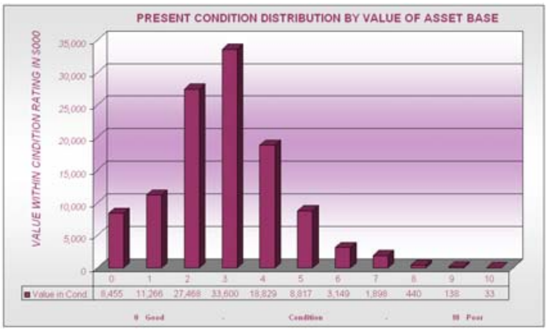
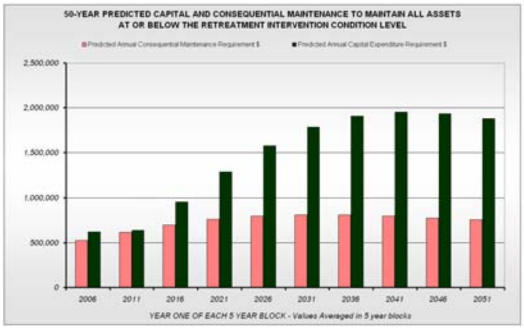
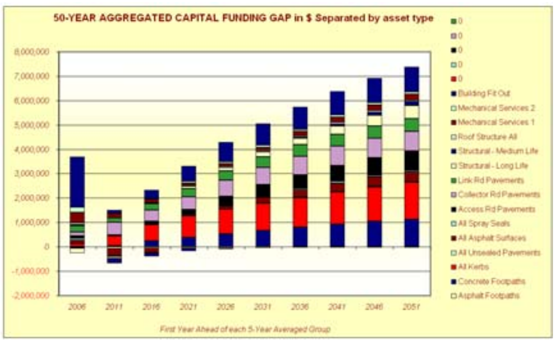
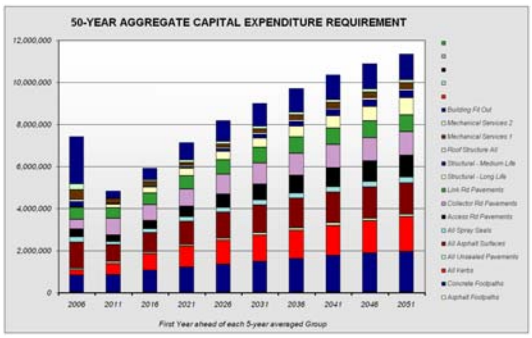
MOLONEY A.M. SYSTEMS





THE FINANCIAL MODELLING MODULE





A BRIEF DESCRIPTION

Dec 2005

1.0 Summary of Financial Modelling Process:

The Moloney Financial Modelling software contained within the excel file “Model All.xls” is really a generic modelling tool that is applies at a whole of asset group level (network level). It is designed to operated on any asset type which once created degrades with time and required periodic renewal or rehabilitation.

The modelling process within the Moloney system operates in the following way.

- It is a network-based model that looks at the expected financial performance of the **total** asset group.
- Modelling commences with the present condition distribution of an asset group.
- The asset group is degraded with time in accordance with a user defined asset degradation curve.
- There are then two distinct modelling paths from this point.
- Model No 1 ***Proposed Capital Expenditure Model*** has a user defined 50-year proposed capital expenditure profile and predicts future asset condition outcome.
- Model No 2 ***Predicted Capital Requirement Model*** has a user-defined asset Condition outcome and predicts the future capital expenditure profile necessary to achieve this.
- The future capital funding gap or shortfall is delivered by taking the proposed expenditure profile in model No 1 from the required expenditure profile in model No 2.
- Both models track future asset condition and via user defined parameters enable the prediction of future “Consequential Maintenance” cost movements.
- The model tracks total cost by combining capital rehabilitation with the corresponding “Consequential maintenance cost” for both models.
- Individual asset or sub asset modelling results can be combined into aggregated financial forecast reports for up to 20 different asset sets.

2.0 The Modelling File Structure:

The Modelling file “Model All.xls” can be seen as containing the following four generalized sections:

- Data Storage area – Holds base data ready for loading into the model
- Modelling Variables Section – Holds all of the variable data for each modelling operation
- Individual modelling result sheets – Four sheets that present the modelling results for individual asset sets
- Aggregate Modelling results sheets – Three Sheets that aggregate the individual modelling results into single reports

2.1 Data Storage Sheet:

This is a single sheet within the modelling file that stores the base modelling data required for the modelling operation as well as providing the capacity to store the seven modelling variables for each of the 20 individual asset sets that can be modeled and aggregated within the file.

The base modelling data can be program loaded to this sheet from other Moloney or Conquest AM Systems or uploaded directly from a specially designed “Input Pro Forma”. It can also be manually entered into the sheet from other systems and sources.

2.2 The Modelling Variables Sheet:

This sheet is used to vary the 7 modelling variables such as the degradation curve, intervention level etc. once the base data for a single asset set has been loaded into the model. Typically you would trial a range of variables here to check the sensitivity of the model to those variables. All seven variables are amended on this one sheet.

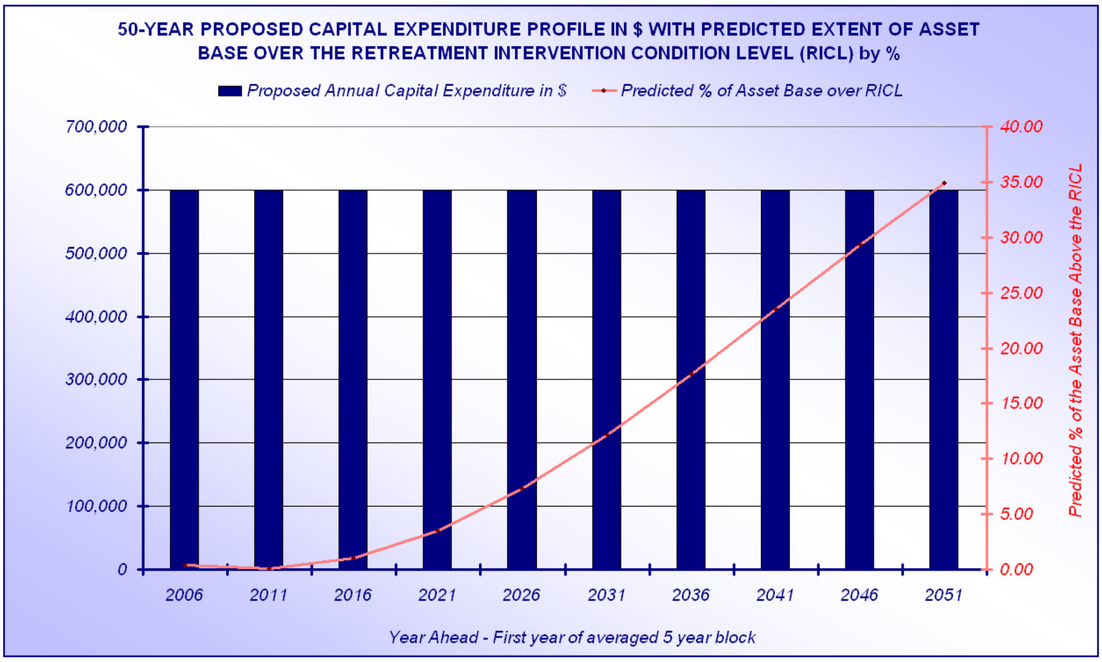
2.3 The Individual Modelling Results Sheets:
There are 4 sheets within this group that provide a series of graphical reports based upon your modelling input data for a single asset group. The sheets are as detailed below.

- **Existing Condition Sheet** – Provides a condition distribution of the present or starting condition.
- **Model 1 Proposed Expenditure** – Provides a prediction of future condition outcome based upon a proposed expenditure profile
- **Mode 2 Predicted Capital Requirement** – Predicts the future Capital Requirement based upon a selected condition outcome.
- **Funding Gap** – Illustrates the gap in capital funding between the required expenditure profile and your proposed expenditure profile.

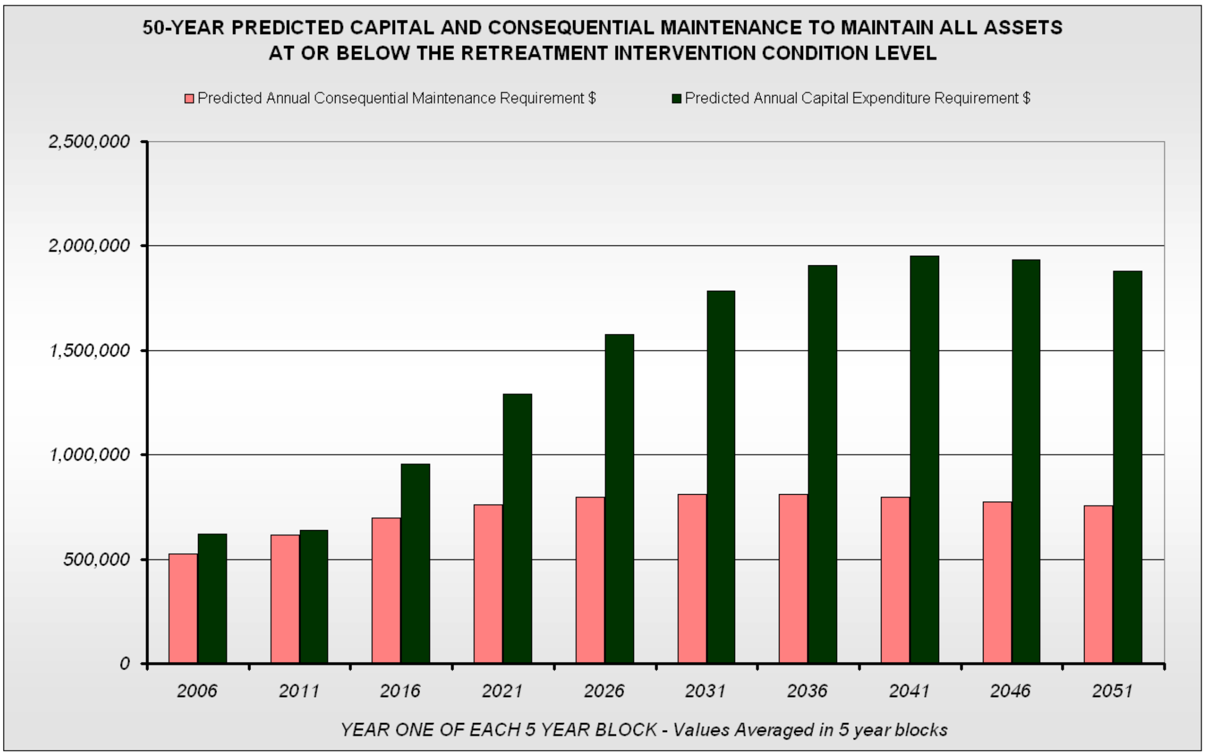
2.4 Aggregated Modelling Results:
The system can model up to 20 individual asset sets one at a time, with the individual modelling results then being aggregated into a set of single reports covering the 20 asset sets. The three individual modelling reports are mirrored as aggregated reports in the following three sheets.

