



ROAD DESIGN Standards & Guidelines

Detail Design Development

Responsibility:

Designer Manager, Designer

Scope:

The purpose of this document is to provide the Designer with details on good design technique that must be considered when undertaking Geometric Design.

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Model Naming

A “model” is a collection of strings used to separate and store data. Each model has a unique name that represents the information it contains, for example strings defining an existing terrain surface or a design surface.

A “Project Model” is a collection of models used to define the road project. The project model is output in “MX GENIO” format for use in other modelling systems. In a project model, all strings and models are named using the standard convention.

The names of **models** shall be as follows:

Proposed name	Comments
Survey Model	All survey string used to form the surveyed surface
Xsurvey	Extra strings not used in triangulation
BDY Model	Surveyed boundary
Services Model	Surveyed services
Services Depth	The depth of a services
Bridge	Surveyed bridge
Design Final	All design strings used to form the design surface
Design Control	All control strings (MC, GC, MA, GA, MK, GK)
Design Extra	Extra design strings not used for the final surface. Shall include a boundary string around the design model used to exclude any triangles.
Design Drain	All drainage strings
Design Setout	All 'X' and 'P' strings used for setout
Design Services	All strings representing proposed service location.
Tria Survey	Survey triangulation
Tria Design	Design triangulation
Cont Survey	Survey Contours
Cont Design	Design Contours
Xsect XXXX	Cross sections relative to control string XXXX
Lsect XXXX	Longitudinal sections relative to control string XXXX

1. String Naming

Refer to DP001 and the layer matrix for string details and Appendix 1 for typical sections.

2. Project set out requirements

Projects shall be set out either by surveyors using coordinated point information, or by the use of a tape measure to locate features from dimensions shown on the drawings.

Generally, on small projects which do not involve changes to existing levels and the new features involve simple geometry, set out by dimensions is acceptable, otherwise set out by co-ordinates will be required.

There are different requirements depending upon which set out method is to be employed.

2.1 Set out by Dimensions

Sufficient dimensions and notes shall be provided on the drawings to allow all features to be fully located from these dimensions and notes alone.

Each of the dimensions shall be referenced from two existing features so that every item can still be located in the event that one of these features is destroyed or moved.

2.2 Set out by Co-ordinates

2.2.1 Control Strings

The geometric reference string "MC-Alignment Control 6D" may represent the centreline or any other convenient features eg. Median edge or gutter lip. "MC-Alignment Control 6D" shall incorporate the horizontal and vertical tangent points and points at 10m chainage intervals. Other control strings are "MA-Carriageway Control 6D" and "MK-Other Control 6D".

Additional strings are required to be designed over Control Strings. The additional strings are included in the 'Design Final Model' to complete the surface.

2.2.2 Master Strings

A master string is used to represent the bitumen edge around wings "MR-Bitumen edge – Wing 6D" and traffic islands "MT-Bitumen edge-Island 6D". An additional string designed over the MR and MT is not required.

Master strings may also be used to define complex linemarking:

Continuous lines should be designed as MU strings "MAST-MU-Linemarking (Continuous) 6D"

Turn lines should be designed as MV strings "MAST-MU-Linemarking (Turn Line) 6D"

Curved control and master strings, used to represent features such as wings, islands and line marking, shall have the following point intervals.

- Less than 30m radius shall have point interval of 3m
- 30m-100m radius shall have point interval of 5m

More than 100m shall have a point interval of 10m

2.2.3 Feature Lines

Feature strings are used to define the geometric shape of a road. The feature strings are three-dimensional (X, Y, Z) and shall be referenced to a six-dimensional control string where possible by use of horizontal and vertical offsets. Ensure that points line up.

Feature strings shall be no more than 5m apart and where possible these strings shall be located on lane lines or centrally within the carriageway. Extra points shall be included on the reference string at start and end of tapers.

It is good practice to use a string label convention. This involves using a consistent 3rd character to group strings to a reference string. Eg. CE10, CE11 reference MC10

2.2.4 Traffic Islands

Traffic islands are represented by "MT – Bitumen edge – island 6D". A separate string shall be created for each portion of the island created by the ramp cut outs.

2.2.5 Line Marking

Final surface levels shall be provided on all line marking strings for projects that involve new pavement.

