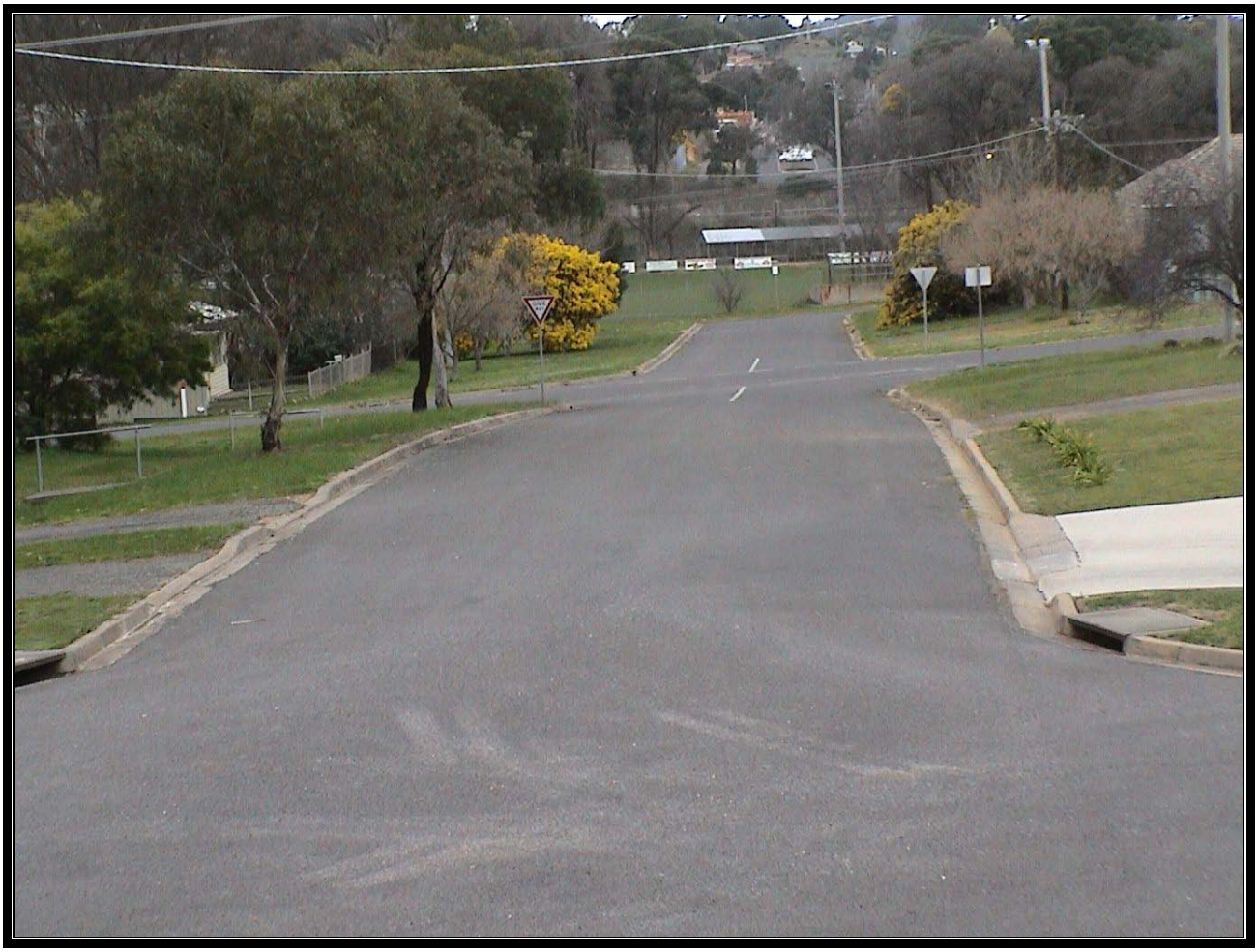
Moloney Asset Management Systems (MAMS)



Details Relating to

Condition Assessment of Road Assets

June 2018

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1.0 Introduction:

This document provides the background to the undertaking a visual condition assessment of the road network in accordance with the Moloney Asset Management Systems MAMS methodology and as outlined within this document. Further details of our methodology can be obtained from our roads software manual which is available from our web site at www.moloneys.com.au

The visual assessment of road asset condition can be quite difficult to deliver in an accurate and consistent manner. The key to achieving good results is the engagement of experienced and committed staff with extensive experience and thorough training.

Around 30% of our projects are undertaken for councils that use other asset management software, but who understand and value our methodology.

2.0 Condition Assessment Staff and Training:

Moloney Asset Management Systems (MAMS) has been undertaking road asset condition assessments on a full time basis since 1995. There have been some 245 projects undertaken for 67 councils across 5 States of Australia. There is a core of 2 condition assessors who have been with us since we started in 1995 and a total field staff of 4 full time assessors.

Our three core assessors all have in excess of 35 years experience each, in the design, construction and maintenance of road assets. In addition to this we have been using the same basic assessment methodology since1995.

All 204 projects have been fully undertaken by the 4 existing staff members as detailed below:

2.1 Assessors – Experience and Qualifications:

Detailed below is a summary of the 5 assessors who would be used on this project.

2.1.1 Assessor No 1

Name:	Peter Moloney
Qualifications:	Diploma of Civil Engineering and Member of IE Aust.
Experience:	Total of 45 years as civil engineer engaged primarily with Local Government infrastructure assets.
Road Cond. Experience:	Involved in road asset condition assessments since 1990 and developed the Moloney assessment methodology in conjunction with around 67 councils and our other assessors over 23 years.

2.1.2 Assessor No 2

Name:	Robert Pointon
Qualifications:	Completed around two thirds of a Diploma of Civil Engineering
Experience:	Total of 40 years as technical Officer engaged primarily with Local Government infrastructure assets.

Road Cond. Experience:	Involved in road asset condition assessments with MAMS since 1995 with around 200 projects for 59 councils. Also contributed to the development of the Moloney condition assessment methodology.

2.1.3 Assessor No 3

Name:	Peter Watling
Qualifications:	Completed around three quarters of a Diploma of Civil Engineering
Experience:	Total of 40 years as technical Officer engaged primarily with Local Government infrastructure assets.
Road Cond. Experience:	Involved in road asset condition assessments with MAMS since 1995 with around 200 projects for 59 councils. Also contributed to the development of the Moloney condition assessment methodology.

2.1.4 Assessor No 4

Name:	Duncan Brown
Qualifications:	Completed schooling to year 12 level
Experience:	Had a variety of occupations including statistical analyst with motor accident board of Victoria. Moved to Country Victoria and took up a job with the former Newstead shire in road maintenance and construction where he was engaged in for around 10 years.
Road Cond. Experience:	Commenced with MAMS in 2003 as a pavement condition assessor. Has been involved in around 100 condition assessment projects on a full time basis since that time.

2.1.5 Assessor No 5

Name:	David Moloney
Qualifications:	Completed schooling to year 12 level
Experience:	Had a variety of occupations including musician and manager of music retail store.
Road Cond. Experience:	Commenced with MAMS in Jan 2006 as a pavement condition assessor. Has been involved in around 80 condition assessment projects on a full time basis since that time.

2.2 Training of Condition Assessors:

We do not bring on new assessors very often (as can be seen from the above details) and take great care to ensure that we select people with an appropriate aptitude for the work. Obtaining and keeping good staff is of the utmost importance. Selecting staff with an aptitude for the job and a good attitude is the first step. Then providing them with appropriate training and good remuneration will ensure that all parties benefit from the experience.

2.2.1 Training of new staff

New staff members with MAMS are restricted to repeat projects for their first 12 months. This provided them with a constant reference back to the former condition ratings and greatly assists in gaining a firm understanding and calibration of the assessment methodology.

We have a formal induction program that is undertaken by Peter Moloney. This focuses on the occupational health and safety aspect of the job as well as the technical side of the assessment process. The induction generally takes a day and includes a minimum of 2 sessions where the new employee is asked to assess a road without any assistance or reference to a former assessment. The work is then reviewed with the trainer and further explanations undertaken as required.

Initial training will continue until the trainer is satisfied that the new employee has a good understanding of the condition assessment requirements. Following this process the new employee is placed with one of the experienced assessors for around a week and then goes onto another assessor for a second week. At the end of that time we all meet to discuss the outcome and if all assessors are satisfied with the results delivered by the new assessor than he or she is allocated an area to assess alone.

One of the more experienced assessors (generally Peter Moloney) will have the task of reviewing all of the results delivered by the new assessor for that test assessment area. Based upon the performance of the individual assessor the extent of checking will tend to drop off after around a further week.

Further sample checking will occur daily for around a month to ensure consistency. The new assessor would be limited to repeat projects for the first 12 months, where he or she is able to view the previous results before completing the new assessment. After that time their experience should be sufficient to undertake the assessment of new projects.

2.2.2 Ongoing verification of results

At the commencement of each project we get all assessors together and spend several hours looking at a range of assets in different conditions and coming to an agreement on the ratings for each. This is undertaken to calibrate our individual condition ratings. In addition to this random checks are undertaken of all assessors generally on a weekly basis.

In order to maintain consistency on repeat projects we try as far as is possible to have the same assessor repeat the same area that they did on the previous survey. This greatly assists individual segment consistency but does have the draw back of not cross referencing between assessors. However, on any project there will be a reasonable degree of cross referencing simply because of the way the work needs to be scheduled.

3.0 The MAMS Road Condition Assessment Methodology

The Moloney Asset Management Systems MAMS road condition assessment methodology has been developed over the last 23 years in conjunction with the 67 local government authorities for whom projects have been undertaken. Some of the main drivers of the system are detailed below.

- Designed for a road network where heavy traffic loading is not the prime driver of asset life.
- Designed to deliver works programs in the areas of, road resurfacing, pavement rehabilitation, major pavement dig outs and kerb replacement and isolated repair.
- Uses condition rating variables that are easily understood by all stakeholders.
- Condition details should also be suitable for asset accounting valuations and future financial modelling

There is a fundamental difference in the condition assessment requirements relating to heavily trafficked roads, where traffic loading is the key pavement life driver and lightly trafficked local roads where it is

more the environment that drives pavement life. The MAMS methodology has (in conjunction with around 67 Local Government partners) concentrated on the later class of the above road networks.

Road condition assessments MUST be able to deliver first cut works programs. The MAMS methodology has been developed with this outcome as its primary focus.

If the condition data delivers sound works programs then asset valuations and future financial modelling will fall straight out of the same data set.

3.1 Sub assets within the road asset group

The total road asset group is broken down within the MAMS system into the following 4 sub asset components or groups

- Formation – Earthworks
- Pavement – Load Carrying element
- Sealed Surface- Water proofing membrane
- Kerb - Longitudinal Drainage

Formation details are of only minor interest as these do not generally decay with time.

Pavement is very important, particularly in terms of delivering the two ongoing renewal programs of pavement rehabilitation and major patching – dig outs.

The sealed surface is also very important and the condition information here is used to deliver the ongoing sealed surface – resurfacing program.

Kerbs condition in the urban area is an important consideration in relation to pavement rehabilitation as it is often a combination of both pavement and kerb condition that drives the renewal program.

3.2 Information to be collected in the field survey

The MAMS road condition survey is a fully visual assessment methodology. It must also include sufficient inventory information to quantify the assets. Being a visual methodology it does rely upon experienced assessors and should not be tackled by inexperienced staff (see section 1 and 2 above).

This section will deal with the condition and inventory information that is to be collected for the road network.

3.2.1 The Formation Sub Asset set

The fields to be collected for the road formation are generally as detailed below:

- Formation Code
- Formation Width
- Horizontal Alignment
- Longitudinal Grade
- Rural Shoulder Condition
- Longitudinal Drainage

3.2.1.1 Formation Code

Formation codes have been developed that specify the extent of the earthworks associated with each formation. This is of great use in the valuation of the assets in that the unit rate per square metre of the formation can be linked to an actual extent of earthworks.

