COLLECTING 'FIT FOR PURPOSE' ROAD PAVEMENT DATA

For information about road condition to be of value, there must be a close alignment between the quality of the information and the end-use to which it is being put.

By Ashay Prabhu

Councils in Australia, which are responsible for thousands of kilometres of roads, spend tens of thousands of dollars each year in collecting road condition and inventory data. Some councils collect this data every year whilst others may have a two to three year cycle.

The data is extremely important to councils and is the foundation block of a council's road asset register. It is the basis of council's decision-making platform for all of the following:

- annual programming - reseals, overlays, footpath repair, patching, and rehabilitations;
- capital works planning;
- forecasting renewal and identifying renewal tactics;
- spending strategies for next five years;
- periodic maintenance planning and scheduling;
- road pavement performance analysis.

In addition, availability of condition and inventory data enables council staff to answer those tough questions that management or ratepayers may ask from time to time.

In spite of the absolute importance of this data, in particular its accuracy, currency and integrity, very few councils tend to ensure that their data is relevant to their needs, i.e. that the data is fit for purpose.

Whilst a lot of time and effort is spent on determining cost-effective ways and efficient practices of data collection, in the past very little thought has gone into determining the nature, type and fitness for purpose of this data.

Table 1

End use	Data attribute
Routine Maintenance	Pot-holes Edge breaks Corrugations Minor deformations (<2sqm) Edge drop off Drain blockage
Periodic Maintenance	Cracking Surface texture Bleeding Stripping Oxidisation Roughness Minor Rutting Major deformations (>2sqm) Surface Defects Shape Loss
Capital Works	Roughness Major Rutting Pavement strength Pavement Defects Geometry and Safety factors Alignment

So, what is fit for purpose data and why is it so important?

Fit for purpose data, as the name suggests, is data that is needs-based and relevant to its end use. For example, with road pavements, if the data is relevant to asset preservation needs, then it should be able to drive maintenance work - i.e. routine maintenance, periodic maintenance and capital works. As shown in Table 1, the type of data that drives routine maintenance may be different to the type of data that drives periodic maintenance or capital works. The table shows how important it is to know what type of data to collect based on its end use.

The type of data needed to drive decisions may vary for the same asset, based on its end-use - this is the fundamental characteristic of fitness for purpose. As a simple example, if the end-use of collecting data related to road pavements is for OHS and legislation reasons, then the data should reflect the type of defect in a pavement that causes OHS problems like ride quality, undulations, deformations, skid resistance or smoothness. This data is clearly different to the data required purely to drive maintenance activities.

Fitness for purpose also includes *fitness of measurement scale* from a measurement

Table 2

End Use	
1. Annual work planning and scheduling.	Yes
2. Safety	No
3. Hazard reduction	No
4. Legislative	No
5. Annual Performance analysis	Yes
6. Reactive Maintenance	No
7. Routine Maintenance	No
8. Five year works programming	Yes
9. Ten year strategy development	Yes
10. Annual Budgeting	Yes

perspective. Once the data attribute-set (defects) to be measured has been identified, the rating scale that is used should reflect council-specific intervention levels.

In some instances the scales of measurements for the same defect characteristic would vary within the council network depending on road class, hierarchy, traffic and other criteria. After all, the data must be able to provide trigger points that justify decisions and these trigger points may be different in different parts of the network. This is explained later in this article.

The examples in Table 1 show us the value in determining data needs prior to collecting data. Inframax has assisted a number of councils in Victoria and Tasmania to develop fit for purpose data collection methods.

Whilst the process involved in developing these methods is the same, the data attributes and measurement criteria vary from council to council. Having fit for purpose data is the only means of ensuring that decisions are guided by best possible information. The process is described below.

Step 1 - Determine End Use of Data

The end-use of data is the purpose for which the data will be used. A sample of some end-uses identified in this case study is shown in Table 2.

