Implementing a Spatially Integrated AMS
DPTI - PTS

Speaker:
- Liam Nicholls AMS Analyst

Government of South Australia
Department of Planning, Transport and Infrastructure

Public Transport Services

A Division of SA Government's Department of Planning, Transport and Infrastructure (DPTI). Manages Adelaide's public transport network

Bus Services

- 9000 + services /d
- 1145 Busses
- 8303 bus stops

Train Services

- Over 500 services / d
- 100+ railcars
- 300 km track
- 84 Stations

Tram Services

- Over 200 services / d
- 22 trams
- 28 Stops
- 35 Km track

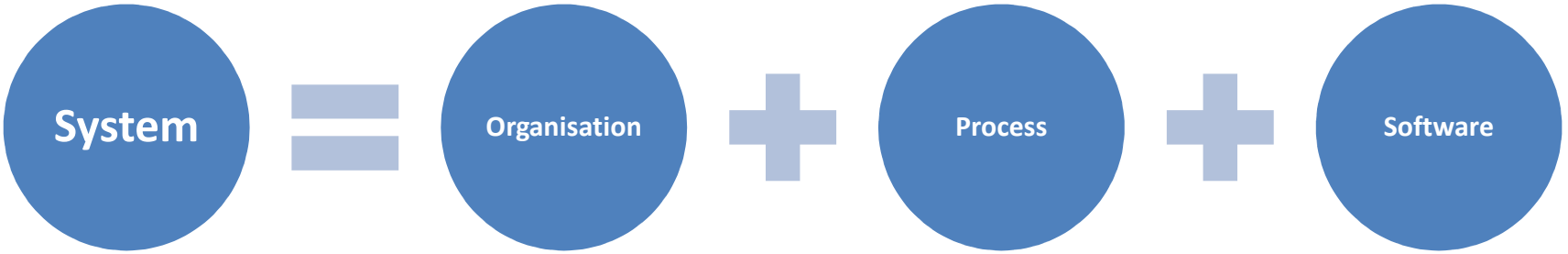
Total services

- Over 60m trips / y
- 9m Train 3mTram 48m Bus

Rail Revitalisation Projects

- 30 years of little investment
- SA Government's $3 billion ten year commitment was the biggest single investment ever in public transport in SA.
- The majority of the investment was to revitalise Adelaide's passenger rail network.
- Upgrades include:
  - Track upgrade
  - Extending Noarlunga line to Seaford
  - Electrification of Seaford line
  - New electric Trains & Trams (larger fleet)
  - Overhaul of several train stations
  - Increased services
  - Tramline extension (to Entertainment Centre)

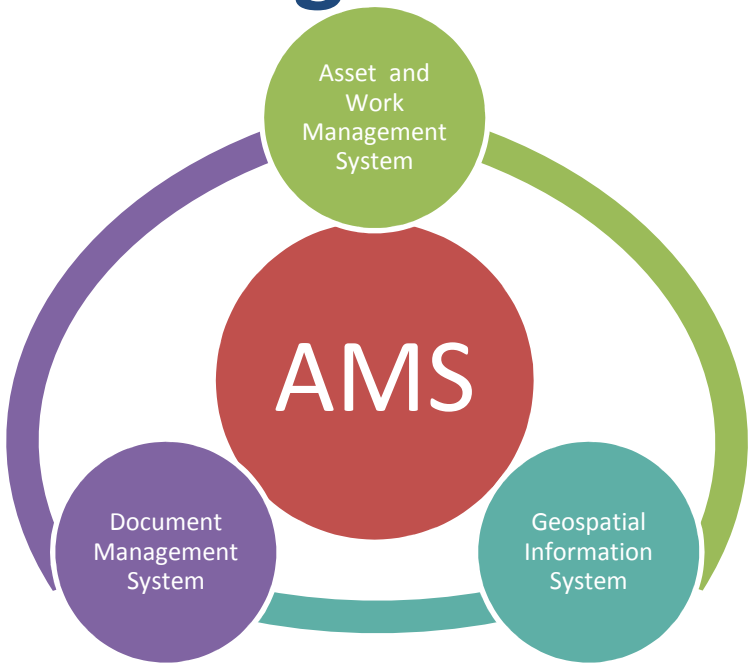
Enhancing the PTS AMS



80% of all your potential (AMS) improvements could and are most likely related to **Process and Organisation.**

Q: How can an organisation and it's processes be enhanced through increased system functionality?

Systems integrated functions

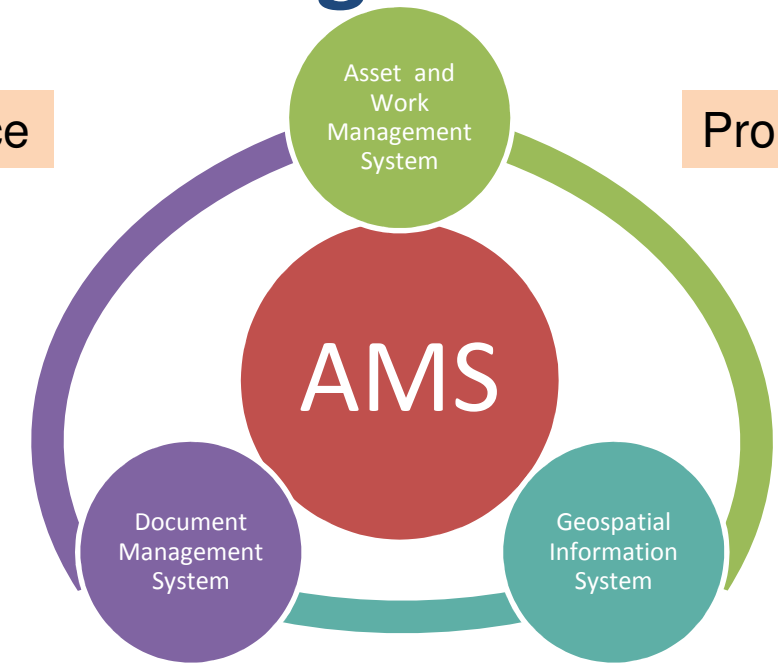


Systems integrated functions

Transit Performance

Train Notices

Network Access

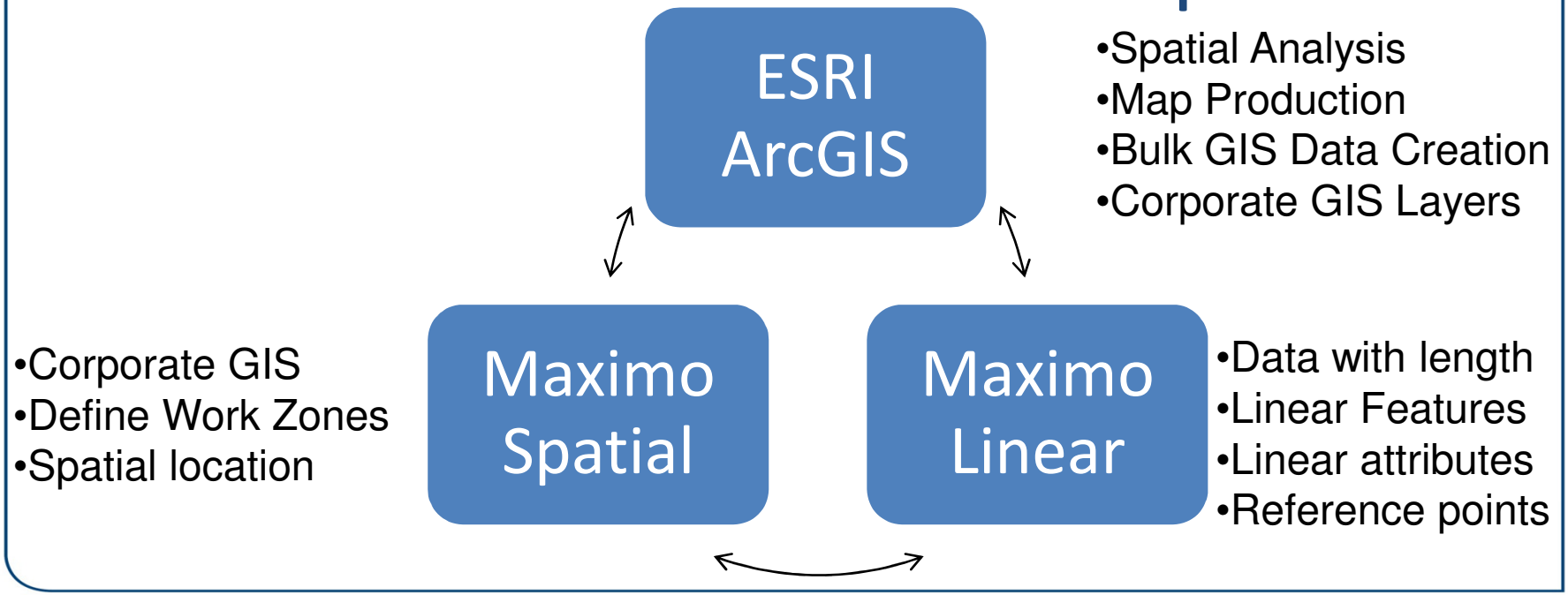


Property Location Browser

Landmarks

Network Diagram

Maximo with Linear and Spatial



What Maximo Linear does?

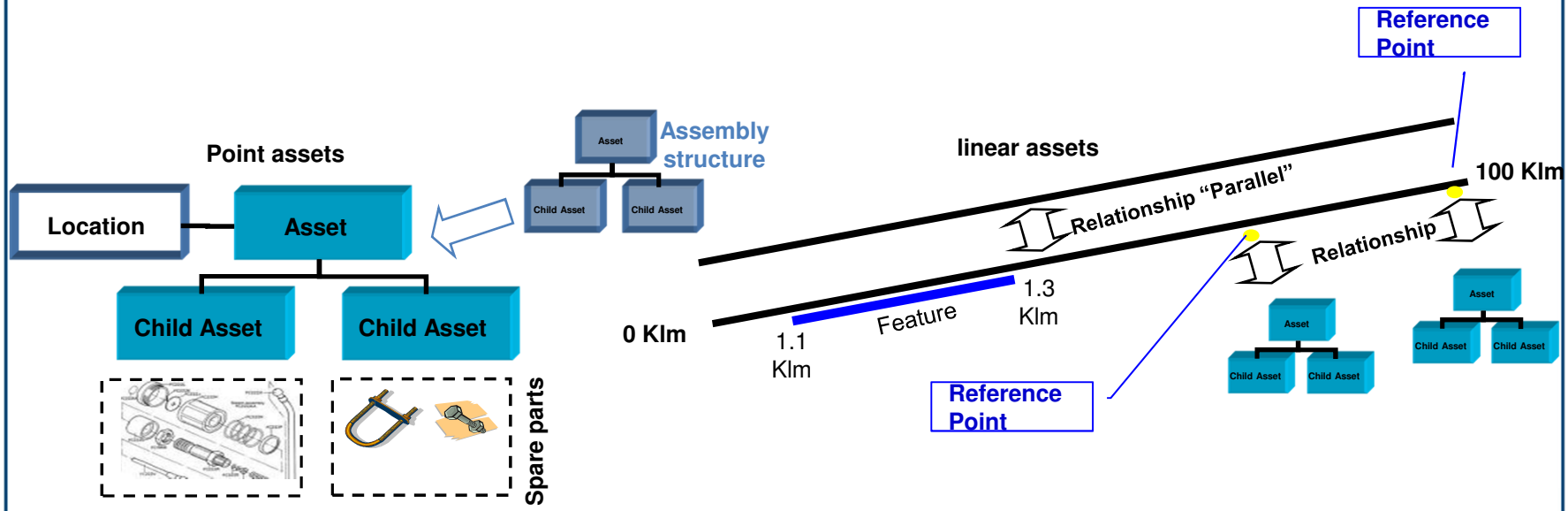
- Discrete assets/work orders/service requests