- Aggregate Proposed Expenditure
- Aggregate Capita Requirement
- Aggregate Funding Gap

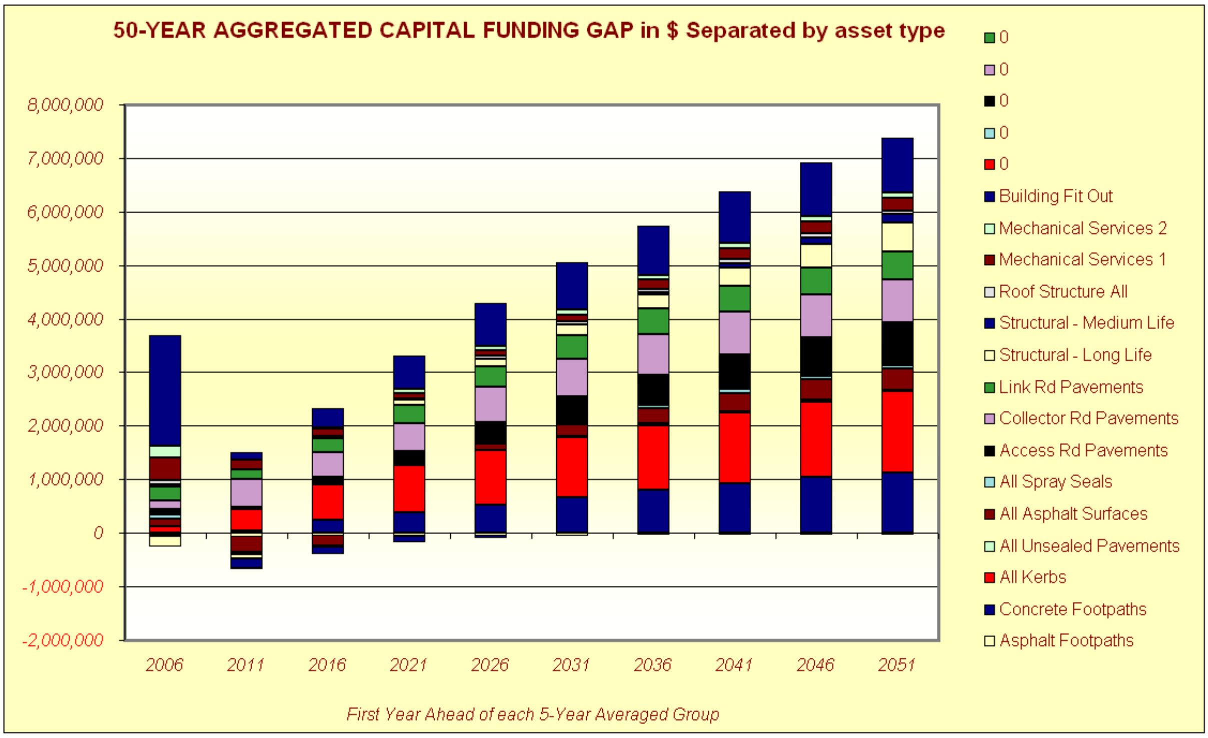
3.0 Some Sample outputs:



Sample 1 Predicted future asset condition - based upon nominated expenditure profile



Sample 2 Predicted Capital Rehab demand combined with Consequential Maintenance Based upon a desired condition outcome



Sample 3 Predicted Capital Rehabilitation funding gap for an aggregated set of assets

Appendix A

A1.0 Financial Modelling Explanation with sample data

This Appendix will provide a detailed explanation of the financial modelling process contained within the Moloney System.

The Moloney excel modelling function is to some extent a generic modelling tool. You may undertake the modelling operation on up to 20 asset sets and then combine the individual results into a single aggregated report. It is a network model and can be applied to any asset set that once created decays with time and requires periodic rehabilitation.

The model requires a series of ten input criteria. The first 3 relate to asset inventory matters, while the next seven are more the variable modelling input data. The following three items would normally be drawn from the Moloney software but can be brought in from other sources.

1. **Asset Quantity**
2. **Asset Unit Rehabilitation Cost**
3. **Asset Condition**

With the above basic information in place modelling becomes a mathematical operation based upon a series of seven user-defined variables. Within the Moloney modelling system the user defined variables are.

4. **Asset degradation or performance curve**
5. **Proposed 50 year capital expenditure profile**
6. **Expected annual growth in asset base (if any)**
7. **The year ahead that you wish to view the future predicted condition distribution**
8. **The adopted retreatment intervention condition level.**
9. **The current annual maintenance expenditure on the asset group**
10. **The Maintenance – Asset Condition relationship factor**

With the above 10 variables in place the model has two distinct paths. The first predicts future capital rehabilitation demand based upon a desired asset condition outcome. The second predicts future asset condition based upon a proposed level of capital expenditure. The two modelling paths will be explained in more detail below.

A.1 The Present Condition Distribution

The asset present condition distribution within figure A.1 below contains all of the details relating to the first 3 items above in a summary format, ready for the commencement of the modelling process.

The asset quantity and unit rehabilitation cost have been combined into a single rehabilitation cost for the assets. While the asset condition is superimposed within the distribution. Thus the single outcome for modelling purposes of the first 3 basic requirements above is a rehabilitation cost – condition distribution, based upon a zero to ten-condition scale.

The present condition distribution in figure A.1 below is all that is required from the database to commence the network model process. The remaining seven variables are the user defined input variables.

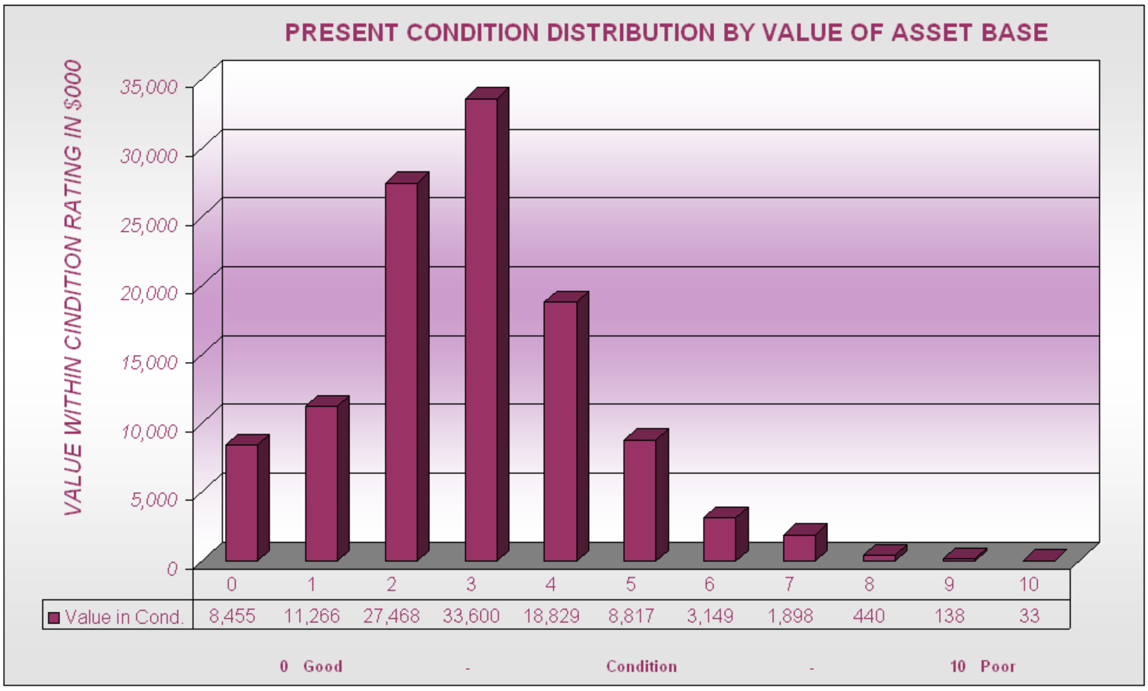


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Fig A1 Present Condition distribution for Sealed Pavement Assets

The above graph represents the present condition distribution of a set of sealed pavement assets. It indicates the valuation spread of the assets across the whole of the asset condition range. **It is also important that asset valuations be based upon the expected rehabilitation cost and not simply the original construction cost**. The two figures can be quite different and for modelling purposes, costs ***must*** be based upon future liability not historic cost.

