Development of Network Level Performance Prediction and a Rolling Capital Planning Job Jar

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ABSTRACT

This project involved uses strategic and tactical performance prediction modelling software that considers surfaced road condition data (distresses, severities and extents), treatment costs, maintenance costs, treatment life (deterioration curves), allocated budget and maintenance performed on road segments to enable Parkland County, Alberta, Canada, to integrate the road rehabilitation and maintenance programs into an optimized preservation program. The optimized preservation program developed leads to the process of developing Parkland County's rolling capital road program (called the Job Jar).

The paper covers some of the technical and organizational aspects of how this three year asset management project was developed and implemented. The project was successfully completed in 2010 and implemented in 2011.

Through applying this process to create the Job Jar, Parkland County's Engineering Services Department is able to meet Parkland County Council's Strategic Goal of; ***"Maintaining high quality infrastructure that will ensure sustainable growth of the County."***

The paper discusses:

- How performance prediction modelling software was used to develop the performance prediction models (both strategic and tactical models) over multiple years,
- The details of using information from the strategic and tactical modelling to develop a prioritized three year rolling program or the Job Jar,
- Linking of the Job Jar to a specific strategy for the Parkland County's surfaced road network,
- Developing the documented business processes to define the employees' and the organization's roles, responsibilities and timing of the annual processes to ensure the Job Jar can be presented during Parkland County's annual budget presentation.

1 BACKGROUND

Parkland County is a rural municipality located in Alberta, Canada, immediately west of the City of Edmonton. With a population of over 30,000, Parkland County maintains 2060 km of roads, covers 242,595 hectares, has 365 country residential rural subdivisions, 12 hamlets and employs 209 (FTE) employees. Residents enjoy a mix of agricultural, professional and industrial employment opportunities for Parkland County contains excellent farm land, two of Alberta's largest coal fired power generating stations and has immediate access to all of the amenities provided by the City of Edmonton.

At the commencement of this project Parkland County had been measuring condition of the rural grid road network for four consecutive years. The work associated with collecting that data consistently has been reported on in a separate paper. The collection of good consistent time series data enabled the task of developing performance prediction models for the grid road network to commence. The details related to determining what distresses were collected and how the quality of the data assured has been reported in detail in the paper prepared for the 2012 conference of the Transportation Association of Canada, held in Fredericton, New Brunswick, titled *Development of a Rural Municipal Road Conditions Assessment Method and Associated Quality Assurance Process*.

The members of the Parkland's asset management team were well aware of the need for consistent and relevant data prior to setting management goals for the road network. To be successful in managing the long-term performance of a complex network of assets the asset manager should have to capability to predict long-term outcomes within various sets of constraints. The most acceptable strategic scenarios form the basis of a corporate plan for the infrastructure for the future. The success of the plan can be measured by comparing the planned outcomes versus actual network performance on a periodic basis.

The more objective the inputs the more likely the process is to be successful for all stakeholders. The generic management framework that was used for this work is summarized in this paper.

2 THE STEPS

To enable Parkland to have an asset management system they realised that they needed to move from current processes that had a high degree of subjectivity underlying them to a more objective decision-making framework.

It was understood that no decision making environment is totally objective and that should not be the intent. There will always be a place for business skills in the making of business decisions. There is also a strong need for technical skills in moderating system generated business decisions as a computer cannot know everything that is needed to make a good decision for 100% of the time.

Parkland rapidly identified that much of the core business of asset management could benefit from the application of more objectivity as a significant part of those processes were driven by subjectivity - not moderated by it.

2.1 Community Benefits

The road network represents a primary part of the community's transport and communications infrastructure. Cost effective management of the road system asset and its operation over its life must ensure that the asset is effective in meeting the needs and expectations of the community and that the benefits provided to the community are valued more highly than the

continuing cost of the asset. It is essential that these desired outcomes are identified as the starting point for the development of any management strategy, and closely monitored as part of strategy implementation.

Parkland's senior management and council realized they should adopt the broadest view of community benefits as that is the conceptual starting point for an asset management strategy. Both tangible and intangible benefits should be considered at the starting point of the management decision making process.

A road system is only of value to the community because of the benefits it provides through its use and potential use. The level of service provided must be appropriate to the needs, affordability and expectations of the community. Developing an asset network which provides a level of service beyond what is needed, and expected, may waste community resources. While supply of a network of assets at a level of service which does not meet needs may be unacceptable and ineffective.

One of the biggest community benefits that is often not considered is the savings in taxpayers dollars by **efficient** and **effective management** of the asset at predefined levels of service. These levels of service **must** be objectively linked to the measurable physical attributes of the system.

2.2 Road System Performance

An early step in the development of asset management in Parkland County was the identification of how the community benefits are achieved through the performance of the road system. Road system performance is dependent upon the features of the asset, its condition and use.

Road users will assess the acceptability of the service provided by the road transport system, by how reliable and accessible the system is versus the cost of providing and preserving the system. Road system performance can be assessed by a range of quantifiable measures for the network as a whole or for individual roads. Importantly the performance measures must enable the manager to determine rates of physical deterioration and treatment costs. This was the major challenge for Parkland in developing measures that enabled treatments to be triggered reliably and the overall network to be sustainably managed.

2.2.1 Asset Features

A strategic approach to the management of any asset requires a comprehensive understanding of the asset portfolio. Asset features are determined in the planning and initial design and construction phases, and modified by subsequent enhancements. The road asset can be described in terms of a road's function and purpose (classification), location, alignment, length, width, and design load capacity (relative to standards and guidelines), material quality and quantity, construction standards and subsequent treatments.

2.2.2 Asset Condition

Many of the measures of road system performance relate directly to the physical and financial condition of the road asset over an extended time horizon.

It was a significant challenge in the project for the condition of the asset to be measured and monitored accurately and that the relationship between condition and performance measures be understood. The condition of the asset can be described by physical parameters which reflect its structural capacity and/or serviceability for users, in addition to financial parameters which

reflect its capital worth to the community. Parkland identified some key distresses that were significant to the road network and its rate of deterioration over time. An important factor was understanding the rate of change of conditions with time. Knowing the change of condition versus environmental factors and usage patterns enables a better assessment of management options in the future.

Many parameters can be used to measure pavement conditions including ride, rutting, cracking, surface texture, level of patching, edge conditions, deflection under load, binder condition, various measures of material quality and skid resistance. Parkland identified that the key parameters are Ravelling (surface texture), Cracking, and Condition of Surface Patches as the primary triggers of treatments on their network. Rutting was initially considered but turned out to be minor after measuring it as part of the process.

2.3 Physical Treatments

Physical treatments are designed to ensure asset condition can provide the desired level of road system performance for minimum life cycle cost.