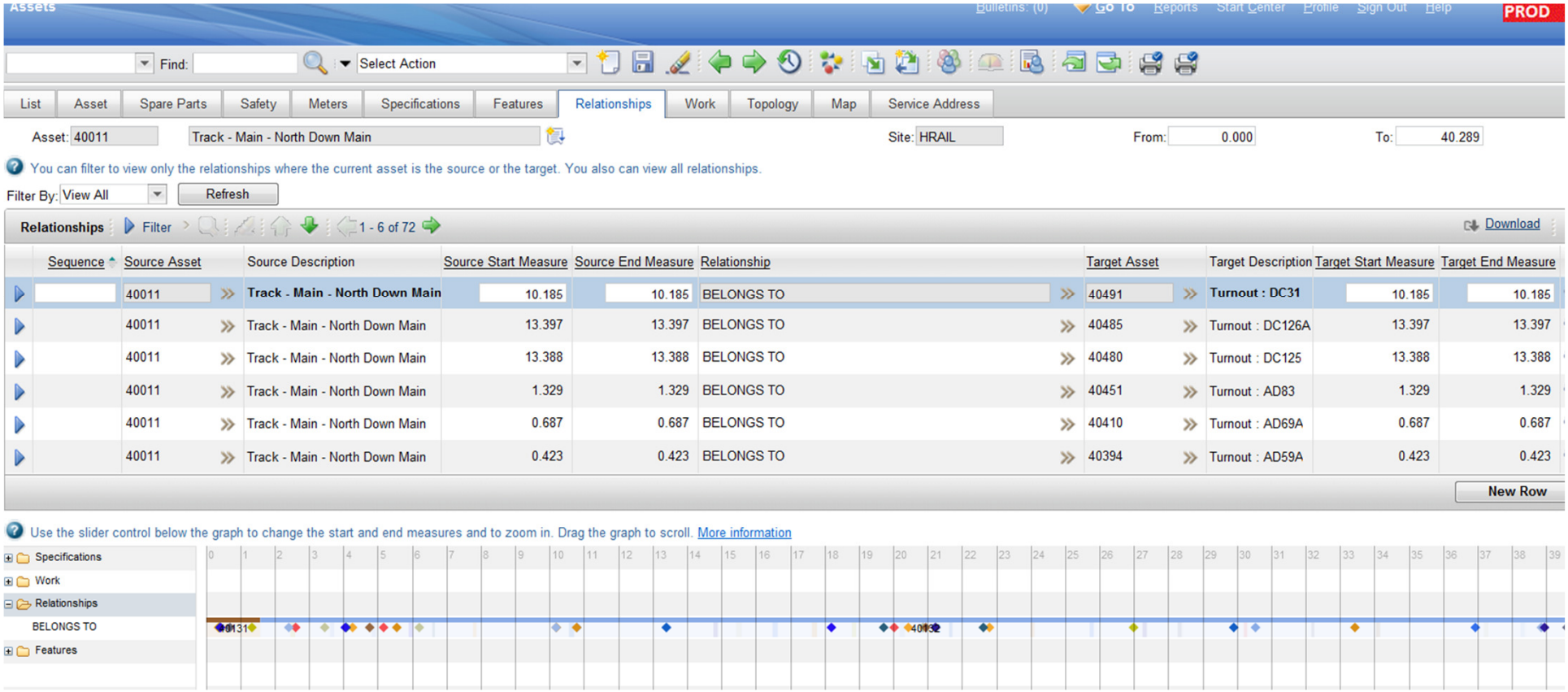
  @ a location, can have (or can be) child assets

- Linear assets/work orders/service requests

  Has length (or exists along a line). Assets can be segmented using features, and can have attributes, reference points and relationships.

What Maximo Linear does?





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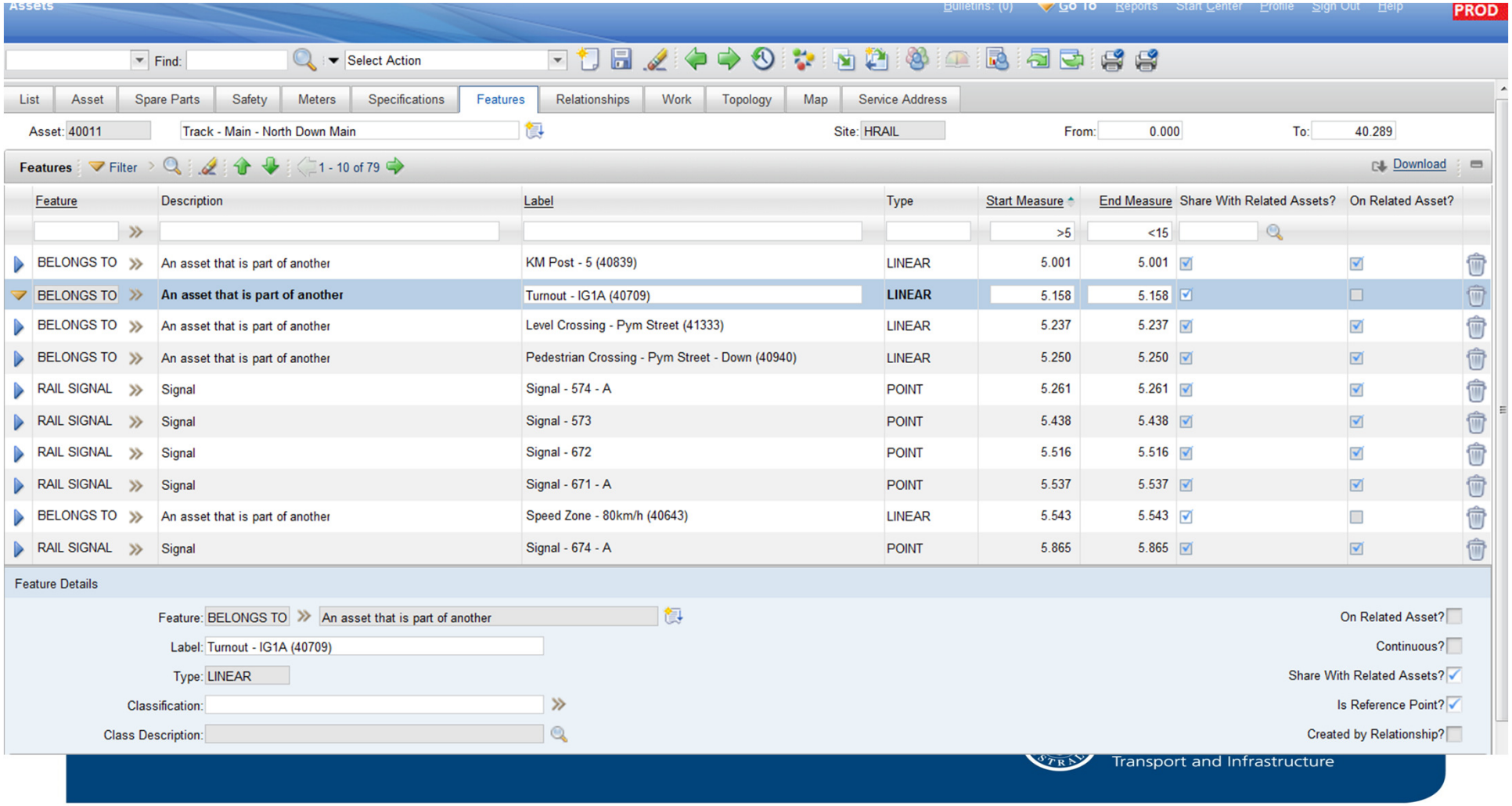
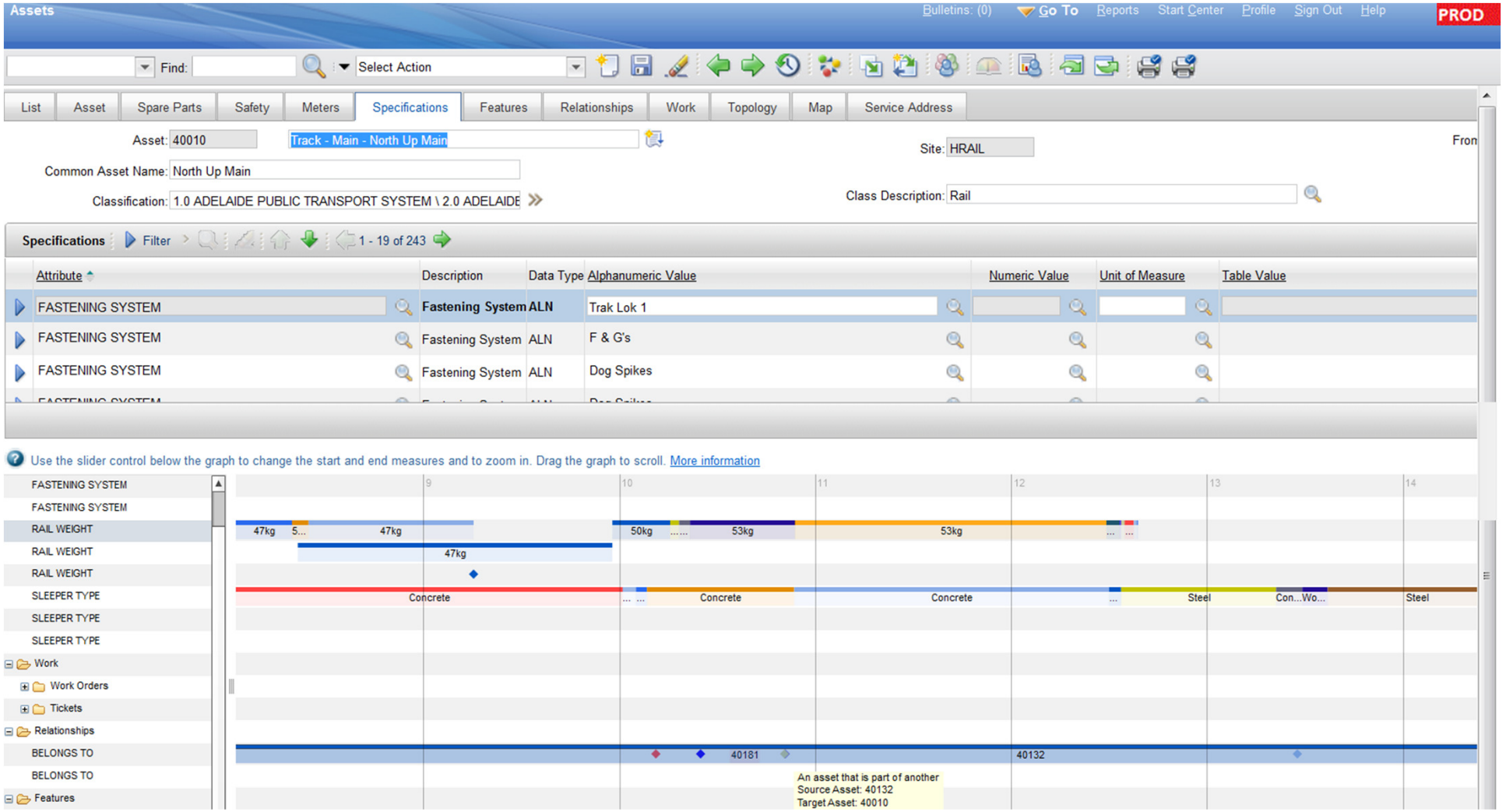

Assets
Bulletins: (0)
Go To
Reports
Start Center
Profile
Sign Out
Help
PROD
Find:
Select Action
List
Asset
Spare Parts
Safety
Meters
Specifications
Features
Relationships
Work
Topology
Map
Service Address
Asset: 40011
Track - Main - North Down Main
Site: HRAIL
From: 0.000
To: 40.289
Features
Filter
1 - 10 of 79
Download
Feature
Description
Label
Type
Start Measure
End Measure
Share With Related Assets?
On Related Asset?
>5
<15
BELONGS TO
An asset that is part of another
KM Post - 5 (40839)
LINEAR
5.001
5.001
BELONGS TO
An asset that is part of another
Turnout - IG1A (40709)
LINEAR
5.158
5.158
BELONGS TO
An asset that is part of another
Level Crossing - Pym Street (41333)
LINEAR
5.237
5.237
BELONGS TO
An asset that is part of another
Pedestrian Crossing - Pym Street - Down (40940)
LINEAR
5.250
5.250
RAIL SIGNAL
Signal
Signal - 574 - A
POINT
5.261
5.261
RAIL SIGNAL
Signal
Signal - 573
POINT
5.438
5.438
RAIL SIGNAL
Signal
Signal - 672
POINT
5.516
5.516
RAIL SIGNAL
Signal
Signal - 671 - A
POINT
5.537
5.537
BELONGS TO
An asset that is part of another
Speed Zone - 80km/h (40643)
LINEAR
5.543
5.543
RAIL SIGNAL
Signal
Signal - 674 - A
POINT
5.865
5.865
Feature Details
Feature: BELONGS TO
An asset that is part of another
Label: Turnout - IG1A (40709)
Type: LINEAR
Classification:
Class Description:
On Related Asset?
Continuous?
Share With Related Assets?
Is Reference Point?
Created by Relationship?
Transport and Infrastructure