Asset groups that are to be modelled together must have a similar degradation or performance curve. It would not be appropriate to model heavily trafficked pavements constructed on poor sub-soils where the total expected life was 30-years, with lightly trafficked roads on good sub-soils with an expected pavement life of 80-years.

But having said that, the first modelling exercise undertaken on a road asset set may be simply modelled in the one parcel with some broad assumptions made. The other thing to remember is that the model is a network based model and does rely upon a large sample size for accurate results. Thus it is often a compromise between the conflicting demands of sample size and common performance.

A.2 Modelling Variable Data – User Defined

The seven user defined variables within the Moloney Financial model are listed below with a detailed explanation for each to follow.

- Asset degradation curve
- Proposed 50 year capital expenditure profile
- Expected annual growth in asset base (if any)
- The year ahead that you wish to view the future predicted condition distribution
- The adopted retreatment intervention condition level.
- The current annual maintenance expenditure on the asset group
- The Maintenance adjustment factor

A.2.1 Asset Degradation Curve

The starting point for all modelling is the present condition distribution of the asset set (See Fig A.1 above). This is generally established via an inspection of the assets but can be age based or drawn in from any reliable source. The basic requirement is that an asset be within condition zero when new and condition 10 when it has no remaining life.

Within the Moloney system the asset degradation curve is defined by the amount of time in years that an asset is expected to remain within a given condition rating before jumping to the next higher condition rating. So an asset may remain in condition zero for 5-years on average before rising to condition one. It may then have 10-years in condition one before jumping to condition two etc. The total asset life is thus the sum of the individual life within each condition rating.

The degradation process is applied to the present condition distribution by degrading the asset base annually. If five years is adopted as the average life within a given condition then the model degrades 20% of the assets within that condition rating to the next higher condition annually. This process goes on annually across the whole condition range and with no other intervention all assets would eventually end up in condition 10.

Coupled with the degradation process are two distinct modelling paths. The first model requires a user defined asset condition outcome and the model predicts the capital expenditure requirement to achieve this. The second model requires a proposed capital rehabilitation expenditure profile and the model predicts future asset condition. The two models will be explained in more detail below.

Degradation curves are a key driver to the modelling process and within the Moloney system are developed by undertaking a statistical analysis of the asset condition change between two or more consistent condition surveys. In simple terms if 30% of the assets were found to have degraded from one condition rating to the next over a 3-year period then the annual probability of this event would be 0.1 (10% per year) and the average expected life within the starting condition would be 10-years.

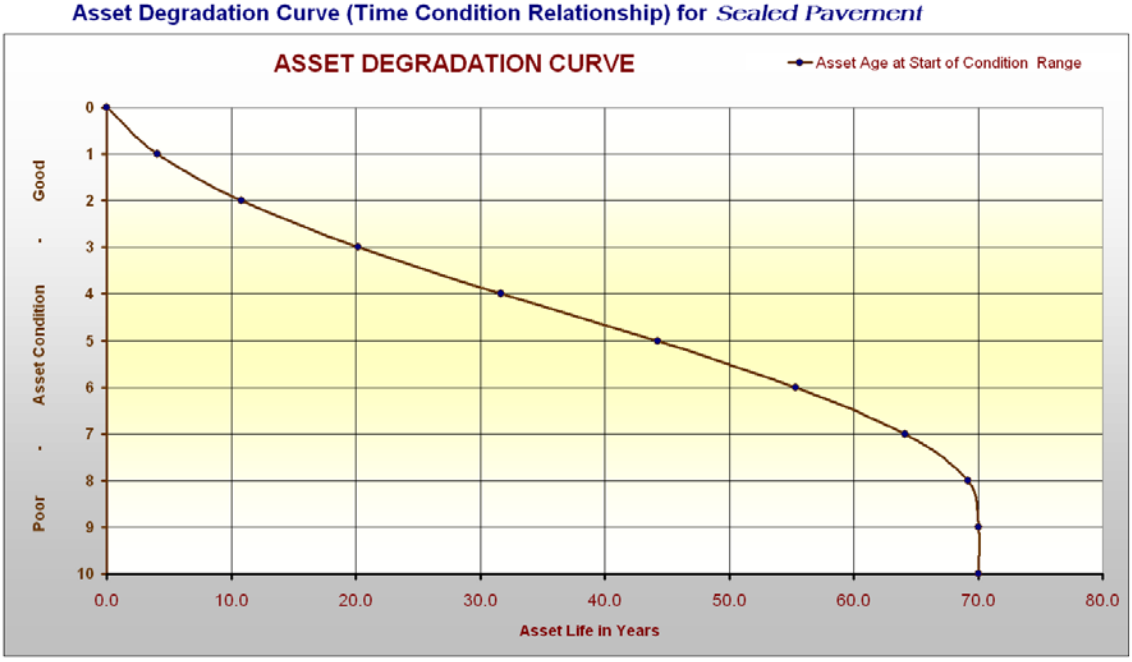

Fig A2 Asset Degradation curve – Sealed Pavement assets

The graph above within Figure A2 was developed via a statistical analysis of the change in asset condition between two asset condition surveys. It suggests that the total asset life of a pavement from new condition zero to the end of its useful life at condition 8 is around 70-years. How the total 70-years is distributed across the condition range will have a very big impact on the overall modelling outcome and it is important that these degradation curves be individually developed for each district based upon the historic condition change with time.

A.2.2 Proposed 50 year capital rehabilitation expenditure profile

This variable is simply the planned profile of your capital rehabilitation expenditure over the next 50-years. It is good practice to average these figures over several years to smooth out any peaks and troughs in the annual expenditure patterns.

A.2.3 Expected annual growth in asset base (if any)

The model has the capacity to allow for an annual growth rate and this is expressed in terms of an annual percentage growth rate that can be varied over the 50-year forecast period. The same facility can be used to shrink the extent of the asset base with time.

A.2.4 The year ahead that you wish to view results

One of the models predicts future asset condition based upon a proposed capital expenditure profile. This variable is used within the model to determine the year ahead that you want a graph to display the starting condition distribution against the predicted distribution. In strict terms it is not really a modelling variable as all it does is set the display year of a graphical output.

A.2.5 Retreatment intervention condition level (RICL)

This variable defines the condition level at which you believe an asset should be rehabilitated. It will vary from asset to asset depending upon the condition assessment criteria. It is the condition level at which rehabilitation is planned to take place, based upon your required condition outcome and rehabilitation methodologies.

A.2.6 Current annual maintenance expenditure on the asset group

The total cost of owning and operating an asset is made up of two parts. First there is the capital construction and periodic capital rehabilitation cost and then there is the annual ongoing maintenance cost. The model uses the current level of maintenance expenditure as the starting point for the establishment of the asset group (maintenance cost – Condition relationship). It is recommended that the figure be averaged over several years also.

A.2.7 The Maintenance adjustment factor

There is a link between asset condition and what is termed “The Consequential Maintenance Cost”. In simple terms, if asset condition is good, maintenance cost is low. If asset condition is poor, maintenance cost will be higher. This factor creates the link between asset condition and maintenance cost.

The concept is that the “Maintenance Adjustment factor” (MAF) represents the amount by which the cost of maintenance will increase for every whole number condition rise. A figure of 1.00 would result in a constant maintenance cost irrespective of asset condition. A figure of 1.20 would result in a 20% rise in maintenance cost for every whole number jump in asset condition.

The modelling program commences by taking the existing maintenance expenditure and distributing it across the asset set, based upon the adopted MAF and the extent of the asset base within each condition rating. This then provides a variable unit maintenance cost structure over the whole condition range that can be used within the model to predict future total maintenance cost based upon predicted future asset condition.

Figure A3 below represents the maintenance cost structure used within the model for this exercise. Note that a pavement in condition 3 is allocated an annual maintenance cost of $556.00 per km while a pavement in condition 6 has $2,275 PA. This distribution is set up within the program using the present total maintenance expenditure and then distributing it based upon the adopted MAF. The program is set to soften the extent of the exponential increase in maintenance cost after condition 7.

This may not be a perfect approach to tracking the movement in consequential maintenance cost but it is the best we have been able to come up with so far. It could be amended if a better relationship were to be developed. A used defined link to the maintenance cost – asset condition relationship is needed and at least this one can be understood and its effects observed within the model.

Fig A3 Asset Condition – Maintenance Cost Relationship

A.3 The Two Modelling Paths

With all variable data within the model there are two distinct modelling paths available.

- **Model No 1 "Proposed Expenditure Model"**
- **Model No 2 "Predicted Capital Requirement Model"**

Note the graph shading convention used for the modelling outputs. All graphs coming from the **Model No 1 "Proposed Expenditure Model**" are shaded with a light blue background while those associated with the **Model No 2 "Predicted Capital Requirement Model"** are shaded with a light grey background

A.3.1 Model No 2 "Predicted Capital Requirement Model"

This model can be seen as the ideal asset management model. The user determines an upper condition level at which assets should be rehabilitated. The model then predicts the capital expenditure requirement to achieve this outcome.

The modelling process is summarised below.

- Model starts with the present condition distribution See Figure A.1 above
- The degradation process in applied to the present condition distribution
- A Retreatment Intervention Condition Level (RICL) is nominated
- As assets reach the RICL through the degradation process, on an annual basis, they are returned as a capital expenditure requirement
- The model assumes the assets have been rehabilitated and returns them back to new condition zero assets
- The model rolls on for 50-years degrading assets and rehabilitating those that reach the RICL
- The primary output is a 50-year capital expenditure profile that will treat all assets that are predicted to reach the RICL
- A secondary outcome is the 50-year "Consequential Maintenance" cost prediction, based upon the maintenance cost structure as developed in A.2.7 above being applied to the varying future condition outcome.

While the upper limit of the condition range is set within Model No 2 there is movement across the condition distribution within the model, as assets degrade and the consequential maintenance cost does vary. However within this model maintenance cost generally remains relatively static, as assets are not permitted to rise above a given RICL.