A strategy will usually specify a mix of:

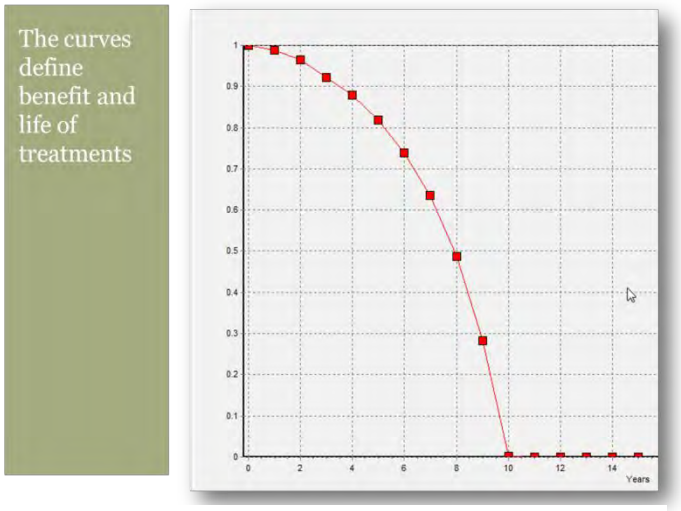


Figure 1 – Deterioration curves for the effect of treatments on each distress

- **Maintenance treatments** applied throughout the life of the asset to keep it in a safe operating condition and extend the time before a major treatment is required to restore condition. (see Figure 1 for a typical performance curve of a road under maintenance action)
- **Rehabilitation treatments** applied to restore the condition of the asset to a new, or near new; level and
- **Construction or reconstruction** which is designed to substantially alter the condition and/or capacity of the asset.

Treatment decisions should recognize the life cycle costs of treatments, the effect on asset condition throughout the life cycle and how it impacts on road system performance.

2.4 Asset Management Strategy

An asset management strategy presents a set of programmed management actions to achieve asset performance objectives, within the constraints that are set by the political environment that the decision is being made within.

In Parkland's case the strategy uses the performance standards (amount of good and poor for each distress) to achieve a measurable outcome by identifying the optimal mix of physical treatments that will achieve the specified performance within the external and internal constraints.

Typically a road network strategy will include the level of service expected in five to ten years' time. The strategy is directly linked to the funding scenarios that are likely to occur over that time period. Network level strategies are not site specific but rely on probabilistic performance modelling to predict the future network level performance. This technique is gaining greater popularity with asset managers around the world as experience is demonstrating that road network performance in the long term is reliably probabilistic but highly unreliable if modelled deterministically for more than a few years.

2.5 Implementing the Strategy

The Asset Management Strategy needs to be implemented within an organizational business process. Ideally all parts of the business process have some synergy that maximizes the effectiveness of the strategy development and implementation. A complex organization like Parkland cannot go from not doing asset management to being asset managers by using software alone. The County has developed business processes that generally follow the conceptual process model illustrated in Figure 2.

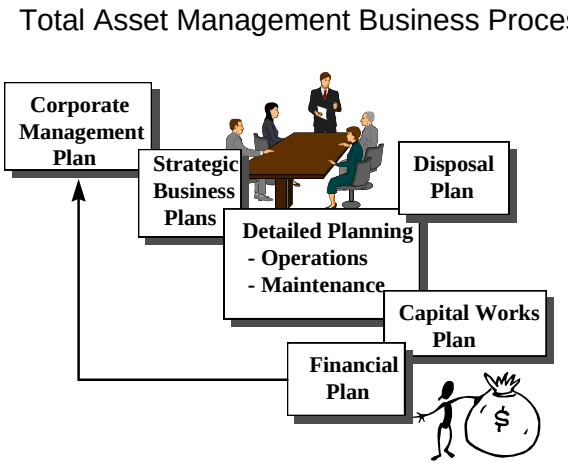


Figure 2 Implementing the Asset Management

Strategy implementation usually relies on a rolling program of works that look from three to five years into the future. The program of works must include funding for maintenance as the expected life of treatments assumes a level of maintenance that should be clearly defined as part of the asset management strategy.

Financing an asset management strategy within a government agency like Parkland is made difficult due to the traditional budgeting cycles. The fact that many agencies treat maintenance (operating) and rehabilitation (capital) under two distinctly different budgeting processes is a distinctive difficulty when implementing an asset management strategy. This is a difficult thing to overcome. They should both be treated as synergistically preserving the network at the least total cost. For example if maintenance is under-funded then the network will deteriorate more quickly than planned and rehabilitation works will be required more frequently than otherwise over the life of the asset. Conversely if rehabilitation is under-funded then more maintenance repairs will be required on a more regular basis. Also the timing of budget deliberations is often out of sync with the best time to measure asset performance which leads to ongoing challenges in designing processes that meet constraints whilst being as objective as possible.

Early in the process Parkland started with a good corporate plan for the road network that defines the stakeholders' expectations for the network is essential to delivering a good asset management strategy.

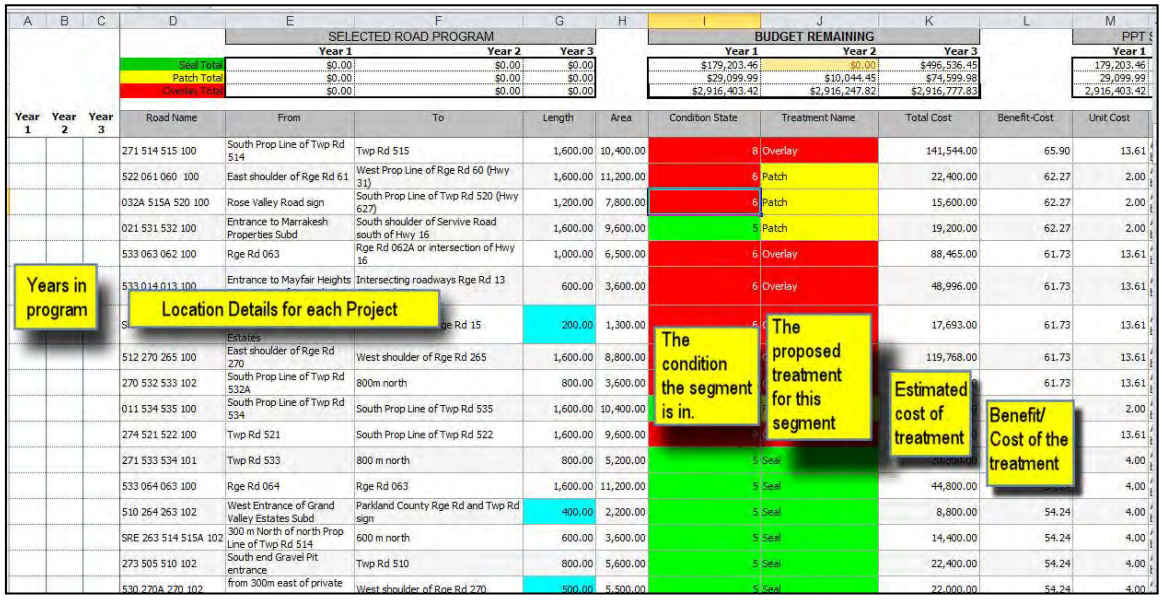
Detailed planning for the next year of work often requires detailed co-ordination of many different work units and the true cost effectiveness of this is usually reliant on good plans and good communication. The Job Jar has been developed in Parkland County to address the issues of developing the rolling plan within a strategy that has been agreed to by management and council.

