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"DATA MAINTENANCE IS BORING!"

... and other things the Strategic Asset Manager needs to know about modelling

The past decade has seen a great surge in data collection and the creation of asset information systems. In this issue we look at three basic questions:

- **What is it that data and data modelling is designed to achieve?**
- **Is data accuracy the most pressing issue?**
- **And, if so, are the models doomed to failure – to collapse under the weight of the boredom produced by continuous data upgrading?**

These questions were inspired by a comment sent to me by an extraordinary asset management model designer and builder whose work I have carefully followed. (My normal practice of 'credit where credit is due' has been temporarily suspended because of the sensitivity of the issues for the writer.)

> "I established the city's main database, but keeping it up-to-date and quality controlled is a problem. This is not a financial problem - we have the budget; rather it is a people problem - the technicians or students assigned to updating data get easily bored as it is a very tedious job. Because of this, it requires a lot of time to perform quality control checks to ensure quality data.
>
> I used to do quality checks, but no more. The reason for this is that I notice that senior management has little appreciation for the work, so why in the world should I spend my time doing something that is time-consuming and not appreciated? After all I am an engineer who likes to optimize operations. Why not optimise my time!"

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Why not indeed?

It is a recognised fact that organisations consistently underestimate the cost of data collection and data upgrade. But if we understate the dollars, even more so do we understate the human costs.

How important is data accuracy to a model?

If the answer is 'critical' and if you cannot ensure continued data accuracy, perhaps you shouldn't even start? But does it have to be this way?

WHAT DO YOU WANT FROM YOUR MODEL? ANSWERS OR QUESTIONS?

First you have to determine what you want from a model – and, basically, you only have two options:

- You can get answers, OR
- You can get questions.

Most of you may think you want answers and that your models are designed to produce answers, but are they really?

Are models really designed to provide answers? - or are they designed to help YOU find the answers?

Take a pavement management system. The output of this system is a list of activities to be carried out and the nature of that activity – 're-seal this' 'reconstruct that', 'patch something else'.

A good model is a FILTER

- it reduces the number of decisions you need to think about—but not to zero!

But I know of no road engineer or planner worth his salt who would automatically schedule all of the activities listed by the PMS *without first checking that the work really needs to be done, or to be done at the level suggested.* Moreover, I know of no case where such checks failed to make any change to the proposed program. (And many instances where something critical was observed during the check phase that was not even on the list at all!)

"Just a calibration problem?" No! The PMS is a filtering tool. *It is not designed to produce answers but to help the asset manager refine his search and make his own decisions*. The better the calibration, the better the filter, but short of a PMS budget the size of the entire defence force, it will never be 100% accurate. At some stage, you do the trade-off and say

"We CAN make it more accurate, but the ongoing modelling and data collection costs outweigh the benefits".

WHY USE A MODEL?

Models help to organise complexity

- to enable us to take more things into account than we would be able to do unaided.

PMS systems and other complicated models are useful when it is difficult to keep all the various parameters in your head at the same time. Consider the following, the PARMS model or Pipeline Asset Risk Management System by the CSIRO's Divisions of Building, Construction and Engineering and Land & Water.

> "Traditionally water reticulation systems have been operated so that pipeline repair/replacement occurs on a reactive basis, based upon the number of failures, the consequence of failure and the cost. Planning for future replacements and the costs associated with these replacements has generally been based upon a best guess on pipe lifetimes, which have generally been very conservative, when compared to the actual pipe life obtained.
>
> Factors such as the required level of customer service, trade offs between repair and renewal, or operating practices such as pressure reduction or shut-off block reduction have not been widely considered, except when they are required under the water authorities operating licence. To allow long-term strategies to be implemented for the replacement or refurbishment of water pipelines, a planning model called the Pipeline Asset and Risk Management System (PARMS) has been developed. This model, has been designed to allow a range of what if scenario's to be analysed to determine their effects on water authorities long term costs. This model although based upon life cycle costing methodologies has been designed to incorporate whole of life costing and life cycle analysis methodologies as data on externality and environmental costs becomes available.

Even with a model as complicated as this, with so much built into it on both the supply and demand side, decision makers cannot simply 'take the answers produced by the model and run with them'. Why not? Because no matter how complex the model, the real world is MORE complex. So this complex model is still only a filter – a good filter, but nevertheless, still a filter.

For Strategic Asset Management Decisions

- the buck cannot be passed to a model

And perhaps if we value our jobs, we should be glad this is the case – or else all the decision-making could be automated. In fact, the only places where the model provides answers that feed directly into decision making is just exactly there – in automated industries – remote control pump stations or sewage operations or hydro electricity plants. And here the decisions that are being made are purely operational. For them to operate successfully, the strategic decisions have been taken at a prior stage and at a different level.

THE BEST MODELS PRODUCE THE BEST (MOST USEFUL) QUESTIONS.

Models USE data

— but they are built up from **ASSUMPTIONS**

What a good model does is allow you to focus your questions in the right spot.

… and for this, more than just information is required.

