

Implementing a Spatially Integrated AMS DPTI - PTS

Speaker:

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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
- 3m Tram
- 48m Bus

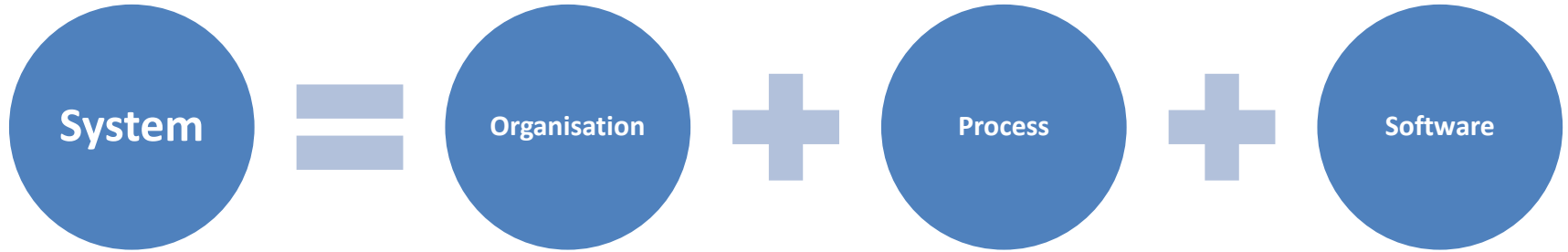


Rail Revitalisation Projects

- 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

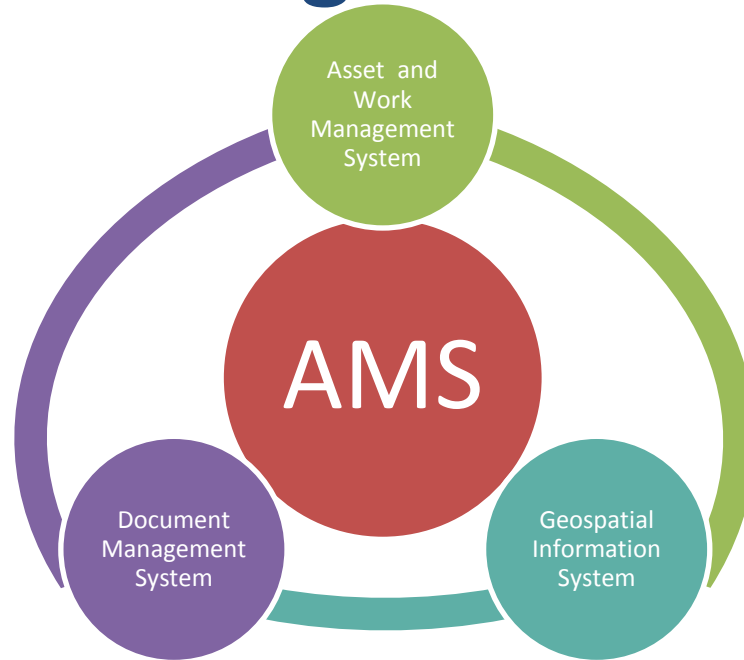


80% of all your potential (AMS) improvements could and are most likely related to **Process and Organisation**.

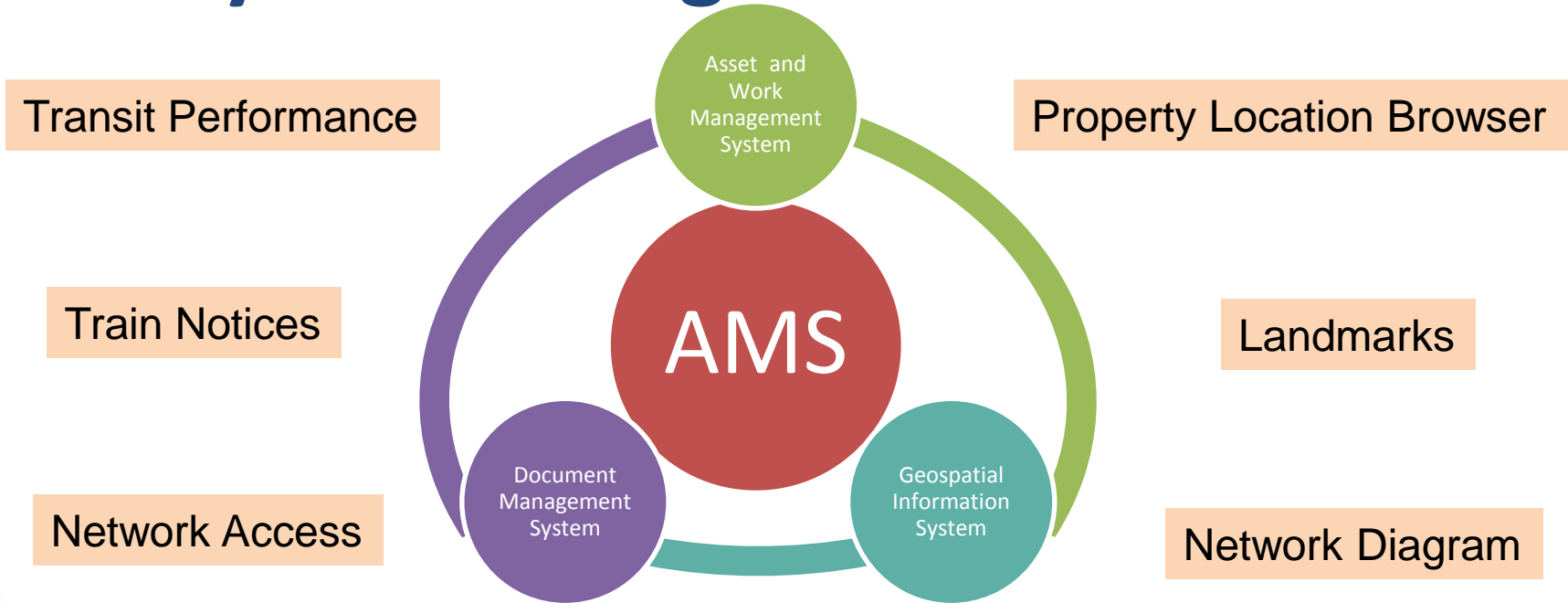
Q: How can an organisation and its processes be enhanced through increased system functionality?