3 THE PARKLAND COUNTY SPECIFICS

A key part of the project was for Parkland to develop business processes that enable network performance goals to be set by senior management and for the Engineering Services Department to develop capital preservation programs to support those goals. These business processes looked at who is responsible to do **what** and **when** throughout the annual planning cycle!

The strategic part of the overall business process enables Parkland to develop comprehensive performance management strategies for the long term preservation of the grid road network, which includes a specific desired target for condition as the preferred long-term strategy. This strategy meets the constraints of budget and resources whilst giving the most desirable long-term outcome of all strategies analysed. The strategy encompasses a 5 to 10 year view of the future with the specific expected level of service for each condition being part of the strategy. The strategy also includes the expenditure in each year on each major treatment class.

So by this stage Parkland knows what it can afford to achieve in network condition in the longer term. Once council have ratified the strategy process then moves towards developing the Job Jar which includes all projects in the next three years that satisfy the strategy. The Job Jar (see Figure 3 for a sample) is produced by analysing the treatment effectiveness of various treatment options on all segments within the County. The treatments with the greatest benefit cost are ranked at the top of the Job Jar and the treatments with the least benefit cost are at the bottom of the Job Jar. Treatments that have no significant benefit are filtered out of the Job Jar at the start of the process.



					SELECTED ROAD PROGRAM			BUDGET REMAINING					PPT
					Year 1	Year 2	Year 3	Year 1	Year 2	Year 3			Year 1
				Seal Total	$0.00	$0.00	$0.00	$179,203.46	$0.00	$496,536.45			179,203.46
				Patch Total	$0.00	$0.00	$0.00	$29,099.99	$10,044.45	$74,599.98			29,099.99
				Overlay Total	$0.00	$0.00	$0.00	$2,916,403.42	$2,916,247.82	$2,916,777.83			2,916,403.42
Year 1	Year 2	Year 3	Road Name	From	To	Length	Area	Condition State	Treatment Name	Total Cost	Benefit-Cost	Unit Cost	
			271 514 515 100	South Prop Line of Twp Rd 514	Twp Rd 515	1,600.00	10,400.00	8	Overlay	141,544.00	65.90	13.61	
			522 061 060 100	East shoulder of Rge Rd 61	West Prop Line of Rge Rd 60 (Hwy 31)	1,600.00	11,200.00	6	Patch	22,400.00	62.27	2.00	
			032A 515A 520 100	Rose Valley Road sign	South Prop Line of Twp Rd 520 (Hwy 627)	1,200.00	7,800.00	6	Patch	15,600.00	62.27	2.00	
			021 531 532 100	Entrance to Marrakesh Properties Subd	south shoulder of Servive Road south of Hwy 16	1,600.00	9,600.00	5	Patch	19,200.00	62.27	2.00	
			533 063 062 100	Rge Rd 063	Rge Rd 062A or intersection of Hwy 16	1,000.00	6,500.00	6	Overlay	88,465.00	61.73	13.61	
			533 014 013 100	Entrance to Mayfair Heights	Intersecting roadways Rge Rd 13	600.00	3,600.00	6	Overlay	48,996.00	61.73	13.61	
			S	Estates	e Rd 15	200.00	1,300.00	5		17,693.00	61.73	13.61	
			512 270 265 100	East shoulder of Rge Rd 270	West shoulder of Rge Rd 265	1,600.00	8,800.00	6		119,768.00	61.73	13.61	
			270 532 533 102	South Prop Line of Twp Rd 532A	800m north	800.00	3,600.00	6			61.73	13.61	
			011 534 535 100	South Prop Line of Twp Rd 534	South Prop Line of Twp Rd 535	1,600.00	10,400.00	8				2.00	
			274 521 522 100	Twp Rd 521	South Prop Line of Twp Rd 522	1,600.00	9,600.00	6				13.61	
			271 533 534 101	Twp Rd 533	800 m north	800.00	5,200.00	5	Seal			4.00	
			533 064 063 100	Rge Rd 064	Rge Rd 063	1,600.00	11,200.00	5	Seal	44,800.00		4.00	
			510 264 263 102	West Entrance of Grand Valley Estates Subd	Parkland County Rge Rd and Twp Rd sign	400.00	2,200.00	5	Seal	8,800.00	54.24	4.00	
			SRE 263 514 515A 102	300 m North of north Prop Line of Twp Rd 514	600 m north	600.00	3,600.00	5	Seal	14,400.00	54.24	4.00	
			273 505 510 102	South end Gravel Pit entrance	Twp Rd 510	800.00	5,600.00	5	Seal	22,400.00	54.24	4.00	
			530 270A 270 102	from 300m east of private	West shoulder of Rge Rd 270	500.00	5,500.00	5	Seal	22,000.00	54.24	4.00	

Figure 3- The Job Jar rolling program spreadsheet

The spreadsheet shown in Figure 3 was developed by Parkland's asset management project team. It contains all the information that is extracted from the analysis of current condition and treatment performance on an annual basis. The information from the performance prediction analysis is exported to the spreadsheet annually or when condition is updated.

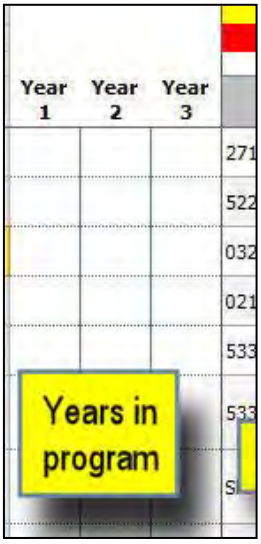


Figure 4 - Multiyear selection

As can be seen in Figure 4 the first three columns of the spreadsheet enable the County to choose a project from the Job Jar for a particular year in a rolling three year program. The spreadsheet is set up in such a way that if *"yes"* is entered into any of the first three columns the project that makes up that row of the spreadsheet becomes part of the proposed program for the year.

As mentioned earlier in this paper the projects at the top of the spreadsheet have a greater benefit cost ratio than projects at the bottom of the spreadsheet. However only projects that are of significant benefit are included in the Job Jar from the start.

Typically the program manager will work down through the Job Jar to prepare the rolling forward program to find segments that make sense from an overall program coordination viewpoint as well as from a pure benefit viewpoint.

In determining the makeup of the program the program manager looks at the information about where the segment is and what is adjacent to that segment. A portion of that information from the Job Jar is shown in Figure 5.

