# Road Design

## Geometric Model Details

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DEPARTMENT FOR INFRASTRUCTURE AND TRANSPORT

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# Document Management

# Contents

Road Design 1
1. Geometric Models 5
1.1 Introduction 5
1.2 String Naming 5
2 Project Setout by Dimensions 6
2.1 Introduction 6
2.2 Detail 6
3 Project Setout by Coordinates 7
3.1 Control Strings 7
3.2 Master Strings 7
3.3 Feature Lines 7
3.4 Set-out Strings 8
4 Design Deliverables 11
4.1 General 11
4.2 Design Model Format 11
4.3 Design Model Description 11
4.4 Estimate Drawing 12
4.5 Sketch Drawing 12
4.6 Design Report 12
4.7 Land Acquisition Sketches 12
4.8 Design to Survey Compliance Checklist 12
4.9 Drawings for Approval IFA 12
4.10 Approved Drawings IFC 12
5 Appendix 1 – Design String Labels 13

# 1. Geometric Models

## 1.1 Introduction

1.1.1 The ‘Geometric Model’ is a collection of design models used to store unique information about the design and define the road project.

1.1.2 The ‘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.

1.1.3 The ‘Geometric Model’ is output for a design package in a format that can be used by other modelling systems and set out by Surveyor to assist in the construction of the project.

1.1.4 The ‘Geometric Model’ shall include the following design models as a minimum:

| Model Name | Description |
|---|---|
| Design Final | All design strings used for the final design surface |
| Design Control | All control strings |
| Design Extra | Extra design strings not used for the final surface |
| Design Setout | All ‘X’ and ‘P’ strings used for setting out design features |
| TRIA Design | Design triangulation |

1.1.5 The ‘Geometric Model’ may include additional design model where required to store additional geometric information. The model will have a unique name that represents the information it contains.

1.1.6 Example additional model names:

| Model Name | Description |
|---|---|
| Design Drain | All drainage strings |
| Design Services | All strings representing proposed services |
| Cont Design | All design contour stings |
| Xsect XXXX | Cross sections relative to control string XXXX |
| Lsect XXXX | Longitudinal sections relative to control string XXXX |

## 1.2 String Naming

1.2.1 The departments string naming convention is described in the Road Design CAD Layer Matrix along with the corresponding layer name and line type.

1.2.2 In most cases only the first two characters of the string label are relevant for string recognition.

# 2 Project Setout by Dimensions

## 2.1 Introduction

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

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

## 2.2 Detail

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

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

# 3 Project Setout by Coordinates

## 3.1 Control Strings

3.1.1 The geometric reference string “MC-Alignment Control 6D” may represent the centreline or any other convenient features (e.g., 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”.

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

## 3.2 Master Strings

3.2.1 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.

3.2.2 Master strings may also be used to define complex line marking:

3.2.3 Continuous lines should be designed as MU strings “MAST-MU-Linemarking (Continuous) 6D”

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

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

a) Less than 30m radius shall have point interval of 3m

b) 30m-100m radius shall have point interval of 5m

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

## 3.3 Feature Lines

3.3.1 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.

3.3.2 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.

3.3.3 It is good practice to use a string label convention. This involves using a consistent 3rd character to group strings to a reference string (e.g., CE10, CE1I reference MC10).

### Traffic Islands

3.3.4 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.

### Line Marking

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

### Pavement Boundaries

3.3.6 Pavement boundaries strings ‘SB’ are created around the pavement areas as follows:

a) Up to lip of gutter

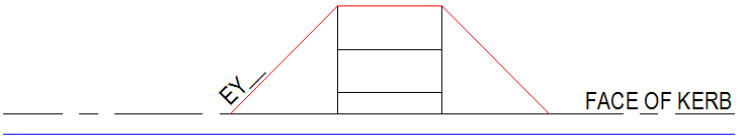
b) Where no gutter - up to face of kerb

c) Where no kerbing exists - to 0.5 metre beyond the edge-line

## Pedestrian and Cyclist Kerb Ramps

3.3.7 Kerb ramps are represented by “EY – Pedestrian Ramp”.

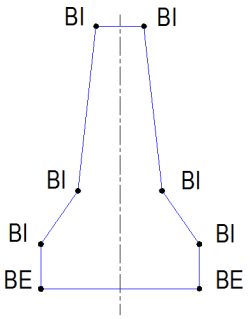
3.3.8 A separate string shall be created for each ramp. The string will represent the outside edge of the ramp. Refer to S-4074 sheet 6 for ramp types.




