PART D
LRMS SOFTWARE APPLICATION

6 LRMS SOFTWARE

Overview

The **LRMS Software Applications** is the set of computer systems that are required to use and manage Transit New Zealand's location referencing system. While each system mentioned below has applications outside of location referencing, this chapter focuses only on their use in the context of location referencing.

The primary computer systems used for managing the location referencing system are:

- The Road Assessment and Maintenance Management **(RAMM)** system, which is the central asset register where attribute and location data is stored;
- Highways by Exor **(Highways),** which is the system used to manage changes to the linear network. It is also where the spatial representation of the network resides including historic alignments; and
- The Transit New Zealand System Integration eXchange **(T6),** which is the system that translates data between the above systems and keeps them synchronised.

In addition to the above systems, Transit New Zealand operates a number of other computer systems that utilise location referencing. These include:

- **dTIMS** (Multi-year Programming and Optimisation)
- **LAR** (Limited Access Roads)
- **NOMAD** (Forward Works Programming)
- **TOPS** (Overweight Permits)
- **PROMAN** (Project Management)
- **TMS** (Traffic Monitoring Information System).

This chapter provides **advanced users** of the above systems with a broad overview of how route positions (locations) are managed within the LRMS applications and how dependant systems could be structured to ensure they are maintained in sync with Transit New Zealand's primary referencing system.

In this Chapter

The topics in this chapter are listed below:

6.1 Key Definitions

Introduction

Before describing the role RAMM and Highways by Exor will play in the management of the road network and the associated business processes, it is first worth explaining the key terminology that is being used to describe how Transit New Zealand's road asset is represented in the LRMS software applications.

Network

The term **network** is used to describe the foundation for referencing road inventory. The 'network' defines the highway in terms of both a linear description (series of RS lengths) and a spatial description (centreline in GIS).

Section 6.3, describes how the network is physically represented within Highways.

Inventory

The generic term '**inventory**' is applied to all data held in RAMM/Highways that describes the physical road environment and demands placed upon it, excluding the network elements described above. Inventory can be broken into four components:

- Physical Inventory
- Condition Data
- Demand Data
- Event Data

Physical Inventory: Data held about the physical features along the road (e.g. surface type, drainage, signs, structure).

Condition Data: Condition data held about the road or associated road features (e.g. roughness, texture, rating, strength).

Demand Data: Information held about the physical environment and demands placed on the asset (e.g. traffic volumes, loading, climate, hierarchy, land use, regional administration).

Event Data: Historic information held about events that occur on the asset that are not part of physical inventory (e.g. crash records, routine maintenance).

Inventory Types

Inventory can either be referenced as a linear or point attribute. Inventory stored as single points (e.g. signs, intersections) only have a start displacement. Inventory that is stored as a linear attribute (e.g. surfacing, markings, railings) have both a start and end displacement.

6.2 Role of RAMM/T6/Highways

Introduction

While Transit New Zealand has implemented Highways to manage the location referencing system, it recognised that it must retain its investment in its other legacy systems. To achieve this, clear definitions were required as to the roles of each system and a communication hub was needed to keep these systems synchronised.

The sections below defines the three components of Transit New Zealand's LRMS Software Applications, namely:

- RAMM;
- Highways by Exor; and
- The T6

RAMM

The Road Assessment and Maintenance Management **(RAMM)** system is Transit New Zealand's primary road asset inventory database. It contains routines and procedures for the efficient entry and management of this data and modules such as NOMAD and the Treatment Selection Algorithm for assisting with the management of the highway network. However, in terms of location referencing, the RAMM system will be used to:

- Create and Delete road inventory
- Modify inventory attributes (excluding location unless due to maintenance/improvements)

Highways by Exor

Highways by Exor, is a road management system that Transit will use to:

- Create, Modify and Delete the road network
- Modify the 'location' of inventory when the network changes
- Store a historic view of the network and inventory
- Translate linear to spatial referencing methods
- Interrogate inventory data spatially