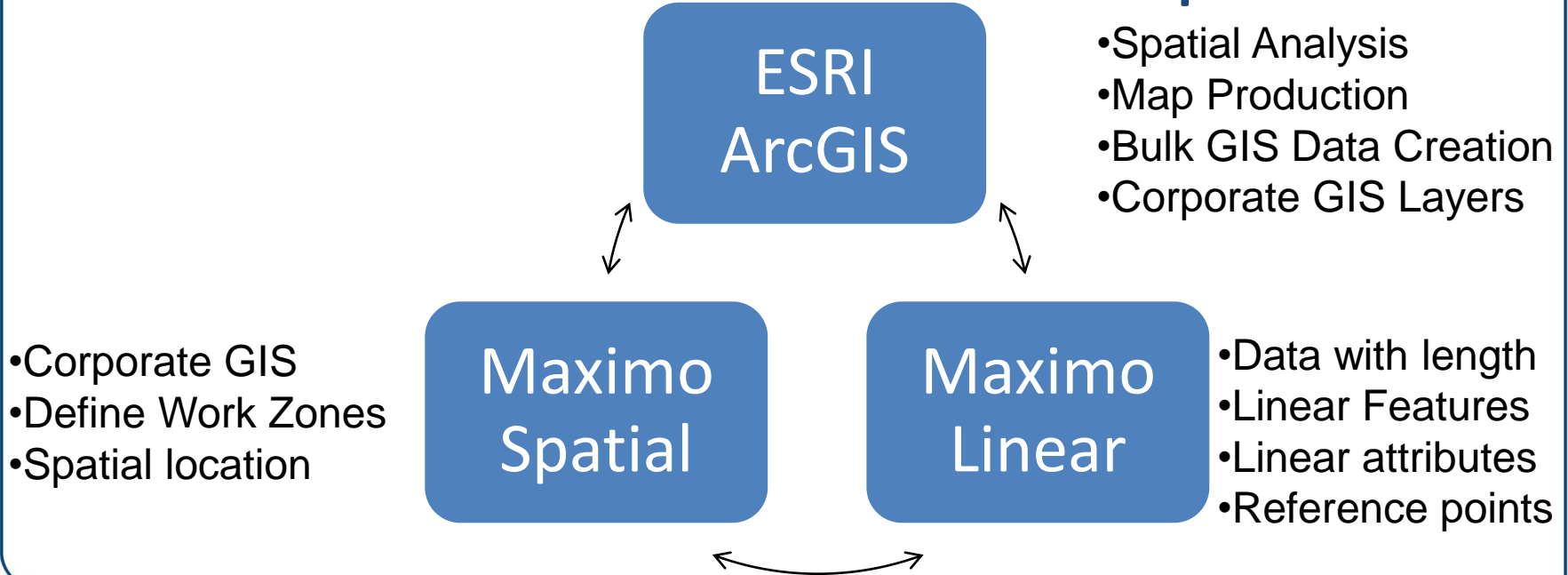
Systems integrated functions



Systems integrated functions



Maximo with Linear and Spatial

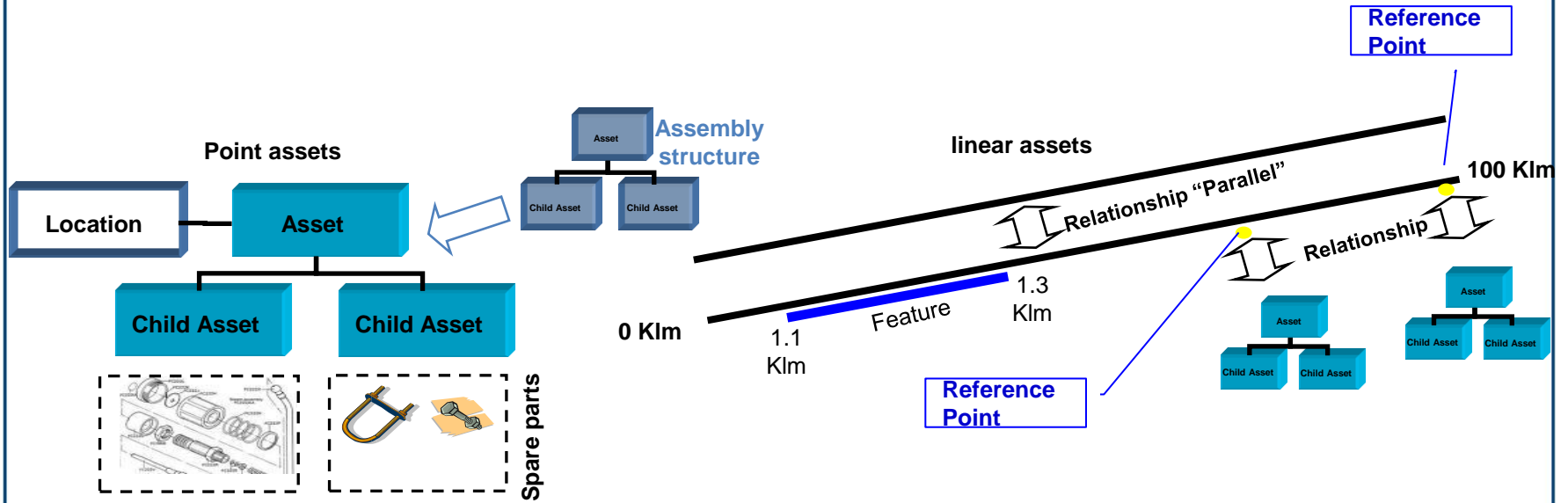


What Maximo Linear does?

- 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?



Find: Select Action

List Asset Spare Parts Safety Meters Specifications Features Relationships Work Topology Map Service Address

Asset: Track - Main - North Down Main Site: From: To:

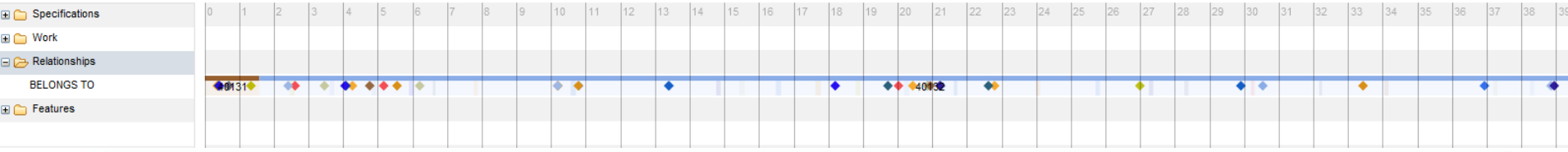
You can filter to view only the relationships where the current asset is the source or the target. You also can view all relationships.

Filter By:

Relationships Filter 1 - 6 of 72 Download

| Sequence | Source Asset | Source Description | Source Start Measure | Source End Measure | Relationship | Target Asset | Target Description | Target Start Measure | Target End Measure |
|----------|--------------|--------------------------------|----------------------|--------------------|--------------|--------------|--------------------|----------------------|--------------------|
| | 40011 | Track - Main - North Down Main | 10.185 | 10.185 | BELONGS TO | 40491 | Turnout : DC31 | 10.185 | 10.185 |
| | 40011 | Track - Main - North Down Main | 13.397 | 13.397 | BELONGS TO | 40485 | Turnout : DC126A | 13.397 | 13.397 |
| | 40011 | Track - Main - North Down Main | 13.388 | 13.388 | BELONGS TO | 40480 | Turnout : DC125 | 13.388 | 13.388 |
| | 40011 | Track - Main - North Down Main | 1.329 | 1.329 | BELONGS TO | 40451 | Turnout : AD83 | 1.329 | 1.329 |
| | 40011 | Track - Main - North Down Main | 0.687 | 0.687 | BELONGS TO | 40410 | Turnout : AD69A | 0.687 | 0.687 |
| | 40011 | Track - Main - North Down Main | 0.423 | 0.423 | BELONGS TO | 40394 | Turnout : AD59A | 0.423 | 0.423 |

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](#)



Find: Select Action

List Asset Spare Parts Safety Meters Specifications **Features** Relationships Work Topology Map Service Address

Asset: Track - Main - North Down Main Site: From: To:

Features Filter 1 - 10 of 79 Download

| Feature | Description | Label | Type | Start Measure | End Measure | Share With Related Assets? | On Related Asset? |
|----------------------|---|---|----------------------|---------------|-------------|-------------------------------------|-------------------------------------|
| <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | >5 | <15 | <input type="text"/> | <input type="text"/> |
| ▶ BELONGS TO | » An asset that is part of another | KM Post - 5 (40839) | LINEAR | 5.001 | 5.001 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ▼ BELONGS TO | » An asset that is part of another | Turnout - IG1A (40709) | LINEAR | 5.158 | 5.158 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| ▶ BELONGS TO | » An asset that is part of another | Level Crossing - Pym Street (41333) | LINEAR | 5.237 | 5.237 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ▶ BELONGS TO | » An asset that is part of another | Pedestrian Crossing - Pym Street - Down (40940) | LINEAR | 5.250 | 5.250 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ▶ RAIL SIGNAL | » Signal | Signal - 574 - A | POINT | 5.261 | 5.261 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ▶ RAIL SIGNAL | » Signal | Signal - 573 | POINT | 5.438 | 5.438 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ▶ RAIL SIGNAL | » Signal | Signal - 672 | POINT | 5.516 | 5.516 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ▶ RAIL SIGNAL | » Signal | Signal - 671 - A | POINT | 5.537 | 5.537 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| ▶ BELONGS TO | » An asset that is part of another | Speed Zone - 80km/h (40643) | LINEAR | 5.543 | 5.543 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| ▶ RAIL SIGNAL | » Signal | Signal - 674 - A | POINT | 5.865 | 5.865 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

Feature Details

Feature: »

Label:

Type:

Classification:

Class Description:

On Related Asset?

Continuous?

Share With Related Assets?

Is Reference Point?

Created by Relationship?

