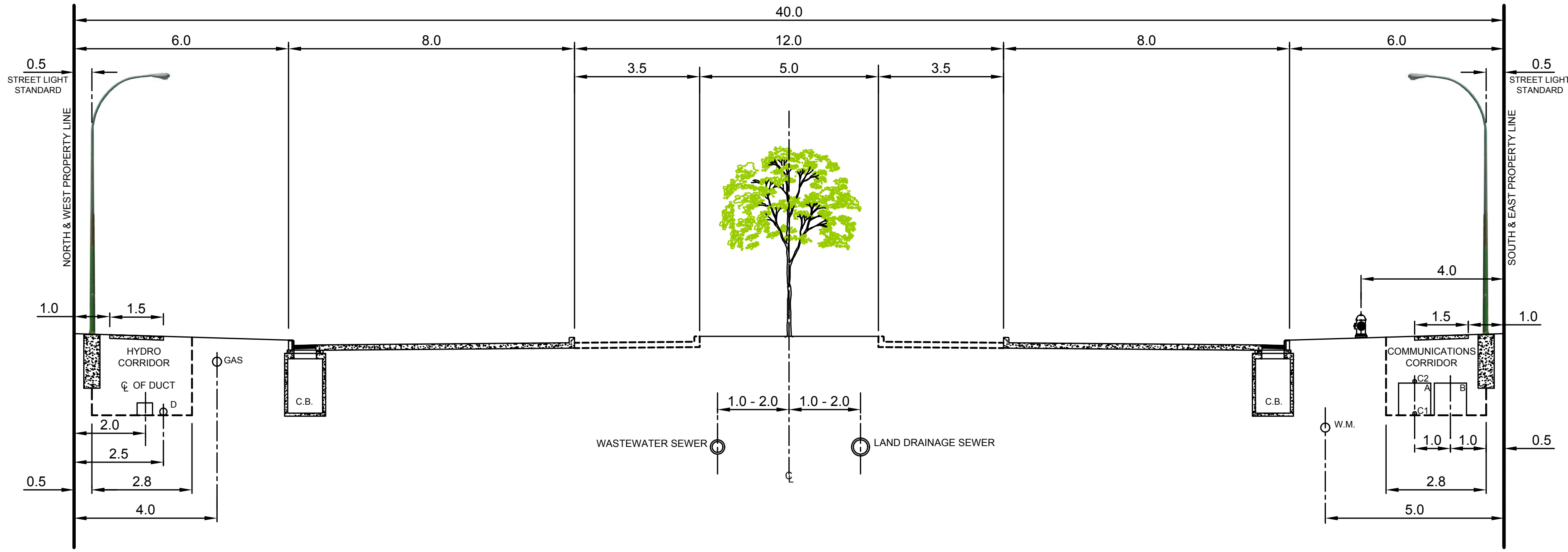


NOTES:

1. 2.8m SPACE ALLOTMENT FOR HYDRO AND COMMUNICATIONS CORRIDORS ARE FOR MANHOLE INSTALLATION ONLY. OTHER UTILITIES INSTALLED WITHIN THE CORRIDOR WILL BE SO CONSTRUCTED TO AVOID CONTACT WITH THE MANHOLE.
2. ORDER OF CONSTRUCTION WITHIN THE COMMUNICATIONS & HYDRO CORRIDOR:
   A. FIRST DUCTLINE INSTALLATION
   B: SECOND DUCTLINE INSTALLATION
   C1 & C2 - ORDER OF DIRECT CABLE BURIAL INCLUDING STREET LIGHTING CABLE.
3. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL AT "D"
4. L.D.S. LARGER THAN 525mm IN DIAMETER, DEPICTED ON DRAWING M-2

DRAFT

Winnipeg — THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	33m MINOR ARTERIAL STREET	STANDARD LOCATIONS FOR UTILITY STRUCTURES
DRAWN BY: AP DATE: 2012-04-25 — SCALE: N.T.S.	APPROVED BY: DATE	DRAWING NO. M-6

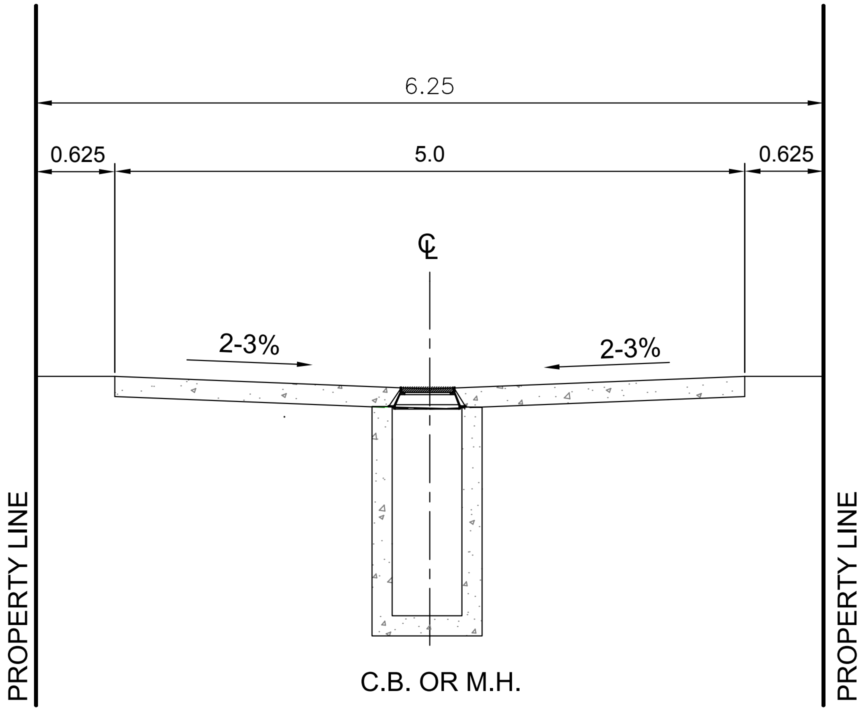


NOTES:

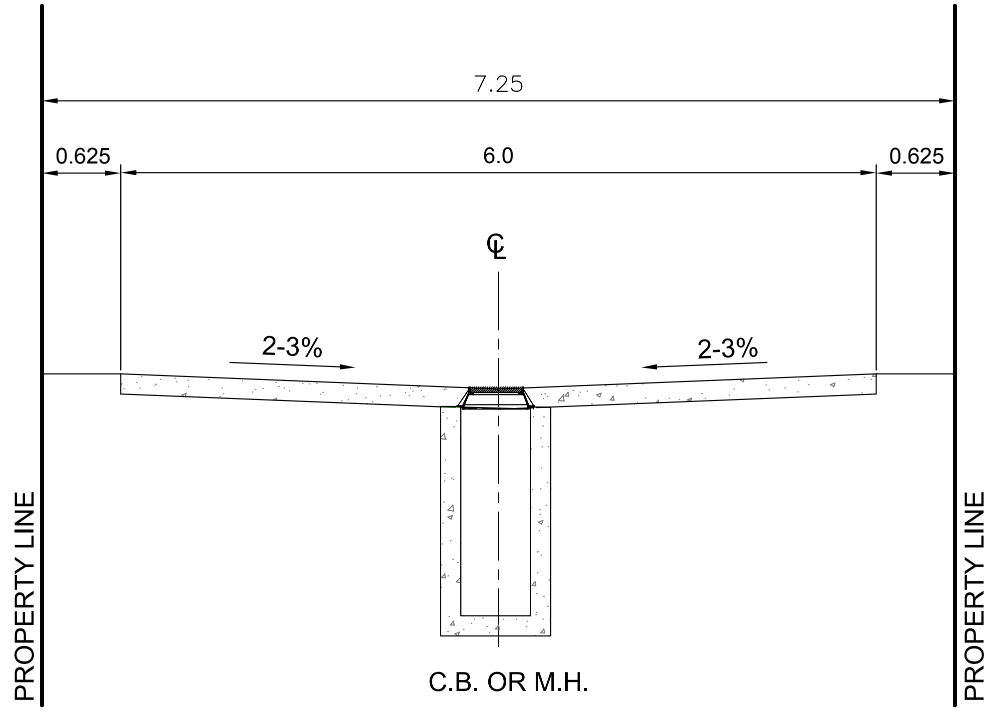
1. 2.8m SPACE ALLOTMENT FOR HYDRO AND COMMUNICATIONS CORRIDORS ARE FOR MANHOLE INSTALLATION ONLY. OTHER UTILITIES INSTALLED WITHIN THE CORRIDOR WILL BE SO CONSTRUCTED TO AVOID CONTACT WITH THE MANHOLE.
2. ORDER OF CONSTRUCTION WITHIN THE COMMUNICATIONS & HYDRO CORRIDOR:
   A. FIRST DUCTLINE INSTALLATION
   B: SECOND DUCTLINE INSTALLATION
   C1 & C2 - ORDER OF DIRECT CABLE BURIAL INCLUDING STREET LIGHTING CABLE.
3. ADDITIONAL M.T.S. OR HYDRO DIRECT CABLE BURIAL AT "D"
4. L.D.S. LARGER THAN 525mm IN DIAMETER, DEPICTED ON DRAWING M-2

DRAFT

THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	40m MAJOR ARTERIAL STREET	STANDARD LOCATIONS FOR UTILITY STRUCTURES
DRAWN BY: AP DATE: 2012-04-25 / SCALE: N.T.S.	APPROVED BY: DATE	DRAWING NO. M-7



RESIDENTIAL LANE



COMMERCIAL LANE

DRAFT

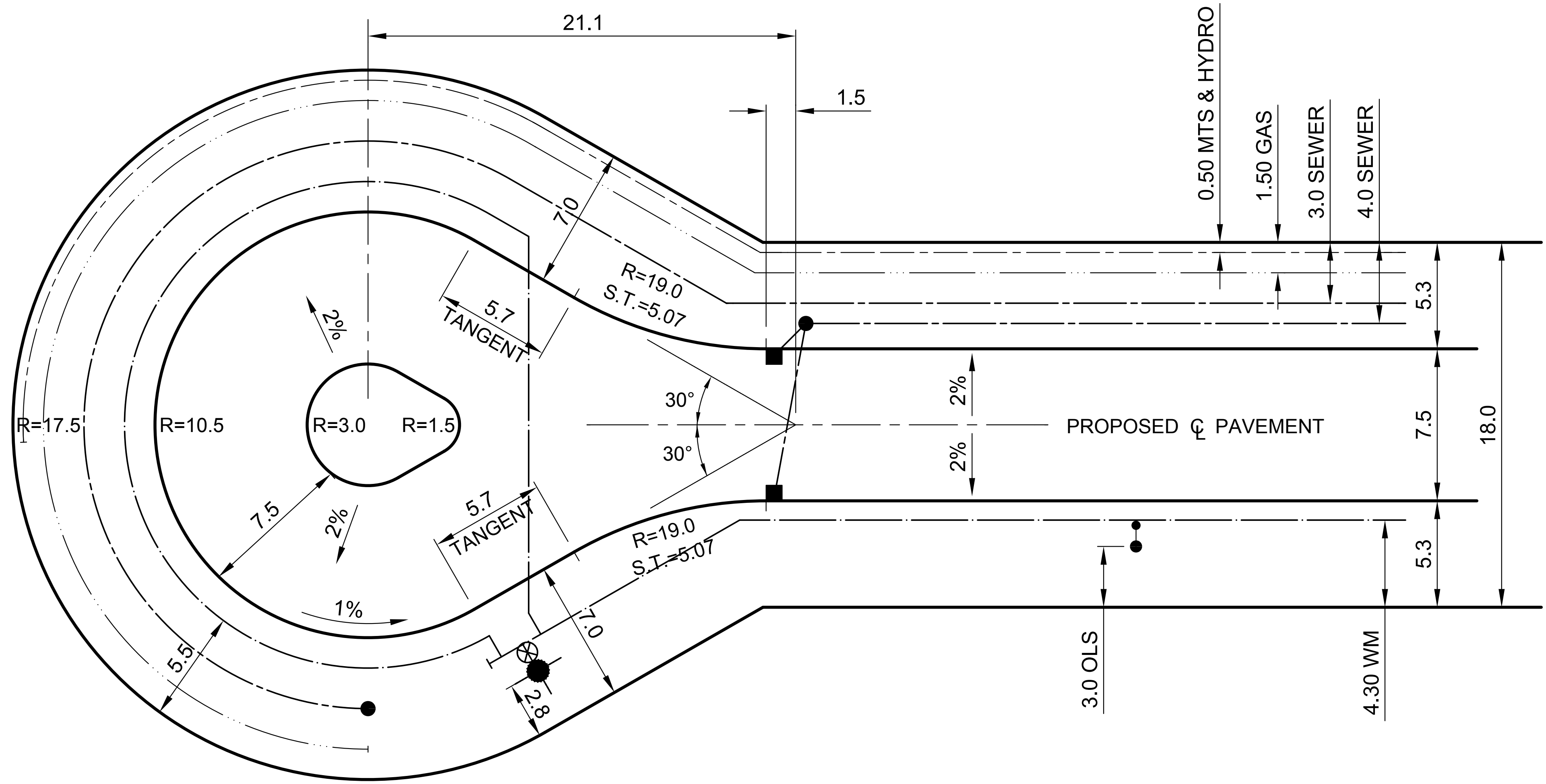
Winnipeg

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

PUBLIC LANES

STANDARD LOCATIONS FOR UTILITY STRUCTURES

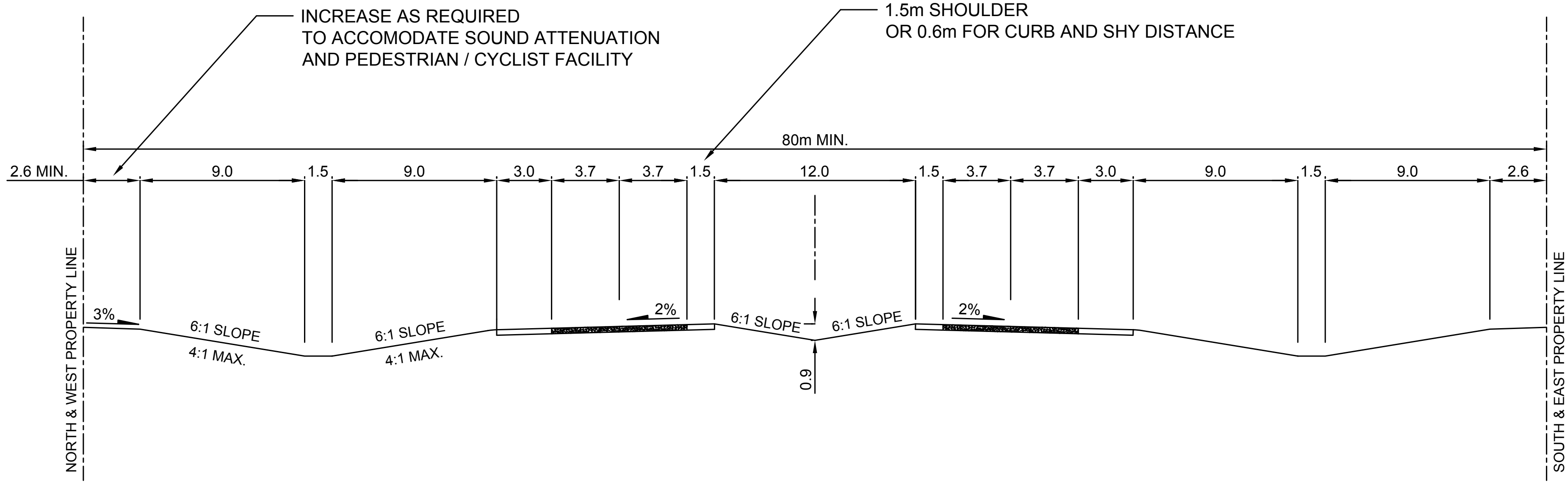
DRAWN BY: AP DATE: 2012-04-25	SCALE: 1: 60	APPROVED BY: DATE	DRAWING NO. M-8



NOTES:
1. HYDRANT AND SEWER MANHOLES TO MOVE LONGITUDINALLY AS REQUIRED.

DRAFT

Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	TYPICAL RESIDENTIAL STREET CUL-DE-SAC	STANDARD LOCATIONS FOR UTILITY STRUCTURES
DRAWN BY: AP DATE: 2012-04-25 SCALE: 1: 300	APPROVED BY: DATE	DRAWING NO. M-10



DRAFT

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

80m
EXPRESSWAY

STANDARD LOCATIONS
FOR
UTILITY STRUCTURES

DRAWN BY: AP
DATE: 2012–05–31
SCALE: N.T.S.
APPROVED BY:
DATE
DRAWING NO. M-13

This page is intentionally left blank.

DRAFT

Section 3 – Roundabout Design Standards

The design of roundabouts shall be in accordance with **NCHRP Report 672: Roundabouts: An Informational Guide**. This section of the Manual will address particular aspects that are also within NCHRP Report 672. This Manual shall govern in these instances. Due to the site specificity of roundabout design, additional information related directly to each intersection being considered for a roundabout must also be obtained in consultation with the City.

This document currently addresses single lane urban roundabouts only.

3.2 Applications of Roundabout Use in the City

Roundabouts may be used within the City for the design of new intersections and for the improvement of existing intersections. Refer to Appendix 'C' of the City of Winnipeg Transportation Impact Study Guidelines for the analysis required to determine if a roundabout is viable for a new or existing intersection.

General reasons why a roundabout may not be an appropriate intersection treatment include:

- Close proximity to another controlled intersection
- Estimated operational performance is not acceptable
- Property acquisition is not feasible
- Significant grades greater than 4% as excessive speeds and slope could facilitate vehicle instability
- Significant traffic volumes
- Conflicts with utilities or existing access

General reasons why a roundabout should be considered as an intersection treatment include:

- High amount of collisions at an existing intersection
- In lieu of a four way stop controlled intersection such as between two collectors
- Unconventional intersection geometry
- Intersection with increased capacity needs
- Intersection with constrained queue storages
- Controlled access facilities
- Limited available right-of-way for intersection improvements
- Locations where traffic patterns are uncertain
- As a gateway feature to a development or destination

Consideration shall be given to pedestrian volumes and movements, cyclists and transit.

Roundabouts shall not be used on expressways but can be considered for use on a collector-distributor road serving an interchange.

DRAFT

3.3 Roundabout Geometric Design Standards

Figure 3.1 describes the basic parameters of a typical single lane urban roundabout. Detectable warning tiles are not shown for clarity.

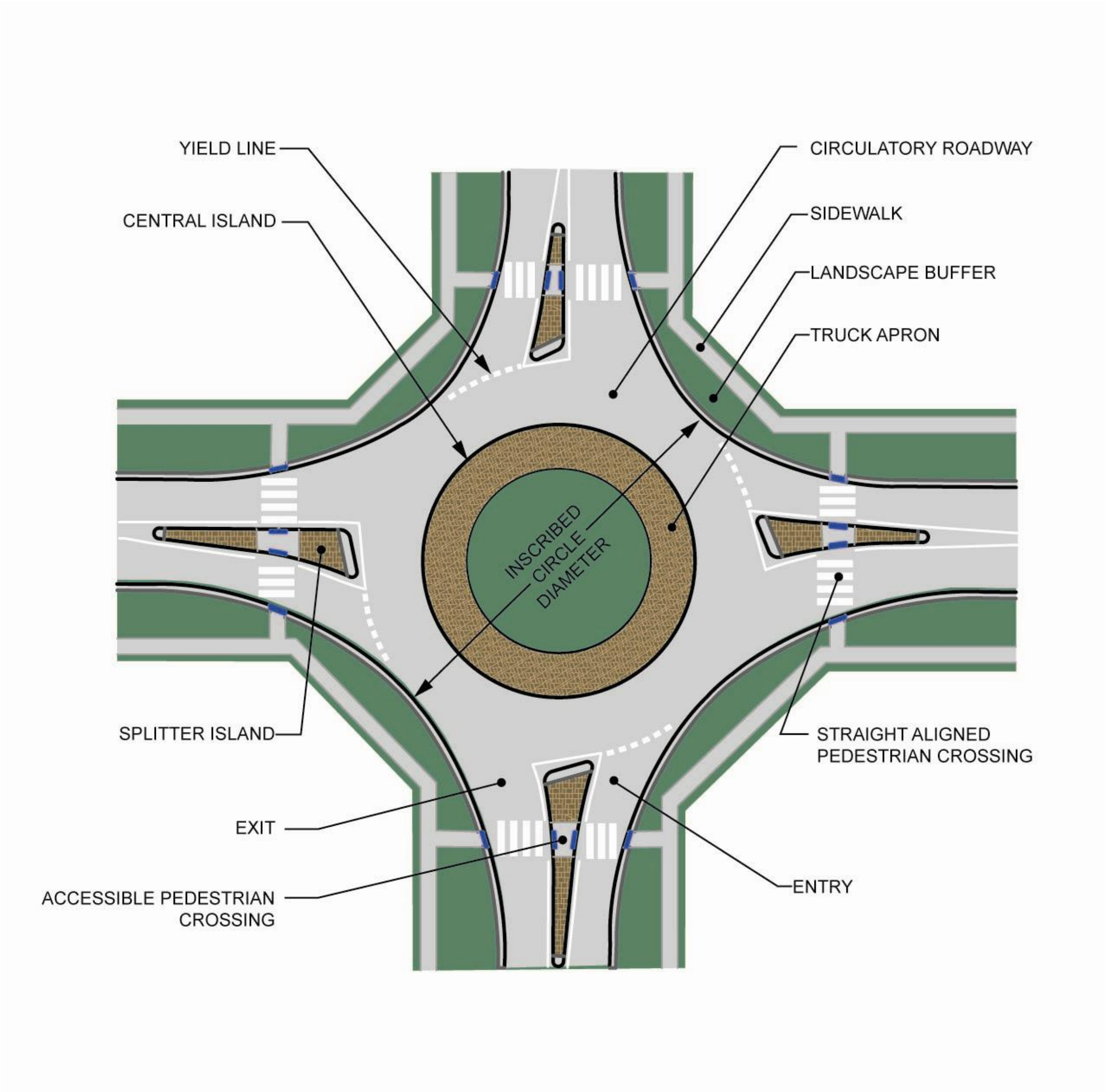


Figure 3.1 – Basic Roundabout Parameters

Design Vehicles

Buses/Major Incident Response Vehicle

All roundabouts within a current or proposed transit route shall be designed to accommodate a City of Winnipeg DLF-40 Transit Bus without encroachment onto the apron area. Figure 3.2 - Transit Bus Standard Template provides the necessary information to evaluate a City bus using design software. The Transit Bus Standard Template is also considered adequate to accommodate the City's Major Incident Response Vehicle.

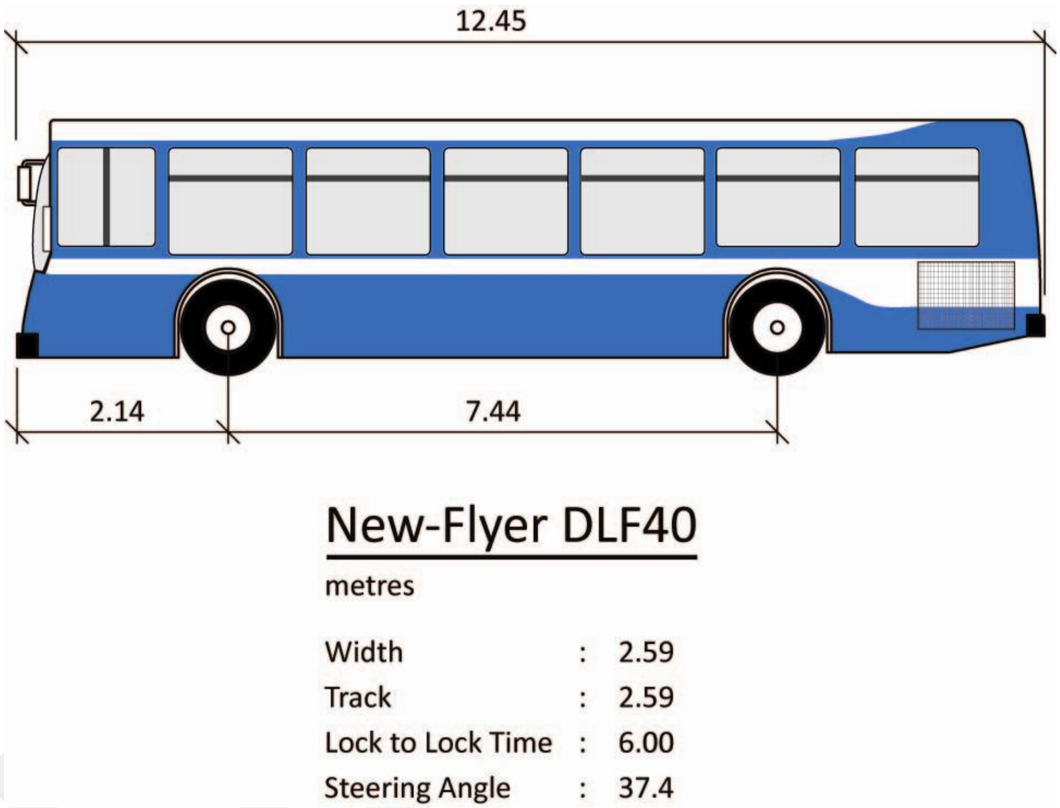


Figure 3.2 – Transit Bus Standard Template

Trucks

All roundabouts at a minimum are to accommodate a WB-20 design vehicle with encroachment onto the apron area.

Design Elements

Table 3.1 – Element Design Guidance describes various design elements that have been adjusted to meet local conditions and climate. Refer to SI-15 in the standard drawing section of the manual for additional detailed information about the below various design elements.

Table 3.1 – Element Design Guidance

Design Element	Discussion and Design Standards
Curbing	All splitter islands and the exterior curb of the circulatory road shall be an integral 180mm height modified barrier curb (SD-203B). The interior curbing of the apron shall be 180mm height modified barrier curb (SD-203B). The interior curb of the circulatory road adjacent to the apron shall be an integral 75mm lip curb (SD-202A). Separate concrete splash strip (SD-223B) shall be installed where a roundabout is adjacent to grassed areas with exclusion to the central island. The minimum bullnose radius on a splitter island shall be 0.5m.
Apron and Splitter Island Materials	The apron and splitter island materials shall be finished with a surfacing material of different texture and colour than that of the circulatory roadway. If paving stones are used they shall be placed in a herring bone pattern with the exclusion of any bordering soldier courses. The minimum apron width to be 2.0m.
Circulatory Lane Width and Pavement Jointing	The clear width of the circulatory roadway shall be a minimum of 5.0m. The concrete jointing shall be radial. In reference to the City of Winnipeg Manual for the Production of Construction Drawings (November 1984), roundabouts are considered important and complex intersections therefore a pavement jointing plan is required.
Exit Speed Geometry	Controlling exit speed through appropriate geometry is critical for roundabouts within a residential or mixed use area to increase the probability of an exiting vehicle to yield to pedestrians. Straight exits are generally not acceptable. Exit speed shall not exceed 48 km/h (30 mph). The speed differential between the circulating speed (R2) and exit speed (R3) shall not be more than 20 km/h (12 mph).

DRAFT

Design Element	Discussion and Design Standards
Pedestrian and Cyclist Access	The pedestrian path of travel across an entry or exit leg shall be in one direct straight line, not perpendicular to the curb line. Adjacent sidewalks, multi-use pathways, and bike paths shall be set back a minimum 1.5m from the back of curb or splash strip in existing locations within constrained areas. If there are existing constraints that prohibit a set-back than the sidewalk shall be 2.4m wide complete with a paving band behind the curb or splash strip. The preferred set-back is 3.0m to accommodate snow storage. Pedestrian crossings on the splitter island shall be paved in concrete with curb ramps. The maximum longitudinal slope shall be 3%. Splitter islands shall have a minimum width of 1.8m from back of curb to back of curb to provide a pedestrian area. The pedestrian area must be distinguishable within the splitter island. Additional way finding measures are to be utilized for pedestrian crossings at a roundabout. Detectable warning surfaces shall be installed at all crossings as a minimum. Cyclist accommodation will be facility specific.
Landscaping	Landscape drawings shall be reviewed by a Professional Engineer prior submitted for City review. The central island, splitter islands and adjacent landscaping shall strictly adhere to the minimum the sight line requirements described in NCHRP Report 672. The sight lines are to be based on mature plant heights. The central island and splitter island landscaping shall be low maintenance. Landscaping features in the centre island shall be set back a minimum of 0.6m from the back of the curb.

DRAFT

This page is intentionally left blank.

DRAFT

Section 4 – Geometric Design Standards

4.1 General

The primary objective in the design of any transportation system is to provide a safe, logical, efficient and aesthetically pleasing access and circulation system for the movement of people and goods. The designer should use a combination of engineering parameters that best meet the intention of the design while staying within the accepted ranges.

4.2 Alignment Design

Table 4.2 – Summary of Basic Geometric Design Criteria summarizes the basic geometric design criteria for the different categories of streets within the City of Winnipeg Street Classification System. The criteria listed were developed to ensure uniform requirements between the various street categories. Wherever possible, the designer should use values that exceed the minimums listed in the table. Although the visual aspect of street design was not taken into specific consideration in developing the above referenced table, it is nonetheless an important consideration in street design and should be given due attention during the design process.

Design Speed

With the exception of public lanes, cul-de-sacs and residential local streets, generally the design speed of a City roadway is 10 km/h higher than the posted speed limit of the road unless otherwise specified by the City. This Section is intended to address only roads with a $D_s \leq 90$ km/h. Roads with a $D_s > 90$ km/h should reference the TAC GDG.

Horizontal Alignment

In addition to Table 4.1 and the TAC Geometric Design Guide the following is provided:

- Spiral transition curves are to be used on all expressway and major arterials with a design speed of 90 km/h or higher to transition into and out of super elevation. Spiral curves may be used on major arterials with design speeds less than 90 km/h based as required.
- Proposed collector streets that form a tee into an arterial street, if applicable, are to be designed to consider the effects of the operational characteristics of the design if a fourth leg is subsequently added to the intersection, including;

    1. On the collector, evaluating the effect of the proximity of median openings and approaches to the intersection.
    2. Evaluating the sight lines for future opposing left turn traffic with existing left turn traffic.

3. Mitigating potential operational issues by utilizing an appropriate alternative design that could be efficiently and effectively modified when a fourth leg is added.

4. Minimize the potential for illegal dual movements, i.e. a future through lane used as a second left turn lane.

To summarize, if a fourth leg may be required in the future, the geometry must be planned to include a fourth leg which will aid in evaluating the above issues. When the fourth leg is added the opposing leg may require modification.

- Appropriately designed left turn lanes and median widths that improve the sight lines will also improve the capacity of the intersection as it is easier for drivers to identify gaps.

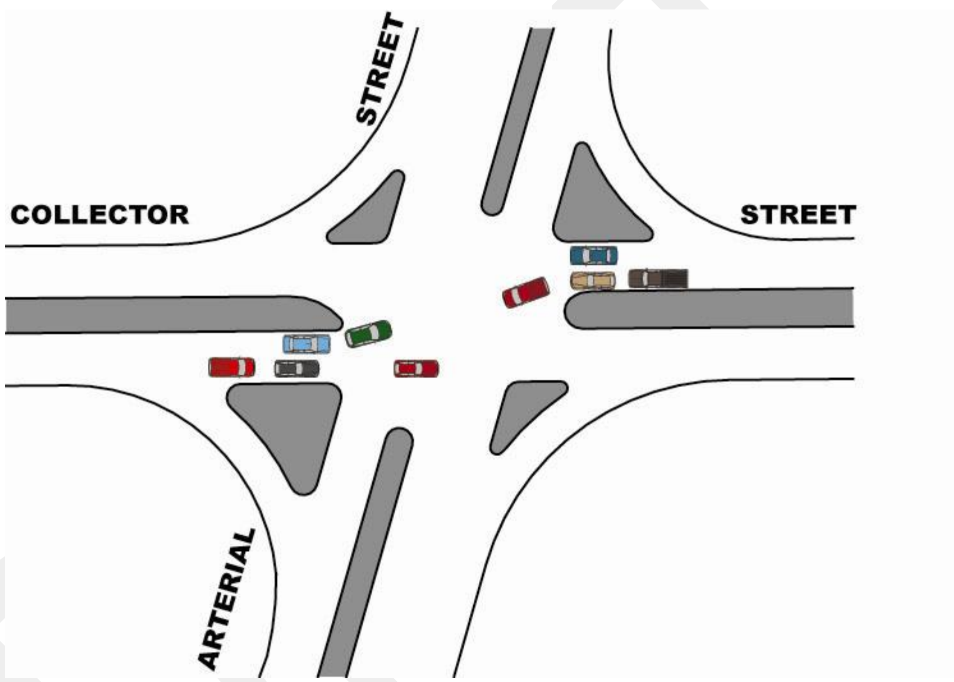


Figure 4.1 – Improper left turn geometry with a high demand results in poor sight lines

- Entrance and exit tapers to expressways are not permitted; instead parallel acceleration lanes shall be used. Tapers in urban environments have some negative implications which include;

1. Does not meet driver expectations within the City. The City desires consistency in road design to encourage proper driver behaviour

2. Tapers can allow higher turning speeds, which decrease the likelihood of a motorist to adequately yield prior to a pedestrian crossing.