## Barriers

3.3.9 Concrete barriers are represented by “BE – Concrete barrier edge and BI – Concrete barrier intermediate”.

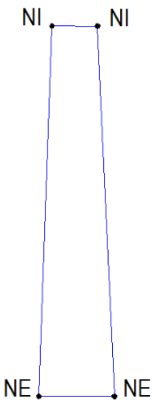
3.3.10 The ‘BE’ strings are used to show the outside edges of the concrete barrier. The shape of the barrier is represented by ‘BI’ strings.




## Noise Walls

3.3.11 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.

3.3.12 The shape of the noise wall is represented by ‘NI’ strings.



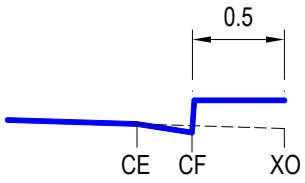

# 3.4 Set-out Strings

3.4.1 Additional set out strings are required to aid in the construction of the project.

3.4.2 These strings are used to locate and orientate features such a light poles and drainage pits.

## XO – Kerb Base Extent

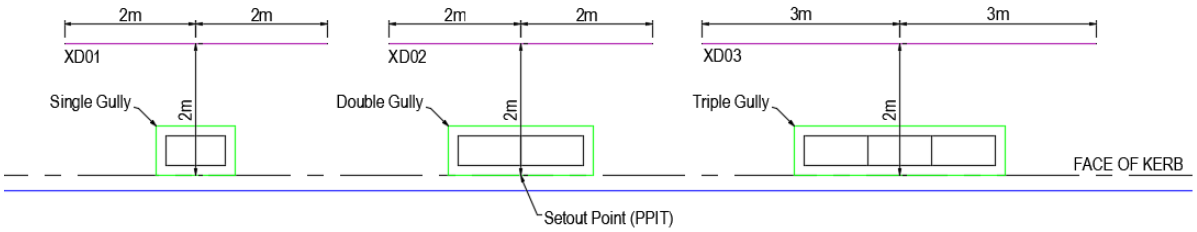
3.4.3 Shall be provided for any geometric design which requires new pavement and are required at 0.5m behind face of kerbs (for boxing out). Extended crossfall of the adjacent pavement shall be applied (i.e., ignoring gutter invert).




3.4.4 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

3.4.5 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.

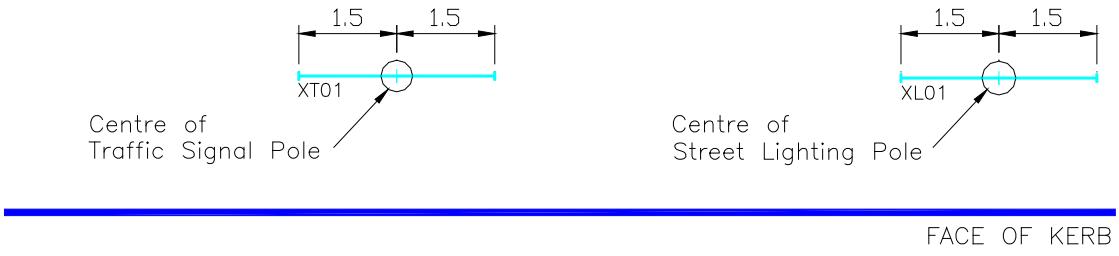



## XL - Light Pole Orientation

3.4.6 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

3.4.7 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.

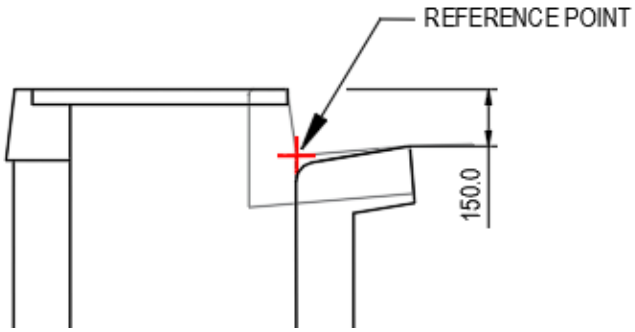


## PLIG – Lighting Pole

3.4.8 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

3.4.9 A three-dimensional point string shall be provided with each point on that string representing the reference point of the drainage structure. X, Y is the centre of pit at the kerb invert. Levels on this string shall represent the finished surface level i.e., gutter invert on design grade.




## PRAM – Ramp and Island / Median Cut outs

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

## PTSP – Signal Pole

3.4.11 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).

## NJ – Saw Cut

3.4.12 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.

## D – Pipe Invert

3.4.13 For projects involving drainage pipes, a ‘D’ string shall be used to represent the invert of the pipe of box culvert. Points shall have null levels.

# 4 Design Deliverables

## 4.1 General

4.1.1 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.

4.1.2 All survey data to be provided as described by Master Specification Part PC-S15.

4.1.3 All design data to be provided in a string-based models. All models shall include sequential strings and point strings. String naming and feature types are listed in the CAD Layer Matrix.