A.3.2 Model No 1 "Proposed Expenditure Model"

This model is more the real world model where condition outcome is predicted based upon the adoption of a proposed capital expenditure profile.

The modelling process is summarised below.

- Model starts with the present condition distribution See Figure A1 above
- The degradation process in applied to the present condition distribution
- A proposed 50-year capital expenditure profile is input into the model
- Assets to the value of the proposed annual capital expenditure are redirected from the poor condition end of the condition distribution to the new condition end on an annual basis
- This process rolls on for the full 50-year modelling period
- The primary outcome is a prediction of asset condition change over the 50-year forecast period
- A secondary outcome is the 50-year "Consequential Maintenance" cost prediction, based upon the maintenance cost structure as developed in A.2.7 above being applied to the varying future condition outcome

While this model predicts condition outcome based upon a proposed capital expenditure profile, it is difficult to provide a single 50-year condition outcome graph. This is achieved within the model in three ways. Firstly the weighted average condition of the assets for each year is presented. Secondly the extent of the asset base predicted to be over the Retreatment Intervention Condition Level (RICL) is plotted on an annual basis.

Finally a predicted asset condition distribution can be presented for any selected year between 1 and 50. The model also tracks the "Consequential Maintenance" which is linked to the predicted change in asset condition.

The weighted average asset condition for a whole asset group in any one-year is a single average condition rating, which has been weighted for the extent of the asset within each condition rating. It is useful as a trend indicator but does have some inherent problems. Being a single weighted average figure its theoretical range is from zero to 10 however its normal practical range is more like 3.0 to 4.70. Thus small movements in this figure are quire significant.

A4 Modelling Operations and Outputs

This section will deal with the modelling outputs. The model has an extensive array of graphical outputs not all of which will be dealt with here. But the outputs detailed here have been selected as the most commonly used within the system. Note also that the model generally has 20-year and 50-year graphical outputs for each situation. The 50-year outputs have been used more commonly here but 20-year graphs are available in most cases if required.

Detailed below is a summary of the seven modelling variables.

Adopted Total Asset Life – Degradation Curve	**70 years**
Present Annual Capital Expenditure Level (used as 50-year prop exp.)	**$600,000**
Expected annual growth in asset base in % per year	**0.00**
Year ahead for new predicted condition distribution	**2020**
Retreatment Intervention Condition level (RICL)	**Condition 8**
Existing Maintenance Expenditure Level in $/Annum	**$500,000**
Maintenance Adjustment Factor	**1.6**

The degradation curve details have been summarised as a single total life. How this life is distributed across the zero to 10-condition scale will have a big impact on the outcome but will not be examined here in detail. The degradation curve used here is a curve that has been developed via a statistical analysis of two asset condition surveys. If unique degradation curves are not available they will need to be assumed or borrowed from other sources.

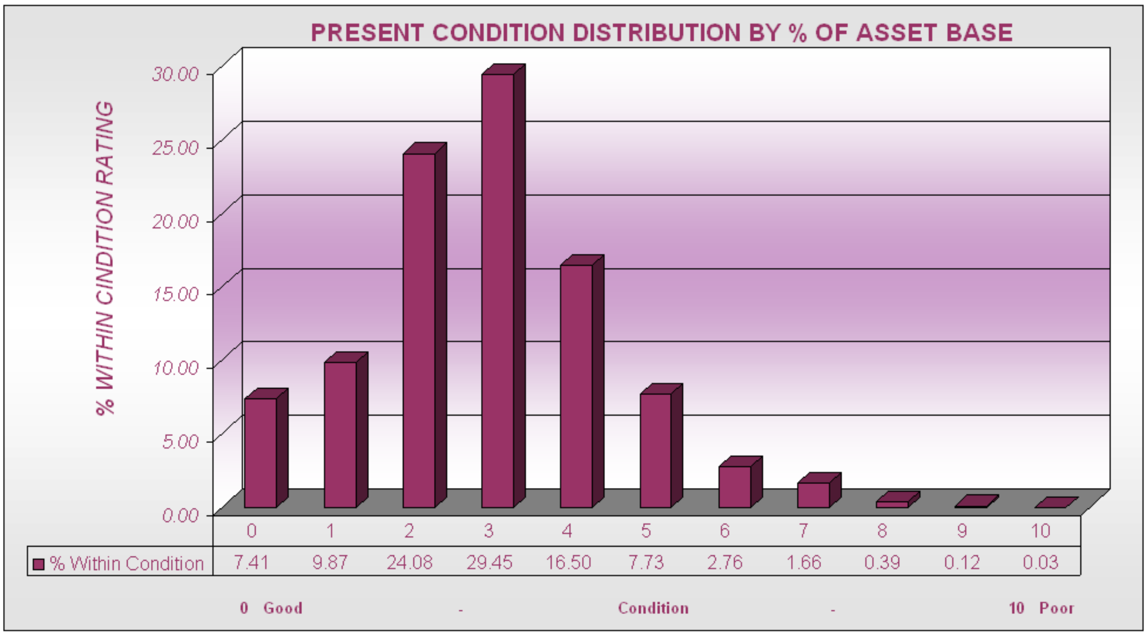

Fig A4 Present Condition distribution for Sealed Pavement Assets by % of asset

Modelling will commence with the present condition distribution of the asset set as detailed in figure A4 above. This is essentially the same graph as Figure A1 accept that the scale indicates the extent of the asset base within a given condition range as a percentage rather than a dollar rehabilitation figure. It is felt that the graph with the percentage scale is easier to read, compare and understand. The model still uses the actual dollar rehabilitation figures for each condition range as its starting point.

A4 1 Model No 2 – The Predicted Capital requirement Model Outputs

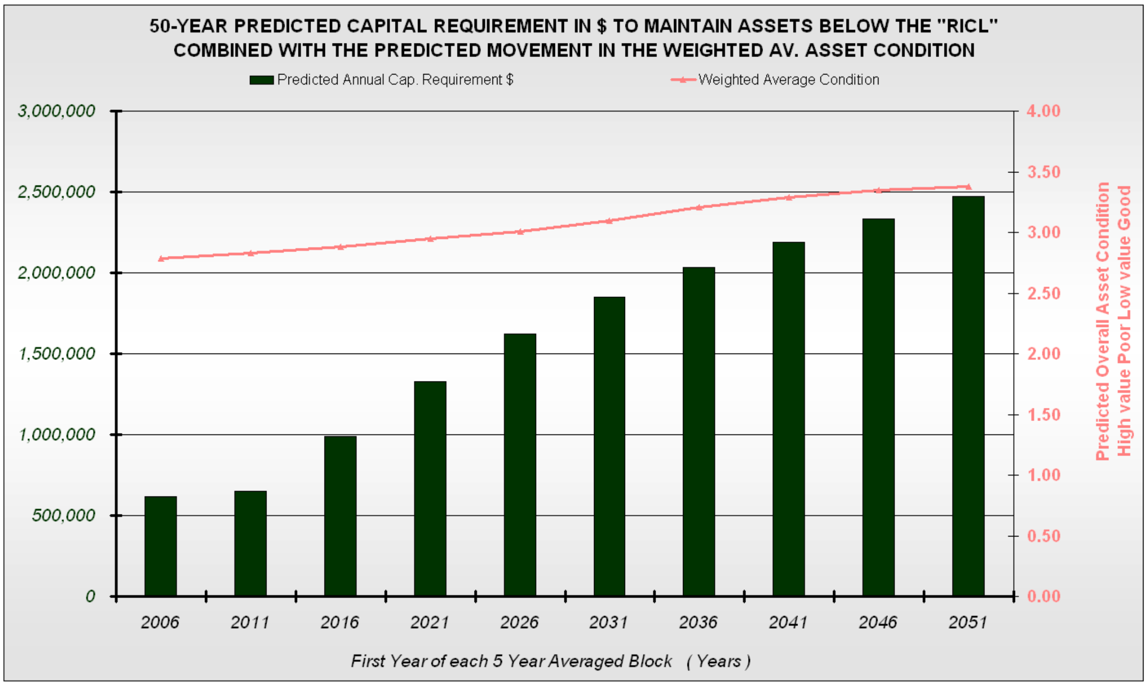

Fig A5 Predicted Capital Demand to maintain assets at Condition 8

Figure A5 is a prediction of the capital rehabilitation demand to treat all assets (in this case pavements) that degrade to the Retreatment Intervention Condition Level RICL of condition 8 over the next 50-years.

The graph also plots the predicted movement in the weighted average asset condition WAAC over the same period. The WAAC is an attempt to deliver a single representative condition for the whole asset set on an annual basis. It is the average of the 11 possible condition ratings from 0-10, weighted for the extent of the asset within each condition rating.

It may not be ideal but it is an indicator of overall asset group condition movement. Within the model, even though all assets that reach condition 8 are rehabilitated, the WAAC does decline in early years. This is because capital expenditure demand in the early years is lower than the long-term average demand and condition must decline while capital expenditure is lower than the long average.

This decline in asset condition should not be of concern. Consider the extreme case where a whole group of new assets with a 70-year total life are to be modelled. Capital expenditure demand will be zero for many years and the WAAC will decline during this period. However, it would not be an appropriate strategy to try and maintain the starting WAAC of Zero on an ongoing basis. Thus it must be accepted that good condition asset groups will decline in condition under this model, as they no doubt will in the real world.

The next output from the "Predicted Capital Requirement Model" is really a variation of the above graph. Here the required capital expenditure profile is plotted against the "Consequential Maintenance" cost outcome. Section A.2.7 above provides an explanation of how the maintenance cost is linked to asset condition.

Figure A6 below indicates that the predicted maintenance cost will rise as a result of the decline in overall asset condition in early years but will recover a little as capital expenditure increased in later years.

