9th International Conference on MANAGING PAVEMENT ASSETS (ICMPA9)

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Initial Steps for Unsealed Network Pavement Management

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AASHTO THE VOICE OF TRANSPORTATION

VirginiaTech Transportation Institute

TRB

U.S. Department of Transportation Federal Highway Administration

WORLD ROAD ASSOCIATION MONDIALE DE LA ROUTE 1909-2009

VDOT Virginia Department of Transportation

Initial Steps for Unsealed Network Pavement Management

High level of investment

Desired service standards not achieved

Initial Steps for Unsealed Network Pavement Management

Plan of Attack – Initial Steps

1. **Network pavement condition survey**

2. **The overall condition of the network**

3. **Identify extent of works involved in achieving the desired service standards**

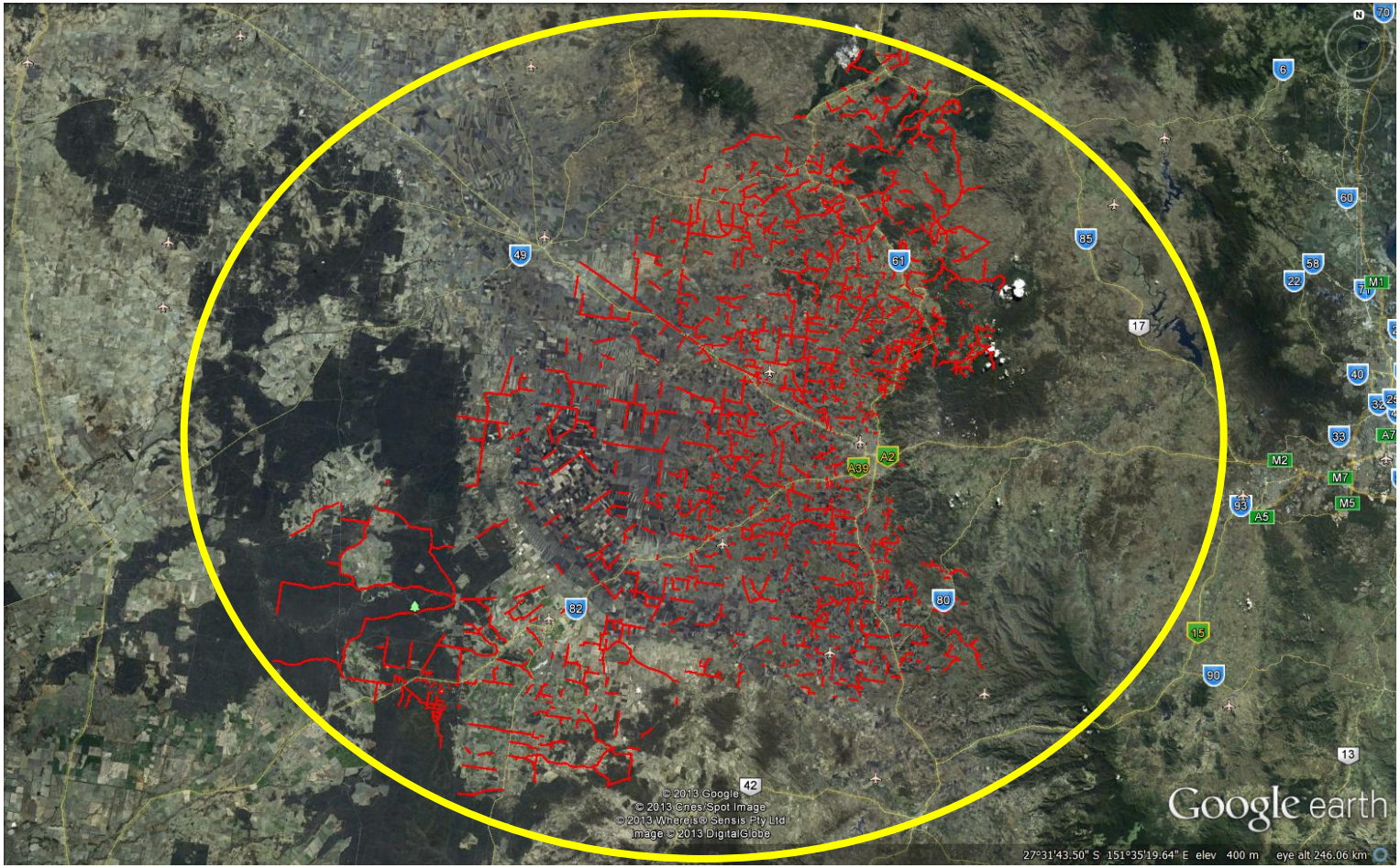
Initial Steps for Unsealed Network Pavement Management

1. Plan of Attack – Network Pavement Condition Survey

Parameters to be Considered

- ✓ **Materials Type**
- ✓ **Pavement Profile**
- ✓ **Pavement Condition**

Initial Steps for Unsealed Network Pavement Management



3200 Km Unsealed

Initial Steps for Unsealed Network Pavement Management

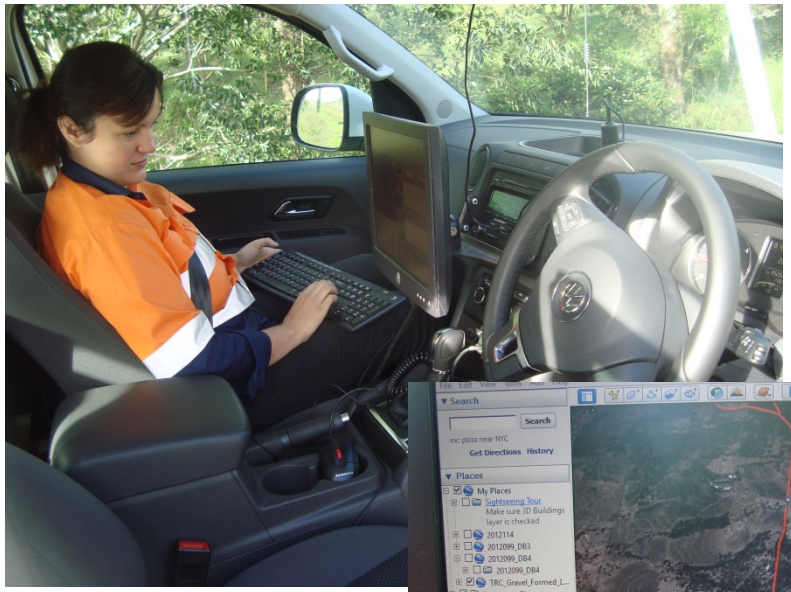
Methodology

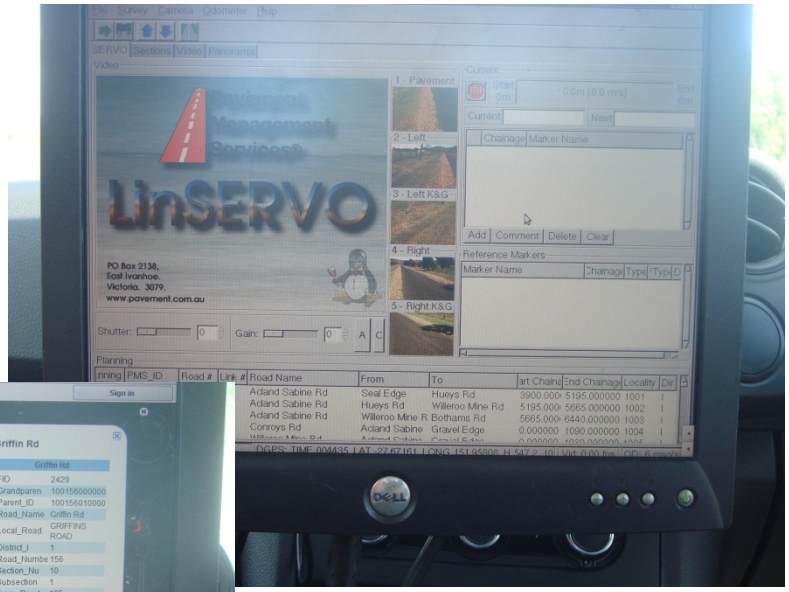
- **Ground Penetrating Radar:**
  - Horn / Air coupled (2200MHz)
  - Dipole / Ground coupled (400MHz; 900MHz and 1500MHz)