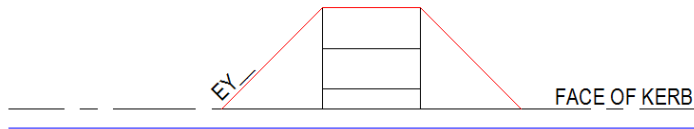
2.2.6 Pavement boundaries

Pavement boundaries strings 'SB' are created around the pavement areas as follows:

- Up to Lip of Gutter.
- Where no gutter - up to Face of Kerb.
- Where no kerbing exists - to 0.5 metre beyond the edge-line.
- Pavement boundaries are broken at sheet matchlines.

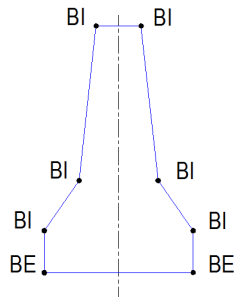
2.2.7 Pedestrian and cyclist kerb ramps

Kerb ramps are represented by "EY – Pedestrian Ramp". A separate string shall be created for each ramp. The string will represent the outside edge of the ramp. Points shall have null levels. Refer to S-4074 sheet 6 for ramp types.



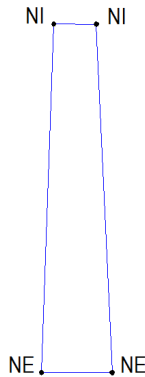
2.2.8 Barriers

Concrete barriers are represented by "BE – Concrete barrier edge and BI – Concrete barrier intermediate". The 'BE' strings are used to show the outside edges of the concrete barrier. The shape of the barrier is represented by 'BI' strings.



2.2.9 Noise walls

Noise walls are represented by "NE - Noise wall edge and NI – Noise wall intermediate". The 'NE' sting is used to show the edge of the noise wall. The shape of the noise wall is represented by 'NI' strings.



2.2.10 Cross sections

The Cross section interval used for construction drawings may vary depending on the scope of the project. Typically urban roads will have sections at 10m intervals and rural roads at 20m intervals.

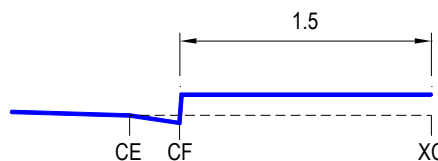
2.2.11 Set out strings

Additional set out strings are required to aid in the construction of the project. These strings are used to locate and orientate features such as light poles and drainage pits.

XC – Kerb Line Offset

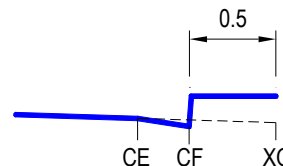
On projects involving kerbing, an offset string shall be provided 1.5 meters behind the face of kerb (not including medians).

This string shall be created by projecting a normal from the reference string through every point on the gutter lip string. The level shall be the same as the gutter lip string.



XO – Kerb Base Extent

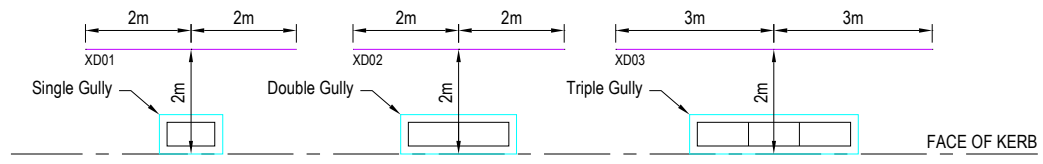
Shall be provided for any geometric design **which requires new pavement**, and are required at 0.5m behind face of kerbs (for boxing out). Extended crossfall of the adjacent pavement shall be applied (ie ignoring gutter invert)



Wing construction strings shall be kept separate from through construction strings, run in the same direction as the wing master and the point numbers shall 'line up'.

XD – Drainage pit orientation

A two point string shall be created for each gully, these points shall be located 2 metres behind the face of kerb, and 2 metres left and right of the centre of the gully (3 metres for a triple gully). Points shall have null levels.

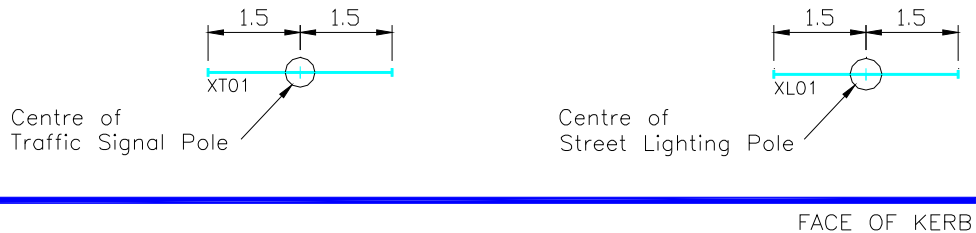


XL - Light pole orientation

A two point string shall be created for each post, these points shall be located through the centre of the post, and 1.5 metres left and right of the centre of the pole. The XL string is to be perpendicular to the light pole outreach. Points shall have null levels.