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

Front

Common Asset Name: North Up Main

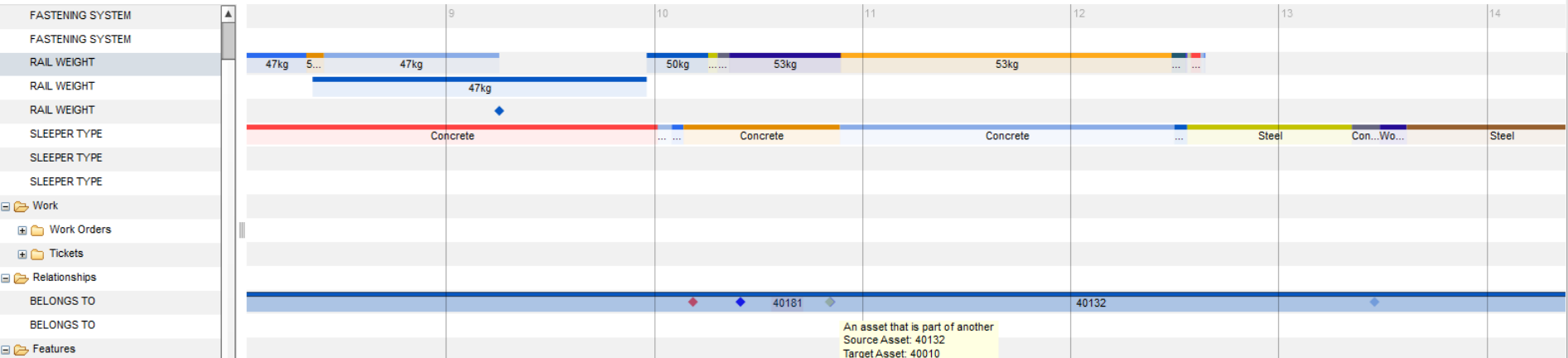
Classification: 1.0 ADELAIDE PUBLIC TRANSPORT SYSTEM \ 2.0 ADELAIDE >>

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 | | | |
| 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](#)



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 |
|----------------------|-----------------------------|----------------------|----------------------|----------------------|-------------------------------------|----------------------|----------------------|
| <input type="text"/> | HEIGHT <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| 1 | 000HEIGHT | Platform Height 0m | GAUGE | MM | <input checked="" type="checkbox"/> | 38.246 | 38.246 |
| 2 | 010HEIGHT | Platform Height 10m | GAUGE | MM | <input checked="" type="checkbox"/> | 38.256 | 38.256 |
| 3 | 020HEIGHT | Platform Height 20m | GAUGE | MM | <input checked="" type="checkbox"/> | 38.266 | 38.266 |
| 4 | 030HEIGHT | Platform Height 30m | GAUGE | MM | <input checked="" type="checkbox"/> | 38.276 | 38.276 |
| 5 | 040HEIGHT | Platform Height 40m | GAUGE | MM | <input checked="" type="checkbox"/> | 38.286 | 38.286 |
| 6 | 050HEIGHT | Platform Height 50m | GAUGE | MM | <input checked="" type="checkbox"/> | 38.296 | 38.296 |
| 7 | 060HEIGHT | Platform Height 60m | GAUGE | MM | <input checked="" type="checkbox"/> | 38.306 | 38.306 |
| 8 | 070HEIGHT | Platform Height 70m | GAUGE | MM | <input checked="" type="checkbox"/> | 38.316 | 38.316 |
| 9 | 080HEIGHT | Platform Height 80m | GAUGE | MM | <input checked="" type="checkbox"/> | 38.326 | 38.326 |
| 10 | 090HEIGHT | Platform Height 90m | GAUGE | MM | <input checked="" type="checkbox"/> | 38.336 | 38.336 |

New Row



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Transport and Infrastructure

Find: Select Action ↕

- List
- Asset
- Spare Parts
- Safety
- Meters
- Specifications**
- Features
- Relationships
- Work
- Topology
- Map
- Service Address

Asset: Corridor - Outer Harbor Site: From: To:

Common Asset Name:

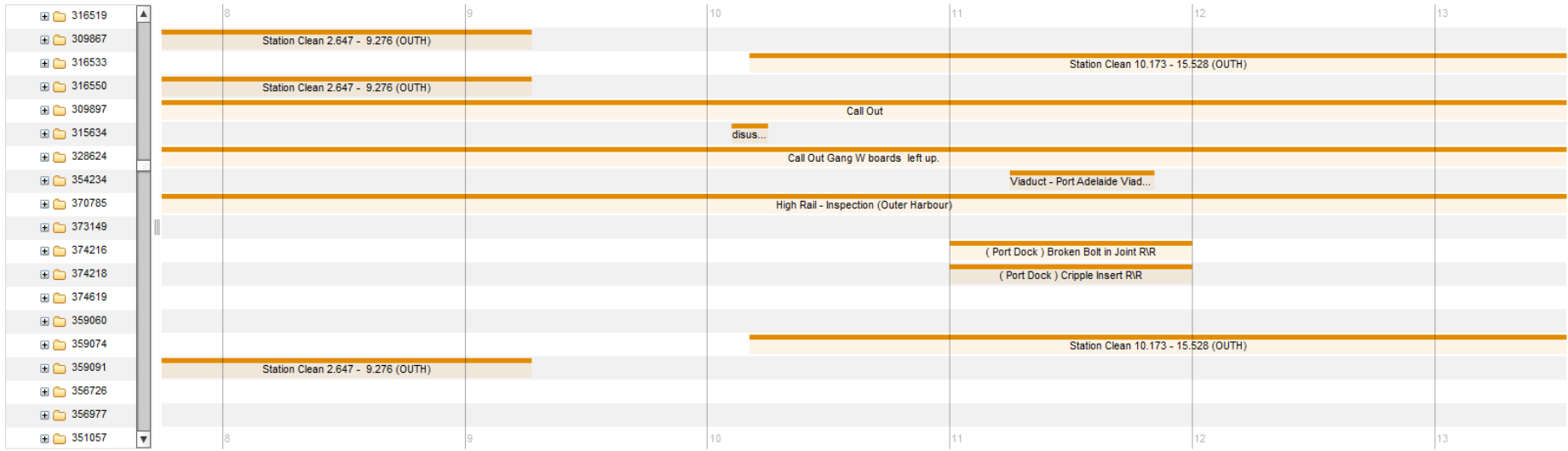
Classification: >>> Class Description:

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](#)



Search for Work Orders

Start Measure: Owner Group:

End Measure: Work Type:

Corridor:

Find Reset

Advanced Search Save Query Bookmarks

Work Orders Filter Download

| Work Order | Description | Common Asset Name | Scheduled Start | Corridor | Priority | Status | Start Meas | End Meas |
|------------|--|------------------------------|-------------------|----------|----------|--------|------------|----------|
| | | | | OUTH | | | >5 | <10 |
| 226288 | Platform Inspection - West Croyden | West Croyden Platform 1 | 22/11/12 11:00 AM | OUTH | 2D | COMP | 5.000 | 5.134 |
| 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 rosetta street bridge down o/h line | Rosetta Street Bridge | | OUTH | 2D | APPR | 5.106 | 5.106 |
| 347681 | (Re-insulate Rosetta 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 |
| 393626 | 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 fill 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 (L.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 |
| 393500 | 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 kilkeny road xing | Outer Harbor Up Line | | OUTH | 2D | APPR | 6.040 | 6.040 |
| 200300 | 10186 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

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: Z Offset: Y Reference: 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: Z Offset: Y Reference: Z Reference:

Scheduling Information

Target Start: Scheduled Start: 18/11/13 3:00 PM Actual Start: 20/11/13 11:25 AM

Target Finish: Scheduled Finish: 18/11/13 3:00 PM Actual Finish:

Tasks for Work Order 201870 Download

| Sequence | Task | Summary | Estimated Duration | Status | Owner Group |
|----------|------|-----------------------------------|--------------------|--------|-------------|
| 1 | 10 | Re-gauge as required. As per code | 0:00 | INPRG | TRACK |

New Row

Planned Labor Actual Labor Work Log

Labor 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

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



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



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.