3. Due to higher volumes there is potential for lane blockage and therefore reduced ability to utilize the right turn channelization and will encourage motorists to encroach onto the shoulder if one is present to access the right turn lane.

Commentary for Drawing SI-8 (Located in Section 4A)

The design and lane configurations of collector street and arterial street intersections will be site specific for each design. There are an abundance of options and configurations that vary depending on how many legs are planned, what are the traffic volumes and major movements, and reviewing various user operations. The intent of SI-8 is to demonstrate the critical design factors such as;

- The right-of-way is widened for the channelized section to ensure adequate boulevard space.
- The introduction of a raised median on the collector uses the standard geometry.
- If one lane is planned for the departure leg of a turning vehicle, the geometry must be able to accommodate truck turning movements onto the collector street. This is done by adjusting the size of the island, or geometry of the bullnose.

Vertical Alignment

In addition to Table 4.1, Table 4.2 and the TAC Geometric Design Guide the following is provided:

- Evaluation of the horizontal and vertical alignment must be performed to identify and mitigate concentrated locations of surface drainage from crossing the traveled vehicular path. Typical examples include:

    1. Transitions from superelevated sections to normal cross fall on a curbed roadway.

    2. Run-off from the boulevard crossing over the curb and across the road in super elevated sections.

    3. Run-off from a large island across a channelized right turn lane.

    4. Reducing or restricting water running through intersections.

    Mitigation solutions for the above examples could include the provision of drainage swales and fly-by catch basins.

- False grading shall be applied to vertical sag curves at the low points on the gutter side.
- An alternative to using vertical curves for lower speed routes is to use progressively changing grades to reduce the amount of vertical deflection felt by the driver at one location.
- Crossfall should be reduced through intersections where appropriate.

Table 4.1 Vertical Design Parameters

Vertical Design Parameter	Road/Construction Type	Value(s)
Longitudinal Grade	New Construction with curbed gutter	Minimum 0.5%
	MJRH	Minimum 0.3%
	Mill and Fill	Minimum 0.3%
Cross Fall for Normal Crown	All paved road/construction types	2%
	Granular surfaced road	3%
	MJRH	2% typical. Can vary between 1-4% where constraints exist
Cross Fall for Normal Crown	Mill and Fill	Match existing, improve deficient cross falls where feasible to minimum standards.
Vertical Curves Usage	Expressways and Major Arterials with a D_s of 90 km/h	Use vertical curves where algebraic difference of grades at a PVI is > 1.5%
	Other Arterials	Use vertical curves where algebraic difference of grades at a PVI is > 1.5%
	Collector streets	Use vertical curves where algebraic difference of grades at a PVI is ≥ 2.0%
	Residential Locals, Public Lanes, Cul-de-sacs	Vertical curves should not be used unless extreme grade differences present a constraint
Longitudinal Grade for Radii ≤ 15.0m	New Intersections	1.0% minimum
	Intersections part of a MJRH or Mill and Fill	0.7% minimum
	Non-intersections	0.7% minimum

Table 4.2 – Summary of Basic Geometric Design Criteria

LOCATION/TYPE	CLASSIFICATION	X-SECTION DWG. NO.[1]	DESIGN SPEED (km/h)	MIN. RADIUS (m)	MINIMUM CURVE LENGTH (m)	MAXIMUM SUPER ELEVATION (m/m)[3]	LONGITUNDIAL GRADIENT		MINIMUM TANGENT LENGTH
							MIN. (%)	MAX. (%)[5]	
All	Expressway	M-13	90-100	TAC	TAC	0.06[4]	0.5[2]	3.0	TAC
	Major Arterial	M-7	90	TAC	TAC	0.06[4]	0.5	4.0	TAC
	Major Arterial	M-7	60-80	TAC	TAC	0.04	0.5	4.0	TAC
	Minor Arterial	M-6	60-80	TAC	TAC	0.04	0.5	4.0	TAC
Residential	Major / Minor Collector	M-3,M-4,M-6	60	185	60	0.02 (R.C.)	0.5	3.0	60
	Local	M-1,M-2,M-14P10	50	100	60	N/A	0.5	3.0	30
	Cul-de-Sac	M-10	N/A	75	30	N/A	0.5	3.0	N/A
	Public Lane	M-8	N/A	N/A	N/A	N/A	0.5	3.0	N/A
Industrial	Collector	M-6	60	185	TAC	0.04	0.5	3.0	60
	Local	M-3,M-4	50	100	60	0.02 (R.C.)	0.5	3.0	30
Rural	Collector		60	185	TAC	0.02 (R.C.)	0.1	3.0	60
	Local		50	100	60	N/A	0.1	3.0	30

DRAFT

Notes:

1. Refer to Section 2.1 of this manual.
2. If curbs are present.
3. Use TAC Superelevation Rate for Urban Design Tables unless otherwise noted.
4. Use TAC Superelevation Rate for Rural and High Speed Application.
5. Adjustment to the terrain may be required.

Additional Drainage Design Considerations

Gutter spread analysis is important in determining the location and spacing of catch basins. The criteria for determining the gutter spread and related catch basin spacing is different for each street classification. It is less critical from a transportation perspective for residential streets since catch basins are typically placed at the low points that are sufficiently spaced, as well as at locations to prevent concentrated water from crossing intersecting streets where there is potential for ice formation.

Gutter spread is critical for roads classified as arterial or higher because when speeds increase, safety concerns are introduced as water can build up on the road and impede traffic and emergency vehicle movement. Catch basin spacing and quantities should be adequately designed to satisfy the correct gutter spread while still considering cost efficiency.

The following resources are to be used for the development of the project specific design criteria for gutter flow and pavement spread calculations:

1. Design criteria from previous major projects that have demonstrated adequate performance.
2. The City of Winnipeg's "Review of Culvert and Drainage Inlet and Outlet Safety Report – 1998"
3. Hydraulic Engineering Circular No. 22 (HEC-22) Second Edition – Urban Drainage Design Manual prepared by the US DOT – FHWA, August 2011.

The following are examples of how catchment efficiency can be improved:

1. Fly-bys could be placed with one in front of the other, as shown in Figure 4.2. This is applicable is adequate shy distances or shoulders are available.
2. Adding additional catch basins at the low point, as shown in Figure 4.2. The spacing is typically 2.0m a part on centre, but further analysis may be required for case specific reasons such as at sag locations for underpasses.
3. Recessing the catch basins into a recessed area in the median or boulevard, as shown in Figure 4.3.
4. Utilizing fly-by catch basins; if two or more fly-by catch basins are required they should be placed 5.0m apart on centre, as shown in Figure 4.4.

Although roads with a rural cross section are permitted to have minimal longitudinal grade, introducing a greater longitudinal grade can be beneficial to the road sub-drainage system.

Figure 4.2 – Example of a way to maximize catchment efficiency at the low point of an underpass.

Figure 4.3 – Example of offset fly-by catch basins with a recessed curb.

DRAFT

Figure 4.4 – Example of properly spaced fly-by catch basins.

Auxiliary Lanes

Auxiliary lanes provide a space for motorists to decelerate outside of the through lane, accelerate to merge into a through lane and provide storage for vehicles that are turning. Designing the optimal length of these lanes is critical to ensure they are used appropriately and safely and that they perform as intended. For higher speed roadways the Acceleration and Deceleration Tables from the TAC Geometric Design Guide – Interchange Section shall be used.

On existing roadways where space may be limited or other constraints exist and a left turn is required, the geometric design parameters for the lane transition and the required length may be reduced.

Table 4.3 – Auxiliary Lane Transition lists the recommended values for the parameters used in the design of auxiliary lane transition sections for various design speeds.

Above Minimum Designs for Median Openings

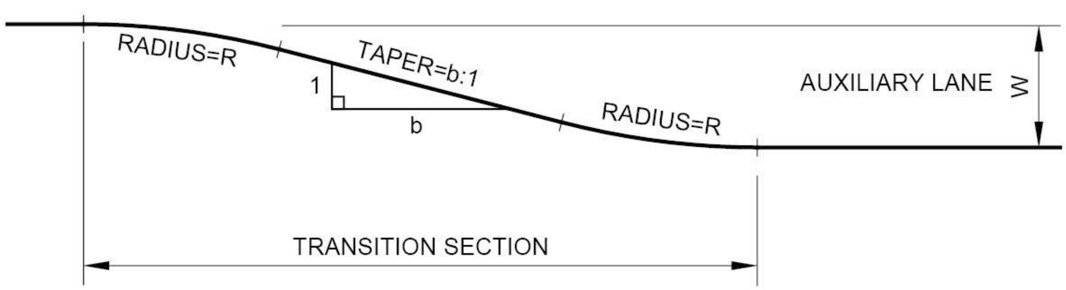
In cases of existing higher volume, lower speed roads with low left turn demand and where space is not available or there are other constraints restricting the use of an auxiliary lane, a bullet nose taper can be utilized. The bullet nose taper offers more accommodating left turn geometry to guide left turning motorists out of the through lane quicker, provides more storage and can preserve existing trees. This geometry is more commonly used for rehabilitation projects. Refer to SI-16 for design specifications.

Commentary on Drawing SI-16

The drawing is directly interpreted from the AASHTO Geometric Design Guide for Highways and Streets and is intended to be used as guidance. Critical design aspects to consider are the taper angle and 'R1'. This application may also be used successfully on medians less than 4.0m. The radius adjacent to the opposing traffic related to 'c' is commonly not present and the curb is run straight to the bullnose.

Table 4.3 – Auxiliary Lane Transitions[2]

Design Speed (km/h)	Taper Ratio	Radius (m)	Length (m)[1]
50	8:1	90	39.21
60	9:1	115	44.24
70	10:1	140	48.97
80	12:1	165	55.73
90[(3),(4)]	15:1	190	65.15



$$\text{LENGTH} = (b \times W) + \left(\frac{2R}{\sqrt{1+b^2} + b} \right)$$

Notes:

1. Lengths given are for an auxiliary lane width of 3.5 metres.
2. Data provided on this table are for transitions on tangent sections. Transitions on curves may require alternative treatment.
3. Auxiliary lanes on expressway roads are to follow the Interchange Section of the TAC manual with the inclusion of reverse curves.
4. Auxiliary lanes on major arterial roads with a design speed of 90 km/h or higher may follow the above table or the Interchange Section of the TAC manual based on project design variables.

4.3 Cross Section Elements

Shoulders

Table 4.4 provides design guidance for shoulders. If granular roads intersect with a paved road the granular road shall be paved a minimum of 20.0m from the inside edge of the shoulder to reduce granular drag out onto the major road as well as reduce the wash-boarding effect prior to the major road and to provide an enhanced stopping surface at the intersection.

Table 4.4 – Shoulder Design for New and Reconstructed Regional and Truck Route Pavements

Shoulder Location	Width	General Uses and Discussion
Inside Shoulder for a Divided Roadway	1.5m	Typical inside shoulder width. Shoulder to be fully paved. For concrete pavements the shoulder may be partially concrete and partially asphalt.
	<1.5m	Generally not acceptable. Where are existing roads with 0.6m wide shoulders; these widths may be retained during rehabilitation. However, consideration should be given to widening to 1.5m during reconstruction.
	No Shoulder	This is common on the Inner Ring road system. If no shoulder is used a curb must be provided with the appropriate shy distance.
Outside Shoulder	2.5m	Used for locations where ROW width is constrained. Can be used on streets with volumes less than 3000 vpd. May be partially paved a minimum width of 0.8m or fully paved.
	3.0m	The typical shoulder width. May be partially paved a minimum width of 0.8m width or fully paved. ATN designated routes are to be fully paved.
	Partially Paved	Full width granular shoulders are not permitted. Partially paved shoulders may be used as a cost saving measure in lieu of a fully paved shoulder where other warrants exist. The minimum partially paved width shall be 0.8m. This width accommodates line painting, vehicle wandering and rumble strips. Partially paved shoulders shall change to a fully paved shoulder a minimum of 25.0m from the start of a radius of an intersection.

Shoulder Location	Width	General Uses and Discussion
Auxiliary Lanes	1.5m	If no curb is present.
Shoulders with Curbs		Shoulder width to be inclusive of curb width.
Raised Shoulders	Their use is not preferred as they have shown to be detrimental to pavement integrity and cumbersome for snow clearing. They may be retained during rehabilitation and consideration to paving existing raised granular shoulder should be considered. There may be some special cases that may benefit from a raised shoulder, such as bike shoulders, if so that shoulder should be paved.	

Edge Rounding

Edge rounding is discussed in Section 5.0 - Roadside Safety.

Lane Widths

This section is to provide additional design guidance when the Standard Cross Sections are not applicable.

Drawings produced for City projects are to reference dimensions to the back of curb when curbs are present or the edge of pavement. Consistency in this practice is important to reduce conflicts and confusion when identifying clear distances. Clear lane width refers to the space available in the lane to the user which is exclusive of shy distances, shoulders or curbs.

When a safety curb or traffic barrier is utilized the plan shall show the theoretical back of curb which is at least 150mm from the face of curb. This is to ensure that the faces line up during construction. The plans may show the face of safety curb or barrier for clarity.

When curb and gutters are utilized it is prudent to show the face of gutter for clarity. The gutter portion is not to be considered as part of the travelled lane measured width except for residential locals and collectors. The gutter portion is to be considered for use as a shy distance.

The concrete joints on a concrete collector street may aid in lane assignments. A seldom used alternative to this typical layout is to provide a parking lane by offsetting the crown. If this method is used and parking was assumed on the incorrect side of the street or is not utilized the longitudinal pavement joints will undergo additional stress as they will be in line with the tire track. Additional details for residential collector jointing can be found in SD-218B and SI-89.

For higher speed roadways and rural cross sections that may have curbs near intersection or no curb at all; the drawings should indicate the lane lines including the gutter side to clearly show the planned shy distances and how shoulder widths are introduced and transitioned.

For new facilities careful considerations must be given to how the lane widths will correspond with the placement of the painted lines.

DRAFT

Table 4.5 – General Lane Width Design Guidance

Lane Type	General Width and Discussion
Lanes Designated for Buses	Bus lanes are to be a minimum of 3.5m. Bus bays are to be a minimum of 3.0m.
Auxiliary Lanes	Auxiliary lanes are to be 3.5m. For clarity the following examples are provided: *Asphalt Roadway with Barrier Curb and Gutter* Edge of through pavement to face of gutter to be 3.35m. Lane width to be 3.35m + gutter width + curb width. *Concrete Roadway with Barrier Curb* Edge of through pavement to face of curb to be 3.35m. Lane width to be 3.35m + 0.150m. *Concrete Roadway with Integral Modified Barrier Curb* Edge of through pavement to face of curb to be 3.20m. Lane width to be 3.20m + 0.300m. This example is an exception to represent current practice that is deemed acceptable by the City for consistency purposes.
Parking Lanes	Parking lanes can vary in width on different streets. The minimum is 2.80m.
Through Lanes for Roads with a $D_s \geq 80$ km/h	Lane widths are to be 3.70m. If a curb is present a shy distance of 0.3m to face of curb is required.
Minimum Through Lane Widths	On existing roadways and in confined locations such as downtown the minimum clear width should be 3.35m. For clarity the following example is provided: *Six lane divided curbed concrete roadway with a $D_s \leq 80$ km/h* From back of curb to back of curb in each direction the width shall be 10.35m. [(2 x 3.5m) + 3.35m]

Lane Type	General Width and Discussion
Shared Lanes	Shared lane widths are to have a clear width between 4.0 and 4.2m.
Widths for One Lane per Direction on Divided Roadways	Where only one lane is available per direction on a divided curbed roadway, including channelized right turn lanes. In these cases it is important to choose a width that will not be perceived as two lanes and will also allow other vehicles to pass a possible disabled vehicle. These lanes shall be between 5.0m and 6.0m.

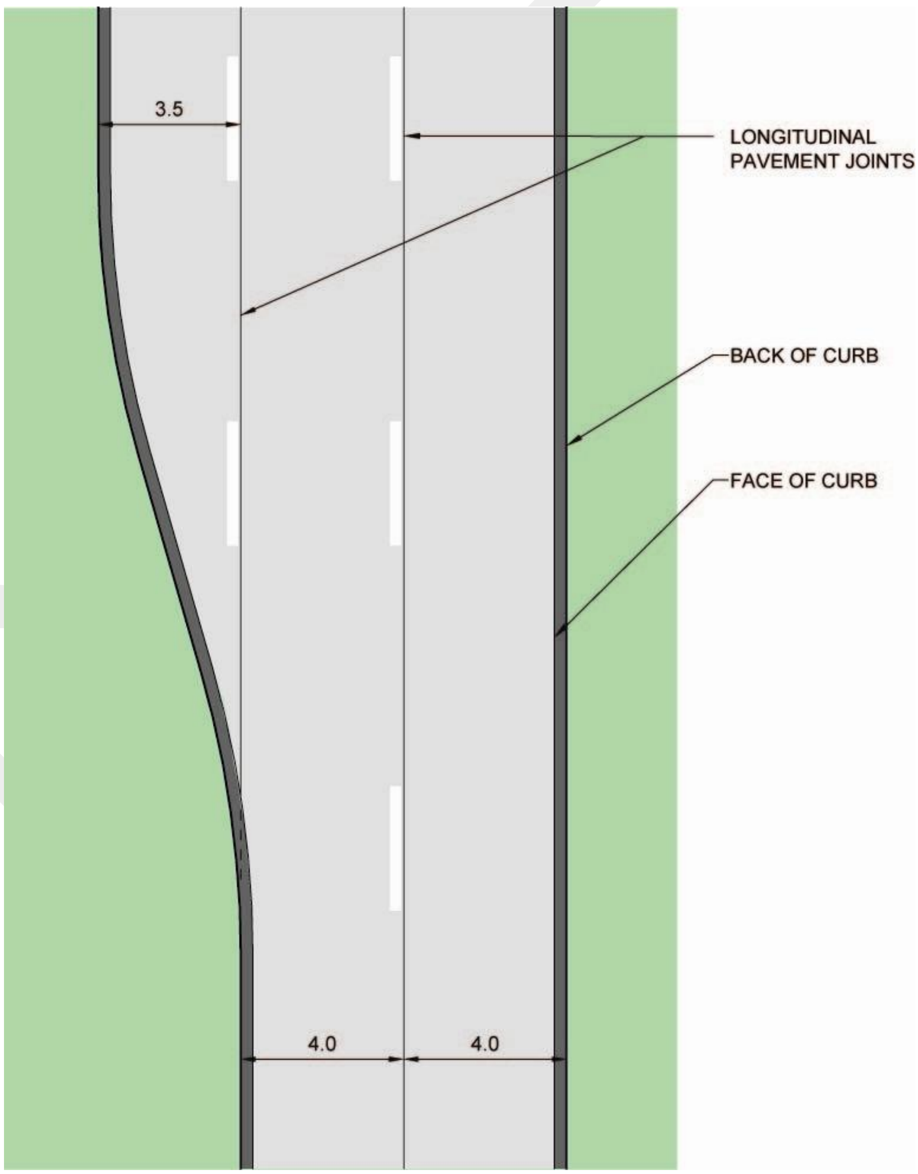


Figure 4.5 – Example of lane widths for a concrete minor arterial roadway with barrier curb.

Median Design

The median is the space between two opposing roadways. Medians require a sufficient width to provide a safe separation between opposing traffic, plant trees, place signage, provide a reserve for future road widening, provide pedestrian and vehicular refuge and to delineate traffic for left turn lanes.

Good median design for alternative collector streets and arterial roadways shall consider the affects the desired median width has on compatibility with adding additional left turn lanes in the future and roadway expansion. If additional left turn lanes are to be added in the future, or either intersecting road is widened, the median will decrease in width and the travel distance through the intersection may increase resulting in the median being pushed back further from the intersection. The negative impacts of the median getting pushed back further include;

- Decreased way-finding for pedestrians as the bullnose tip that they initially had as a reference would now be relocated.
- Reduction or omission of a pedestrian median area if required for long distance crossing
- Driver non-compliance with the stop line location.

Figure 4.6 – Good median design on Chief Peguis Trail allows for the bullnoses to be placed adjacent to the pedestrian crossing.

Median widths should also be evaluated for increased width for arterials within industrial areas that have to accommodate heavy truck turning movements. *For Example*: Oak Point Highway between Egesz Street and Lucas Avenue.

The following design standards are provided to facilitate maintenance, performance and aesthetics of the median;

- Medians widths < 1.5m from back of curb to back of curb shall be safety median for road with a design speed ≤ 70km/h.

DRAFT

- Medians with less than 3.0m between back of curbs shall be hard surfaced. Medians with a width of 3.0m or greater between the back of curbs may be grassed or hard surfaced. Consideration must be given to the surrounding area existing median treatments, maintenance constraints and splash potential.
- Residential cul-de-sac islands are to be hard surfaced.
- Industrial cul-de-sac islands, if required, are to be hard surfaced.
- Appropriate shy distances must be provided from the face of an F-shape traffic barrier to the traveled lane.
- Medians with a continuous cross slope steeper than 5:1 shall be hard surfaced.
- For most intersections where the pedestrian crossing distance is not excessive the bullnose should not intercept the path of pedestrian travel.
- On existing arterials where the pedestrians have to cross through a median 1.5m or less in width, and the median cannot be pulled back, it would not be practical to provide curb ramps with a sidewalk. A practical solution is to provide a concrete surface flush with both sides of the median. *For Example:* Crossing Osborne Street at Granite Place.
- Median widths between through lanes for high speed roadways should be equal or greater than the clear zone. If this width cannot be less than a median barrier warrant exercise should be performed.

Splash Strips for Medians

Splash strips are intended to reduce the boulevard maintenance directly behind the curb due to concentrated residual de-icing agents and from snow clearing operations.

A 600mm concrete splash strip shall be placed behind the median curb on all Regional Streets and Collector Streets if the median is grassed for new construction and MJRH projects.

A 600mm concrete splash strip shall be placed around the whole perimeter of the median area between the frontage road and adjacent collector street.

Figure 4.7 – Warde Avenue show the standard median design for developmental collectors and arterials that includes an integral modified barrier curb with a separate splash strip

Boulevard Design

The boulevard is the area adjacent to the road that requires sufficient area to accommodate utilities, store snow, bus stops, provide a clear zone, street furniture, signage and trees. The following design standards are provided to the facilitate maintenance, performance and aesthetics of the boulevard.

- Splash strip should be placed behind the curb on all Regional Streets as directed by the City. The splash strip provides an aesthetic and durable alternative to grass within the grass 'kill zone' created by snow clearing operations and street de-icing agents. A splash strip is not necessary behind a curbed shoulder as the shoulder itself will act as a buffer.
- Salt tolerant seeding shall be used within a minimum distance of 2.0m from the back of curb on all Regional Streets. A 600mm wide strip of sod may be used to border the salt tolerant seeding to mitigate erosion and differential settlement of the area between the boulevard and a sidewalk.
- Boulevards less than 1.5m in width shall be hard surfaced.
- The maximum slope of sound attenuation or landscaping berms shall be 4:1. The preferred slope is 5:1. Proximity of the sound berm to the road shall consider snow storage requirements.
- The minimum boulevard crossfall is to be 2%; however, 3% is preferred and is the standard minimum for new construction.

- The maximum boulevard crossfall is to be 8%.
    - Where public lanes exist in neighbourhoods and sidewalks are separated from the street by a grassed boulevard, the boulevard should be designed to accommodate a privately installed hard surface walkway to the curb edge. This is to accommodate accessible pick up and drop to the front entrances of residences, if required.
- Short and isolated locations can be up to 10% to allow for some flexibility in the design to reduce the need for short retaining walls. Slopes greater than 10% are considered embankments.

Curbs

The curb has many beneficial functions, including:

- Provides guidance for snow clearing
- Allows for an elevated boulevard
- Separates modes of transportation
- Delineates where vehicles can drive
- Facilitates drainage
- Identifies points where a sidewalk intersects a road
- Provide shielding from objects in low speed applications

Although all these benefits, selecting the proper curb is important to prevent vehicle instability and rollover during impact, accelerated curb deterioration and driver non-compliance with intended designs. The curb type can also have an impact on the roads running speed as a larger more significant curb can have a more confining feeling while a smaller sloped curb can create more of a sense of openness. Consideration shall also be given to curb types on adjacent and surrounding streets for continuity.

Discussion of curb type selection is described in Table 4.6 – Curb Selection and then summarized in Table 4.7 – Summary of Common Curb Type Applications for Various Street Segments

Table 4.6 – Curb Selection

Curb Type & Standard References	General Uses and Discussion	Standard Uses Where Technically Feasible
Barrier Curb and Gutter SD-200	The curb and gutter is used with asphalt pavements. The height can be specified as 150 or 180mm. The shape of the curb can also be any of the other standard shapes while maintaining the 600mm overall width. Other shapes are possible and should be approved by the City prior to implementing. The most common application for barrier curb and gutter is for reconstructing local streets. The cross slope of the gutter pan must be cautiously monitored during construction to ensure it does not retain water at intersection radii and the slope should match that of the road cross slope.	New local street asphalt construction.

DRAFT

Curb Type & Standard References	General Uses and Discussion	Standard Uses Where Technically Feasible
120mm Mountable Curb SD-201	This shape is used on higher speed roadways as the sloped face and shorter height is more forgiving during a vehicular impact.	All roads with $D_s \geq 80$ km/h when a curb is utilized. $D_s = 80$ km/h is a grey area and other variables are to be considered in the context such as operational speed to consider 180mm barrier or 180mm modified barrier curb. This shape is used for underpasses including low speed.
40mm Lip Curb SD-202B	This shape is used in conjunction with a gutter for approaches on asphalt roadways for local streets. It is also used for private approaches when renewing local streets.	
75mm Lip Curb SD-202A	This is the standard curb for new local street construction with private approaches. During rehabilitation of local streets the 75mm lip curb is generally milled off and replaced with dowelled barrier curb except at approach locations.	Local residential streets with fronting private approaches
Modified Lip Curb SD-202C	This curb may be used for the renewal of local streets.	
Barrier Curb Integral SD-204	This curb may be used for the construction and renewal of any street with a $D_s \leq 70$ km/h.	Renewal of some local streets
Barrier Curb Separate SD-203A Dowelled SD-205	This curb may be used for the renewal of most streets with a $D_s \leq 70$ km/h.	Optional use for road with a $D_s = 80$ km/h. Maximum height of 150mm for MJRH projects that include asphalt overlay.

DRAFT

Curb Type & Standard References	General Uses and Discussion	Standard Uses Where Technically Feasible
180mm Integral Modified Barrier Curb SD-203B	This curb is robust and resilient to snow clearing impacts due to its slightly sloped face and width. It is more forgiving for low speed impacts and prohibits vehicles from encroaching onto landscaped areas. On roads with narrow through lanes with parking adjacent to the curb this profile prohibits cars from parking as close as a barrier curb, but is more forgiving on low speed wheel impacts that could occur while parallel parking.	On all collector streets. On local streets flankages and where no private approaches are fronting for one complete segment. On radii <25m or for locations where there is a high likelihood of impact from wandering trucks.
Dowelled Modified Barrier Curb SD-203B	Generally used along radii on rehabilitation projects or for spot repairs. Not generally used as a mainline curb if curb replacement is warranted for a rehabilitation.	On radii <25m or for renewal locations involving and asphalt overlay where there is a high likelihood of impact from wandering trucks.
Safety Curb SD-206B	Used on lower speed roadways to protect errant vehicles from fixed roadside objects such as Rail Warning Systems, OHSS and bridge columns. Safety median is used for median widths less than 1.5m. Where median cross slopes are excessive on low speed route, typically where left turn lanes are added on existing roadways, a safety curb may be considered for one side of the median to reduce the cross slope.	For protection of fixed objects on roads with a $D_s \leq 70$ km/h where technically feasible. For medians less than 1.5m in width. Only for $D_s \leq 70$

Curb Type & Standard References	General Uses and Discussion	Standard Uses Where Technically Feasible
Separate Concrete Splash Strip SD-223A	This splash strip is used in conjunction with an integral curb.	On medians for new collector street construction. On medians and gutter sides for reconstructed regional streets when utilizing an integral curb. On medians and gutter sides for image routes.
Monolithic Concrete Splash Strip SD-223B	This curb is used on new construction or rehabilitation of regional streets.	

Table 4.7 – Summary of Common Curb Type Applications for Various Mid-block Street Segments

Curb Type	Curb Height (mm)	Street Classification	Construction Type	Design Speed km/h			
				60	70	80	90
Barrier	150	Local, Collector, Arterial	MJRH	●	●	●	●
	180	Local, Collector, Arterial	MJRH	●	●		
		Arterial	New Construction	●	●		
Modified	180	Collector, Arterial	New Construction	●	●		
Lip	75	Local	New Construction	●			
Mountable	120	Arterial, Expressway	New Construction			●	●

● – standard application

DRAFT

Figure 4.8 – An example of a ‘Curb Type Key Plan’ that is to be included as part of residential subdivision drawings set. The figure also demonstrates the City standard curb types for residential subdivisions.

Bridge Cross Sections

Shy distances are introduced or increased along bridges to aid in safety and driver comfort due to the presence of rigid barriers, to allow space for disabled vehicles such that traffic can be maintained and to provide an area for maintenance activities. During rehabilitations structural constraints or space may be limited so minimal values are presented in Table 4.8, but higher values should be used where economically feasible. Ranges are also given to allow flexibility in design based on site specific variables and constraints. The shy distances are to be measured from the edge of the travelled lane to the base of the rigid barrier.

Table 4.8 – Bridge Cross Section Guidance for New Construction and Rehabilitation Projects

	Left Shy Distance (Inside) (m)		Right Shy Distance (Outside) (m)		Sidewalk Width (m)		Clear Lane Width (m)	
Low Speed < 70 km/h	Range	Typical	Range	Typical	Range	Preferred	Range	Preferred
All Road Classifications	0.3 – 1.0	0.6	0.9 – 1.8	1.0 – 1.5	1.8 – 3.0	2.5	3.35 – 3.7	3.5
High Speed ≥ 70 km/h								
Expressway	1.0 – 1.5	1.5	2.0 – 2.3	2.3	1.8 – 3.0	2.5	-	3.7
Arterials	0.9 – 1.5	0.9	1.0 – 2.3	1.5	1.8 – 3.0	2.5	-	3.7
Comments								
	Values are dependent on rehabilitation constraints. Values for shy distances on rehabilitation projects should be maximized based on economic analysis. Consideration is to be given to the bridge length, amount of lanes, maintenance requirements, whether shoulders are present on the connecting road, and other factors. The right shy distance value is to consider whether the structure is part of the ATN or if there is a separate cyclist facility.				The minimum value would apply to rehabilitation projects with constraints. The maximum value is based on the under-bridge crane maximum reach.		No ranges are given for high speed roads as the bridge lanes must match the approach roadway lanes.	

4.4 Sidewalks and Pedestrian Connectivity

The following is some additional guidance for the design of accessible walkways within the City right-of-way:

1. When an off road bike path is present in the boulevard, the sidewalk shall be located closest to the property line. The bike path will be placed between the sidewalk and the road.

2. Separation of pedestrians and cyclists is desirable for streets with high public transit usage.

3. The sidewalk design shall be consistent with the City of Winnipeg Accessibility Design Standards and Standard Construction Specifications.

4. Sidewalks shall be designed in a consistent manner. Where way-finding edge banding is used or where a surface treatment within the sidewalk setback is provided, the choice of material colour and texture should be consistent with the surrounding community. The designer should also consult with the appropriate community stakeholders to ensure conformity and consistency.

5. Wider sidewalks shall be considered at locations abutting schools, community centres, hospitals, or where there is potential for higher pedestrian volumes. Wider sidewalks within and adjacent to residential communities accommodate bidirectional pedestrian movement as well as facilitate sharing the sidewalk with vulnerable users. Wider sidewalks could also be considered at roundabouts to improve traffic operations. If wider curb ramps are used, the curb ramps on either side of the crossing shall be of equal width.