The codes also describe weather the formation is in fill, cut or a combination of cut and fill. This information can be useful when looking at pavement rehabilitation options especially within rural areas.

The table below contains some examples of the formation codes and associated valuations as used within the MAMS system.

CODE	FORMATION CODE DESCRIPTION	VALUE		Form.	Valuations
		Unit Rate $ / sqm	% Residual Value	Life	Updated By / ON
C1	Cut Depths up to 100 mm	1.07	95.00	100	PM Mar 2010
C10	Cut Depths between 500 - 1,000 mm	7.48	95.00	100	PM Mar 2010
C15	Cut Depths between 1,000 - 1,500 mm	13.89	95.00	100	PM Mar 2010
CF10	Cut and or Fill Depths between 500 - 1,000 mm	7.48	95.00	100	PM Mar 2010
CF15	Cut and or Fill Depths between 1,000 - 1,500 mm	13.89	95.00	100	PM Mar 2010
F2	Fill Depths between 100 - 200 mm	2.14	95.00	100	PM Mar 2010
F20	Fill Depths between 1,500 - 2,000 mm	19.24	95.00	100	PM Mar 2010

Figure 1 Formation Codes and descriptions

3.2.1.2 Formation Width

Measure and record the total width of the road formation from edge of batter or inside of table drain on each side of a road without kerbs and from face of kerb where a kerb is present

3.2.1.3 Horizontal Alignment

A ranking of 0 - 5 is used to describe the horizontal alignment. The following descriptions are provided as a guide to the use of the variable.

0 Very straight and high speed capable of 100km/hr

1 Good Alignment Large Radius curves Design Speed of 80 - 90 km/hr

2 Reasonable alignment Good curves Design Speed of 60 - 80 km/hr

3 Alignment with some slow points & Design Speed of 50 - 60 km/hr

4 Poor alignment with tight curves and a design speed of 30 - 50 km/hr

5 Very Poor alignment with tight curve and design speed of less than 30 km/hr

3.2.1.4 Longitudinal Grade

A ranking of 0 - 5 is used to describe the longitudinal grade. The following assessment of the ranking is provided as a guide.

0 Flat Grade

1 Very Gentle Grades of up to say 1%

2 Gentle Grades of up to 3%

3 Moderate Grades of up to 7%

4 Steep grades of up to 10%

5 Very Steep grades in excess of 20%

The measure of longitudinal grade can be of great use in many situations. If for example you were considering a kerb replacement program the grade of the kerb could influence the selection of replacement candidates,

3.2.1.5 Rural Sealed Road Shoulder Condition

The Rural sealed shoulder condition covers two main problem areas.

Firstly drop offs and steep cross falls where additional material is needed to rebuild the shoulder. Condition ratings here range from 0 - 10 where 0 indicates a perfect shoulder and at condition 8 the drop off would be in excess of 75 mm.

Secondly there can be a build up of material and grass on the shoulder that holds water on the sealed road. Here the Rating is -1 to -10 with -8 having a build up of around 75 mm

3.2.1.6 Longitudinal Drainage

It is often very difficult to get this rating to a high degree of accuracy because of grass growth etc. But if problems are obvious they will be reported on the basis of a 0 - 5 scale. Zero having no drainage problems and 5 having very obvious problems.

We encourage council to do their own drainage assessment in wet weather, when problems can be identified far easier. W are trying to record 7 pavement and 10 seal parameters and these are our focus so this one is not always complete but if something is obvious it will be reported.

3.2.2 The Pavement Sub Asset set

The assessment of sealed road pavement condition within the MAMS system is a real point of differentiation between us and most other methodologies. Section 3.2.2.4 below has a detailed explanation of the MAMS methodology, but in simple terms the methodology is built upon the following assumptions.

- Traffic loading is not the main driver of pavement life on lightly trafficked local roads.
- Pavement life is more linked to environmental impact with time and the standard of construction
- Pavements fail in two ways, shape loss and localised failures and pavement condition should be linked to these factors
- The condition information collected should feed directly into the major works programs
- The same condition information should deliver asset valuations and forward financial modelling.
- All stake holders should be able to understand the condition rating parameters

The fields to be collected for the road Pavement are as detailed below:

- Pavement Code
- Pavement Width
- Single Overall Pavement Condition
- % of Immediate Pavement Failures
- % of Potential Pavement Failures
- Mode of Pavement Failure
- Roughness
- Rutting
- Profile
- Comments relating to Pavement

3.2.2.1 Pavement Code.

The pavement code is a user definable code designed to assist with both the asset valuations and the estimated renewal demand cost. The table below contains some examples of common pavement codes.

CODE	PAVEMENT CODE DESCRIPTION	VALUE Normal $ / sqm	Small Areas $ / sqm 100	Pave Life Years	Valuations Updated By / ON
S/A	Sealed Local Access Road Pavements	38.00	95.00	90	PM Mar 2010
S/C	Sealed Collector Road Pavements	44.00	110.00	70	PM Mar 2010
S/L	Sealed Link Road Pavements	55.00	137.50	50	PM Mar 2010
U/P10	Unsealed Pavement with design depth of pavement material 100 mm	8.00	20.00	18	PM Mar 2010

Figure 2 Sample of Pavement Codes

3.2.2.2 Pavement Width

The width of the pavement is as measured on site. It is the width between the faces of the kerb, if a kerb is present and the edge of seal plus 300 mm if there is no kerb

3.2.2.3 Overall Pavement Condition

The overall pavement condition is a figure that lies between 0 and 10. At Condition 0 the pavement is new and has the whole of its life ahead of it, while at condition 10 there is no remaining life or value within the pavement. In practice a sealed road would never get to condition 10 because if it were still in use there would be some residual value and if it were so bad that it could not be used it would be ripped up or closed to the public.

The Overall Condition assessment of a sealed road depends upon factors such as pavement shape and the extent of localised pavement failures. The figure is not used directly in the development of the "Program Condition" but is collected as a check on the consistency of the figures that are used to deliver it. It is the assessors gut feeling of single overall condition and should align reasonably well with the program condition that is based on 6 other parameters.

A brief explanation of the pavement overall condition is detailed below.

Sealed Road Pavement Condition 0-1

This would be a new pavement or one that was in as new condition. There would be no signs of any pavement problems or wear. The pavement would be very smooth to ride on and there would be no evidence of any movement since the construction of the pavement was completed.

Sealed Road Pavement Condition 2

At condition 2 a pavement would be in excellent condition with no signs of any distress or unwanted movement. The ride would be excellent with only the most minimal roughness evident.

Sealed Road Pavement Condition 3

Condition 3 pavements would be in excellent condition with only minor signs of roughness or deformation and pavement failures would be extremely rare. To some extent it would be the age of the pavement that had moved it from condition 2 up to 3. But the pavement would tend to be slightly rougher and or more miss shaped than a condition 2 pavement. This would still be a very good and true shaped pavement.

Sealed Road Pavement Condition 4

At condition 4, a pavement would be exhibiting some signs of distress. It may have lost some shape or it could have a degree of roughness associated with it. Condition 4 pavements would not be expected to

have extensive pavement failures, although there may be some minimal and localised pavement failures. The pavement would be quite structurally sound and in most cases it would be the slight loss of shape and or moderate roughness level that warranted the condition 4 rating.

Pavements within condition 4 would be expected to have half or perhaps a little more of their life remaining and could be in excess of 40 years old.

Sealed Road Pavement Condition 5

By the time a pavement reaches condition 5, there would be obvious signs of distress. There could be a number of reasons why the pavement has been rated at condition 5. Often it will simply be the general roughness or shape of the pavement. A pavement rated at condition 5 for roughness and general profile only would need to be reasonably rough. In the rural area you would be aware of the roughness at 100 km per hour but it would not feel that the road needed immediate attention.

In other cases a pavement would be rated at condition 5 because of the extent of localises pavement failures. If there were 15 – 20% of the pavement area subject to some form of potential pavement failure then this could place an otherwise well shaped pavement into condition 5. If the pavement had both the failures and the roughness then it may be a condition 6 pavement.

Sealed Road Pavement Condition 6

At condition 6 a pavement would be quite noticeably rough if it were roughness and shape alone that constituted the condition 6 rating. The ride on the road in this case would be quite noticeably rough but not to the point of being uncomfortable in a standard sedan car.

If it was pavement failures that were driving the rating then the extent of the failures would be in excess of 30% of the pavement area. Where a combination of the two factors came together to create the condition 6 rating then neither factor would need to be as severe as described here. If it were, then the pavement condition would probably be a condition 7 pavement.

At condition 6 the pavement would still be expected to have a reasonable life in front of it although the bulk of its life would have been spent. The pavement could be heading for a minor or major capital rehabilitation within a few years if it was a strategic route but equally could have many years of remaining service as a minor route.

Sealed Road Pavement Condition 7

At condition 7 a pavement is in poor condition and is approaching the time where it should be scheduled for reconstruction or major rehabilitation. If the roughness and shape of the pavement were the principle mode of failure then the pavement would be very rough. The speed of vehicular travel over the pavement would be restricted because of the roughness.

There would generally be obvious signs of pavement failure present but a condition 7 pavement could be based upon roughness alone. Condition 7 could also be allocated if the pavement exhibited extensive areas of failure or potential failure over a large portion of the segment. This would generally be in excess of 40% – 50% of the area of the segment.

A combination of roughness and pavement failure to a lesser extent than detailed above could also constitute a condition 7 pavement. You should think of a condition 7 pavement as one that does not need to be rehabilitated immediately but it would have serious and obvious structural flaws and as such could require rehabilitation in the near future.

Sealed Road Pavement Condition 8

Condition 8 can be thought of as the general intervention level for rehabilitation of local road pavements. The more strategic heavily trafficked pavements may be rehabilitated at condition 7.

At condition 8 a pavement would be exhibiting severe problems. If attributed to roughness and shape alone the roughness would be extreme and the driveability of the road would be a real problem. If linked to pavement failure the extent of the failures would exceed 50% of the pavement area.

In most cases a condition 8 pavement would have some degree of pavement failure. It would be rare to achieve a condition 8 rating based upon roughness and shape alone, but it does occur. The pavement would be in need of immediate rehabilitation and this would be obvious to the assessor. The pavement could in fact be starting to be a little dangerous to drive upon at the design speed.

Condition 8 could be allocated for roughness alone where the design speed was high, where on a low speed with the same roughness the overall condition may be rated at condition7.

You should think of a condition 8 pavement as one that requires immediate rehabilitation.

Sealed Road Pavement Condition 9-10

These condition factors are not often used, as a pavement at condition 9 would be in a very dangerous state and should not be subject to traffic movements. The condition factors may be applicable on rare occasions where roads are found to be in extremely poor condition and obviously should not be in service. You should think of condition 9 and 10 pavement as pavements that are dangerous and in such a poor state that they should be closed off to the public.

3.2.2.4 The Program Pavement condition – Delivered by the software

The program pavement condition is a single condition rating on a 0 – 10 scale that is developed within the MAMS software package based on 3 shape characteristics and the extent of immediate and potential failures. This section is provided for information only as the field assessor does not directly set this figure. However, it is important to understand how it is derived and what base data drives it.

This factor is the main point of differentiation between the MAMS system and most other assessment methodologies. It comes down to a question of what drives the expected life of a local Government sealed road pavement. The classic assumption is that traffic loading determines pavement life. However, a very high percentage of the Local Government network is subject to such low traffic loading that it is not really a factor in determining pavement life.

What drives the need to rehabilitate a Local Government road pavement can be summarised in two overriding factors.

- Shape Loss
- Localised Failures

The Moloney methodology collects 3 common shape characteristics and 2 failure characteristics. It then has a well developed algorithm that uses this information do deliver a single overall program pavement condition based on a 0 – 10 scale.