XT – Traffic Signal pole orientation

A two point string shall be created for each post, these points shall be located through the centre of the post, and 1.5 metres left and right of the centre of the pole. Points shall have null levels.

**PLIG – Lighting pole**

A three dimensional point string shall be provided with each point on that string representing the centre of each light pole. Levels on this string shall represent the finished surface level (i.e. the base of the pole).

PPIT – Drainage structures

A three dimensional point string shall be provided with each point on that string representing the reference point of the drainage structure (refer to standard drawings for reference point location). Levels on this string shall represent the finished surface level.

PRAM – Ramp and Island/median Cutouts

A three dimensional point string shall be provided with each point on that string representing the centre of each ramp/cutout at the face of kerb. Points shall have null levels.

PTSP – Signal pole

A three dimensional point string shall be provided with each point on that string representing the centre of each Traffic Signal pole. Levels on this string shall represent the finished surface level (i.e. the base of the pole)

XS – Full Depth Pavement Extents

For projects that include a sealed shoulder, an 'XS' string shall be used to represent the extent of full depth pavement.

NJ – Saw cut

For projects involving the extension of pavement, an 'NJ' string shall be used to represent the location to cut the existing pavement to form the new joint. The 'NJ' string is usually located 0.5m from the existing pavement edge and shall contain pips that line up with the reference string. Levels on this string are to be existing surface.

DI – Pipe Invert or DB – Box Culvert Invert

For projects involving drainage pipes, a 'DI' or 'DB' string shall be used to represent the invert of the pipe or box culvert. Points shall have null levels. This string is used in the Drainage schedules for setting out purposes.

3. Design outputs

An electronic copy of the complete Project Model, including the survey and geometric design data, is to be supplied at the completion of the design project. The departmental standard for the provision of digital Project Model data is in the MX GENIO format.

The following design outputs are required.

- Sketch drawings
- Design Report
- Design output for estimates
- Land acquisition sketches
- Design model check
- Design to survey compliance checklist
- Project models in MX Genio format
- Design DTM
- Geometric Report
- Cross section Report
- Presentation Review checklist
- Drawings for approval
- Approved Drawings and Drawing details spreadsheet

4.1 Sketches

Sketch drawings are required during the design process. A sketch drawing may be used to show specific detail requested by the project manager. The sketch title block is available from the DPTI standard block library.

4.2 Design Report

A Design Report shall document the standards used for a project, and include any non conforming design elements. Refer to Road Design Technical Standards and Guidelines for the Design Report Template.

4.3 Design output for estimates

Refer to Road Design Technical Standards and Guidelines for process. The “Design output for estimates” may not be required on all projects

4.4 Land acquisition sketches

Refer to Road Design Technical Standards and Guidelines for process. A land acquisition sketch may not be required on all projects.

4.5 Design model check

Use MX Surface checker tool to review the design model for the following items:

- Null levels
- Zero levels
- Single point strings
- Coincident Points
- Intersection Points

Fix any issues and print the output in pdf format as a record of conducting the review. The file shall be called Surface Checker.pdf

4.6 Design to Survey compliance checklist

Refer to Road Design Technical Standards and Guidelines for the “Design to Survey Compliance checklist”. Complete the form and print in pdf format.

4.7 MX Genio

Output the following Design models in MX GENIO format:

- Design Final
- Design Control
- Design Extra
- Design Setout
- Design Drain
- Design Services

The input file Georep.inp has been supplied to assist in creating the MX GENIO output. The output file shall be named GENIO_DESIGN_AMD_0.TXT

4.8 Design DTM

Output the "Design Final" model in 3D dwg format.

The input file xr-design surface.inp has been supplied to assist in creating the 3D surface drawing. The file will triangulate the Design surface and create a drawing to be exported. The 3D version of the drawing is required as the design output.

4.9 Geometric report

Refer to Road Design Technical Standards and Guidelines for "Reporting of geometric details".

A Geometric report shall also be supplied with the Project Model. The Designer shall ensure that the GENIO, Geometric report is created from the same version of the Design. The output file shall be named GEOMETRIC_REPORT_DESIGN_AMD_0.DOC

4.10 Cross section report.doc

Refer to Road Design Technical Standards and Guidelines for "Reporting of geometric details".