Assets
Bulletins: (0)
Go To
Reports
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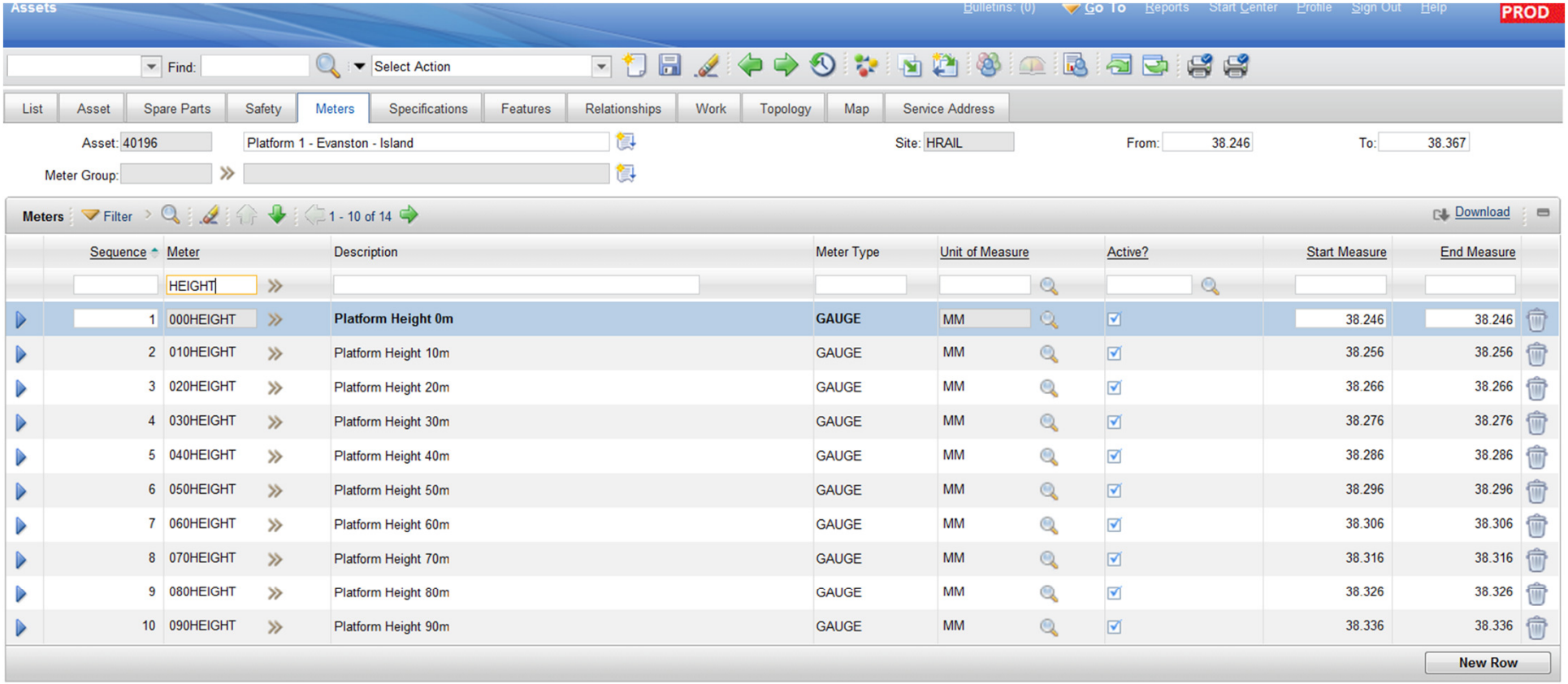
Profile
Sign Out
Help
PROD
Find:
Select Action
List
Asset
Spare Parts
Safety
Meters
Specifications
Features
Relationships
Work
Topology
Map
Service Address
Asset: 40010
Track - Main - North Up Main
Site: HRAIL
Fron
Common Asset Name: North Up Main
Classification: 1.0 ADELAIDE PUBLIC TRANSPORT SYSTEM \ 2.0 ADELAIDE
Class Description: Rail
Specifications
Filter
1 - 19 of 243
Attribute
Description
Data Type
Alphanumeric Value
Numeric Value
Unit of Measure
Table Value
FASTENING SYSTEM
Fastening System
ALN
Trak Lok 1
FASTENING SYSTEM
Fastening System
ALN
F & G's
FASTENING SYSTEM
Fastening System
ALN
Dog Spikes
Use the slider control below the graph to change the start and end measures and to zoom in. Drag the graph to scroll. More information
FASTENING SYSTEM
FASTENING SYSTEM
RAIL WEIGHT
RAIL WEIGHT
RAIL WEIGHT
SLEEPER TYPE
SLEEPER TYPE
SLEEPER TYPE
Work
Work Orders
Tickets
Relationships
BELONGS TO
BELONGS TO
Features
9
10
11
12
13
14
47kg
47kg
50kg
53kg
53kg
47kg
Concrete
Concrete
Concrete
Steel
Steel
40181
40132
An asset that is part of another
Source Asset: 40132
Target Asset: 40010


Assets
Bulletins: (0)
Go To
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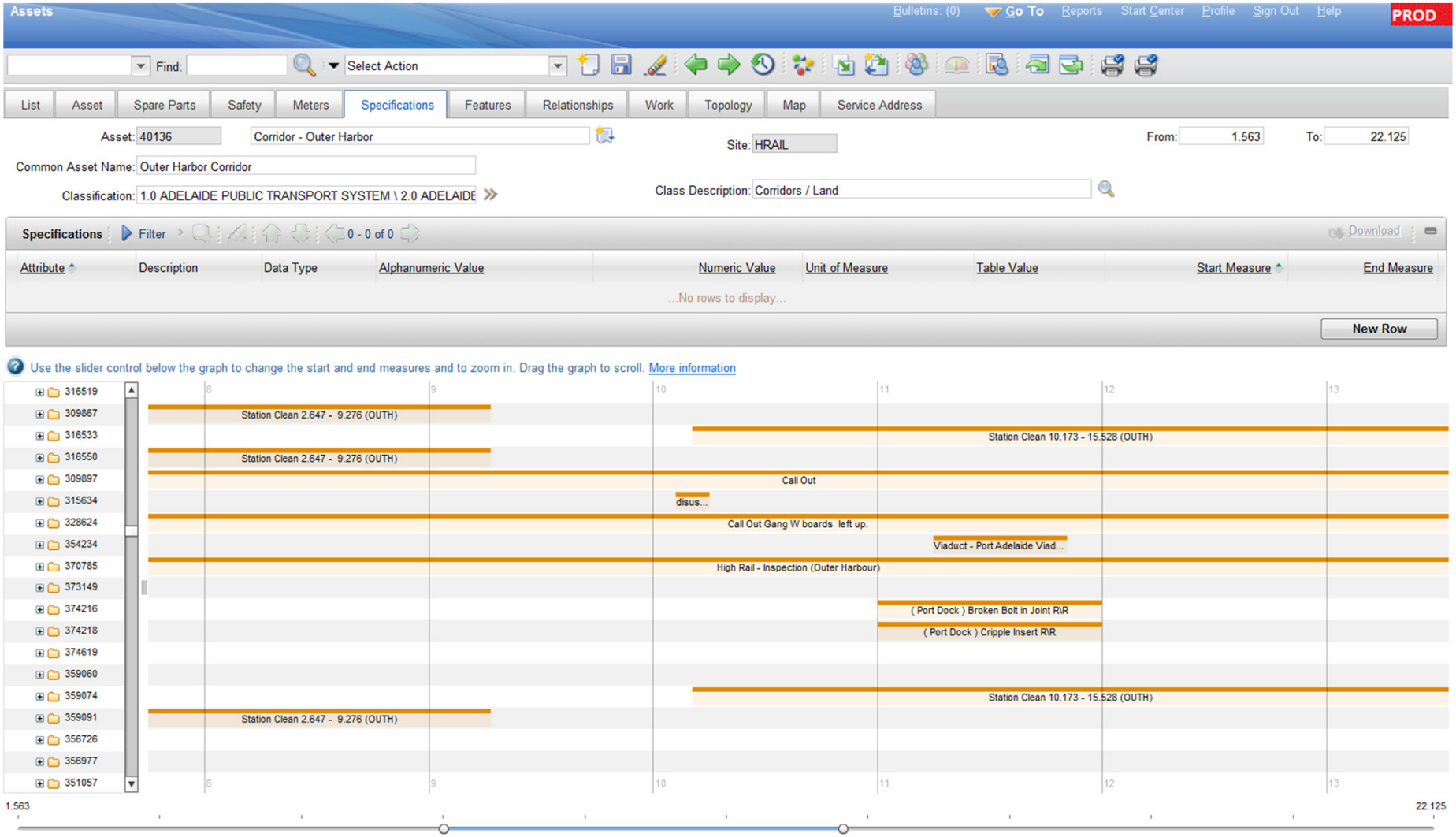
Sign Out
Help
PROD
Find:
Select Action
List
Asset
Spare Parts
Safety
Meters
Specifications
Features
Relationships
Work
Topology
Map
Service Address
Asset: 40196
Platform 1 - Evanston - Island
Site: HRAIL
From: 38.246
To: 38.367
Meter Group:
Meters
Filter
1 - 10 of 14
Download
Sequence
Meter
Description
Meter Type
Unit of Measure
Active?
Start Measure
End Measure
HEIGHT
1 000HEIGHT Platform Height 0m GAUGE MM 38.246 38.246
2 010HEIGHT Platform Height 10m GAUGE MM 38.256 38.256
3 020HEIGHT Platform Height 20m GAUGE MM 38.266 38.266
4 030HEIGHT Platform Height 30m GAUGE MM 38.276 38.276
5 040HEIGHT Platform Height 40m GAUGE MM 38.286 38.286
6 050HEIGHT Platform Height 50m GAUGE MM 38.296 38.296
7 060HEIGHT Platform Height 60m GAUGE MM 38.306 38.306
8 070HEIGHT Platform Height 70m GAUGE MM 38.316 38.316
9 080HEIGHT Platform Height 80m GAUGE MM 38.326 38.326
10 090HEIGHT Platform Height 90m GAUGE MM 38.336 38.336
New Row