If there are no pavement failures then the program condition is fully driven by shape and becomes the worst of the 3 shape characteristics. In simple terms the road condition is driven by the nature of its ride ability or shape.

As pavement failures commence and increase (expressed as a % of total segment pavement area) these add to the Program Pavement Condition in a slightly exponential way, such that low levels have minimal impact and high levels have a big impact.

The field assessment of the 3 shape characteristics and 2 failure extents represent the key drivers in the assessment of the MAMS pavement condition. The methodology works very well for lightly trafficked local roads and less well where pavement life is dictated by high traffic volumes.

The Program Pavement Condition formulae is user definable and can be amended. It could for instance include weightings from the seal area covering cracking and patching. However, we find that all current users have adopted the default formulae.

3.2.2.5 Pavement Immediate Failures.

This is the first of the measurements of the extent of isolated failures. This factor is intended as a means of flagging isolated pavement failures requiring immediate attention. The assessor is required to

estimate the percentage of the pavement area that is subject to pavement failure. There is no limit to the percentage that can be called up but in practice a figure between 0.1 and 20 would be expected.

If the percentage is low then the impact of these failed areas on the program condition is minimal. The assumption here is that the dig out areas will be treated under a major patching program and thus the future road condition will not be affected by the small failed areas.

The extent of the failure is expressed as a % of the total segment pavement area. The extent does not need to be measured but care must be taken to ensure that the selected % is reasonably accurate. Immediate failures are those that need to be attended to right now as they are already potentially hazardous.

As well as feeding into the program pavement condition the immediate failures are also used to deliver a costed major patches or dig out report within the MAMS system.

3.2.2.6 Percentage of Potential Pavement Failures.

This is the second of the measurements of the extent of isolated failures. This condition factor is intended as a further means of identifying isolated pavement failures requiring attention at some future time. The assessor is required to estimate the percentage of the pavement area that is subject to pavement failure. Potential failures can sometimes be small but can also be as large as 100%.

If the percentage of potential failure is low then the impact of these failed areas on the program condition is negligible.

The extent of the failure is expressed as a % of the total segment pavement area. The extent does not need to be measured but care must be taken to ensure that the selected % is reasonably accurate.

The classic example of potential failure is crocodile cracking. Pavements with extensive crocodile cracking will have a very much reduced service life and the program condition takes this into account.

3.2.2.7 Mode of Pavement Failure.

Along with assessing the extent of the pavement failure the field assessor is required to assess the mode or type of pavement failure. There can be up to 3 different modes of failure within the one road segment as illustrated below with the 3 separate failure modes separated by "/".

CC/PM/PF – Crocodile Cracking, Pavement Movement and Pumping of fines

Modes of failure are fully user definable but there has been developed over the years a set of standard failure modes that cover most situations. Figure 3 below contains a list of the MAMS standard modes of pavement failure.

CODE	MODE OF PAVEMENT FAILURE DESCRIPTION	Details Updated By / ON
HP	High Plastic Pavement Material - Generally on Unsealed Pavel	S/US
POT	Pot Holing of Sealed & Unsealed Rds	S/US
V	Various Multiple modes of failure	S/US
W	Water Intrusion or Wet Pavement Problem	S/US
CB	Block Cracking	Sealed
CC	Crocodile Cracking	Sealed
CK	Cracking Generally - Different types	Sealed
CL	Longitudinal Cracking	Sealed
CR	Crescent Cracking	Sealed
PF	Pumping of Fines to surface, Usually with "CC"	Sealed
PH	Pavement Heaving	Sealed
PM	Pavement Movement	Sealed
PS	Pavement Sinking	Sealed
R	Failure due to excessive roughness generally in Sealed Paver	Sealed
RU	Rutting Failure	Sealed
DL	Delamination of Pavement or Asphalt Surface	Sealed
B	Bare or low depth Patch on Unsealed Road	Unsealed
FG	Fine grading - Resulting in Loose Material on unsealed Pavem	Unsealed
LF	Loss of fines within unsealed pavement (Sandy material that w	Unsealed
LM	Loose Material - within an Unsealed Pavement	Unsealed
SS	Slippery Surface on Unsealed Rd	Unsealed
SSP	Soft Sandy Patches	Unsealed
WW	Water Washing of Unsealed Rd Surface	Unsealed
PM/CC	Pavement movement with Crocidile cracking	

Figure 3 Sample of Pavement mode of failure Codes

3.2.2.8 Pavement Roughness.

This is the first of the 3 pavement shape characteristics that are to be collected. It is normally undertaken as a visual assessment but it could be augmented with laser profile results if required.

Detailed below is a guide to the visual assessment of roughness as it relates to NASRA roughness counts. With care and experience the visual assessment of roughness does prove to be very reliable.

Moloney Condition Rating	Correlation with NASRA roughness Counts	Description of driving conditions at 100 km / hr in a car with standard suspension
0	0 – 20	No discernible roughness at all
1	20 - 40	Roughness very difficult to discern
2	40 - 50	Just at the threshold of discernible roughness
3	50 - 70	Roughness now felt but not causing any problems or discomfort
4	70 - 80	Roughness becoming obvious but still not the cause of any concern

5	80 - 90	Roughness would be quite apparent and being felt in the vehicle but it would not be a real problem to the driver.
6	90 - 110	Roughness would be quite apparent to the driver and it would be beginning to be a little uncomfortable.
7	110 - 140	The road would be rough and quite uncomfortable in the car.
8	140 - 170	Roughness here would be at the point where the roads would need to be rehabilitated because of roughness alone.
9	170 - 200	Roughness would be extreme and driving very uncomfortable. It would be difficult to reach the 100 km/hr speed limit.
10	200 +	Extreme roughness and dangerous to drive upon at speed.

3.2.2.9 Pavement Rutting.

This is the second of the 3 pavement shape characteristics that are to be collected. It is normally a visual assessment or it could be derived from a mechanical means of measurement. Rutting while very important on heavily trafficked roads is not often a problem encountered on local roads & streets.

As a guide to the selection of the rutting condition rating the following details are provided. Rutting occurs in the wheel path of traffic lanes and is caused by underlying deformation resulting from heavy applied traffic loads. A simple way to measure the extent of rutting is to place a 1,200 mm straight edge across the traffic wheel path and to then measure the maximum deformation along the straight edge. As a guide the following correlation between deformation and condition rating is provided.

Deformation in traffic path along a 1200 mm long straight edge in mm	Suggested Rutting Condition Rating
Up to 10	0
10 to 15	1
15 to 20	2
20 to 30	3
30 to 40	4
40 to 50	5
50 to 60	6
60 to 100	7
100 to 150	8
150 to 200	9
Greater than 200	10

3.2.2.10 Pavement Profile.

This is the third of the 3 pavement shape characteristics that are collected. It can be seen as the overall cross sectional shape of the pavement. The shape or profile of the pavement across its horizontal cross-section is a very useful factor in the assessment of the overall pavement condition. The assessment is normally based upon a visual observation but can be measured with laser profiler if required.

Profile probably does not require a 0 – 10 condition scale but for the sake of consistency this is what has been used. Profile is all about the shedding of water from the pavement area when we talk about the retention of water you should neglect the longitudinal grade of the road and think in terms of the expulsion of water across the road cross section.

A guide to the visual selection of the profile condition rating is detailed below.

Description of road Cross Sectional Profile	Suggested Profile Condition Rating
A well shaped road profile that would very quickly disperse rain water from the road surface leaving little or no ponding	0 to 2
A reasonably shaped road profile that would generally disperse rain water but may leave some isolated ponding areas with depths up to around 6 mm	3 to 4
A pavement profile that does not disperse rainwater efficiently. There would be extensive ponding following rain with depths up to 12 mm	5 to 6
A very poorly shaped road cross section with extensive pavement movement. Water would be retained over a large portion of the profile to depths up to around 50 mm	7 to 8
An extremely badly shaped pavement cross section with massive pavement movement and retention of rain water in excess on 50 mm depth	9 to 10

3.2.2.11 Pavement Program Condition Examples

The table below contains some examples of the link between program condition and the shape and failure extent input data.

PAVEMENT						
Program Con 0-10	% Immediate Failure	% Potential Failure	Mode of Fail	Roughness 0-10	Rutting 0-10	Profile 0-10
2.00				2	1	2
5.00				4	1	5
2.11	1.0	2.0	CC/PS	2	1	2
5.28	5.0	20.0	CC/PM/W	4	3	4
7.95	10.0	55.0	CC/PM/W	4	1	4
7.85	1.0	80.0	CK/PM	3	2	3

Figure 4 Examples of Pavement Program Condition

Note that where there is no pavement failures recorded the program condition is set as the worst of the 3 shape characteristics. Then with a very light extent of failures the affect on pavement condition is low. However, as the failure extent increases the failures begin to have a big impact on the pavement program condition.

The treatment of cracking failures within the MAMS system is very different to that of most other systems. Cracking is always recorded as a surface defect and as such directly feeds into the surface condition. However, the assessor MUST specify that the cracking is also a pavement failure (as detailed in figure 4) if it is to be treated as affecting the pavement program condition.

This is a very important point of differentiation between the MAMS methodology and most other systems. Surface cracking is not necessarily associates with deeper pavement problems. But it does require an experienced assessor to make that determination.

Figure 4A below illustrates a very sound pavement with extensive block cracking on around a 1500 mm grid. Pavement shape remains near perfect and there is no sinking around the cracks. With either crack sealing and or some form of elastic reseal the pavement would be fine. Thus the cracking would be counted as a seal defect but not recorded as a pavement failure.

The pavement has no immediate of potential failures and would end up at around condition 2 - 3 based on very minimal shape loss only.

Figure 4A Bad Cracking but not a pavement problem

3.2.3 The Sealed Surface Sub Asset set

The sealed surface condition characteristics used within MAMS are modelled on the same system as developed by Vic Roads in Victoria to manage their sealed surface assets.

The fields to be collected for the Sealed Surface sub asset set are as detailed below

- Seal widths and other dimensions
- Cracking Extent
- Cracking Severity
- Stone Loss or Stripping
- Binder Oxidation
- Patching Extent
- Seal Texture
- Edge Condition
- Code of existing Treatment
- Code of proposed Treatment
- Required date for proposed treatment
- Comments relating to sealed surface
- Date of Inspection

3.2.3.1 Seal widths and other dimensions

The assessor is required to measure the overall width of the sealed surface to the nearest 100 mm. In addition to this if the seal width varies this MUST be accounted for in one of the following ways.

Provide a second and if needed a third width along with the total length of the width change (this is the preferred method where a straight width change occurs and there is no other reason to create a new segment.

Add in any additional square metres for radii at intersections, Court bowls and thresholds to intersecting unsealed roads etc.

The dimensions must be sufficient to accurately assess the total area of the sealed surface within each segment.

3.2.3.2 Cracking Extent – First Seal Condition Parameter

Pavement and seal cracking is an important factor in the overall health of both the pavement and the sealed surface. The extent of cracking is a measure of the extent of the cracking problem over the whole of the seal segment.

The following is a guide to the assessment of the 0-5 Condition rating for Cracking Extent

Condition 0	No cracking visible over the segment
Condition 1	Cracking evident in isolated location or very small number of locations.
Condition 2	Cracking evident over say 10-30% of the segment
Condition 3	Cracking evident over 30-50% of the segment
Condition 4	Cracking evident over 50 - 70% of the segment area
Condition 5	Cracking or block cracking evident over more than 70% of the segment area.

3.2.3.3 Cracking Severity – Second Seal Condition Parameter

This factor is a measure of how severe or wide the cracking is. For example a very fine system of cracking over the whole of the seal may not be as bad as a very severe cracking over only 20% of the area. The following details are provided as a guide to the selection of cracking severity condition.