021 531 532 100	Entrance to Marrakesh Properties Subd	South shoulder of Servive Road south of Hwy 16	1,600.00	9,600.00
533 063 062 100	Rge Rd 063	Rge Rd 062A or intersection of Hwy 16	1,000.00	6,500.00
533 014 013 100	Entrance to Mayfair Heights	Intersecting roadways Rge Rd 13	600.00	3,600.00
	Estates	Rge Rd 15	200.00	1,300.00
512 270 265 100	East shoulder of Rge Rd 270	West shoulder of Rge Rd 265	1,600.00	8,800.00
270 532 533 102	South Prop Line of Twp Rd 532A	800m north	800.00	3,600.00
011 534 535 100	South Prop Line of Twp Rd 534	South Prop Line of Twp Rd 535	1,600.00	10,400.00
274 521 522 100	Twp Rd 521	South Prop Line of Twp Rd 522	1,600.00	9,600.00
271 533 534 101	Twp Rd 533	800 m north	800.00	5,200.00
533 064 063 100	Rge Rd 064	Rge Rd 063	1,600.00	11,200.00
510 264 263 102	West Entrance of Grand Valley Estates Subd	Parkland County Rge Rd and Twp Rd sign	400.00	2,200.00
SRE 263 514 515A 102	300 m North of north Prop Line of Twp Rd 514	600 m north	600.00	3,600.00
273 505 510 102	South end Gravel Pit	Twp Rd 510	800.00	5,600.00

Figure 5 - Segment details for each potential project

In Figure 5 the unique identifier for each segment enables the program manager to rapidly identify the road that the segment is on and the cross roads at the start and end of the segment. A detailed description is also supplied in the adjacent two columns. Next to that is the length of the segment where short segments are highlighted in blue as they are usually a lower priority for the County. The final column displayed in Figure 5 is the area in square metres of the proposed project.

In Figure 6 one can see in detail the next five columns in the Job Jar.

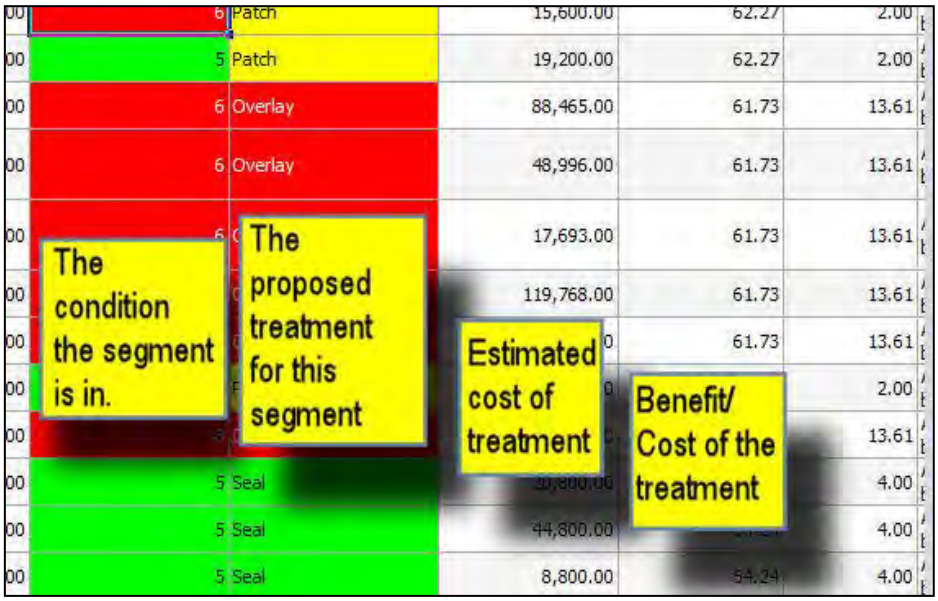


Figure 6 - The treatment details

The first column is the condition state of the segment. In Parkland's case the condition state varies from 1 to 8 with state 1 being a road that has no major deficiencies and 8 being a road that is deficient in all distress as measured by the County. The condition state column is colour coded as Parkland has identified that each state triggers a treatment that is most appropriate for that state. The treatments in the adjacent column are also similarly colour coded. The colour coding in both columns is designed so that the lower cost treatments are green and the higher cost treatments are red. With yellow being treatments that are intermediate costs.

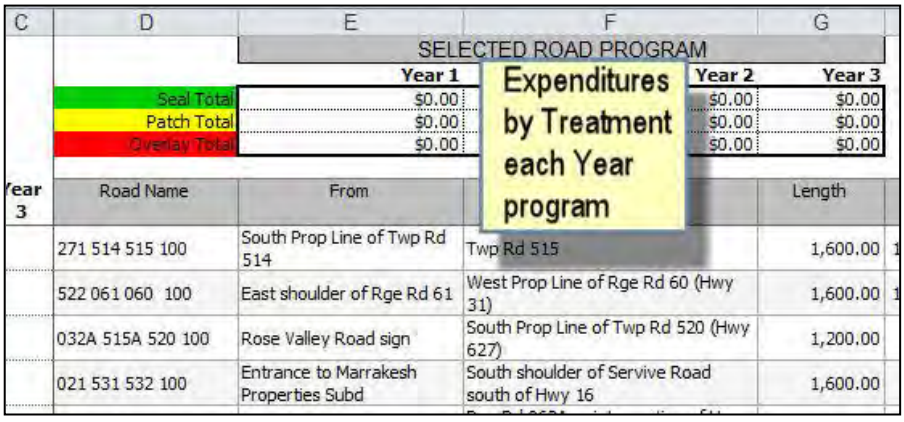


Figure 7 - Expenditure by treatment for each year of the program

Figure 7 shows the summary of expenditure for each year in the program separated out by treatments. This part of the Job Jar is automatically updated as projects are selected for any year. We have found this a handy feature of the Job Jar spreadsheet as sometimes there is a choice to be made by selecting one larger project verses three or four smaller projects that could be a similar level of benefit in the Job Jar. Keeping an eye on the budget totals helps rationalise the choices.

Figure 8 shows the other part of the financial summary information at the top of the Job Jar spreadsheet. This information shows the difference between the expenditure (as illustrated in Figure 7) and of the budget which is also stored in the Job Jar spreadsheet. The budget was derived from the initial strategy phase as described earlier in this paper. Ideally as the program is finalized for all three years the summary shown in Figure 8 should be almost zero.

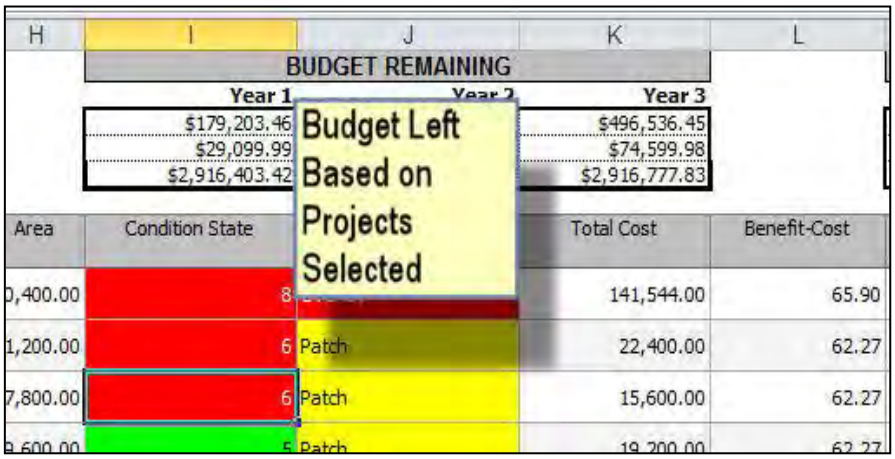


Figure 8 - Unspent funds based on current treatment selections

4 HOW THE JOB JAR IS DETERMINED

The details as to how the Job Jar is determined annually are embedded in the business processes developed by Parkland as part of the project. The Job Jar relies on knowing the expected performance of each treatment on each distress. It is fundamentally trying to work out *"if I apply treatment A then how long before this segment is back to its current condition after applying the treatment?"* It does the same for treatment B and treatment C etc. The end result is that treatments have varying performance effectiveness based on how severe each distress is on the segment.

