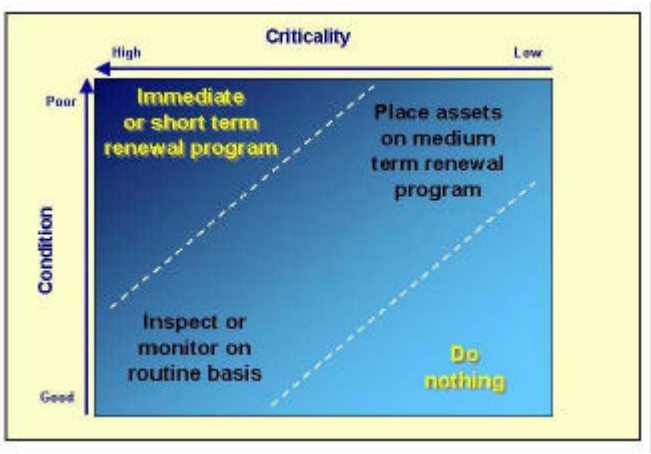
Issue 109, March 7, 2003

AMQ International
Strategic Asset Management

(For Practitioners)

A Simple Risk Assessment and Criticality Rating Tool



Simple techniques that work! The world needs more of them. In this issue Max Anderson of MWH presents a simple technique used to formulate a 20-year rehabilitation program for water supply and sewerage pipelines. The same principles can be applied to non-pipeline assets.

There are more complicated risk assessment models around and for those who have the need, the data, and the analytical know-how to make full use of them, they are the way to go.

But for **small to medium sized** organisations and those **just starting** in the asset management, risk assessment and programming business, the MWH Simple Risk Assessment and Criticality Rating Tool is not only a good start – but it can develop as you do, adding extra layers of refinement to the calculations while retaining the basic approach. See pages 454-459.

The MWH templates for assessing risk and criticality will be found on the Virtual Asset Management Community Website (see the announcement of the new "Tools and Templates" resource on the back page of this issue)

Researched and written by Dr Penny Burns, AMQ International.
Published fortnightly. Subscription, Comment, or Inquiries to

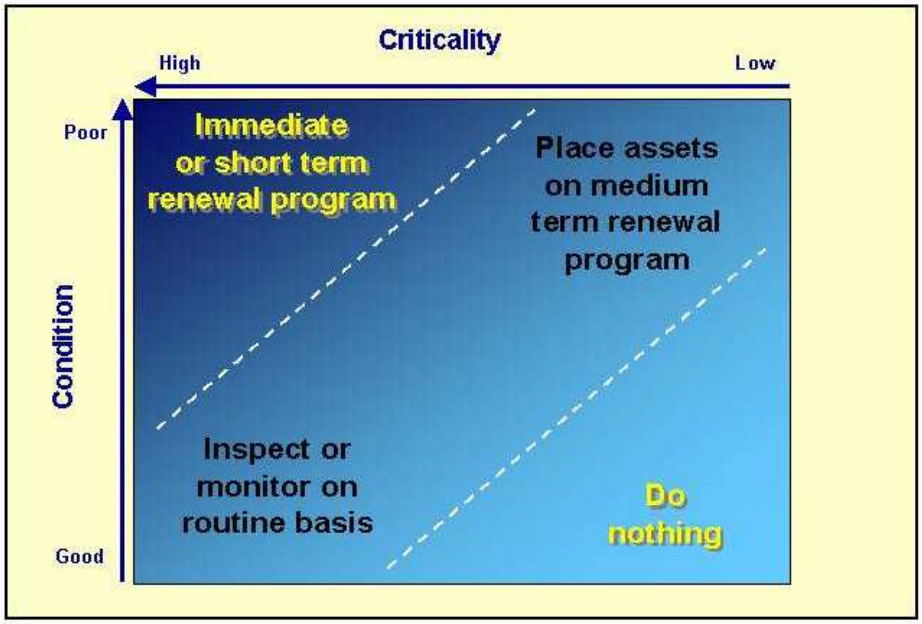
AMQ Intenational
PO Box 75 Salisbury South Australia
Tel: 618 8281 5795

A Simple Risk Assessment and Criticality Rating Tool

Max Anderson, MWH Global,
max.j.anderson@au.mwhglobal.com

Risk Management

The simple risk management model shown below was applied to developing a 20-year capital works rehabilitation program for the Bega Valley Shire's assets.



Risk Management Using Condition and Criticality

The important aspect of the matrix is that condition or the likelihood of failure uses criteria completely separate from the criteria for assessing criticality or the consequences of failure. The combination of the two, presents the assessment of risk. Assets of high criticality need to be managed through a process of monitoring, inspecting or rehabilitation, often at a time well in advance of their predicted failure. Assets with a low consequence of failure can be managed through a process of monitoring with rehabilitation only when levels of service deteriorate below target levels.