Condition 0	If no cracking visible over the segment
Condition 1	Fine cracking less than 0.5 mm in width
Condition 2	Fine cracking up to 1.0 mm in width
Condition 3	Cracking between 1.0 - 5.0mm
Condition 4	Cracking Between 5.0 & 10.0 mm
Condition 5	Severe cracking Greater than 10mm in width.

Note that cracking is ALWAYS recorded as a seal distress as per the above two factors. However unlike many other systems it does not automatically translate to a pavement distress or failure. To qualify as a pavement failure it MUST be independently called up by the assessor as a pavement failure (see section 3.2.2.5 – 3.2.2.7 above).

3.2.3.4 Stone Loss or Stripping – Third Seal Condition Parameter

The stripping or stone loss of the sealed surface includes not only the classic loss of aggregate from a chip seal but also includes the loss of aggregate and other finer material from an asphalt surface. Below is a guide to the assessment of the Stripping condition.

Condition 0 - No stripping or stone loss visible over the segment

Condition 1 - Only very minor stripping evident in isolated locations

Condition 2 - If isolated stripping evident at several locations throughout the segment or major stripping in an isolated area. Also if there is a general but very light loss of some of the fine material from an asphalt surface.

Condition 3 - If stripping evident to a light degree over the whole of the segment or major stripping in multiple isolated areas. For asphalt surfaces the loss of material would be general and would be greater than the fine material and would be beginning to include a small portion of the largest nominal sized aggregate in the mix.

Condition 4- The loss of aggregate in chip seals would be general and severe while for asphalt the loss of material would include a large portion of the largest nominal sized aggregate within the upper portion of the asphalt surface.

Condition 5 - Aggregate loss in both asphalt and chip seals would be general across the segment and extreme.

3.2.3.5 Bitumen Oxidation – Forth Seal Condition Parameter

This is the most important of the surface condition factors and is perhaps the most difficult to deal with. The bitumen binder that holds the aggregate in place within a bituminous chip seal oxidises and becomes brittle with age. Oxidation is linked to age and so if you have age records for a seal then these should be consulted. However, age alone does not provide a total measure of bitumen oxidation.

The method used for Spray Seals is quite different to that used for Asphalt and detailed below is the MAMS approach for both situations.

Bitumen Oxidation Preheat Method for spray seals

Preheat a small area of the surface to 60 degrees centigrade and check the temperature with a non-contact thermometer. With a chisel or screwdriver and hammer dig out a piece of the seal and examine the bitumen around the top layer of stone only. As you do the test check that the actual bitumen temperature is 60. Allocate an oxidation condition based upon the use of the following descriptions as a guide.

Condition 0 - Bitumen strings for at least 100 mm and is extremely sticky to touch and is difficult to remove from the fingers.

Condition 1 - Bitumen strings for up to75 mm and is extremely sticky to touch and is difficult to remove from the fingers.

Condition 2 - Bitumen strings for around 25 to 50 mm and is tacky to touch

Condition 3. - Bitumen draws into points about 5 - 10 mm long away from the stone and is still black and smooth in appearance.

Condition 4. - Bitumen will not draw from the stone for more than a few millimetres.

Condition 5 - Bitumen appears dull and has no shine or stickiness and does not draw from the stone at all.

Bitumen Oxidation methodology for Asphalt surfaces

With asphalt surfaces the key to oxidation is the upper surface of the asphalt as once this has oxidised the surface will become progressively rougher as material is lost from the asphalt mass. Once the loss of the larger nominal size stone within the upper surface of the asphalt is wide spread then oxidation has been allowed to progress beyond the desirable intervention point for surface re-treatment.

Condition 0 - No loss of surface material at all and surface very black

Condition 1 - Loss of fine material from surface just starting to be evident

Condition 2 - Loss of fine material from surface apparent but in no way severe

Condition 3. - Loss of fine material evident as well as larger stone in Asphalt now protruding up to 20% of nominal stone size

Condition 4. - Loss of fine material evident as well as larger stone in Asphalt now protruding up to 50% of nominal stone size

Condition 5 - Larger stone in Asphalt now protruding beyond 50% of nominal stone size

3.2.3.6 Patching – Fifth Seal Condition Parameter

Assessed here is the degree of patching that has been undertaken as well as that which needs to be undertaken. The degree of seal surface patching that is present or needed to be undertaken is used as one of the means of establishing the overall seal condition. It is a seal condition distress indicator and hence the extent of patching that has been both undertaken together with the extent that needs to be undertaken is combined into the one factor.

Patching that has been undertaken prior to the most recent reseal is ignored. A guide to the assessment of the patching condition factor is detailed below.

Condition 0 No patching evident over the whole of the segment.

Condition 1 Very little patching evident. (Even as low as one patch)

Condition 2 Heavy isolated patching in one or two locations or light patching scattered at isolated locations over the segment.

Condition 3 Heavy isolated patching in several locations or light patching spread out but extending over most of the segment.

Condition 4 Heavy patching at frequent intervals over most of the segment or light patching at close (under 4m) intervals over the majority of the segment.

Condition 5 Extensive heavy patching over most of the segment or light patching at very close intervals (under 1 m) over the whole or majority of the segment.

3.2.3.7 Texture – Sixth Seal Condition Parameter

Texture is a measure of the height of the existing bitumen level within a chip or spray sealed surface. The following is a brief explanation of the recommended rating for this factor. This condition primarily relates to a chip sealed surface. However it is also recorded for asphalt, but here it tends to be closely related to the stripping or stone loss factor.

Texture is a very important factor for spray seals as it is a measure of the amount of bitumen binder present in the seal. It is often a trade off between getting the most bitumen on the ground and avoiding flushing problems.

For the lightly trafficked local road the more bitumen you can get onto the road without causing flushing problems the better. Total seal life will be greatly enhanced with high bitumen levels on local roads and the ideal texture is within the range 1 – 2 while on highways it may be 3. Detailed below is a guide to the selection of texture condition for spray seals.

Condition 0 A Flush surface condition with bitumen right up to or very close to the surface.

Condition 1 A surface with an over supply of bitumen such that the level is generally 70% – 80% up the full depth of the Aggregate.

Condition 2 A surface that is still bitumen rich with the level at or around 50-60% of the Full depth of the aggregate. This is the ideal texture for lightly trafficked local roads

Condition 3 A seal with bitumen level of around 30-40% of the full depth of the aggregate. Ideal for highly trafficked roads.

Condition 4	A seal with a low bitumen level of around 20% of the full depth of the aggregate. Some stone stripping would generally be evident because of the low bitumen level.
Condition 5	A seal with a very low bitumen level of around 10% or less of the full depth of the aggregate. Extensive stone stripping would generally be evident because of the low bitumen level.

You may find that the assessment of texture on local roads is compounded by a vast variation across the road cross section. The seal may be flushed within the traffic wheel lines and very hungry at the centre and edges. In such cases texture you need to bear in mind that the texture level is often used to assist in the selection of the next seal treatment. High texture condition on a large stone would normally result in a small stone for the next treatment. Low texture condition would support the selection of a larger stone.

3.2.3.8 Edge Break – Seventh Seal Condition Parameter

Here the extent of seal edge break away is assessed on a 0 to 5 scale. This will normally be associated with non-retained seal edges. However in some cases edges can be lost against an existing kerb particularly if the overall condition of the seal surface has been allowed to oxidise to an excessive level.

Condition 0	No edge breaks present
Condition 1	Very minimal edge breaks present – under 1% of total length.
Condition 2	Minor edge breaks under 5% of total length.
Condition 3	Moderate edge breaks up to 10% of total length
Condition 4	Extensive edge breaks over 10% of total length or severe breaks in terms of distance into the seal width over a lesser extent
Condition 5	Extreme edge breaks in terms of both % of length affected and severity of seal width affected.

3.2.3.9 Code of Existing seal treatment

The assessor is required to nominate the type of seal treatment that is currently in place. The code used is user definable but MAMS had developed a set of standard codes that cover most situations as illustrated in Figure 4 below.

The codes are used to describe the type of seal that is in place as well as providing unit costs for renewals and accounting purposes.

3.2.3.10 Proposed treatment Code

The assessor is also required to select an appropriate next seal treatment to go over the existing surface. The code will come from the same table below as used for the above code. The assessor will need to have had considerable experience with spray seals and asphalt surfacing in order to select an appropriate next treatment.

3.2.3.11 Date for the proposed next treatment

Along with the type of next seal treatment the assessor is required to nominate the proposed year for the next treatment. Considerable experience is needed here and an understanding of the expected life of the existing treatment along with a sound knowledge of the loss of life due to the affect of the 7 seal condition ratings is essential.

The proposed re-treatment date is not used in the development of the overall seal condition but is used as a check on the consistency between the proposed date and the 7 seal condition factors.

CODE	SEALED SURFACE CODE DESCRIPTION	VALUATION $ per sqm $ / sqm	Seal Life Years	Valuations Updated By / ON
AS	Asphalt Surface Unknown Depth	25.00	45	PM Mar 2010
BP	Clay Brick & other masonry Paveing Cost with Pavement	0.00	50	PM Mar 2010
DS5/10	Double Application seal size 5 over 10 mm Stone	12.00	20	PM Mar 2010
DS7/14	Double seal size 7 over 14 mm	12.00	20	PM Mar 2010
EAS	Asphalt with Elastic Membrane unerneath	30.00	45	PM Mar 2010
ER10	Elastic type Re Seal size 10 mm	10.00	18	PM Mar 2010
ER14	Elastic type Re Seal size 14 mm	11.00	18	PM Mar 2010
ER7	Elastic type Re Seal size 7 mm	9.00	18	PM Mar 2010
FS10	Final Seal Size 10 mm	8.00	18	PM Mar 2010
FS14	Final Seal Size 14 mm	9.00	18	PM Mar 2010
FS7	Final Seal Size 7 mm	7.00	18	PM Mar 2010
GR7/14	Geofabrick Double seal 7 mm over 14 mm	20.00	30	PM Mar 2010
IS10	Initial Treatment P & S - Costed with Pavement	9.00	20	PM Mar 2010
IS14	Initial Treatment P & S - Costed with Pavement	9.00	20	PM Mar 2010
IS7	Initial Treatment P & S - Costed with Pavement	8.00	18	PM Mar 2010
PC	Patterned Concrete paveing (Cost Inc with Pavement	0.00	80	PM Mar 2010
PS10	Primer Seal 10 mm - Costed with Pavement	8.00	18	PM Mar 2010
PS14	Primer Seal 14 mm - Costed with Pavement	8.00	18	PM Mar 2010
PS7	Primer Seal 7 mm - Costed with Pavement	7.00	18	PM Mar 2010
R10	10mm RESEAL	8.00	18	PM Mar 2010
R14	14mm RESEAL	8.00	18	PM Mar 2010
R5	5 mm RESEAL	7.00	16	PM Mar 2010
R7	7mm RESEAL	7.00	16	PM Mar 2010
RC	Reinforced Concrete Surface	0.00	100	PM Mar 2010
RCON	Surface requireing Reconstruction	0.00	75	PM Mar 2010
SR10	10mm Rubber Reseal	9.00	18	PM Mar 2010
SR7	7mm Rubber Reseal	9.00	16	PM Mar 2010
SS	15mm SLURRY SEAL	13.00	12	PM Mar 2010

Figure 5 Sample of Sealed Surface Codes

3.2.3.12 Comments relating to seal inspection

Any special comments relating to the seal segment need to be recorded.

3.2.3.13 Date of inspection

The date of the seal inspection also needs to be recorded. This is generally done in month and year in excel date format

3.2.4 Segmentation set up and description

Roads and streets are broken up into segments of like performing and like condition assets. Each segment has the following basic segmentation details recorded.