Assets
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Go To
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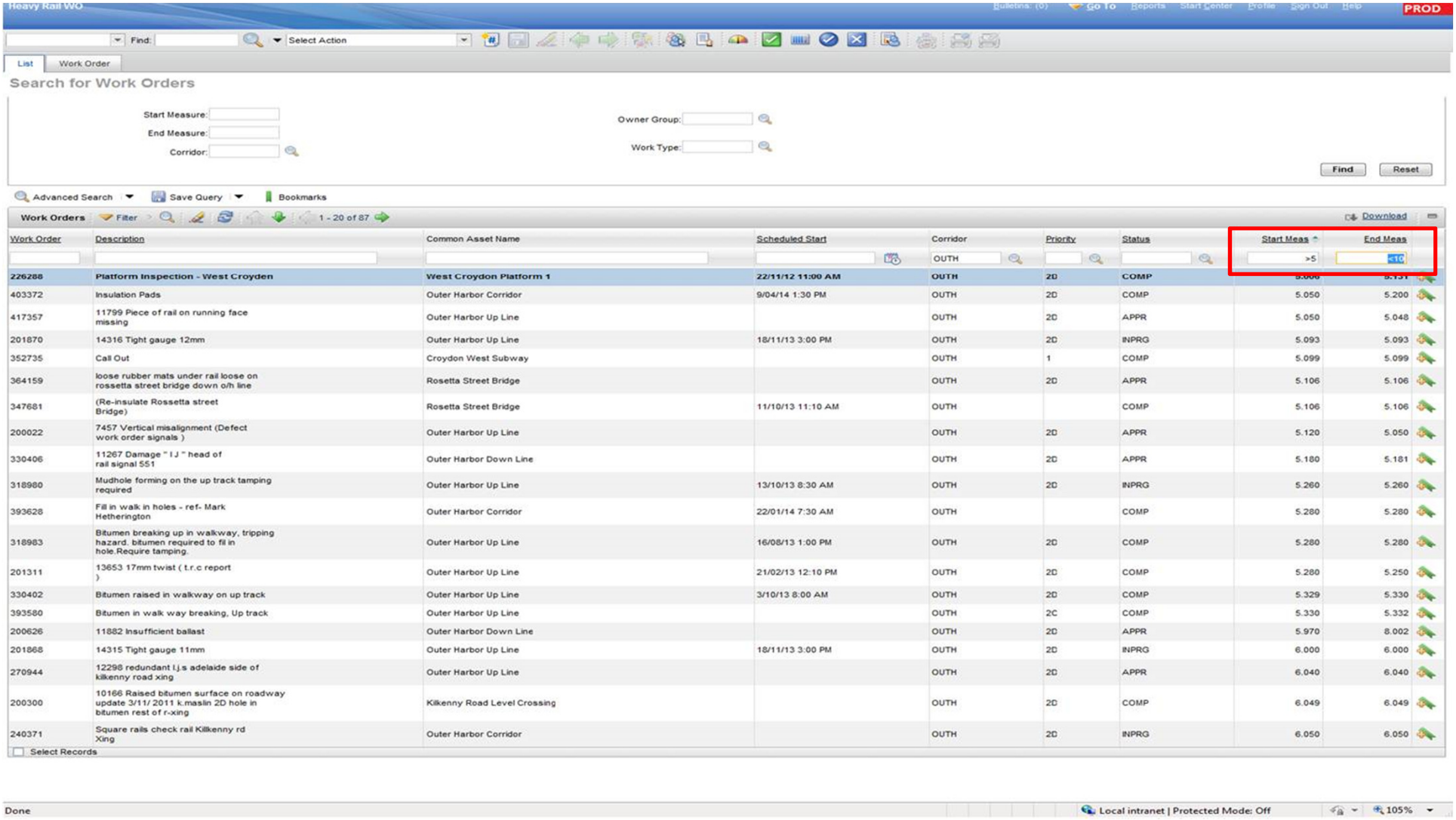
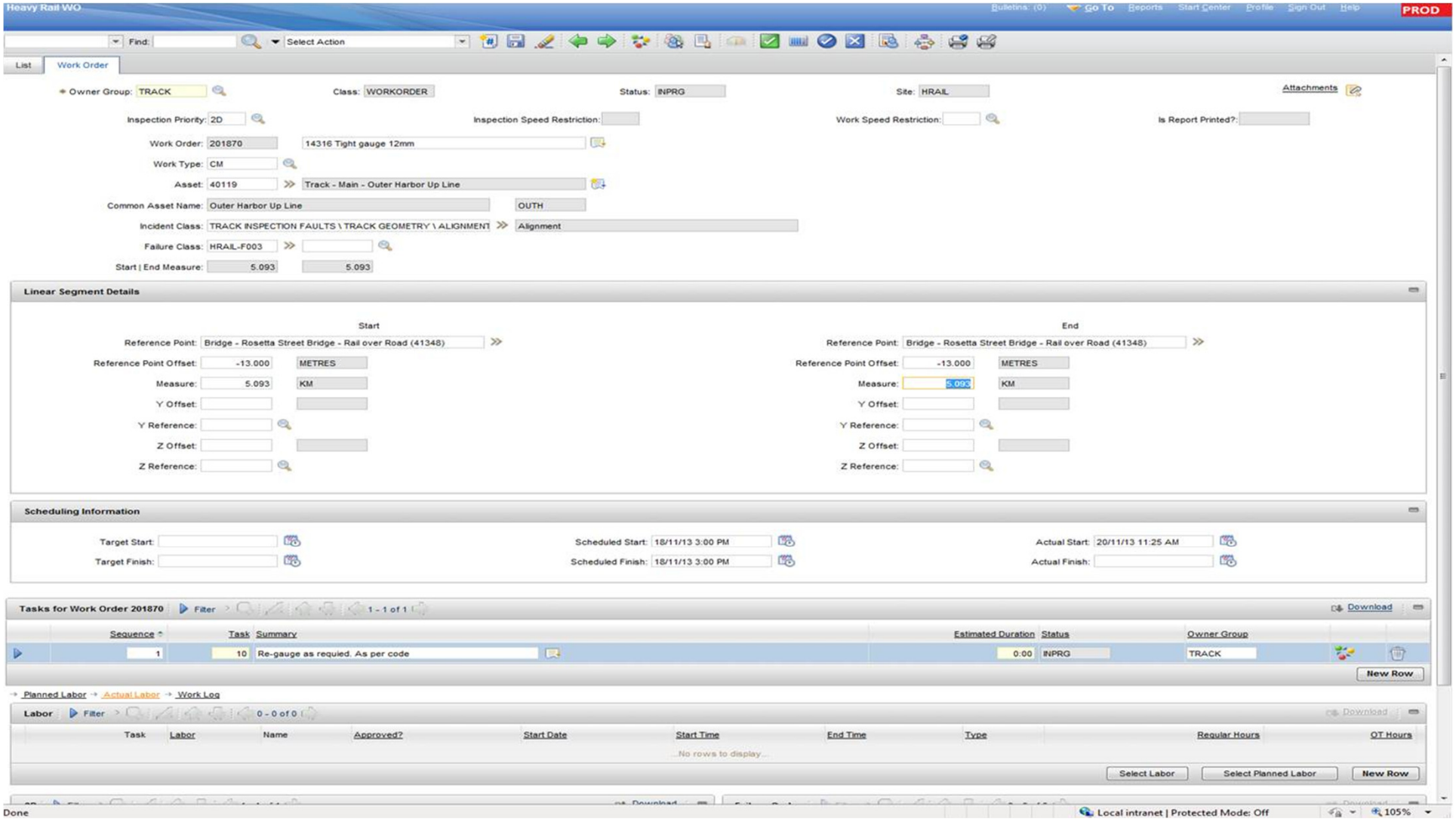
Profile
Sign Out
Help
PROD
Find:
Select Action
List
Asset
Spare Parts
Safety
Meters
Specifications
Features
Relationships
Work
Topology
Map
Service Address
Asset: 40136
Corridor - Outer Harbor
Site: HRAIL
From: 1.563
To: 22.125
Common Asset Name: Outer Harbor Corridor
Classification: 1.0 ADELAIDE PUBLIC TRANSPORT SYSTEM \ 2.0 ADELAIDE
Class Description: Corridors / Land
Specifications
Filter
0 - 0 of 0
Download
Attribute
Description
Data Type
Alphanumeric Value
Numeric Value
Unit of Measure
Table Value
Start Measure
End Measure
...No rows to display...
New Row
Use the slider control below the graph to change the start and end measures and to zoom in. Drag the graph to scroll. More information
316519
309867
316533
316550
309897
315634
328624
354234
370785
373149
374216
374218
374619
359060
359074
359091
356726
356977
351057
8
9
10
11
12
13
Station Clean 2.647 - 9.276 (OUTH)
Station Clean 10.173 - 15.528 (OUTH)
Station Clean 2.647 - 9.276 (OUTH)
Call Out
disus...
Call Out Gang W boards left up.
Viaduct - Port Adelaide Viad...
High Rail - Inspection (Outer Harbour)
(Port Dock) Broken Bolt in Joint R\R
(Port Dock) Cripple Insert R\R
Station Clean 10.173 - 15.528 (OUTH)
Station Clean 2.647 - 9.276 (OUTH)
1.563
22.125


Heavy Rail WO
Bulletins: (0)
Go To
Reports
Start Center
Profile
Sign Out
Help
PROD
Find:
Select Action
List
Work Order
Search for Work Orders
Start Measure:
End Measure:
Corridor:
Owner Group:
Work Type:
Find
Reset
Advanced Search
Save Query
Bookmarks
Work Orders
Filter
1 - 20 of 87
Download
Work Order
Description
Common Asset Name
Scheduled Start
Corridor
Priority
Status
Start Meas
End Meas
>5
<10
226288 Platform Inspection - West Croydon West Croydon Platform 1 22/11/12 11:00 AM OUTH 2D COMP
403372 Insulation Pads Outer Harbor Corridor 9/04/14 1:30 PM OUTH 2D COMP 5.050 5.200
417357 11799 Piece of rail on running face missing Outer Harbor Up Line OUTH 2D APPR 5.050 5.048
201870 14316 Tight gauge 12mm Outer Harbor Up Line 18/11/13 3:00 PM OUTH 2D INPRG 5.093 5.093
352735 Call Out Croydon West Subway OUTH 1 COMP 5.099 5.099
364159 loose rubber mats under rail loose on rossetta street bridge down o/h line Rosetta Street Bridge OUTH 2D APPR 5.106 5.106
347681 (Re-insulate Rossetta street Bridge) Rosetta Street Bridge 11/10/13 11:10 AM OUTH COMP 5.106 5.106
200022 7457 Vertical misalignment (Defect work order signals) Outer Harbor Up Line OUTH 2D APPR 5.120 5.050
330406 11267 Damage " I J " head of rail signal 551 Outer Harbor Down Line OUTH 2D APPR 5.180 5.181
318980 Mudhole forming on the up track tamping required Outer Harbor Up Line 13/10/13 8:30 AM OUTH 2D INPRG 5.260 5.260
393628 Fill in walk in holes - ref- Mark Hetherington Outer Harbor Corridor 22/01/14 7:30 AM OUTH COMP 5.280 5.280
318983 Bitumen breaking up in walkway, tripping hazard. bitumen required to fil in hole.Require tamping. Outer Harbor Up Line 16/08/13 1:00 PM OUTH 2D COMP 5.280 5.280
201311 13653 17mm twist (t.r.c report) Outer Harbor Up Line 21/02/13 12:10 PM OUTH 2D COMP 5.280 5.250
330402 Bitumen raised in walkway on up track Outer Harbor Up Line 3/10/13 8:00 AM OUTH 2D COMP 5.329 5.330
393580 Bitumen in walk way breaking, Up track Outer Harbor Up Line OUTH 2C COMP 5.330 5.332
200626 11882 Insufficient ballast Outer Harbor Down Line OUTH 2D APPR 5.970 8.002
201868 14315 Tight gauge 11mm Outer Harbor Up Line 18/11/13 3:00 PM OUTH 2D INPRG 6.000 6.000
270944 12298 redundant i.j.s adelaide side of kilkenny road xing Outer Harbor Up Line OUTH 2D APPR 6.040 6.040
200300 10166 Raised bitumen surface on roadway update 3/11/ 2011 k.maslin 2D hole in bitumen rest of r-xing Kilkenny Road Level Crossing OUTH 2D COMP 6.049 6.049
240371 Square rails check rail Kilkenny rd Xing Outer Harbor Corridor OUTH 2D INPRG 6.050 6.050
Select Records
Done
Local intranet | Protected Mode: Off
105%


Heavy Rail WO
Bulletins: (0)
Go To
Reports
Start Center
Profile
Sign Out
Help
PROD
Find:
Select Action
List
Work Order
Owner Group: TRACK
Class: WORKORDER
Status: INPRG
Site: HRAIL
Attachments
Inspection Priority: 2D
Inspection Speed Restriction:
Work Speed Restriction:
Is Report Printed?:
Work Order: 201870
14316 Tight gauge 12mm
Work Type: CM
Asset: 40119
Track - Main - Outer Harbor Up Line
Common Asset Name: Outer Harbor Up Line
OUTH
Incident Class: TRACK INSPECTION FAULTS \ TRACK GEOMETRY \ ALIGNMENT
Alignment
Failure Class: HRAIL-F003
Start | End Measure: 5.093 5.093
Linear Segment Details
Start
Reference Point: Bridge - Rosetta Street Bridge - Rail over Road (41348)
Reference Point Offset: -13.000 METRES
Measure: 5.093 KM
Y Offset:
Y Reference:
Z Offset:
Z Reference:
End
Reference Point: Bridge - Rosetta Street Bridge - Rail over Road (41348)
Reference Point Offset: -13.000 METRES
Measure: 5.093 KM
Y Offset:
Y Reference:
Z Offset:
Z Reference:
Scheduling Information
Target Start:
Target Finish:
Scheduled Start: 18/11/13 3:00 PM
Scheduled Finish: 18/11/13 3:00 PM
Actual Start: 20/11/13 11:25 AM
Actual Finish:
Tasks for Work Order 201870
Filter
1 - 1 of 1
Download
Sequence
Task
Summary
Estimated Duration
Status
Owner Group
1
10
Re-gauge as requied. As per code
0:00
INPRG
TRACK
New Row
Planned Labor
Actual Labor
Work Log
Labor
Filter
0 - 0 of 0
Download
Task
Labor
Name
Approved?
Start Date
Start Time
End Time
Type
Regular Hours
OT Hours
No rows to display...
Select Labor
Select Planned Labor
New Row
Done
Local intranet | Protected Mode: Off
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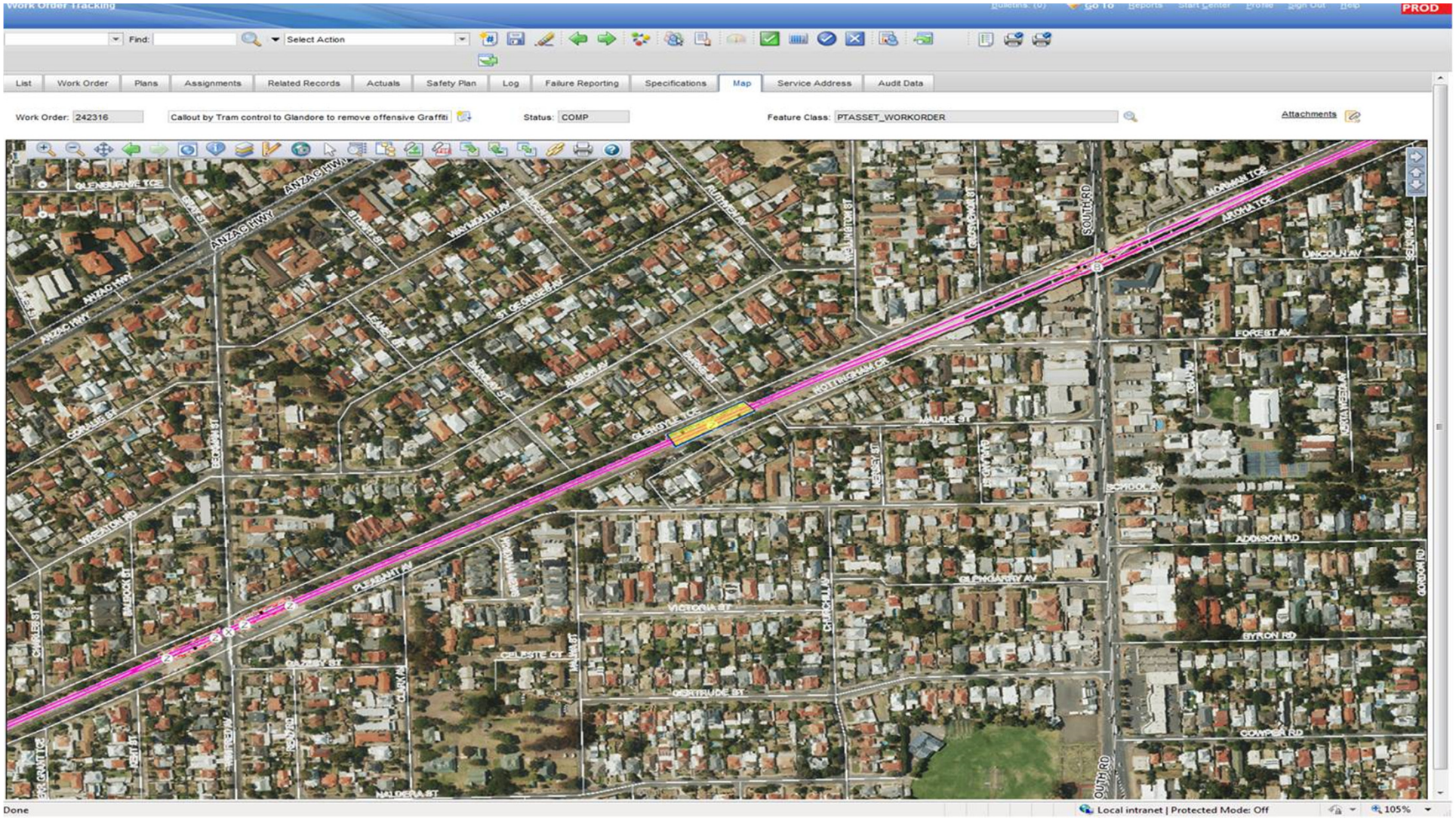
What Maximo Spatial does?