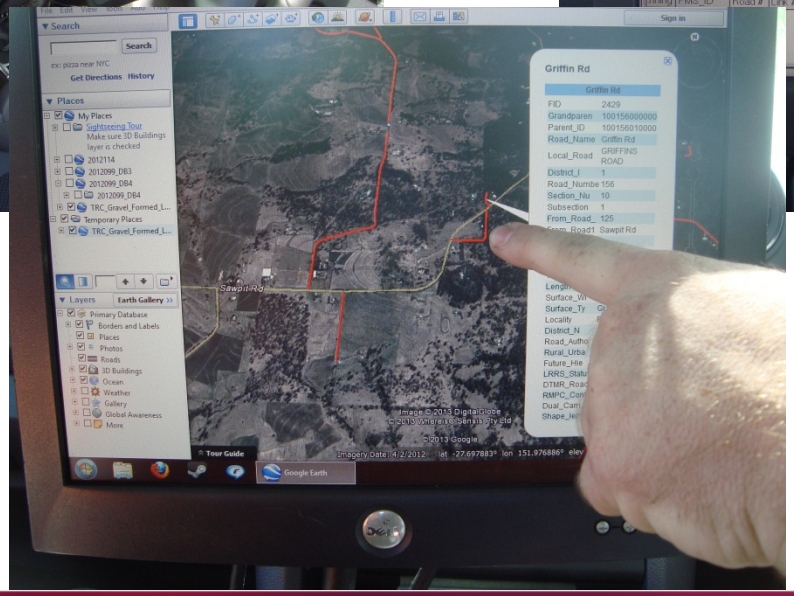
- **Pavement Defects/Materials:**
  - Type of Materials
  - Pavement Defects (Potholes, Corrugation, Embedded Stones)
  - Cross Section Profile
  - Drainage
  - Shoulder Level
  - Road Side Asset