- Road or Street Name
- Start Chainage
- Start reference description
- End Chainage
- End Chainage Description

Chainages within the one road or street are normally continuous, even if this requires the creation of an empty segment with no assets present to preserve chainage continuity.

3.2.4.1 Road or Street Name

This is the name of the road or street being assessed and is a required field.

See the list of standard abbreviations below for assistance with the description of specific situations with road names or amend the list if you have specific requirements.

3.2.4.2 Street Name From

Within an urban district this would normally be the name of the Street where the segment commenced. It is recommended that segments within urban areas commence at property boundaries for the first segment and terminate at the road centreline of the next intersecting street. The last segment in any street would normally terminate at the property or building line. This sets up a fixed and repeatable reference system. For town streets each block becomes a segment and additional segments may need to be created for special intersection treatments and where asset condition changes substantially mid block.

In Rural areas segment changes will generally be at the point where a seal or construction change occurs. If this point is close to, but not at an intersecting road, then the following convention applies to the segment descriptor. The descriptor could be "**8.66 Back Rd"** the 8.66 being the actual chainage of the Back Rd Intersection while the chainage of the actual segment condition change is close but different at say 8,500... Thus the intersection was 160 metres past the segment change.

It is important to document the chainage of as many intersecting roads as possible in the rural area. This will make the job of finding the segment ends far easier in the future.

3.2.4.2 Distance From

This is the chainage in metres or distance along the street or road from the starting point of the segment under consideration. Accurate chainage or distance measurements are vital as they must be repeatable. A calibrated odometer is used to set and check chainages.

3.2.4.3 Street Name To

The name of the Street or other reference for the end point of the segment is recorded. If the road continues on then this will also be the street from reference for the next segment.

3.2.4.4 Distance To

The chainage or distance along the street or road for the end point of the segment is recorded.

3.2.4.5 General Segmentation Requirements

The road and street segmentation and associated descriptions are vitally important. It is recommended that the following rules apply.

Every road or street name should be complete and unique. No two roads or streets should have the same name as this can create difficulties in sorting the data. For example 2 Back Rd entries may be distinguished as Back Rd Melbourne and Back Rd Sydney.

Standard abbreviations should be used where possible to describe road types and other shortcuts in naming descriptions as detail in the table below. The table may be added to if required.

We would adopt your existing segmentation if that is what is wanted or we could modify it to better suite the MAMS methodology by agreement with the city. The primary aim is to segment such that the assets within each segment are consistent in both type and condition.

List of Standard Abbreviations used By Moloney in Condition Assessment Surveys

Abbreviation	Description of Abbreviation
C/P	Car Park - Generally Off Street - Uses as a part Descriptor for the Road Name
P/B	Parking Bay along Side a road way - Uses as a part Descriptor for the Road Name
B/P	Bicycle Path - Uses as a part Descriptor for the Road Name
I/S	Intersection Swing on at a "Y" Type Intersection - Uses as a part Descriptor for the Road Name
BOK	Back of Kerb - Used as an additional descriptor for Chainage Ref.
EOS	Edge of Seal - Used as an additional descriptor for Chainage Ref.
S/R	Service Road - Uses as a part Descriptor for the Road Name
F/P	Footpath
C/W	Carriageway - Uses as a part Descriptor for the Road Name
Nth C/W	North Bound Carriageway Etc - Uses as a part Descriptor for the Road Name
Rd	Road
St	Street
Av	Avenue
Ct	Court
Cct	Circuit
Dr	Drive

Figure 6 Sample List of abbreviations used with road names

3.3 Assessment Methodology:

The following is a brief explanation of the condition assessment methodology adopted by MAMS for the assessment of sealed roads.

3.3.1 Preliminary Matters

There are a number of preliminary matters that need to be addressed prior to the commencement of any works. MAMS has developed a checklist that is signed off with the client council prior to the commencement of any work. The checklist covers the following general areas.

- Details of the asset sub sets and broad condition information to be collected
- Treatment of Main or State responsibility roads with council assets contained therein
- Condition assessment methodology
- Details of any special code requirements for the project
- Design depth for Unsealed road pavements
- Segmentation requirements
- Road register – Road list details to identify council assets

3.3.2 Pre commencement meeting with assessors

Prior to the commencement of any project a briefing is held with all assessors to go through the council checklist and any other special requirements that council may have raised with us.

We also use this meeting to highlight any points of difference that may exist with the data set such as the commencing chainage reference point (Property line, edge of seal, centreline etc.) and any special concerns that Council may have with their assets that require particular attention. This meeting is generally held on location or at our Newstead offices prior to commencement of any works.

3.3.3 Day one of Condition Assessment

On the first day of a new project following the pre commencement meeting we commence individual assessments with assessors in close proximity to each other. We generally work for around 1 hour and then come together to discuss the findings. All assessors then go to one of the locations and discuss the findings. They stay at that location until agreement is reached on the adopted condition ratings.

The same process is repeated at another assessor's location and when consensus has been reached at this second location the assessors go their separate way to continue their individual assessments.

3.3.4 Ongoing Monitoring

The process adopted above on day one is repeated weekly to ensure consistency. In addition to this Peter Moloney generally audits a random sample of segments for each assessor once a week and joint inspections follow if there are discrepancies of more than one whole condition rating number found.

3.3.5 Data Entry Checks– in Field

When redoing an existing project the assessor is required to dot the existing data if not amending it to indicate that it has been considered. For the pavement and sealed surface assets we have an inbuilt check on the validity of the data by coming at the answer in two different ways. The results of both must be consistent.

3.3.6 Check Off of Data

In order to ensure that all assets have been inspected and reported upon a check off is undertaken towards the end of the project. If it is a new project then this is done against the road list supplied by Council. If a repeat project then all segments within the existing data set are signed off.

3.3.7 Post Condition Assessment Checks

When data has been updated into the computer following the condition assessment, we have a number of data validation tests to assist with the locating of typing errors and errors of omission by assessors. Essentially for the very important assets assessments of pavement and sealed surface we have two ways of coming at the answer and checks are undertaken to ensure that the two results are consistent.

If errors are found then the data enterer (generally Peter Moloney) goes back to the data capture sheets to resolve the matter. In this way we can correct most typing errors and errors of omission.

3.4 Summary:

Consistency and accuracy can be difficult to achieve with the visual assessment of road asset condition. There are however several means of assisting this outcome and some of the more important ones that we employ are summarised below

- Choose condition assessors with the right attributes and experience for the job
- Provide sound training to new assessors
- Audit the work of the new assessors regularly and provide strong feedback
- Allow new assessors to work only of repeat projects for their first 12 months where they can be guided to a certain extent by the prior assessments
- Have an audit system in place to validate the results of all assessors
- Maintain contact with assessors regularly to ensure consistency of approach and to cater for individual council special requirements
- For the very important assets of sealed road pavement and sealed surface, have inbuilt checks
- Review the performance of assessors at regular intervals
- Remunerate assessors well, based upon performance. (We find that around 70% of the total project income generally goes to the assessors). They are working away from home and need to feel that they are doing well to keep up enthusiasm and continue to deliver good outcomes.

4.0 What the data delivers:

The Condition assessment is designed to deliver the following:

- Costed Capital Renewal Programs
- Major Maintenance Programs
- Asset Valuations
- Forward Forecasting of future financial renewal demand over the next 10 – 20 years.
- Benchmarking of asset condition against 45 council districts assessed on the same basis.

4.1 Capital Renewal and Major Maintenance Programs

Costed capital renewal programs are developed within the MAMS software based upon the asset condition information. Provision is also available within the software to weight the raw condition figures based on the hierarchy or importance of the particular road segment.

4.1.1 Sealed Pavement Renewal and Dig out Programs

This section deals with the two programs in the system that deliver pavement renewal recommendations and pavement major patching or dig out recommendations.

Figure 7 below contains the details of the first draft of the pavement rehabilitation program that comes directly out of the data set. This one has not been modified for road hierarchy weightings but that process is very simple once the road hierarchy has been placed within the data set.

Seg ID No.	ROAD OR STREET NAME	SEGMENT DETAIL				Pavement Condition Details								Cumulat.
		FROM		TO		Prog	%	%	Mode	Rug	Rut	Pro	Re-Treat	Replace
		Street Name or Description	Dist. m	Street Name or Description	Dist. m	Con 0-10	Imm Fail	Pot Fail	of Fail	0-10	0-10	0-10	Cost $	Cost
3395	Racecourse Rd	Hickey La	1,114	Mulberry Ct	1,286	**9.78**	1.0	50.0	CC/CK/PH	7	4	0	115,312	115,312
2913	Tynan Rd	Hume Freeway	0	Railway Line	38	**9.60**	20.0	30.0	CK/PS	6	1	6	11,625	126,937
2797	Teal St	Lowry St	0	Swan St	83	**9.40**		60.0	CC/CL	6	2	5	45,182	172,119
1367	Hume Hy	Seal Change	4,205	Seal Change	4,615	**9.03**	20.0	20.0	CC/PS/PF	4	5	6	132,397	304,516
1570	Kiewa St	Seal Change	2,928	Nathan Av SBL	2,961	**9.03**	20.0	20.0	CC/PM	5	5	6	37,639	342,155
373	Buchhorn Ln	Klose St	135	Sanders St	281	**8.37**	10.0	30.0	CC/PS	6	3	6	57,755	399,910
247	Bernhardt St West B C/W	Bernhardt St	168	Bernhardt St	292	**8.19**		25.0	CC/CL/PM	7	2	6	44,964	444,874
1428	Jemalong Av	Start of Bowl	113	End of Bowl	134	**8.09**		70.0	CC/PM	4	1	3	23,814	468,688

Figure 7 Sample List of pavement rehabilitation projects with costing

At a level below the full rehabilitation of the whole pavement segment the software also delivers an isolated failures or major patches report. Here the Excel filters can be used to exclude segments where the overall pavement condition is poor and the segment is more likely to be dealt with under a full reconstruction program.

Target segments are costed with a user definable costing structure which can be varies based upon the scale of the works. The reports within figures 7 and 8 both have in excess of 90 detailed fields available from which to select the target projects and you may well be using far more fields than are displayed here, the limitation being the width of the page for display.

The software does prioritise capital works projects. But the real power is in providing the end used with the tools to select target projects based upon their unique needs and understanding of the assets using any of the 90 + fields available.

Seg ID No.	ROAD OR STREET NAME	SEGMENT DETAIL											Repair Cost Immediate Failures		
		FROM		TO		Prog	%	%	Mode	Rug	Rut	Pro	Repair	Repair	Repair
		Street Name or Description	Dist. m	Street Name or Description	Dist. m	Con 0-10	Imm Fail	Pot Fail	of Fail	0-10	0-10	0-10	Area sqm	Rate $/sqm	Cost $
2956	Union Rd	Burrows Rd	3,847	Burrows Rd	3,868	**7.03**	20.0	20.0	CK/PM	4	3	4	212	65.93	13,996
2914	Tynan Rd	Railway Line	38	Perryman	98	**4.87**	15.0	10.0	CK/PS	3	2	3	66	59.80	3,947
391	Bundarra Pl	Ashford St	0	Start of Bowl	26	**6.80**	10.0	20.0	CC/PS	5	2	5	29	164.83	4,747
519	Centaur Rd	End of Kerbs	1,395	Greta Dr	1,530	**6.80**	10.0	20.0	CK/PH	5	3	5	162	65.93	10,681
392	Bundarra Pl	Start of Bowl	26	End of Bowl	56	**5.80**	10.0	20.0	CC/PS	4	1	3	43	164.83	7,022
1555	Kiewa St	Smollett St	1,577	Dean St	1,780	**5.80**	10.0	20.0	CC/PS	4	4	4	204	65.93	13,439

Figure 8 Sample Pavement Major patching program

4.1.2 Sealed Surface Renewal Program

The MAMS software also delivers a similar report within the sealed surface area. Figure 9 below details the first part of the recommended resurfacing program with renewal costs included. As with the pavement programs, the sealed surface program can be weighted for road hierarchy. This is done within the software by modifying the raw program condition based upon a desired weighting for the various road hierarchy classes.