A Cross section report shall also be supplied with the Project Model. The Designer shall ensure that the GENIO, Cross section report is created from the same version of the Design. The output file shall be named CROSS_SECTION_REPORT_DESIGN_AMD_0.DOC

4.11 Presentation Review checklist

The Designer shall review the drawings and complete the checklist prior to sending plans for approval. Refer to Road Design Technical Standards and Guidelines for "Presentation Review Checklist".

4.12 Drawings for approval

Refer to DP001 section 21.1 for details on the requirements for drawings During the course of the project.

4.13 Approved Drawings (DWG DWFx and Drawing Details Spreadsheet)

Refer to DP001 section 21.2 for details on the requirements for drawings During the course of the project.

D BDGE

- BA Bridge Abutments
- BB Bridge Deck
- BP Bridge Piers

D BUIL

- WB Retaining wall Bottom
- WT Retaining wall Top

D CWAY

- CB Kerb Back
- CE Outside Bitumen Edge
- CF Gutter Invert
- CI Inside Bitumen Edge
- CM US Traffic Lane Edge
- CT Kerb Top
- EI Inside US Shoulder Edge
- ES Outside US Shoulder Edge
- LC Control Line Level
- NL Intermediate Level

D VERG

- EH Outside Verge Edge
- EV Inside Verge Edge
- EW Front of Footpath
- EX Back of Footpath
- EY Pedestrian Ramp
- WD Driveway Edge

D EWKS

- IA Ground Interface
- IB Bench Back Edge
- IC Bench Front Edge
- ID Table Drain Front Edge
- IE Table Drain Back Edge
- IF V Drain Invert
- IL Intermediate Level
- IM Mound Front Edge
- IN Mound Back Edge
- R Rounding -Top of Cutting
- SS Slope Signature

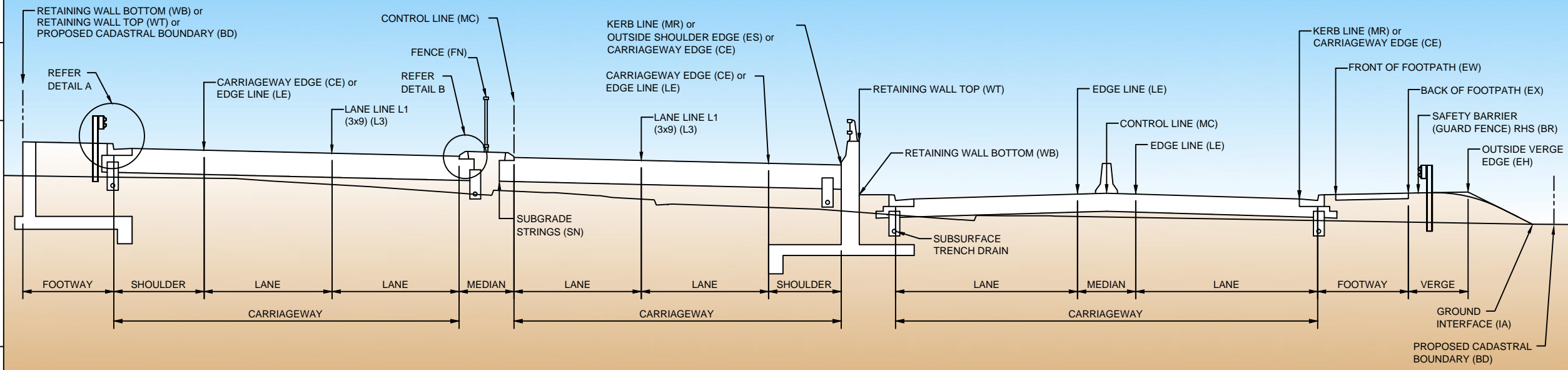
D FURN

- BL W Beam (LHS)
- BR W Beam (RHS)
- BS WRSF
- BE Concrete Barrier Edge
- BI Concrete Barrier Intermediate
- FN Pedestrian Fence
- NE Noise Wall Edge
- NI Noise Wall Intermediate