Initial Steps for Unsealed Network Pavement Management

Methodology

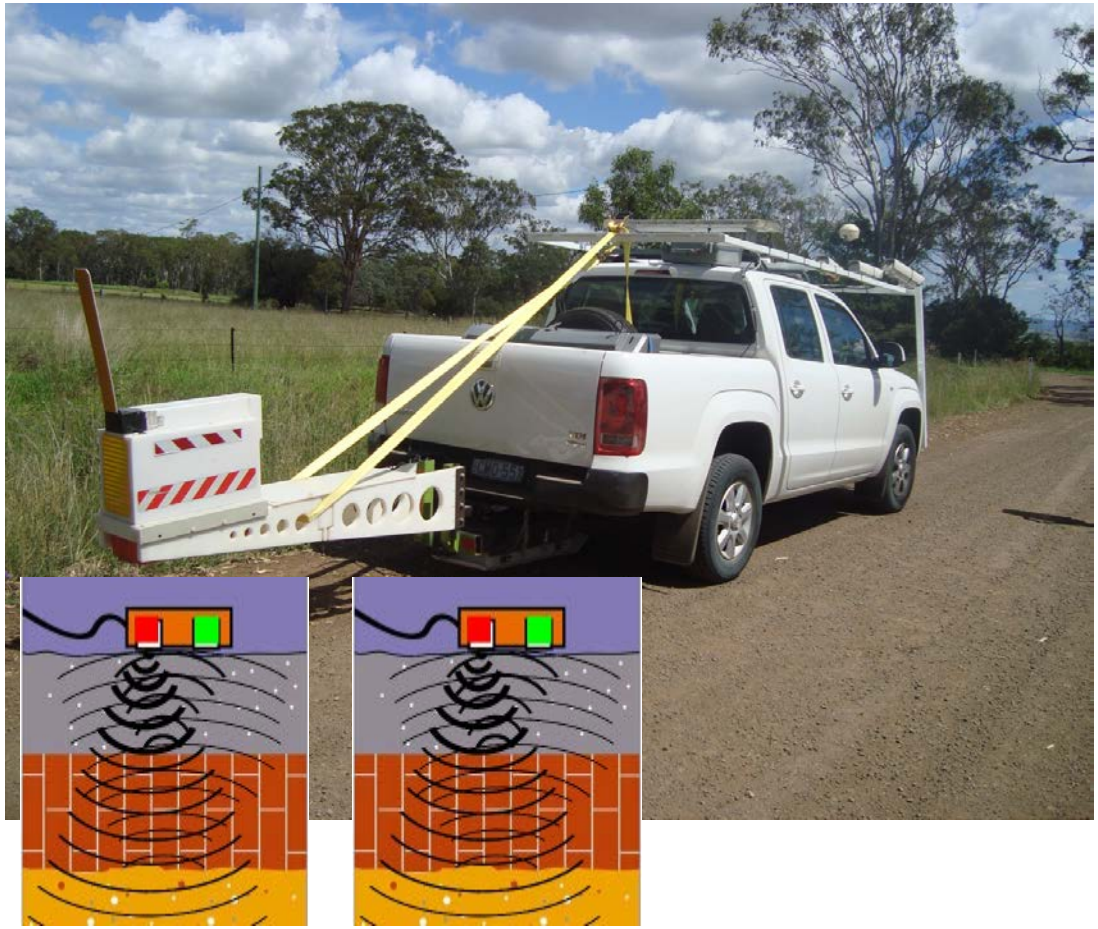






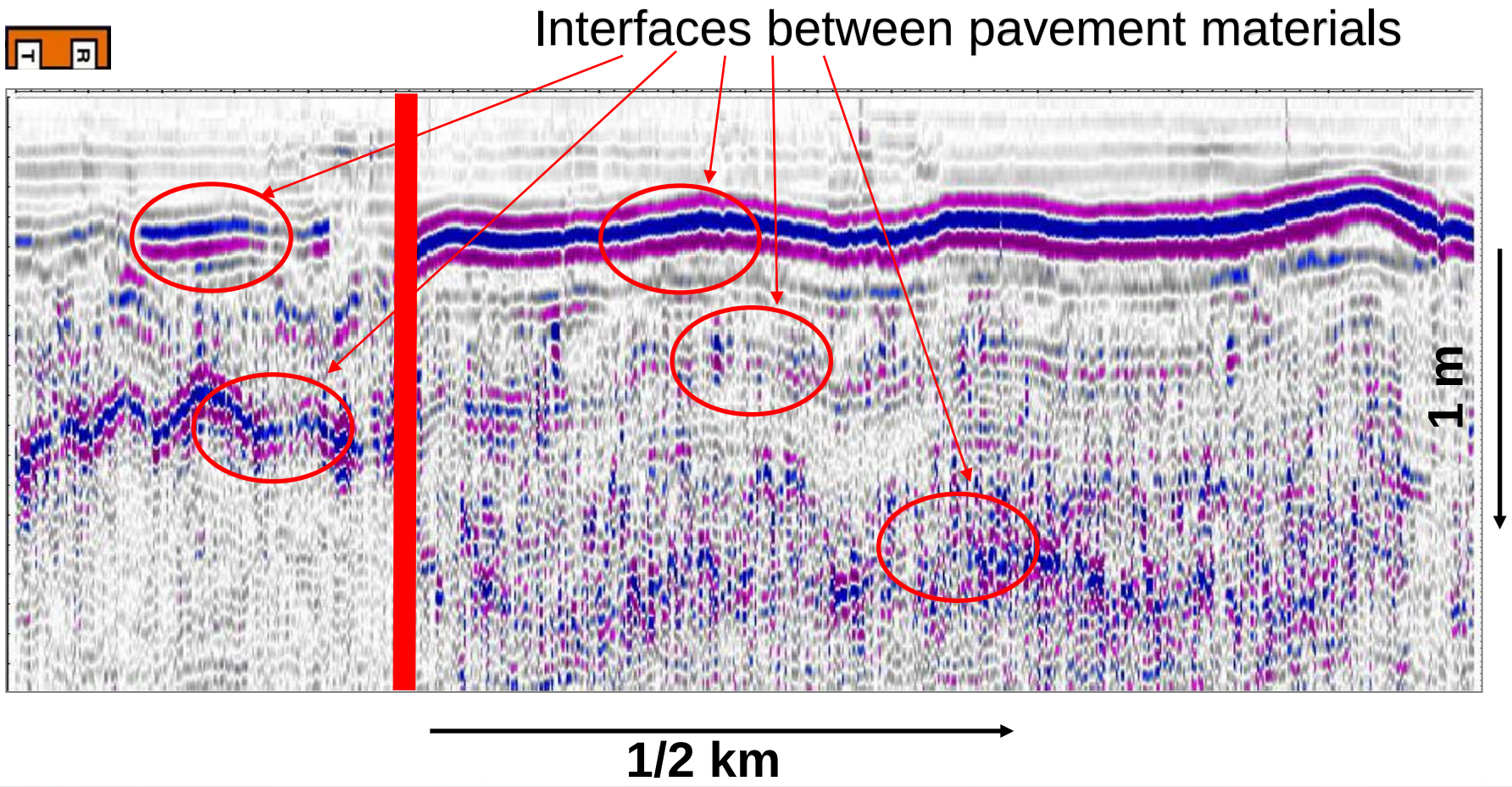
Initial Steps for Unsealed Network Pavement Management

Ground Penetrating Radar



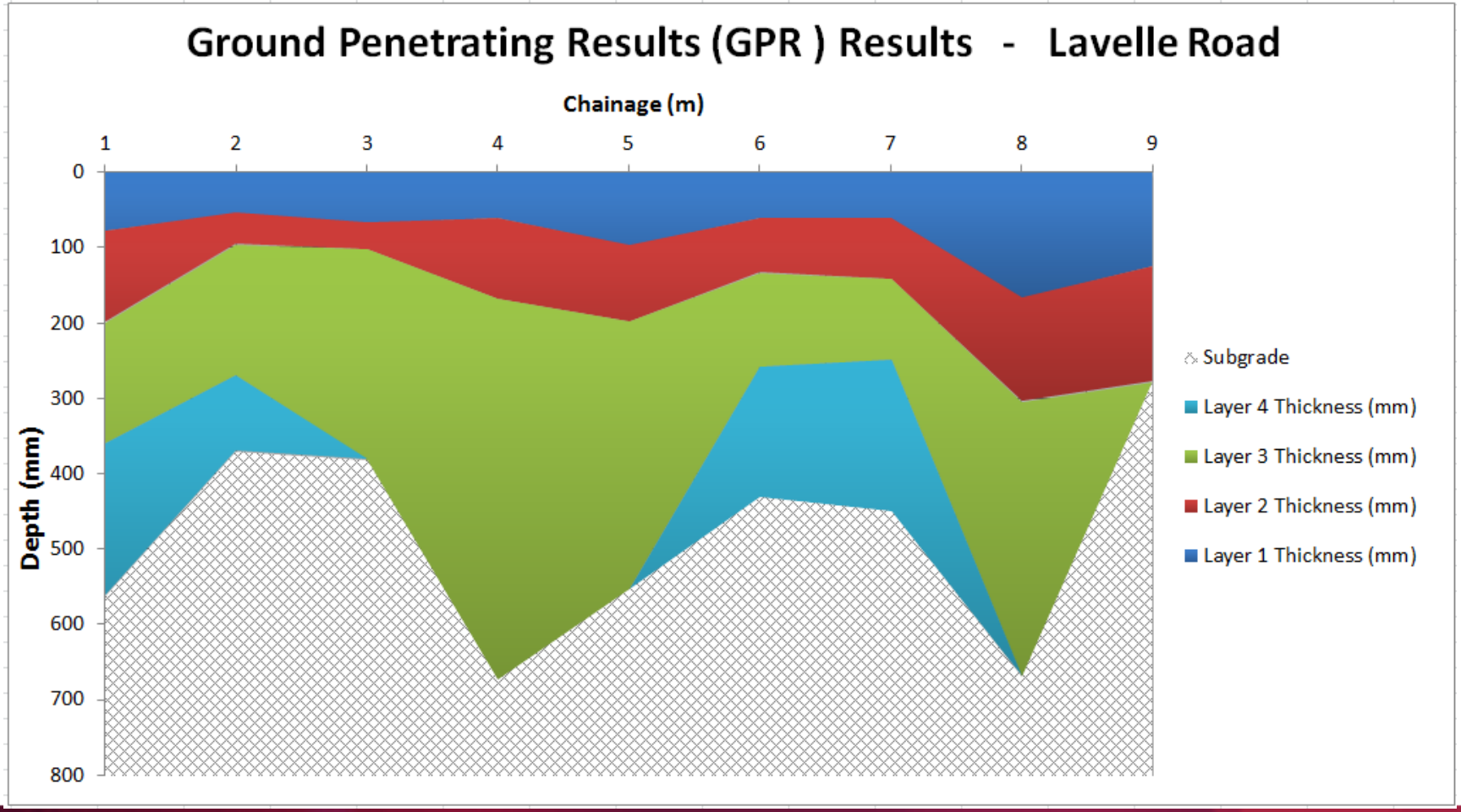
Initial Steps for Unsealed Network Pavement Management

Ground Penetrating Radar



Initial Steps for Unsealed Network Pavement Management

Pavement Profile



Initial Steps for Unsealed Network Pavement Management

Gravel Type	Picture	Characteristics
Decomposed Granite **Colour:** Pink - Yellow – Grey **Type:** Igneous		Homogeneous grain, small-medium particle size, granular appearance
Soft Rock * **Colour:** White - Orange **Type:** Sedimentary		1. Fine grained/ argillaceous; comprising of fine grains with fine texture. When weathered becomes mainly silts and clay minerals. Rock types include siltstones, shales and mudstones 2. Coarse grained/ arenaceous; comprising of silica grains that are usually cemented together by other minerals. Medium to course texture. Rock types include sandstone, conglomerate, tillite and breccia.
Basalt Gravel **Colour:** Grey – black with brown – red fines **Type:** Igneous		Angular, medium-large particles size, well graded, mixed composition
Ridge Gravel * **Colour:** Red - Grey **Type:** Residual rocks – weathered sedimentary or metamorphic rocks		Angular fragments, mixed composition, have an association with clay binders

*Rock type descriptions extracted from *ARRB Unsealed Roads Guide 2009*

Initial Steps for Unsealed Network Pavement Management

Pavement Defects

Pavement Defects to be Considered

1. Drainage
2. Potholes
3. Corrugation
4. Embedded Stones
5. Cross Section Profile

Other: Shoulder Level
Road Side Asset

Degree Classification

Initial Steps for Unsealed Network Pavement Management

Pavement Defects

	Degree 1 (X 2 3 4 5)	Degree 3 (1 2 X 4 5)	Degree 5 (1 2 3 4 X)
Cross Sectional Profile	Very good 	Flat 	Very uneven 
Drainage	Well above ground 	Level with ground 	Water flows along road 
Potholes	< 10mm deep 	20 – 50mm deep 	> 75mm deep 
Corrugation	Not felt or heard in a vehicle 	Felt and heard, Speed reduction necessary 	Felt and heard, must drive very slow 
Embedded stones	Not felt or heard in a vehicle 	Felt and heard. Speed reduction necessary 	Felt and heard; must drive very slow 

Jones, D & Paige G. 2000, Draft TMH12 Pavement Management System: Standard Visual Assessment Manual for Unsealed Roads, Council for Scientific and Industrial Research Transportek, Pretoria, South Africa.