4.1.4 The design data will include a Design DTM that represents the finished design surface.

## 4.2 Design Model Format

4.2.1 Design Models are to be provided in the following formats:

a) AutoCAD 3D DWG (or dxf)

b) Native Design file format i.e., 12da

c) Land XML

4.2.2 Summary of design models outputs

| Model Name | Type | Output | Additional Output |
|---|---|---|---|
| Design Final | String | 3D DWG | 12da |
| Design Control | String | 3D DWG | 12da |
| Design Extra | String | 3D DWG | 12da |
| Design Setout | String | 3D DWG | 12da |
| TRIA Design | TIN | 3D DWG (3D faces) | Land XML |

4.2.3 Separate DWG Files are required for each design model, refer to CAD matrix for layer naming.

4.2.4 Where providing the Design Models in 12D a single 12da file consisting multiple design models is required.

## 4.3 Design Model Description

### Design Final

4.3.1 The Design Final model consists of strings used to create the Triangulated Irregular Network (TIN).

4.3.2 Strings in this model should not contain null levels.

4.3.3 Crossing and intersection strings are not permitted as they cause issued with the triangulation of the design surface.

### Design Control

4.3.4 Design Control model consists of strings that control the horizontal and vertical alignments of the road carriageway. Design control features include MC, MA, MK, etc.

### Design Extra

4.3.5 Design Extra model consists of design features whose heights are not to be used for the creation of the TIN.

### Design Drain

4.3.6 Design Drain consists of design features that represent the drainage design.

### Design Services

4.3.7 Design Services consists of all design strings representing the proposed service location.

### TRIA Design

4.3.8 All Designs shall include a Design DTM. The Design DTM forms the finished design surface.

4.3.9 The model shall consist of 3D faces and be supplied in AutoCAD 3D dwg (or dxf) and/or Land XML format.

4.3.10 The model is to be named TRIA DESIGN.

## 4.4 Estimate Drawing

4.4.1 The Estimate Drawing is to be supplied as described in the DIT requirements for the measurement of earthworks volumes – EST-03, in AutoCAD 3D dwg format with layers as per CAD Matrix.

## 4.5 Sketch Drawing

4.5.1 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 DIT standard block library.

## 4.6 Design Report

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

## 4.7 Land Acquisition Sketches

4.7.1 Refer to Road Design Presentation Guidelines for details.

4.7.2 A land acquisition sketch may not be required for all projects.

## 4.8 Design to Survey Compliance Checklist

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

## 4.9 Drawings for Approval IFA

4.9.1 Refer to Road Design CAD Manual Section 14 for ‘Drawing Transmittal requirements’ during the course of the project.

## 4.10 Approved Drawings IFC

4.10.1 Refer to Road Design CAD Manual Section 14 for ‘Drawing Transmittal requirements’

4.10.2 At project completion the IFC drawings shall be supplied in DWG and PDF and accompanied by the Drawing Details spreadsheet.

# 5 Appendix 1 – Design String Labels

## 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

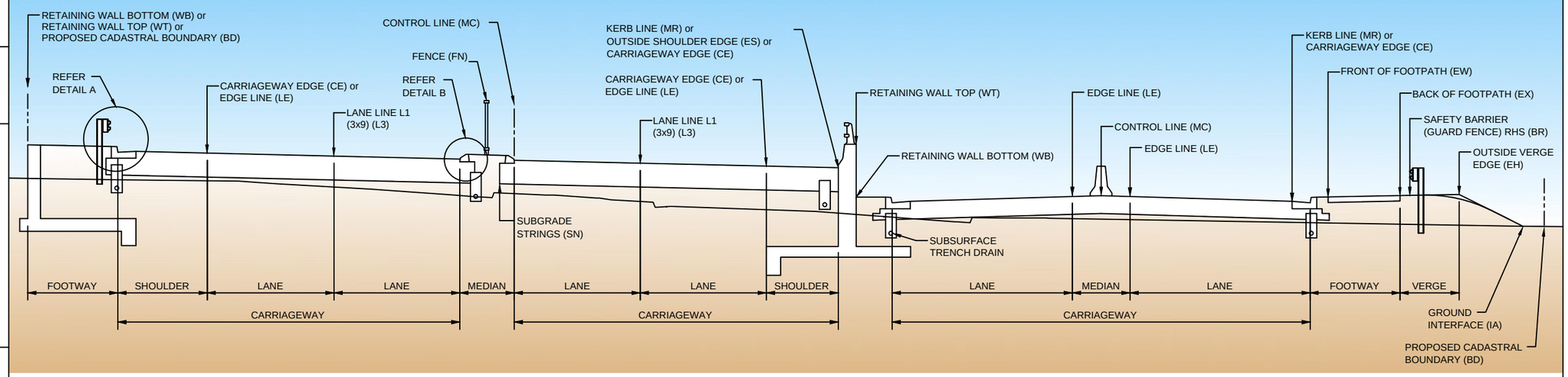
## D VERG
- EH Outside Verge Edge
- EV Inside Verge Edge
- EW Front of Footpath
- EX Back of Footpath
- EY Pedestrian Ramp
- WD Driveway Edge