Pavement condition can also be called up within this report so that the very poor condition pavements can be excluded from the program (the assumption being that they will be dealt with under the reconstruction program)

Seg ID No.	ROAD OR STREET NAME	SEGMENT DETAIL				Seal Condition							Treatments			Seal Valuations		Cumul Replace. Cost
		FROM		TO		Prog	Ck	Ck	St	Bit	Pat	Tex	Exist	Prop		Seal	Replace	
		Street Name or Description	Dist. m	Street Name or Description	Dist. m	Cond 0-10	Ex 0-5	Se 0-5	St 0-5	Ox 0-5	0-5	0-5	Code	Code	Prop Date	Area sqm	Value $	
379	Buckingham St Pt 2	Frauenfel. St	190	Mate St	463	**8.79**	4	3	4	**5.0**	3	4	R10	ER10	Jan-10	1,530	15,300	15,300
796	Dights Forrest	Gerogery Rd	0	Raven Cl	352	**8.79**	2	2	5	**5.0**	5	4	R10	ER7	Jan-10	2,288	20,592	35,892
797	Dights Forrest	Raven Cl	352	Seal Change	936	**8.79**	2	2	5	**5.0**	5	4	R10	ER7	Jan-10	3,796	34,164	70,056
1179	Griffith St	Wyse St	0	School	205	**8.49**	2	3	4	**5.0**	3	4	R10	ER7	Jan-11	1,144	10,296	80,352
3302	Corrys Rd	Telopea St	1,672	End	2,122	**8.33**	3	4	3	**5.0**	3	3	PS10	FS7	Jan-10	2,525	20,203	100,555
373	Buchhorn Ln	Klose St	135	Sanders St	281	**8.33**	5	3	2	**5.0**	5	0	R5	AS	Jan-10	657	17,082	117,637
205	Batten St	Boronia St	0	Start of Bowl	123	**8.18**	3	3	4	**5.0**	2	3	R10	ER10	Jan-11	1,524	15,240	132,877
507	Cemetery 3 Rd	Cemetery 2 Rd	0	Glenmorus St	148	**8.18**	3	4	3	**4.5**	4	4	AS	ER10	Jan-11	488	4,884	137,761
889	East St	Schubach St	380	Campbell Ct	657	**8.18**	3	3	4	**4.5**	4	4	AS	ER10	Jan-11	3,407	34,071	171,832
890	East St	Campbell Ct	657	Seal Change	763	**8.18**	3	3	4	**4.5**	4	4	AS	ER10	Jan-11	1,304	13,038	184,870
2231	Peel St Pt 2	North St	0	End	32	**8.18**	1	3	3	**5.0**	3	4	AS	ER10	Jan-11	256	2,555	187,425
2909	Turner St	Clarence St	104	Balston St	245	**8.18**	3	3	3	**5.0**	3	3	R10	R7	Jan-10	1,692	11,844	199,269
521	Centaur Rd	Seal Change	1,895	Overend St	2,165	**8.18**	4	3	3	**5.0**	4	2	R10	ER14	Jan-10	1,189	13,079	212,348

Figure 9 Sample Sealed Surface renewal Program

4.1.3 Kerb Renewal and repair Programs

The same basic programs that are available for the pavement assets are also available for both the kerb and footpath assets.

Seg ID No.	ROAD OR STREET NAME	SEGMENT DETAIL				Kerb & Channel - All Segments						Kerb Replacement Value	Cumulat. Replace Cost
		FROM		TO		Code	Leng m	Con 0-10	Iso Fail	Urg 0-3	Kerb Locat.		
		Street Name or Description	Dist. m	Street Name or Description	Dist. m								
1177	Griffith Rd	Jason Rd	1,378	Jennifer Rd	1,582	K6	204	**8**			Right	13,260	13,260
1568	Kiewa St	George St	2,728	Crisp St	2,797	K6	66	**8**			Right	4,290	17,550
1601	Klose St	Darke St	0	Wahroonga St	132	K6	130	**8**			Right	8,450	26,000
1937	Moffat St	Mair St	180	Fox St	365	K6	180	**8**			Right	11,700	37,700
2901	Tulla St	Bralgon St	250	Caratel St	371	K6	96	**8**			Left	6,240	43,940
2908	Turner St	Union St	0	Clarence St	104	K6	103	**8**			Left	6,695	50,635
2909	Turner St	Clarence St	104	Balston St	245	K6	140	**8**			Right	9,100	59,735
2931	Union Rd	Seal Change	730	Turner St	864	K6	134	**8**			Right	8,710	68,445
78	Alldis Av	Douglas Rd	0	Comans Av	244	K6	243	**7**			Right	15,795	84,240
151	Balston St	Sutherland St	154	Turner St	281	K6	115	**7**			Right	7,475	91,715
219	Bell St	Ashford St	0	Kotthoff St	136	K6	144	**7**			Right	9,360	101,075

Figure 10 Sample Kerb renewal Program

Figure 10 above provides the details of the worst sections of overall kerb within the council district. These are kerbs that require full renewal for the whole length of the segment.

Seg ID No.	ROAD OR STREET NAME	SEGMENT DETAIL				Kerb & Channel - All Segments					Kerb Repair Costing			
		FROM		TO		Code	Con 0-10	Iso Fail in m	Urg 0-3	Kerb Locat.	Renewal Value $	Repair Rate $	Cost of Repair	Cumul Cost
		Street Name or Description	Dist. m	Street Name or Description	Dist. m									
176	Baranbale Wy	Conargo Wy	862	Buranga Dr	882	K6	**4**	80	3	Left	845	120	9,600	9,600
3039	Wagga Rd	End of Splitter	114	Kaylock Rd	607	K6	**4**	70	3	Right	31,655	120	8,400	18,000
312	Boronia St	Batten St	435	Cnr (E)	584	K6	**6**	40	3	Left	9,685	120	4,800	22,800
1574	Kiewa St Sth B C/W	Abercorn St	0	Panmure St	210	K6	**6**	40	3	Right	13,845	120	4,800	27,600
2304	Poplar Dv	Seal Change	374	Michelle Av	472	K6	**5**	40	3	Right	6,695	120	4,800	32,400
2196	Parkland Cr	Southerland St	543	Cheyenne Dv	627	K6	**7**	30	3	Left	5,850	120	3,600	36,000
250	Bevan St	Kambora Ct	210	Mcdonald Rd	333	K6	**6**	30	3	Left	8,255	120	3,600	39,600
1288	Highview Cr	Colley St	0	Pine Av	282	K6	**6**	30	3	Left	18,330	120	3,600	43,200
1288	Highview Cr	Colley St	0	Pine Av	282	K6	**6**	30	3	Right	18,720	120	3,600	46,800
1602	Klose St	Wahroonga St	132	Buchhorn Ln	270	K6	**6**	30	3	Left	7,800	120	3,600	50,400
1755	Logan Rd	Alemeia Rd	558	Seal Change	782	K6	**6**	30	3	Left	14,560	120	3,600	54,000
2541	Schaefer St	Hague St	0	Woodbury Ct	130	K6	**6**	30	3	Right	8,450	120	3,600	57,600
841	Douglas Rd	Daly Rd	1,707	Barlow	1,767	K6	**5**	30	3	Left	3,510	120	3,600	61,200
1763	Logan Rd	Chenery St	1,790	Range Rd	1,957	K6	**5**	30	3	Right	10,855	120	3,600	64,800
1719	Livermore St	Union Rd	0	End of Road	182	K6	**4**	30	3	Left	12,350	120	3,600	68,400
1757	Logan Rd	Fairview Rd	851	Capt. Cook Dv	1,097	K6	**4**	15	3	Left	15,210	205	3,075	71,475
1812	Mann St	Moffat St	0	End	152	K6	**4**	10	3	Left	10,790	205	2,050	73,525

Figure 11 Sample Kerb Isolated Failure Program

Figure 11 above provided a costed table of kerb isolated failure repairs. The repairs are all ranked with an urgency rating from 0 – 3 with 0 being non urgent and 3 being very urgent and generally associated with dangerous situations or escalating pavement problems.

Both kerbs and Footpath assets are treated this way within the MAMS system, with two works programs coming directly out of the condition data. The first in Figure 10 being the renewal of full segment lengths of the asset and the second in Figure 11, being the identification of smaller failed sections within a segment.

4.1.4 Summary of works program analysis

The MAMS system has been primarily designed to deliver the basic renewal and major maintenance programs that a council undertakes on an annual basis. This was our focus when setting up and then developing the system in conjunction with our 40 council users.

It has always been our belief that if the works programs can be delivered then the other reporting requirements of the data set will fall into place easily.

4.2 Asset Valuations

Asset valuations can be undertaken within the MAMS software based on the following criteria:

- Replacement value is delivered at a segment level by applying unit replacement rates to asset quantities as measured in the field
- Present worth is delivered by factoring back the replacement value based upon the asset condition
- Annual depreciation is delivered by dividing the replacement value by the expected life of the asset

The table within figure 12 below provides a sample of the valuation outputs for the sealed road pavement assets.

The software also has the capacity to allow for the annual depreciation amount since the date of the last survey. And a recent amendments enables the WDV to be delivered based on the age of the assets.

Seg ID No.	ROAD OR STREET NAME	SEGMENT DETAIL							Pavement Valuations				
		FROM		TO		Prog Con 0-10	Pave Area sqm	% Res Val	Replace Value $	Asset Life Years	Written Down Value	Accum. Dep.	Annual Dep.
		Street Name Description	Dist. m	Street Name Description	Dist. m								
3272	Abbott Dr	Lyne Dr	0	T Section	204	**0.00**	1,760		116,010	75	116,010	0	1,547
3273	Abbott Dr	T Section	204	North End	233	**0.00**	183		12,045	75	12,045	0	161
1	Abercorn St	Oliver St	0	Plummers St	100	**3.17**	1,210		79,749	75	48,124	31,625	1,063
2	Abercorn St	Plummers St	100	Kiewa St	215	**3.09**	1,300		85,676	75	52,547	33,129	1,142
3	Abercorn St	Kiewa St	215	Townsend St	456	**3.00**	1,687		111,224	75	69,515	41,709	1,483
4	Abercorn St	Townsend St	456	End of Seal	542	**3.00**	516		34,020	75	21,262	12,757	454
5	Acacia Pl	Kurrajong Pl	0	Start of Bowl	21	**2.00**	210		13,845	75	10,384	3,461	185
6	Acacia Pl	Start of Bowl	21	End of Bowl	47	**2.00**	369		24,341	75	18,256	6,085	325

Figure 12 Sample of Asset Valuation output for Sealed Road Pavement assets

4.3 Key Performance Indicators and Benchmarking

The MAMS system uses the same condition assessment techniques and characteristics for all condition surveys that are undertaken. This enables the development of some very strong key performance indicators for benchmarking.

Benchmarking is delivered both internally (between 2 consecutive condition surveys at the one Council) and externally (by comparing the results from one council with those of all councils assessed by MAMS).

Both forms of benchmarking are of great value to a council, but with 2 consecutive condition assessments a very strong picture of performance can be delivered. Detailed below are the 8 key performance indicators that have been developed for the sealed road pavement assets. Similar indicators have been developed for all of the road sub assets and the pavements are being presented here as example of all sub assets.

4.3.1 Key Condition Indicators for sealed rd pavements

MAMS have developed a series of 6 key performance indicators that can be applies to all sealed road pavements. They are used to measure condition movement between field surveys some years apart. They are also used to benchmark against other council districts assessed on the same basis.