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TABLE A1: General description of degree classification

Degree	Severity	Description
0	None	No distress visible
1	Slight	Distress difficult to discern. Only the first signs of distress are visible.
2	Between slight and warning	
3	Warning	Distress is distinct. Start of secondary defects. (Distress notable with respect to possible consequences. Maintenance might be required in near future e.g. potholes can be removed by blading)
4	Between warning and severe	
5	Severe	Distress is extreme. Secondary defects are well-developed (high degree of secondary defects) and/or extreme severity of primary defect. (Urgent attention required e.g. potholes require manual repair).

Jones, D & Paige G. 2000, Draft TMH12 Pavement Management System: Standard Visual Assessment Manual for Unsealed Roads, Council for Scientific and Industrial Research Transportek, Pretoria, South Africa

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Visual Assessment Rating		
1.0		
3.0		
4.0 - 5.0		

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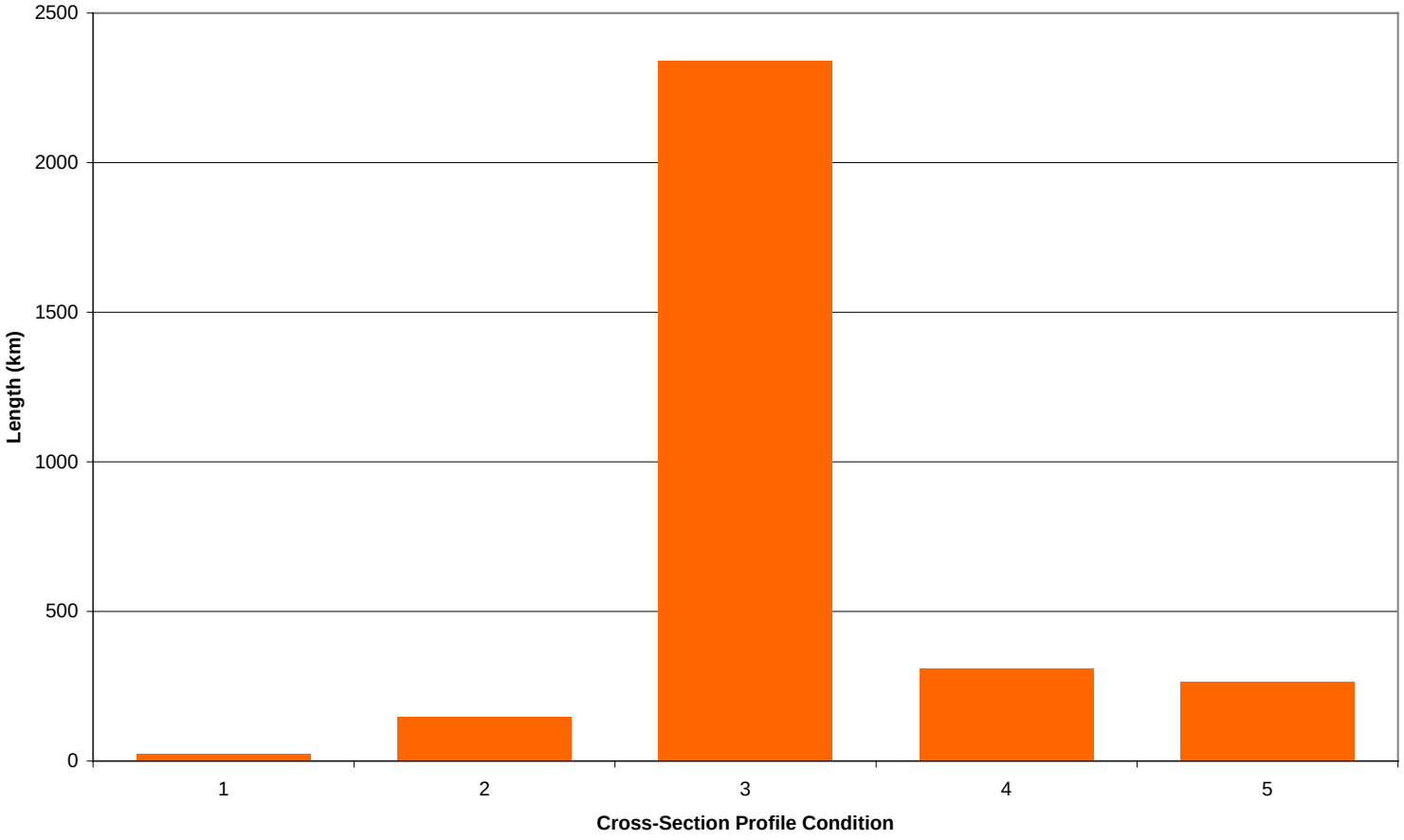
Cross-sectional Profile

	Degree 1	Degree 3	Degree 5
	X 2 3 4 5	1 2 X 4 5	1 2 3 4 X
Cross Sectional Profile	Very good 	Flat 	Very uneven 

Condition	Description
1 (Very Good)	Well formed camber (about 3 - 4 per cent)
2 (Good)	Good camber (about 2 per cent)
3 (Flat)	Some unevenness with camber mostly less than 2 per cent
4 (Uneven)	Obvious development of irregularities that will impede drainage and form depressions
5 (Very Uneven)	Development of severe irregularities impeding drainage and likely to cause extensive localised ponding. Water tends to flow to the centre of the road or individual lanes

