



**27<sup>th</sup>** annual **INCOSE**  
international symposium

**Adelaide, Australia**

July 15 - 20, 2017



# The Transport for NSW Transport Network Architecture Model

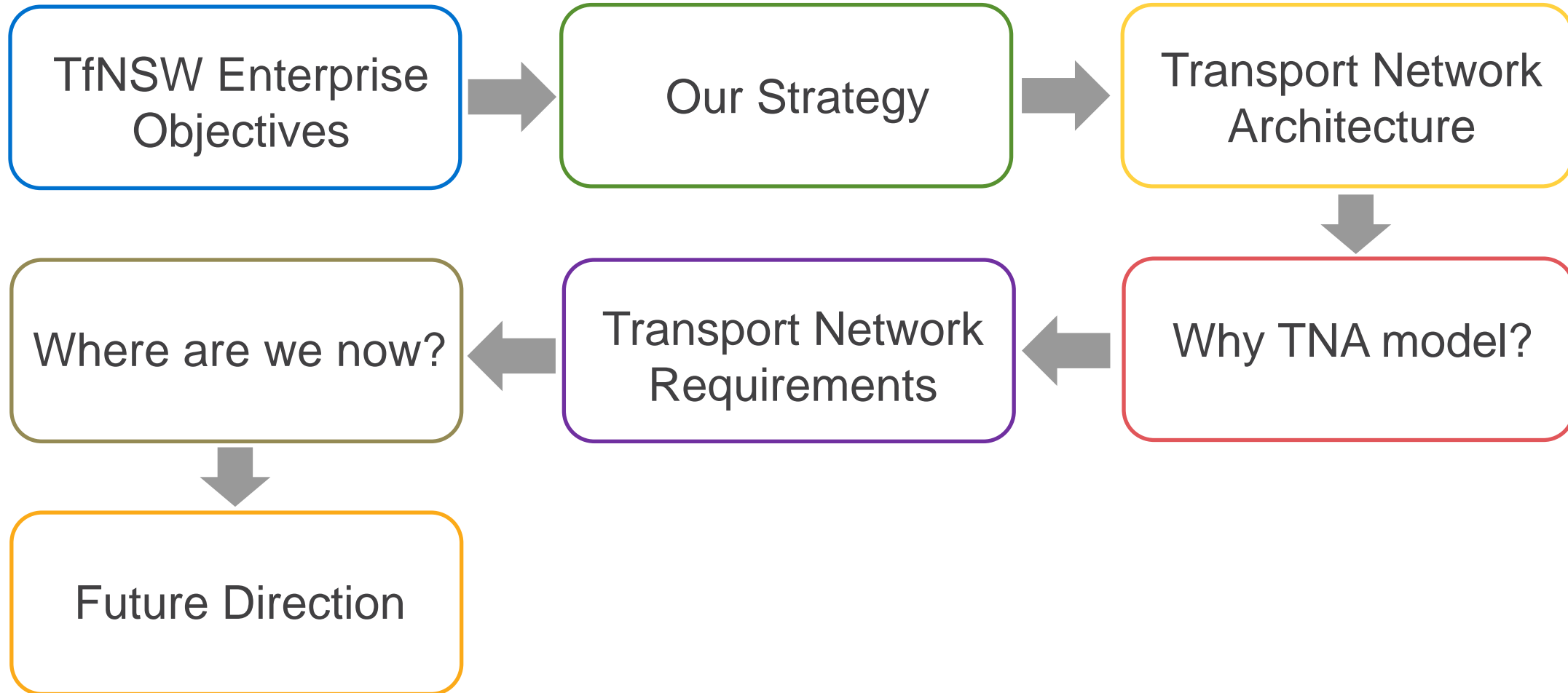
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# Key topics