The designers of the PARMS model recognise this when they say:

> "Two factors are critical to allow planning models such as PARMS to work –
> (1) adequate cost data and
> (2) accurate lifetime models for the individual components of the water reticulation system."

Another word for 'accurate lifetime models' is 'relevant assumptions'. There is little point in knowing the age of your asset and its present condition with great accuracy if you don't know the rate at which it is likely to decay or the optimum time of intervention. The age and present condition are "data"; the rate of decay or the optimum time of intervention are both "assumptions".

Good ASSUMPTIONS can cope with quite poor data

But the reverse is not true, no amount of good data can compensate for poor ASSUMPTIONS

And another word for 'assumptions' is 'guesses'. Think of a model as a pair of scissors. There is little point in have one blade (the age, valuation, condition assessments) as 'accurate' as you can make it, while the other blade (the relevant and useful assumptions) is blunt to the point of uselessness.

On the other hand, with good and thoughtful assumptions, even poor data can be quite useful as a 'first filter'. At the very least, good assumptions can tell you how critical data accuracy is to the decision that has to be made. (Years ago I made some assumptions for a housing renewal model based on the best information I had to hand on the probable lives of individual components. I was asked "whether I would stake my life on the outcomes". I replied that 'even if I am out by 10% or even 20%, the decision implications for management would be exactly the same.' (The strategic decision that the agency had to make was whether it could afford to go on adding to its portfolio at the rate it was doing, without making any provision for renewal.) The data we had to work with was admittedly 'first-cut'. That is what I mean by a robust model – it can still give good decision-worthy information, even if the data is not too good. (Note that the benefit of this model was that it made the organisation challenge their objectives – ie, to ask questions.)

100% accurate data is not essential

- and just as well, or we would be able to do no modelling at all. But how do you ensure that your data is as good as you can afford it? What can you do to overcome the 'boredom effect'?

HOW DO YOU REDUCE THE BOREDOM QUOTIENT TO GET THE BEST DATA YOU CAN AFFORD?

One of the lessons of the total quality management movement was that you cannot 'inspect in' quality – it has to be 'built in'. And this is an important lesson to learn. There are really only three ways to get good quality data

- You can automate the process (this is what the remote hydro stations, etc, do)
- You can get the information as a 'spin-off' from other work that is being done in the organisation that has a greater involvement factor (e.g. infrastructure depreciation can be a costless 'spinoff' from asset management planning, which is something that we will discuss in a later issue.) OR
- **You can increase the involvement factor**.

All three will work, but the one most easily susceptible to action on your part is the third. If you want good quality data then the people collecting the data must have their own stake in the quality.

Give your data maintainers a stake in the quality of their work

This is really much easier to do than you might expect – simply tell them what kind of things you are looking for. Let me give a simple example from my own experience. If it works for me, it can work for you.

Example: As a post graduate student I ran over 500 experiments with 'live subjects'. In each experiment, data had to be collected – written down on the board as traders made bids, and each trader's record sheets had to be taken, graphed and analysed. This was 'pre-computers', and I was an impoverished graduate student unable to pay to have the work done for me. I did what third world nations do today; I used my family—my mother and my two young daughters. My dedicated mother would carefully record the bids on the board but as they were meaningless to her sometimes mistakes could be made. Then I found out how to reduce errors – I explained, in simple terms, the hypotheses that I was testing (and I had the foresight to tell her that information that contradicted my hypothesis was just as interesting, perhaps more interesting, than information that supported it.) Her interest in watching the trends develop – whether they supported or contradicted the hypotheses – almost completely eliminated errors. (The errors that did occur were caused by mis-hearing a bid but by explaining to the traders that it was their responsibility to correct such recorded errors, even these were eradicated.) So successful was this 'involvement' factor that I then did the same thing for my daughters – aged 12 and 15 who painstakingly hand graphed hundreds of market trends. They became interested in the results and when a graph point was misplaced it looked 'odd' to the girls and they double-checked.

Play fair—and you will improve your data quality

Organisations have a habit of asking one set of people to do the boring data collection chore (usually technicians or the regions) and a different set of people (usually policy makers or head office) to have all the fun of seeing what the data means. Not only is this highly unfair, it doesn't work.

Ok, you ask, what if the information is inherently boring and cannot be made interesting?

EXAMPLES

The same thing can be done with any of your data collection – find the interest factor. What needs to be recorded?

(have a go at the answers for yourself – and remember that comment on this or any aspect of this article is much welcomed on our discussion website at **www.amqi.com**)

How would you deal with the following? Road seal condition, Pavement condition, Pipe diameter, Material , Length, Year Installed, location, depth, soil type, Hydraulic condition rating, fire flow capacity and leak & break records. Unit construction cost for new and Rehabilitated pipes?

Which ones can be (a) automated? (e.g. road condition recorded by machine?) Which can be costless spin-offs from another system (e.g. unit costs from the accounts section?) And which can be managed by intelligent involvement ? (e.g. leak and break records—especially if the technicians have previous records for such leaks and breaks for their region on a hand-held computer that they can refer to.) Remember, assign the people most likely to benefit from the data work or, failing that, generate interest in your data collectors by involving them in the discoveries. For students, you could ask for an analysis of the data collected to be written up and then publish it and circulate it around your unit. It may cost you an extra day or two but it would be worth it.