Initial Steps for Unsealed Network Pavement Management

2. Plan of Attack – Current Network Condition: Cross-sectional Profile

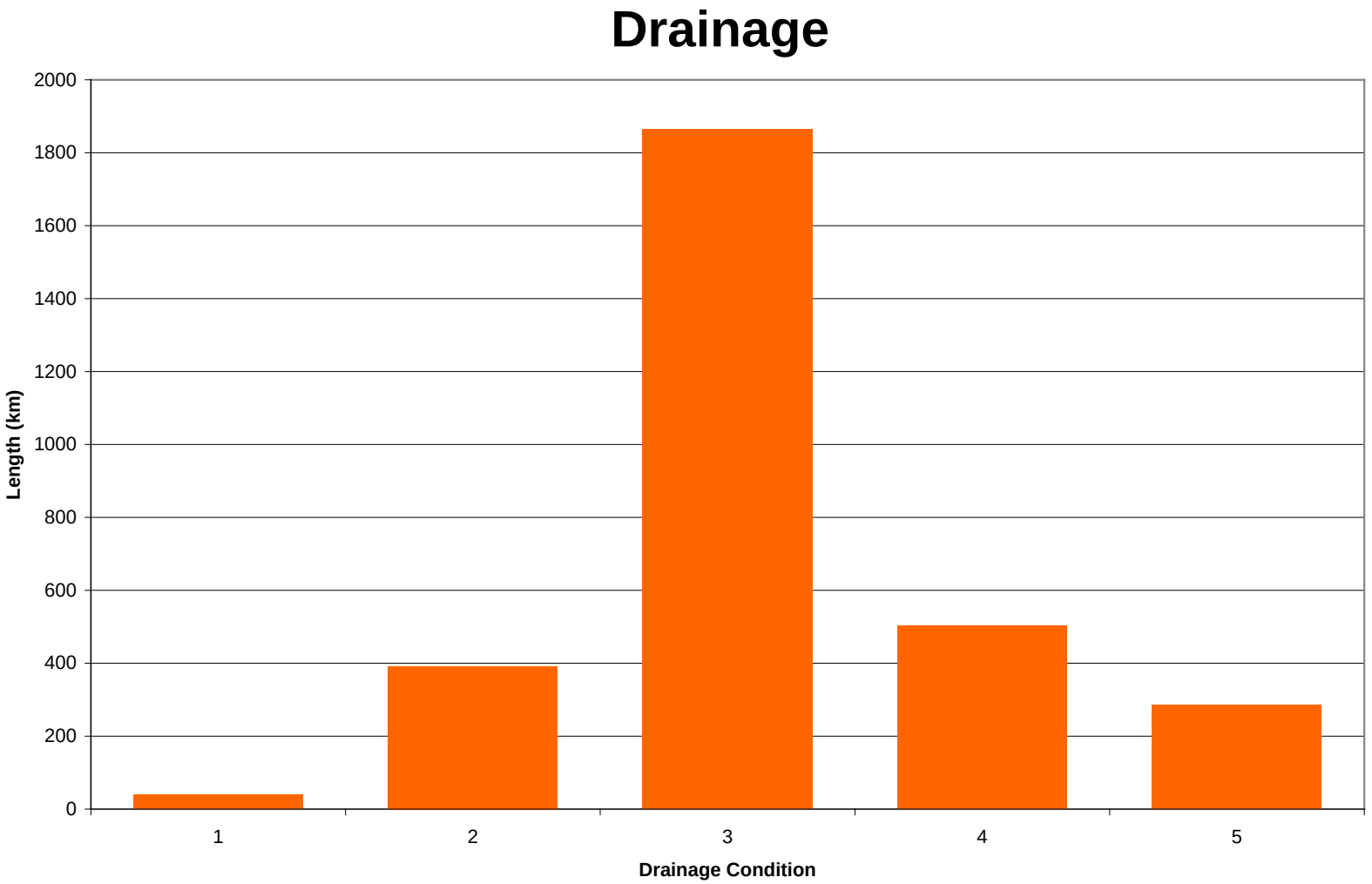


Initial Steps for Unsealed Network Pavement Management

Cross-sectional Profile

Class \ Condition	1 (Very Good Shape)	2 (Good Shape)	3 (Flat)	4 (Uneven)	5 (Very Uneven)	Average Condition
Class 4. Highway	0.000	0.000	3.540	0.000	0.000	3.0
Class 5. Regional Arterial	0.000	0.000	10.762	0.430	0.210	3.1
Class 6. Sub-Arterial	0.000	0.000	5.546	0.166	0.252	3.1
Class 7. Distributor	0.000	7.384	73.214	2.126	2.810	3.0
Class 8. Collector	0.729	16.622	82.348	0.438	1.617	2.9
Class 9. Local	23.774	122.352	2163.884	304.615	259.557	3.2
Total (Km)	**24.503**	**146.358**	**2339.294**	**307.775**	**264.446**	**3.2**

Initial Steps for Unsealed Network Pavement Management

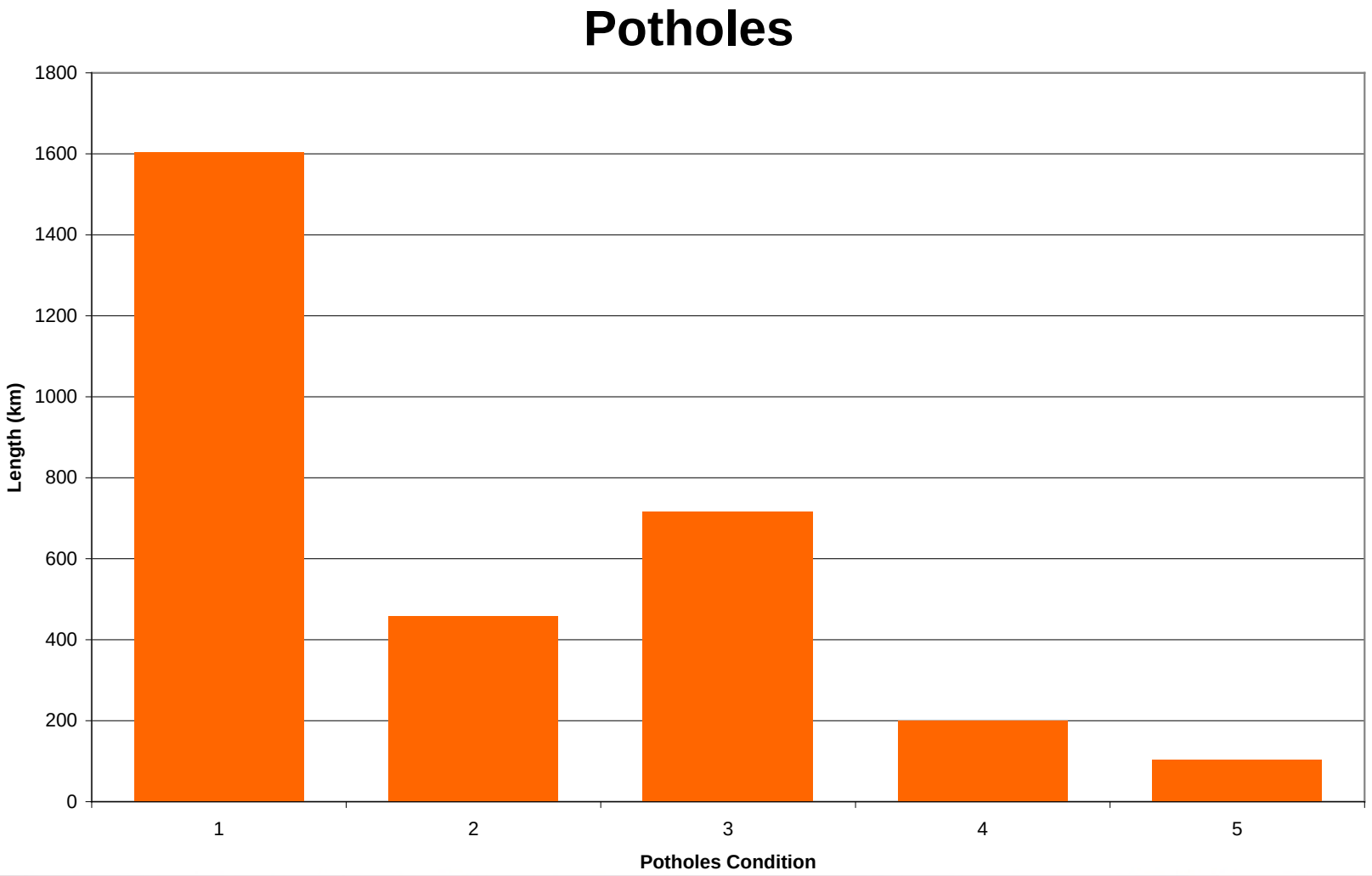


Initial Steps for Unsealed Network Pavement Management

Drainage

Class \ Condition	1 (Well above Ground)	2 (Slightly above Ground)	3 (Level with Ground)	4 (Slightly below Ground)	5 (Canal)	Average Condition
Class 4. Highway	0.000	0.542	2.998	0.000	0.000	2.8
Class 5. Regional Arterial	0.000	0.524	10.772	0.106	0.000	3.0
Class 6. Sub-Arterial	0.026	3.468	2.248	0.222	0.000	2.4
Class 7. Distributor	0.000	10.796	67.672	4.256	2.810	3.0
Class 8. Collector	3.811	19.329	45.605	16.931	16.078	3.2
Class 9. Local	34.774	357.019	1734.999	480.436	266.954	3.2
Total (Km)	**38.611**	**391.678**	**1864.294**	**501.951**	**285.842**	**3.2**