# TfNSW Enterprise Objectives

- NSW Long Term Transport Master Plan\*



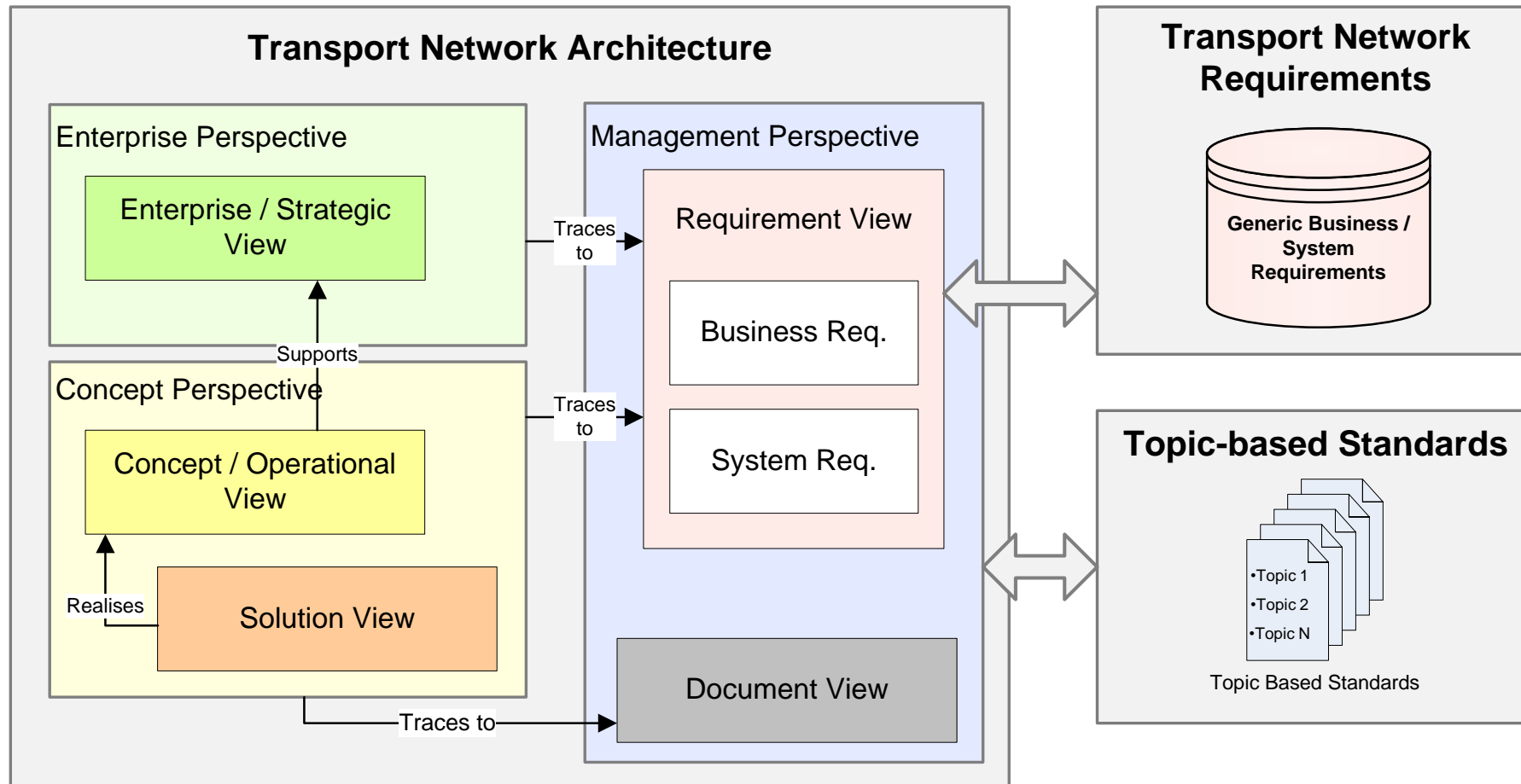
## Subordinate plans:

- Sydney's Rail Future
- Sydney's Light Rail Future
- Sydney's Bus Future
- Sydney's Ferry Future

["NSW Long Term Transport Master Plan"](#), Dec 2012, section 1.1, p22: 'Our Transport Objectives'

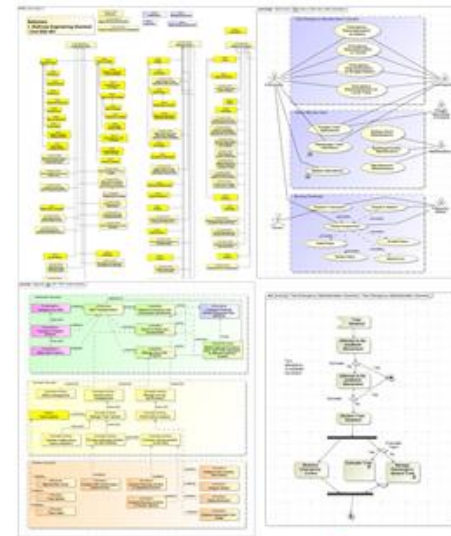
\*To be superseded by [Future Transport Strategy](#) currently under development

# Our Strategy





# The Transport Network Architecture





# Why TNA model?

- Enable innovative solutions
- Requirement traceability to long term goals
- Improve quality of requirements
- Encourage use of model-based approach