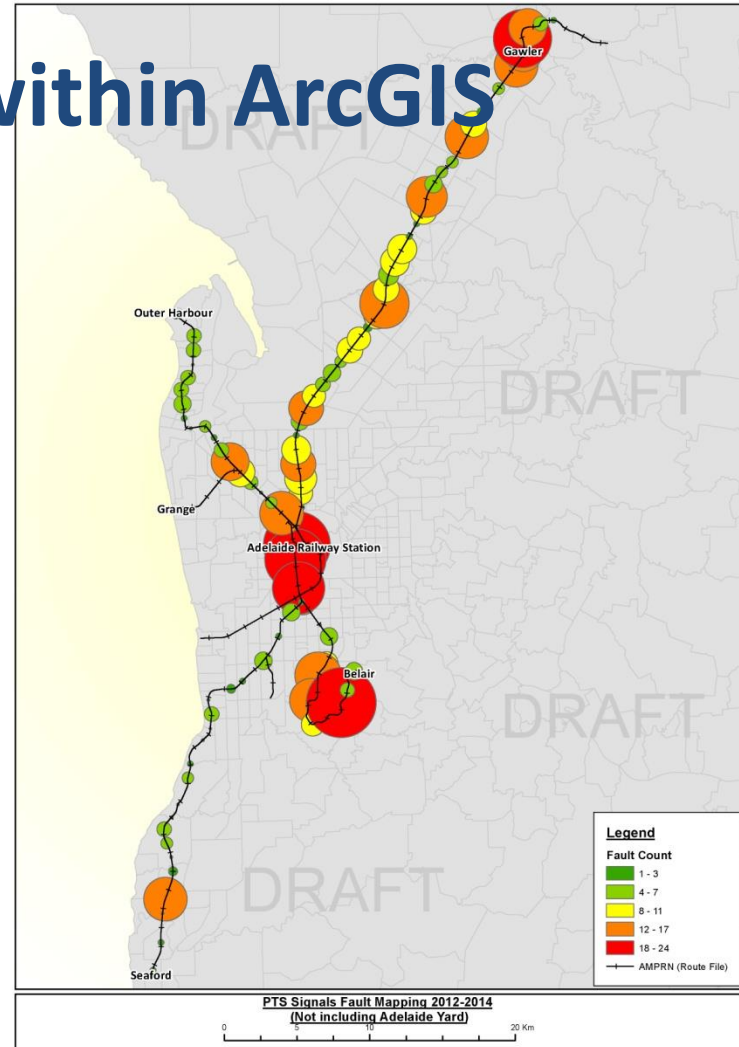
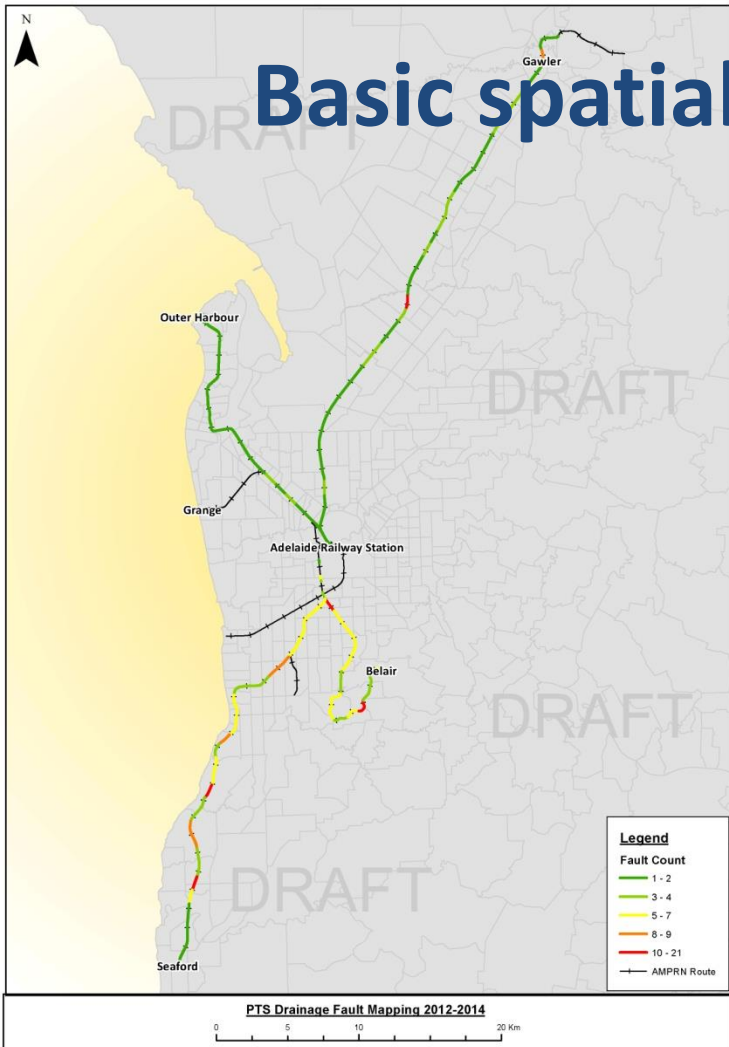
The crews view and complete assigned work orders using toughbooks.



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Basic spatial analysis within ArcGIS



Expanding Linear and Spatial functionality

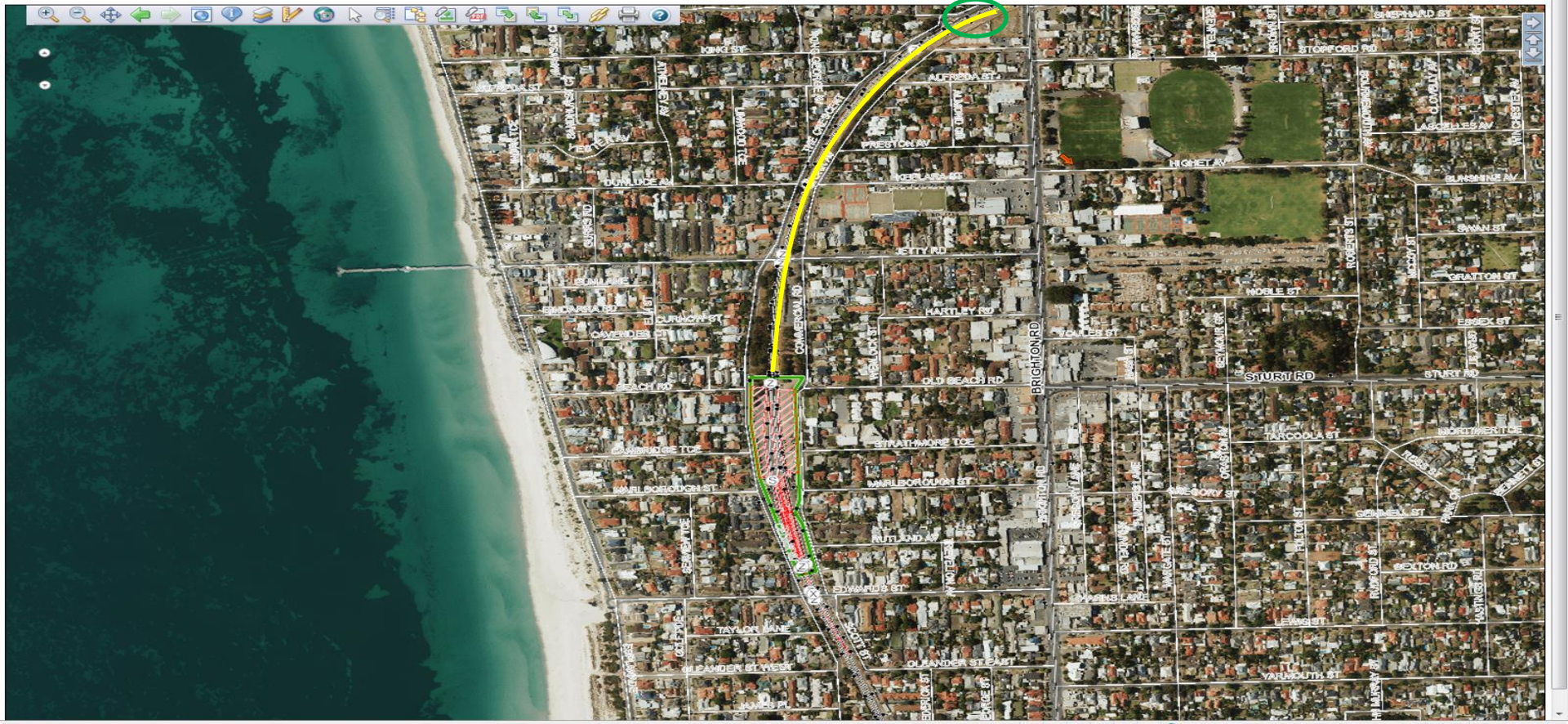
- ArcGIS is capable of converting linear information (i.e chainage) into point or line features.
- This allows for linear work orders to be displayed spatially.
- Although Maximo Spatial is capable of linking to the asset at fault, it can not spatially identify the linear section of an asset at fault.