Initial Steps for Unsealed Network Pavement Management

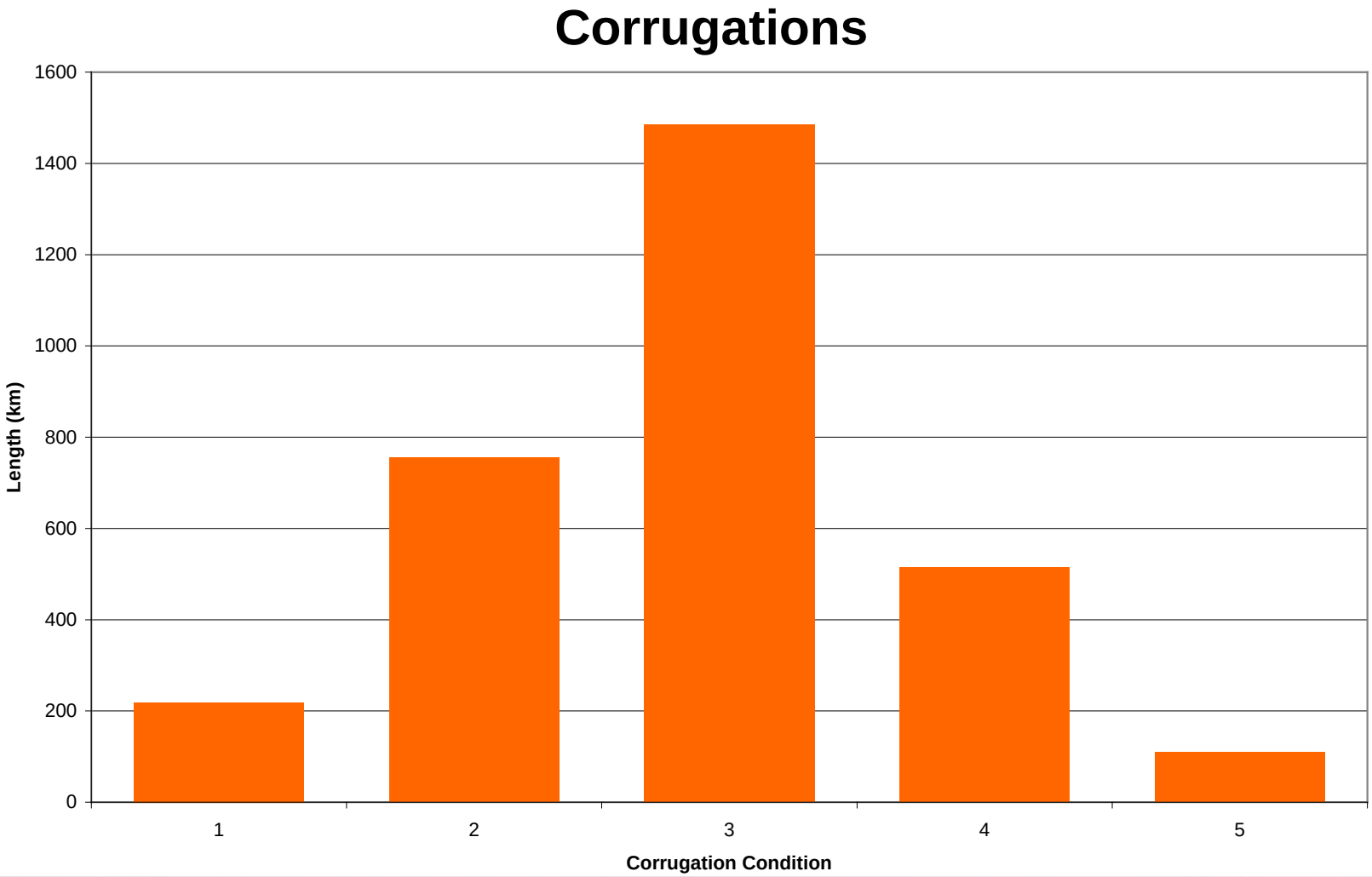


Initial Steps for Unsealed Network Pavement Management

Potholes

Class \ Condition	1	2	3	4	5	Average Condition
Class 4. Highway	3.540	0.000	0.000	0.000	0.000	1.0
Class 5. Regional Arterial	11.180	0.072	0.116	0.022	0.012	1.0
Class 6. Sub-Arterial	3.352	0.154	2.376	0.066	0.016	1.9
Class 7. Distributor	55.442	7.212	14.500	2.360	6.020	1.8
Class 8. Collector	30.458	25.478	40.312	5.444	0.062	2.2
Class 9. Local	1499.911	425.301	658.648	192.097	98.225	1.9
Total (Km)	**1603.883**	**458.217**	**715.952**	**199.989**	**104.335**	**1.9**