6. Sidewalks shall have a cross slope of 2% for newly constructed facilities where boulevards are present.

7. Where feasible, sidewalk alignments should be optimized to facilitate the natural walking path alignment which is typically the shortest or straightest route. Corner radii or chamfers can be used at sidewalk intersections where soft landscaping is anticipated to be a maintenance issue. The location should also consider a logical alignment for snow clearing operations.

8. Curb ramp location should consider the locations of poles and push buttons at signalized intersections. Locations of ramps must be verified with proposed signal placement and may have to be modified in the field or after the formal drawing approval process to address utility conflicts.

9. The sidewalk approach to a street crossing should have the same alignment as the intended crossing where feasible. Visually impaired pedestrians establish their travel path on the approach to the road and rely on their line of travel.

DRAFT

10. For skewed intersections consider if the street crossing should be perpendicular to the intersecting road, which will offer the shortest distance or alternatively should the street crossing be parallel to the road running along the path of vehicular travel. Running parallel may result in a longer crossing but can be advantageous as the pedestrian will cross the road in the same alignment at the thru traffic and visually impaired users can follow the sound of traffic as guidance.

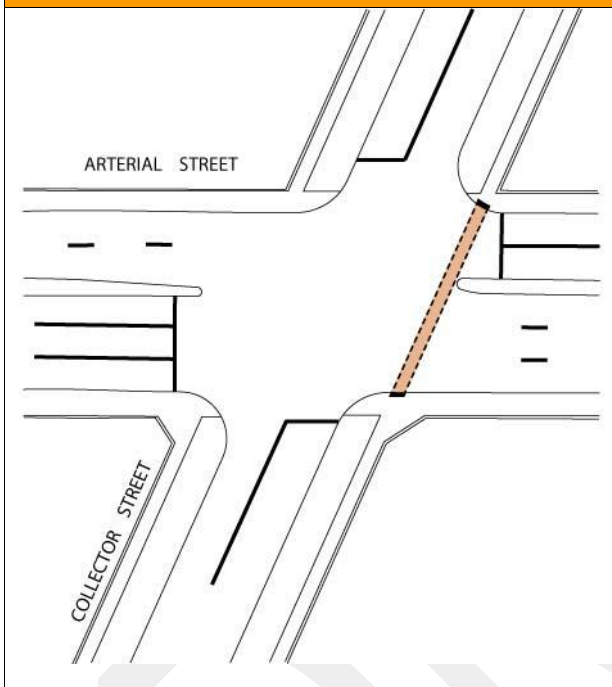
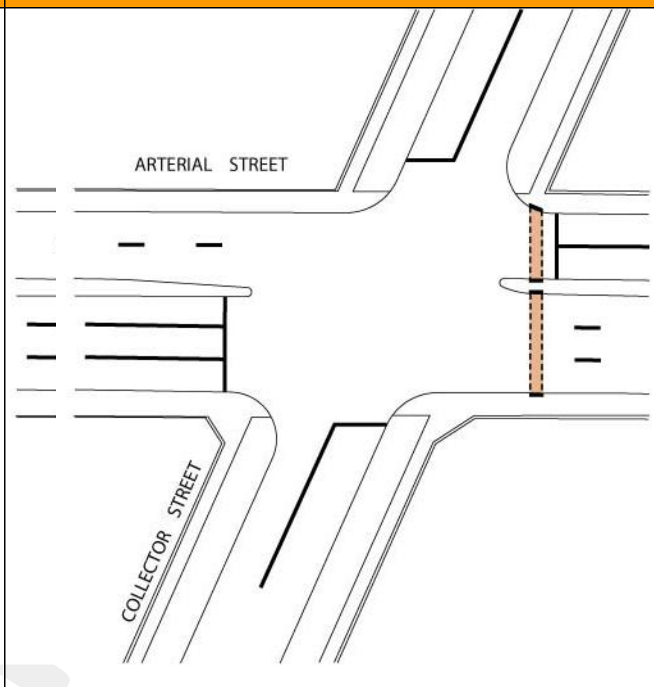
<table>
<tr><th>Skewed Crossing Alternative</th><th>Perpendicular Crossing Alternative</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>• Offers a similar alignment to the adjacent street.
• Offers a more direct path
• Longer crossing
• May have less grade conflicts with existing buildings with no set-back</td><td>• Reduces the pedestrian crossing
• Pulls one curb ramp further from the intersection
• Likely requires additional pole for push button
• Driver non-compliance with stop line would result in blocking the pedestrian path</td></tr>
</table>

Figure 4.9 – Pros and cons of two acceptable solutions

11. Grass is an appropriate medium for way-finding and should be used strategically and with consistency to provide directional guidance where feasible.

12. Reduce large concrete areas or distinguish the clear path of travel to aid in way-finding by providing surfacing adjacent to the sidewalk that is of a different texture and colour.

13. Setting the sidewalk back with a consistent offset from the road to create a buffer is preferred regardless of street classification. If feasible, for existing Regional Streets with constraints, the minimum full width for a fully paved sidewalk adjacent to the road is 2.5m.

14. If existing obstacles present hazards, they may be relocated or removed where economically and technically feasible. Barriers should not interrupt the shortest path of travel. New full width sidewalk boulevards should be planned to have signage and other utilities out of the clear path of pedestrian travel.

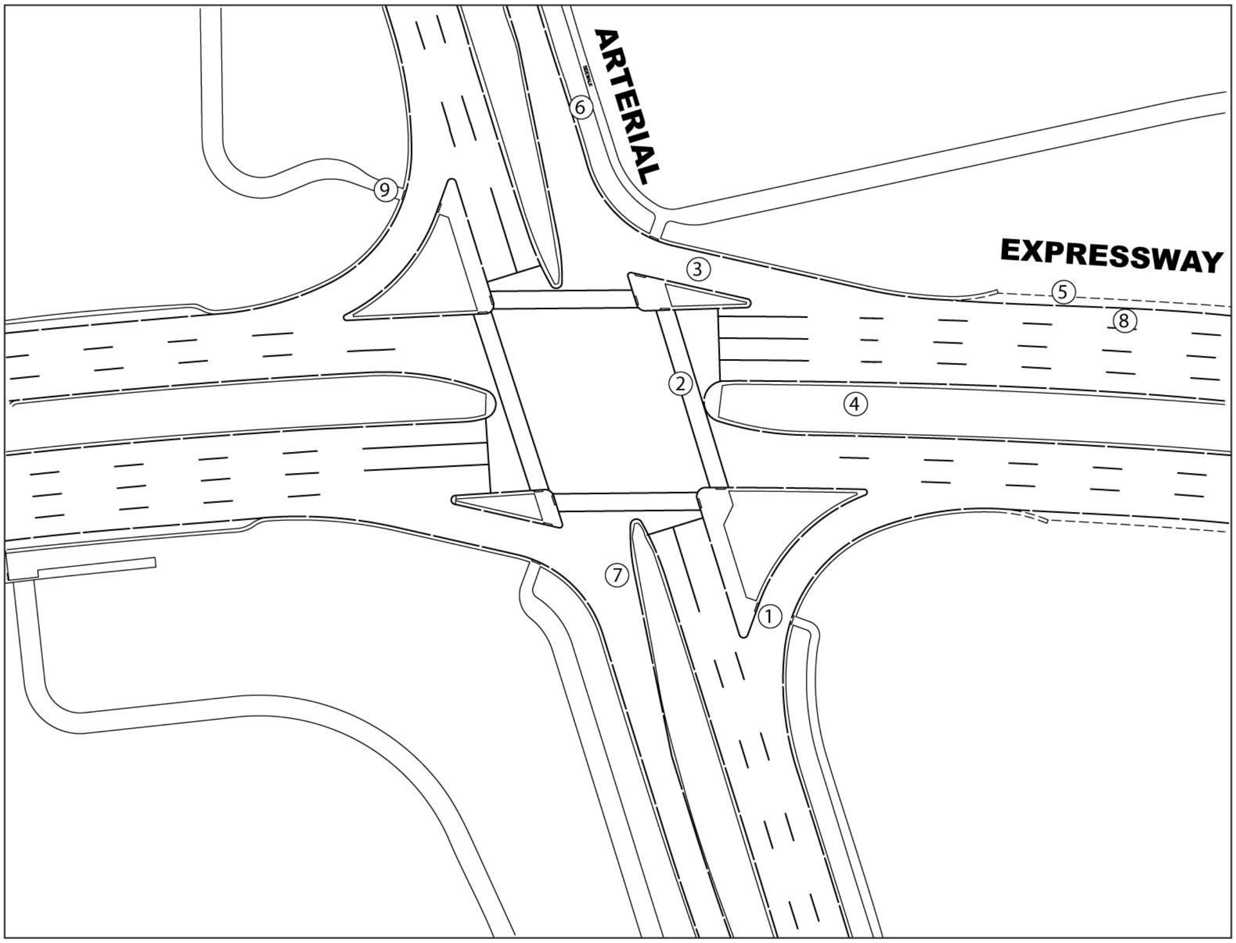
15. Community connectivity should be analysed to determine where the sidewalks lead to and how it connects to surrounding networks while considering the origin and destination of the pedestrians. Reserving property for walkways in developments for connecting local street pedestrians to arterial sidewalks can greatly reduce trip distances and aid in the shortest route to school as well as allow for more direct access to major intersections for transit connectivity. Generally the length of the pedestrian connection between private properties should influence the width of the right-of-way reserved. As the length increases, the width should as well to reduce a confining environment, to enable adequate sight lines, as well to conform to CPTED principles. Other influences include drainage design and space for landscaping. For a 50.0m length, which is approximately one single family dwelling lot length, 6.0m minimum right-of-way width opening is acceptable.

16. Plan for bus stop access by determining where and what side of the street they located on and how do pedestrians get to and from the stops, this is typically done by reviewing desire lines. New sidewalk connections to existing disconnected (parachute) bus stops should be included with street rehabilitation projects, as should the replacement of substandard bus stop platforms or bus stop platforms made up of precast concrete slabs, and the lengthening of 8.5 m bus stop platforms to 14.5 m for articulated buses (where applicable).

DRAFT

4.5 Intersections

Figure 4.10 demonstrates a well designed intersection that incorporates some of the following design guidance.



Number	Description
1	Proper application of an upstream pedestrian crossing
2	Clear pedestrian crossing with a properly placed bullnose
3	Proper application of a smart channel
4	Wide median for higher speed route and future widening
5	Proper shoulder widths for auxiliary lanes and curb terminations
6	Proper sidewalk set-back
7	Appropriately design geometry for the design vehicles
8	Auxiliary lanes provided on and off of high speeds routes designed to the appropriate length
9	Properly planned curb ramp widths for mixed use path crossings

Right Turn Geometry and Channelization

With the exception of smart channel designs, which typically require that the pedestrian crossings be downstream of the traffic, the pedestrian crossings are preferred to be in the pedestrians' line of travel, or established perpendicular to the midpoint of an island. Locating the pedestrian crossing should also consider the closest path and the route the pedestrian will travel once out of the intersection as well as whether a dedicated right turn lane prior to the island is present.

Figure 4.11 – Example of a smart channel

Additional discussion about the location of the curb ramps within the channelized lane are as follows:

Downstream End

Placing the pedestrian crossing at the downstream end allows additional time for the driver to perceive the pedestrian and would allow additional stopping distance. This location also places the sighting of the pedestrian by the driver at the end of the driver workload which has a negative impact on the driver's ability to yield if they have determined there is no conflicting traffic.

Placement at this location is the most accommodating to align the crossing in the pedestrians' line of travel.

Figure 4.12 – Provencher Boulevard right turn onto Tache Avenue demonstrates how the downstream crossing allows for good sight lines for the driver.

At the Midpoint

Placing the pedestrian crossing at the midpoint is the most common location for within the City and therefore it is widely understood and expected by both drivers and pedestrians. This location may allow for the shortest crossing distance and is simplest to accommodate accessible sidewalk grades. This locations also can allow space for a vehicle to store between the pedestrian crossing and the cross street.

Upstream End

Placing the pedestrian crossing at the upstream end allows for the driver's sighting of the pedestrian to be at the top of the driver workload. If there is a lot of street furniture and objects on the island in some cases the pedestrian may be made more visible by situating the pedestrian in front and ahead of the other objects. Where there is no dedicated right turn lane in advance of this crossing, the driver would have to stop in the through lane which may result in a rear end collision.

DRAFT

Figure 4.13 – McPhillips Street right turn onto Logan Avenue demonstrates the benefits of placing the pedestrian crossing upstream for visibility

Table 4.9 provides additional design information for right turn design.

Table 4.9 – Right Turn Geometry and Channelization

Right Turn Geometry	General Uses and Discussion	Guidance for Locating Pedestrian Crossing
Single Radius	Used in a variety of applications, generally not used on roads with a $D_s \geq 90$ km/h. The smaller the radius generally the more optimal the curb ramp design and placement. The right turn radii in residential areas must be able to accommodate buses (if the street is a bus routes), moving trucks utilizing the majority of the pavement and delivery trucks. If bike lanes are present, radii could be reduced or modified as the effective radius of the vehicle would be larger than the physical one.	Separate curb ramps for each crossing direction as per SD-229A.

Right Turn Geometry	General Uses and Discussion	Guidance for Locating Pedestrian Crossing
2-Centred Curve	Used on Truck Routes.	Separate curb ramps for each crossing direction as per SD-229A if there is no island present. If an island is present the preferred crossing is at the midpoint.
3-Centred Curve	Most commonly used treatment where right turn channelization is required. This method is used for approaching a merging condition. Allows for a vehicle to make a more natural right turn when no conflicts are present.	Typical crossing is at the midpoint for low speed standard sized islands.
Smart Channel	Good application to use when coming from a higher speed roadway to a lower speed roadway. When coming from a deceleration lane the geometry forces the vehicle to slow down thus reducing the stopping distance. The discontinuous geometry forces vehicles to operate at a lower speed than a typical compound curve. Can be used from lower speed roadway to lower speed roadway where channelization is warranted. Used if extended islands are required for bus stops located on the island. When used in high pedestrian movement areas, the vehicles are forced to slow down due to the geometry, the drivers have a clear view of the pedestrian in front of them at the downstream end. The design uses less property that a typical compound curves. The geometry is beneficial to reduce the amount drivers are required to turn their heads to see oncoming traffic for them to yield to, especially at skewed intersections. The benefit may be marginal where there are large truck volumes unless an apron is provided or for going onto a higher speed road with a merge condition. Good application is where the intersecting street has a bike lane, as the driver is better positioned to see the oncoming cyclists. Refer to SI-14 for smart channel design guidance. Existing examples within the City include Provencher	Typical crossing is near the downstream end.

DRAFT

	Boulevard and Tache Avenue, River Osborne Street and River Avenue, Templeton Avenue and Pipeline Road, and Gateway Road and Chief Peguis Trail.	

Dual Turning Movements at Major Tee Intersections

Dual turning movements at tee intersection must consider the following design variables:

- Percentage of traffic volume and types of trucks
- Widths of the medians for both the intersecting streets; the departure median widths are generally large
- Templates should be used to determine vehicle off tracking
- Amount of lanes for both the intersection streets
- Presence of shoulder or curbs
- Due to the single perpendicular leg not having an opposing leg, the ability to widen the departure leg to the outside is not an option as there is no island present.

The following design values are provided which are generally used;

- Signal controlled dual right turns generally have outside compounded radii of 125-62.5-125 with a 10.0m wide pavement.
- The dual left turns from the single perpendicular leg will generally have inside compounded radii of 35-50.

DRAFT

Table 4.10 – Minimum Edge of Pavement Radius for Right Turns at Intersections

	Public Lane (Residential)	Public Lane (Industrial/ Commercial)	Residential Local	Residential Collector	Industrial Local	Industrial Collector	Minor Arterial	Major Arterial	Expressway
Public Lane (Residential)	4.5								
Public Lane (Industrial/ Commercial)	4.5	6.0							
Residential Local	4.5	6.0	7.5						
Residential Collector	4.5	6.0	9.0	12.0					
Industrial Local	N/R	6.0	N/R	15-36	15-36				
Industrial Collector	N/R	6.0	N/R (7.5 or 9.0)	12.0	15-36	50-25-50			
Minor Arterial	N/R	N/R	N/R (7.5 or 9.0)	12.0	15-36	50-25-50	50-25-50		
Major Arterial	N/R	N/R	N/R	12.0	15-36	50-25-50	50-25-50	50-25-50	
Expressway	N/P	N/P	N/P	N/R	N/R	50-25-50	50-25-50	70-35-100	70-35-100

Notes:

1. Values are in metres.
2. Values given are for 90° intersections. Effects of skew must be taken into consideration for other angle of intersections.
3. N/R = Not recommended. The values are given for existing situations only.
4. N/P = Not permitted.
5. Bracketed values are for MJRH projects
6. Rural Local and Collector are treated the same as Urban design for this Table.
7. 15-36 represents a two-centred curve as shown on Drawing SI-5 of this Section.
8. 50-25-50 represents a three-centred curve with an island as shown on Drawing SI-9 of this Section.
9. 70-35-100 represents a three-centred curve with an island as shown on Drawing SI-9 of this Section.
10. Other values for three point curves will be required for project specific reasons such as a dual right turn signal controlled movements or intersection skews.
11. Differentiation between yield and merge conditions as well as smart channel geometry is not included.

DRAFT

Island Design

Islands offer a place to house bus stops, signals lights, provide traffic delineation as well as reduce pedestrian crossing distances. Islands also present additional work load for drivers and pedestrians. There is a multitude of island geometry scenarios and the ultimate design should be based on safe operation by all modes of transportation.

Islands must be appropriately sized so they have room to house traffic signals if present, and to allow for appropriate spacing from the pedestrian push button to the position of the pedestrian. They must also be adequately sized to accommodate the appropriate accessible design grades. Islands that are small can be cumbersome for wheelchair users, impact snow clearing operations and may not provide sufficient room for pedestrian refuge. Existing small islands should be evaluated during rehabilitation projects to determine if the undersized island should be removed and the right turn geometry modified.

Island offset are quantified in Table 4.11 – Island Offsets. Offset selection is important to ensure adequate shy distance is provided, reduces the potential for snow clearing impact damage, and to reduce interruption to cyclists.

Table 4.11 – Island Offsets

	Near Side (m)		Far Side (m)	
Design Speed	**First Offset**	**Second Offset[1]**	**First Offset**	**Second Offset**
$D_s \leq 70$ km/h	1.0	0.5	0.5	0.5
$D_s = 80\text{-}90$ km/h	1.5	1.0	1.0	1.0
$D_s = 90$ km/h[3]	2.5	2.0	2.0	2.0

Note 1: If the tangent section length of the island is great, the second offset could occur at a selected point between the bullnose and the curb ramp and the remaining length of the tangent may remain at that consistent offset.

Note 2: May be increased for rural roads or for roads on the AT network to not interrupt the cyclist riding on the shoulder. May also match the shoulder width in special cases but generally is not done where pedestrian crossings are present.

Note 3: Optional for project specific warrants.

Introducing and Terminating Raised Medians and Curbs at Rural Intersections

On roads with rural cross sections, curbed medians and gutters are introduced in some applications at intersections for the following reasons:

- provides delineation for auxiliary lanes
- aids in speed adaptation
- facilitates curb ramps
- reduces the pedestrian crossing distance
- provides a bullnose to aid in stop line compliance and signal light placement
- restricts vehicles from crossing the median in an illegal manner
- facilitates roadway drainage
- provides snow clearing guidance
- allows for additional room to improve ditch slopes if required

Introducing a curb on a rural cross section has some issues that need to be considered in the design such as:

- improper placement and curb selection can cause a wandering vehicle to roll over
- can provide additional workload for snow clearing
- should not interrupt a cyclists travel path using the shoulder
- the road may require vertical drainage

There are different alternatives permissible within the City to introduce either curbs or raised medians which are demonstrated with more detail in drawings SI-12 and SI-13. These alternatives should be selected based on site specific design requirements. Curbs can also be introduced at the start of the auxiliary lane transition or within the auxiliary lane itself, for example left turns lane from Lagimodiere Boulevard onto Grassie Boulevard. The negative impact to this is if the storage length was assumed too low, or traffic growth is higher than anticipated, the queued vehicles will encroach onto the main line shoulders causing accelerated deterioration. For new facilities, longer than minimum curb lengths presented in the standard drawings should be considered for aesthetic or other reasons.

The alternatives provided in this document are restricted to design speeds of 90 km/h or lower. For road with design speeds greater than 90 km/h TAC GDG should be followed.

<u>Method 1 – Introduce with a Shy Distance</u>

The curb can be introduced with a shy distance offset from the lane. This is the most commonly used method.

<u>For Example:</u> McPhillips Street and Murray Avenue
Kenaston Boulevard and Scurfield Boulevard
Waverley and Lee Boulevard

Figure 4.14 – Merging onto Lagimodiere Boulevard from Warde Avenue demonstrates proper curb termination that encourages driver comfort to merge

Method 2 – Introduce at the Back of Shoulder

The curb can be introduced at the back of shoulder for the through lane. The standard shoulder width for an auxiliary lane is 1.5m; the curb can be introduced on the outside of the shoulder near the intersection. This method will also maintain a consistent median shoulder width through the intersection if the rural cross section needs to be continued passed the intersection. If islands are present these should remain at the standard offsets so that vehicles do not confuse the shy distance as a third lane. This method is used for major routes entering the City limits as curb is first introduced to facilitate speed adaptation.

For Example: Lagimodiere Boulevard and Headmaster Row

The termination of the curb at the upstream end should have a return radius of 25.0m and taper down to zero height. The end of the curb return should be reviewed to determine whether concentrated runoff will occur and if rip rap is required to mitigate erosion. The length of the introduction of curb should be a minimum of 7.0m and a maximum of 25.0m and be specific to the project requirements.

DRAFT

Method 3 – Introduce within the Auxiliary Lane

The curb can be introduced within the auxiliary lane. This method is typically used for long lanes to reduce costs as well may be used during rehabilitation projects to retrofit in a curb.

Curb Extensions

The use of curb extensions, or also commonly described as a bump-out, has many advantages such as defining parking lanes, calming traffic, adding landscaping, facilitating 'road diets', and reducing the pedestrian crossing distance. Collector streets are the most common street type for using bump outs. The design guidance for a bump-out is as follows:

- Bump-outs shall have at least a 7.0m tangent section parallel to the through lane to provide sight guidance for the driver.
- The minimum radius is 6.0m to facilitate street cleaning.
- Bump outs should have the appropriate shy distance from the through vehicular lane.

Figure 4.15 – Bump-outs on Portage Avenue allow for more landscaping and reduce the pedestrian crossing distances

4.6 Subdivision Street Network Design

The design of a subdivision street network shall utilize the City of Winnipeg Street Classification System to determine that all streets in the network are appropriately classed based on volume, speed and access and that all streets are connected in the appropriate hierarchal order. The design shall also integrate the planning of access to the public transportation system. Additional design information is as follows:

- Local street systems should be designed to minimize through vehicle traffic movements by creating discontinuities in the local street system and by channelizing or controlling median crossings along peripheral arterial routes.
- The local street system should be designed for a relatively low uniform volume of traffic.
- Local streets should be designed to discourage excessive speeds, through the use of curvilinear alignments and discontinuities in the street system.
- Residential single family private approaches are not permitted to connect directly to a Collector Road. These private approaches may only connect to a frontage road or a public lane.
- Pedestrian-vehicle conflict points should be minimized. This can be achieved through the well-coordinated layout of the street system and land uses to establish safe and direct pedestrian routes that align with intersections of the street system.
- Intersections on curves are undesirable and should be eliminated wherever possible.
- Offset residential local streets intersecting along a collector are acceptable if the offset is 45m or greater between centrelines. Offset residential collector streets are acceptable along a collector if the offset is 75m or greater between centerlines.
- Intersection angles of less than 75° are unacceptable.
- The maximum acceptable pavement length of cul-de-sac streets is 105 metres, measured from the property line of the intersecting right-of-way to the top of the cul-de-sac bulb.
- The maximum acceptable length of a back lane is 300 metres between access points.
- The distance from a frontage road to an intersection or a roundabout are to be designed to accommodate garbage and fire truck movements.
- All streets which are to become part of a transit route in new residential developments shall be constructed to residential collector street standards, as a minimum.
- Walkways should be provided to facilitate pedestrian movement to and from proposed transit routes, commercial areas, institutional areas, parks, etc.

- When planning neighborhoods for transit connectivity, no dwellings should be greater than 350m from the nearest collector or arterial roadway, it order to minimize the walking distance to transit service.
- Direct access to arterial streets from private holdings should be restricted to those holdings which contain or are zoned to permit development expected to generate significant volumes of traffic (i.e. shopping centers, major sports facilities, etc.)
- Sidewalks are to be provided on both sides of streets classified as arterials or collectors.
- In the selection of school sites, consideration must be given to the proximity of the site to existing pathway networks, and sidewalks and the connectivity of those walking networks to accommodate shorter walking times to school.
- Sidewalks are to be provided on one or both sides of streets classified as Local if any one of the following warrants is met:

    1. Land uses adjacent to the street are expected to generate high pedestrian and vehicular volumes (eg. schools, commercial areas, multiple family dwellings, recreational areas, etc.)
    2. There is a higher potential for collisions or other safety problem(s) related to pedestrians.
    3. There is a need for sidewalk(s) to provide sidewalk continuity, routes to schools, commercial areas, transit routes, etc.
    4. The first segment of a local street between another local street and the collector will have a sidewalk on the flankage side of the street. These short road segments generally have higher peak volumes for all modes of transportation. (See Figure 4.16)
    5. The street is part of the ATN.

DRAFT

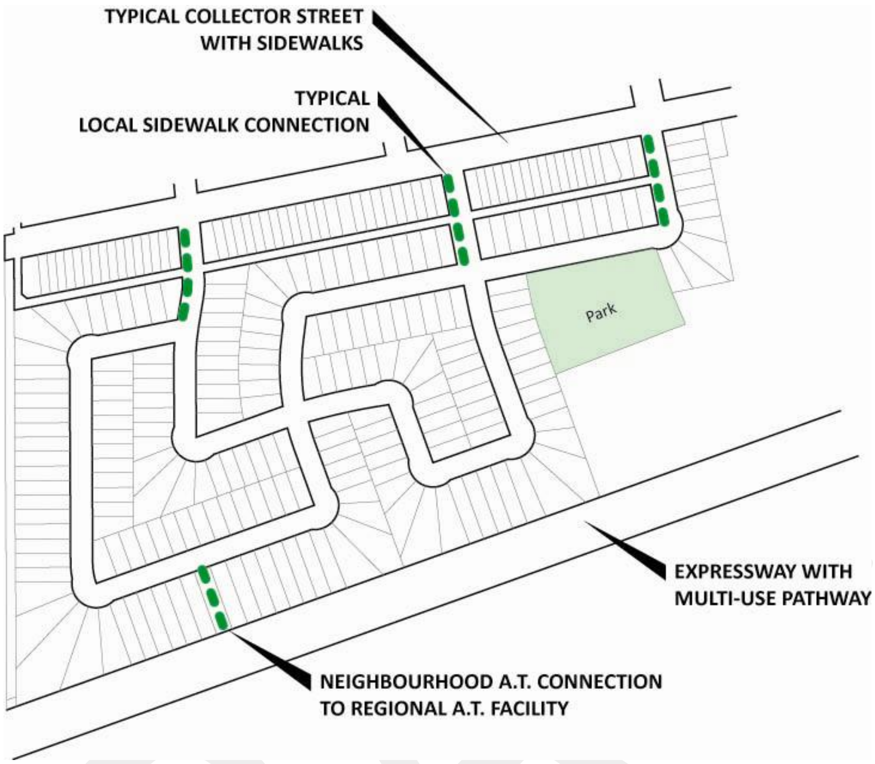


Figure 4.16 – A neighbourhood street network that benefits from adding various sidewalk links on local streets

6. Street segments longer that 375m. Long straight streets can enable higher running speeds and higher volumes for that segment. (See Figure 4.17)

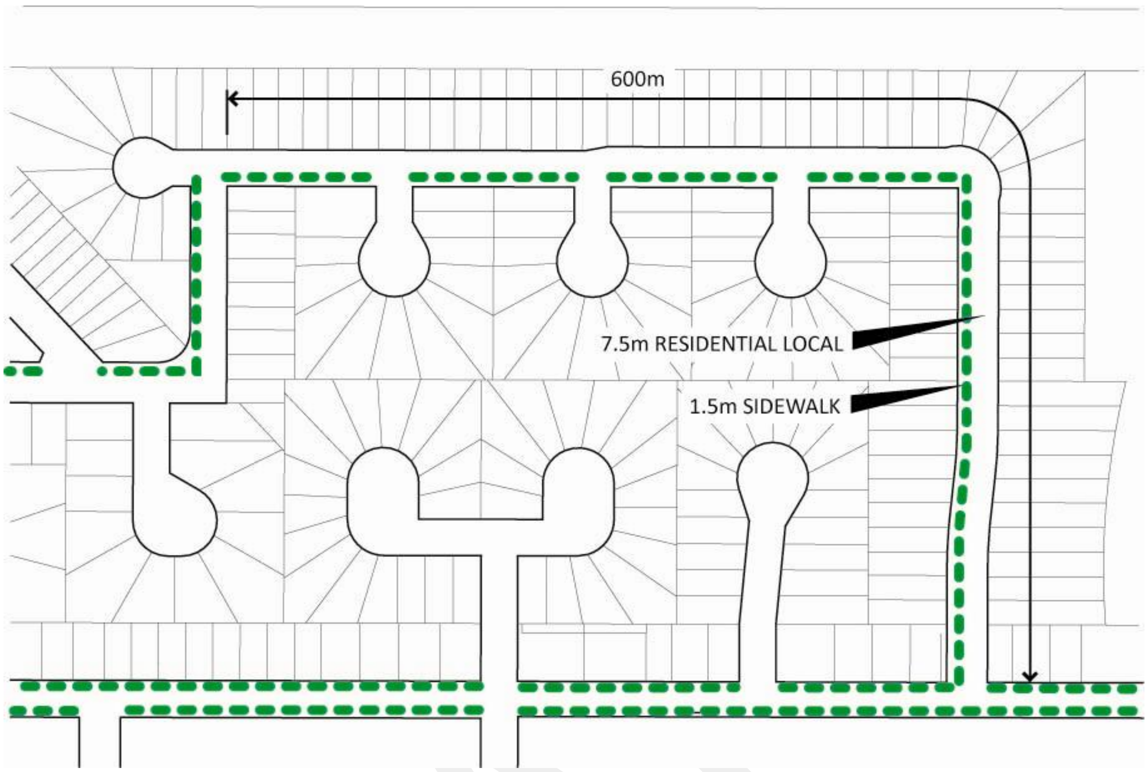


Figure 4.17 – A neighbourhood street network that benefits from adding a sidewalk due to the long travel distances.

DRAFT

DRAFT

This page is intentionally left blank.

Section 4A – Standard Drawings for Intersections and Turnarounds

The safety and efficiency of any street network depends to a great extent upon the design of the intersections and turnarounds. The Public Works Department of the City of Winnipeg has developed illustrations of recommended geometry for various intersections and turnarounds, which may be included in the design of a typical street network.