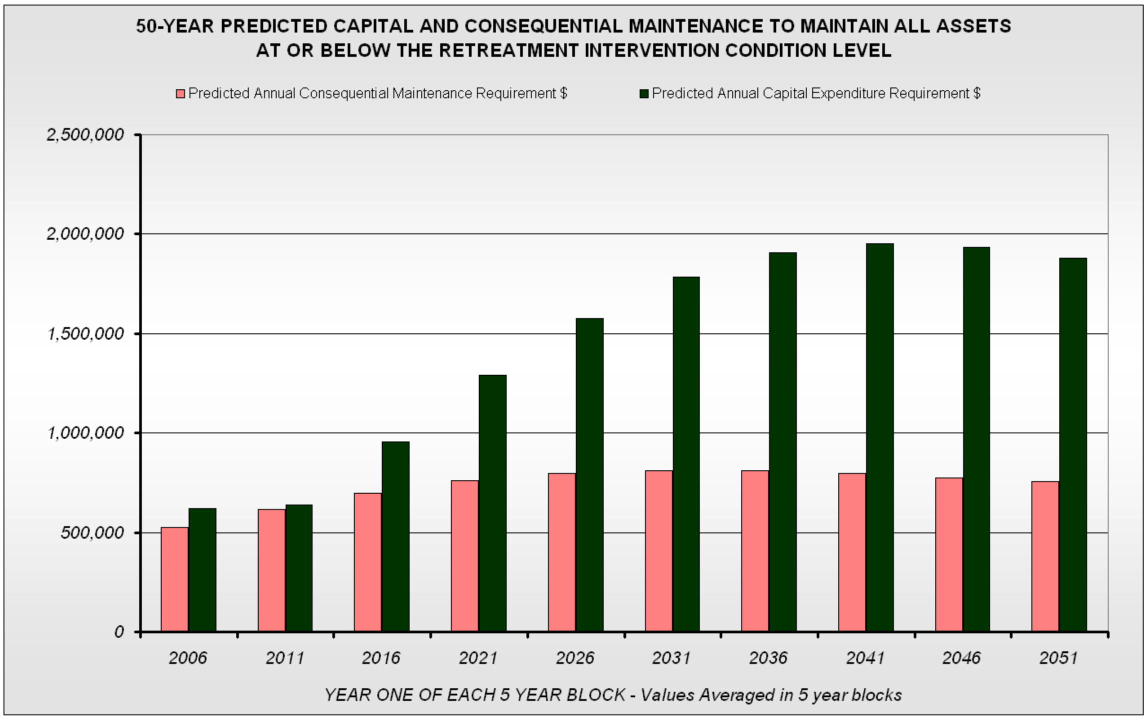

Fig A6 Predicted Capital demand to maintain assets at condition 8 with consequential maintenance

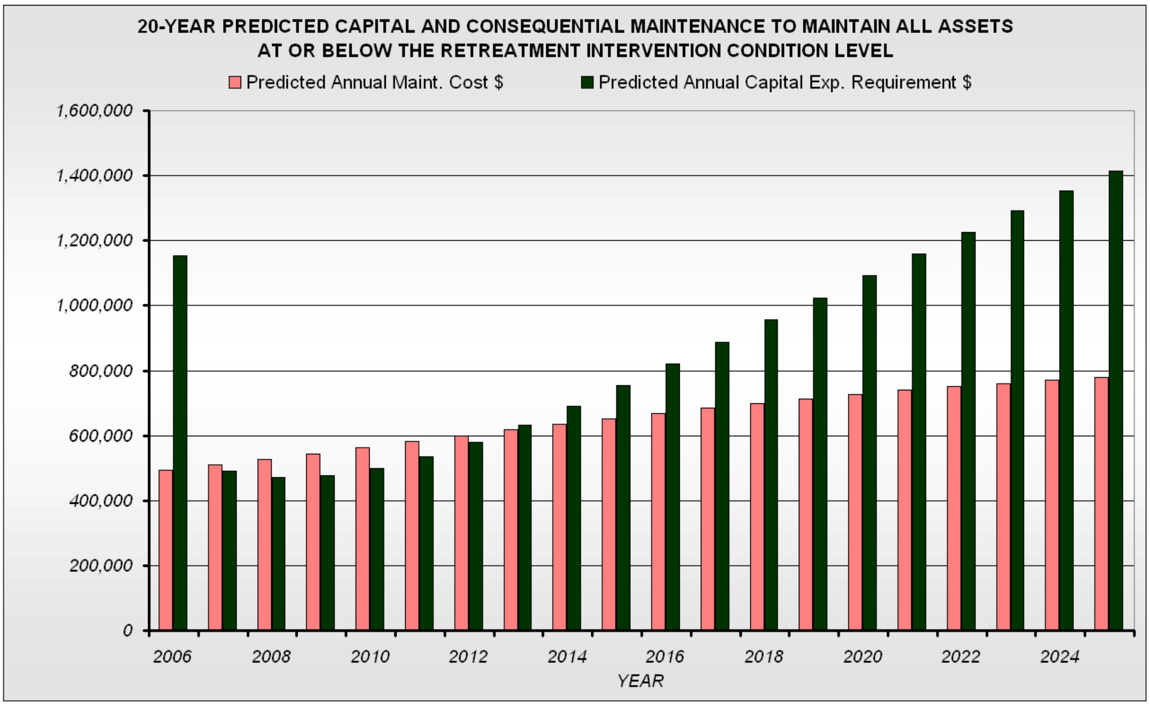

Fig A7 Predicted Capital demand to maintain assets at condition 8 with consequential maintenance 20-Year

Figure A7 is a 20-year version of the same graph within A6. Most of the modelling outputs are available in both formats but it is often confusing to display both. The 50-year graphs are derived by averaging the raw results in 5-year blocks, thus they do tend to even out any spikes that may occur.

Reports can be prepared on any time frame up to 50-years by manipulating the scale of the graphical outputs within the modelling file. However, within this document the graphs will generally be presented on a 50-year basis.

A4.2 Model No 1 – The Proposed Expenditure Model Outputs

This model takes a proposed 50-year capital expenditure profile and from there predicts future asset condition outcome. There are four ways in which the future asset condition is presented within the graphical outputs all based upon the adoption of a proposed capital expenditure profile. The first three being direct condition related outputs and the forth being an indirect relationship to the consequential maintenance outcome.

- Extent of the asset base predicted to be over the Retreatment Intervention Condition Level RICL
- The predicted movement in the Weighted Average Asset Condition WAAC
- A plot of the predicted condition distribution within a selected year
- The predicted movement in the consequential maintenance outcome

Within this document the 50-year capital expenditure profile has generally been set at the present level of capital expenditure for the whole 50-yaer period. The reason for this is twofold. Firstly this enabled the presentation of a graphical display of the predicted funding shortfall (if there is one). Secondly the scope of the document is such that it does not cover the trialing of different expenditure profiles and outcomes. The first output from this model in figure A8 below which plots the movement in the extent of the asset base predicted to be over the RICL based upon the adopted 50-year capital expenditure profile.

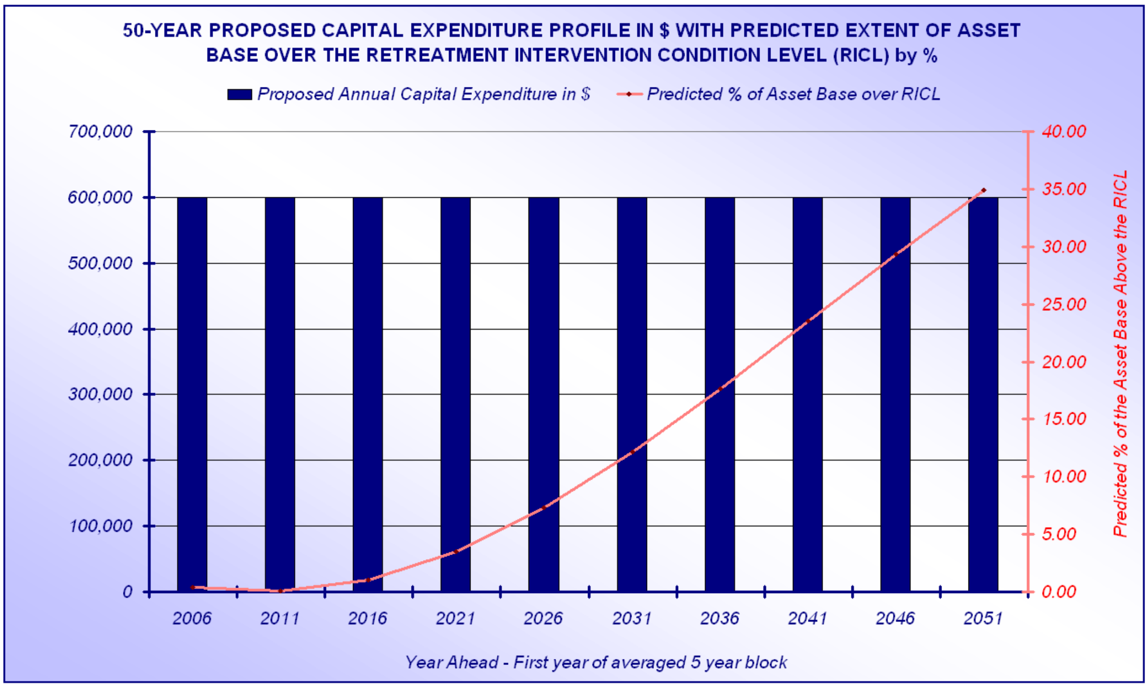

Fig A8 Predicted Extent of asset base above the RICL

Based upon the continuation of the current capital rehabilitation expenditure level of $600,000 PA the model predicts that the extent of the asset base over the RICL will rise steadily suggesting that funding must be raised. This graph is also available in a form that expresses the extent of the asset base by rehabilitation value in place of percentage.