Initial Steps for Unsealed Network Pavement Management

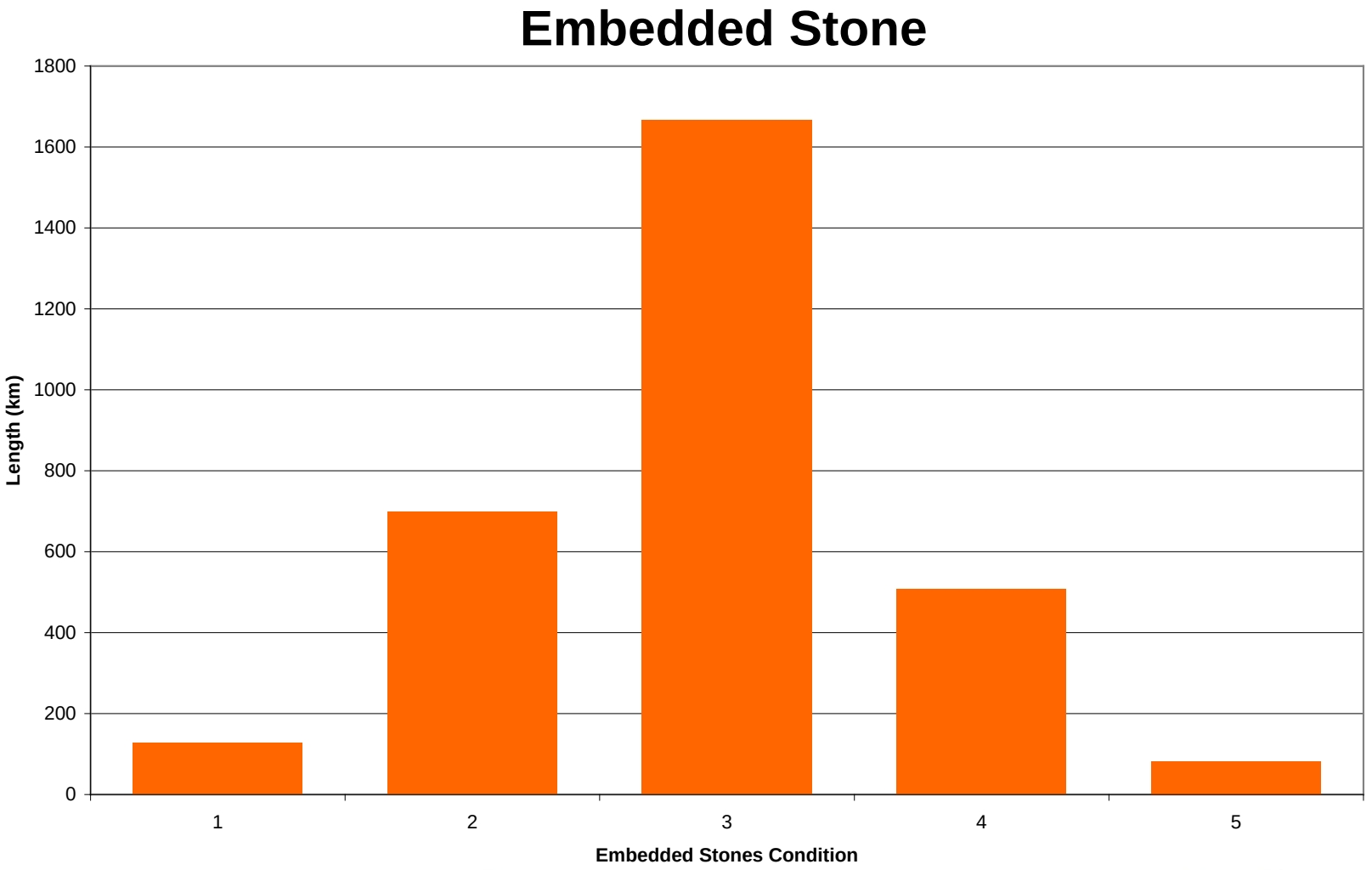


Initial Steps for Unsealed Network Pavement Management

Corrugations

Class \ Condition	1	2	3	4	5	Average Condition
Class 4. Highway	0.000	0.614	1.460	1.466	0.000	3.2
Class 5. Regional Arterial	2.506	2.641	5.704	0.551	0.000	2.4
Class 6. Sub-Arterial	2.696	1.362	1.906	0.000	0.000	1.9
Class 7. Distributor	1.262	30.403	43.311	8.000	2.558	2.8
Class 8. Collector	2.586	20.079	60.624	17.231	1.234	2.9
Class 9. Local	209.892	700.416	1371.528	487.042	105.304	2.9
Total (Km)	**218.942**	**755.515**	**1484.533**	**514.290**	**109.096**	**2.9**

Initial Steps for Unsealed Network Pavement Management



Initial Steps for Unsealed Network Pavement Management

Embedded Stones

Class \ Condition	1	2	3	4	5	Average Condition
Class 4. Highway	0.000	0.000	3.540	0.000	0.000	3.0
Class 5. Regional Arterial	1.302	2.502	7.522	0.076	0.000	2.6
Class 6. Sub-Arterial	0.160	3.904	1.810	0.024	0.066	2.3
Class 7. Distributor	0.321	7.960	52.589	15.560	9.104	3.3
Class 8. Collector	2.964	45.650	43.347	8.812	0.981	2.6
Class 9. Local	123.292	637.942	1556.844	483.794	72.310	2.9
Total (Km)	**128.039**	**697.958**	**1665.652**	**508.266**	**82.461**	**2.9**

Initial Steps for Unsealed Network Pavement Management

Unsealed Condition Score (UCS)

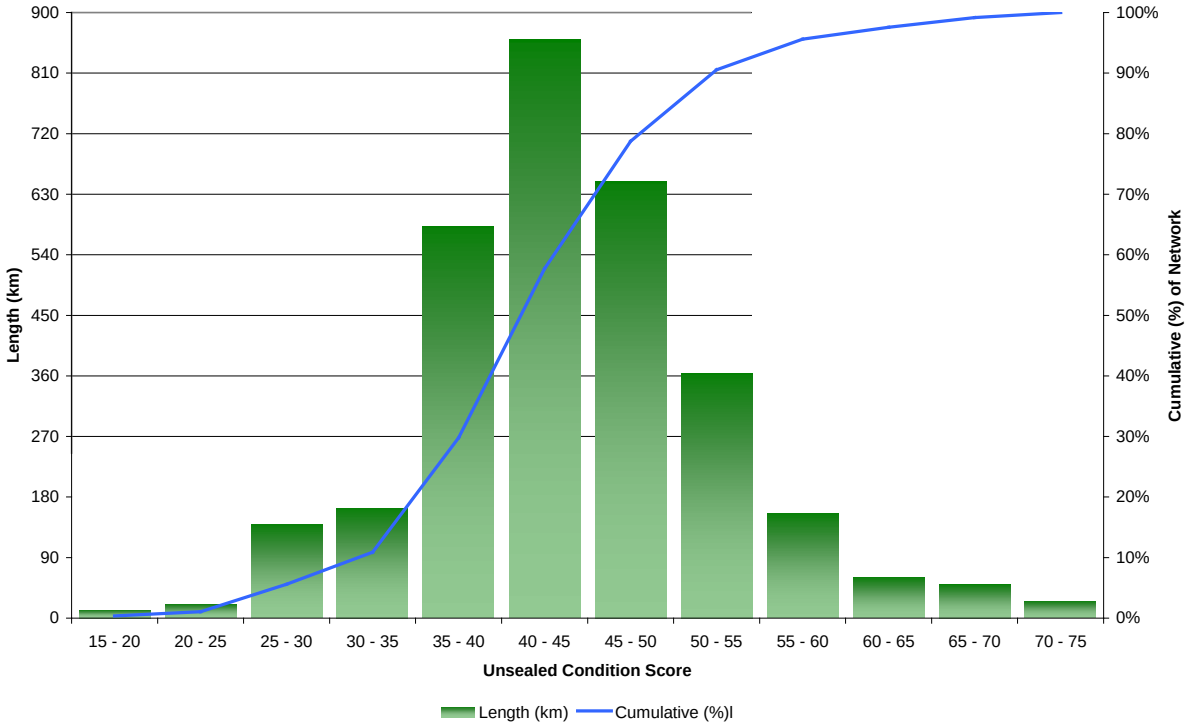
- Represents the overall condition of the unsealed network.
- Weighted based on the importance of each distress.
- Value from 15 to 75.