# The Transport Network Architecture

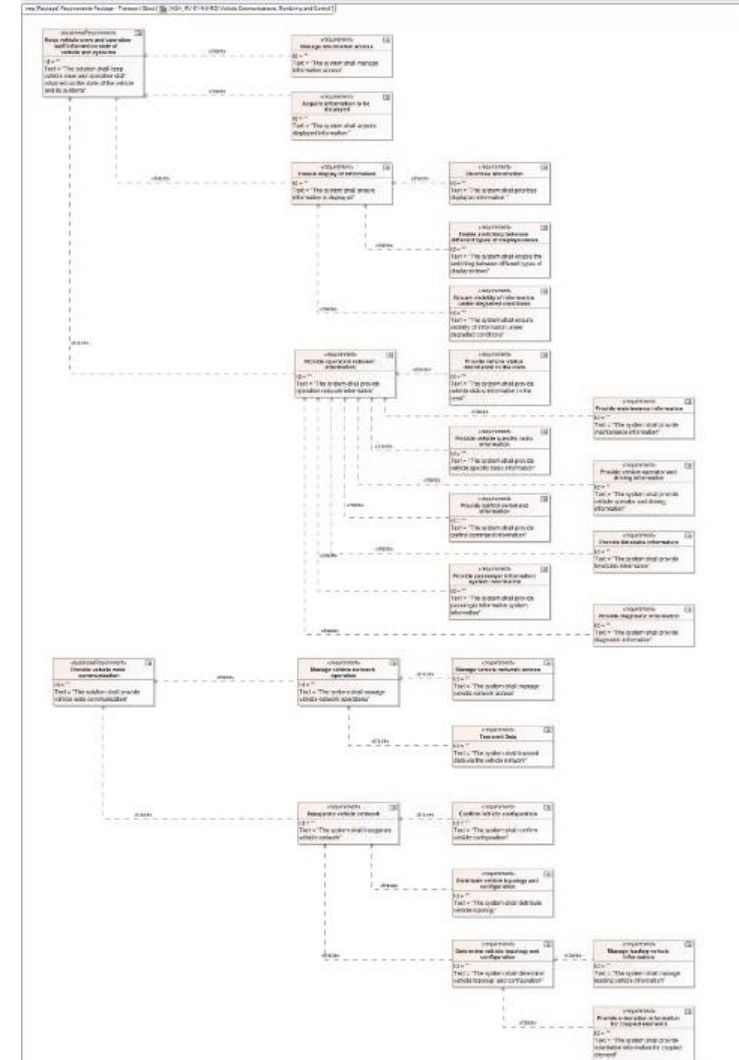
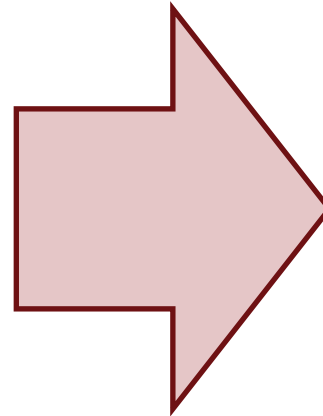
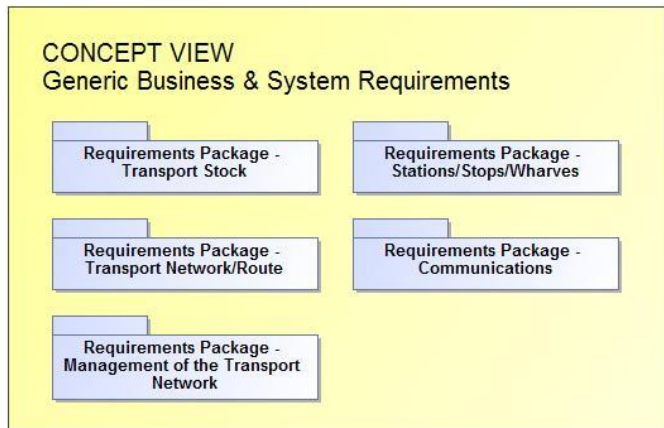
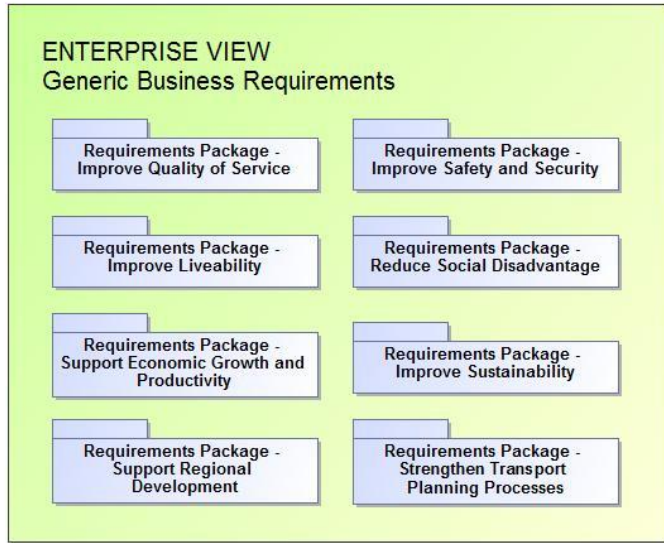
## How is it developed?

- Adopt a Model-Based Engineering approach
- Adopt 'TRAK' Metamodel as Framework
- Adopt UML and SysML as Modelling Language
- Acquire stakeholder input
- Use a system architecture tool



# The Transport Network Requirements

package [Package] 7 All Views [ [ASA-AV-01-HR-MD] Requirement Views ]