- Ties an asset, work order or service request to a spatial location (point, line or polygon feature).
- Terminology difference between a Maximo Feature and a Spatial Feature.
  - A spatial dataset within ArcGIS is referred to as a Feature Class. A Feature Class contains features
  - Features can be Points, Lines or Polygon


Work Order Tracking
PROD
Find:
Select Action
List
Work Order
Plans
Assignments
Related Records
Actuals
Safety Plan
Log
Failure Reporting
Specifications
Map
Service Address
Audit Data
Work Order: 242316
Callout by Tram control to Glandore to remove offensive Graffiti
Status: COMP
Feature Class: PTASSET_WORKORDER
Attachments
GLENBURNIE TCE
ANZAC HWY
WAYMOUTH AV
ST GEORGES AV
NOTTINGHAM CR
GLENGYLE TCE
MAUDE ST
SOUTH RD
MORMAN TCE
ARDHA TCE
LINCOLN AV
FOREST AV
SCHOOL AV
ADDISON RD
GLENGARRY AV
BYRON RD
COWPER RD
PLEASANT AV
VICTORIA ST
GERTRUDE ST
CELESTE CT
NALDERA ST
CORALIE ST
WREATON RD
Done
Local intranet | Protected Mode: Off
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A planning use case

A priority 1 work order comes in through Maximo.

Planner organises immediate dispatch of crew to fix fault. Planner then interrogates the system for surrounding faults

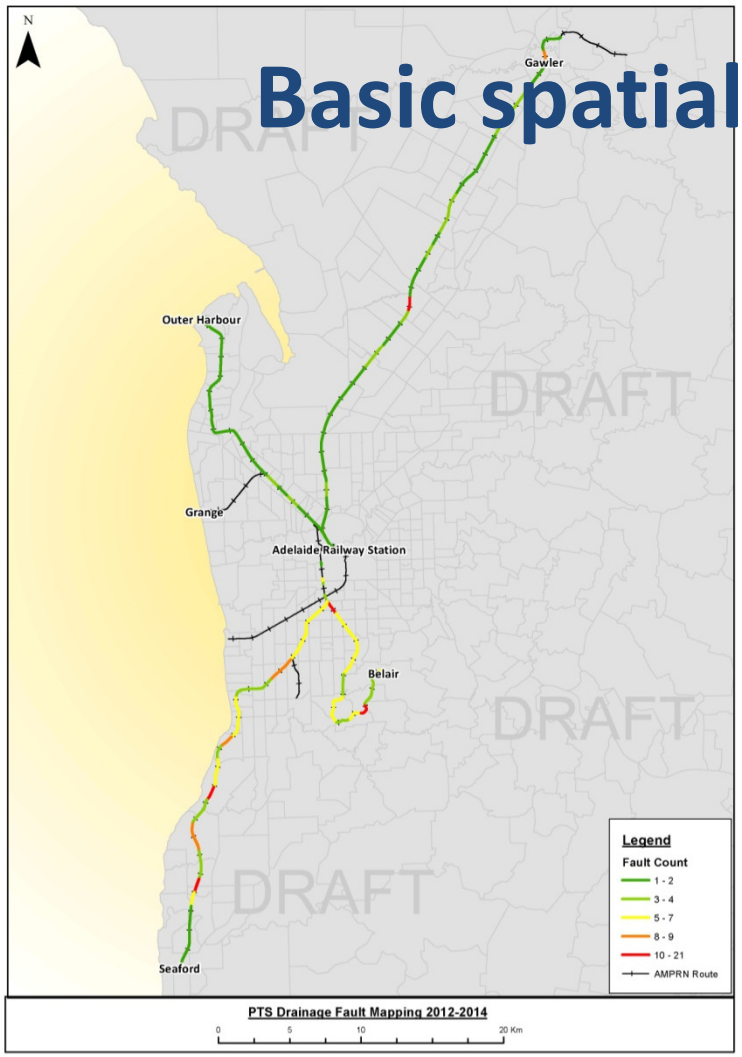
Planner uses the spatial select tool to drag a 500m radius around the work site and identifies 20 jobs.

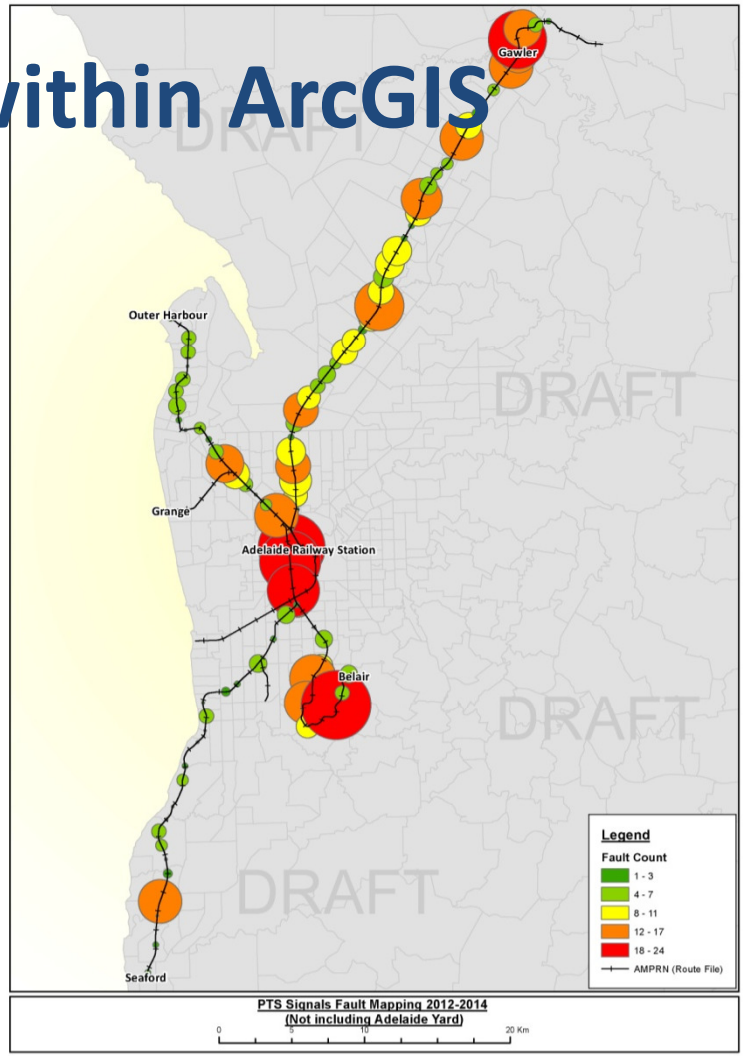
He pushes the selected work orders into the list screen, and filters by owner group, picking up 3 additional work orders that can be completed by the dispatched crew.

He then assigns additional work to the crew, to be completed after rectifying the high priority fault.

The crews view and complete assigned work orders using toughbooks.

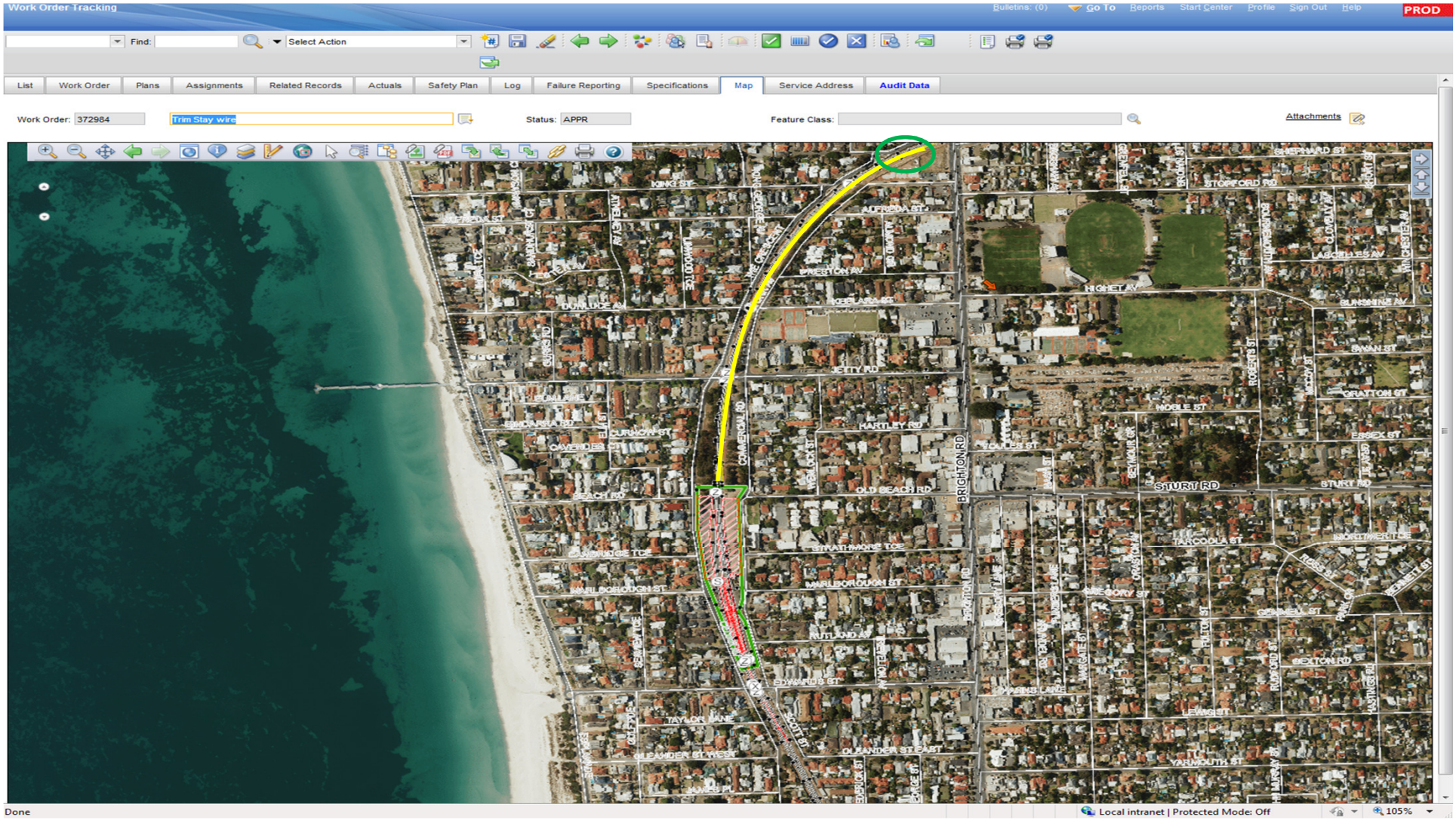
Basic spatial analysis within ArcGIS





Expanding Linear and Spatial functionality

- ArcGIS is capable of converting linear information (i.e chainage) into point or line features.
- This allows for linear work orders to be displayed spatially.
- Although Maximo Spatial is capable of linking to the asset at fault, it can not spatially identify the linear section of an asset at fault.