T6

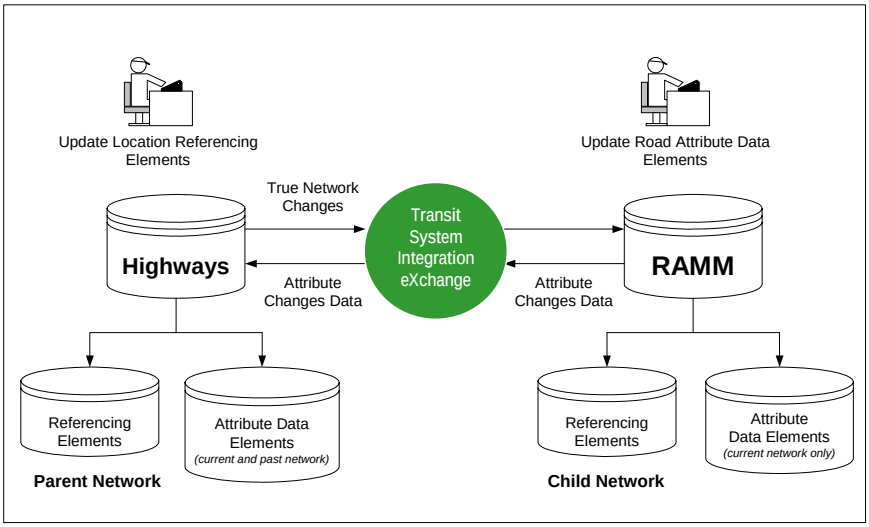
The **Transit Systems Information eXchange** (T6), is purely a messaging system: a mechanism by which one system (RAMM) informs another (Highways) that data has changed.

A useful analogy is that of the software that synchronises a palm pilot with a desktop PC. The synchronisation will be automated unless problems requiring administrative intervention are encountered.

As with all system interfaces, one system must be the 'master' or

owner of the data. Highways by Exor is the owner of the network, both spatial and linear, hence realignments or new roads are set up in Highways and propagated via the T6 to RAMM. Conversely, RAMM owns the road inventory, and inform Highways via the T6 when it is changed.

The T6 allows RAMM to retain all of its functionality and reporting while introducing the additional capabilities of Highways such as viewing and interrogating data spatially, i.e. on a map and through Highways we are able to view the network and inventory spatially at different points in time.



6.3 Defining the Network Model in Highways

Introduction

Section 6.1, introduces the terminology of the "network" and associated "inventory" data in terms of the LRMS Software Applications. This section further elaborates on how the network is actually modelled within the Highways by Exor product.

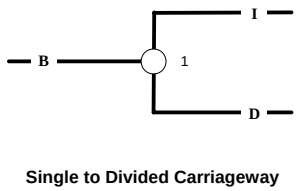
The Logical Network Model

The Logical Network Model defines how the network is represented in the LRMS Software. In it's most fundamental sense, the network is made up of a series of **nodes** and **elements**.

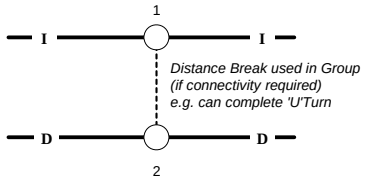
A **Node** is used to identify the start and end positions of a road element (c.f. record in RAMM roadnames table). To ensure logical connectivity across the road network the end node of one road element will be the start node of the adjoining road element, thus a single node point may be the start node of one element and the end of another.

Nodes are created on the linear network at the following locations:

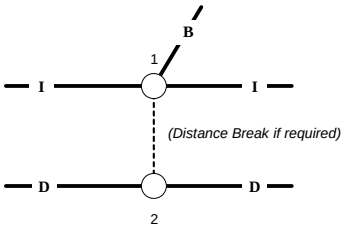
- The start and end of a state highway,
- The intersection of two (or more) state highways,
- The start and end of a divided highway,
- At reference station locations not defined above,
- The beginning and end of a ramp,
- At roundabouts and
- At start and end road sections not defined above.