Step 2 - Identify Organisational Activities that are Linked to End Use

Each end-use identified in Table 2 is made up of a series of activities. For example routine maintenance on road pavements may be made up of pothole patching, edge repair, minor patching, minor drainage works etc.

This step is about precisely identifying those activities. It can only be undertaken in a workshop-style consultation with end-users. Typically with road network data, the people involved in this session would include supervisors, foremen, asset managers, engineers, reseal crews and maintenance crews.

This step is a means of collating their collective experience and knowledge of organisational work practices and the types of treatments that have been undertaken on their pavements. Table 3 shows a sample of activities identified in this case study.

Table 3

End use	Activities or Treatments
Annual work planning and scheduling.	Surface Enrichment
Annual Performance analysis	Spray Seals
Five year works programming	Spray seals with Fabric
Ten year strategy development	Ac overlays
Annual Budgeting	Ac overlays with Fabric
	Defect patching
	Rut regulation
	Rehabilitation

Table 4

Treatment/Activity Decision	Criteria that is driving decisions – Data Set							
	Surface Texture	Oxidation	Cracking		Rutting	Shape Loss	Pavement Defects	Roughness
			Crocodile	Linear				
Surface Enrichment	Yes	Yes	No	No	No	No	No	No
Spray seals	Yes	Yes	Yes	No	No	No	No	No
Spray seals with fabric	Yes	Yes	Yes	No	No	No	Yes	No
AC overlay	N/A	N/A	Yes	No	No	Yes	No	No
Ac overlay with fabric	N/A	N/A	Yes	Yes	No	Yes	Yes	No
Defect Patching	N/A	N/A	No	No	No	No	Yes	No
Rut Regulation	N/A	N/A	No	No	Yes	No	No	No
Rehabilitation	N/A	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Crack Sealing	N/A	N/A	N/A	Yes	N/A	N/A	N/A	N/A

Table 5

Data	Method	Cost	Value	Decision
Surface Texture	Visual	Low	High – unique trigger for surface enrichment, currently considered a good, holding treatment.	Yes – collect this data
Oxidation	Visual	Low	High – council's specific trigger for reseals	Yes – collect this data
Crocodile Cracking	Visual or Electronic (automated)	Medium if visual and high if automated. No evidence available to suggest that automated methods may be more accurate.	High – specifically drives spray seals with fabric treatment in council's works program.	Yes – collect this data using visual methods
Linear Cracking	Visual or Electronic (automated)	Medium if visual and high if automated.	Low – does not drive council's major treatments.	No – do not collect this data
Rutting	Visual or Electronic (automated)	Medium if visual and high if automated. Testing has shown that visual methods are not reliable.	Very high – specific distress that currently is of concern and is a key driver of rut patches and reconstructions.	Yes – collect this data using automated means.
Shape Loss	Visual	Low	Very high – specifically used to determine regulation and overlay	Yes – collect this data
Pavement Defects	Visual	Low	Medium – typically used to refine treatment selection at project level	To be determined after further analysis
Roughness	Automated	Very high	Medium	No – do not collect this data

Step 2 - Identify Data that is Needed to Trigger the Treatments

The fundamental basis of this step is the simple paradigm that "We undertake these activities for certain reasons best known to us. These reasons are specific to our roads and our environment and our history".

In identifying the key decision criteria, the initial assessment is subjective and is again undertaken as a consultative session with the key decision-makers, i.e.

engineers, maintenance and periodic maintenance crew, foremen, supervisors etc.

The subjective assessment is then converted into objective decision-making data criteria called a fit for purpose data set. A sample set for this case study is shown in Table 4.

Step 3 - Identify Costs and Compare Value

The next step is to identify the costs of collecting these data attributes. In most cases, whilst it would be nice to have the time and resources to collect the entire data set, funding may restrict councils in doing so. In this case, it would be prudent to do a cost/value analysis to determine what part of the data set may be collected for optimal returns.