Find: Select Action

List Work Order Plans Assignments Related Records Actuals Safety Plan Log Failure Reporting Specifications **Map** Service Address **Audit Data**

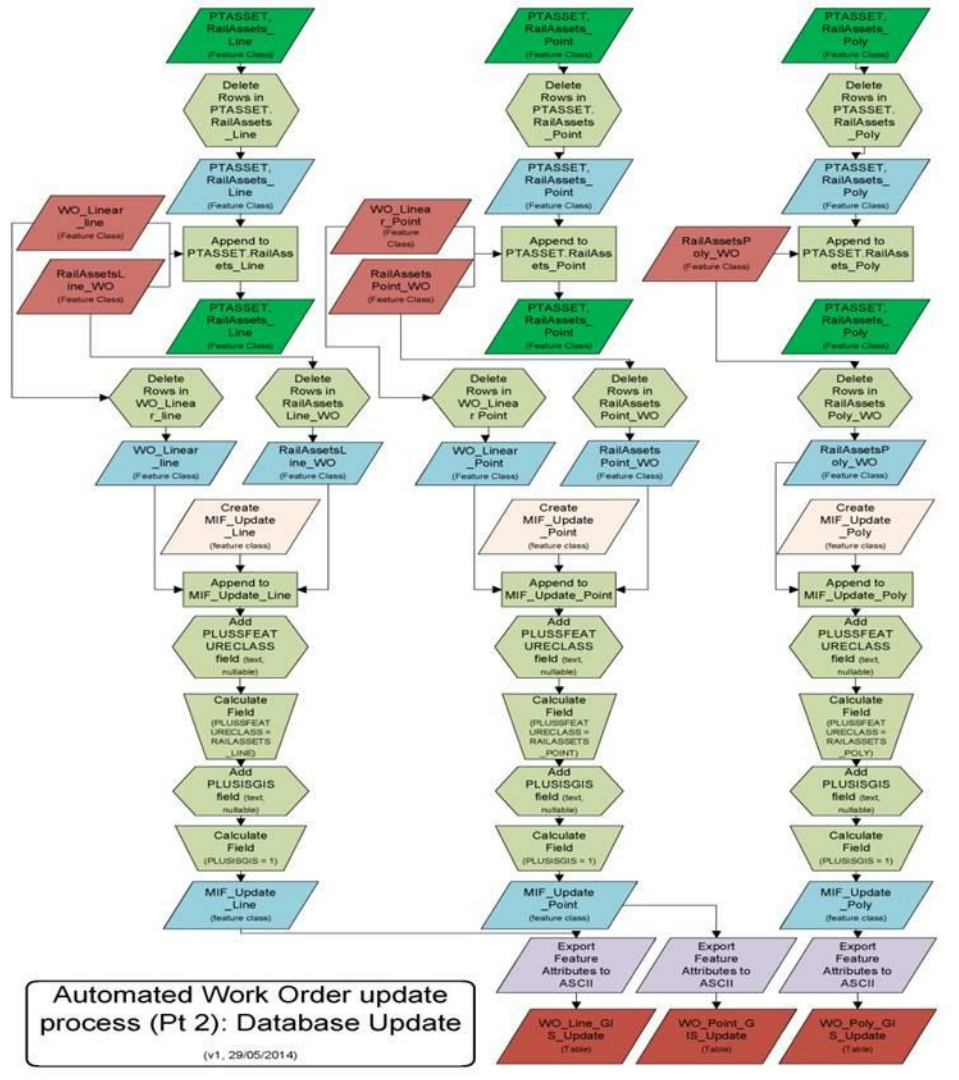
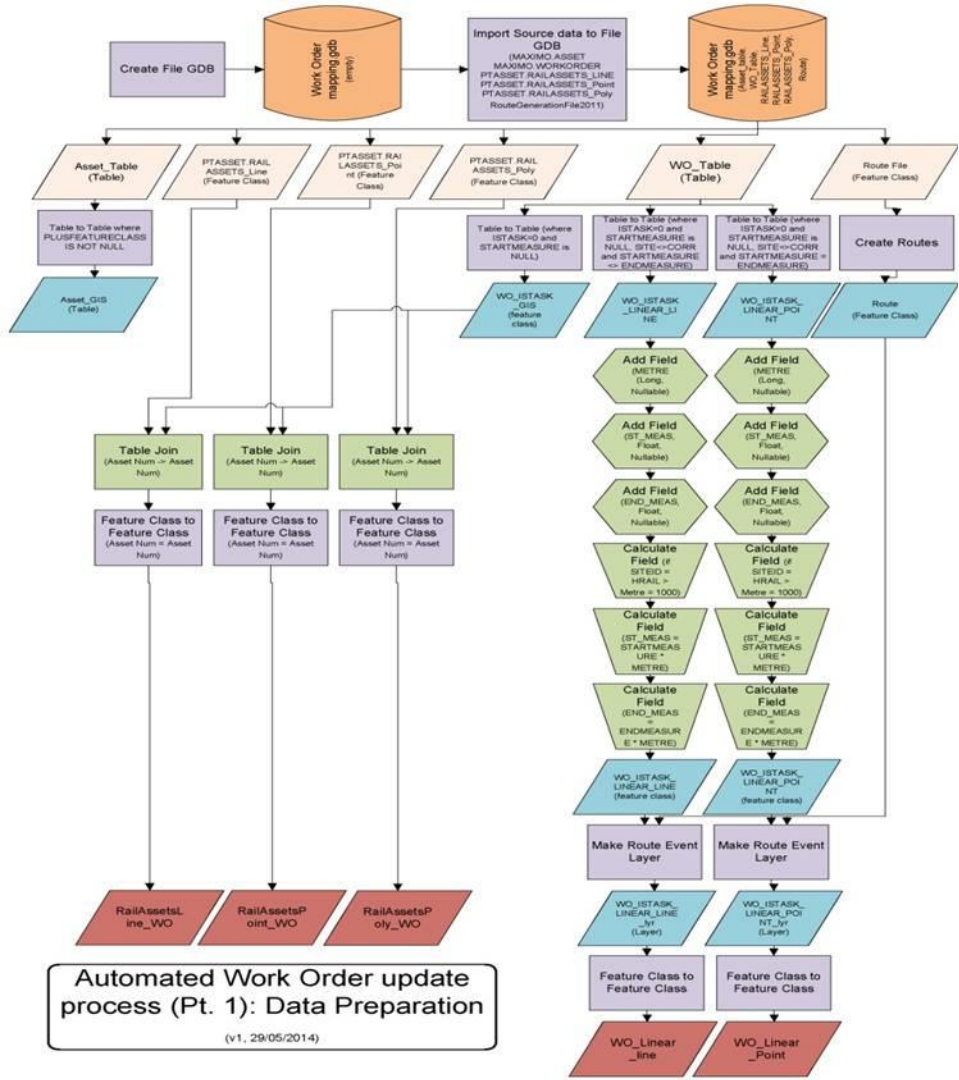
Work Order: Status: Feature Class: [Attachments](#)



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





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.

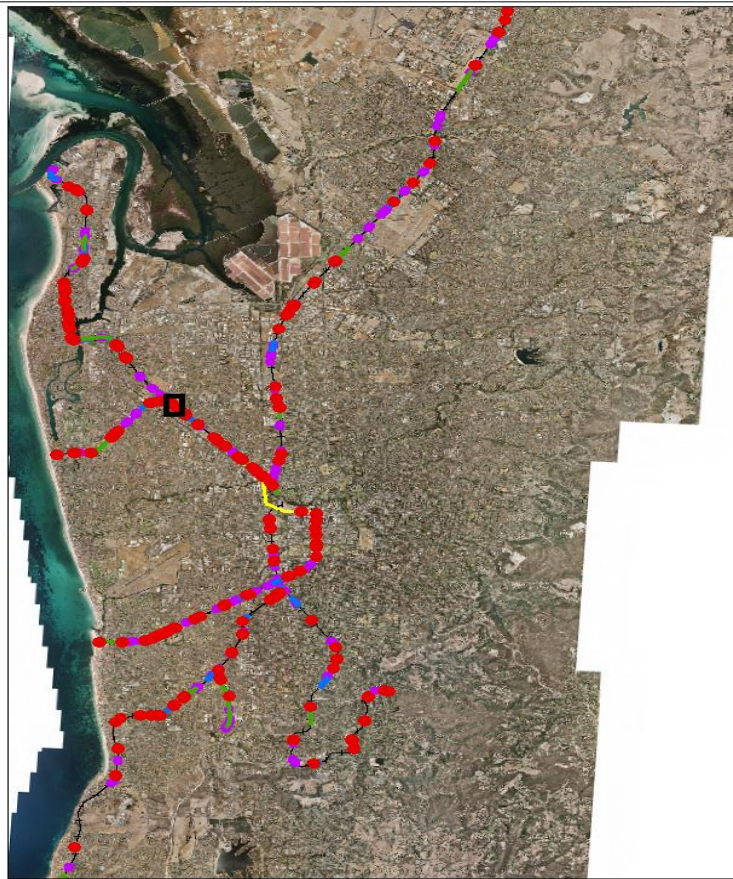
Example: Work orders displayed by length.