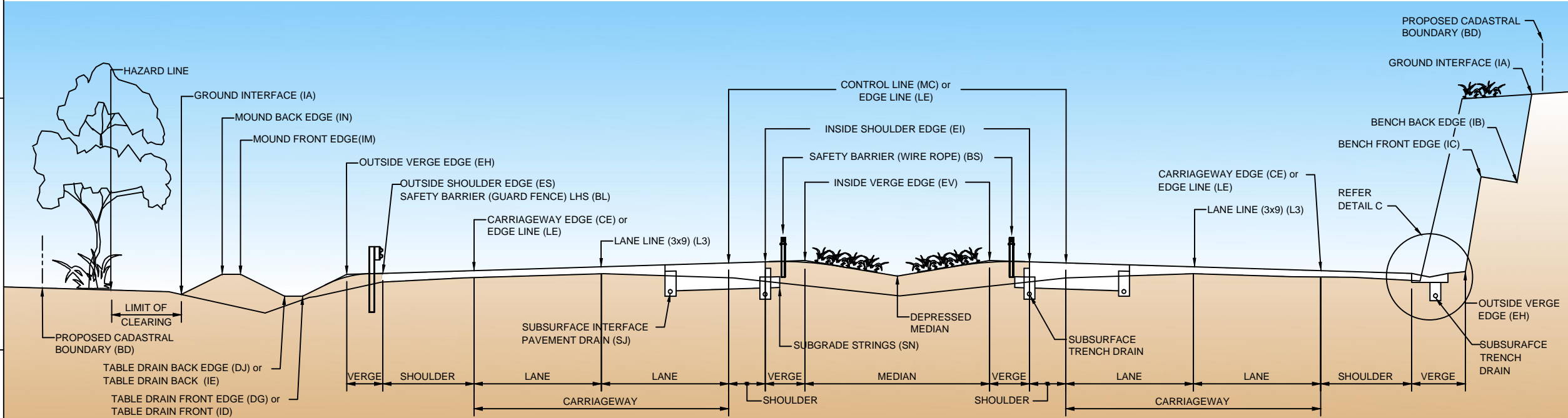
D LNMK

- L3 Lane Line (broken 3x9)
- LA Continuity Line (standard 1x3)
- LD Barrier Line (both directions)
- LE Edge Line (broken 23x1)
- LH4 Holding Line (below 80kph)
- LH6 Holding Line (80kph or above)
- LL Barrier Line (one direction) LHS
- LO Outline (continuous)
- LP Pedestrian Crossing (0.6x0.3)
- LR Barrier Line (one direction) RHS
- LS4 Stop Line (below 80kph)
- LS6 Stop Line (80kph or above)
- LT Turn Line (0.6x0.6)
- LU Dividing Line (continuous)

NOTE : TYPICAL SECTIONS SHOWN ARE DIAGRAMMATIC ONLY.
FOR DESIGN STANDARDS, REFER TO DTEI'S ROAD DESIGN GUIDE



URBAN EXAMPLE WITH SERVICE ROAD



RURAL EXAMPLE

D DRAI

- DI Pipe or BC Invert
- DT Pipe or BC Top
- HA Headwall Apron
- HT Headwall Top

D BDYS

- BD Property Boundary

D MAST

- GA Carriageway Control Geometry
- GC Alignment Control Geometry
- GK Other Control Geometry
- GR Wing Control Geometry
- GT Island Control Geometry
- GU Line Marking Control Geometry
- MA Carriageway Control 6D
- MC Alignment Control 6D
- MK Other Control 6D
- MR Wing Control 6D
- MT Island Control 6D
- MU Line Marking Control 6D

D CONT

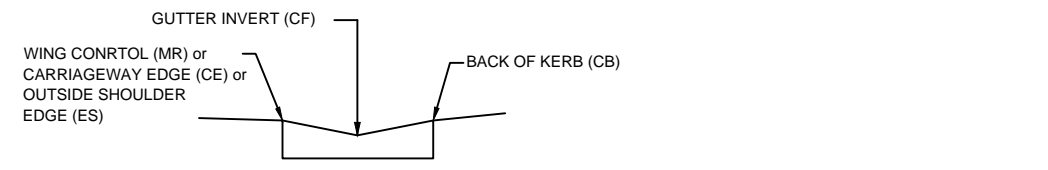
- 1 Major Design Contour
- D Minor Design Contour

D PAVT

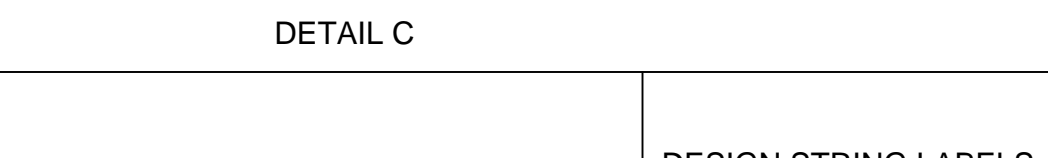
- NJ New Joint on existing
- SB Pavement Boundary
- SN Subgrade strings



DETAIL A



DETAIL B



DETAIL C

DESIGN STRING LABELS