Costs are affected by the method of collection. Often, automated or electronic methods are more expensive than visual methods. However, for certain data attributes, the value from accurate electronic data may be better value for money. For certain data attributes, the costs of electronic methods may far outweigh the costs - i.e. the accuracy from visual methods may suffice. This analysis is therefore critical prior to finalising in the organisational data collection process.

A sample of the analysis for this case study is shown in Table 5.

Step 4 - Build an Intervention-rule Based Rating Scale

Having established the fit for purpose data set, it is still extremely critical to ensure that the measurement scale adopted is also fit for purpose. Councils using a Pavement Management System will recognise the value of this step as it also provides the interventions for treatments in their deterioration profiles for roads.

Rating scale samples from the case study in Table 6 are shown in Table 7.

It is worth noting that in the context of a PMS, fit for purpose scales are absolutely critical. Some organisations often blame the PMS for predicting inaccurate outputs. The reality is that the PMS lacks fit for purpose data sets and fit for purpose measurement scales to enable accurate decisions and outputs.

The Outcomes and Benefits from this Process

The council in this case study now has an extremely robust and value-adding data collection process. This process has been documented in the organisation pavement data collection manual. The measurement methods and scales have been clearly explained in this manual as an organisational rulebook. Documenting the process allows council to refer to and refine the manual as its activity lists and end-use lists evolve in the future.

Fit for Purpose Data Analysis has ensured that council's activity intervention levels are accurate and that these are accurately reflected in council's PMS. Their outputs are now optimal and there is ownership of these outputs from the end-users.

In this case study, council has been able to reduce its data collection costs by over 15% by only collecting desired data. As the long-term performance models based on this data are more reliable, the savings through council's pavement management process run into millions of dollars.

As the data and PMS outputs are reliable and linked to intervention levels, the council is now able to determine a *strategic rating cycle* by rating strategically selected samples of their road network in the second and third year, followed by a complete re-rate in year four. This will further reduce data collection costs.

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Table 6

Treatment	Optimal Intervention Levels – and % of segment area affected							
	Surface Texture	Oxidation	Cracking: Crocodile	Cracking: Linear	Rutting	Shape Loss	Pavement Defects	Roughness
Surface Enrichment	20%	Level 3	Must not be more than 5%	N/A	Must not be more than 2%	Must not be more than 2%	Must not be more than 2%	Must not be more than 60
Spray seals	30%	Level 4/5	Must not be more than 10%	N/A	Must not be more than 2%	Must not be more than 5%	Must not be more than 5%	Must not be more than 60
Spray seals with fabric	30%	Level 4/5	10-20%	N/A	Must not be more than 2%	Must not be more than 5%	Must not be more than 5%	Must not be more than 60
AC overlay	N/A	N/A	20-40%	N/A	Must not be more than 5%	5-15%	0-5%	60-110
Ac overlay with fabric	N/A	N/A	40-60%	N/A	Must not be more than 5%	5-15%	5-10%	70-110
Defect Patching	N/A	N/A	N/A	N/A	N/A	N/A	10-25%	N/A
Rut Regulation	N/A	N/A	N/A	N/A	5-20%	N/A	N/A	N/A
Rehabilitation	N/A	N/A	>60%	N/A	>20%	>15%	>25%	>110
Crack Sealing	N/A	N/A	N/A	>30%	N/A	N/A	N/A	N/A

Table 7

Surface Texture

Rating Scale	% of segment affected	Optimal Treatment
1	<20%	Surface Enrichment
2	20-30%	Reseal
3	>30%	Reseal with Fabric

Oxidation

Rating Scale	Oxidation Level	Optimal Treatment
1	1-2	No treatment
2	3	Reseal
3	4-5	Reseal with Fabric

Crocodile Cracking

Rating Scale	% of segment affected	Optimal Treatment
1	<10%	No treatment
2	10-20%	Reseal with Fabric
3	20-40%	AC overlay
4	40-60%	AC overlay with fabric
5	>60%	Reconstruction