As can be seen in Figure 9 the area under the curve is based on where the distress will be on the curve immediately after the treatment is applied (that is the gain in condition *"future value on the chart"*) which forms the vertical dimension of the area under the curve and the horizontal dimension is based on the time taken for the distress to get back to its current condition should this treatment be applied. The shape of the curve bounds the upper area under the curve. The calculation is then done for all the distresses that exist on that segment. Of course not all treatments have the same effect on a distress therefore the additive effect of a treatment on all distresses is often unique. The cumulative area under each of the curves becomes the total benefit calculation for applying that treatment to that segment. If the segment exhibits only a

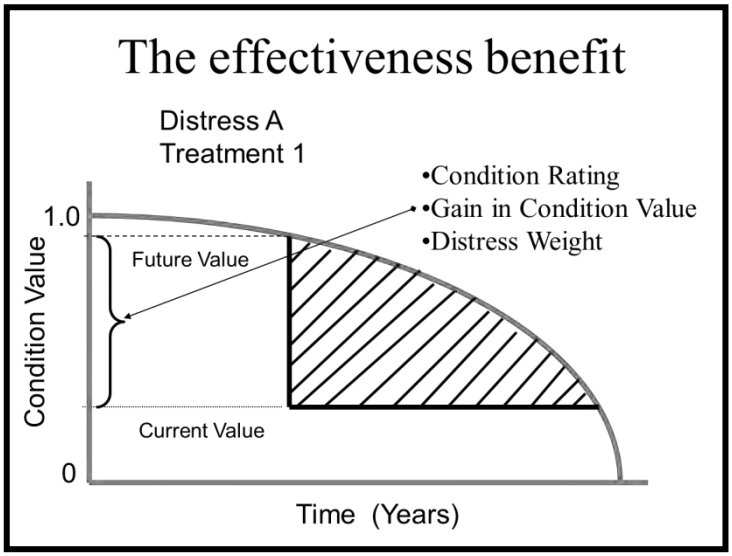


Figure 9 - The determination of treatment effectiveness

slight amount of distress then the benefit will be quite small compared to the cost of applying the treatment. Alternatively, if there are significant distresses and a treatment only fixes one of those distresses then its benefit costs will be quite small compared to a more significant treatment that would affect all distresses. Of course there is a cost for applying these treatments and that is why the benefit cost ratio has been more useful in prioritizing projects than benefits alone.

4.1 The impact of traffic on the Job Jar order

The analysis of evaluating the Job Jar includes an understanding that there is a greater benefit in treating a more heavily trafficked road than a lightly trafficked road. The impact of traffic has been sensitively determined to only slightly affect the order of proposed projects in the Job Jar.

5 HOW THE CURVES WERE ESTABLISHED

As the Job Jar is very dependent on the curves for treatments vs. distresses it was important to come up with a reasonable estimate of the curves. As more data is collected over a longer time period the curves will be refined but at this stage they were refined using a lifecycle analysis of the realistic impact of treatments on distress over a 60 year time period.

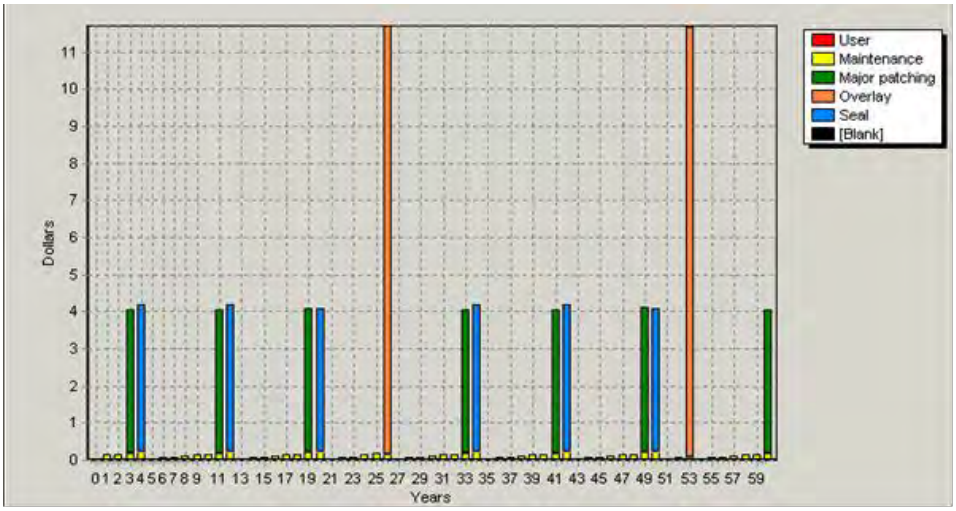


Figure 10 - Typical life cycles for Parkland County

Figure 10 shows a typical lifecycle for Parkland County.

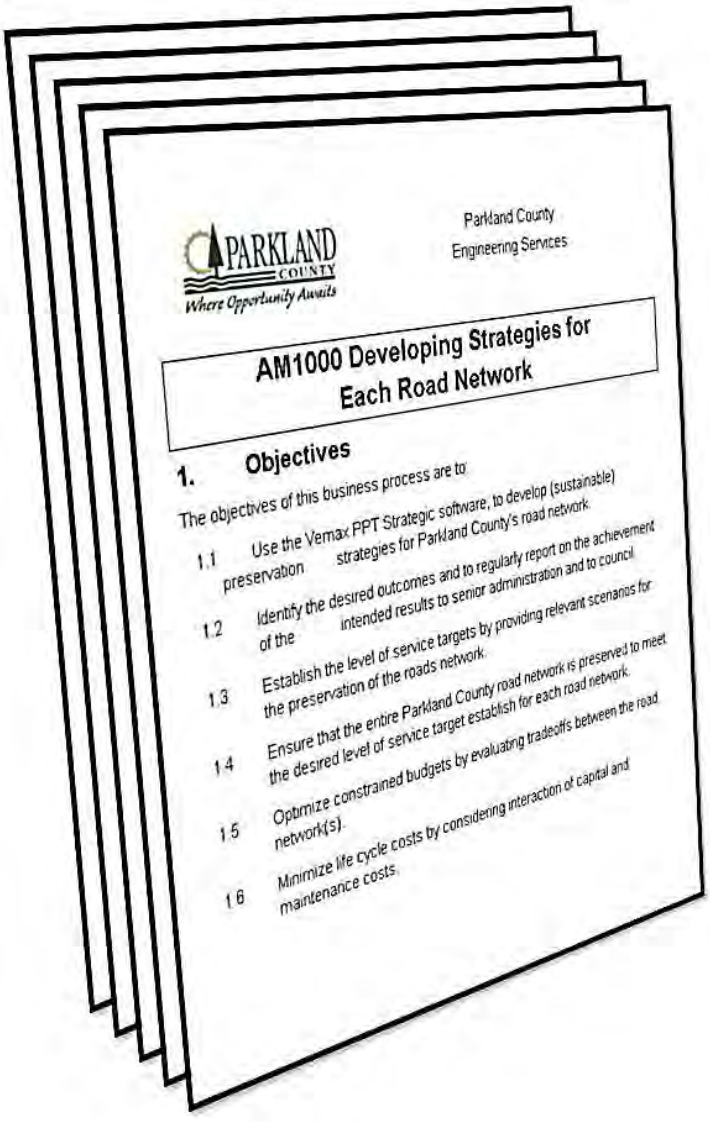
Many of these life cycles were created by the authors of this paper early in the asset management project for Parkland. The life cycles were determined under a variety of initial starting conditions and treatment strategies. This identified any shortcomings in the County's treatment toolbox. The life cycles gave significant insight into the anticipated performance of treatments vs. the practical experience of Parkland County to date. The life cycles were based on performance curves which were then revised as a result of performing the life cycle analysis. This iterative process tended to yield realistic performance curves for Parkland's conditions.