# The Transport Network Requirements

| #   | Name   | Text  | Owner                      |
|---|--|---|----------------------------|
| <b>[ASA_RV-04-MU-RS] Vehicle Communications, Monitoring and Control</b> |  |   |                            |
| #   | Name   | Text  | Owner                      |
| 1   | Keep vehicle crew and operation staff informed on state of vehicle and systems | The solution shall keep vehicle crew and operation staff informed on the state of the | Vehicle communications, r  |
| 2   | Acquire information to be displayed  | The system shall acquire displayed information  | Keep vehicle crew and ope  |
| 3   | Manage information access  | The system shall manage information access  | Keep vehicle crew and ope  |
| 4   | Ensure display of information  | The system shall ensure information is displayed                                      | Keep vehicle crew and ope  |
| 5   | Enable switching between different types of displays/views                     | The system shall enable the switching between different types of displays/views       | Ensure display of informat |
| 6   | Ensure visibility of information under degraded conditions                     | The system shall ensure visibility of information under degraded conditions           | Ensure display of informat |
| 7   | Prioritise information   | The system shall prioritise displayed information                                     | Ensure display of informat |
| 8   | Provide operation relevant information   | The system shall provide operation relevant information                               | Keep vehicle crew and ope  |
| 9   | Provide control command information  | The system shall provide control command information                                  | Provide operation relevant |
| 10  | Provide diagnostic information   | The system shall provide diagnostic information                                       | Provide operation relevant |
| 11  | Provide maintenance information  | The system shall provide maintenance information                                      | Provide operation relevant |
| 12  | Provide passenger information system information                               | The system shall provide passenger information system information                     | Provide operation relevant |
| 13  | Provide timetable information  | The system shall provide timetable information  | Provide operation relevant |
| 14  | Provide vehicle operator and driving information                               | The system shall provide vehicle operator and driving information                     | Provide operation relevant |
| 15  | Provide vehicle specific radio information                                     | The system shall provide vehicle specific radio information                           | Provide operation relevant |
| 16  | Provide vehicle status information to the crew                                 | The system shall provide vehicle status information to the crew                       | Provide operation relevant |
| 17  | Provide vehicle wide communication   | The solution shall provide vehicle wide communication                                 | Vehicle communications, r  |
| 18  | Manage vehicle network operation   | The system shall manage vehicle network operations                                    | Provide vehicle wide commr |
| 19  | Manage vehicle network access  | The system shall manage vehicle network access  | Manage vehicle network o   |
| 20  | Transmit Data  | The system shall transmit data via the vehicle network                                | Manage vehicle network o   |
| 21  | Inaugurate vehicle network   | The system shall inaugurate vehicle network   | Provide vehicle wide commr |
| 22  | Confirm vehicle configuration  | The system shall confirm vehicle configuration  | Inaugurate vehicle networ  |
| 23  | Determine vehicle topology and configuration                                   | The system shall determine vehicle topology and configuration                         | Inaugurate vehicle networ  |
| 24  | Manage leading vehicle information   | The system shall manage leading vehicle information                                   | Determine vehicle topolog  |
| 25  | Provide orientation information for coupled elements                           | The system shall provide orientation information for coupled element                  | Determine vehicle topolog  |
| 26  | Distribute vehicle topology and configuration                                  | The system shall distribute vehicle topology  | Inaugurate vehicle networ  |
| 27  | Manage Vehicle Operation Modes   | The solution shall manage vehicle operation modes                                     | Vehicle communications, r  |
| 28  | Manage battery protection mode   | The system shall manage battery protection mode                                       | Manage Vehicle Operator    |
| 29  | Manage energy saving mode  | The system shall manage energy saving mode  | Manage Vehicle Operator    |
| 30  | Manage in service mode   | The system shall manage in-service mode   | Manage Vehicle Operator    |
| 31  | Manage service retention mode  | The system shall manage service retention mode  | Manage Vehicle Operator    |



# The Transport Network Requirements



## Why develop it?

### Business Requirements Specification

#### Newcastle Light Rail

#### Document Information

Version: 1.10  
 Version Release Date: 7 December 2015  
 Author(s):  
 Print Date: 7 Dec 2015  
 Status: Approved  
 Objective No: A4809567  
 Restriction: Restricted

#### Endorsement

| Name and Position                                     | Date     | Signature   |
|---|----------|-------------|
| Deputy Secretary Freight, Strategy and Planning, TNSW | 25/11/15 | [Signature] |
| Deputy Secretary, Customer Services, TNSW             | 2.12.15  | [Signature] |

#### Approval

| Name and Position                                  | Date     | Signature   |
|--|----------|-------------|
| Deputy Secretary Infrastructure and Services, TNSW | 27/11/15 | [Signature] |