The management of assessed risk for each asset component is assisted by applying the decision rules once the asset is categorised by condition and criticality. The table on the following page provides the rules developed for Bega Valley Shire's pipeline assets.

The applied decision rules are the means to control asset performance and the levels of service. The management of pipelines failures such as collapses and bursts, and pipeline serviceability problems such as chokes, is managed independently by each water authority. Decision rules can be varied to deliver higher or lower levels of service.

The lovely Bega Valley

The Assessment and Verification of Pipeline Condition

A two step process was applied to assessing the condition of all the water supply and sewerage pipelines across the Shire. The first step was to apply a coarse condition grade. The subsequent stage used historical pipeline performance to refine the condition grade.

Asset Rehabilitation Decision Matrix

Condition Grade	Criticality		
	A	B	C
5 **< 1 year**	Rehabilitate within 1 year	Rehabilitate within 3 years	Rehabilitate from 5 – 10 years
4 **1 – 5 years**	Rehabilitate within 3 years	Rehabilitate from 5 - 10 years	Rehabilitate within 20 Years
3 **5 - 20 years**	Rehabilitate from 5 - 10 years	Rehabilitate within 20 years	Do Nothing
2 **20 - 50 years**	Rehabilitate within 20 years	Do Nothing	Do Nothing
1 **> 50 years**	Do Nothing	Do Nothing	Do Nothing

A Reminder & An Opportunity

Condition and Criticality Templates are available at **www.amgi.com** - just go to our "Resources" Section.

And Max Anderson will be happy to answer questions on the design and application of this condition/criticality matrix on the **Discussion Forums** at **www.amgi.com**

Coarse Condition Grading

The five condition grades shown in the above table were assigned to each pipeline (asset component section) according to the estimated time or residual life to the first or next failure. The coarse condition grade was determined by the differentiation of the pipelines into their function of water or sewer, by their year of pipe laying, by the material of the pipe and, where possible, by the pipe size. The coarse condition grade did not consider operating pressures or ground types.

In most cases, the grading value assigned was based on industry knowledge about the performance of certain pipe materials such as concrete, AC and cast iron.

The analysis of performance by category of pipeline did provide some verification of the assigned coarse condition grades. In particular, there were enough failure records on AC water mains to derive a trend in the performance of these pipelines.

Taking that subsection of the asset base of 100 mm diameter AC water mains that had experienced at least one failure and looking at the median period of time to first failure, then allowing for the creep in this age over time as more of the asset class fail, a 50 year median life was adopted for this class.

Under the guidelines adopted for coarse condition grading, all pre 1951, 100 mm diameter AC water mains were assigned a condition grading of 5 indicating a theoretical residual life of less than 1 year. Post 1950, 100 mm AC mains laid to 1960 were assigned a coarse condition grade of 4 indicating a number would fail within five years.

Other categories such as concrete sewers have an expected life of between 60 and 100 years based on studies by the Urban Water Research Association Australia (Research Report No. 17)

With collated industry knowledge and more understanding of failure mechanisms, the coarse condition grading for different categories will improve.

Non-Pipeline Assets

The same approach can be taken to Non-Pipeline Assets

Example of Coarse Condition Grading of Non-Pipeline Assets

Grade	Description
1	Near as new condition with no defects. Asset is fully serviceable.
2	Superficial deterioration. Minor issue with reliability. Minor maintenance only is required.
3	Significant deterioration. Assets are operational but display efficiency deficiencies. Routine maintenance and for refurbishment is required.
4	Major or serious deterioration is evident. Asset is not operating and major problems are imminent. Major maintenance or rehabilitation is required.
5	Asset has failed, is about to fail or has stopped working. The asset is unserviceable. Asset replacement or renewal is required immediately or within 12 months.

Refined Condition Grading

To further refine the coarse condition grade applied to individual sewer and water mains, the available historical knowledge or asset performance over time was applied. (For example: use of Burst Records to refine water pipe condition assessments or the use of sewer chokes Maintenance Records to refine condition of sewer pipeline assessments.)

The use of CCTV to help refine the condition of sewer pipelines was also considered.

The choice of the number of incidents necessary to change the pipe's condition grade is subjective. However, they do reflect a course of action by an Authority to rehabilitate its pipeline assets as performance deteriorates.