6 THE DEVELOPMENT OF BUSINESS PROCESSES

Parkland County developed and documented a set of business processes to define the employees' and organization's roles, responsibilities and timing of the annual processes to ensure the Job Jar can be presented during the annual budget presentation. The business processes documents **how**:

- the direction of the network is set,
- the Job Jar is updated and follows that overall network direction, and
- the collection of the pavement condition is managed.

The business process identifies the "who, what, when and how", inputs, reviews and approvals, at various steps of the processes are conducted. To develop the business process, key staff met and first created a business process diagram to show what steps were required to be performed at what time in the annual planning cycle.


Parkland County
Engineering Services

AM1000 Developing Strategies for Each Road Network

1. Objectives

The objectives of this business process are to

1.1 Use the Vemax PPT Strategic software, to develop (sustainable) preservation strategies for Parkland County's road network.

1.2 Identify the desired outcomes and to regularly report on the achievement of the intended results to senior administration and to council.

1.3 Establish the level of service targets by providing relevant scenarios for the preservation of the roads network.

1.4 Ensure that the entire Parkland County road network is preserved to meet the desired level of service target establish for each road network.

1.5 Optimize constrained budgets by evaluating tradeoffs between the road network(s).

1.6 Minimize life cycle costs by considering interaction of capital and maintenance costs.

Figure 11 - The business processes describe in detail the organization's role in the process

Figure 11 shows the typical layout and categorization of the business processes.

The key processes are:

- AM1000 Developing Strategies for Each Road Network
- AM2000 Developing the Job Jar, to be compliant with the strategy
- AM3000 Managing the Collection of Data

All of the business processes are all stored in the same format and are similar to ISO 9000 compliant Quality Management Documents.

The business processes allow Parkland to develop network performance goals that are set by senior management and for the Engineering Services Department to develop capital preservation programs to support those goals.

The initial step was to diagram the processes in a traditional Use Case Diagram which a small portion of is displayed in Figure 12.

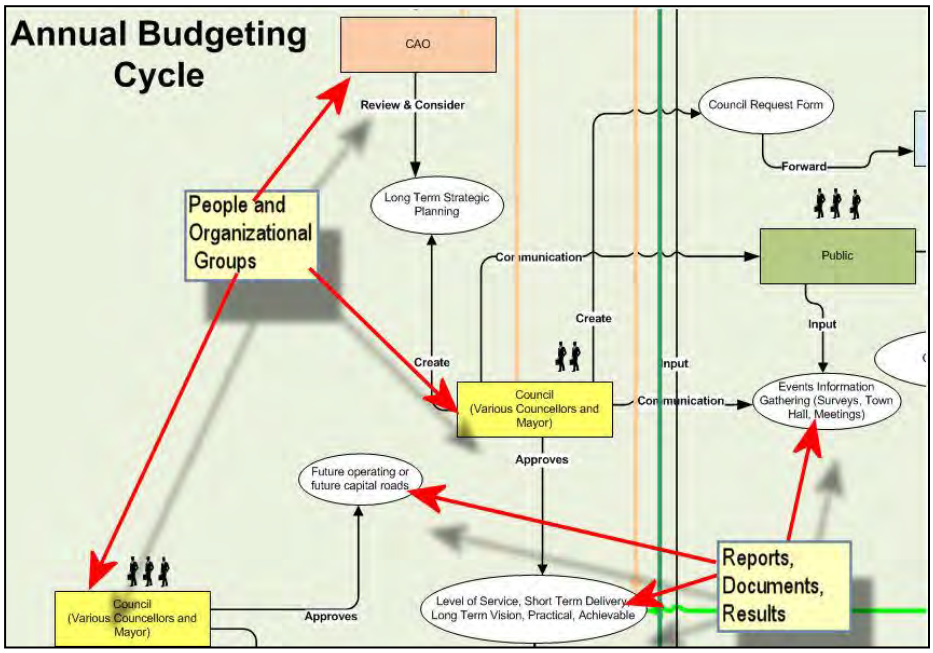


Figure 12 - Initial person centric Use Case Diagrams of proposed processes

The Use Case Diagram enabled senior management over a series of workshops to focus on how the processes of managing the infrastructure will be operated within an annual business cycle for Parkland County. During this early work in designing the processes the most senior members of Parkland's staff were highly involved. This generated good understanding of the organizational issues confronting Parkland in implementing and institutionalizing asset management. After this initial diagramming of processes the project team then started working on the detailed documentation of the processes and meshing the technical processes with the time constraints Parkland's annual planning cycles. This was then summarized in a process flow diagram, like Figure 13, and a