## 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

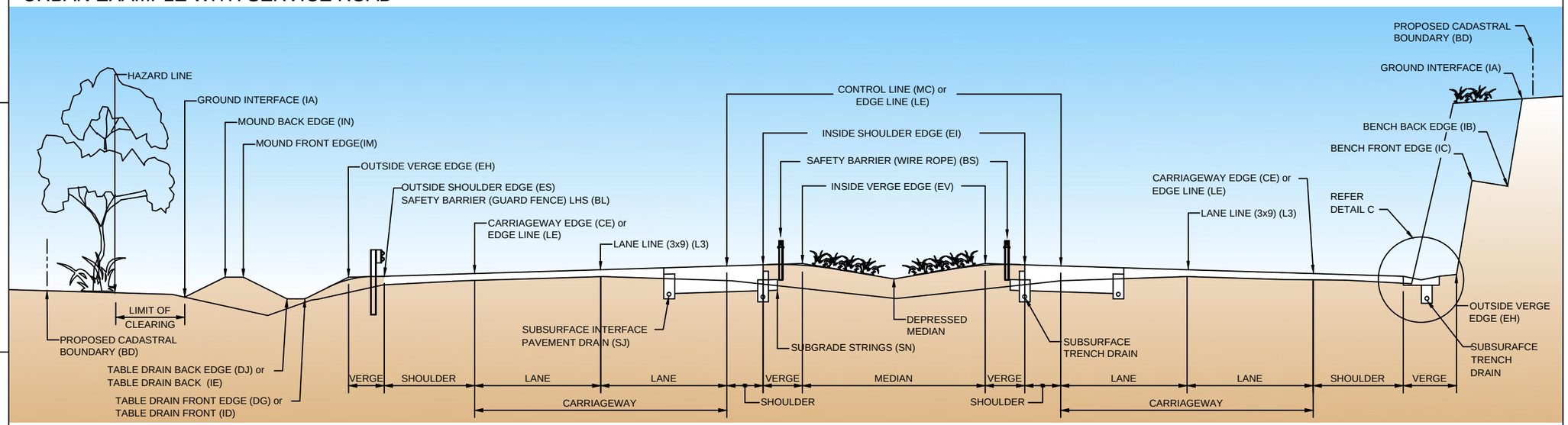
## D FURN
- BL W Beam (LHS)
- BR W Beam (RHS)
- BS WRSF
- BE Concrete Barrier Edge
- BI Concrete Barrier Intermediate
- FN Pedestrian Fence
- NE Noise Wall Edge
- NI Noise Wall Intermediate

## 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

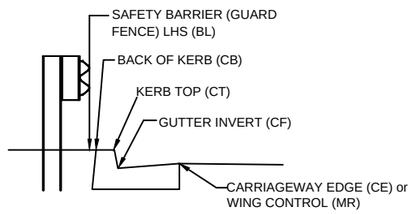
## D DRAI
- DI Pipe or BC Invert
- DT Pipe or BC Top
- HA Headwall Apron
- HT Headwall Top

## D BDYS
- BD Property Boundary

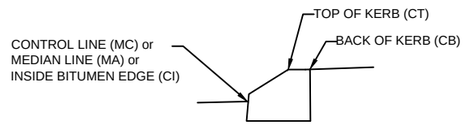
## D MAST
- GA Cariageway Control Geometry
- GC Alignment Control Geometry
- GK Other Control Geometry
- GR Wing Control Geometry
- GT Island Control Geometry
- GU Line Marking Control Geometry
- MA Cariageway Control 6D
- MC Alignment Control 6D
- MK Other Control 6D
- MR Wing Control 6D
- MT Island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

## D CONT
- 1 Major Design Contour
- D Minor Design Contour

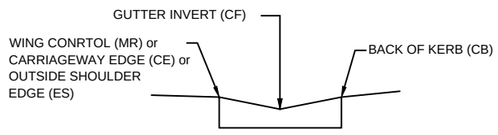
## D PAVT
- NJ New Joint on existing
- SB Pavement Boundary
- SN Subgrade strings




DETAIL A




DETAILB




DETAIL C

# DESIGN STRING LABELS

APPENDIX 1