REFINING YOUR MODEL OUTCOMES

Are the first model outcomes a 'worst case scenario'?

Another interesting comment was the following. (I had argued that the renewal forecasts produced by your model could be regarded as a 'worst case' scenario.) This provoked the following comment:

> "In our view, renewal forecasts are not "worse case Scenarios. They reflect future needs based on current operation & maintenance (O&M) practices. Actually, for municipal Infrastructure (Roads, Water and Sewer Systems) the short term forecast (less than 7-10 years) should be the optimal level of expenditure. And long-term forecast can be improved by adopting new approaches, material, improved maintenance practices. The point I am making is that you cannot take your 5-year infrastructure improvement plan to Council and say this is worst possible scenario! Those water or sewer pipes need to be replaced within next 5 years, we can do very little to improve the situation. But we can extend the useful life of newer infrastructure by adopting better maintenance programs."

There IS little that can be done by way of operational asset management to improve the forecasts of required funding in the short term. But there is a lot that can be done by way of "strategic asset management' or better use of information for planning.

Some actions that can be taken to REFINE your initial forecasts include:

- **Doing a condition assessment on that section of your assets that the model says is due for imminent renewal.** In many cases, particularly if this is still the early stages of your asset renewal forecasting, your knowledge of asset condition will be limited. A condition assessment can indicate what really has to be renewed and what can be patched, or even what can be disposed of, thus reducing the need to renew. In this way, the forecast can be reduced to more manageable levels.

- **Re-assessing the cost of renewal or replacement options.** The initial modelling would have used generic costs, but now being able to identify exactly what assets are involved gives you the opportunity to see whether these assets could not, in fact, be renewed in a simpler, more cost effective manner.

- **Refining your assumptions**. This can make major differences to your forecasts for near term renewal. When you do your 'first-cut' models, the idea is to keep the assumptions simple. You may, for example, assume that all roads of a certain type have the same economic life and not take into account the different usage, environmental or climatic conditions that they are subject to. This simplification is appropriate at the first-cut stage. But it is too broad to be used for funding proposals. Now that the model has identified what road segments are involved you can refine your assumptions by recognising that some roads (quiet backstreets) last longer than average, whilst others with higher density or more critical traffic would have shorter lives. While you may not care to use information about the shape of the economic life distribution when you do your 'big picture' model, it certainly pays to add this refinement before you use the model outputs as funding requests. (Remember that the models cannot provide you with answers, they can only suggest where you may look, ie they can provide questions. One question may be "Is this economic life assumption correct for this subset of assets?")

EXAMPLE: How a Road Authority Saved $20m a year by RE-THINKING. Some years ago the Department of Road Traffic in South Australia were using economic lives of 35 years for their country roads. Using this figure in the projections for country road renewal gave such a peak of renewal due in one short period of time that the Department realised that this could not be right. Quite simply, it did not conform to their specialist knowledge of the road network. What the modelling did was to get them to ask the question – Why is this heap of renewal being projected when we really don't think the problem is as serious? This question led them back to improving their understanding of road performance; they carried out research into new road technologies and management techniques which resulted in developing pavement management systems and re-assessing the appropriateness of past accepted road standards. By adopting more appropriate (lower) standards for some of the country roads, the Department reduced the amount of replacement required and postponed the time of peak demand. Specifically, whereas past practice had been to replace roads at around 35 years it is now possible to retain many rural roads past the age of 60 years. The benefits of this for the Department at the time were equivalent to an annual saving of 0.5%, or in excess of $20 million annually.

Coming Next Issue

What is a VS? - a vicious sandfly? A Venice sunset, or as Stephen Howe of Boroondara suggested, something entirely mythical like a "Victorian Summer"?

In the next issue all will be revealed. It is my most ambitious and worthwhile asset management venture to date - so look for it in Issue 84

And remember

YOUR comments are much welcomed on our discussion site at

www.amqi.com

Or, if you prefer

Directly to the Editor at info@amqi.com

The link between Benchmarking and Strategic Asset Management?

You may have had similar experiences to our writer. ***We will take up the challenge that this poses in a later issue.***

"As you know our city has a good water asset management system. This year like any other year we needed to give next 10-year budget to Council for approval. Our new senior management thought that preparing our 10-year improvement plan based on comprehensive need analysis and service level expectation is not good enough to convince the council so they asked me to contact a few other city to see what % of water pipes they are replacing so we use the average instead!! I contacted a-few cities their water improvement programs was about 0.4-1% of their system. When I asked how they arrived to that figure. The answer was either who knows or we have done like this for a while. So it is important to have mentality change first. If you have decision makers that think following other towns' program blindly make more sense than doing comprehensive need analysis that is disappointing. You may think these people are very old people , no they are not, actually mostly under 45 and well-educated!"