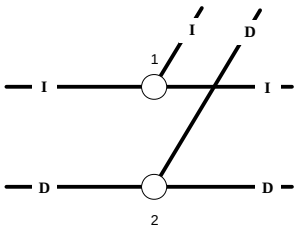
Single to Divided Carriageway



Divided Carriageway



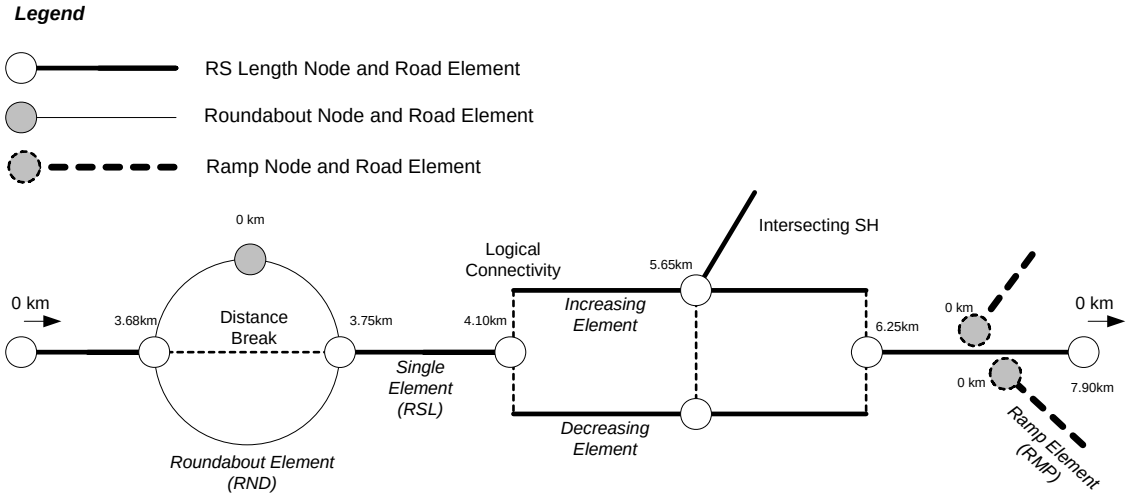
SH Intersecting Divided Carriageway



Intersecting Divided Carriageways

A road **element** is the smallest network element represented in the data model. Road elements run between nodes, which are defined above. There are three basic road element types that represent the SH network.

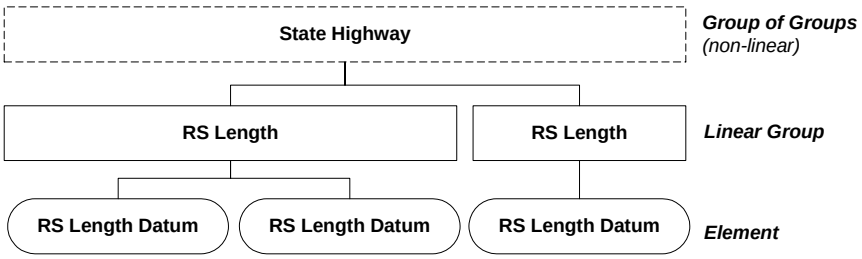
- **RS Length** road elements
- **Ramp** road elements
- **Roundabout** road elements



RS Length Elements

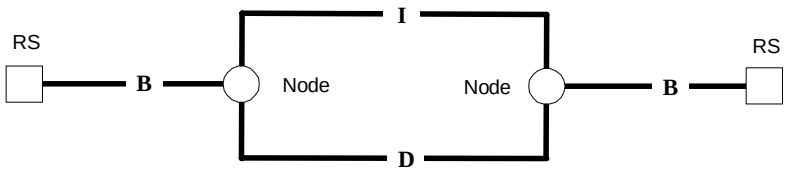
A reference station (RS) length comprises of one or more **RS Length Elements**. The elements within an RS Length will be grouped to form a 'group of elements' representing an entire RS Length. This group of elements will be a 'linear group' and therefore displacements can be derived relative to the start of the RS Length.

The 'State Highway' group is a collection of the linear RS Length groups.



RS Length elements have a 'Sub Classification' to deal with displacements on routes that contained Dual or Divided carriageways. The subclasses are:

- 'B' – Both Directions (Single),
- 'I' – Increasing displacement, and
- 'D' – Decreasing displacement .