Work Order Tracking
Bulletins: (0)
Go To
Reports
Start Center
Profile
Sign Out
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PROD
Find:
Select Action
List
Work Order
Plans
Assignments
Related Records
Actuals
Safety Plan
Log
Failure Reporting
Specifications
Map
Service Address
Audit Data
Work Order: 372984
Trim Stay wire
Status: APPR
Feature Class:
Attachments
KING ST
ALFREDA ST
PRESTON AV
KEELARA ST
NIGHET AV
STOPFORD RD
SHEPHARD ST
LASCELLES AV
SUNSHINE AV
SWAN ST
GRATTON ST
ESSEX ST
STURT RD
NOBLE ST
JETTY RD
HARTLEY RD
OLD BEACH RD
BRIGHTON RD
COMMERCIAL RD
CURNOW ST
CAVENDER ST
BEACH RD
STRATHMORE TCE
MARLBOROUGH ST
TARCOOLA ST
GEMMELL ST
BEXTON RD
EDWARDS ST
TAYLOR LANE
OLEANDER ST WEST
OLEANDER ST EAST
LEWIS ST
YARMOUTH ST
Done
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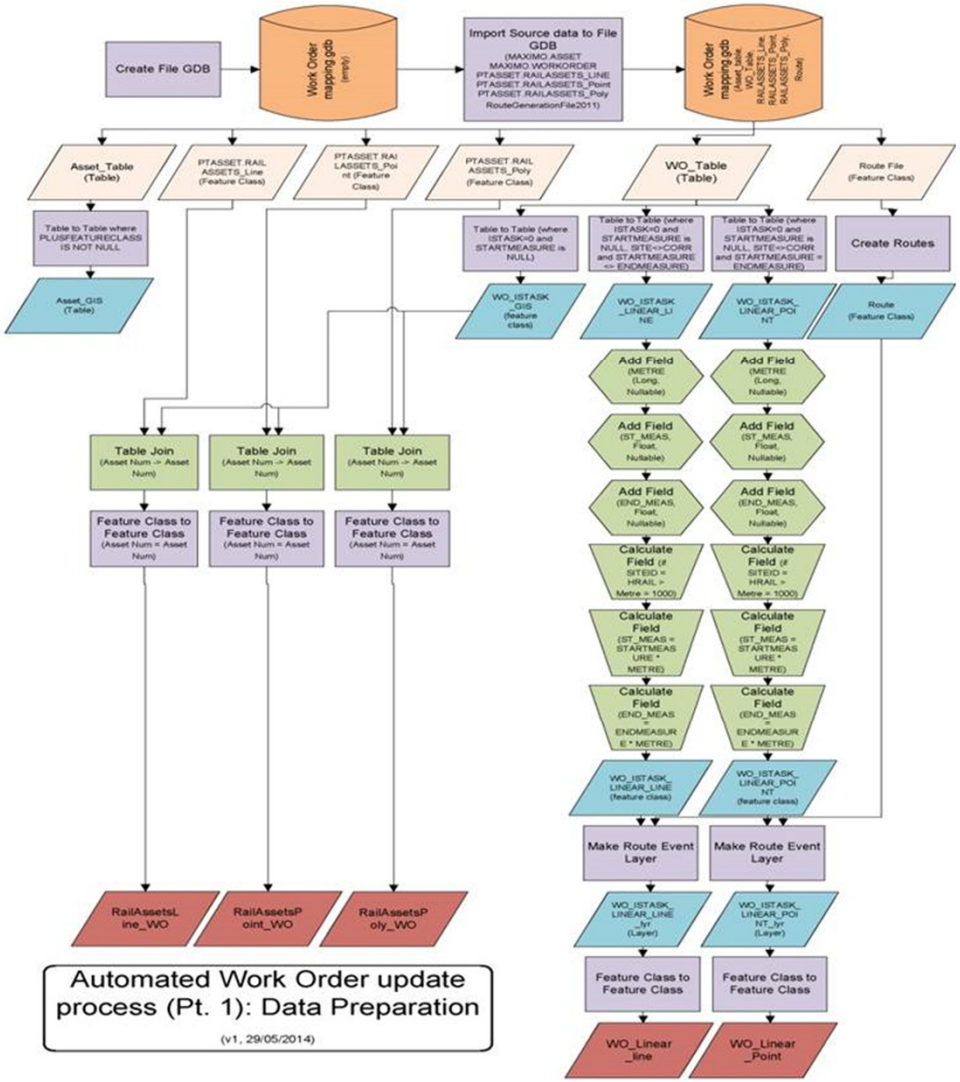
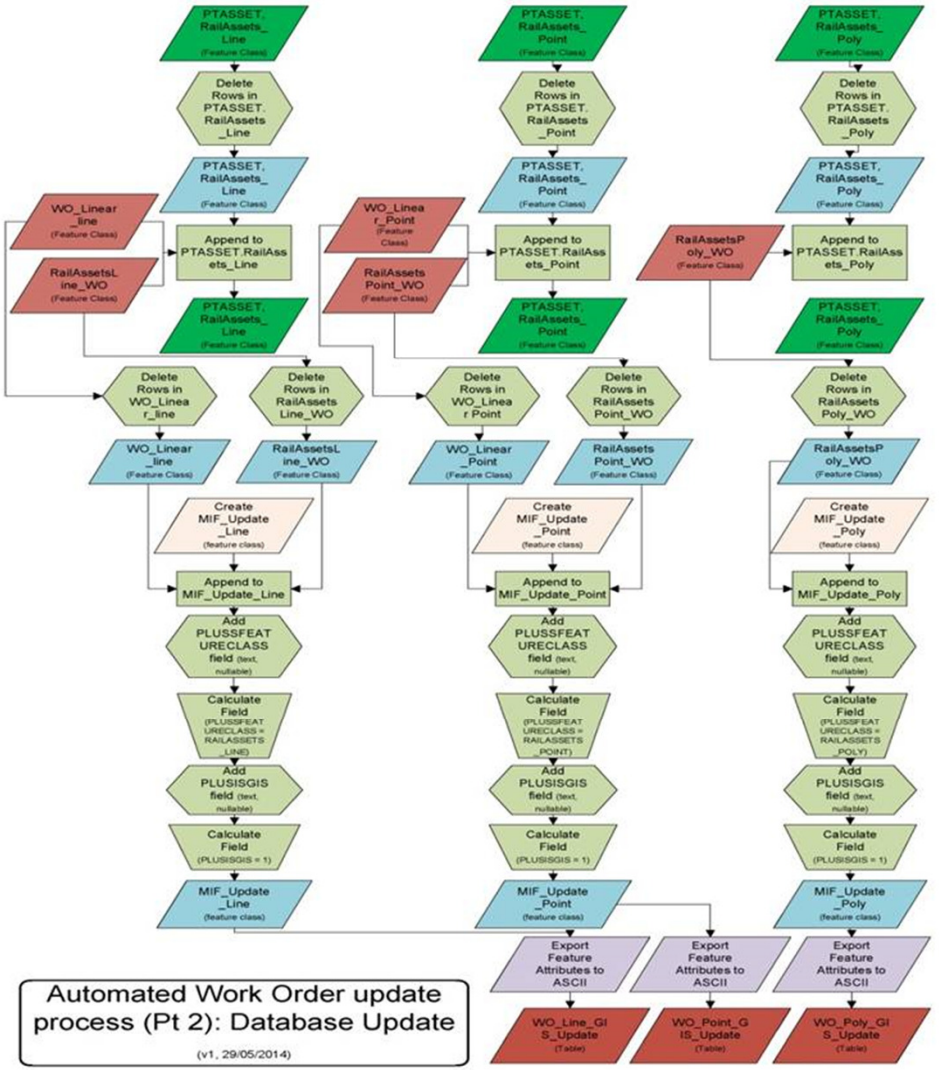
Generation of Spatial features from Linear Information

- References the Maximo WORKORDER table
- Prepares data within ArcGIS for linear referencing
- Creates GIS Features from linear information
- Pushes updated features into the Work Order Feature Class
- Updates Maximo Work Order table via MIF