Detailed below is an explanation of the 6 indicators. Similar indicators are used for the other road sub assets of (Sealed Surface, Unsealed Pavement, Kerb and Footpath).

4.3.1.1 Weighted Average Asset Condition

The weighted average asset condition is a single condition indicator that represents the whole condition distribution in one figure. It is derives by weighting the raw asset condition scale 0 - 10 for the extent of asset within each condition and so provides a basic single figure summary of the overall condition of the asset set and is very useful as a condition movement indicator.

4.3.1.2 Percentage of Urgent Failures

The percentage of urgent failures is a measure of the isolated failures identified in the survey as needing immediate repair. It is expresses as a percentage of the total asset group quantity.

4.3.1.3 Percentage of Other Failures

The percentage of other failures represents those isolated failures, which while present on the ground do not require urgent attention. The figure is again expressed as a percentage of the total asset quantity.

4.3.1.4 Average Roughness

Average roughness is only relevant to pavement assets and for sealed road pavements is a key capital condition indicator of longitudinal pavement shape, while for unsealed pavements is a key maintenance indicator. It is based on a 0 – 10 scale with 0 being perfect and 10 un-driveable.

4.3.1.5 Average Profile

Average pavement profile is similar to the roughness rating and can be seen as the pavement cross sectional shape indicator while roughness is the longitudinal pavement shape indicator. It is based on a 0 – 10 scale with 0 being perfect and 10 un-driveable.

4.3.1.6 Extent of Poor Condition Assets above a given Condition

The percentage of the asset base at and above a given condition rating is a very good way of expressing the extent of poor condition assets present. This figure is expressed as a percentage of the total asset base and is reported at several different condition levels from condition 5 to 8 depending upon the asset set in question. For example sealed road pavements at and above condition 7 would represent the extent of the asset base that would be likely to require rehabilitation over the next 3 – 5 years.

4.3.1.7 The Presentation of Key Performance Indicators

The key performance indicators are presents in different formats for the first and the subsequent condition surveys. For the first survey the indicators are compared with the average of the figures found for all other councils assesses, as detailed within Figure 13 below. Note that this council has relatively good condition assets accept for the extent of urgent and other failures, which are very high. At the bottom of the table the percentage of the long-term average renewal demand being met and the demand coming out of the MAMS financial model is recorded.

If these percentages are low it would be expected that asset condition would be poor. If high, condition would generally be better. These figures are of far more importance in a second survey (see Figure 15) when they should directly relate to the indicator movement between surveys.

Key Cond. Indic. No.	Sealed Pavement Condition Indicator	Mean Indicator for all Councils assessed by MAMS	Figures from Current Survey in Feb-10	Raw Difference Your Figure Less the Mean	% Difference Your Figure to the Mean	Better or Worse than the Mean
1	Weighted Average Asset Condition	3.67	2.70	0.970	26.4	Better
2	% of Urgent Failures	0.25	0.37	-0.125	-50.8	Worse
3	% of Other Failures	1.85	2.80	-0.953	-51.5	Worse
4	Average Pavement Roughness	3.13	2.36	0.770	24.6	Better
5	Average Pavement Profile	2.67	1.91	0.755	28.3	Better
6	% of Asset Base above Condition 6	11.61	4.54	7.068	60.9	Better
7	% of Asset Base above Condition 7	2.88	1.23	1.647	57.2	Better
8	% of Asset Base above Condition 8	0.68	0.26	0.424	62.4	Better

Renewal Demand Being Met For:	% of Long Term Demand Being Met	% of Present Demand (From Model) Being Met
Sealed Rd Pavement Asset Group	62.2	99.2

Figure 13 Key performance indicators for a first survey

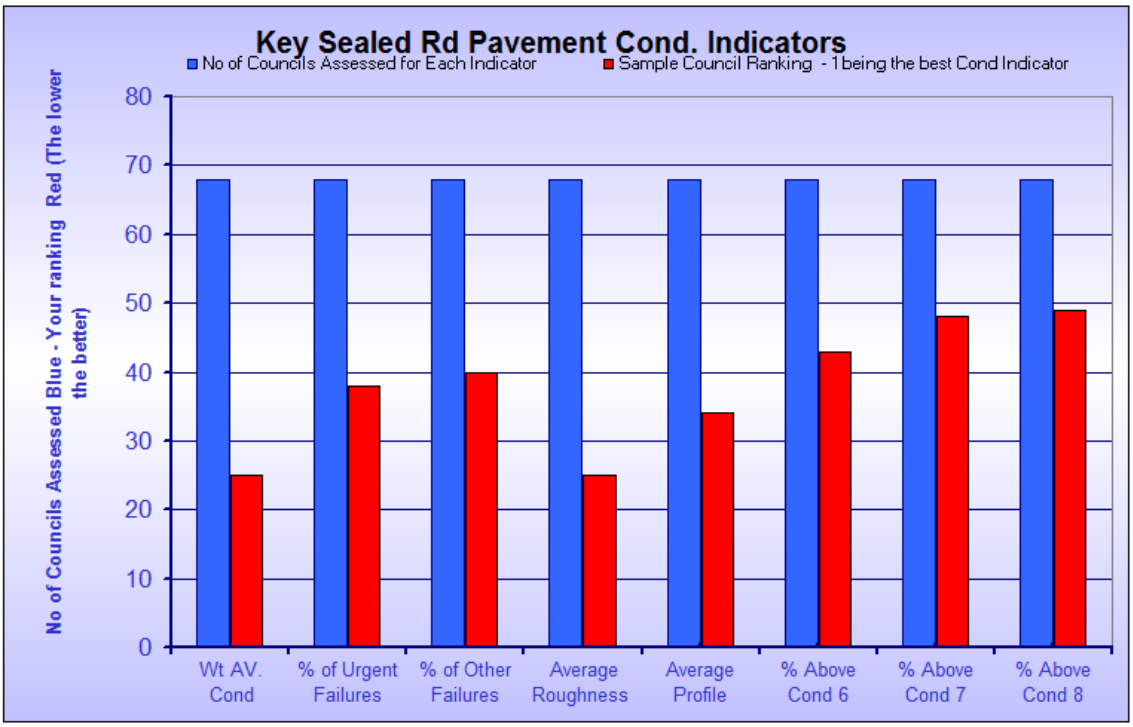

Figure 14 Key performance indicators Bar Graph Display

Figure 14 above details the same key condition indicators used to benchmark Council against all other council districts assessed by MAMS. In this graph the blue bars represent the total number of councils assessed while the red indicate the individual council ranking from best to worst. One being the best and in this case 68 (equal to the Blue bar total) being the worst. In simple terms the lower the red bar the better the condition comparison. The graph provides a simplified way of quickly assessing a councils overall position compared to all 68 councils assessed by MAMS.

In this case the sample council has quite good condition sealed road pavement assets but the extent of poor condition assets at and above condition 7 is a little elevated as is the extent of isolated pavement failures.

Key Cond. Indic. No.	Sealed Pavement Condition Indicator	Figures from Last Survey in Oct-07	Figures from Current Survey in Aug-10	Change between Surveys New Minus Old	% Change Between Surveys	Better or Worse Since last Survey
1	Weighted Average Asset Condition	3.45	3.36	0.083	2.4	Better
2	% of Urgent Failures	0.20	0.12	0.083	40.6	Better
3	% of Other Failures	0.42	0.58	-0.162	-38.7	Worse
4	Average Pavement Roughness	3.185	3.081	0.105	3.3	Better
5	Average Pavement Profile	2.54	2.50	0.042	1.6	Better
6	% of Asset Base above Condition 6	5.32	4.33	0.990	18.6	Better
7	% of Asset Base above Condition 7	1.58	0.89	0.685	43.4	Better
8	% of Asset Base above Condition 8	0.11	0.12	-0.014	-12.6	Worse

Renewal Demand Being Met For:	% of Long Term Demand Being Met	% of Present Demand (From Model) Being Met
Sealed Rd Pavement Asset Group	79.5	134.6

Figure 15 Key performance indicators for a Second survey

The same key performance indicators are used for a second or subsequent survey to indicate the movement in asset condition between the two surveys (see Figure 15 above). In this case most indicators have improves and this is consistent with the reasonably high levels of renewal expenditure indicated at the bottom of the table.

In summary the tracking of key performance indicators between 2 consistent condition surveys provides a strong measure of performance and should always be consistent with the general levels of renewal expenditure recorded at the bottom of the table.

4.4 Projection of Future Renewal Demand

The MAMS software includes a financial modelling package that predicts the future renewal demand associated with the road assets. The software does this by taking the present condition of the assets following the survey. It then degrades them via a degradation curve to simulate the passage of time. Finally a level of service is selected and all assets that rise beyond that level via the degradation process are delivered as a capital renewal demand.

The software delivers a prediction of the annual renewal demand over a 20 year period. It can also model the different sub assets separately, as well as sub sets of the same sub asset set (if their performance is expected to be measurably different).

Detailed below are a series of typical outputs for the prediction of the renewal demand associated with a full set of road assets. The outputs start at a single asset set that is modelled as a one like performing asset set. It then moves on to an asset group level with similar assets but made up of different performing sub sets. Finally there is a single prediction for the whole of the roads group.

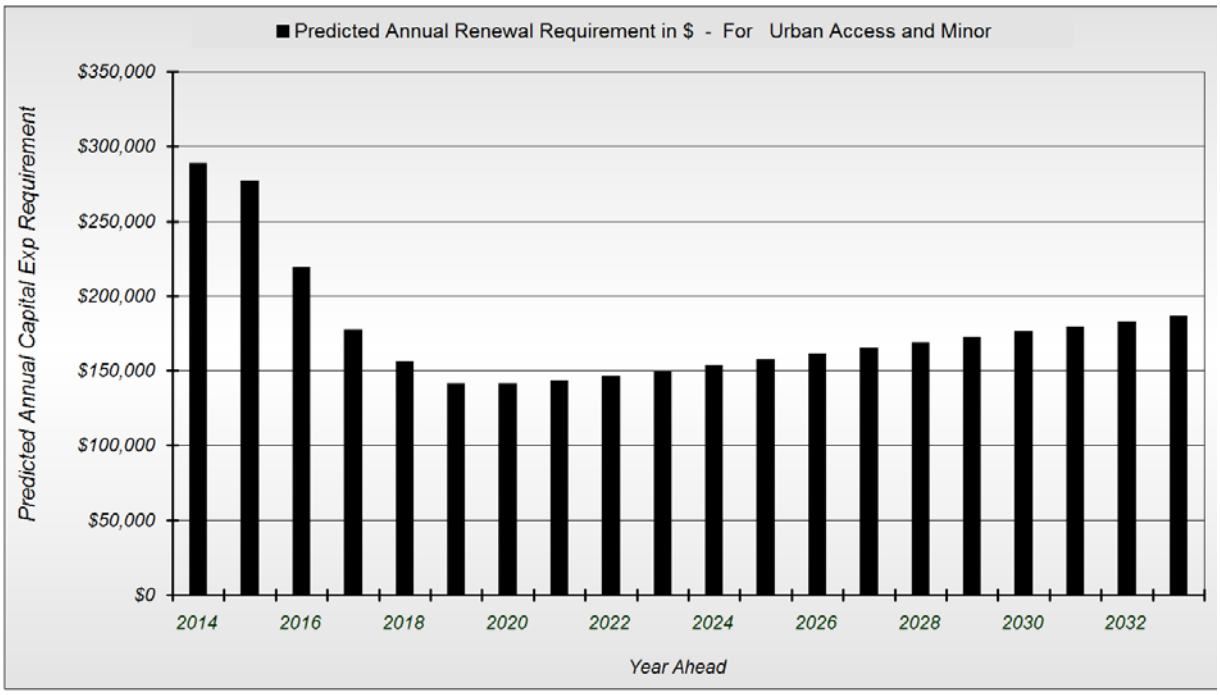

Figure 16 Predicted Annual Renewal Demand for a Single Pavement Asset Set

Figure 16 Above relates to the predicted ongoing renewal demand for one of the sub sets of the sealed pavement assets (the Urban Access Roads)