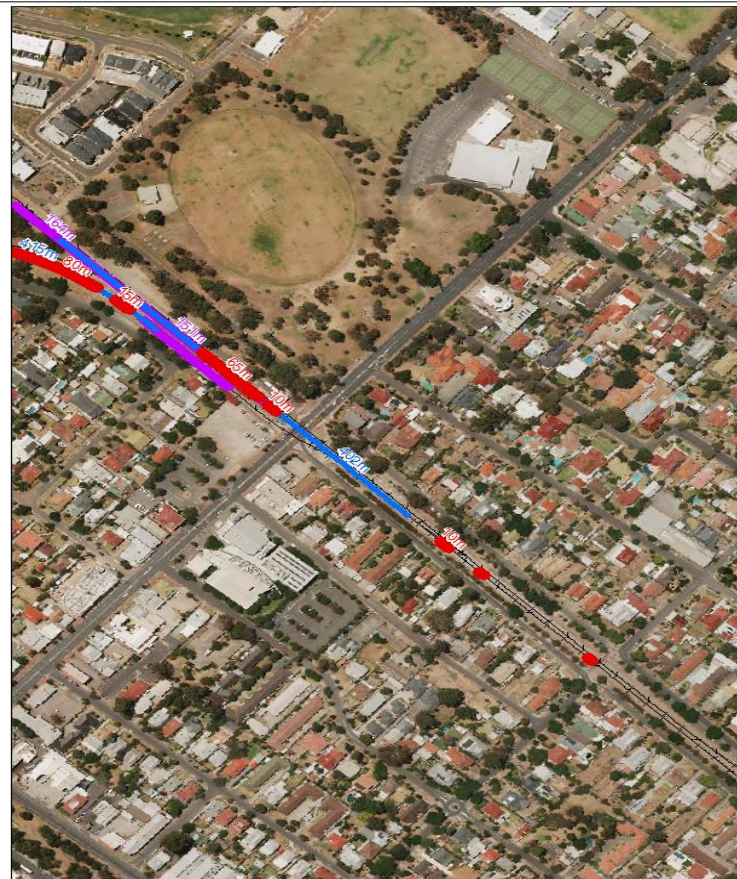
Work Order Length

- 0 - 80m
- 80 - 250m
- 250 - 515m
- 515 - 950m
- 950 - 3233m

—+— Rail

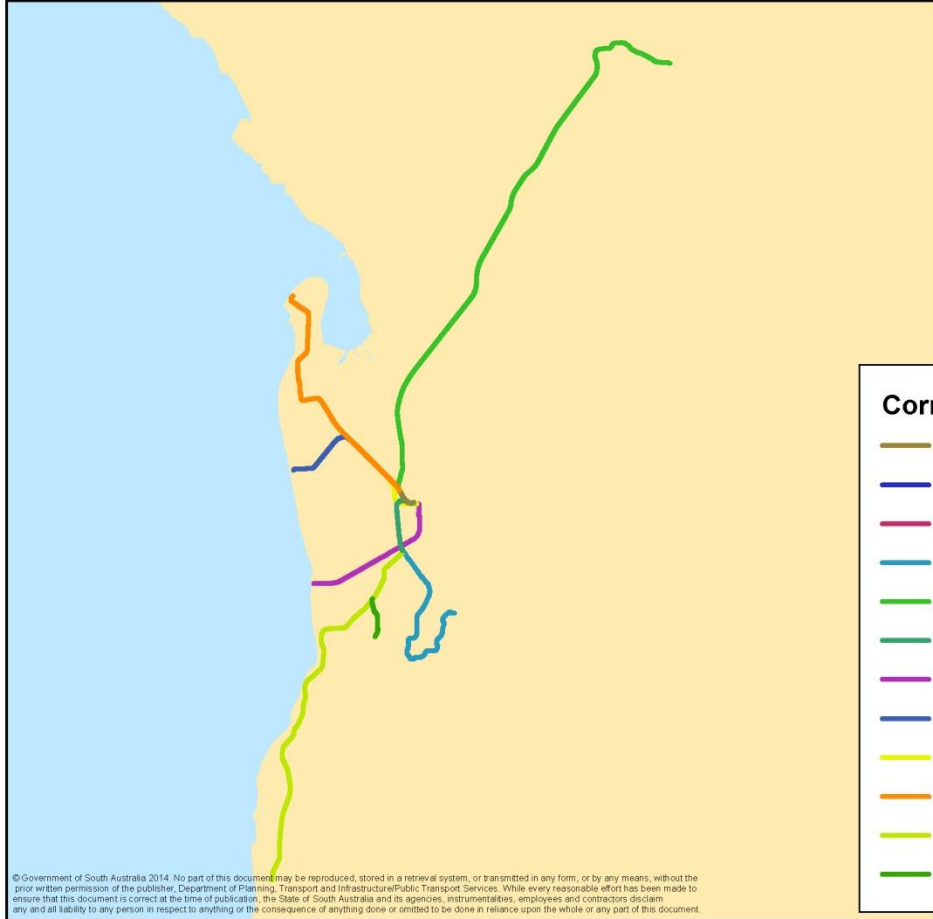


10 5 0 10 Kilometers



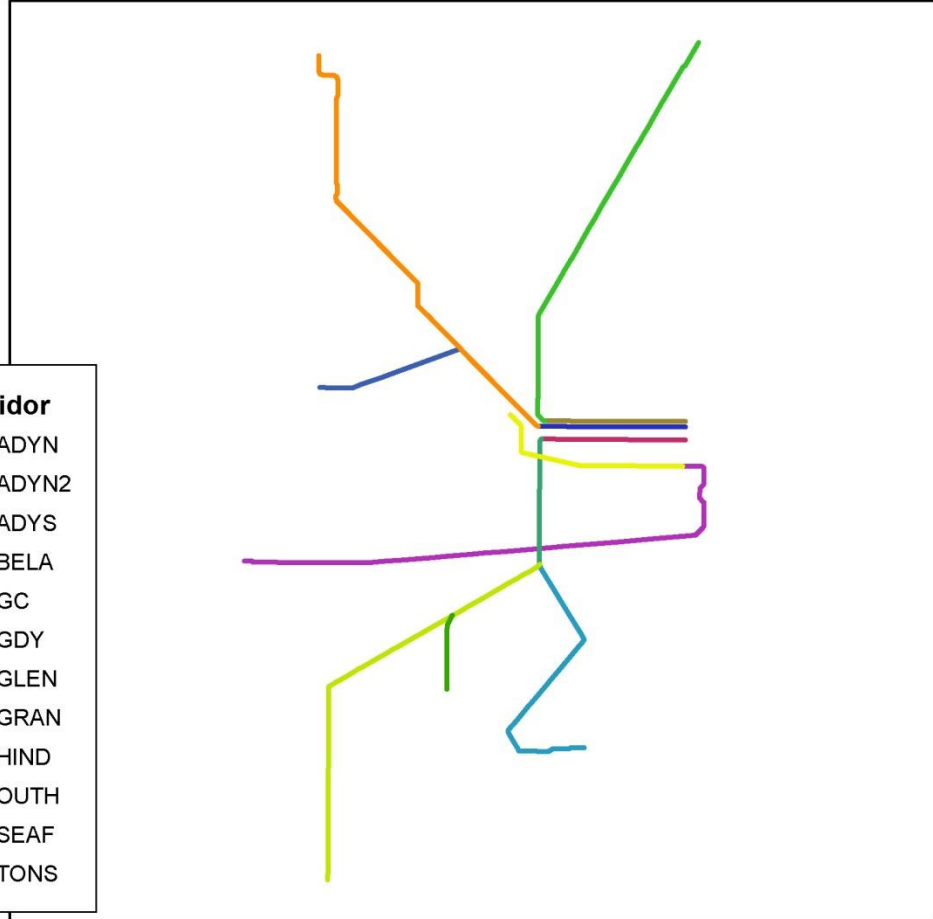
200 100 0 200 Meters

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

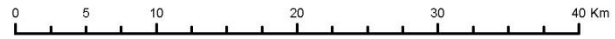


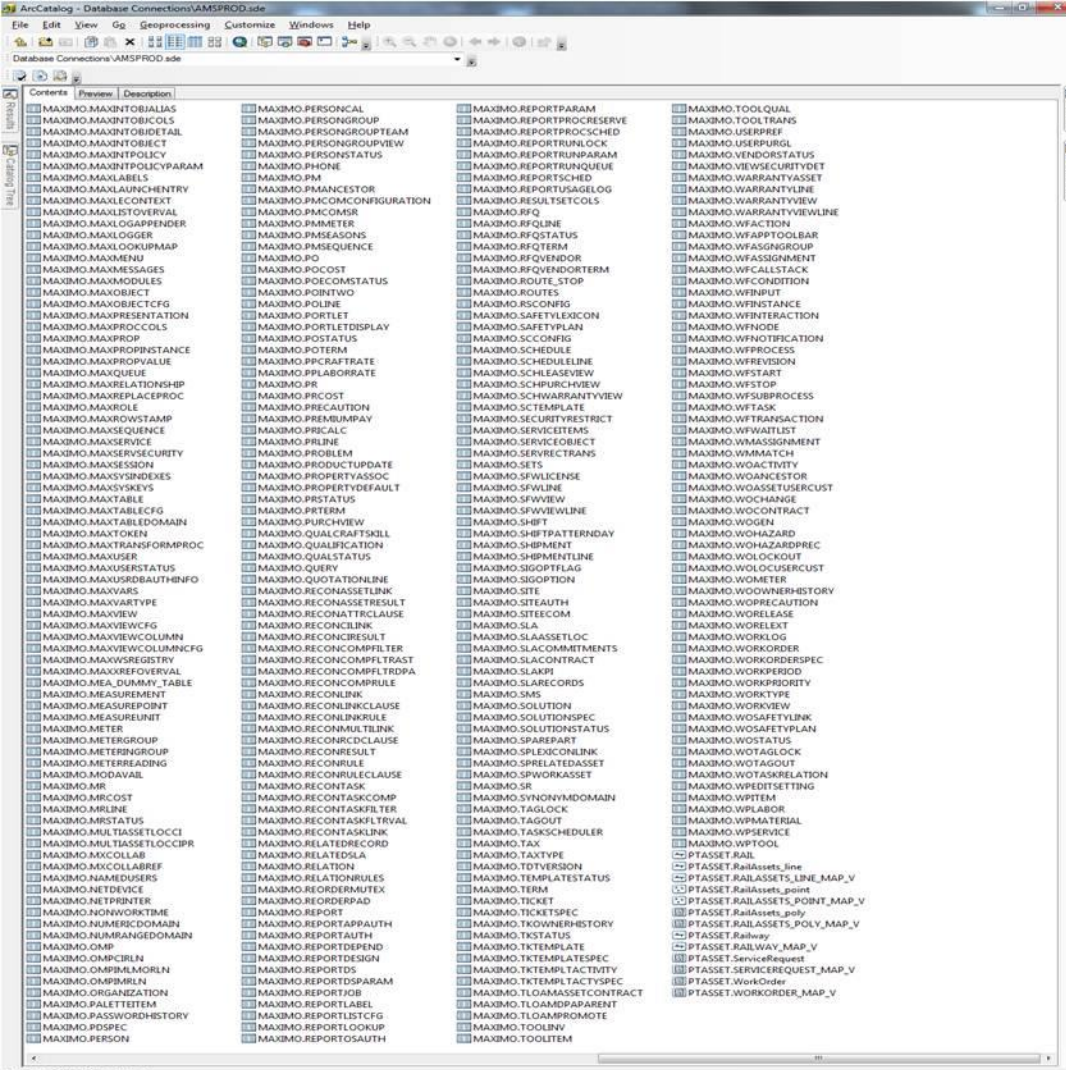