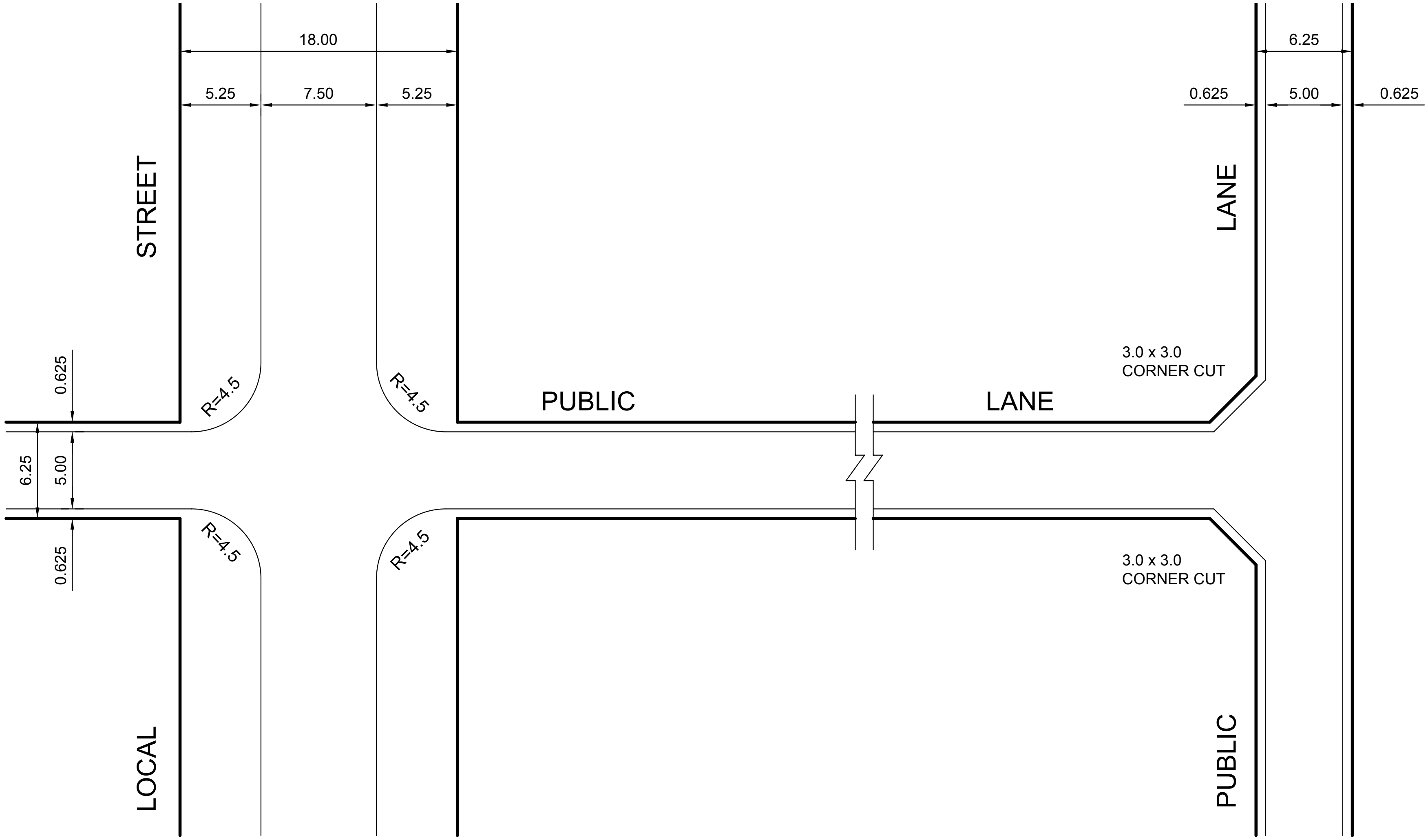
Table 4A -1 – Standard Intersections and Turnarounds

Number	Title
SI - 1	Typical Local Street – Public Lane Intersection (Residential)
SI - 2	Typical Local Street Intersection (Residential)
SI - 3	Typical Local Street – Collector Street Intersection (Residential)
SI - 4	Typical Collector Street Intersection (Residential)
SI - 5	Typical Local Street Intersection (Industrial)
SI - 6	Typical Collector Street (Residential) – Minor Arterial Street Intersection
SI - 8	Collector Street (Residential) – Major Arterial Street Intersection Example
SI - 9	Right Turn Design – Yield Condition
SI - 10	Right Turn Design – Merge Condition
SI - 11	Right Turn Design – Yield Condition (with bus bay)
SI - 12	Introducing Raised Medians at Intersections
SI - 13	Curb Terminations for Rural Auxiliary Lanes
SI - 14	Typical Smart Channel Design
SI - 15	Typical Roundabout Details
SI - 16	Typical B-Nose Median Design
ST - 88	Typical Lane Turnarounds
ST - 89	Residential Bay/Crescent Pavement Geometrics
ST - 90A	Typical Local Street Offset Cul-de-Sac

DRAFT

ST - 90 - RR2	Typical Residential Rural Cul-de-Sac for Two Acre Lots
ST - 90A - RR2	Typical Residential Rural Offset Cul-de-Sac for Two Acre Lots
ST - 91	Typical Industrial Local Street Cul-de-Sac
ST - 91A	Typical Industrial Local Street Offset Cul-de-Sac
ST -98	Median Crossings for Emergency Vehicles
ST - 99 - A	Typical Frontage Road (9.0 m) Alongside of a Residential Collector Street
SB - 1	Bus Bays for Arterial Roads
SB - 2	Typical Collector Street Bus Stop
SB - 3	Typical Bus Stop Adjacent to a Residential Frontage Road

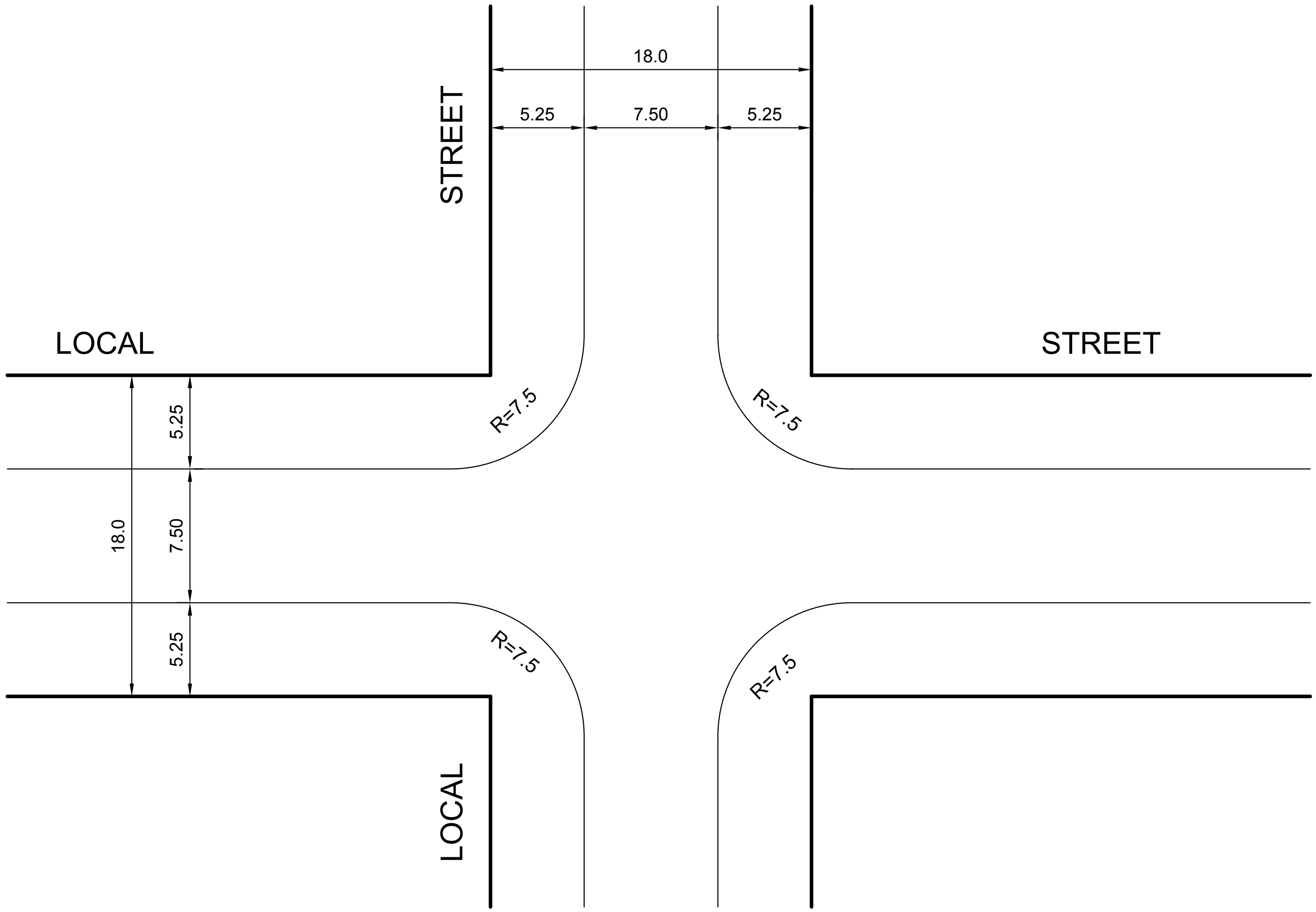
DRAFT



NOTES:

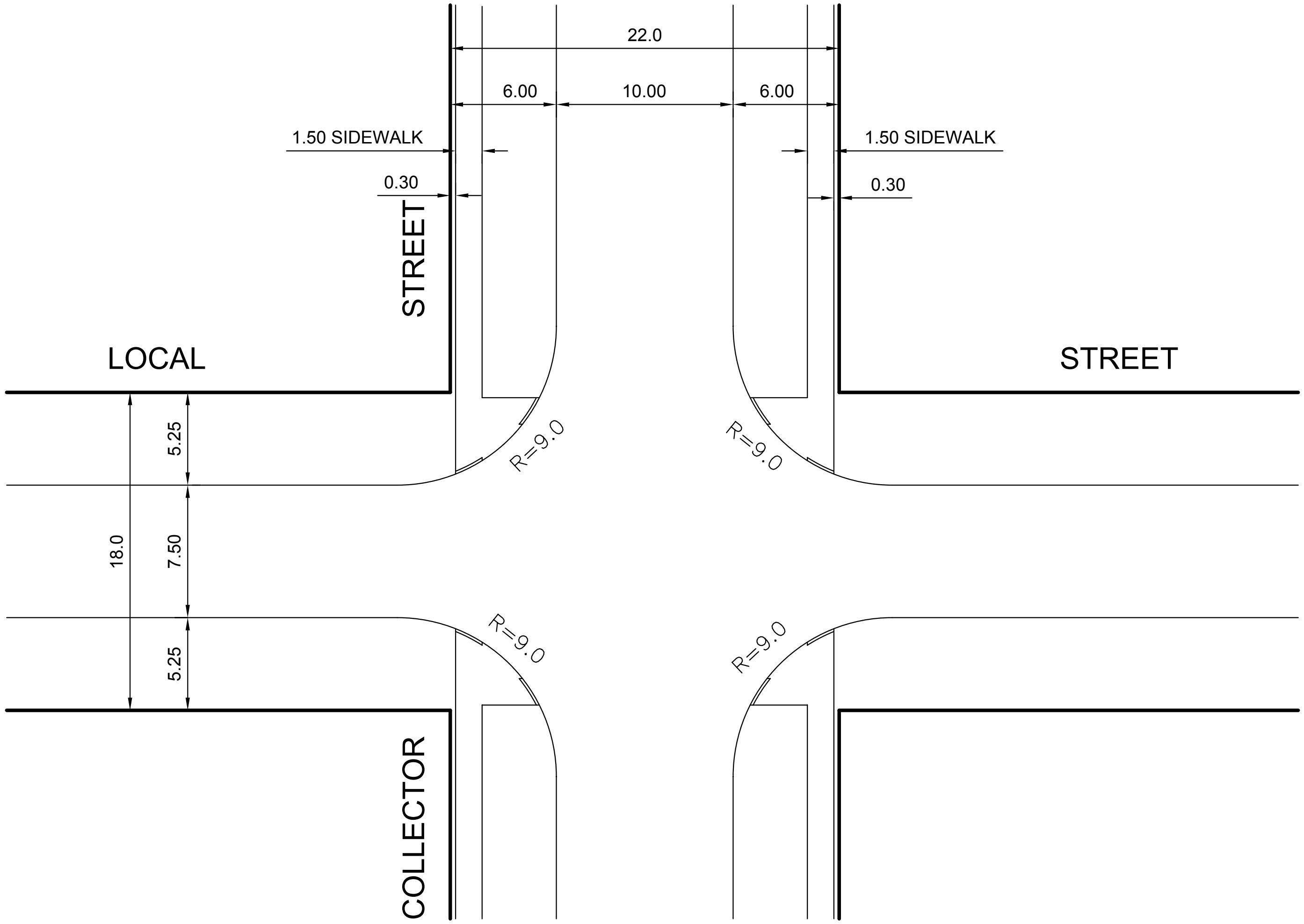
1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB (EDGE OF PAVEMENT IN PUBLIC LANE).

Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	TYPICAL LOCAL STREET - PUBLIC LANE INTERSECTION (RESIDENTIAL)	
DRAWN BY: GW DATE: 2012-06-18 — SCALE: 1:400	APPROVED BY: DATE	DRAWING NO. SI-1



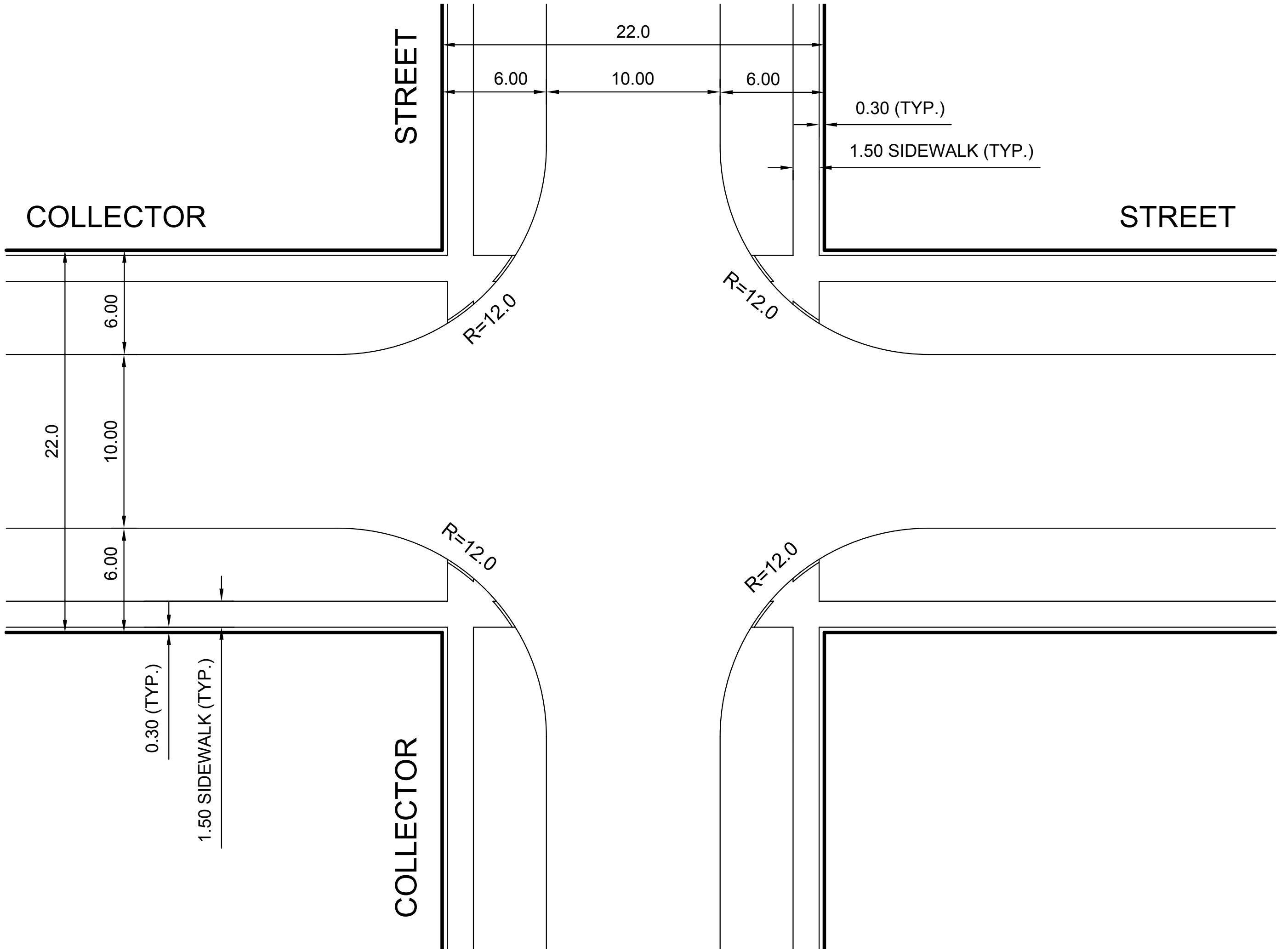
NOTES:
1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB (EDGE OF PAVEMENT IN PUBLIC LANE).

Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	TYPICAL LOCAL STREET INTERSECTION (RESIDENTIAL)	
DRAWN BY: GW DATE: 2012-06-18 — SCALE: 1:400	APPROVED BY: DATE	DRAWING NO. SI-2



NOTES:
1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB (EDGE OF PAVEMENT IN PUBLIC LANE).

Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION		TYPICAL LOCAL STREET - COLLECTOR STREET INTERSECTION (RESIDENTIAL)	
DRAWN BY: GW DATE: 2012-06-18	SCALE: 1:400	APPROVED BY: DATE	DRAWING NO. SI-3

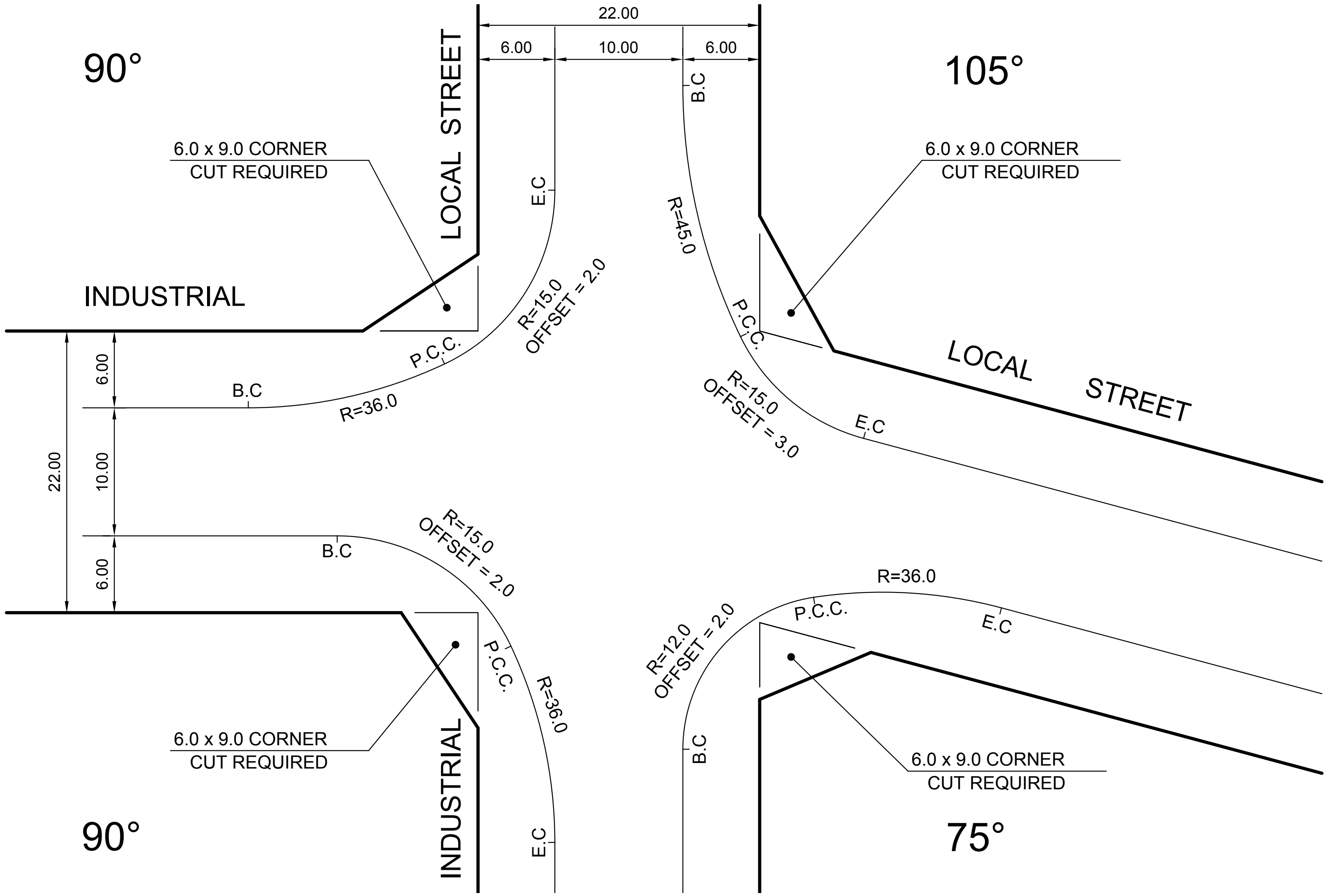


NOTES:
1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB (EDGE OF PAVEMENT IN PUBLIC LANE).

Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

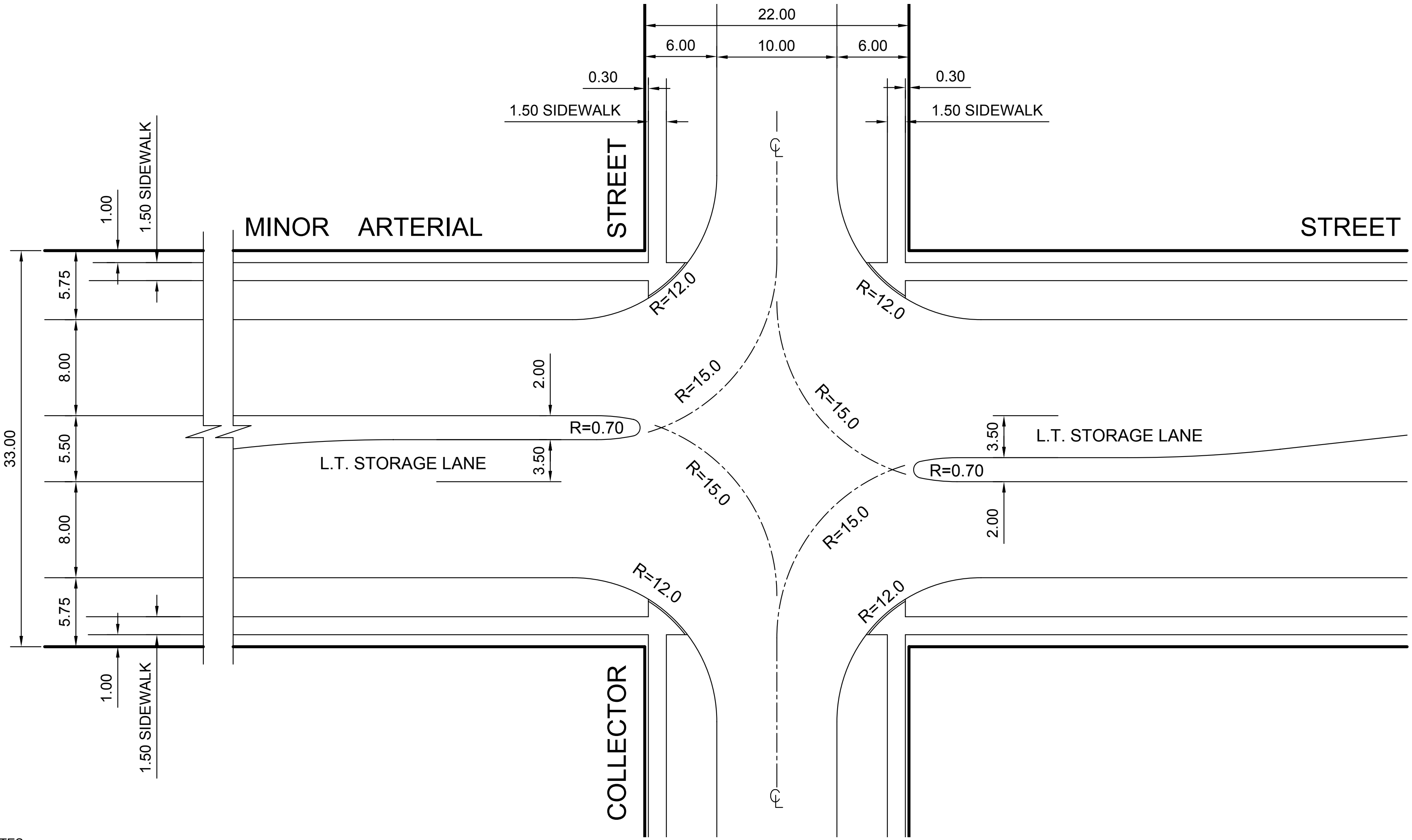
TYPICAL COLLECTOR STREET INTERSECTION (RESIDENTIAL)

DRAWN BY: GW
DATE: 2012-06-18
SCALE: 1:400
APPROVED BY:
DATE
DRAWING NO. SI-4



NOTES:
1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB (EDGE OF PAVEMENT IN PUBLIC LANE).
2. OTHER ANGLES ARE POSSIBLE; 5.5m MINIMUM BOULEVARD TO BE MAINTAINED ON CORNERS.

Winnipeg — THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION		TYPICAL INDUSTRIAL LOCAL STREET INTERSECTION (INDUSTRIAL)	
DRAWN BY: GW DATE: 2012–06–18	SCALE: 1:500	APPROVED BY: DATE	DRAWING NO. SI-5

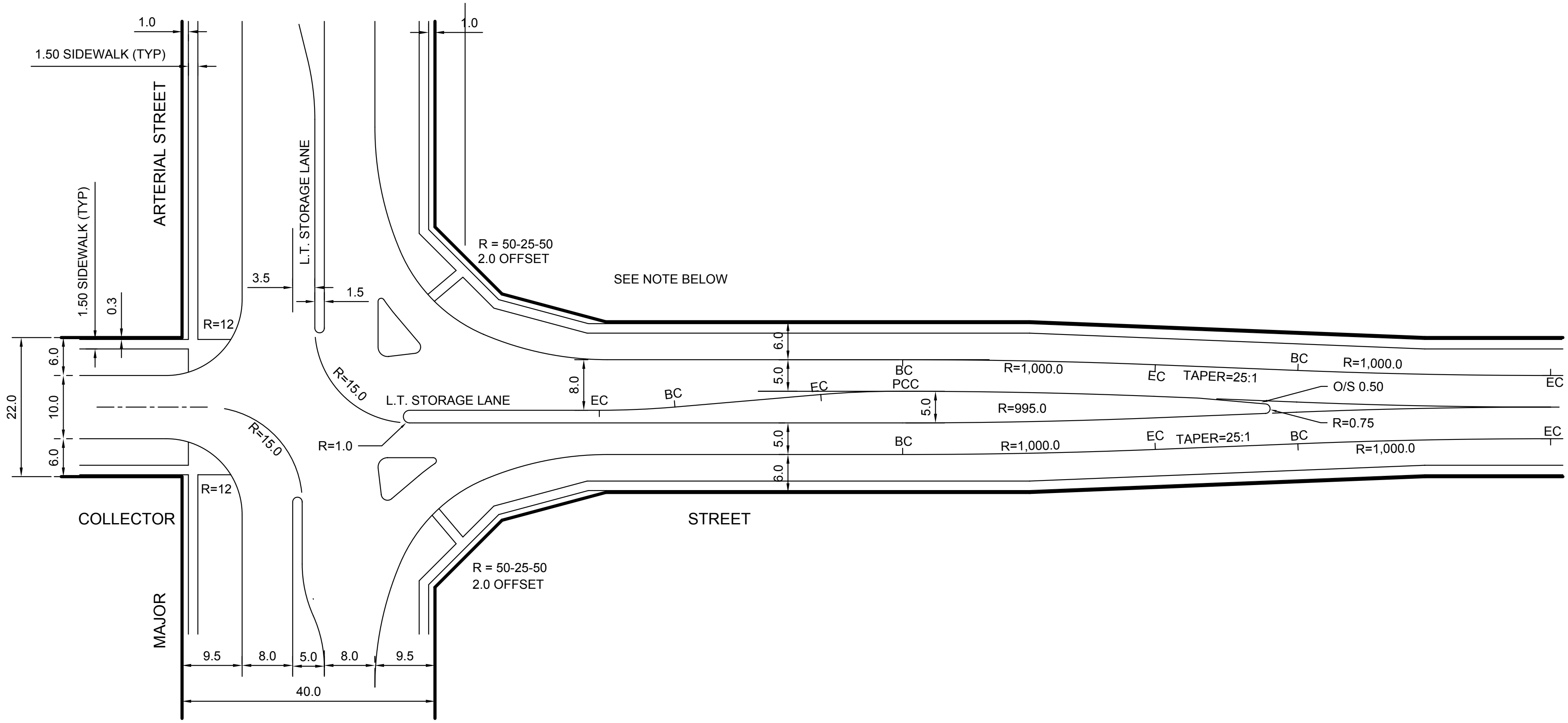


NOTES:
1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB (EDGE OF PAVEMENT IN PUBLIC LANE).