Distress	Weighting
Cross-Sectional Profile	3
Drainage	2
Corrugations	5
Embedded Stone	4
Potholes	1

Initial Steps for Unsealed Network Pavement Management

Unsealed Condition Score

	Network Average	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9
Unsealed Condition Score	44	44	38	35	44	42	44

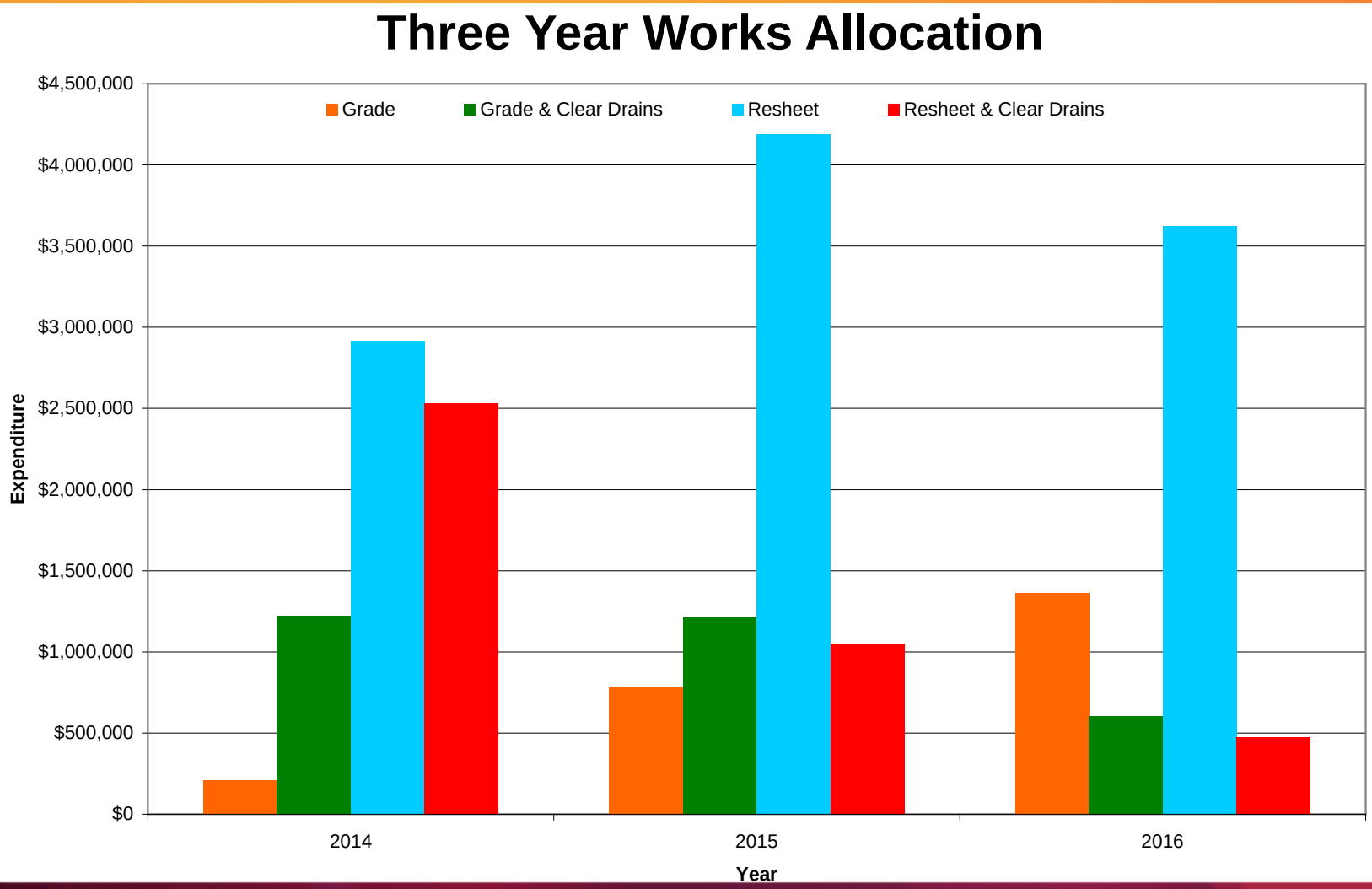


Initial Steps for Unsealed Network Pavement Management

3. Plan of Attack – Treatment Selection and Works Program

- All segments having corrugation or embedded stone in condition 5 or condition 4 for were considered for treatment.
- Gravel resheeting undertaken where gravel depth less than 50mm.
- Grading undertaken where gravel depth greater than 50mm.
- Additional drainage clearing where drainage condition is above 3.

Initial Steps for Unsealed Network Pavement Management

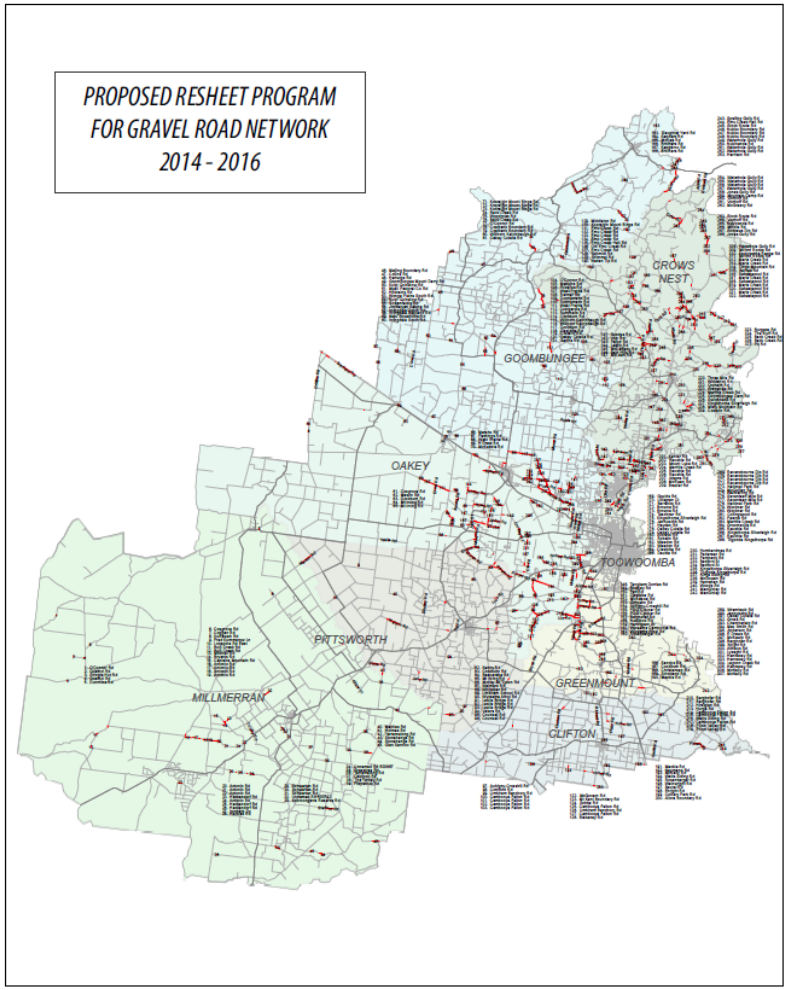


Initial Steps for Unsealed Network Pavement Management

Three Year Regional Works Funding

District	2014	2015	2016	Total
Clifton	$518,463	$369,204	$149,568	**$1,037,236**
Crows Nest	$1,389,755	$1,355,250	$1,312,430	**$4,057,434**
Goombungee	$1,586,634	$1,616,176	$1,630,241	**$4,833,051**
Greenmount	$459,046	$524,466	$260,296	**$1,243,808**
Millmerran	$1,286,297	$1,169,205	$925,922	**$3,381,424**
Oakey	$1,069,375	$1,711,094	$1,499,006	**$4,279,476**
Pittsworth	$555,875	$469,220	$284,905	**$1,310,000**
Toowoomba	$16,304	$14,480	$3,080	**$33,864**
Total	**$6,883,764**	**$7,231,110**	**$6,067,464**	**$20,176,293**

Initial Steps for Unsealed Network Pavement Management



Initial Steps for Unsealed Network Pavement Management

Initial Steps for Unsealed Network Pavement Management

Conclusions

- The data was collected with a reasonable degree of accuracy for a network level pavement investigation.
- There was great variability in the depth of gravel materials on the unsealed road surfaces (< 0.5 m).
- There were limitations experienced with the number of boreholes compared to the network length.
- Total investment of $20.2 million Australian dollars was required for the next three years.

Initial Steps for Unsealed Network Pavement Management

Thank You

Questions?

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