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- Corridor**
- ADYN
 - ADYN2
 - ADYS
 - BELA
 - GC
 - GDY
 - GLEN
 - GRAN
 - HIND
 - OUTH
 - SEAF
 - TONS



Schematic view of network





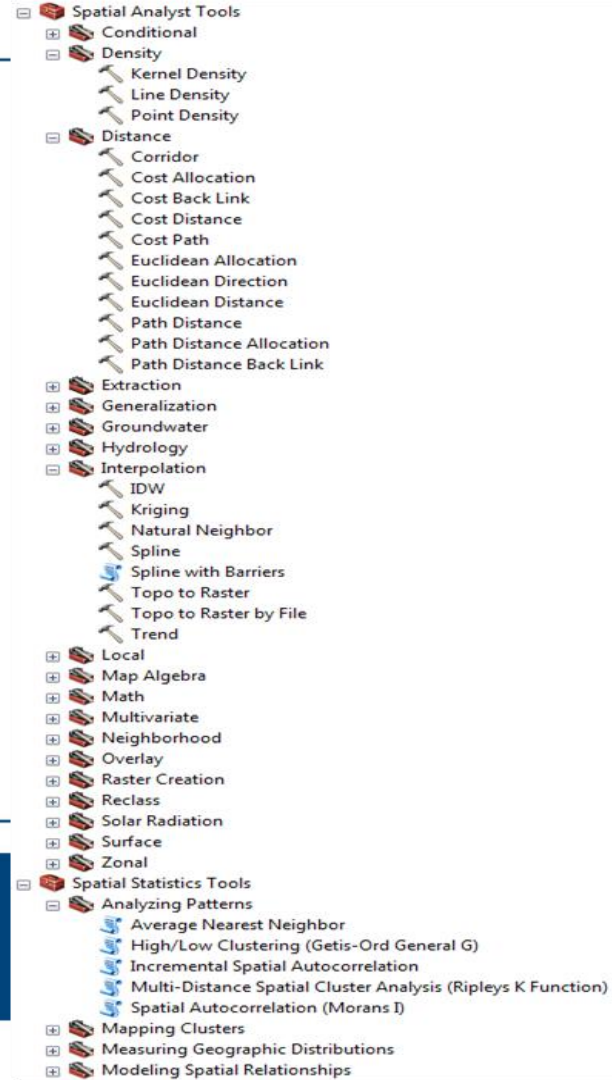
SDE schema with access to Maximo tables



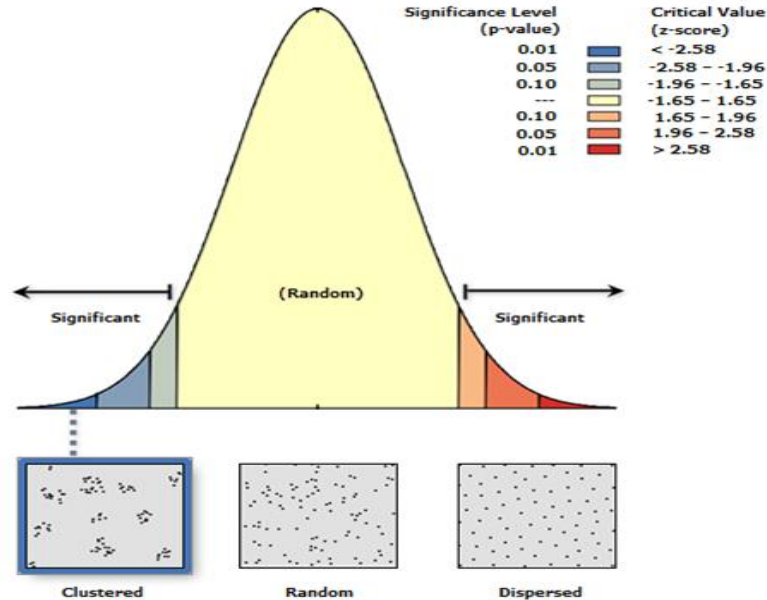
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Transport and Infrastructure