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

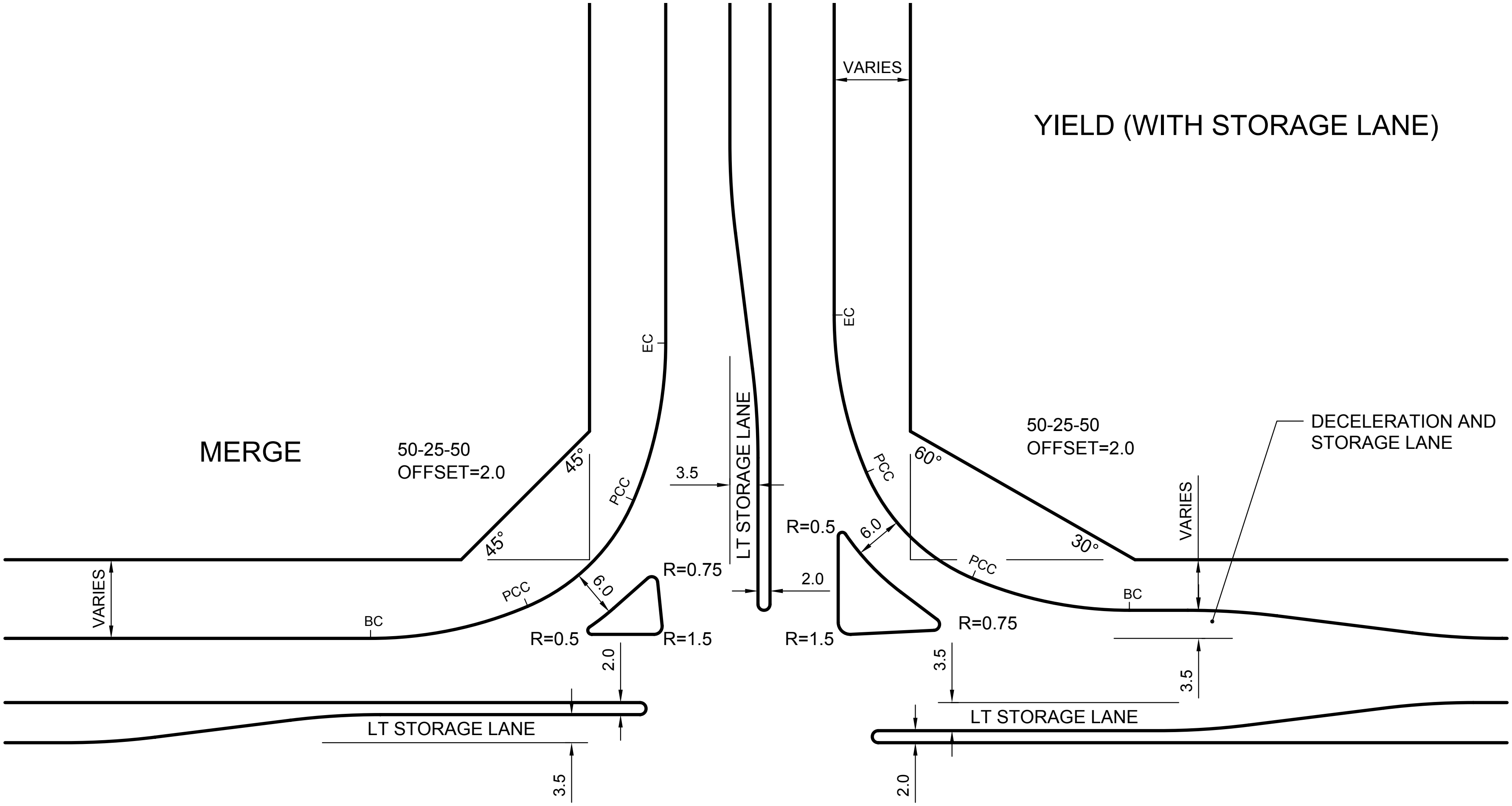
TYPICAL COLLECTOR STREET (RESIDENTIAL) MINOR ARTERIAL STREET INTERSECTION

DRAWN BY: GW DATE: 2012–06–18	SCALE: 1:500	APPROVED BY: DATE	DRAWING NO. SI-6



NOTES:
1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB (EDGE OF PAVEMENT IN BACK LANE).
2. REFER TO 4.2 HORIZONTAL ALIGNMENT FOR ADDITIONAL INFORMATION & COMMENTARY

Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	EXAMPLE OF COLLECTOR STREET (RESIDENTIAL) MAJOR ARTERIAL STREET INTERSECTION	STANDARD LOCATIONS FOR UTILITY STRUCTURES
DRAWN BY: GW DATE: 2012–06–18 / SCALE: 1:800	APPROVED BY: DATE	DRAWING NO. SI-8

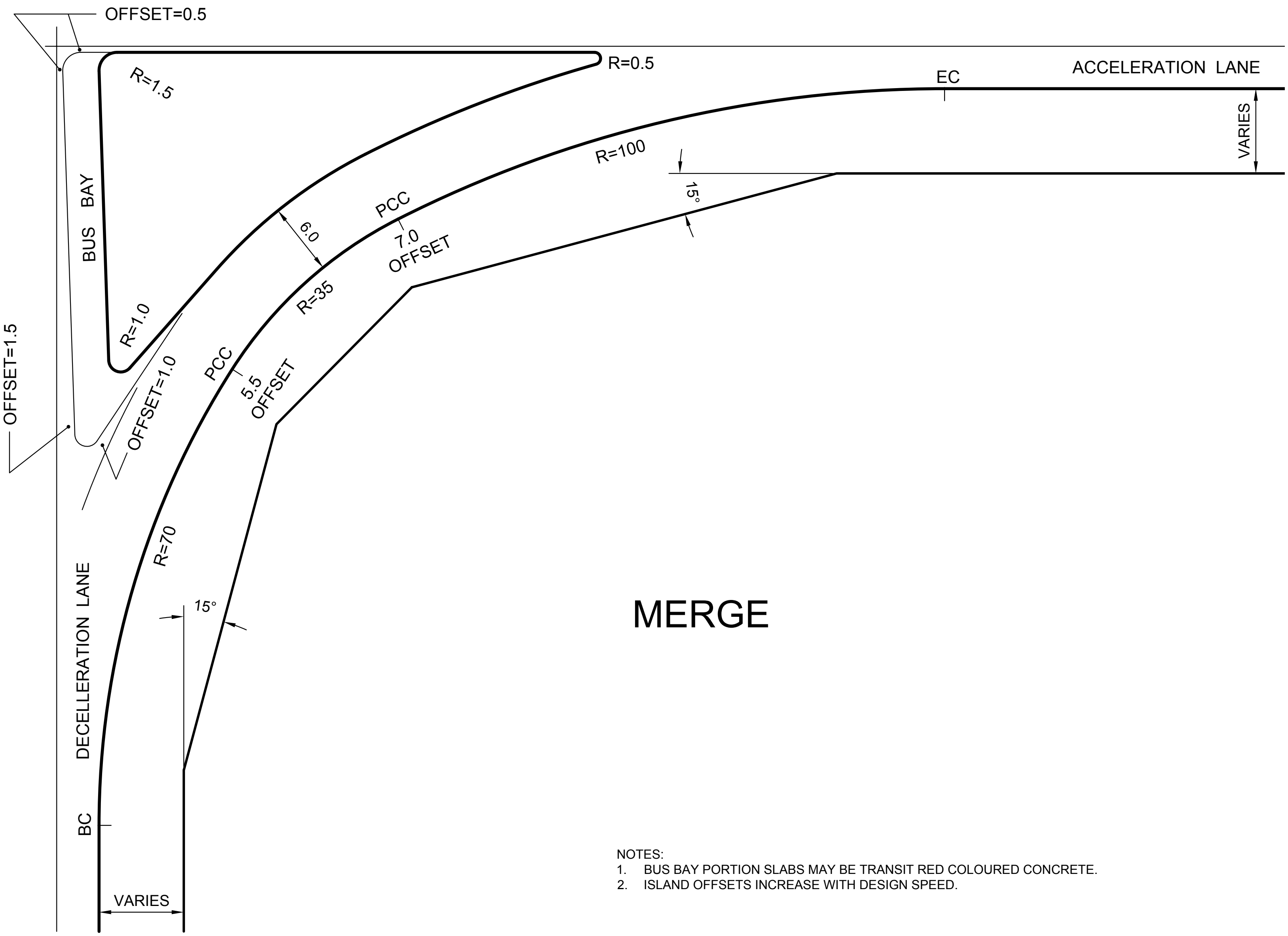


NOTES:
1. ISLAND OFFSETS AND RIGHT TURN ENTRY TAPERS NOT DIMENSIONED.

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

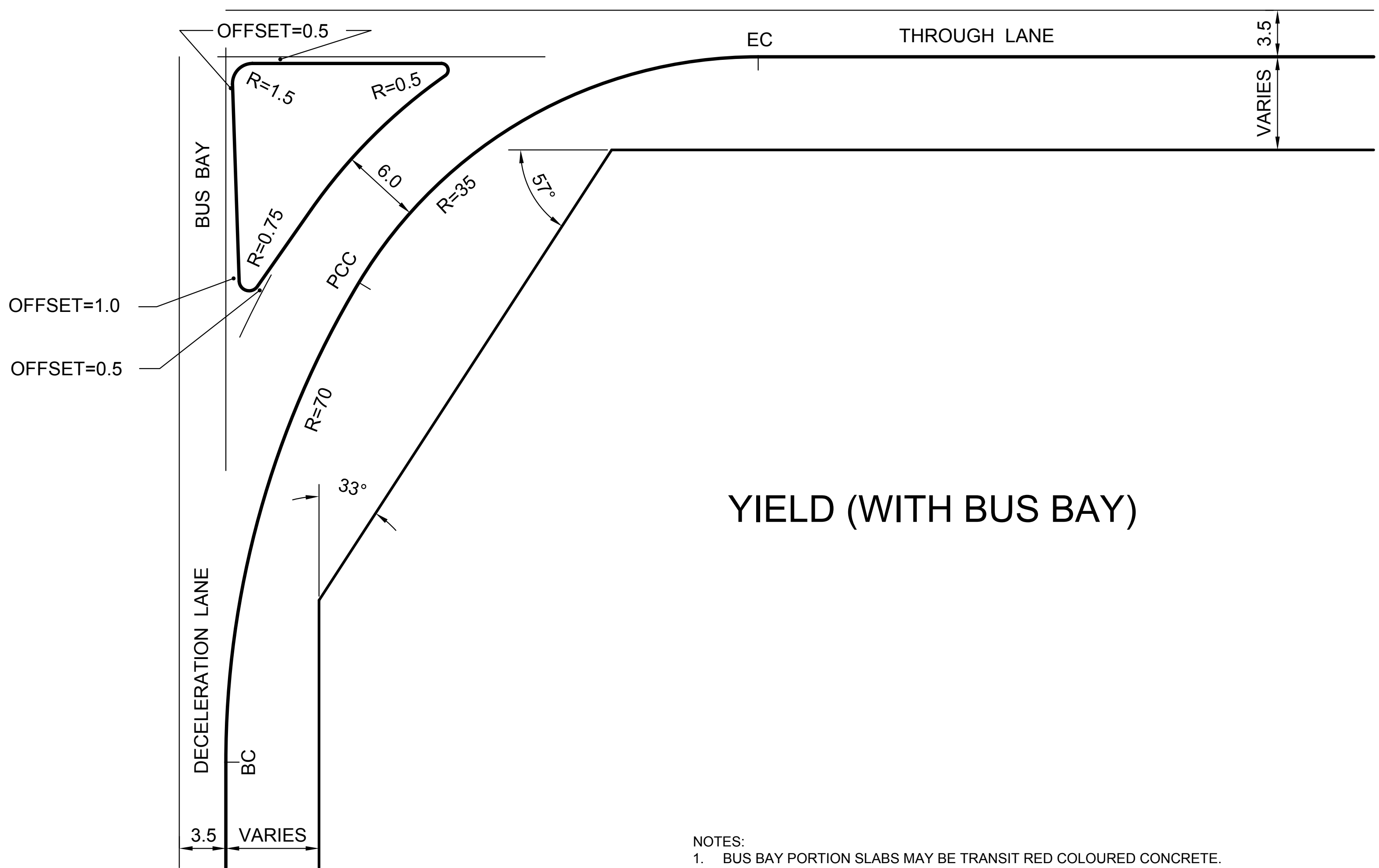
RIGHT TURN DESIGN
YIELD CONDITION

DRAWN BY: AP DATE: 2012-08-16	SCALE: 1:500	APPROVED BY: DATE	DRAWING NO. SI-9



NOTES:
1. BUS BAY PORTION SLABS MAY BE TRANSIT RED COLOURED CONCRETE.
2. ISLAND OFFSETS INCREASE WITH DESIGN SPEED.

Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION		RIGHT TURN DESIGN MERGE CONDITION	
DRAWN BY: AP DATE: 2012-08-16	SCALE: 1:500	APPROVED BY: DATE	DRAWING NO. SI-10



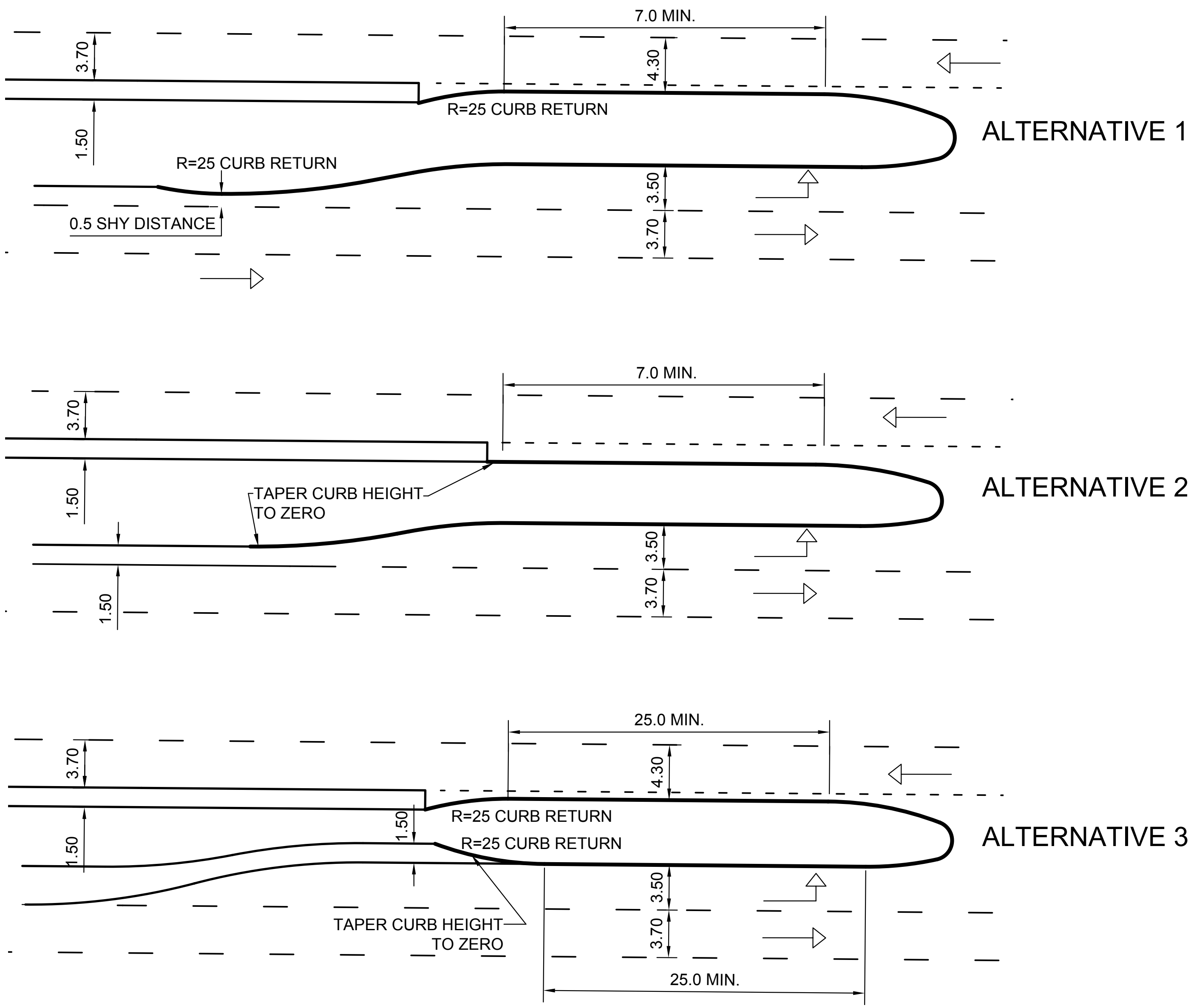
YIELD (WITH BUS BAY)

NOTES:
1. BUS BAY PORTION SLABS MAY BE TRANSIT RED COLOURED CONCRETE.
2. ISLAND OFFSETS INCREASE WITH DESIGN SPEED.

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

RIGHT TURN DESIGN
YIELD CONDITION
(WITH BUS BAY)

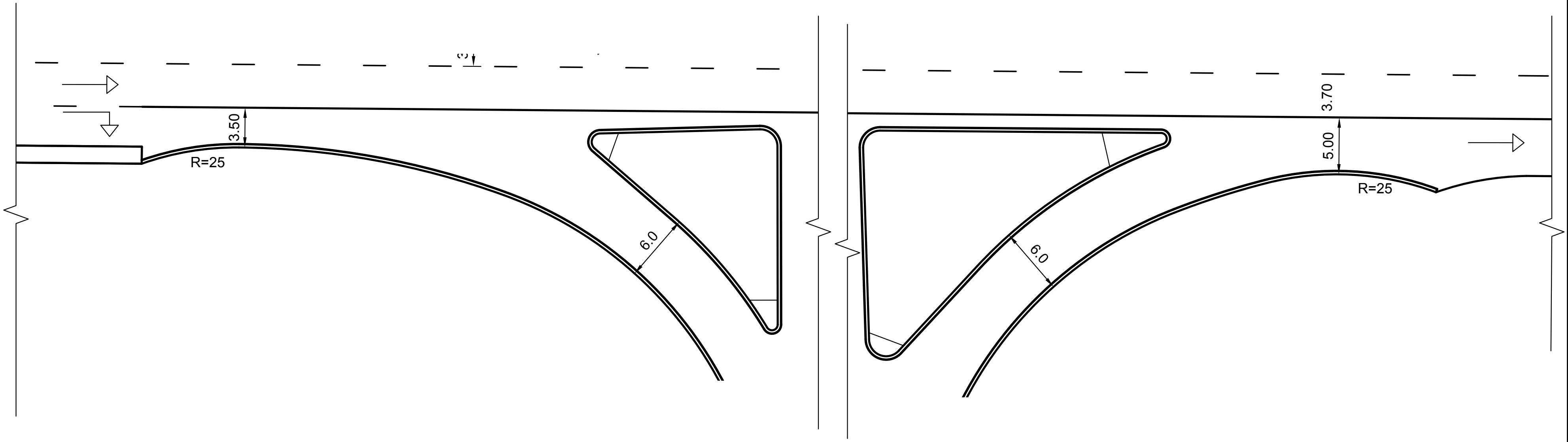
DRAWN BY: AP
DATE: 2012-08-16
SCALE: 1:500
APPROVED BY:
DATE
DRAWING NO. SI-11

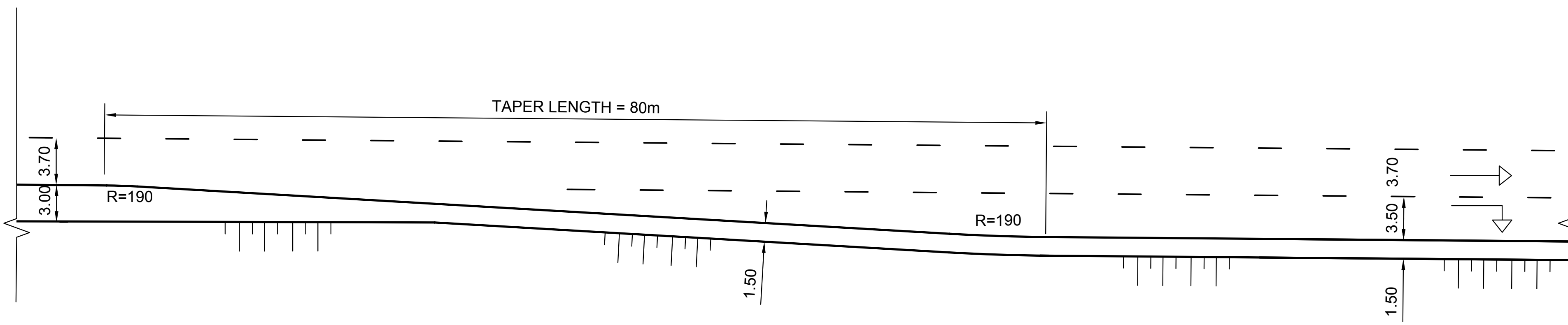


DRAFT

NOTES:
1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB OR EDGE OF PAVEMENT.

Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	INTRODUCING RAISED MEDIANS AT INTERSECTIONS	
DRAWN BY: AP DATE: 2012-06-18 / SCALE: N.T.S.	APPROVED BY: DATE	DRAWING NO. SI-12





NOTES:
1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB (EDGE OF PAVEMENT IN PUBLIC LANE).
2. EXAMPLE IS FOR AN EXPRESSWAY WITH A 90km/h DESIGN SPEED.
3. LENGTH OF AUXILIARY LANES TO BE WITHIN TAC DESIGN DOMAIN.

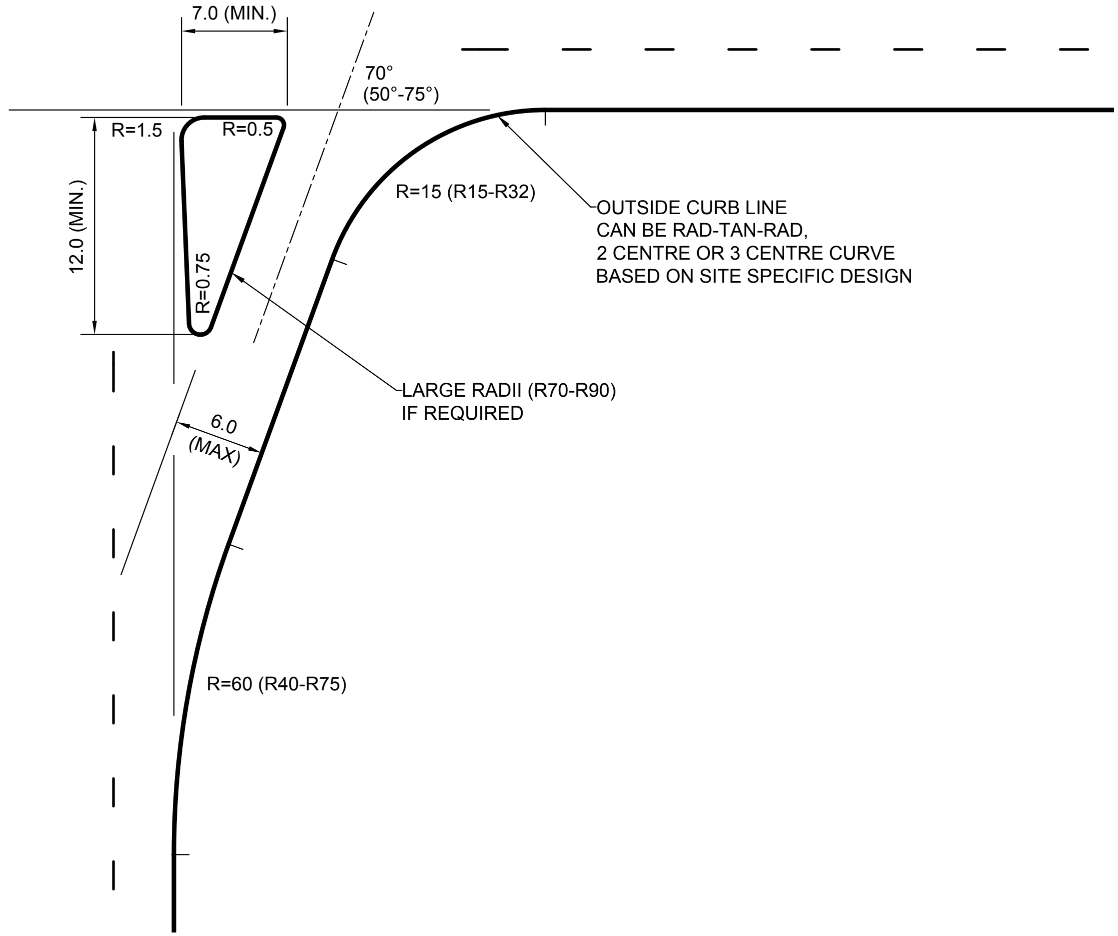
DRAFT

Winnipeg

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

CURB TERMINATIONS FOR RURAL AUXILIARY LANES

DRAWN BY: AP DATE: 2012-06-18	SCALE: N.T.S.	APPROVED BY: DATE	DRAWING NO. SI-13



NOTES:
1. RANGES OF VALUES ARE GIVEN FOR GUIDANCE BASED ON VARYING INTERSECTION SKEWS AND RECEIVING ROADWAY WIDTHS.
2. DESIGN MUST ACCOMODATE BUSES TO ENTER CURB LANE IF REQUIRED.
3. DESIGN MUST ACCOMODATE APPROPRIATE DESIGN VEHICLES.

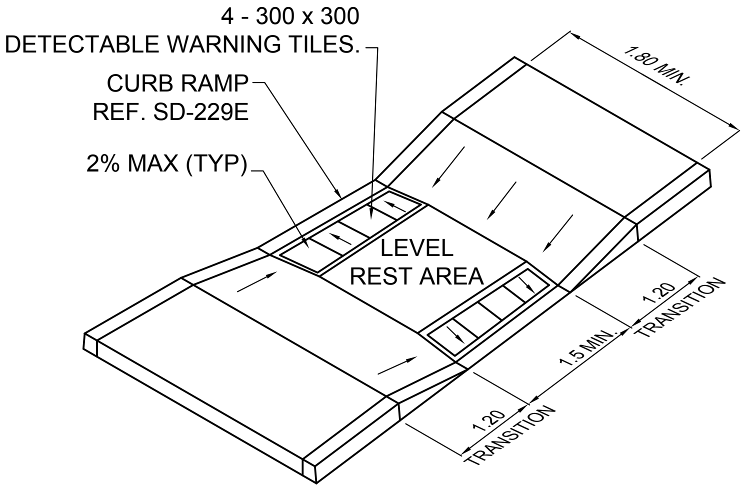
DRAFT

Winnipeg

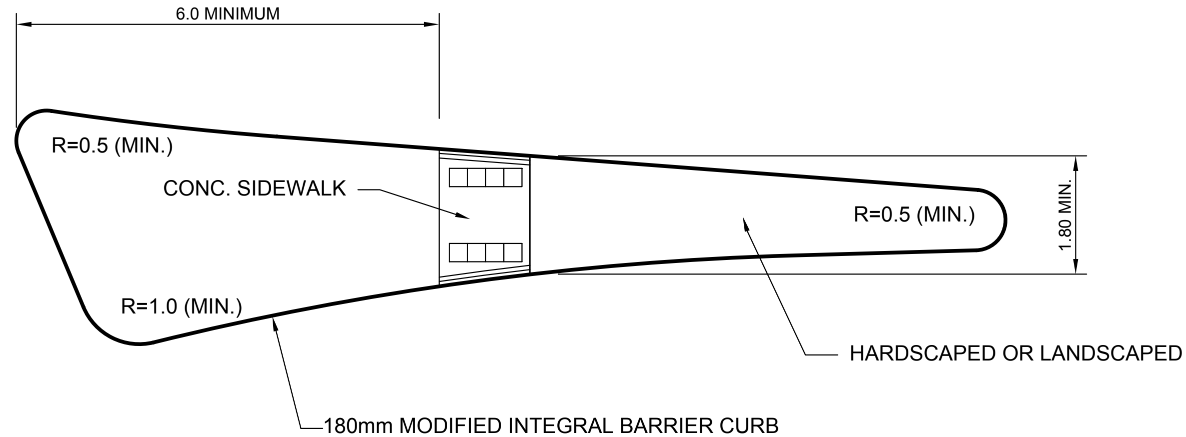
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

TYPICAL
SMART CHANNEL DESIGN

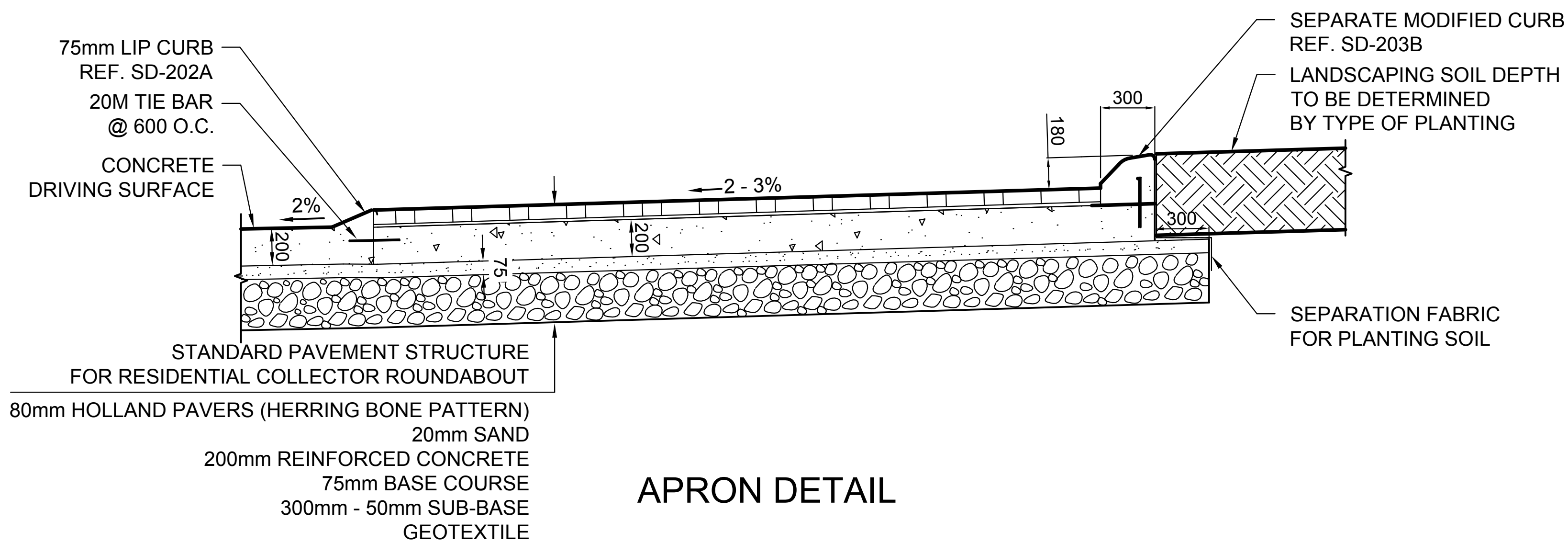
DRAWN BY: AP
DATE: 2012–06–29
SCALE: 1:800
APPROVED BY:
DATE
DRAWING NO. SI-14



TYPICAL SIDEWALK RAMP AT SPLITTER ISLAND



TYPICAL CONCRETE SPLITTER ISLAND



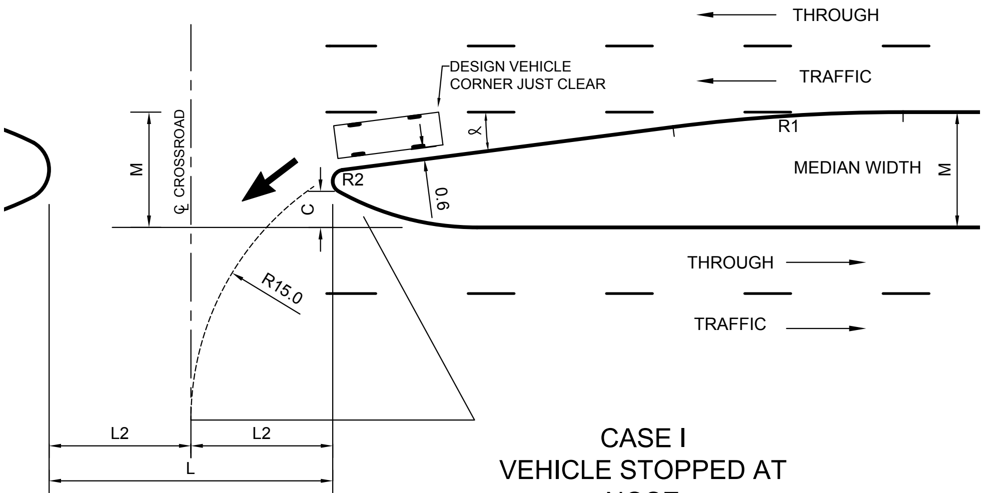
APRON DETAIL

Winnipeg

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

TYPICAL ROUNDABOUT DETAILS

DRAWN BY: AP
DATE: 2012-08-16
SCALE: N.T.S.
APPROVED BY:
DATE
DRAWING NO. SI-15

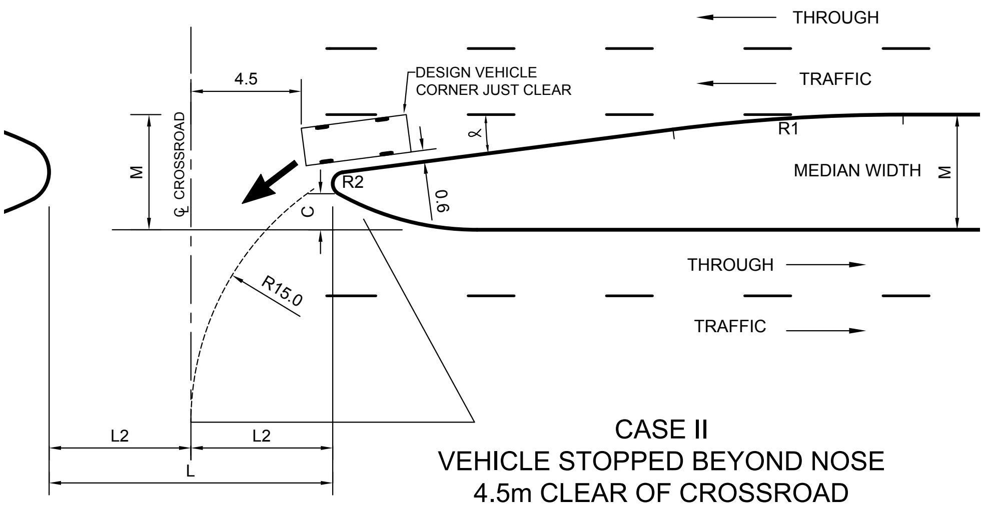


CASE I
VEHICLE STOPPED AT NOSE

Assumed: R=15.0m, R2=0.6m

M in metres			Dimensions for design vehicle					
			P			SU		
C=0.6	C=1.2	C=1.8	α deg	R1 m	L m	α deg	R1 m	L m
5.1	5.8	6.4	7.4	94.5	25.6			
5.4	6.1	6.7	11.0	94.5	23.8			
6.1	6.7	7.3	18.3	48.8	20.1			
6.7	7.3	7.9				12.1	94.5	23.2
7.3	7.9	8.5				16.4	71.6	21.0
7.9	8.5	9.1				20.6	48.8	18.9
8.5	9.1	9.7						
9.1	9.7	10.4						
9.7	10.4	11.0						

NOTE: Preferably use C=1.8m.
R1=94.5m assumed as maximum; larger value may be used



CASE II
VEHICLE STOPPED BEYOND NOSE
4.5m CLEAR OF CROSSROAD CENTRELINE

Assumed: R=15.0m, R2=0.6m

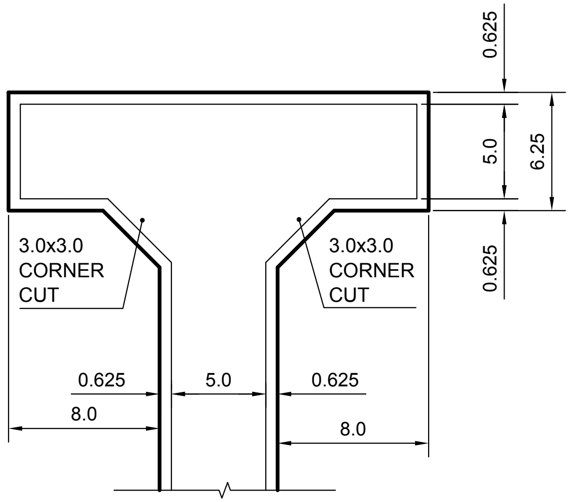
M in metres			Dimensions for design vehicle					
			P			SU		
C=0.6	C=1.2	C=1.8	α deg	R1 m	L m	α deg	R1 m	L m
4.0	4.6	5.1	8.4	94.5	25.0			
4.3	4.9	5.4	16.5	70.1	21.0			
4.9	5.4	6.1				7.4	94.5	25.6
5.4	6.1	6.7				14.6	91.4	21.9
6.1	6.7	7.3				20.0	50.3	19.2
6.7	7.3	7.9						
7.3	7.9	8.5						
7.9	8.5	9.1						
8.5	9.1	9.7						