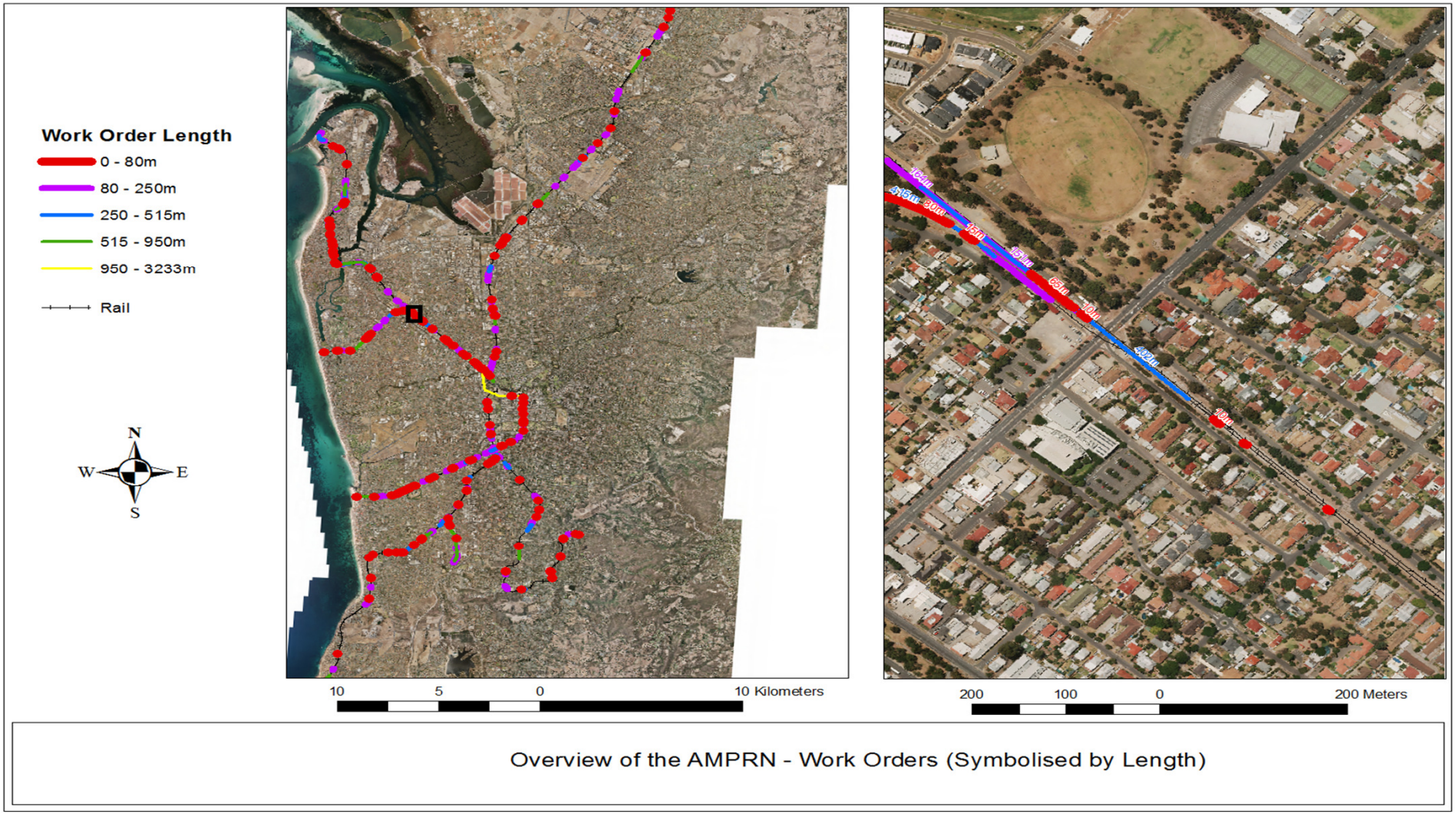

Create File GDB
Work Order mapping.gdb (empty)
Import Source data to File GDB (MAXIMO.ASSET MAXIMO.WORKORDER PTASSET.RAILASSETS_LINE PTASSET.RAILASSETS_Point PTASSET.RAILASSETS_Poly RouteGenerationFile2011)
Work Order mapping.gdb (Asset_table WO_Table RAILASSETS_Line RAILASSETS_Point RAILASSETS_Poly Route)
Asset_Table (Table)
PTASSET.RAILASSETS_Line (Feature Class)
PTASSET.RAILASSETS_Point (Feature Class)
PTASSET.RAILASSETS_Poly (Feature Class)
WO_Table (Table)
Route File (Feature Class)
Table to Table where PLUSFEATURECLASS IS NOT NULL
Asset_GIS (Table)
Table to Table (where ISTASK=0 and STARTMEASURE is NULL)
Table to Table (where ISTASK=0 and STARTMEASURE is NULL, SITE<>CORR and STARTMEASURE <> ENDMEASURE)
Table to Table (where ISTASK=0 and STARTMEASURE is NULL, SITE<>CORR and STARTMEASURE = ENDMEASURE)
Create Routes
WO_ISTASK_GIS (feature class)
WO_ISTASK_LINEAR_LINE
WO_ISTASK_LINEAR_POINT
Route (Feature Class)
Table Join (Asset Num -> Asset Num)
Table Join (Asset Num -> Asset Num)
Table Join (Asset Num -> Asset Num)
Add Field (METRE (Long, Nullable)
Add Field (METRE (Long, Nullable)
Add Field (ST_MEAS, Float, Nullable)
Add Field (ST_MEAS, Float, Nullable)
Add Field (END_MEAS, Float, Nullable)
Add Field (END_MEAS, Float, Nullable)
Feature Class to Feature Class (Asset Num = Asset Num)
Feature Class to Feature Class (Asset Num = Asset Num)
Feature Class to Feature Class (Asset Num = Asset Num)
Calculate Field (if SITEID = HRAIL > Metre = 1000)
Calculate Field (if SITEID = HRAIL > Metre = 1000)
Calculate Field (ST_MEAS = STARTMEASURE * METRE)
Calculate Field (ST_MEAS = STARTMEASURE * METRE)
Calculate Field (END_MEAS = ENDMEASURE * METRE)
Calculate Field (END_MEAS = ENDMEASURE * METRE)
WO_ISTASK_LINEAR_LINE (feature class)
WO_ISTASK_LINEAR_POINT (feature class)
Make Route Event Layer
Make Route Event Layer
WO_ISTASK_LINEAR_LINE_lyr (Layer)
WO_ISTASK_LINEAR_POINT_lyr (Layer)
Feature Class to Feature Class
Feature Class to Feature Class
RailAssetsLine_WO
RailAssetsPoint_WO
RailAssetsPoly_WO
WO_Linear_line
WO_Linear_Point
Automated Work Order update process (Pt. 1): Data Preparation
(v1, 29/05/2014)


PTASSET.RailAssets_Line (Feature Class)
PTASSET.RailAssets_Point (Feature Class)
PTASSET.RailAssets_Poly (Feature Class)
Delete Rows in PTASSET.RailAssets_Line
Delete Rows in PTASSET.RailAssets_Point
Delete Rows in PTASSET.RailAssets_Poly
PTASSET.RailAssets_Line (Feature Class)
PTASSET.RailAssets_Point (Feature Class)
PTASSET.RailAssets_Poly (Feature Class)
WO_Linear_line (Feature Class)
RailAssetsLine_WO (Feature Class)
WO_Linear_Point (Feature Class)
RailAssetsPoint_WO (Feature Class)
RailAssetsPoly_WO (Feature Class)
Append to PTASSET.RailAssets_Line
Append to PTASSET.RailAssets_Point
Append to PTASSET.RailAssets_Poly
PTASSET.RailAssets_Line (Feature Class)
PTASSET.RailAssets_Point (Feature Class)
PTASSET.RailAssets_Poly (Feature Class)
Delete Rows in WO_Linear_line
Delete Rows in RailAssetsLine_WO
Delete Rows in WO_Linear_Point
Delete Rows in RailAssetsPoint_WO
Delete Rows in RailAssetsPoly_WO
WO_Linear_line (Feature Class)
RailAssetsLine_WO (Feature Class)
WO_Linear_Point (Feature Class)
RailAssetsPoint_WO (Feature Class)
RailAssetsPoly_WO (Feature Class)
Create MIF_Update_Line (feature class)
Create MIF_Update_Point (feature class)
Create MIF_Update_Poly (feature class)
Append to MIF_Update_Line
Append to MIF_Update_Point
Append to MIF_Update_Poly
Add PLUSSFEATURECLASS field (text, nullable)
Calculate Field (PLUSSFEATURECLASS = RAILASSETS_LINE)
Calculate Field (PLUSSFEATURECLASS = RAILASSETS_POINT)
Calculate Field (PLUSSFEATURECLASS = RAILASSETS_POLY)
Add PLUSISGIS field (text, nullable)
Calculate Field (PLUSISGIS = 1)
MIF_Update_Line (feature class)
MIF_Update_Point (feature class)
MIF_Update_Poly (feature class)
Export Feature Attributes to ASCII
Export Feature Attributes to ASCII
Export Feature Attributes to ASCII
WO_Line_GIS_Update (Table)
WO_Point_GIS_Update (Table)
WO_Poly_GIS_Update (Table)
Automated Work Order update process (Pt 2): Database Update
(v1, 29/05/2014)

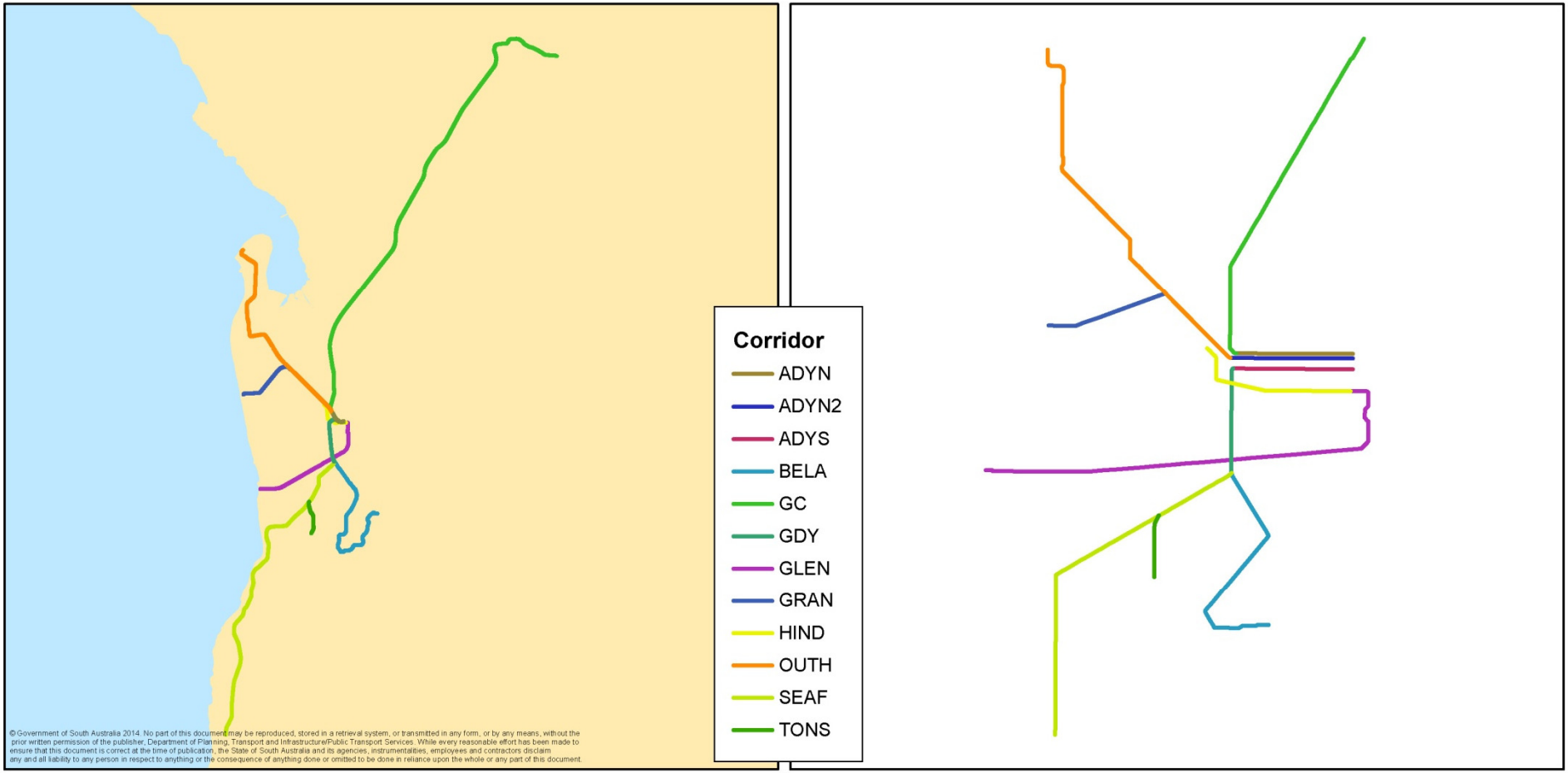
A basic example of the work order output

With the availability of Maximo tables through the SDE, the potential for analysis and interrogation is virtually endless.

Example: Work orders displayed by length.



Overview of the AMPRN - Work Orders (Symbolised by Length)



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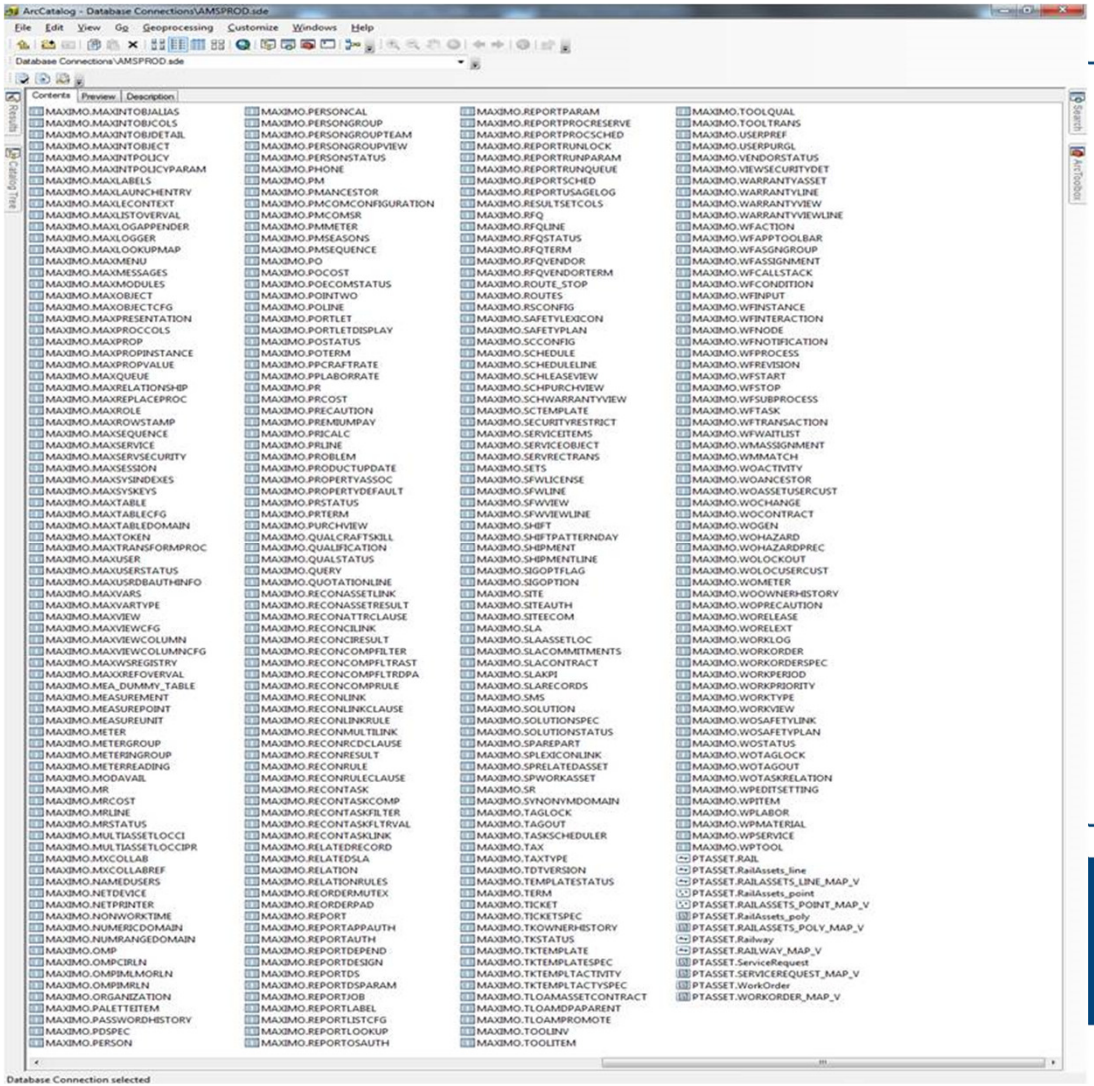
Government of South Australia
Public Transport Services