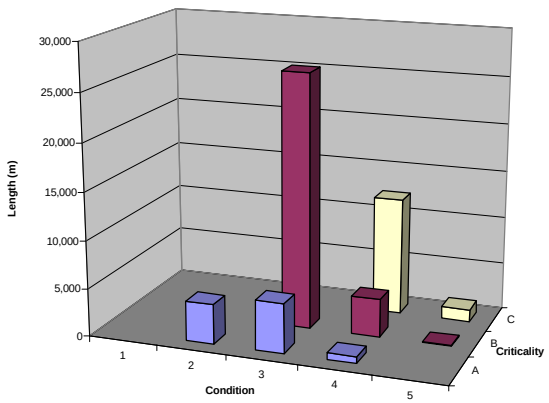
The relationship between scheduled and unscheduled maintenance, service levels and sustainable maintenance management will influence the refined grade criteria over time.

Condition AND Criticality

However, rehabilitation decisions are not made on the basis of condition alone. It is also necessary to consider how critical the assets are to the overall performance of the business.

The aim is to be able to do a two-way analysis of need – by condition and criticality, as illustrated in the picture below.

Sewer Main Renewals –
Condition & Criticality Classification by Length



Criticality Rating

This general approach can be applied to pipeline or non-pipeline assets

Criticality is defined by the consequences that will occur if an asset or asset component fails. It is the assessment of how important an asset component or an asset facility is to the safe operation of water and sewerage services. The criticality rating is valuable because of its consistency of application across all asset classes.

For example, the following criteria was applied in the case of the Bega Valley Shire Assets assessment

Criteria Applied to Assessing Criticality

1. Disruption to Customers

- N/A
- <20
- Up to 100
- Up to 1000
- > 1000

1. Risk to Public Health (including employees)

- Nil
- Remote
- Single Injury
- Multiple Injury

4. Difficulty of Repair

- <1/2 day
- < 1 day
- 1-3 days
- > 3 days

2. Type of Customers

- N/A
- Council Staff
- Residential
- Commercial
- Industrial
- High Risk

4. Environmental Impact

- Nil
- Minor
- Moderate
- Extreme

5. Cost Of Repair

- < $1k
- $1 – $5k
- $5 – $25k
- > $ 25k

Criticality Criteria and Comparative Severity Weightings

Criteria Category	Severity	Score	Weighting	Point Score
Environmental Impact	Nil Minor Moderate Extreme	0 4 6 10	5 5 5 5	0 20 30 50
Type of customer	Not Affected Council Staff Residential Industrial Commercial High Risk	0 2 3 5 7 10	4 4 4 4 4 4	0 8 12 20 28 40
Disruption to customers	None < 20 Up to 100 Up to 1000 > 1000	0 2 5 8 10	4 4 4 4 4	0 8 20 32 40
Risk to Public Health and Safety	Nil Remote Single Injury Multiple Injury	0 4 6 10	3 3 3 3	0 12 18 30
Difficulty of Repair	< ½ day < 1 day 1-3 days > 3 days	4 6 8 10	2 2 2 2	8 12 16 20
Cost of Repair	< $1000 $1k to $5k $5k to $25k > $25k	4 6 8 10	2 2 2 2	8 12 16 20

Through a process of testing and checking with the field assessment staff, the point scoring is refined to finalise the criticality rating as shown below

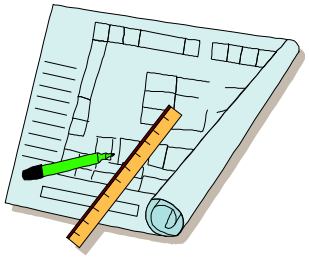
Conversion of Criticality Score to Rating

Criticality	Score	Level	Description
A	> 120 pts	High	Asset components considered so important that contingency plans in the event of their failure must be in place to avoid unacceptable loss of service.
B	101 – 120 pts	Medium	Asset components that are important to the effective day to day operation of the system where redundancy or contingency should be available for restoration of service within a reasonable time.
C	< 100 pts	Low	Asset components which can fail without affecting the operation and service and where repairs or renewal can be realistically deferred.

NEW !

at Virtual Asset Management Community Website, www.amqi.com

Tools and Templates



Templates

Save yourselves months of work developing things from scratch! The VAMC website now has a range of risk and criticality templates (supplied by MWH) and many asset management plan templates and guidelines (supplied by Cardno-MBK and GHD).

Thanks to the generosity of these leading companies you can

Adopt! Adapt! -and Recycle! –

when you have improved on these basic templates, play fair and send back your value-adding versions to help others on their way. All templates acknowledge their contributors!)

Tools

You can also access simple introductions and case study illustrations of asset management related tools, such as process mapping, cause and effect diagrams and benchmarking, to name a few of the 20 or so links now available.

Where to find the tools and templates?

Go to **"Resources"** in the Virtual Asset Management Community Site.

www.amqi.com