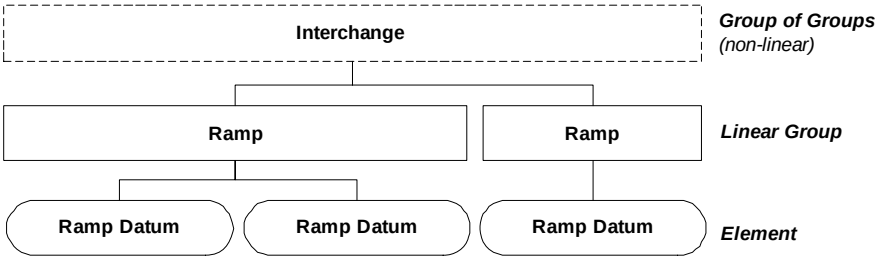


Decreasing is somewhat misleading as the displacement is still measured in the increasing direction, but the 'Decreasing' reference simply means the traffic flow is against the increasing direction.

If the RS Length carries two state highways (i.e. the RS Length is in 'common' with two state highways) the RS Length elements will be allocated to the state highway with the lower state highway number. An attribute called 'common' is used to store the higher state highway number against the RS Length.

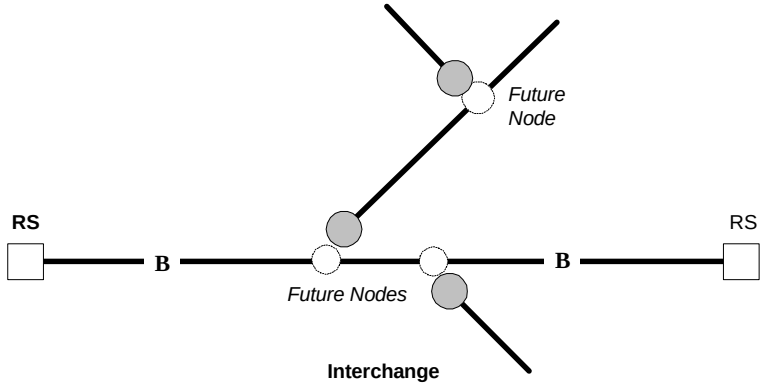
Ramp Elements

Interchanges are made up of a grouping of ramps with a single ramp comprising one or more **Ramp Elements**. A ramp can be seen as a Group of Elements and an Interchange as a Group of Groups. The relationship between Ramp road elements, Ramps and Interchanges can be seen below.



The ramp length does not form part of the linear RS Length, but will be grouped under the State Highway Group of Groups to give the 'total surface length' of the route. The increasing direction for a ramp is the direction of travel.

To model this a relationship is recorded between the ramp element and the RS length datum using a group. The group holds all the ramp elements and a single RS datum element.

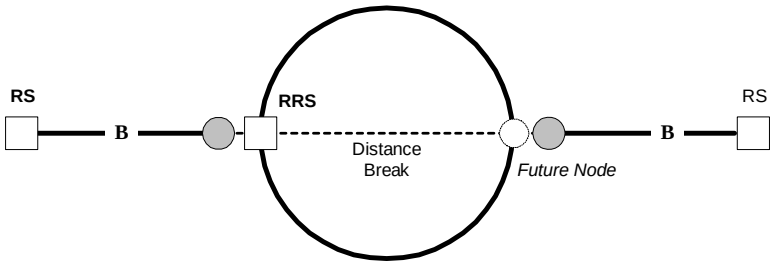


Ramp groups are named with the state highway code, the interchange number, the ramp number and whether they are a primary (1) secondary (2) or tertiary (3) ramp.

Roundabout Elements

Like a ramp, a roundabout is treated as a separate network type consisting of a single **Roundabout Element**.

Roundabouts causes a discontinuity along the RS Length, which is 'bridged' by means of a Distance Break. The distance break will have a non-zero length measure equal to the length traversed through the roundabout.