#### 4.1.7. Light Rail Corridor

| DOORS ID    | Requirement  | Criticality | Additional Information  | Verification  | Owner |
|-------------|--|-------------|---|---------------|-------|
| PRJ-NLR-280 | The Solution shall accommodate light rail services between Wickham and Newcastle East by following the alignment indicated in Figure 1.  | Essential   |   | Design Review | FSP   |
| PRJ-NLR-162 | The new light rail alignment shall be of a type consistent with its operating environments. The following forms shall be applied: <ul style="list-style-type: none"> <li>Segregated, where it is in the disused rail corridor,</li> <li>Separated, where it is in an urban roadway and road width allows for the provision of separate light rail and road vehicle space, and</li> <li>Mixed, where road width is insufficient to allow for separate light rail and road vehicle lanes.</li> </ul> | Essential   |   | Design Review | FSP   |
| PRJ-NLR-163 | The NLR shall implement a line-of-sight signalling Solution that enables safe operation of services and controls conflicts between LRVs, road vehicles and pedestrians at intersections.   | Essential   |   | Design Review | I&S   |
| PRJ-NLR-165 | Works within the public domain shall have a pleasing appearance, provide amenity and create no road safety risk.   | Essential   | This includes the provision of the following types of amenity where required: <ul style="list-style-type: none"> <li>fencing and balustrading;</li> <li>landscaping;</li> <li>street lighting; and</li> <li>footpaths, shared paths and cycleways.</li> </ul> Whole of life costs should be considered in determining the extent of public amenity. | Design Review | CS    |
| PRJ-NLR-166 | The NLR perway shall enable emergency vehicles (under lights and sirens only) to operate on the light rail tracks except for the perway along the disused rail corridor.   | Essential   |   | Design Review | FSP   |

NLR BRS v1.10 APPROVED.docx

Restricted

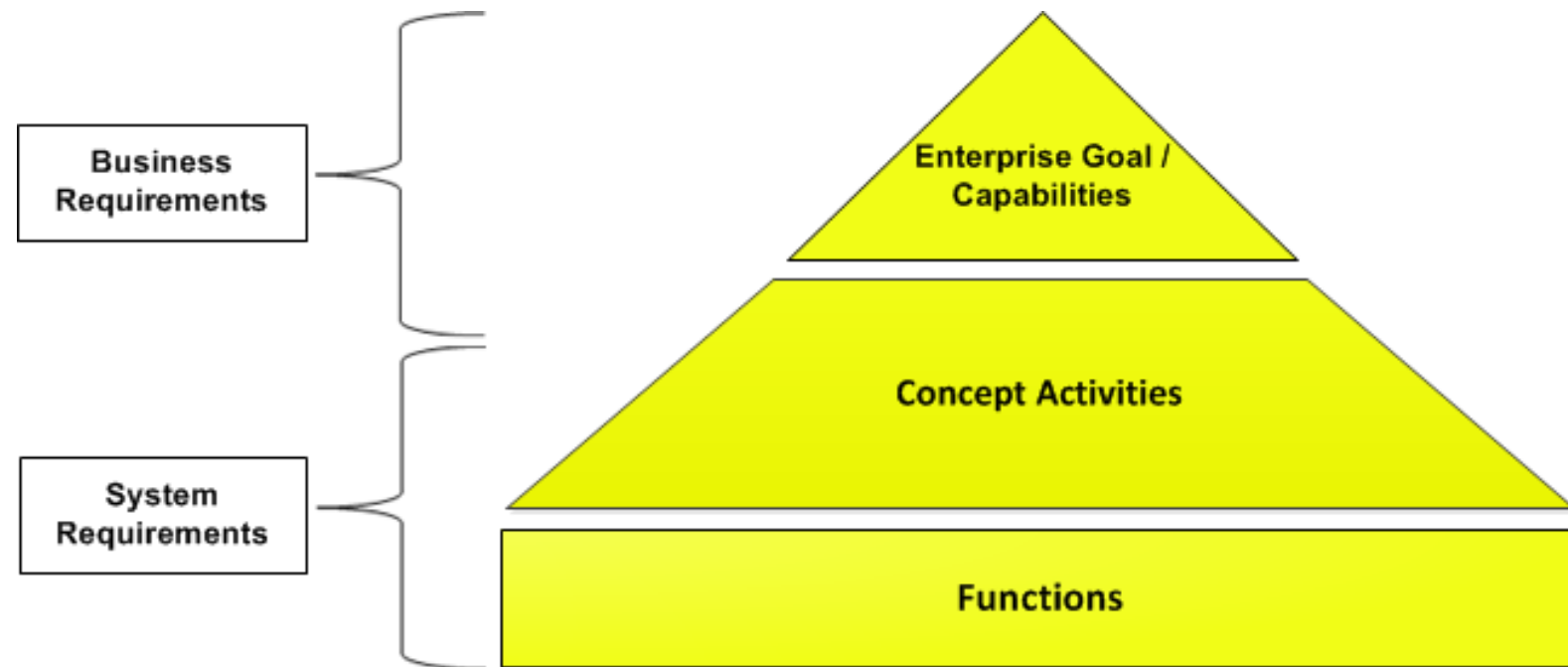
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# The Transport Network Requirements