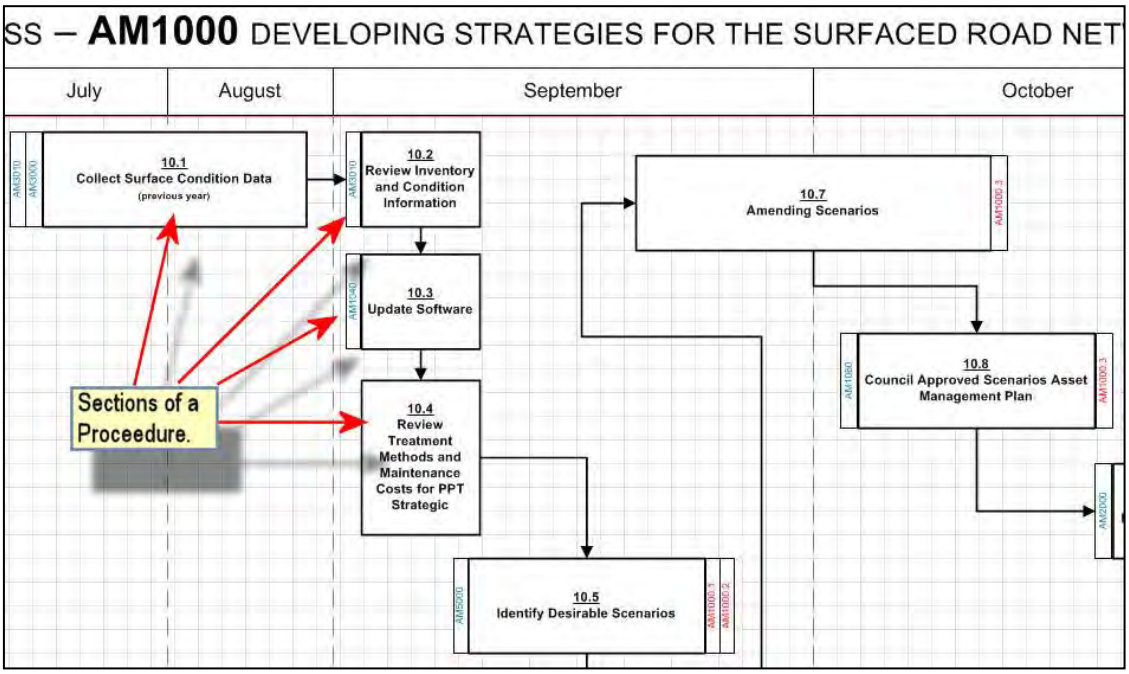
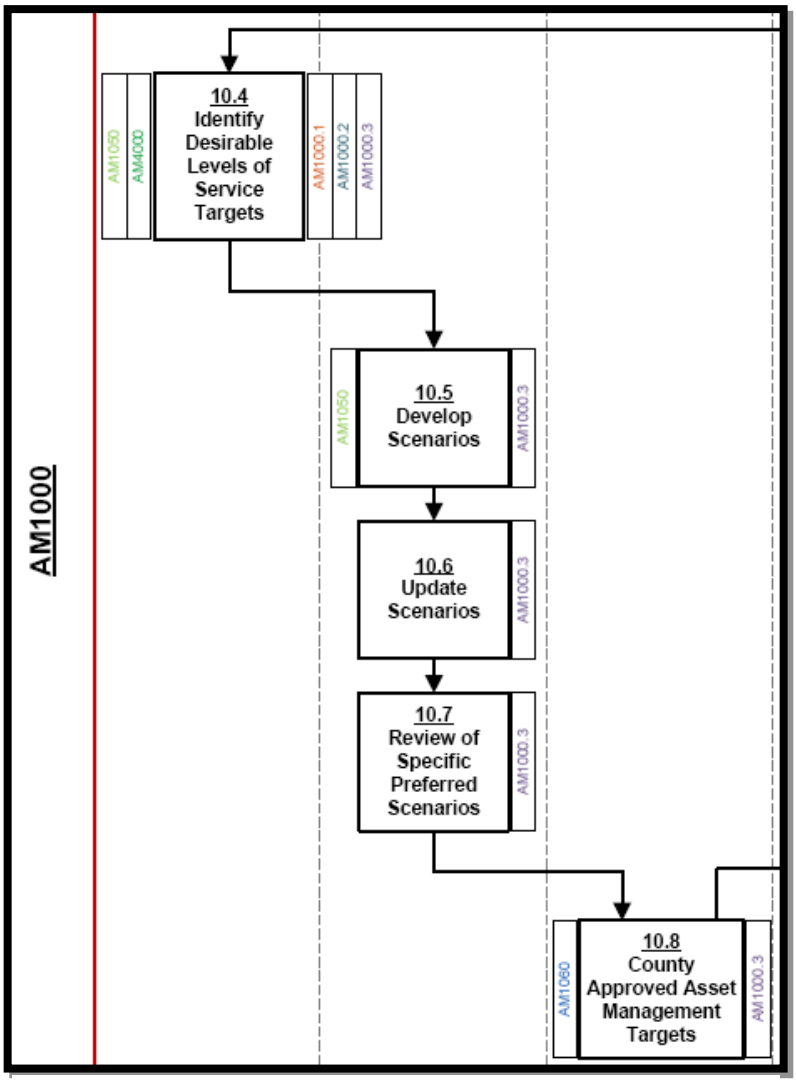


Figure 13 – Annual timeline for one of Parkland County's business processes

more detailed view of a small portion of the diagram in Figure 14.

Once a Business Process Diagram was developed, it becomes easier to identify:

- At what stages tasks such as determining; if treatment changes were required, what cost data was needed and what preservation treatment effectiveness are required to be determined, so the pavement management model can be updated,
- Who is responsible for performing these tasks,
- How the preservation strategy and preferred scenarios are developed,
- What reviews are needed to be undertaken and at what time of the year the reviews are to be completed,
- When certain approvals are required,
- How amendments to the strategy and / or scenarios are tracked,
- When key decisions are required to be made, and
- Who was responsible for approving the key decisions as well as when they are to make the approvals.



The business processes also have templates for preparing standard documents, like reports to council, as well as formats for annual plans which are cross-referenced in the appropriate procedures.

In addition to clearly identifying specific procedures and when each individual step occurs in the year, each business process also identifies the process objectives, scope, references, approvals, responsibilities, inputs and outputs.

As part of the project the Parkland County has also created associated Business Process Forms. The purpose of the forms is to clearly document when decisions or amendments are made throughout the process.

Figure 14 -Detailed section of Business Process Diagram

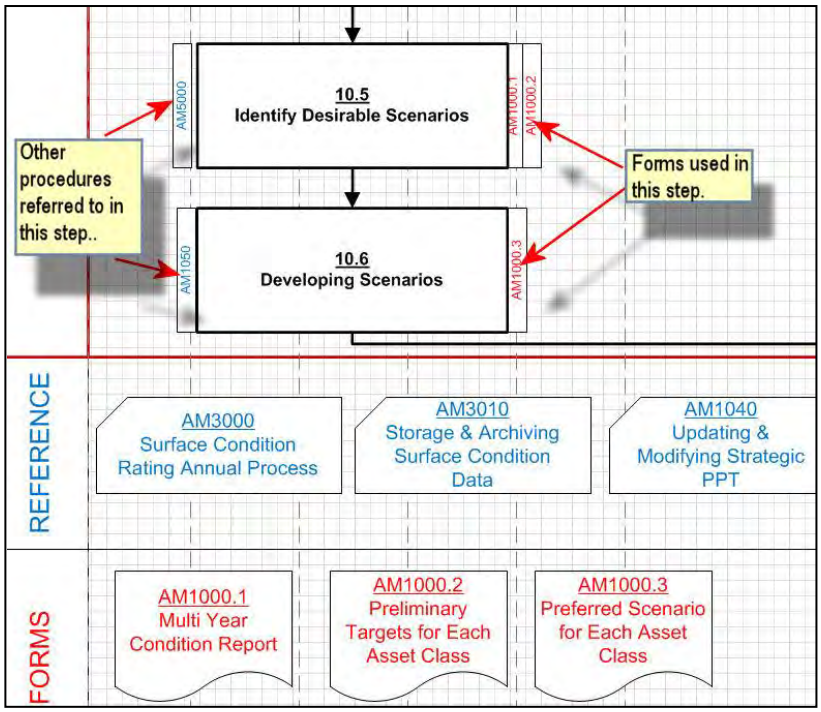


Figure 15 - Detailed cross-referencing in the diagrams

Figure 15 shows how the forms and references are linked to each step of each procedure within the Business Process Diagram. This diagram has become a handy quick reference guide for the county as it follows the procedures. Figure 16 demonstrates how *Business Process Form – 1000.3 Preferred Scenario for Each Asset Class*, is used in procedural step *10.6 Developing Scenarios and Selecting Preferred Scenarios*, of Business Process AM – 1000. In this step (10.6) once the preferred scenario is developed by using the pavement management software, the scenario is recorded on *Business Process Form AM – 1000.3* (see Figure 16).