Figure A9 below is the second graph within this model and illustrates the movement in weighted average asset condition WAAC. It is useful because it can be used to directly compare the condition outcome of the two models. However, it can present a misleading picture of the movement in asset condition. Because of its nature as a WAAC the practical range of this single figure is very limited (say 2.50 to 4.80). Thus figures above a WAAC of 4.50 to 5.00 would represent a disastrous situation.

Historically it was the best condition movement factor we had within the model. But the prediction of the extent of the asset base over the RICL has tended to take over as the preferred condition movement indicator.

The real use of the WAAC is as a measure of the different performance outcomes within the two models and this will be looked at further within the “Funding Gap” area of the model.

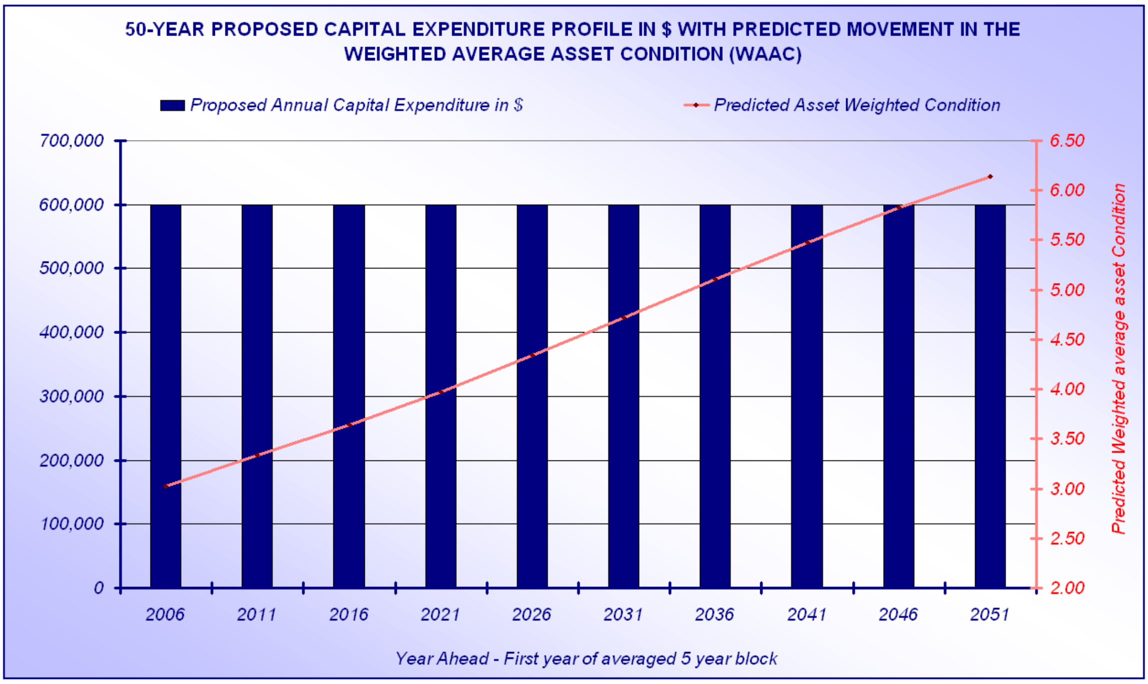

Fig A9 Predicted Movement in the Weighted Average Asset Condition

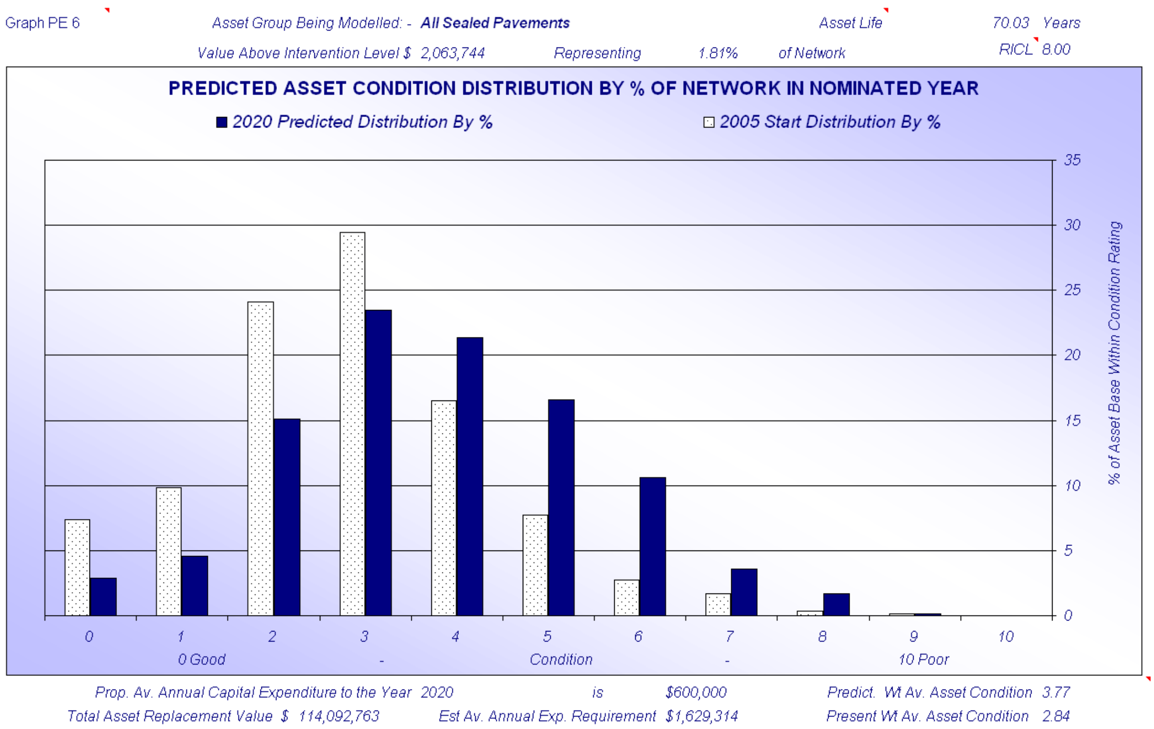

Fig A10 Predicted Asset Condition Distribution in 15-years

Figure A10 contains the present condition distribution as well as the predicted distribution in 2020 based upon the adoption of the proposed capital rehabilitation expenditure profile. There is a lot of information attached to the graph to provide an overall picture of the prediction.

It tells us that within 15-years 1.81% of the network representing a rehabilitation value of $2,063,744 will be over the RICL of condition 8.0. It also indicates that the WAAC will have declined from 2.84 to 3.77 and that the average long term annual rehabilitation demand is $1,629,314 PA. Hence the predicted distribution has moved down towards the poor end of the scale by just about one whole condition rating as can be seen from both the WAAC and the distribution itself.

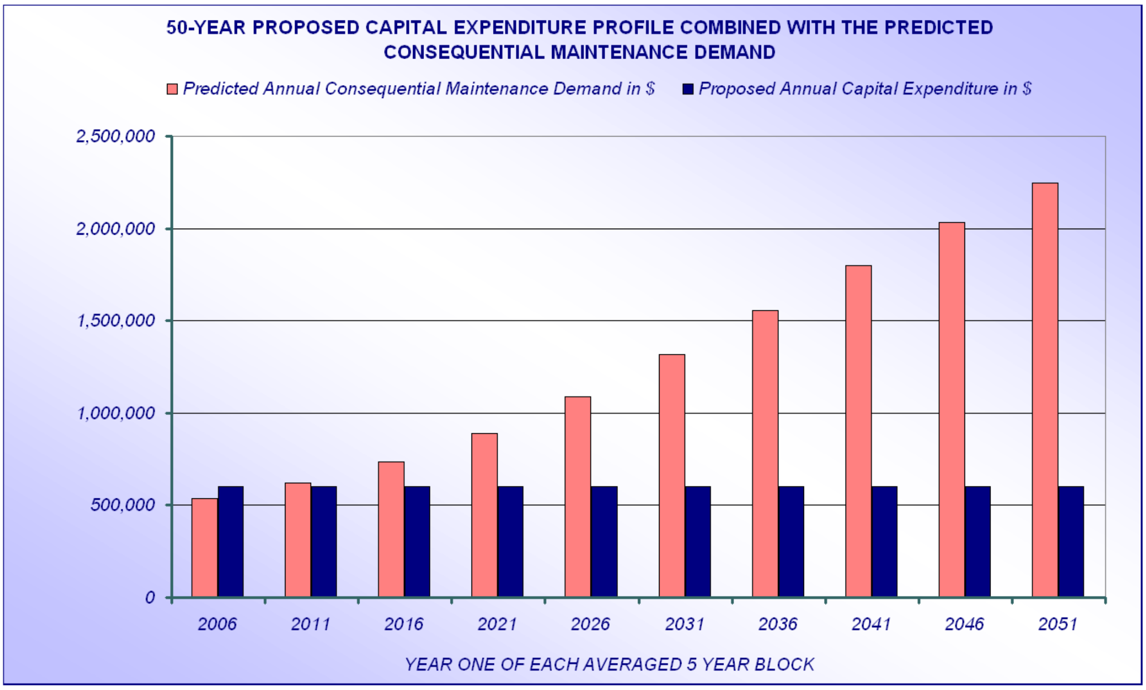

Fig A11 Predicted Movement in Consequential Maintenance Cost based on Proposed Expenditure profile

This sample asset set together with the proposed expenditure levels has been chosen to dramatically illustrate the long-term effect of capital under funding. Clearly the situation would not be permitted to get as bad as predicted above. Capital expenditure levels would have to be lifted and as such the predicted rise in maintenance expenditure would not be as severe.