DRAFT

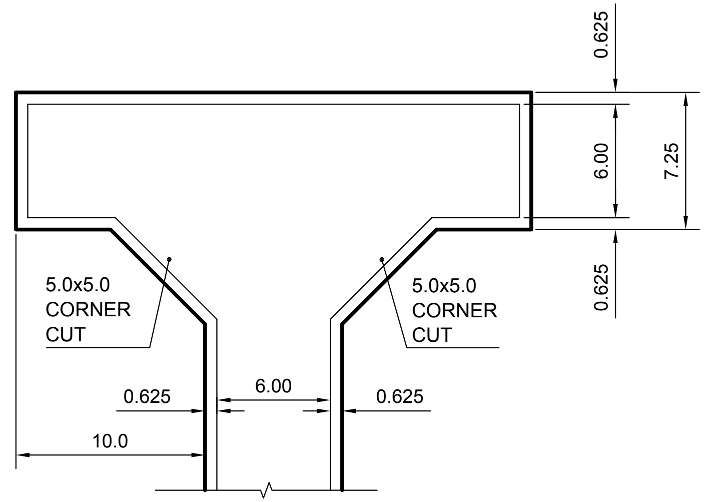
Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

TYPICAL B-NOSE MEDIAN DESIGN

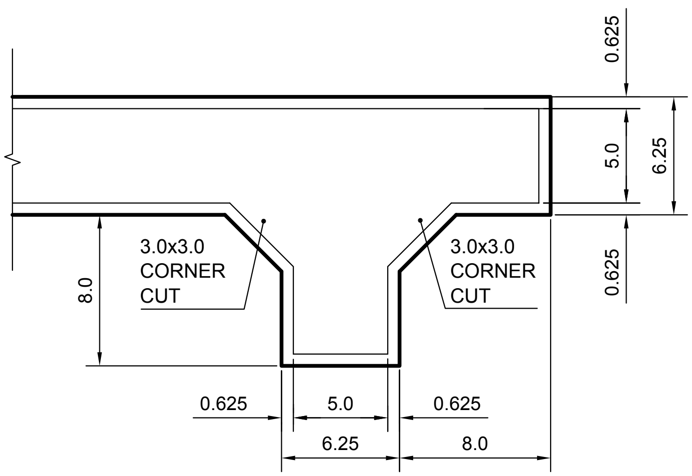
DRAWN BY: AP
DATE: 2012-07-17
SCALE: 1:250
APPROVED BY:
DATE
DRAWING NO. SI-16



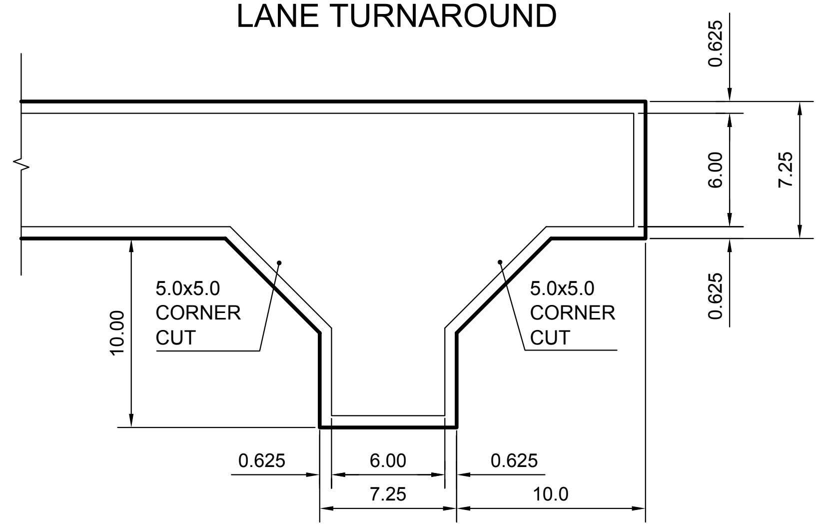
RESIDENTIAL T-TYPE
LANE TURNAROUND



COMMERCIAL T-TYPE
LANE TURNAROUND



RESIDENTIAL BRANCH TYPE
LANE TURNAROUND



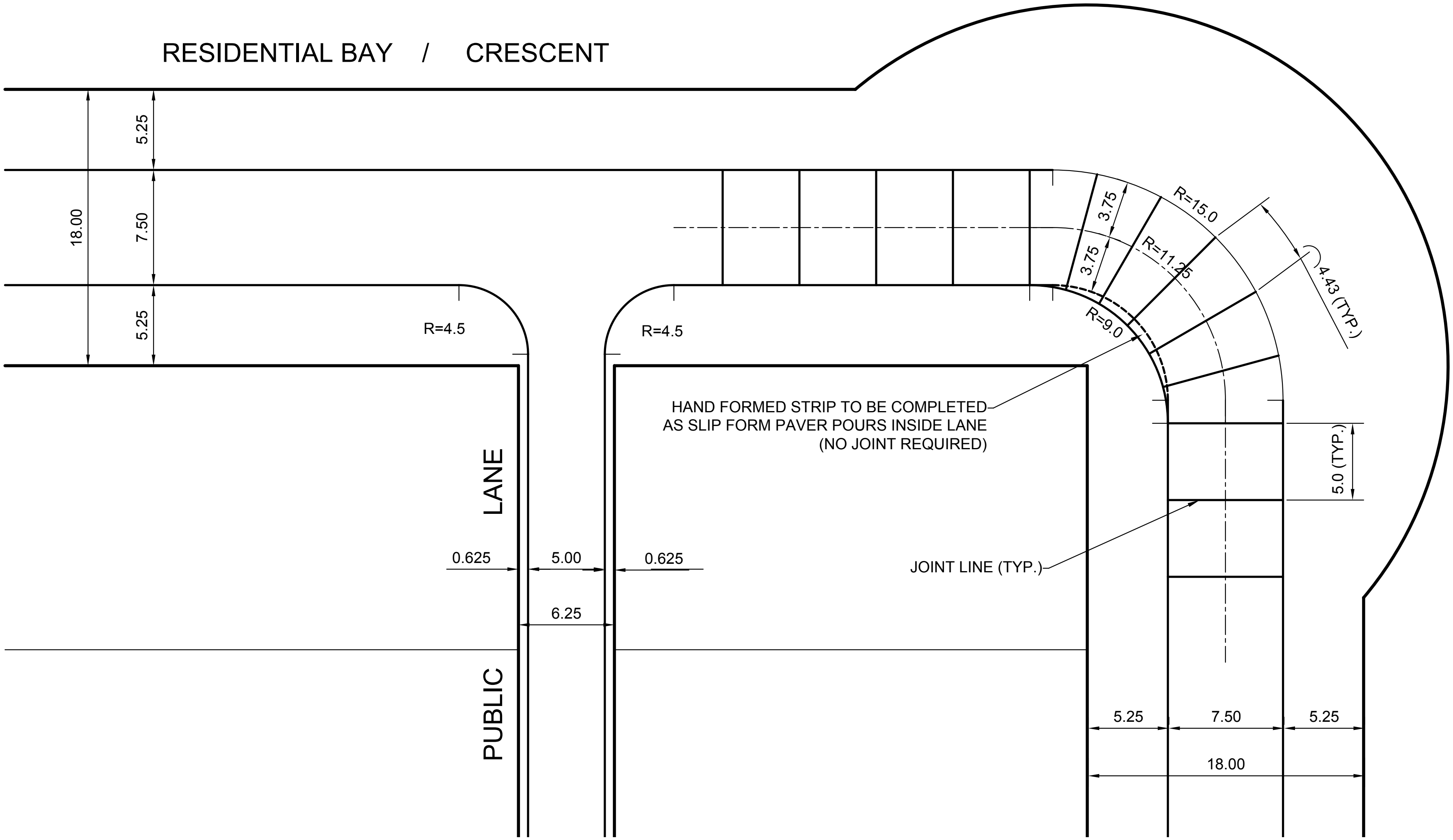
COMMERCIAL BRANCH TYPE
LANE TURNAROUND

NOTES:
1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB (EDGE OF PAVEMENT IN PUBLIC LANE).

Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

TYPICAL
LANE TURNAROUNDS

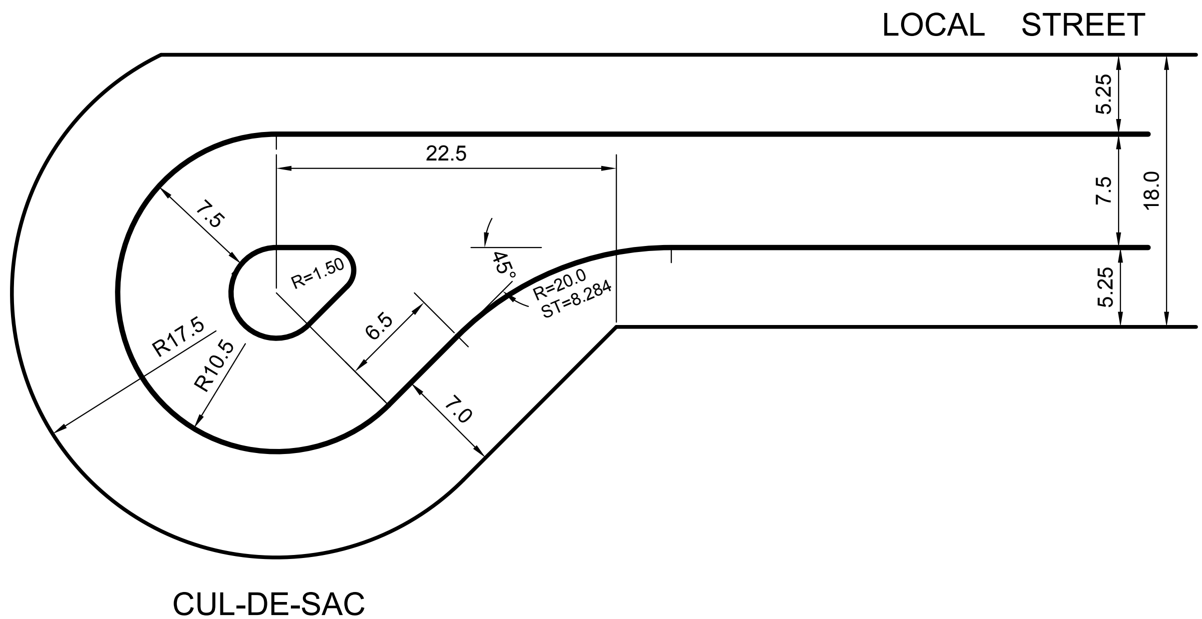
DRAWN BY: GW
DATE: 2012-07-09
SCALE: 1:400
APPROVED BY:
DATE
DRAWING NO. ST-88



NOTES:

1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB (EDGE OF PAVEMENT IN PUBLIC LANE).

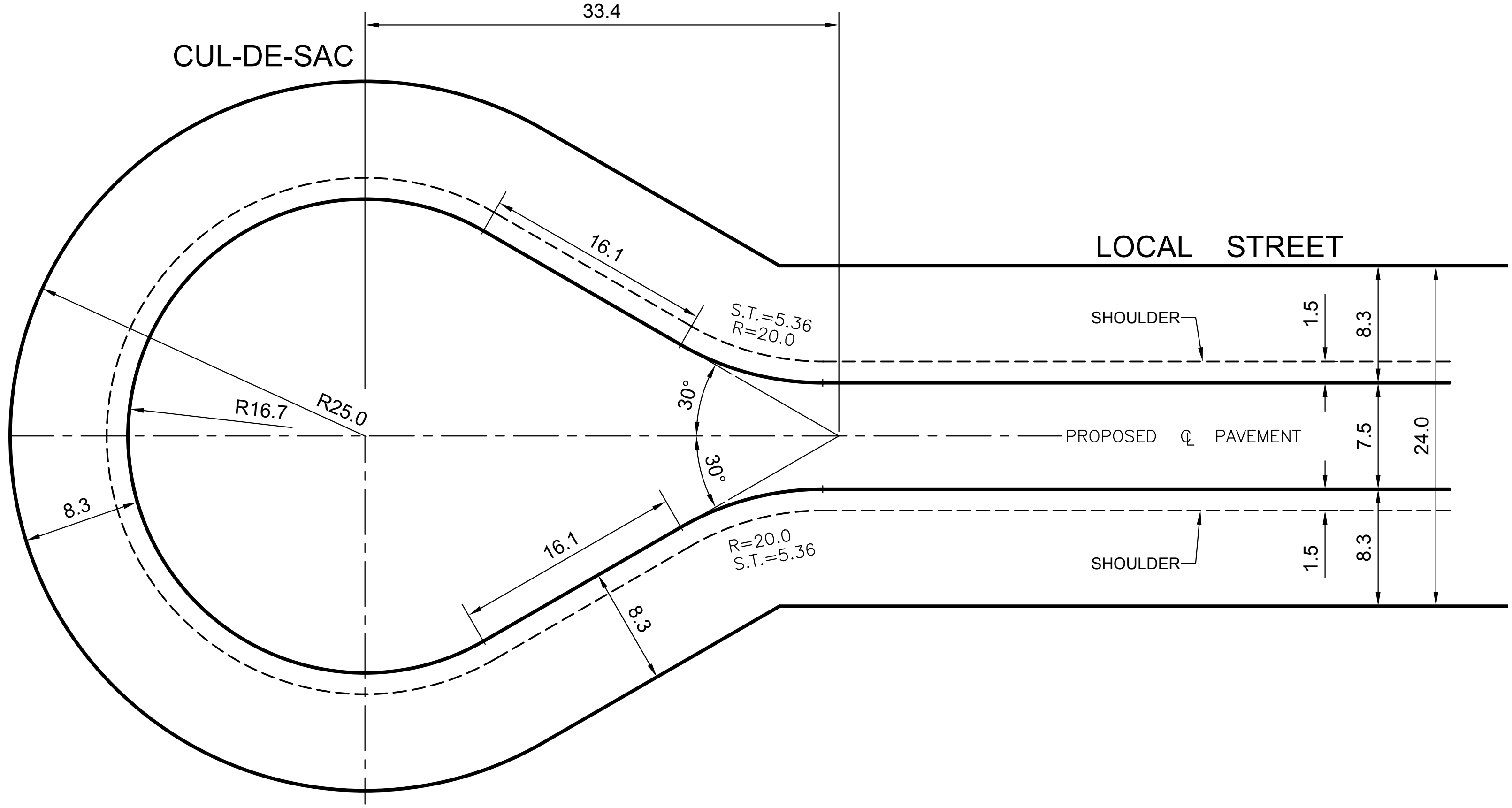
Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	RESIDENTIAL BAY / CRESCENT PAVEMENT GEOMETRICS	
DRAWN BY: GW DATE: 2012-06-19 — SCALE: 1:400	APPROVED BY: DATE	DRAWING NO. ST-89



THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

TYPICAL LOCAL STREET
OFFSET CUL-DE-SAC

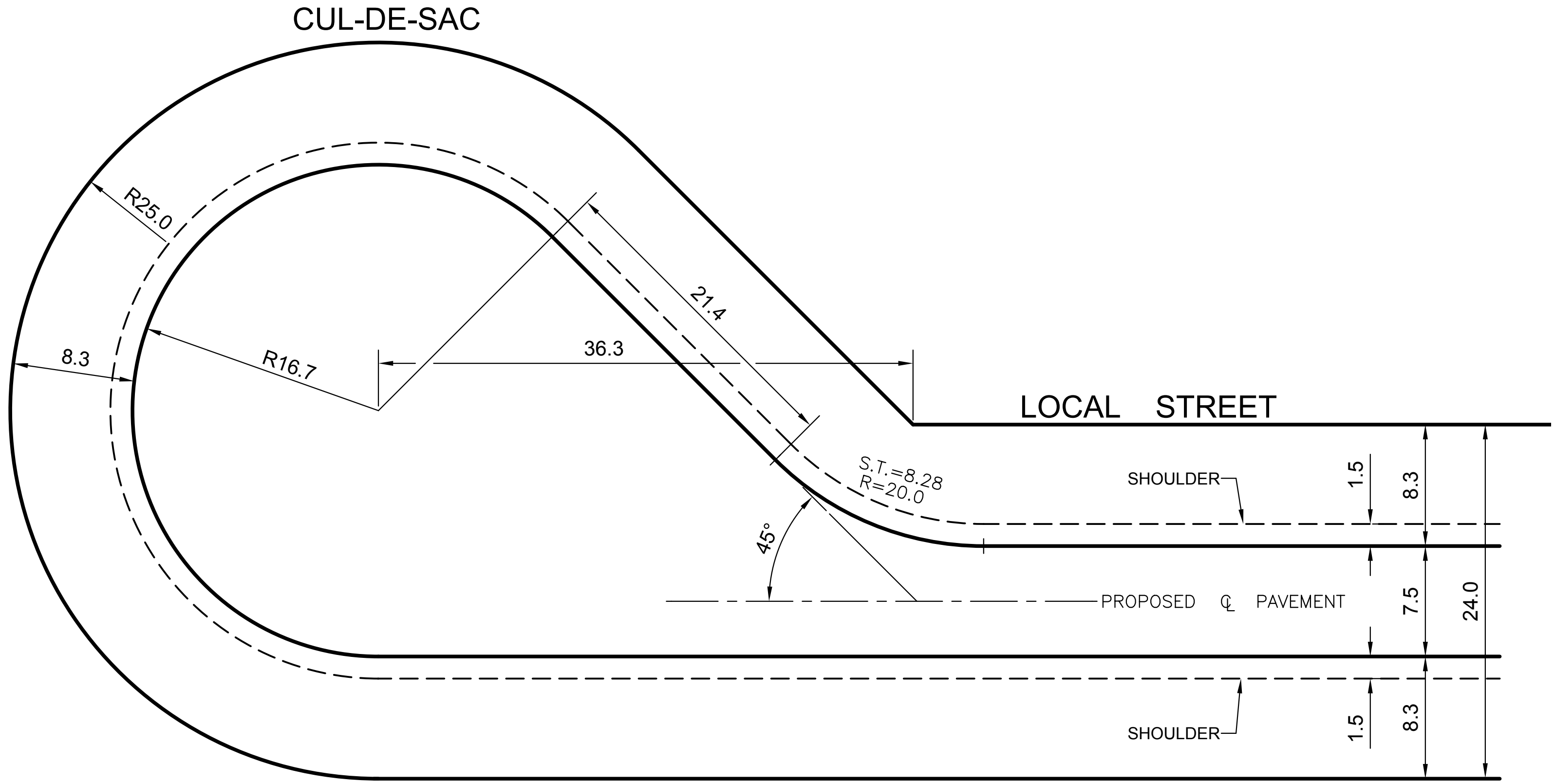
DRAWN BY: GW DATE: 2012-08-16	SCALE: 1:500	APPROVED BY: DATE	DRAWING NO. ST-90A



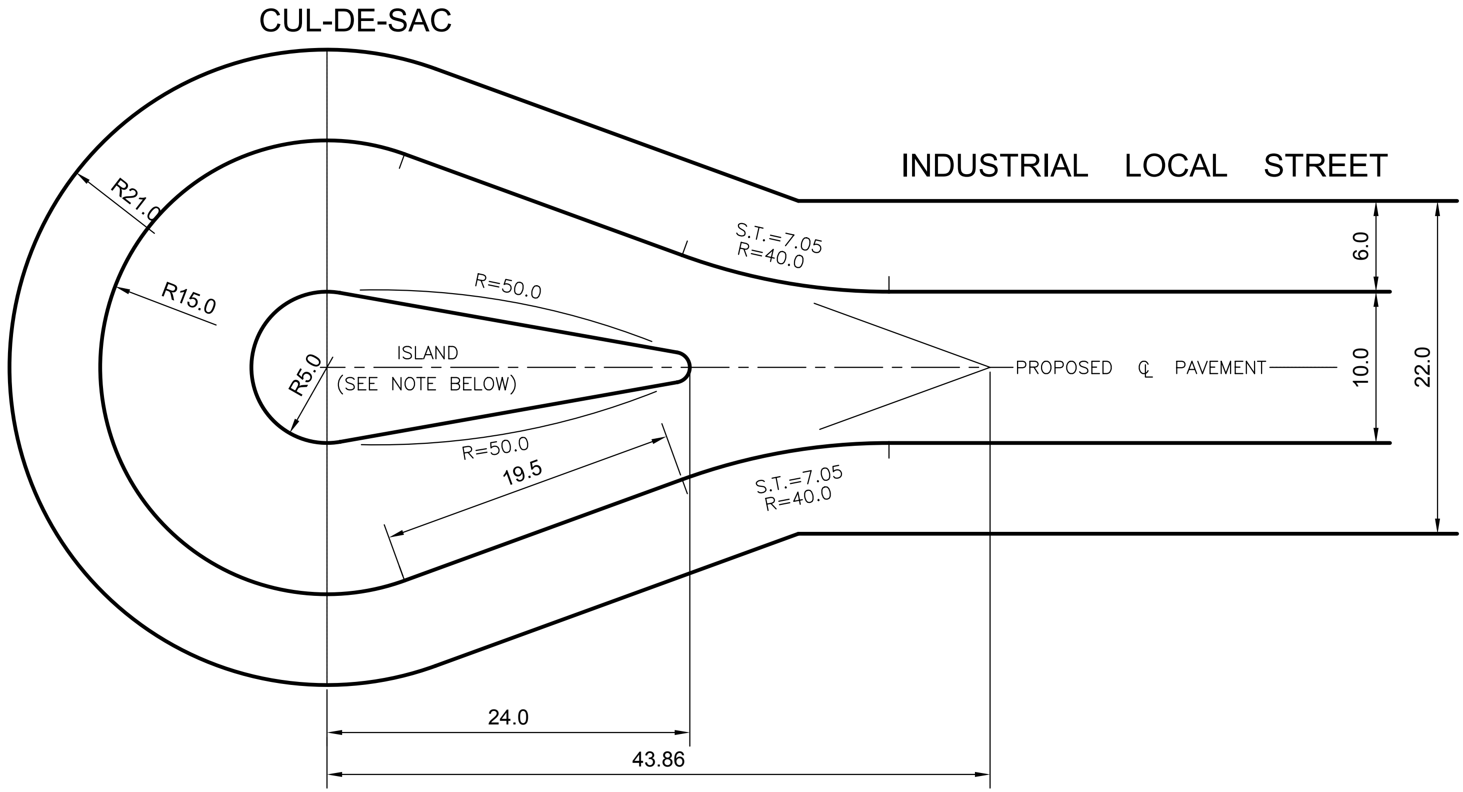
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

TYPICAL RESIDENTIAL RURAL
CUL-DE-SAC
FOR TWO ACRE LOTS

DRAWN BY: AP DATE: 2013-01-04	SCALE: 1:500	APPROVED BY: DATE	DRAWING NO. ST-90-RR2



THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION		TYPICAL RESIDENTIAL RURAL OFFSET CUL-DE-SAC FOR TWO ACRE LOTS	
DRAWN BY: AP DATE: 2013-01-04	SCALE: 1:500	APPROVED BY: DATE	DRAWING NO. ST-90A RR2



NOTES:
1. THE INSTALLATION OF AN ISLAND IS OPTIONAL FOR WB-15 OR SMALLER.
2. BOTH ISLAND SHAPES SHOWN.

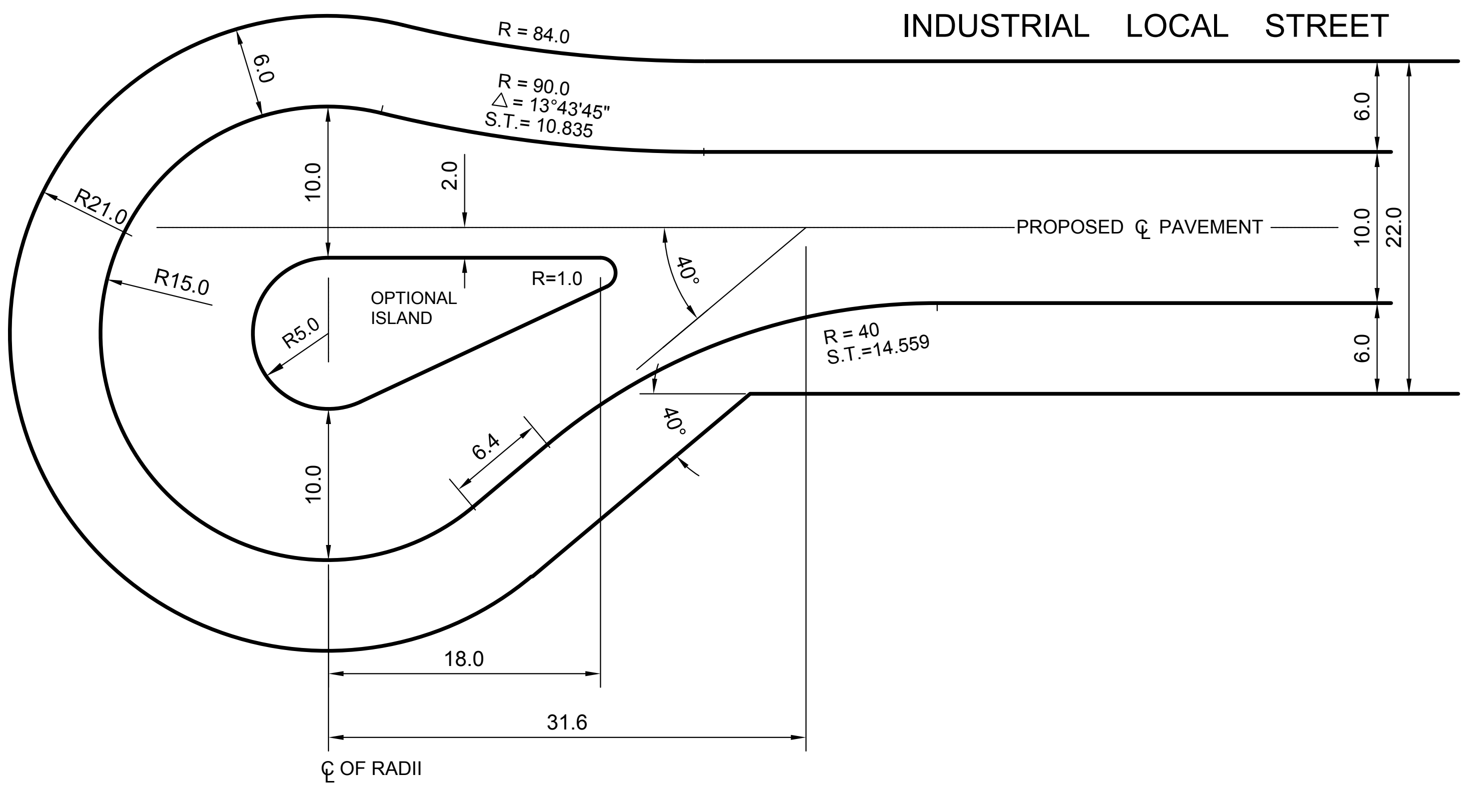
Winnipeg

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

TYPICAL INDUSTRIAL LOCAL STREET
CUL-DE-SAC

DRAWN BY: AP DATE: 2012–08–16	SCALE: 1:500	APPROVED BY: DATE	DRAWING NO. ST-91

CUL-DE-SAC

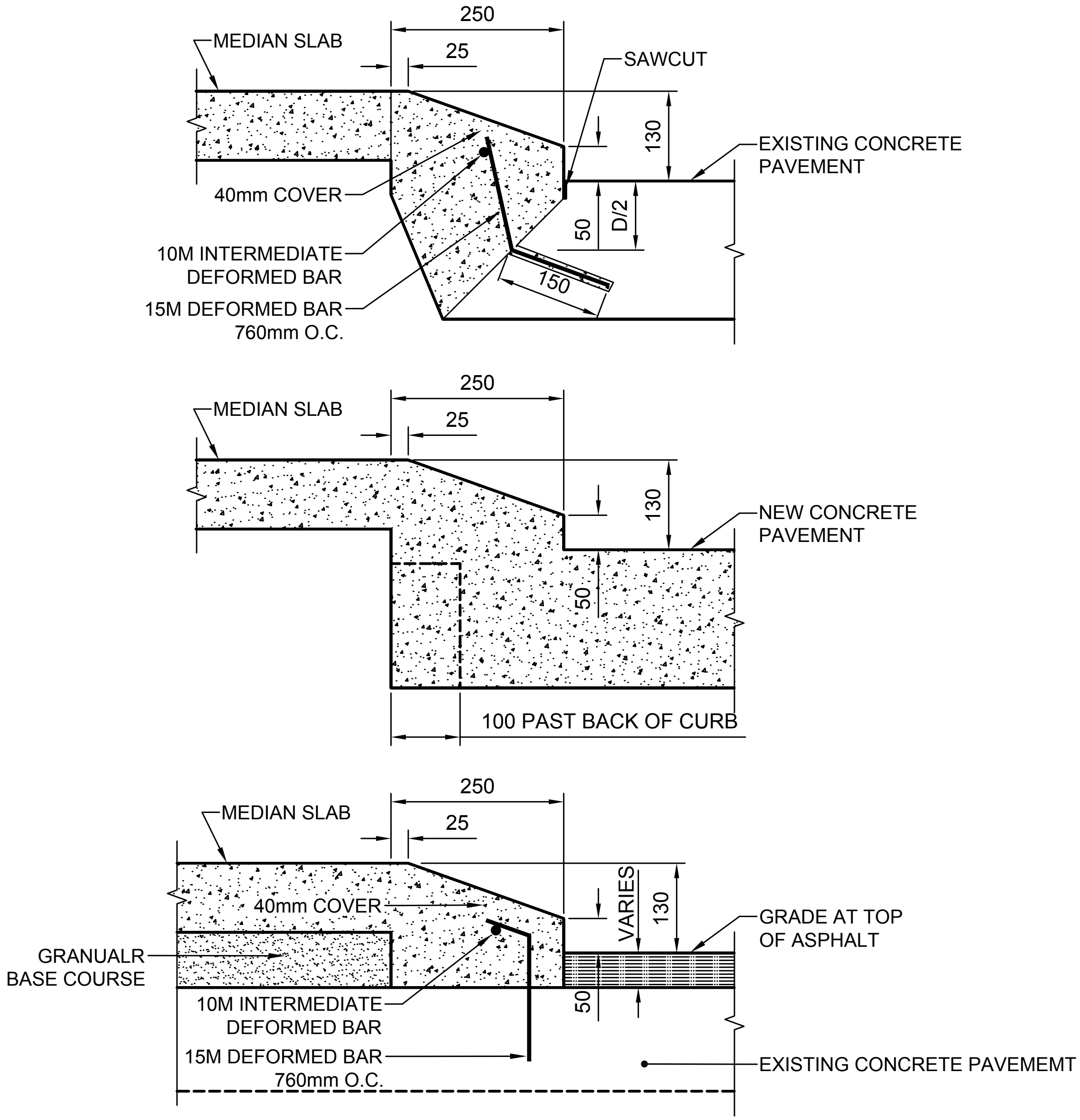


NOTES:
1. THE INSTALLATION OF AN ISLAND IS OPTIONAL FOR WB-15 OR SMALLER VEHICLES.

Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

TYPICAL INDUSTRIAL LOCAL STREET
OFFSET CUL-DE-SAC

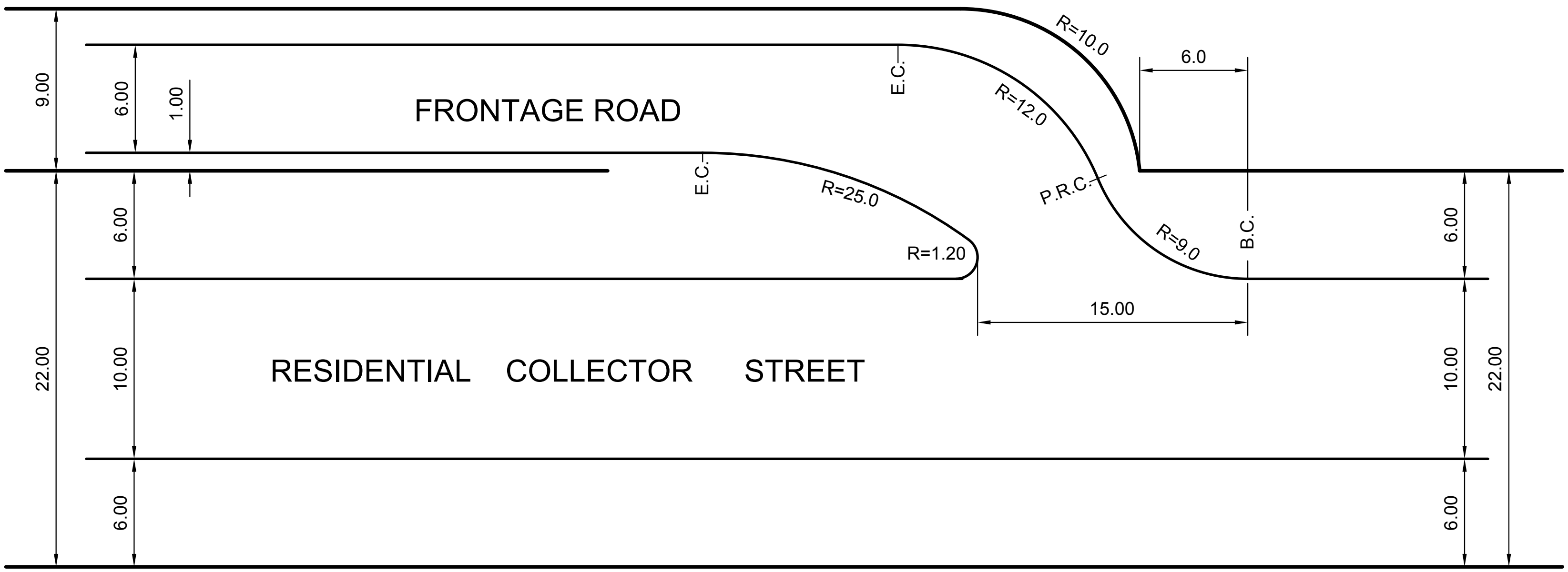
DRAWN BY: AP DATE: 2012–08–16	SCALE: 1:500	APPROVED BY: DATE	DRAWING NO. ST-91A



THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

MEDIAN CROSSING FOR EMERGENCY VEHICLES

DRAWN BY: AP
DATE: 2012–08–17
SCALE: N.T.S.
APPROVED BY:
DATE
DRAWING NO. ST-98



NOTES:
1. ALL PAVEMENT DIMENSIONS ARE TO BACK OF CURB (EDGE OF PAVEMENT IN BACK LANE).
2. IF REQUIRED REFER TO SB-3 FOR TRANSIT STOP DETAILS.

Winnipeg

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

TYPICAL FRONTAGE ROAD (9.0m) ALONGSIDE OF A RESIDENTIAL COLLECTOR STREET

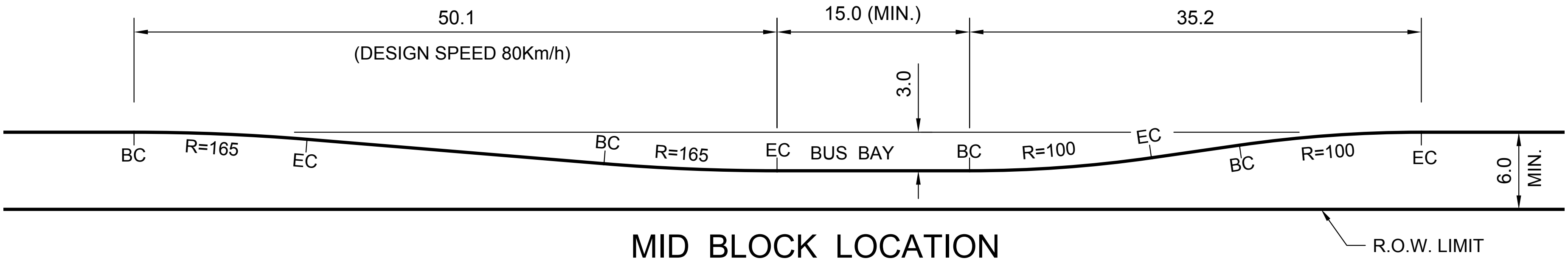
DRAWN BY: GW
DATE: 2012-06-19

SCALE: 1:400

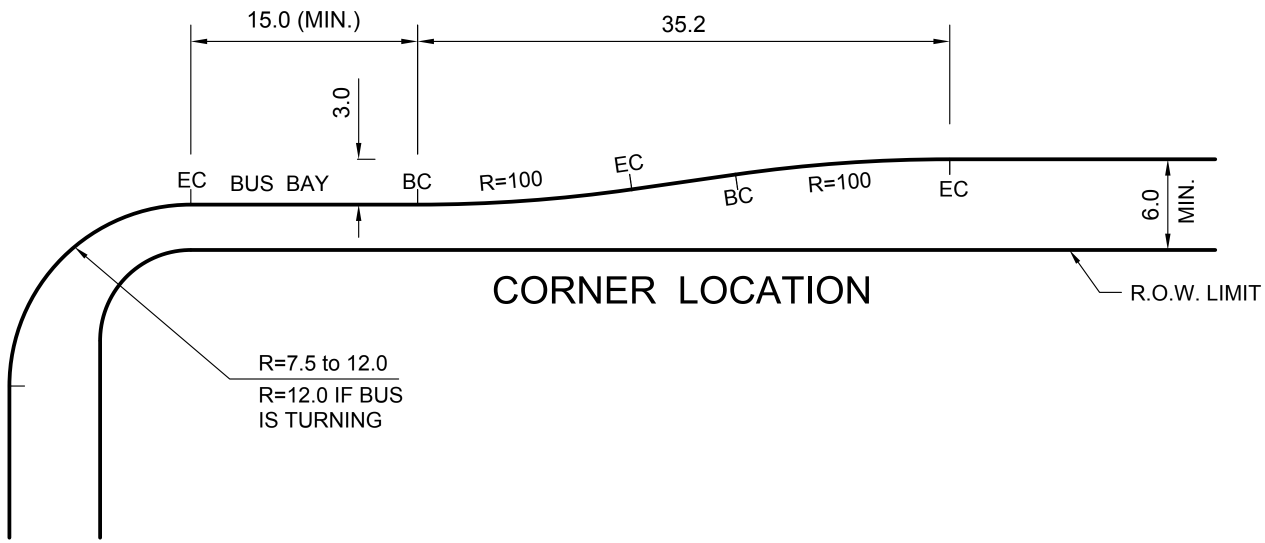
APPROVED BY:

DATE

DRAWING NO. ST-99A



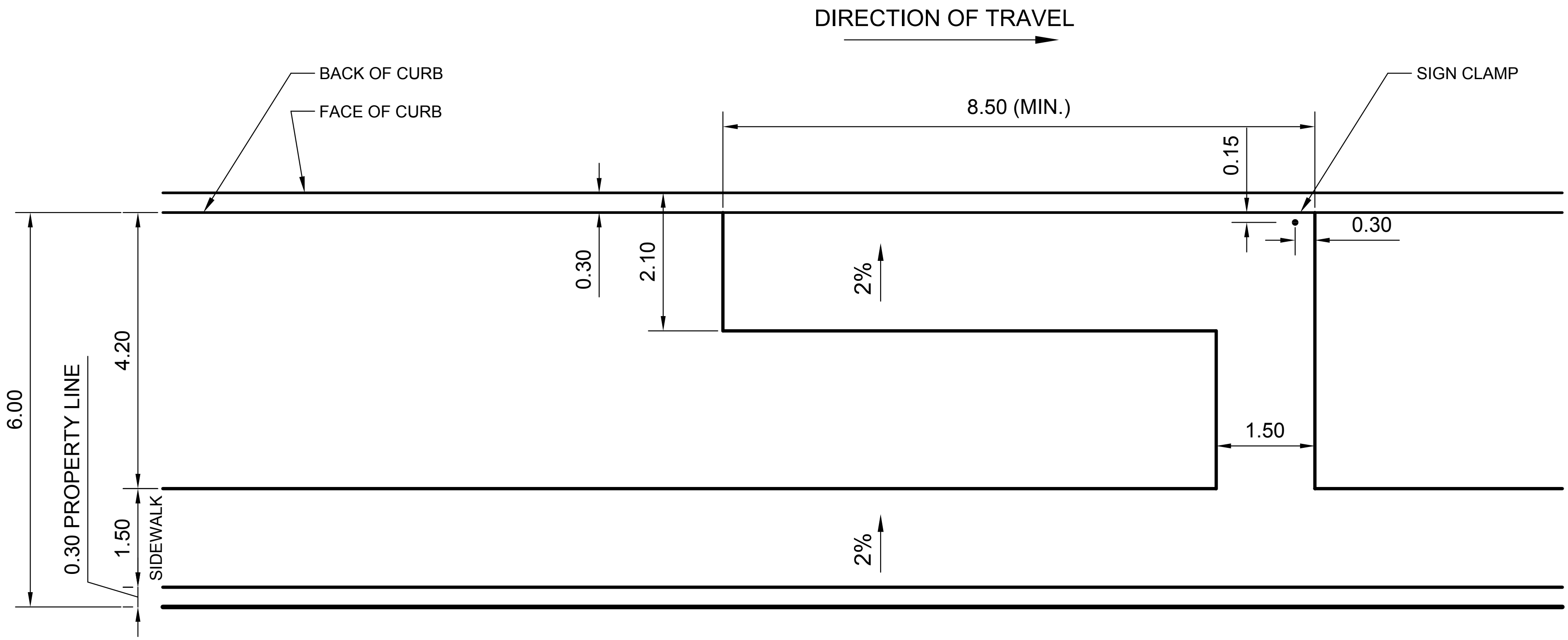
MID BLOCK LOCATION



CORNER LOCATION

NOTES:
1. 15.0 MINIMUM IS TO ACCOMMODATE A STANDARD 12.2m BUS. LENGTHEN AS REQUIRED TO ACCOMMODATE AN ARTICULATED OR MULTIPLE BUSES.
2. BUS BAYS MAY BE CONSTRUCTED WITH RED COLOURED CONCRETE.

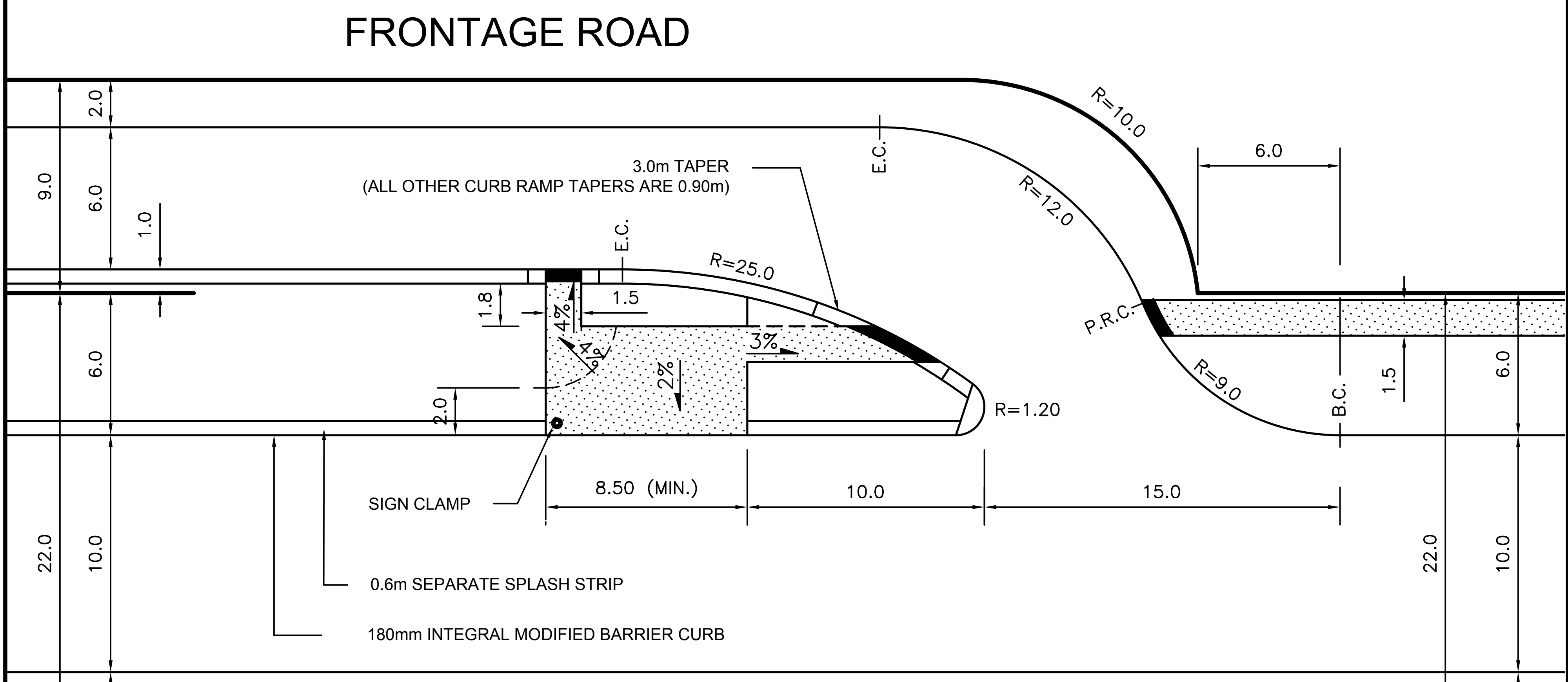
Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	BUS BAYS FOR ARTERIAL ROADS	
DRAWN BY: GW DATE: 2012-07-18 / SCALE: 1:500	APPROVED BY: DATE	DRAWING NO. SB-1



DRAFT

NOTES:
1. PLATFORM LENGTH TO BE 14.5m IF REQUIRED TO ACCOMODATE AN ARTICULATED BUS.

Winnipeg — THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION		TYPICAL COLLECTOR STREET BUS STOP	
DRAWN BY: GW DATE: 2012-07-09	SCALE: 1:100	APPROVED BY: DATE	DRAWING NO. SB-2



6.0

NOTES:
1. STOP IS SHOWN AT THE START OF THE SEPARATION BOULEVARD. MODIFICATIONS ARE REQUIRED IF STOP IS PLANNED AT THE END OF SEPARATION BOULEVARD.
2. GRADES ARE SHOWN FOR GUIDANCE.
3. PLATFORM LENGTH TO BE 14.5m IF REQUIRED TO ACCOMODATE AN ARTICULATED BUS.

6.0

RESIDENTIAL COLLECTOR STREET

DRAFT

Winnipeg

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

TYPICAL BUS-STOP ADJACENT TO A RESIDENTIAL FRONTAGE ROAD

DRAWN BY: AP DATE: 2012-04-25	SCALE: 1:250	APPROVED BY: DATE	DRAWING NO. SB-3

Section 5.0 – Roadside Safety Guidelines

5.1 General

Designs shall be in accordance with the **AASHTO Roadside Design Guide 4th Edition 2011 (RSDG)** with exclusions to Chapters 10 to 12. The AASHSTO RSDG shall supersede the Roadside Safety section from the TAC Geometric Design Guide for Canadian Roads – 1999 Edition for City projects. Previous editions to the AASHTO Roadside Design guide are not accepted for use or reference. This section of the Transportation Standards Manual may address particular aspects that are also within the AASHTO RSDG. The Transportation Standards Manual shall govern in these instances.

For rehabilitation, resurfacing and restoration projects the primary emphasis is maintaining the integrity of the road. The existing roadside objects within or near the clear zone, guardrails, barriers and vehicular/pedestrian safety enhancements should be selectively reviewed for the need for improvement on a project-by-project basis.

This section is not intended to address bridge railings and bridge approach railings.

Table 5.1 and 5.2 summarize basic details about the various road side protection devices described in this section.

Drawing Requirements

The location of overhead sign structures (OHSS), options for bridge pier protection and protection from critical slopes shall be determined within reason at the Preliminary Design phase. All necessary roadside protection devices shall be included with the detailed design drawings. The detailed design drawings shall also indicate placement, layout, connection details, ditch slopes, embankments slopes, etc.

The design of roadside safety devices and warranting that is left to the construction phase generally result in project delays, unnecessary usage, redesign of slopes and ditches, conflicts with utilities, oversights of warrants and reconstruction of new infrastructure for compatibility with those devices.

Although devices installed generally follow the manufacturer's installation procedures and guidelines, the design drawings shall be signed and sealed by a Professional Engineer to demonstrate that the optimal selection, placement and warranting of devices was well thought out. It is the Engineer's responsibility to consider all the variables in their selection to ensure the validity of the warranting and choice of a protection system and test level for the specific application, in consultation with the City.

Test Level Selection for Protection Products

Test level selection for W-beam guardrails shall be TL-3. Test levels 2 or 3 may be used for crash attenuators based on the design speed.

Table 5.1 – Summary of Roadside Protection Alternatives for Higher Speed Roadways

	Protection Type	Placement	Curbing, if Present	Height	End Treatment	Applications Examples
High Speed Roadway **Ds ≥ 80 km/h**	W-Beam Guardrail (MGS)	Back of curb	100mm height. Slope faced preferred. Barrier curb acceptable if required for constructability.	787mm top of rail to top of pavement	NCRHP 350 TL-3 approved product. Flared preferred.	Protection from OHSS, critical slopes, rail warning protection systems, bridge piers. Double sided for protection from vehicle crossover for narrow medians.
		Back of shoulder	100mm height. Slope faced preferred. Barrier curb acceptable if required for constructability.	787mm top of rail to top of pavement	NCRHP 350 TL-3 approved product. Flared preferred.	
		Back of shy distance	No curb	787mm top of rail to top of pavement	NCRHP 350 TL-3 approved product. Flared preferred.	
	Crash Cushion	Front of fixed object with adequate offset to mitigate corner coffin effect	100mm height. Slope faced preferred. Barrier acceptable if required for constructability.			Protection from OHSS, rail warning protection systems. Permanent and temporary end treatment for rigid barriers.
	Sand Barrels	Front of fixed object with adequate offset to mitigate corner coffin effect	100mm height. Slope faced preferred. Barrier acceptable if required for constructability.			Protection from rail warning protection systems. Alternative for temporary use during construction.
	Rigid Barriers	Back of shy distance	No curb	813mm min.	Crash Cushion, buried into embankments	Protection from bridge piers, vehicle crossover for narrow medians
		Outside of shy distance and less than 4.0m	No curb	813mm min.	Crash Cushion, buried into embankments	

Table 5.2 – Summary of Roadside Protection Alternatives for Lower Speed Roadways

	Protection Type	Placement	Curbing, if Present	Height	End Treatment	Applications Examples
Low Speed Roadway **Ds < 80 km/h**	No Protection	Operational and environmental surroundings must be strictly analyzed and approved by Public Works. Objects must be placed in the appropriate boulevard zone.				Broadway, Portage Avenue, Main Street, Corydon Avenue
	Crash Cushion	Front of fixed object with adequate offset to mitigate corner coffin effect if feasible	100mm barrier height if feasible and does not affect sidewalk grades			Protection from OHSS, rail warning protection systems. Permanent and temporary end treatment for rigid barriers.
	ABB	Back of curb	Up to 180mm height, any shape	700mm top of rail to top of curb	Horizontally flared buried end	Protection from OHSS, critical slopes, rail warning protection systems, bridge piers. Double sided for protection from vehicle crossover for narrow medians.
	Safety Curb	Proper alignment with surrounding curb		330mm	3.0m transition to standard curb height	Protection from OHSS, rail warning protection systems, bridge piers. Safety median for protection from vehicle crossover for narrow medians.
	Rigid Barrier	Back of shy distance	No curb	813mm min.	Crash Cushion, buried into embankments, or transition to a safety curb	Protection from bridge piers, vehicle crossover for narrow medians
		Outside of shy distance	125mm mountable	813mm min.	Crash Cushion, buried into embankments, or transition to a safety curb	

Clear Zone

Table 5.3 – Clear Zone Guideline for Regional Streets lists the minimum and desirable distances from the face of curb to a fixed object. These values were obtained from the research report; Development of an Urban Clear Zone Guideline for the City of Winnipeg, December 1996 (RS-95-01). For roads with rural cross-sections designers may reference the TAC manual as this table may not be applicable for rural roadways as the clear zone distance is generally adjusted as the cut/fill slope changes. The clear zone shall be measured from the edge of the lane line or if curb is present than the face of the curb. The curve adjustment factor listed in TAC shall be applied to the values in this table when required.

Table 5.3 – Clear Zone Guideline for Regional Streets

Posted Speed Limit (km/h)	Distance from Face of Curb Free From Unprotected Fixed Objects	
	Minimum (m)	Desirable (m)
50	2.5	3.5
60	3.5	5.0
70	6.0	7.5
80	7.5	9.0

Fixed objects should be placed outside of the applicable clear zone, if feasible, to reduce the need for roadside barriers. If the object cannot be relocated to a safer distance than the applicability of a break-away base shall be reviewed or the item should be frangible. The warranting of fixed objects on breakaway bases shall consider the implication of the fallen object on adjacent land-use.

For lower speed roads or existing image routes, more tolerance and judgement must be used. Larger diameter trees and pay stations are generally close to the back of the curb on existing downtown roads and older neighbourhoods but the likelihood of impact is lower and parking may be permitted on the street. The placement of new roadside objects could be in a similar alignment of the existing trees or at the back of sidewalk with the placement alternatives giving priority to preserving and maximizing sidewalk clear widths. This approach could be generally applied for roads with a design speed of 60km/h at a mid-block location. Less tolerance would be expected at locations with a high collision potential such as at intersections or on existing sub-standard curvature. Mid-block locations on roads with a design speed of 70 km/h should be analyzed in greater detail and would be case specific. Any new installation of a fixed object within a clear zone of any roadway would be considered a design exception.

Median Drainage and Grading

If drainage inlets are required for wide medians they are to utilize catch basins and not exposed pipe or culvert ends.

Cross slopes on typical medians are to have a:

- Maximum 6:1
- Maximum 10:1 if a barrier is present
- Maximum 4:1 at isolated locations near low points where a catch basin is present

Figure 5.1 – Higher speed roadways with wide medians are to have appropriately sloped swales and standard ditch inlets.

Edge Rounding

Edge rounding adjacent to a fill slope shall be at least 0.5m for all design speeds. The designer and field engineer must consider the appropriate edge rounding design and construction for the specific application to afford the drive more control if the vehicle encroaches on to the down slope.

OHSS Placement

Overhead Sign Structures are preferred to be located outside of the clear zone as this will generally result in a lower life cycle cost. The planning of the sign locations at the preliminary design stage will help mitigate any conflicts with other infrastructure that could result in a non-optimal location of the sign structure.

Culvert Headwalls and High Consequence Objects

The clear zone concept considers that 80% of drivers will theoretically be able to recover their vehicle within the clear zone to avoid the hazard. That still leaves the probability of 20% of drivers in a potentially hazardous situation. Significant hazardous objects such as Hydro transmission towers or culvert headwalls may still require shielding even if they are just outside the clear zone because the addition of shielding will likely cost considerably less than the consequences of a lower probable impact.

Ditches & Recoverable Roadside

Culverts located at rural approaches on streets with a design speed equal or less than 80 km/h are to be a correct length to accommodate 4:1 maximum side slope.

Culverts located at rural approaches on streets with a design speed of 90 km/h are to be a correct length to accommodate 6:1 maximum side slope if they are within the clear zone and 4:1 if they are outside the clear zone.

Ditch bottom widths are to be 1.0m minimum and preferred to be 1.5m.

Slopes that are 4:1 are considered traversable. Slopes steeper than 4:1 shall not be placed directly adjacent to the travelling lane.

Slopes less than 3:1 are considered critical and shall be shielded or additional right-of-way should be acquired for widening.

Back slopes (cut slopes) for ditches may be 3:1 for roads with lower design speeds with constrained right-of-way.

Rumble Strips

Rumble strips may be used within the inside or outside shoulder near the edge of the travelled lane. Within an urban environment they can be used to reduce motorists' encroachment onto the shoulder pavement.

Trees

Existing Trees

Generally, trees with a diameter of 150mm or larger are considered fixed objects, as per the TAC GDG.

When trees and shrubs with multiple trunks or groups of small trees are close together, they may have the effect of a single tree with their combined cross-sectional area, as per the TAC GDG.

DRAFT

Older and larger trees offer many environmental benefits but also function as a roadside hazard and can affect sight lines. A safety evaluation should be performed and geometric design alternatives should be considered to preserve existing trees in coordination with the appropriate City Departments.

Proposed Trees

Designers are to refer to the "Tree Planting Details and Specifications – Downtown Area and Regional Streets" for information on respective tree placement.

Trees are not to be placed within the clear zone on roads with design speeds of 80 km/h or higher. Proposed tree plantings are to consider the effects of sight distances, compatibility with future road widening, and size of the tree once matured.

Signal Poles, Street Lights, Sign Posts and other Vertical Structures

Vertical poles and structures within the clear zone of any speed shall be placed on break-aways or be frangible. The exception to this is evaluating the risks and life cycle costs for a fixed base within the clear zone of a lower speed road that if impacted could cause significant damage to buildings or injury to large congregations of pedestrians.

Street Light Placement for Roads with a Posted Speed ≥70 km/h

Street lighting shall be placed outside the clear zone for design speeds of 80 km/h and higher unless technically infeasible. When deemed technically infeasible a solution must be reached in coordination with the Transportation Division. The values to be used for straight sections with slopes equal or gentler than 4:1 leading up to the proposed position of the street light shall use the preferred values from Table 5.3 of this Section.

During the drawing review stage, the Transportation Division, as its discretion may:

- Increase those clear zone values for street lights placed on the outside of horizontal curves of 900m or less by multiplying those values by factors found in the TAC GDG Table 3.1.3.2.
- Allow flexibility to accommodate project specific constraints by allowing the usage of the minimum values for roadways in Table 5.3 only for roads with an urban cross-section that have boulevards sloped 6:1 or less.

Shy Distance for Barriers

The values for shy distances used for rigid barriers and W-beam railing shall follow the RSDG. Additional factors in considering the placement of a barrier with respect to shy distance are;

- Whether a shoulder or curb is present.
- Whether the space between the shy distance and the railing is hard surfaced.

DRAFT

- The grading of the area on both sides of the railing.
- Snow clearing operations.

Flare Rates

Flare rate for rigid barriers and W-beam railing shall follow the RSDG. Flare rates and maximum allowable offset from the device to the travelled lane for W-beam end treatments shall follow the manufactures recommended installation instructions.

The minimum flare rates for the Midwest Guardrail System shall be 10:1. This minimum should be reserved for cases where constraints exists and should not be used in conflict with the end treatments required flare rate.

Reduced flare rates may be used for temporary work site protection in coordination with the Traffic Studies Engineer.

Zone of Intrusion (ZOI)

The zone of intrusion for a typical 813mm high f-shape barrier at a TL-3 shall be 610mm.

Length of Need

The length of need shall be calculated as per the RSDG regardless of type.

Consideration shall be given to the operational speed for the specific location and existing constraints to adjust the length using engineering judgement.

5.2 Rigid Barriers

General

Rigid barriers should be placed outside the shy distance to minimize the overall length. Consideration to future expansion of lanes and elevations shall be considered.

The connection detailing between the barriers, the base anchoring, the need for footings and the reinforcement requirements are not specified here as these variables are project specific.

Accepted Shapes

The following barrier shapes are acceptable for use within The City. It should be noted that each barrier shape will perform at various test levels based on the ZOI and height requirements described further in the RSDG.

F-Shape Concrete Barrier (TL-3 to TL-4)

This is the standard and preferred rigid barrier for use in the City. This barrier has a typical of height 813mm. During MJRH of roadways, the existing barriers and can accommodate a 70mm asphalt overlay. If new barriers are to be installed during new construction and if an asphalt overlay is planned as part of the facility’s life cycle maintenance plan, than the height of the barrier shall be increased to 880mm, with no change to the standard bottom geometry. This will ensure a long term height of 810mm after the planned overlay. This barrier aids in reducing vehicular damage at lower speeds. Designers should consider that the standard height of this barrier may not prevent taller trucks from leaning over the back edge of the barrier.

Figure 5.2 – Typical F-shape barrier in a TL-3 configuration due to the proximity of the retaining wall behind it

10.8 Degree Single Sloped Concrete Barrier (TL-3 to TL-5)

This barrier performs similar to the F-Shape concrete barrier during higher speed impacts. The adjacent pavement can be overlayed with asphalt several times and trucks will have a reduced lean with respect to the back of the barrier, if the height is designed to accommodate. Vehicles will undergo increased damage under lower impact speeds and does not offer the energy reduction feature of the lower portion of the F-Shape.

Vertical Faced Barrier (TL3 to TL-5)

This barrier is used where space is limited to achieve the appropriate design for the ZOI. It also offers a reduced roll over potential for higher speed impacts. It can be designed to be compatible with future road widening elevations.

Figure 5.3 – Vertical faced barriers allow for re-use for future road widening

End Treatments for Rigid Barriers

The ends of rigid traffic barriers can be treated by a variety of methods including; burying ends into embankments, transitioning to safety curb, flaring outside the clear zone with a vertical taper, or a crash attenuation unit. Sacrificial units are not acceptable to the City for permanent installations but can be used for temporary installation for construction detours.

Permanent Treatments

The City prefers the use of non-gating, re-directive crash cushions that conform to NCHRP Test Level 3 or MASH, if other treatments or relocation of the fixed object is not feasible; to treat the ends of rigid barriers and for protection in front of OHSSs' and other fixed objects within the clear zone.

Design guidance for end treatments as follows;

- The foundation design of the unit shall follow the manufactures recommended installation at a minimum.
- The extension panel shall be bolted to the rigid barrier to ensure rigidness continuity between the side of the crash cushion and the rigid barrier.
- The design engineer is responsible for consulting with the Bridge Planning and Operations Engineer to determine the preferred cartridge width and type that is preferred.

Ends of F-shape barriers may be terminated gradually longitudinally into a safety curb on roads with design speeds of 70 km/h or less if space is limited.

Other treatments include burying the ends into embankments.

Figure 5.4 – F-shape barriers can be introduced by transitioning to a safety curb for lower speed roadways.

Self-Restoring Treatments

Existing objects that are frequently impacted should be identified during rehabilitation projects and the installation of self-restoring end treatments should be reviewed from a cost perspective.

Objects that have a high probability of frequent impacts for new facilities should be identified and mitigated such that self-restoring units are not required.

5.3 Flexible Barriers (Guardrails)

General

Flexible barriers shall be placed with the face of rail behind the back of curb if one is present. If no curb is present the guardrail shall be placed at the edge of the shoulder or at the edge of the shy distance.

On a higher speed curbed roadway a design alternative could be to remove the curb in the area of the guardrail and place the guardrail at the edge of the shy distance and pave the area in between and provide positive drainage.

If the back side of the railing is within the clear zone of the opposing traffic, the railing shall be double sided.

The deflection performance of the chosen rail shall be considered in its proximity to the fixed object.

Flexible Barriers for Lower Speed Routes

Aluminum Balanced Barrier (ABB)

Aluminum Balanced Barrier (ABB) has been used for decades within the City of Winnipeg and has generally performed well. Its use is for lower speed roadways.

ABB may be used on streets with a design speed of 70 km/h or less.

Design speeds of 80 km/h may use the ABB under certain circumstances such as;

- An existing road is being widened and an existing ABB can be salvaged and reused.
- The object is considered low risk
- The route is not classified as an expressway
- Rationale can be provided to the City.

W-Beam may be used on streets with a design speed of 70 km/h for situations that are considered high risk. E.g. A steep drop off at the edge of a road on a truck route.

The upstream end treatment shall be a buried end or vertical tapered end, the approximate length of one rail segment.

Horizontal flaring of the upstream end shall be done where feasible. The horizontal flaring shall length shall occur approximately over one or two rail segments. The length is measured for the top rail including the buried section.

The horizontal flare should end at a maximum of 1.46m from back of curb.

The barrier post spacing shall be between 3.00 and 3.85m. The spacing shall accommodate the length of the rail segments such that splices occur 0.3m downstream from the centre of a barrier post.

If splash strip or sidewalk walk is present it shall be blocked out around the barrier post. The blocked out portion shall be filled with asphalt and perched to the post to provide positive drainage.

The length of the rail system shall accommodate typical post spacing and whole rail segments to minimize rail segment cutting. The minimum length of need shall be rounded up to accommodate this if space is available.