The business process identifies how the scenarios are evaluated as well as how the preferred scenarios are chosen and by whom. The process then requires that Parkland's General Manager of Infrastructure Services approves the preferred scenario by signing off on *Form AM – 1000.3*.

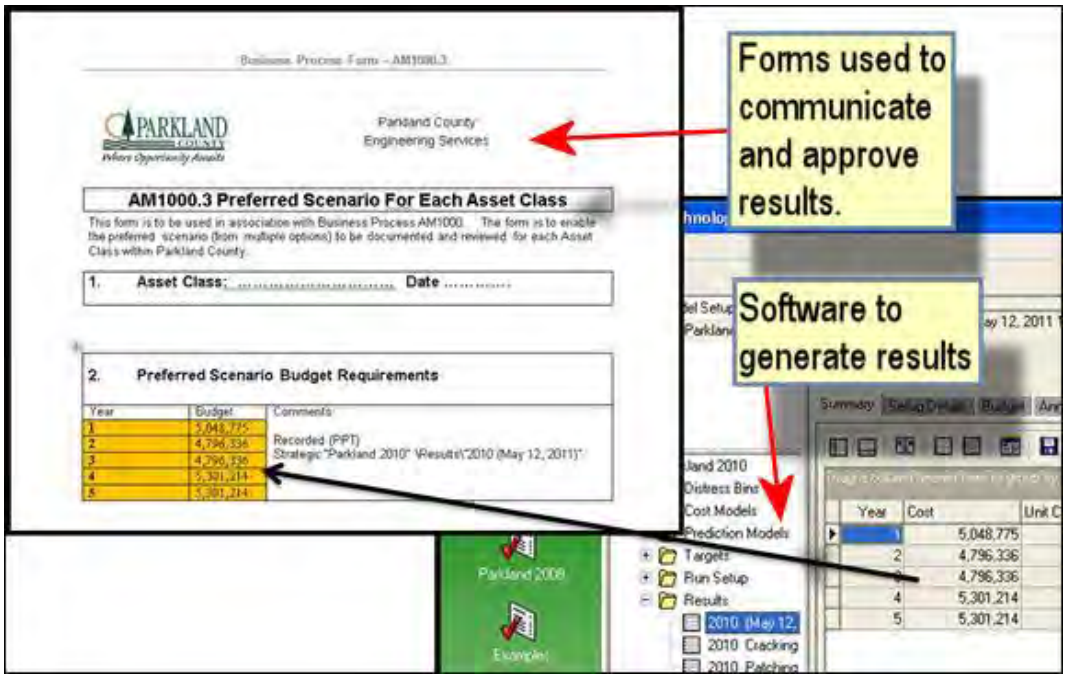


Figure 16 – Business Process Form 1000.3 – Preferred Scenario for Each Asset Class

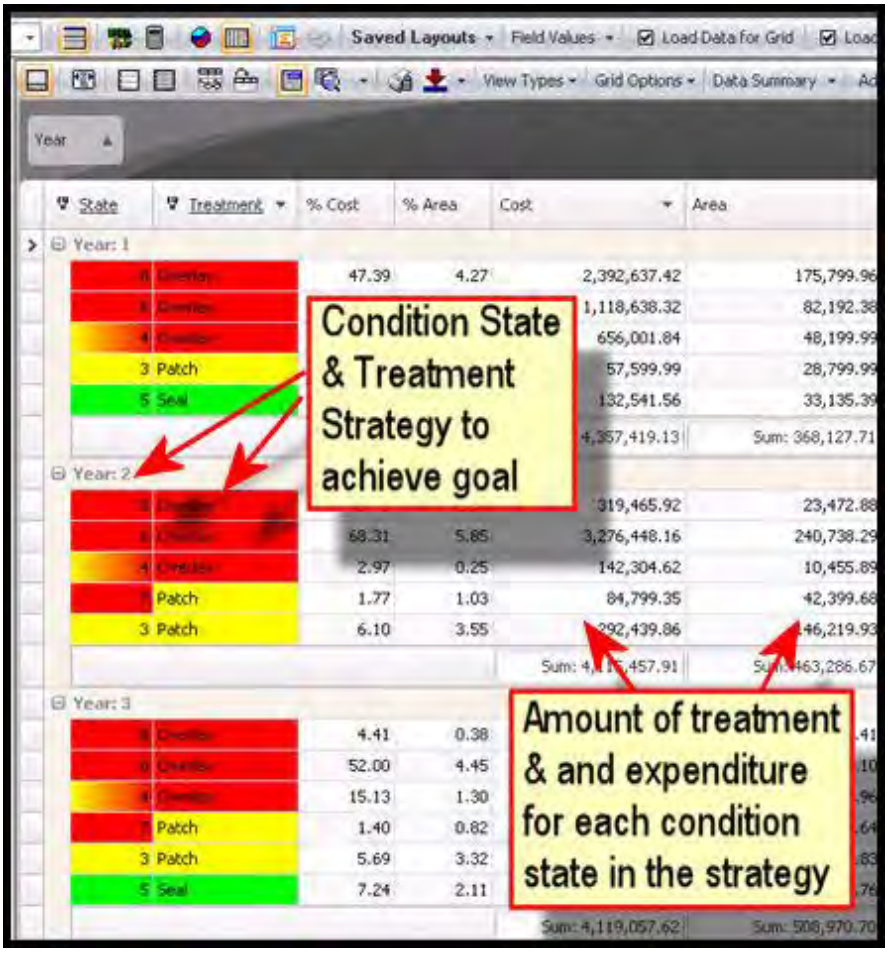


Figure 17 - The approved long-term strategy Road Map

The approved network scenario becomes the **Road Map** (See figure 17) which is used to develop a segment specific treatment program from the Job Jar.

As the Job Jar contains a list of many candidates that can be chosen to make up a three year road program strategic guidance for that selection comes from the Road Map. The Road Map is illustrated in detail in Figure 17.

It is important to understand that the Road Map is specifically the optimal set of actions to deliver a specific scenario that has been approved by senior management of Parkland County. That specific scenario has very specific targets and priorities for each distress on the road network. Following the Road Map is the least cost way to delivering those targets.

7. CONCLUSION

Through using business processes for developing and applying sustainable preservation strategies and scenarios for preserving, maintaining and reconstructed Parkland's road networks, Parkland County's Engineering Services Department is to ensure it is meeting Parkland County Council's Strategic Goal of; ***"Maintaining high quality infrastructure that will ensure sustainable growth of the County"*** for the long term.