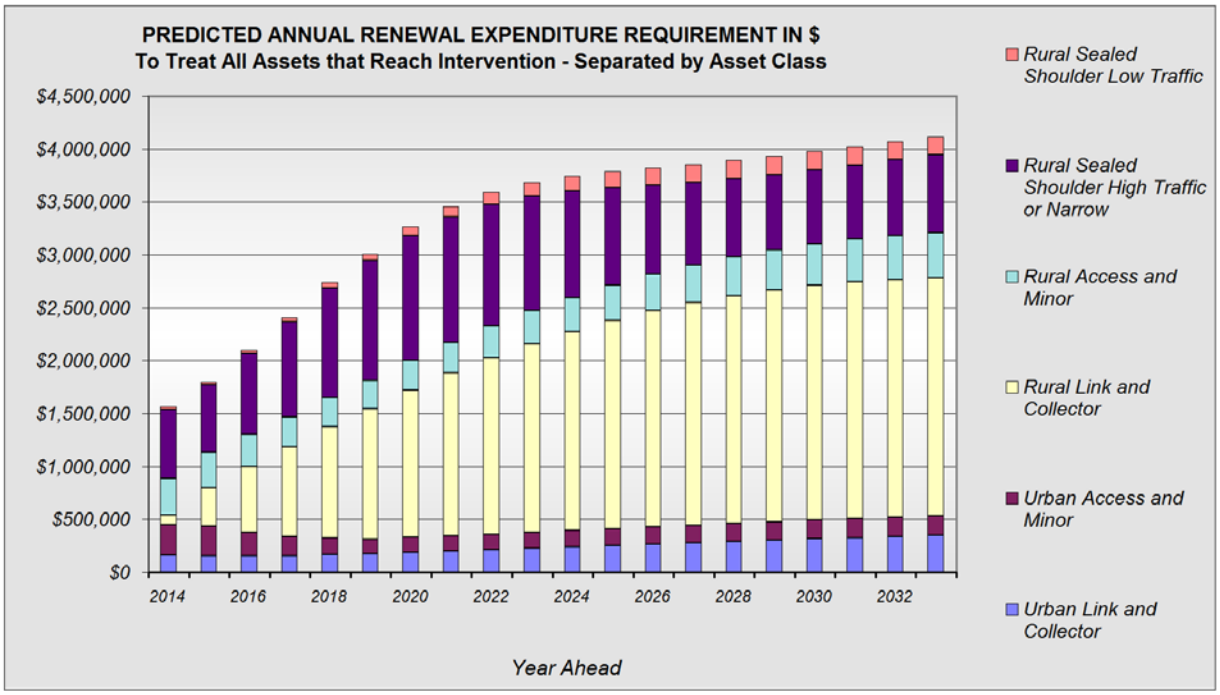

Figure 17 Predicted Annual Renewal Demand for all 4 Pavement sub sets

Figure 17 combines the 6 individual modelling results for the different performing pavement types. In this way we are able to model the different pavement types with appropriate life cycles and levels of service and then combine the results into a single pavement group output where the varying demand can easily be identified. There is a predicted strong growth in the rural link and collector pavements.

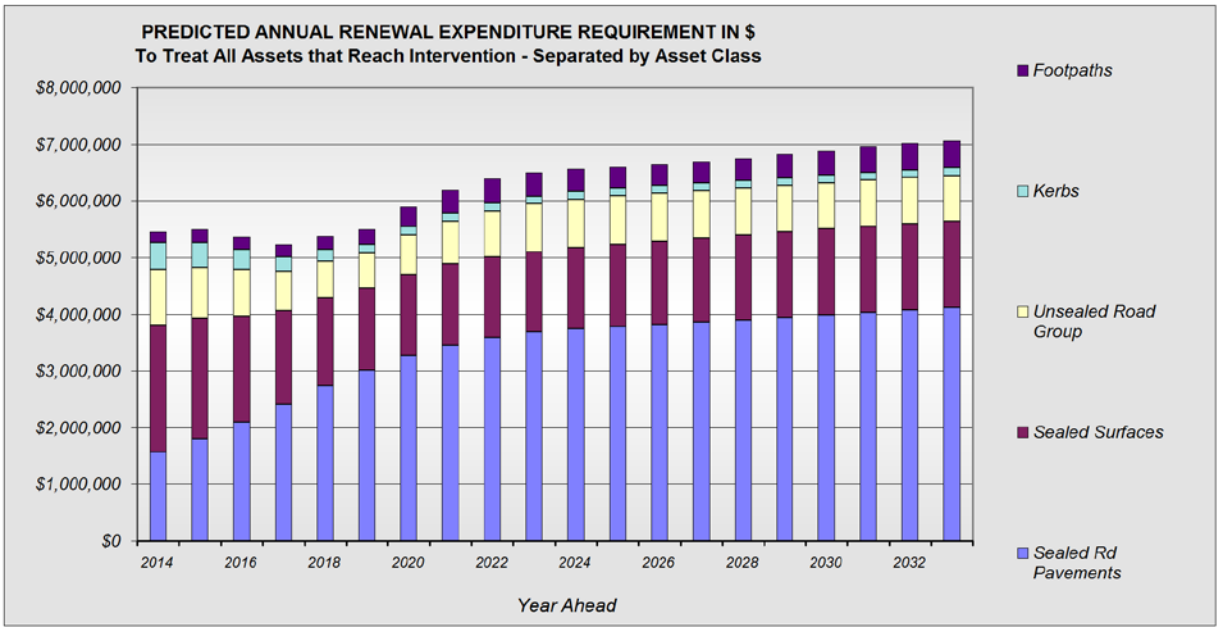

Figure 18 Predicted Annual Renewal Demand for the whole Roads Group

Finally the whole of the roads group can be presented, in this case made up of 20 individual like performing asset sets first placed into 5 road sub asset groups and then finally presented in a single graph for the whole of the roads group as detailed in Figure 18 above.

The model has the great advantage of illustrating where the demand lies right down to an individual data set level. Once two or more surveys have been undertaken the modelling accuracy increases greatly via the use of unique degradation curves developed via a statistical analysis of the condition change between the two consistent surveys.

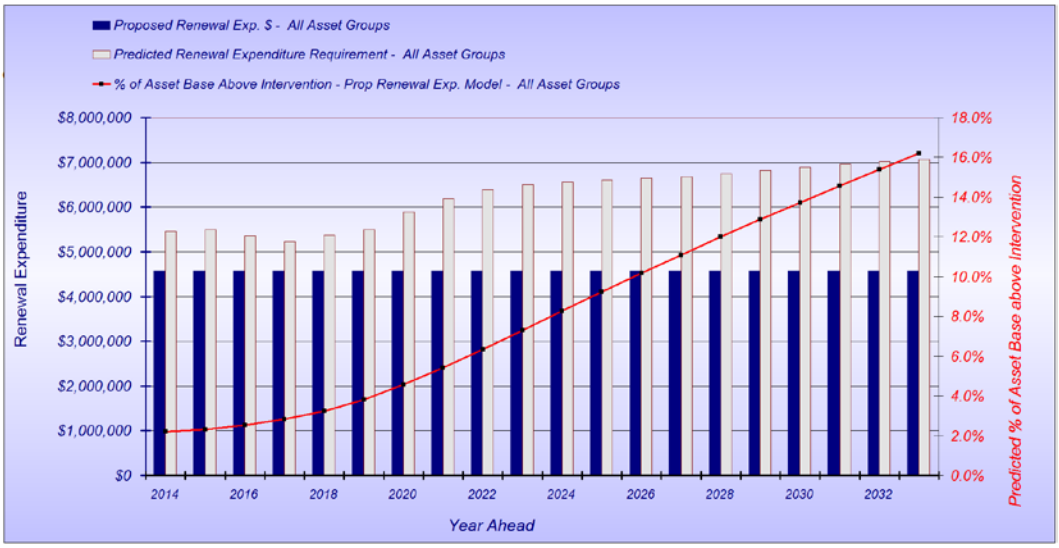

Figure 19 Predicted Future asset condition - Continue with Present expenditure

Figure 19 graphs the projected change in the future extent of over intervention assets (red line) based on the continuation of the present level of total renewal expenditure (Blue bars). It also plots the expenditure necessary to keep all assets below the intervention level (Grey Bars). In this case expenditure is not enough to meet the projected future renewal demand and so the extent of over intervention assets grows from 2% to 16% over 20-years.

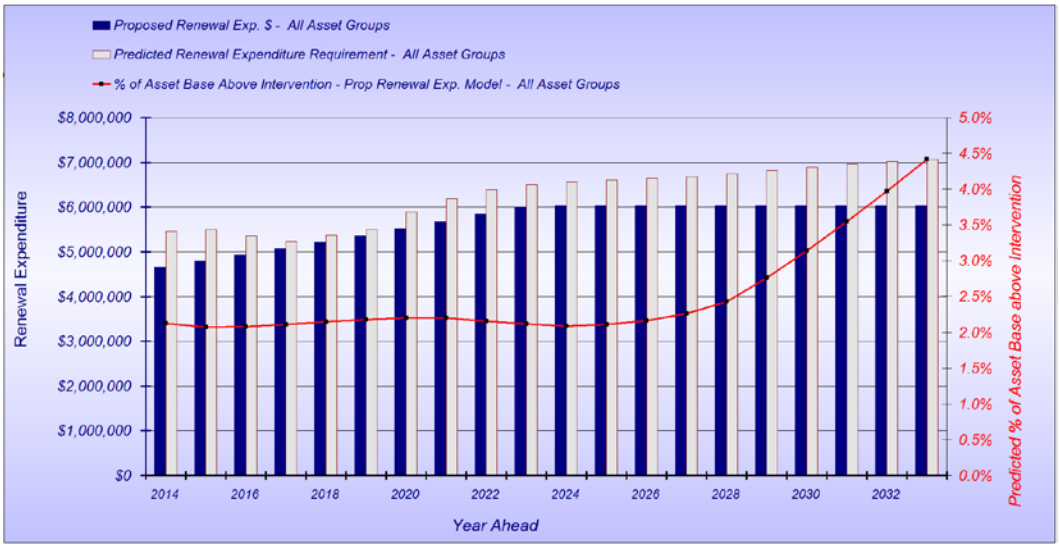

Figure 20 Recommended Future funding strategy

Figure 20 is essentially the same graph as figure 19. However, here the modelling program has been used to develop a recommended funding strategy that will deliver the same extent of over intervention assets as presently exists (2%) after 10-years.

The model has the capacity to deliver any funding scenario for the whole roads group based on 3 overall input variables as detailed below.

- Desired Percentage of over intervention assets
- Time to achieve this outcome
- The rate of any annual percentage increase on funding

5.0 Summary:

1. The Moloney road asset condition assessment methodology has been specifically designed to meet the needs of the Local Government road network.

2. We have undertaken 237 full network surveys over the last 23-years for 68 different councils with many repeat projects.

3. The prime focus is the delivery of costed capital renewal works programmes.

4. The condition rating methodology is simple to understand but does require experienced assessors

5. MAMS has 5 very experienced road condition assessment staff

6. You don't need to use our software to take advantage of our assessment methodology as around 35% of our projects relate to councils with other AM Systems.

7. Asset valuations will come directly from the condition assessment work

8. We can benchmark you both internally from a previous survey and externally against 68 other councils that have been assessed on exactly the same basis.

9. We will deliver very sound predictions of your ongoing renewal demand over the next 10 - 20-years and provide a recommended future funding strategy all as part of the analysis of the condition data upon completion of the project.