The length of need shall not include any part of the rail segment that is less than 700mm in height, i.e. not the buried end treatment.

The height of ABB shall be 700mm from top of boulevard to top of rail.

DRAFT

Figure 5.5 – Example of a new ABB installation on Disraeli Freeway that included a horizontally flared buried end.

Flexible Barriers for Higher Speed Routes

Blocked out w-beam or thrie-beam is to be used on higher speed routes. The particulars can be found in the RSDG.

MGS is a flexible guardrail that is used by the City. It is taller than the standard w-beam height and larger block outs are used to compensate for smaller cars.

The height of railing shall be measured from the pavement elevation to top of railing is a curb is present.

End Treatments

W-Beam Barrier Rail

There are a variety of existing and new end treatments for W-beam barrier rail, the appropriate selection should be done in coordination with the City. Opposing traffic must be outside the clear zone to reduce the risk of an opposing errant vehicle snagging the back side of these units.

Figure 5.6 – W-beam guardrail installation on King Edwards demonstrates a flared end treatment and removal of curb for ease of snow clearing

A tensile anchoring system is required to reinforce the last barrier post to reduce deflection at the end of the system.

Figure 5.7 – A typical downstream end treatment for a W-beam guardrail

Aluminum Balanced Barrier

A buried end that is flared vertically and horizontally is acceptable.

5.4 OHSS and Rail Warning Systems Protection

If OHSS cannot be placed outside of the clear zone they may require protection. Rail warning systems generally are placed within the clear zone to ensure satisfactory sight distance to the lights. Commonly used alternatives for protection of these fixed objects include sand barrels, safety curb, crash attenuators or guardrail.

Sacrificial Treatments

Sand Barrel Cushions systems are one type of sacrificial end treatment currently used in the City. Sacrificial end treatments may be used if the site specific conditions warrant it as the optimal solution, such as locations with low probable impact or temporary installations.

Crash Cushion Treatments

There shall be an extension panel attached to the unit to mitigate the corner coffin effect, if applicable.

Figure 5.8 – Typical OHSS protection utilizing crash attenuators with an extension panel for low angle protection

The design engineer is responsible for consulting with the Bridge Planning and Operations Engineer to determine the preferred cartridge width and type that is preferred.

DRAFT

5.5 Curbing and Curb Transitions

Safety Curb (SD-206B) and Safety Median (SD-226B)

The 330mm height safety curb may be used on urban streets with design speed of 70 km/h or less.

The upstream end treatment of the curb shall be a 3.0m long transition. The downstream end treatment must have a minimum taper of 1.0m, but greater may be used for aesthetic reasons.

When using a safety curb attention must be given to the boulevard, median and sidewalk drainage to ensure it is not restricted.

The length of safety curb shall be determined as defined in the RSDG or alternatively as defined in drawings TS-RS-06 in Section 4A. Shorter lengths may be used for site specific reasons using engineering judgement.

Figure 5.9 – Safety curb protection utilized at rail crossing on McPhillips Street

Curbing Type

Additional discussion about curbing without guardrails present is discussed in Section 4.3.

Curbing and Flexible Barriers

The designer shall consider the type, height and proximity of the curb used in conjunction with guardrails and crash cushions, and the impact the curb has on the system performance.

Curbs placed in front of guardrails shall be no higher than 100mm on roads with a design speed of 80 km/h or greater, including 15.0m upstream of the guardrail. The shape of the curb should be slope faced however a straight face may be used for constructability reasons for retrofits.

Barrier curbs up to 180mm in height is acceptable for use with ABB.

Placing the face of rail slightly behind the curb is critical to ensure that:

- The vehicles bumper trajectory which is influenced by the primary curb impact does not affect the performance of the guardrail.
- Placing the guardrail further back could lead to snow build up which could result in overriding of the guardrail.
- Placing the curb slightly behind the face will reduce accidental impacts from larger vehicles and snow clearing operations.
- Placing the guardrail further from the curb but less than 4.0m away could result in the under riding or over riding the guardrail.

Figure 5.10 – Guardrail installation on Lagimodiere Boulevard demonstrates the use of 100mm curb and W-beam guardrail installation

Curbing and Crash Attenuators

Curb shall be 100mm tall directly adjacent and 15.0m in front of the nose of the crash attenuator is the crash attenuator is less than 4.0 from the curb. In downtown areas where space is limited, crash cushions may be adjacent to sidewalk; therefore the sidewalk grades must take precedence over accommodating the shorter curb height.

DRAFT

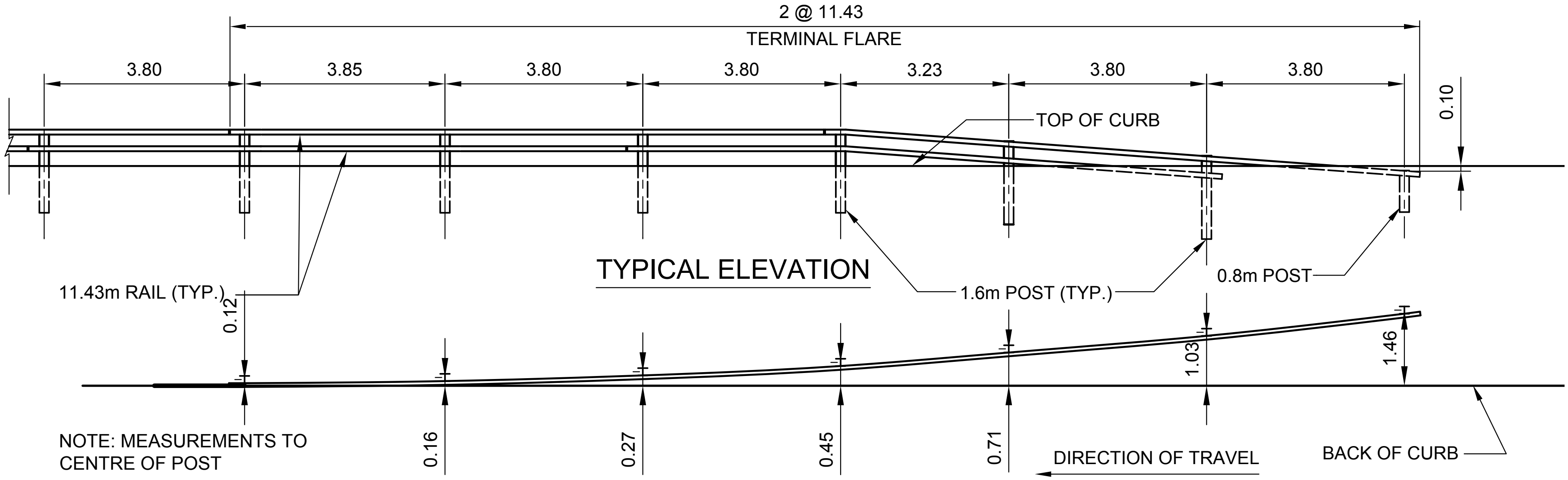
Section 5A – Standard Drawings for Roadside Safety

Table 5A.1 lists the standard drawings that are to accompany this document.

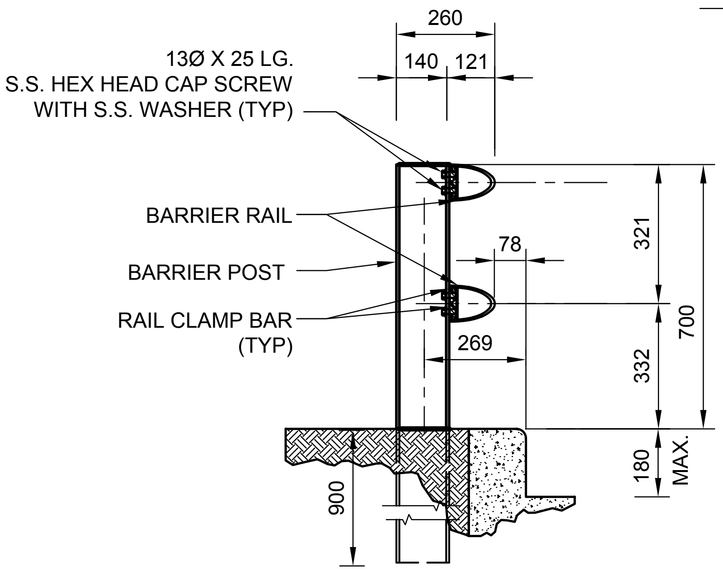
Table 5A.1 – List of Standard Drawings for Roadside Safety

Drawing Number	Title
TS-RS-01	Aluminum Balanced Barrier Details
TS-RS-02	W-Beam Guardrail Details
TS-RS-03	Rigid Barrier Accepted Types
TS-RS-04a &TS-RS-04b	Crash Cushion Details
TS-RS-05	Sand Barrel Cushion Details
TS-RS-06	Safety Curb – Alternative Length of Need Calculation

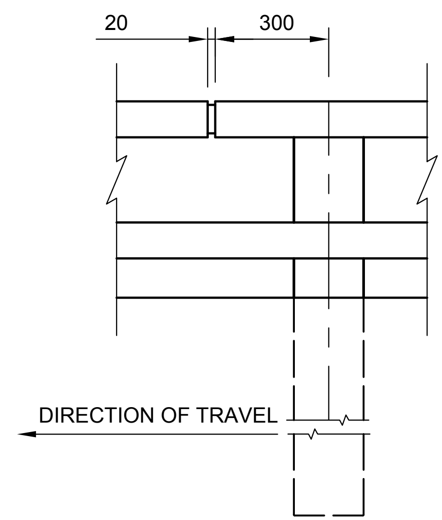
DRAFT



TERMINAL FLARE (TYPICAL)



RAIL TO POST ASSEMBLY DETAIL



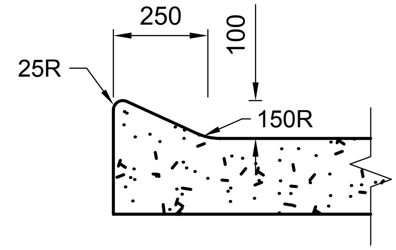
SPLICE DETAIL

DRAFT

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

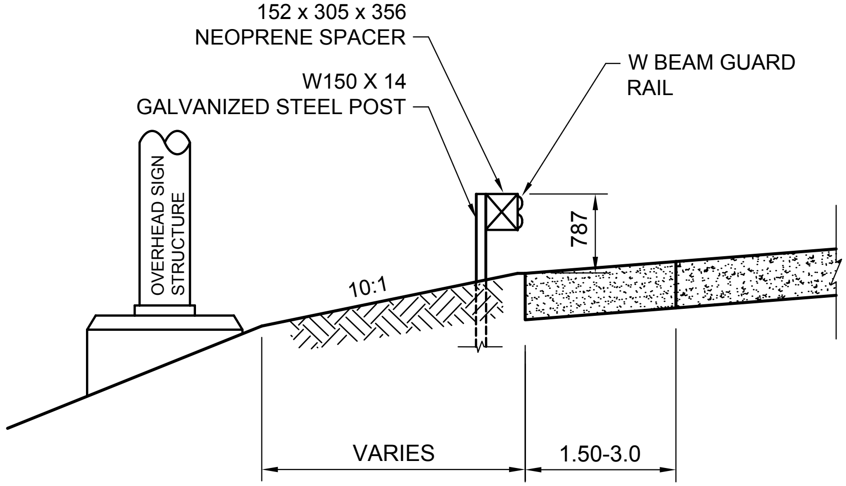
ALUMINUM BALANCED BARRIER
DETAILS

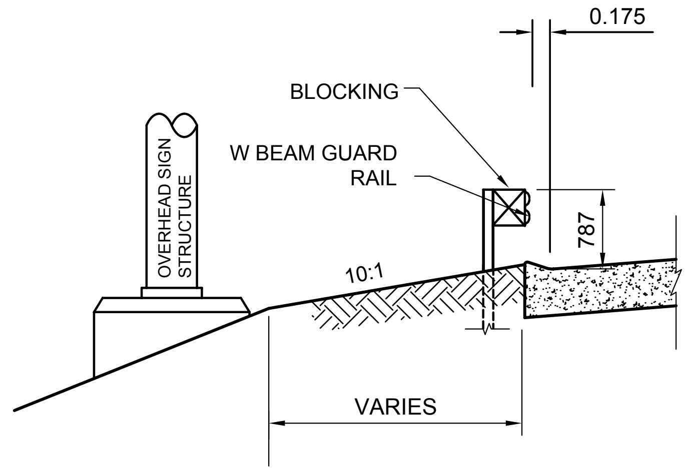
DRAWN BY: MP
DATE: 2012-07-09
SCALE: N.T.S.
APPROVED BY:
DATE
DRAWING NO. TS-RS-01



CURB DETAIL

N.T.S.





GUARDRAIL SECTION WITH SHOULDER

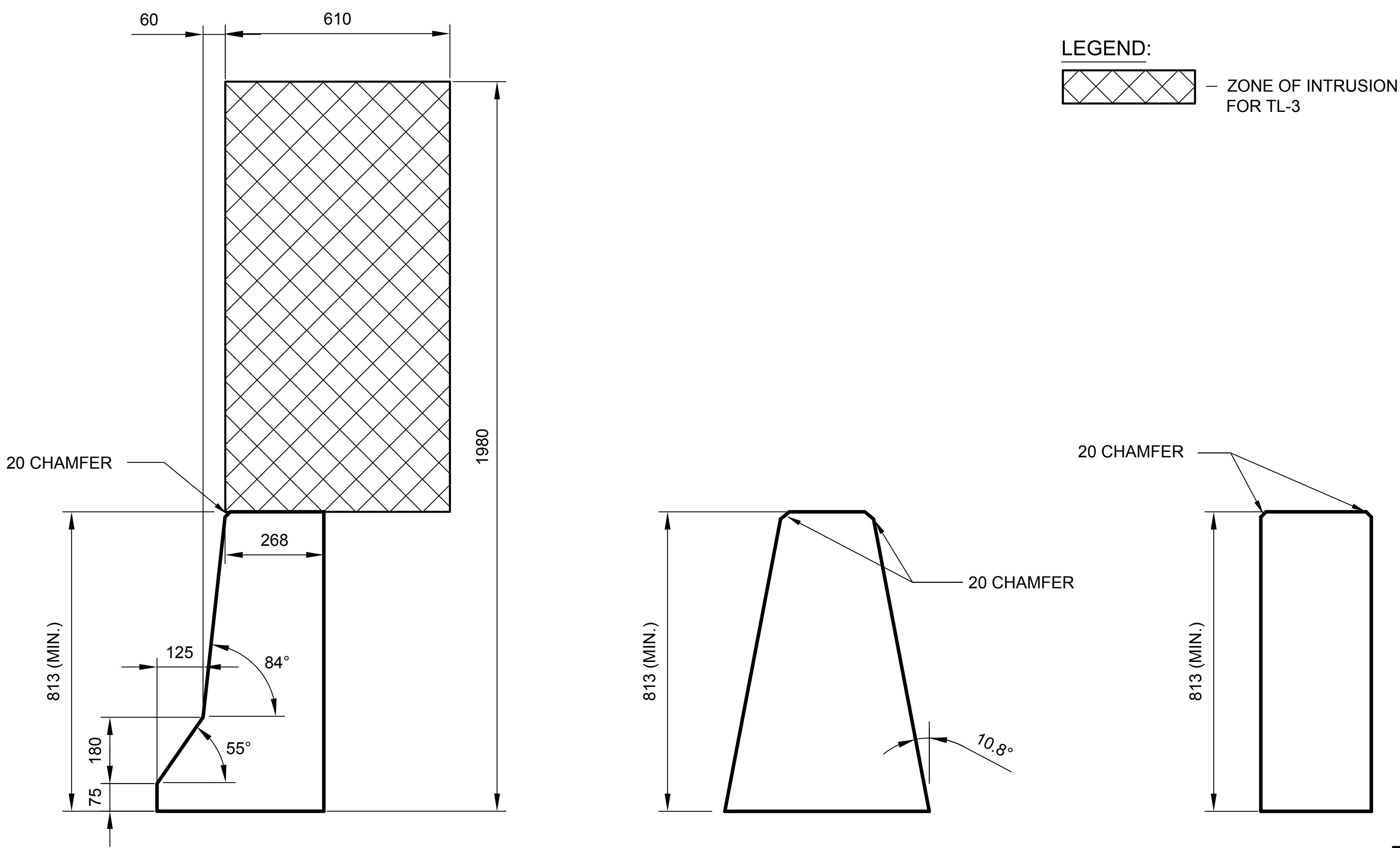
1:75

GUARDRAIL SECTION WITH CURB

1:75

DRAFT

Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	W-BEAM GUARDRAIL DETAILS (MIDWEST GUARDRAIL SYSTEM)	
DRAWN BY: M.P. DATE: 2012–07–16	SCALE: 1: 75	APPROVED BY: DATE	DRAWING NO. TS-RS-02

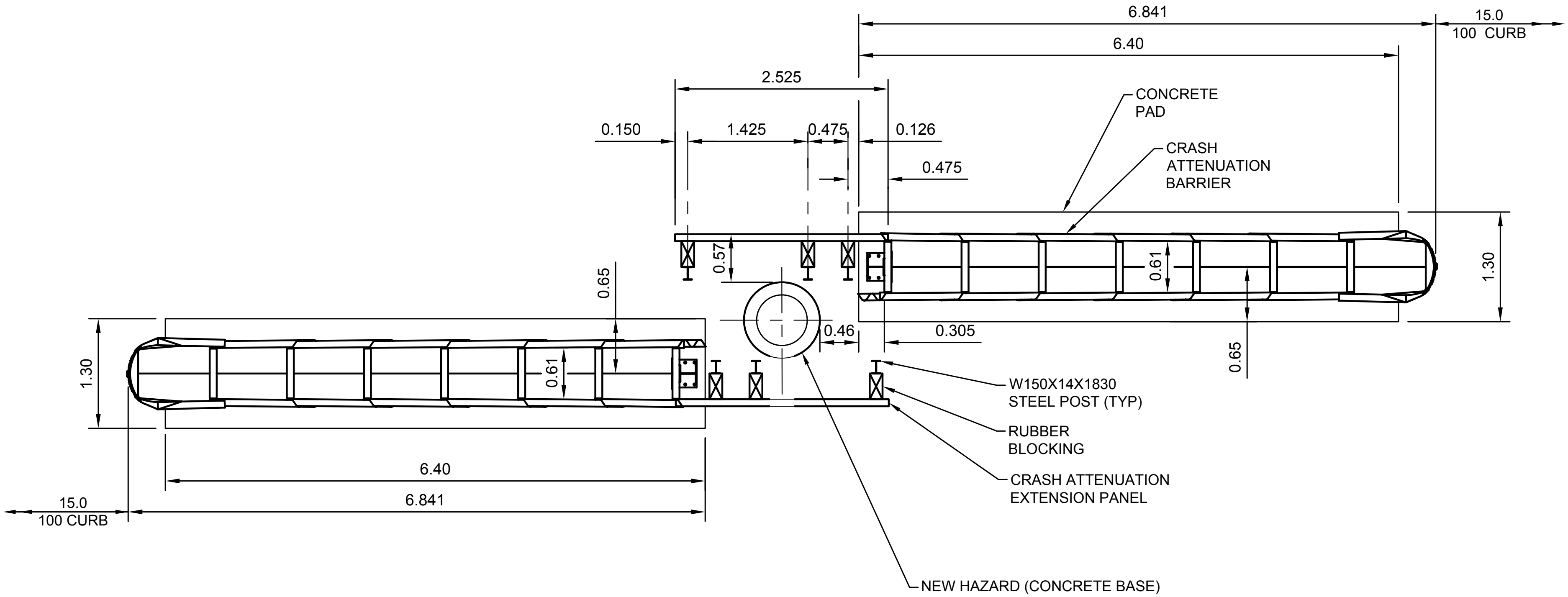


DRAFT

F-SHAPE | SINGLE SLOPED | STRAIGHT FACED

THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	RIGID BARRIER ACCEPTED SHAPES	
DRAWN BY: M.P. DATE: 2012-07-16	SCALE: 1:16	APPROVED BY: DATE

DRAWING NO. TS-RS-03



BI-DIRECTIONAL CRASH CUSHION LAYOUT

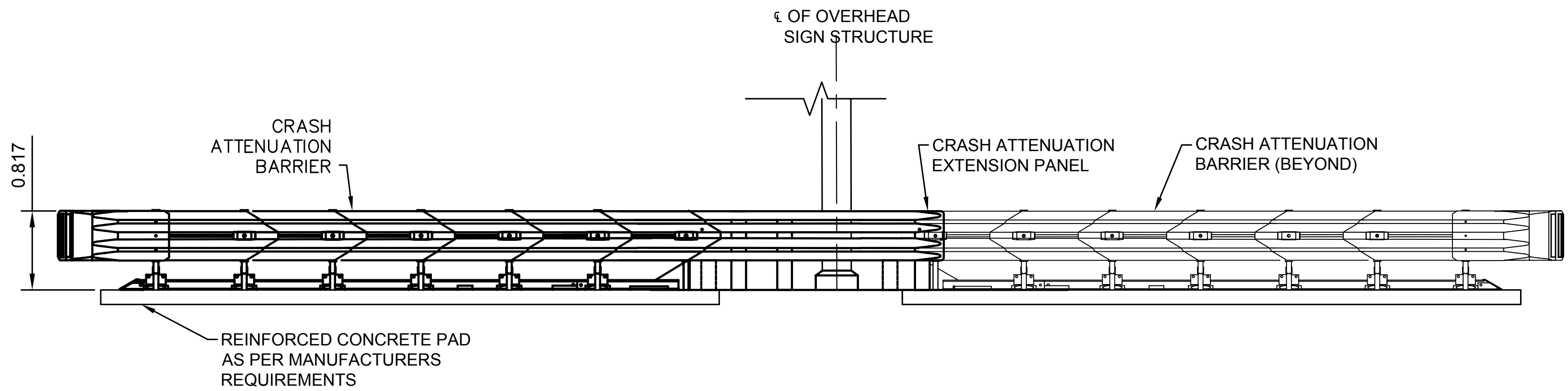
1:75

NOTES:

1. EXAMPLE CRASH ATTENUATION BARRIER. LENGTH SHOWN IS FOR DESIGN SPEED OF 90 km/h. LENGTH TO BE CHOSEN BASED ON APPROPRIATE DESIGN SPEED AS PER MANUFACTURERS DOCUMENTATION
2. CURB TO BE 100 mm HEIGHT. ADJACENT TO CRASH CUSHION AND EXTENSION PANEL.

DRAFT

Winnipeg THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	CRASH CUSHION DETAILS	
DRAWN BY: M.P. DATE: 2012–07–16 / SCALE: 1:75	APPROVED BY: DATE	DRAWING NO. TS-RS-04a

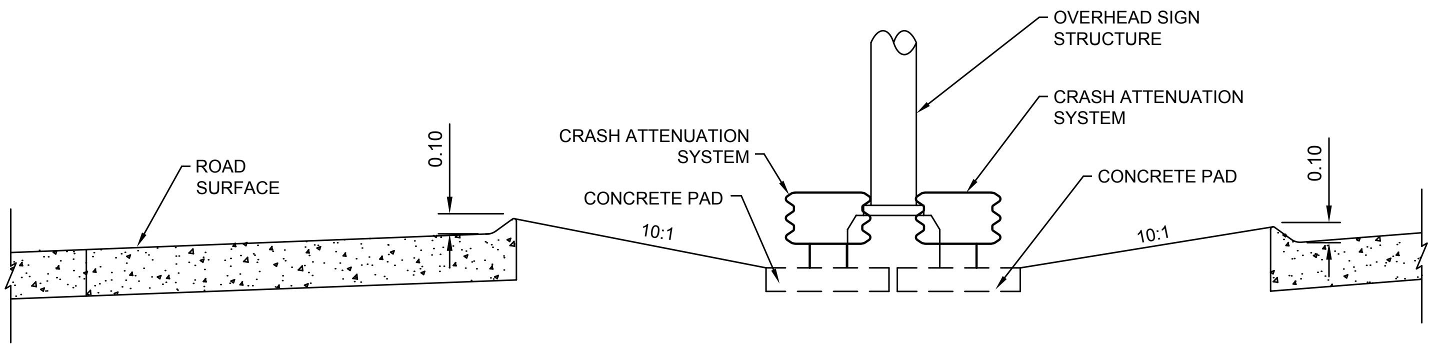


CRASH CUSHION ELEVATION

1:75

NOTES:

1. EXAMPLE CRASH ATTENUATION BARRIER. LENGTH SHOWN IS FOR DESIGN SPEED OF 90 km/h. LENGTH TO BE CHOSEN BASED ON APPROPRIATE DESIGN SPEED AS PER MANUFACTURERS DOCUMENTATION
2. CURB TO BE 100mm HEIGHT. ADJACENT TO CRASH CUSHION AND EXTENSION PANEL.

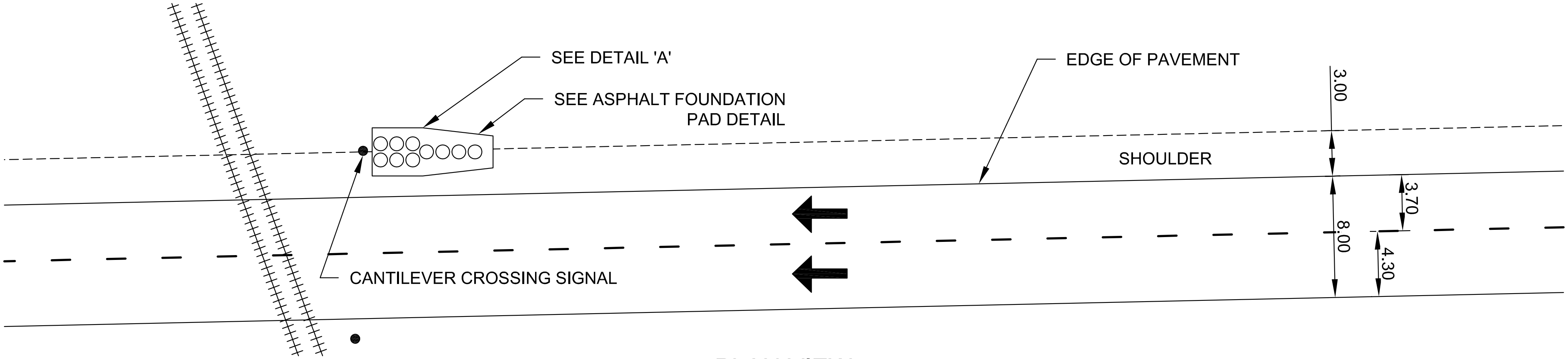


CRASH CUSHION CROSS SECTION

1:75

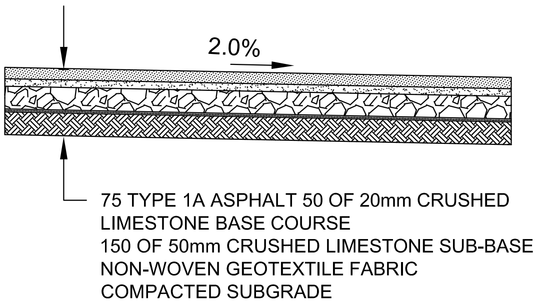
DRAFT

THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	CRASH CUSHION DETAILS	
DRAWN BY: M.P. DATE: 2012-07-16 / SCALE: 1:75	APPROVED BY: / DATE	DRAWING NO. TS-RS-04b



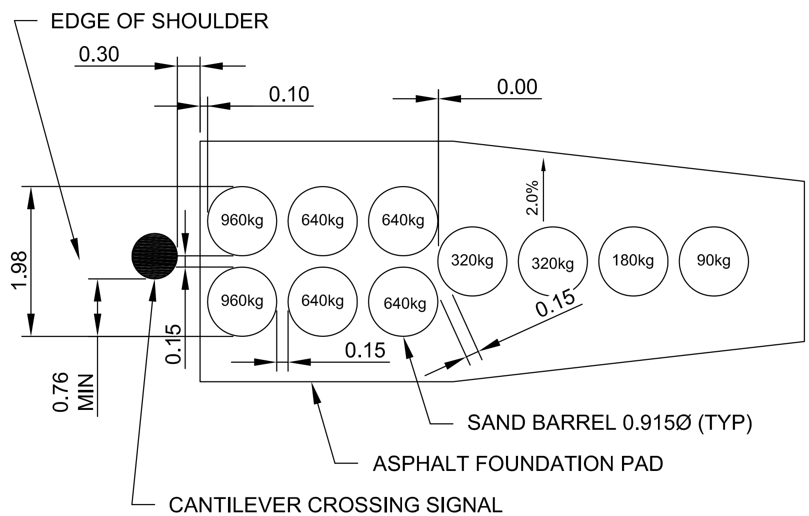
PLAN VIEW

1:400



ASPHALT FOUNDATION PAD DETAIL (TYP)

1:50



DETAIL 'A'

1:100

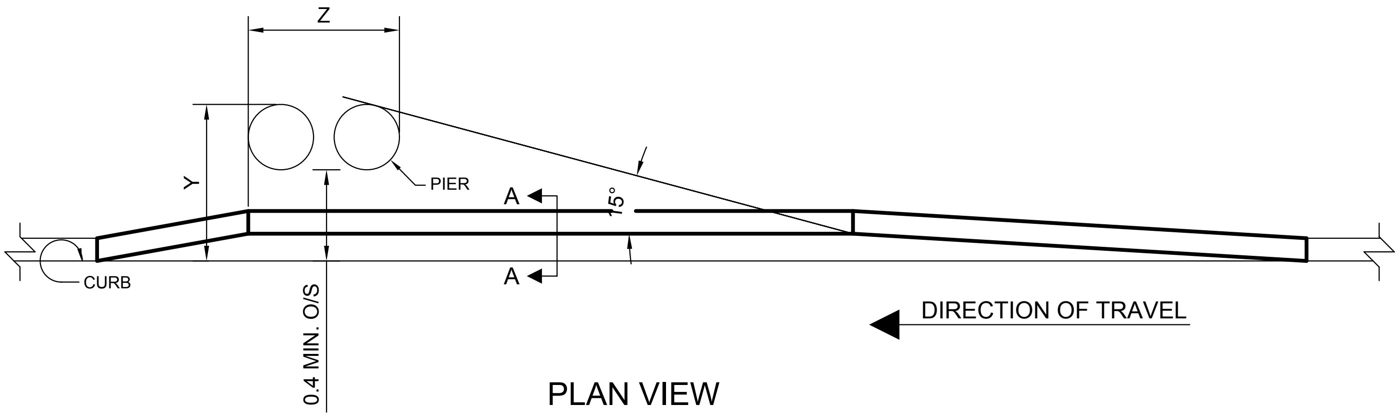
DRAFT

NOTES:

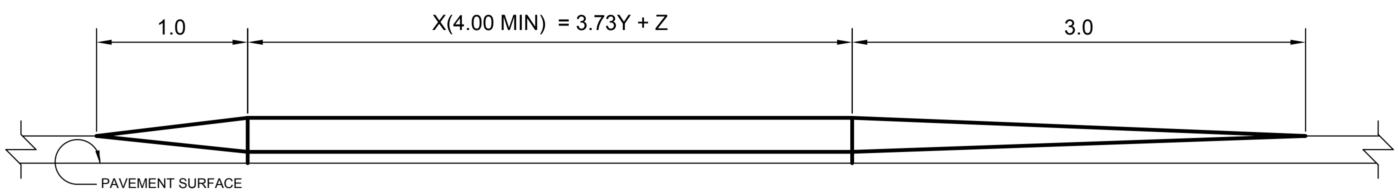
1. ARRAY EXAMPLE GIVEN IS FOR DESIGN SPEED OF 80km/h. ARRAY TO BE CONFIGURED FOR THE APPROPRIATE DESIGN SPEED AS PER THE MANUFACTURER'S DOCUMENTATION.
2. THE SAND MASS SHALL BE CLEARLY MARKED ON EACH BARREL

Winnipeg — THE CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT TRANSPORTATION DIVISION	SAND BARREL CUSHION DETAILS	
DRAWN BY: M.P. DATE: 2012–07–16	SCALE: AS NOTED	APPROVED BY: DATE

DRAWING NO. TS-RS-05



PLAN VIEW



FRONT ELEVATION

NOTE:
`` REFER TO SD-206B FOR ADDITIONAL INFORMATION

DRAFT

Winnipeg

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
TRANSPORTATION DIVISION

SAFETY CURB BARRIER

DRAWN BY: LWB
DATE: 2012–08–21
SCALE: N.T.S.
APPROVED BY:
DATE
DRAWING NO. TS-RS-06