The modelling above is based upon a real situation. Here the assets are in very good commencing condition, the total life cycle is long and hence the early capital demand is low. The current capital expenditure level of $600,000 PA is a little higher than the present capital demand as delivered within the "Predicted Capital requirement" Model

The modelling illustrates the long-term effect of under funding the capital expenditure demand. It also parallels many real situations that have been encountered where assets are in good overall condition but are ageing and will be associated with an escalating capital expenditure demand.

There are more graphical outputs within both models but the ones illustrated above are the ones that are more commonly used.

The two models fulfill quite different functions. The **"Required Capital Expenditure**" model delivers a 50-year capital expenditure profile to rehabilitate all assets that reach a given condition rating RICL. The "**Proposed Capital Expenditure**" model allows you to examine condition outcome based upon an adopted 50-year capital expenditure profile.

A4.3 The Funding Gap Outputs

If the present level of capital expenditure is set for the full 50-year modelling period then the outcome of the two models can be compared to produce a "**Funding Gap**" prediction. But not only can you quantify the capital funding gap you can also examine the maintenance cost implications. The next set of graphs come from the "Funding Gap" section of the modelling file, which summarizes the difference between the two modelling paths.

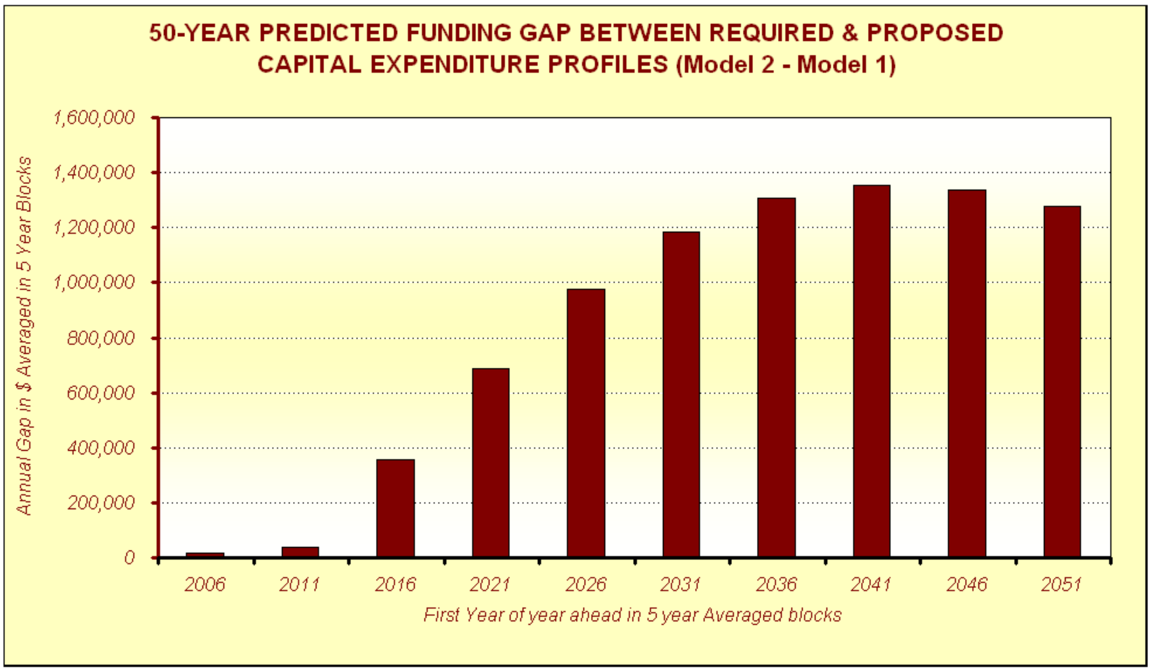

Fig A12 Predicted capital funding gap between Proposed and Required Capital Expenditure Models

Figure A12 represents the difference between the proposed capital expenditure profile ($600,000 PA) and the predicted requirement as detailed within figure A5 above. The graph represents the additional future capital funding that will be needed if all assets that reach the RICL through the degradation process are to be rehabilitated. Note that the present level of capital expenditure is predicted to be sufficient for the first 10-year period. After that the funding gap rises steadily.

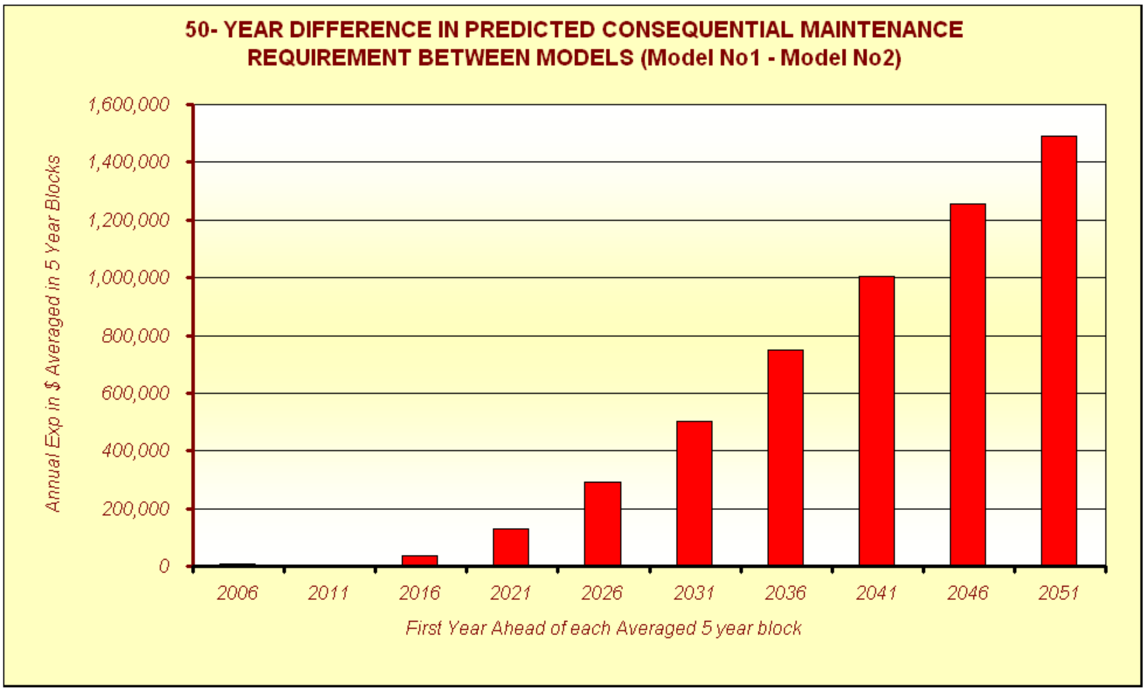

Fig A13 Predicted difference in Consequential Maintenance Expenditure between the two Models

Figure A13 represents the difference in the predicted "Consequential Maintenance" expenditure between the two models. It represents the additional maintenance money that will need to be found over and above the maintenance that would be needed if you went down the "Required Capital Expenditure" model path.

The graph can be seen as the wasted maintenance money that needs to be spent because of the choice to under fund the capital expenditure within the "Proposed Capital Expenditure" Model No 1. In reality the situation would not get this extreme, as capital expenditure would be lifted. However, the graph serves to reinforce the fact that under spending on capital rehabilitation can have a dramatic effect on future "Consequential Maintenance" costs.

Figure A13 could also be used to illustrate the reverse situation. If asset condition were poor then Consequential maintenance would be high. The model could be used to predict the projected maintenance cost savings associated with an increased capital expenditure as asset condition improved in future years. Here the Predicted difference in maintenance cost would be negative.

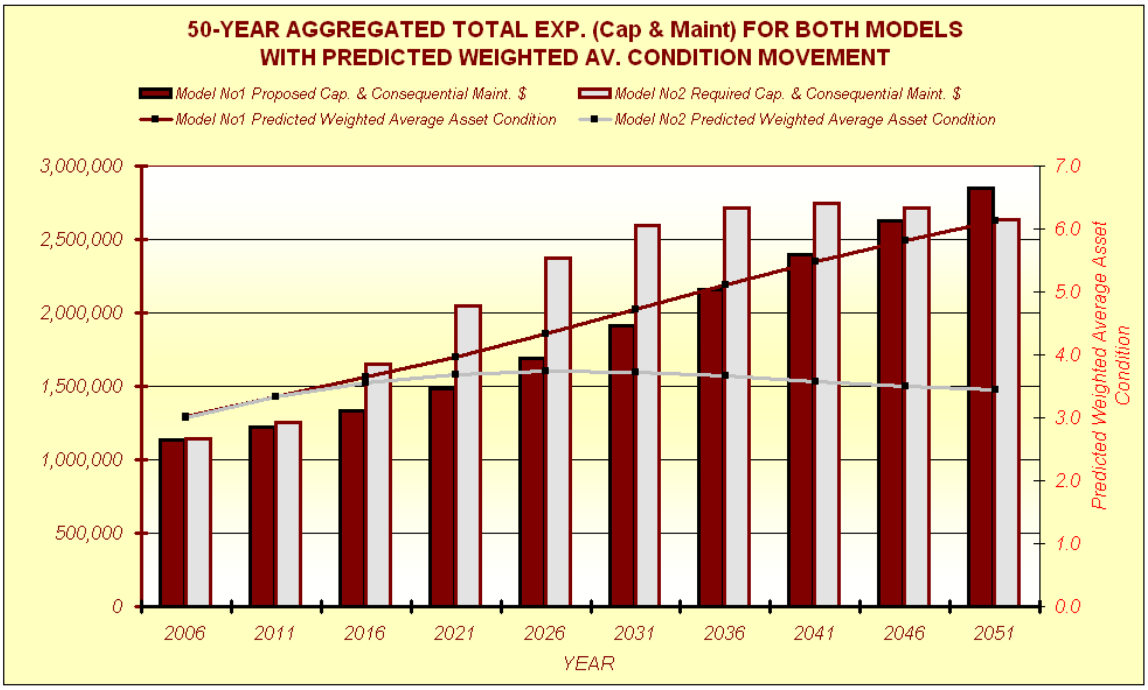

Fig A14 Summary of overall Modelling outcome for Both Models

Figure A14 above provides an overall summary for the two modelling outcomes. There are two scales to the graph. The brown scale on the left relates to the two sets of bars on the graph and represents the combined total expenditure of capital and consequential maintenance for each model. The red scale on the right relates to the two lines on the graph and represents the weighted average asset condition for the two models.