Spatial analysis and statistics

- Nearest Neighbour Analysis
- Density Analysis
- Weighted Density Analysis



Average Nearest Neighbour Analysis



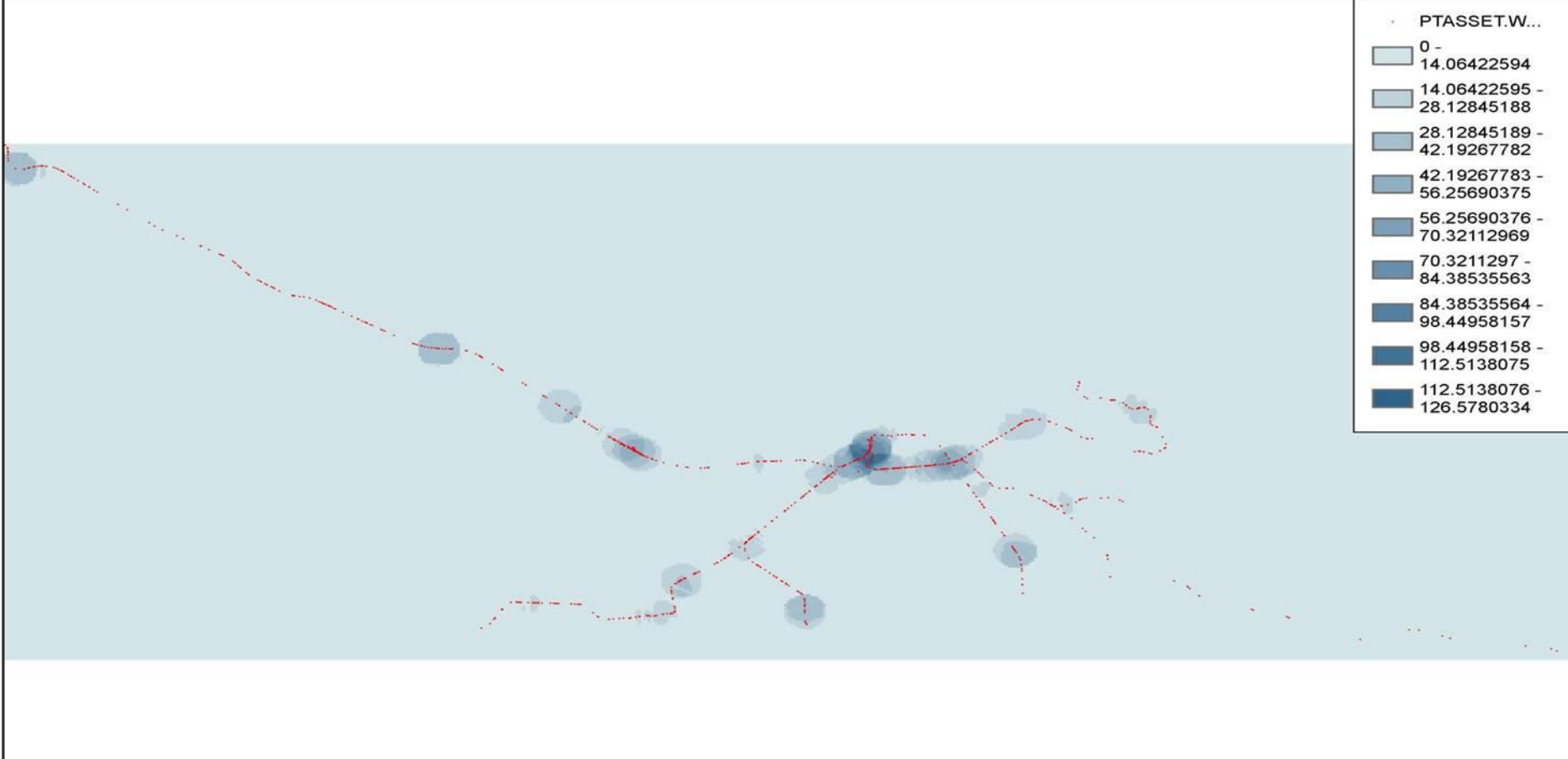
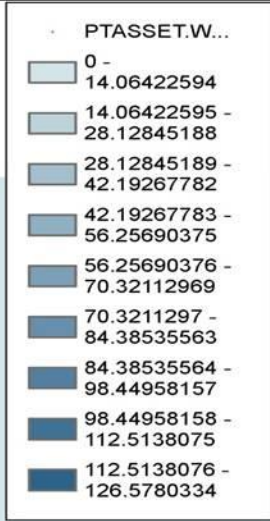
Average Nearest Neighbor Summary

| | |
|--------------------------------|-----------------|
| 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 |





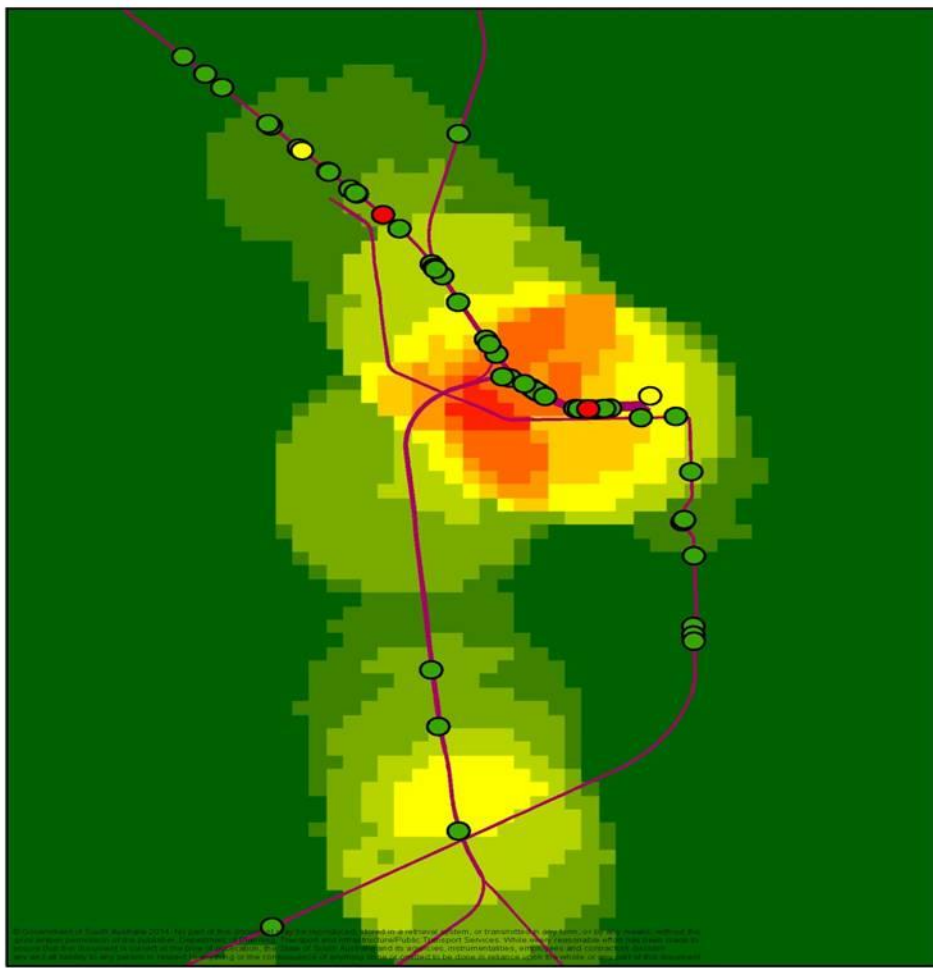
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Density Analysis

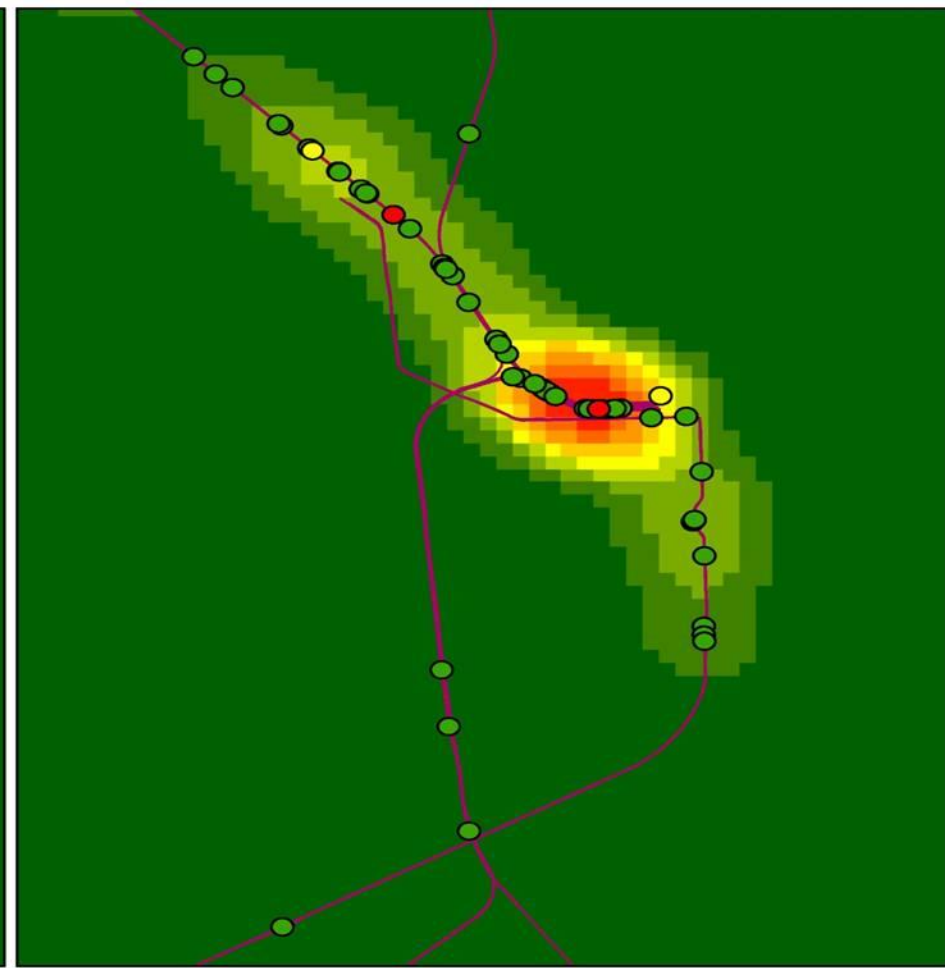
Date: 5/06/2014



1:225,000



Open Faults Density Analysis



Open Faults Kernel Density Analysis

Questions