Schematic view of network

0 5 10 20 30 40 Km

Date: 4/09/2014

1:458,563



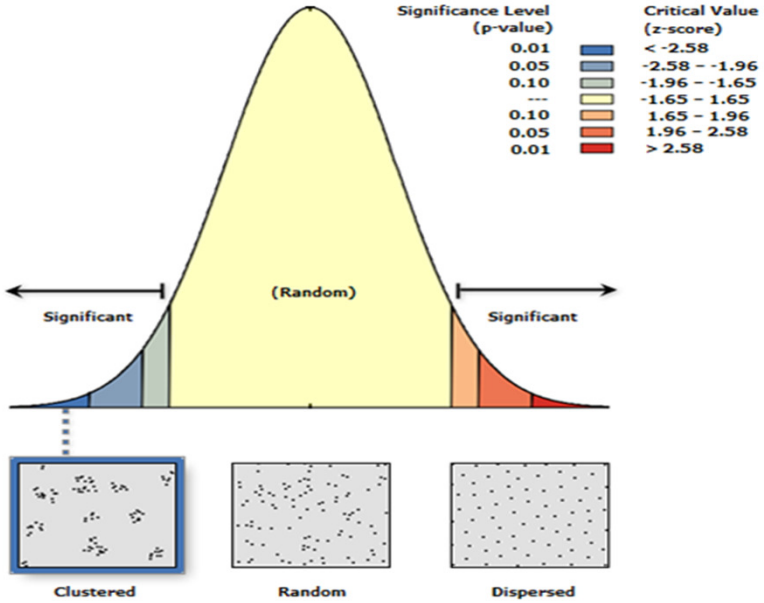
SDE schema with access to Maximo tables

Government of South Australia
Department of Planning, Transport and Infrastructure

Spatial analysis and statistics

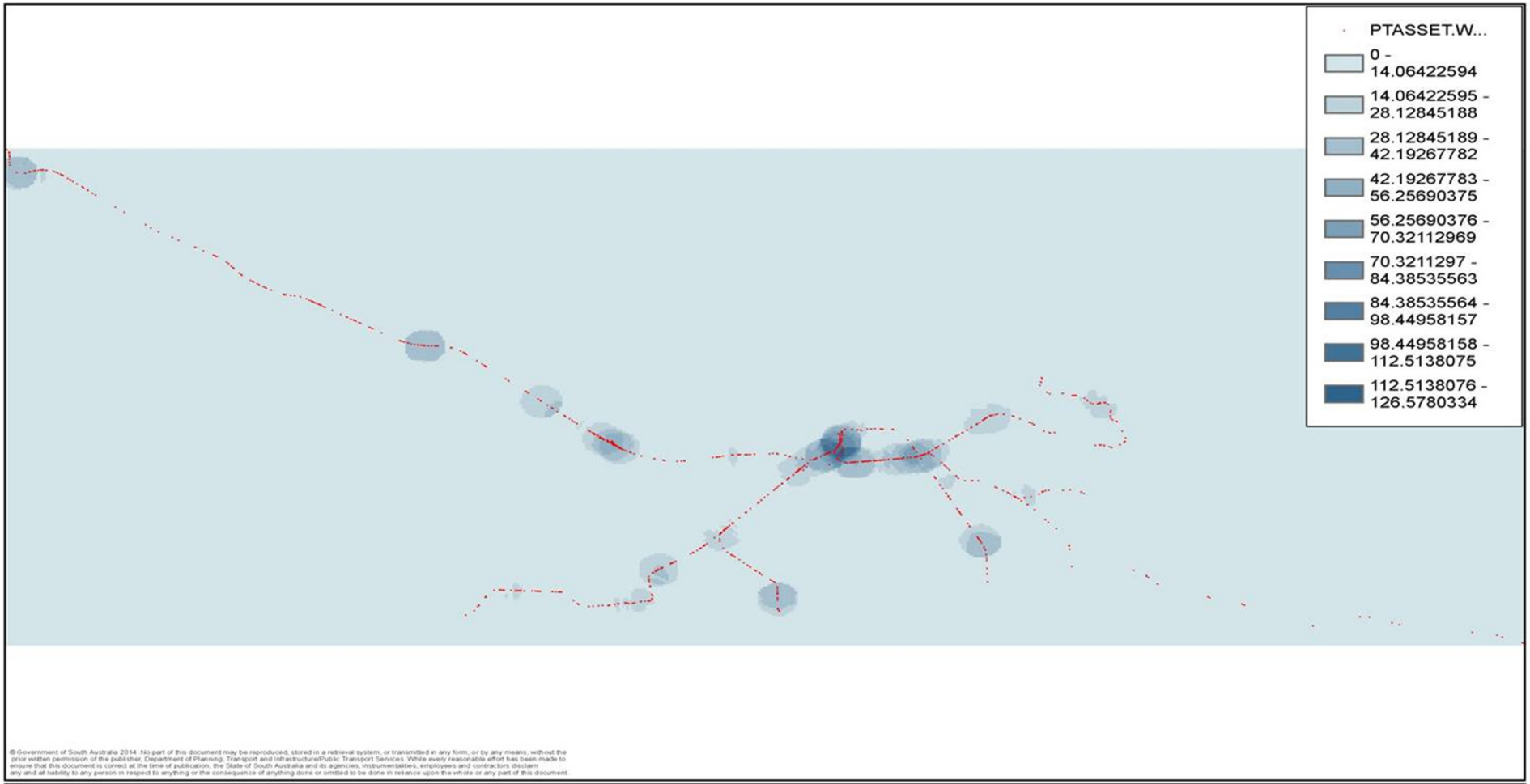
- Nearest Neighbour Analysis
- Density Analysis
- Weighted Density Analysis

Average Nearest Neighbour Analysis



Average Nearest Neighbor Summary	
Observed Mean Distance:	20.7903 Meters
Expected Mean Distance:	392.9702 Meters
Nearest Neighbor Ratio:	0.052905
z-score:	-83.895101
p-value:	0.000000

Dataset Information	
Input Feature Class:	PTASSET.WORKORDER_POINT_MAP_V
Distance Method:	EUCLIDEAN
Study Area:	1324353827.584769
Selection Set:	True



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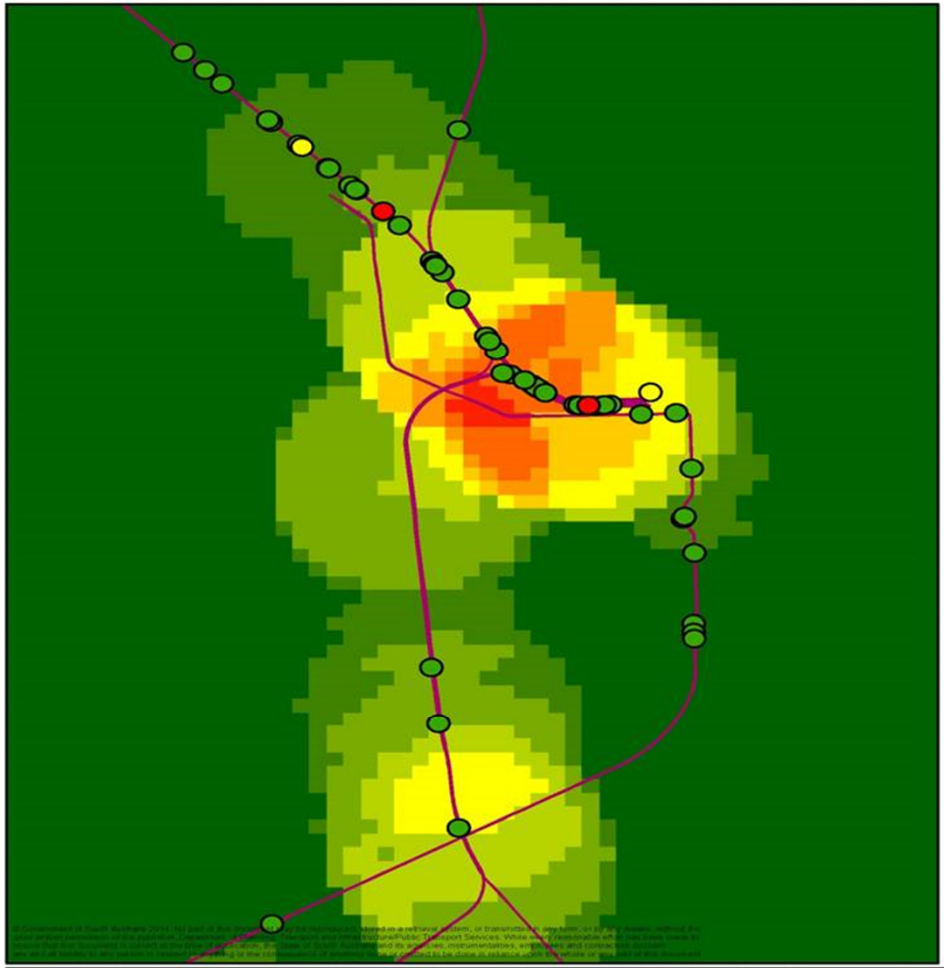
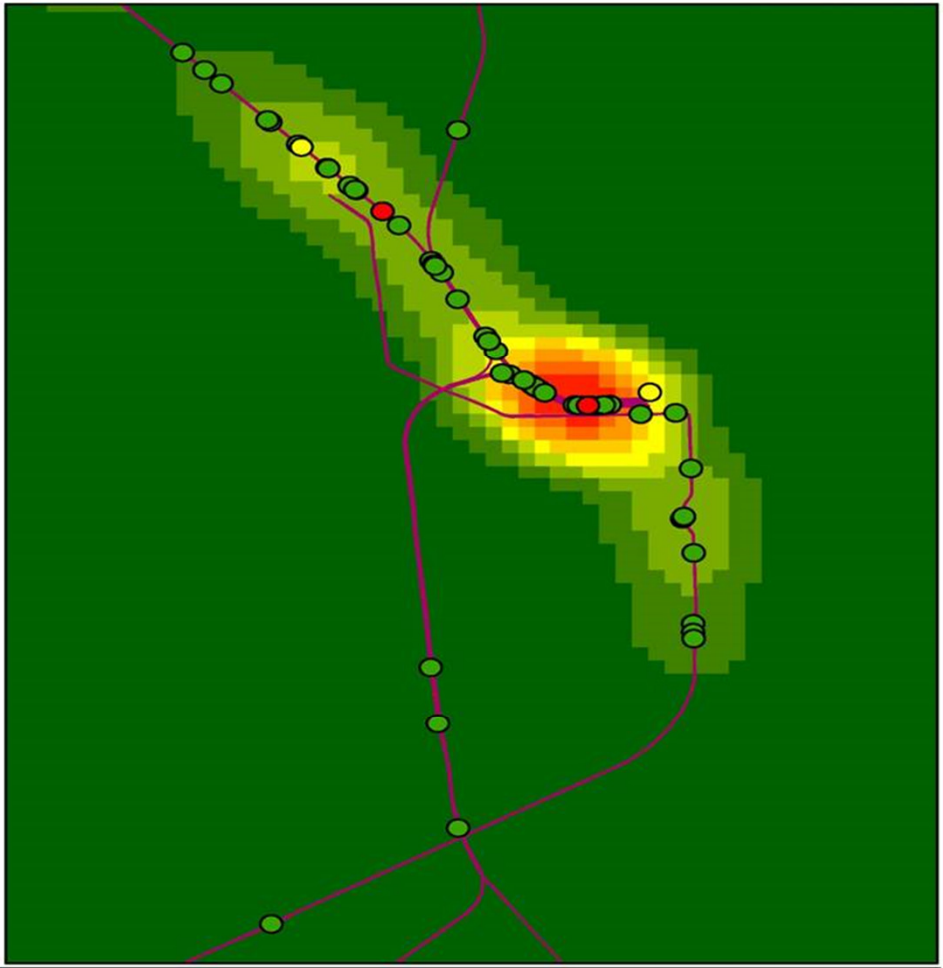
Density Anaylsis

Date: 5/06/2014

0 3 6 12 18 24 Km

1:225,000



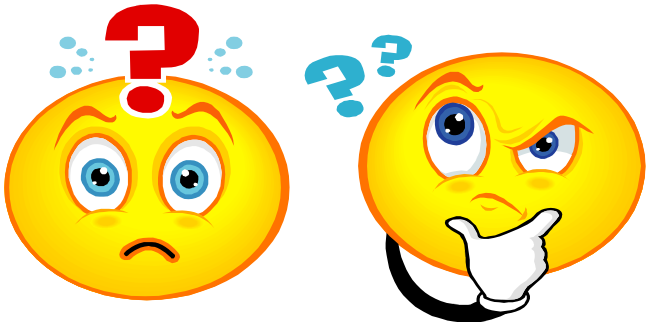


Open Faults Density Analysis

Open Faults Kernel Density Analysis

Date: 5/06/2014

0 0.5 1 2 3 4 Km

1:40,477

Questions