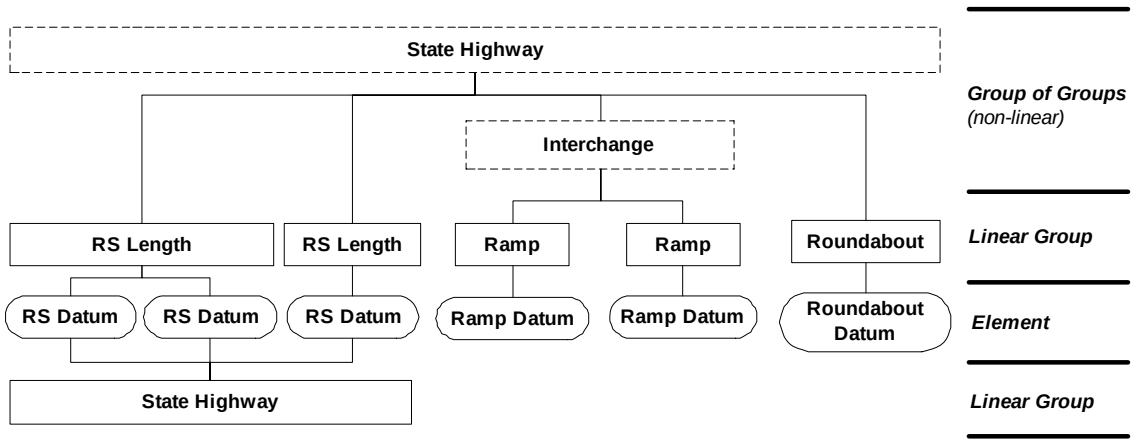


The increasing direction for a Roundabout is the direction of travel.

Schematic of Network Model

The figure below summarises the relationship between the base road elements that make up Transit New Zealand's location referencing network.

Section 6.4 outlines how databases other than those owned by Transit New Zealand may utilise the same network model to ensure they remain compatible with Transit New Zealand's unique location referencing method.



6.4 Managing External Databases

Introduction

Transit New Zealand accepts that there will always be many independently operated databases that will hold inventory about its road network. These include:

- Contractor's maintenance recording systems,
- Consultant's enquiry management systems,
- LTSA's crash analysis system,
- Contractor's traffic signs database, etc

A number of these systems will have key data that must be transferred to Transit New Zealand's Asset Register (RAMM) on a regular basis. As such they must have a unique code that allows the location of the inventory item to be linked to the network.

Unique Location Reference Code

In the past many external systems have used the RAMM Road ID field and displacement as the unique location code for an inventory item. This is not acceptable under the new LRMS as these codes change regularly when changes occur in the network. This change has been introduced to better manage data quality over time.

The table below defines the new fields that should be contained within all external databases to allow the data to be referenced in accordance with Transit New Zealand's location referencing system.

Referencing Inventory along RS Lengths

Field Name	SH	RS	TYPE	DISP	
Format	char(3)	char(4)	char(2)	Integer	
Description	State Highway Number	Reference Station Number	Car'way type (I,D)	Distance from RS in metres	*Written RP*
Examples	01N	0262	I	15623	01N-0262/15.62-I
	006	1001		240	006-1001/0.24
	20A	0000	D	1536	20A-0000/1.54-D

Referencing Inventory along Ramps

Field Name	SH	RS	TYPE	DISP	
Format	char(3)	char(4)	char(2)	Integer	
Description	State Highway Number	Interchange Number	Ramp Number	Distance from RRS in metres	*Written RP*
Examples	01N	0013	R1	120	01N-0013-R1/0.12
	002	0020	R3	36	002-0020-R3/0.04
	01S	0230	R9	292	01S-0230-R9/0.29

Referencing Inventory along Roundabouts

Field Name	**SH**	**RS**	**TYPE**	**DISP**	
Format	char(3)	char(4)	char(2)	Integer	
Description	State Highway Number	R'about Number	Identifier	Distance from RS in metres	*Written RP*
Examples	01N	0999	W	68	01N-0999-W/0.07
	002	0883	W	120	002-0883-W/0.12
	01S	0569	W	35	01S-0569-W/0.04

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