## How is it developed?

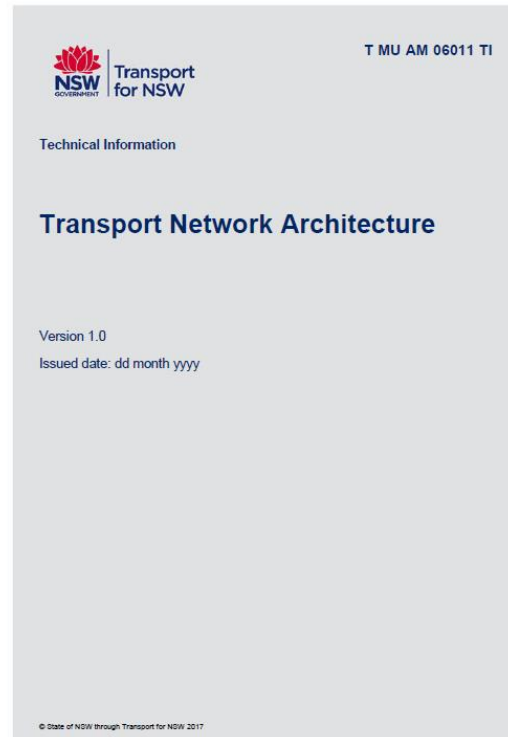
- Validate functional model
- Establish and develop requirement viewpoints





# Where are we now?

## TNA Document v2.0



## TNA Model v1.0

|                |       |
|----------------|-------|
| Elements:      | 6337  |
| Diagrams:      | 1556  |
| Relationships: | 45495 |
| Perspectives:  | 3     |
| Views:         | 7     |
| Viewpoints:    | 29    |

The screenshot shows the 'The Transport Network Architecture Model v1.0' application window. It includes a 'CONTAINMENT' tree on the left with folders for 'Data', 'Transport AF Model', 'Model Views', 'UPDM Perspectives', 'TRAK Perspectives', and 'ASA Perspectives'. The main area displays a 'Package Diagram [ASA\_AV-01-MU-MD] Welcome to the Transport Network Architecture v1.0'. A document preview on the right shows the title 'Transport Network Architecture v1.0', the NSW Government logo, and the text 'Version: 1.0 Issued date: June 2017'. A red box highlights the statistics table.



# Future Direction

- Use the model on transport projects
- Use case development
- Extend TNA model to other modes
- Develop transport network requirements



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