



# THE RIDDLE OF PIPES, PACP® AND REMAINING USEFUL LIFE

By NASSCO TAC Chair Christopher Garrett, P.E., Brown and Caldwell

NASSCO's Technical Advisory Council (TAC) has been fielding a number of questions recently about defining Remaining Useful Life (RUL) of gravity pipe assets based solely on grades per the Pipeline Assessment Certification Program (PACP). This question is not without merit, and PACP has responsibility for the confusion. To clear the air and provide guidance on the issue, the TAC will be authoring a series of articles that address the different facets of this question: What is the relationship between PACP and RUL? As an introduction to the topic, this article examines the relationship and the current recommendation for prioritizing assets for inspections and renewal.

Since its introduction by NASSCO in 2002, PACP has continuously improved its coding, grading and analysis of captured information to promote a fairly objective standard that tracks system condition over time. This continuous improvement process included the introduction of an Asset Management protocol in Version 7 (May 2015) for defining criticality as Consequence of Failure (CoF) and Likelihood of Failure (LoF). These are asset management parameters that define a RUL corollary based on risk. Consequently, the short answer to the PACP vs RUL question is that there is no measurable direct relationship; however, NASSCO recommends an asset management strategy that is documented in Appendix D of the PACP manual.

Some of the confusion for users may relate back to PACP manual versions prior to Version 6 (2010). These earlier versions presented a guideline relationship between PACP grades and RUL under the condition grading system discussion. A qualifier was included in the discussion that the mechanisms and rate of pipe deterioration were dependent on local conditions, and that the guidelines needed verification by research. The guidelines are summarized in the following table.

## PACP Observation Descriptions Prior to Version 6 (2010)

GRADE	DESCRIPTION	DEFINITION
5	Immediate Attention	Defects requiring immediate attention <b>RUL: Pipe has failed or will likely fail within the next 5 years</b>
4	Poor	Severe defects that will become Grade 5 defects within the foreseeable future <b>RUL: Pipe will probably fail in 5 to 10 years</b>
3	Fair	Moderate defects that will continue to deteriorate <b>RUL: Pipe may fail in 10 to 20 years</b>
2	Good	Defects that have not begun to deteriorate <b>RUL: Pipe unlikely to fail for at least 20 years</b>
1	Excellent	Minor defects – <b>RUL: Failure unlikely in the foreseeable future</b>

Adding to the confusion, the guidelines were introduced as a starting point for vetting a standard of care with expectation of continuous improvement as PACP matured; however, its use as a cited source without vetting local conditions has created a credibility concern. In addition, near-term renewal strategies were based on querying Grade 4 and 5 observations without broader context. These unintended consequences prompted a revision from NASSCO.

With the revised grade definitions, NASSCO has been explicit in stating that PACP codes and grades only consider internal pipe observations, and that other factors such as pipe material, depth, soils, and surface conditions also contribute to assessing pipe longevity, as those factors are not included in PACP grade definitions. Likewise, PACP alone as a LoF indicator is inadequate for determining the best renewal option for a pipe asset, as pipe characteristics, resiliency to extreme weather and other CoF criteria often have significant impact on these renewal decisions. Therefore, the PACP Condition Grading System should be used only as a tool for screening pipe segment inspections for severity of defects and one of many considerations for capital and maintenance improvement program decisions. The current guidelines are summarized in the following table:

## Current PACP Observation Descriptions

GRADE	DESCRIPTION	
5	Most Significant Defect Grade	Remaining Useful Life Not Defined for Any PACP Grade
4	Significant Defect Grade	
3	Moderate Defect Grade	
2	Minor to Moderate Defect Grade	
1	Minor Defect Grade	

Ultimately the goal for PACP is to be an integral part of determining RUL. Without anecdotal and research information that relates defect severity grades to RUL or mean time before failure, the relationship will be heavily reliant on CoF with PACP as a LoF benchmark of condition over time. Once we have better documentation to develop decay curves for gravity pipe assets (wastewater and non-wastewater applications), the application of deterioration factors against a pre-determined new pipe expected life expectancy can be the new standard of care for RUL. Until then, look for the next NASSCO Tech Tip from the TAC on this subject. **N**

**TECH TIPS IS A BI-MONTHLY ARTICLE ON TRENDS, BEST PRACTICES AND INDUSTRY ADVICE FROM NASSCO'S TRENCHLESS TECHNOLOGY MEMBERSHIP PROFESSIONALS**

Follow us on social media or visit [nassco.org](http://nassco.org)