It is a complex graph and may require some time to fully understand its significance. The aim of the graph is to provide a single image to summarize the two modelling outcomes. Model No 1 "Proposed Capital Expenditure" model is represented by the brown line and bars. Here all of the increase in expenditure on the brown bars is as a result of the increasing consequential maintenance cost. Note also that the brown line indicates that the weighted average asset condition is rising out of control to around 6.14 by 2050.

Model No 2 the "Required Capital Expenditure" Model in gray is quite different. Here the increase in the total expenditure represented by the gray bars is mostly as a result of planned increases in capital expenditure. As a result of the increased capital expenditure the weighted average asset condition on the gray line is maintained within an acceptable range.

Note that under the proposed capital expenditure model (Brown bars above) the total expenditure (combined capital and consequential maintenance) actually ends up exceeding the required capital profile (Gray bars) but the WAAC is very poor. The entire rise in the proposed capital expenditure model is the result of escalating consequential maintenance costs.

The sample asset set adopted for this modelling demonstration was chosen because of the great divergence between the two modelling paths. It was designed to illustrate the need to fully fund the capital rehabilitation demand and the consequential maintenance expenditure that will be necessary if this is ignored.

It is an extreme example which may not be fully replicated in other situations but it does serve to illustrate a point. Some asset sets such as pavements and sealed surfaces have a very strong link between asset condition and consequential maintenance cost. Others like kerbs have a very weak link and the graphs will not show significant movement in consequential maintenance even when asset condition declines dramatically.

A5 Modelling Summary

The modelling process within the Moloney system operates in the following way.

- It is a network-based model that looks at the expected performance of the **total** asset group.
- Modelling commences with the present condition distribution of an asset group.
- The asset group is degraded with time in accordance with a user defined asset degradation curve.
- There are two distinct modelling paths from that point.
- Model No 1 ***Proposed Capital Expenditure Model*** has a user defined 50-year proposed capital expenditure profile and predicts future asset condition outcome.
- Model No 2 ***Predicted Capital Requirement Model*** has a user-defined asset Condition outcome and predicts the future capital expenditure profile necessary to achieve this.
- The future capital funding gap or shortfall is delivered by taking the proposed expenditure profile in model No 1 from the required expenditure profile in model No 2.
- Both models track future asset condition and via user defined parameters enable the prediction of future "Consequential Maintenance" cost movements.
- The model tracks total cost by combining capital rehabilitation with the corresponding "Consequential maintenance cost" for both models.
- Individual asset or sub asset modelling results can be combined into aggregated financial forecast reports for up to 20 different asset sets.

A6 Aggregated Modelling Results

The Moloney system allows for the aggregation of up to 20 individual modelling operations. Once a single asset set has been modelled the results can be added to the aggregate section of the program. The aggregate section mirrors the individual section in that there are three sheets corresponding to the three sheets within the single modelling section.

This allows the presentation of overall financial trends for a group of asset sets. Detailed below within figures A15 and A16 are a samples of the aggregated outputs within the Funding Gap area. For more details on the aggregated report graphs have a look at the explanations within the excel comments at the head of each graph within the system.

There are many different outputs and the two provided here are only a very small sample of what is available. The aim of this attachment was to provide an explanation of the modelling methodology and assumptions. More detail can be found within the modelling manual and the explanations within the excel comment cells throughout the modelling software.

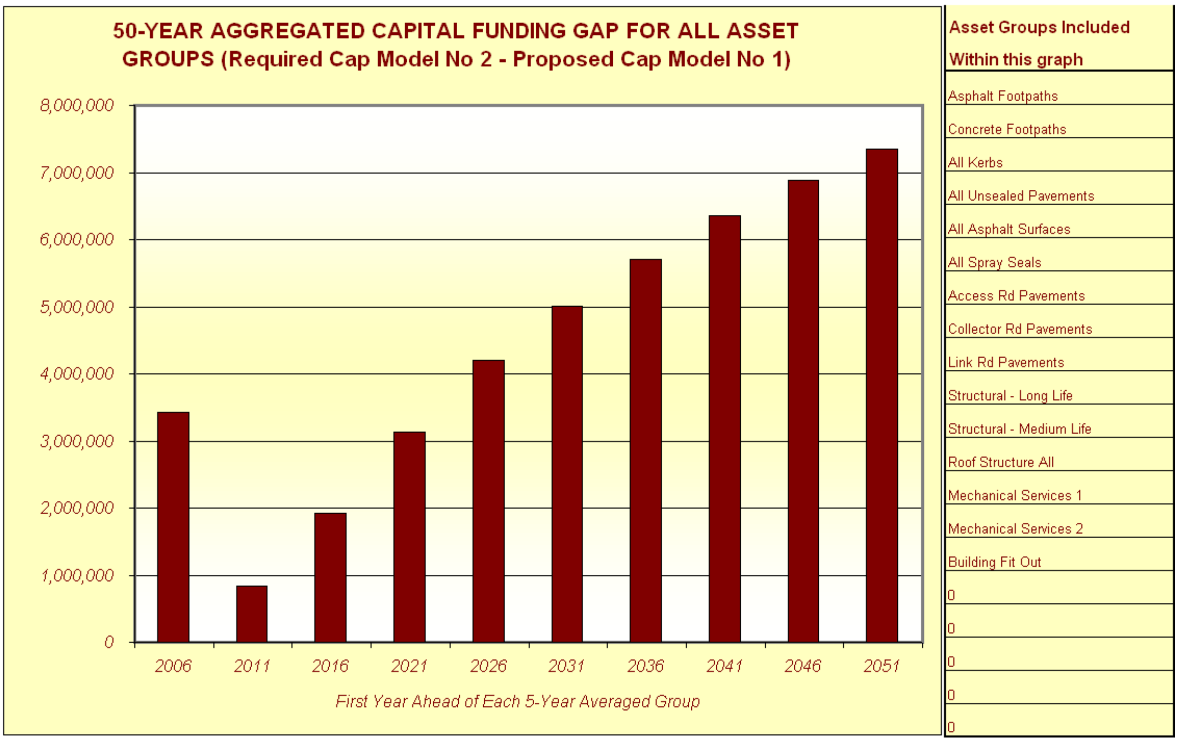

Fig A15 Aggregated Capital Rehabilitation Funding Gap Not separated by asset type

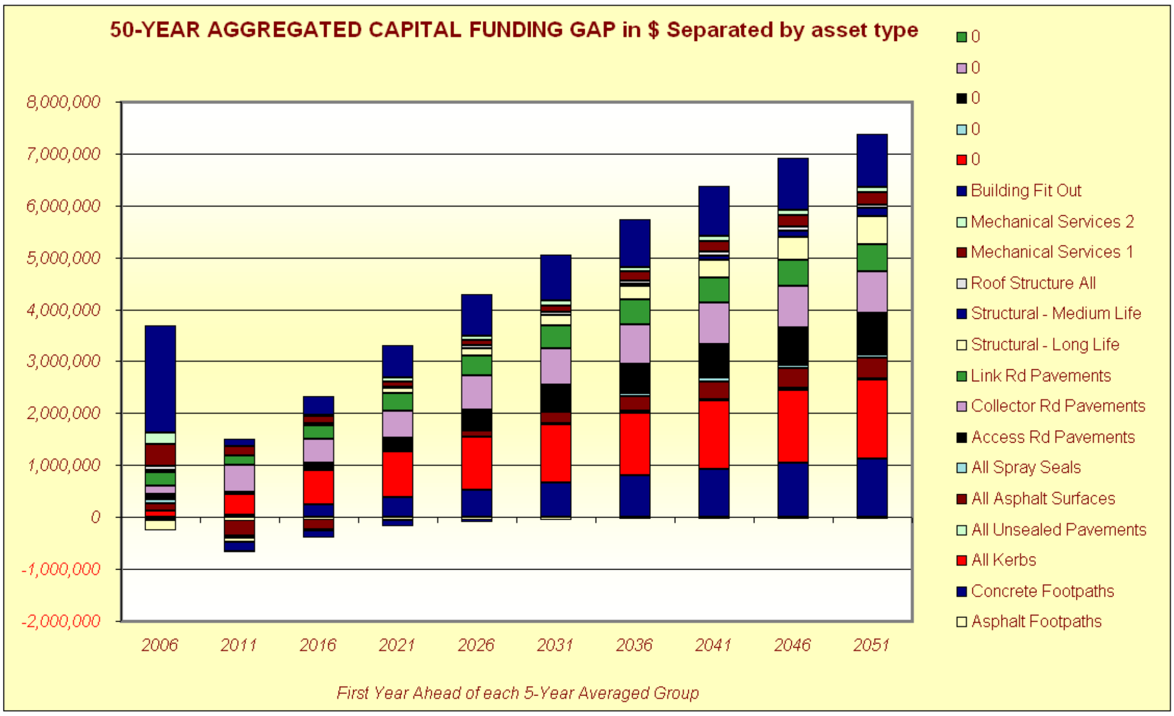

Fig A15 Aggregated Capital Rehabilitation Funding Gap separated by asset type

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