



REMR Technical Note OM-MS-1.13

REMR Management System for Roller Dam Gates

Purpose

To provide information about the REMR Management System for roller dam gates.

Background

The U.S. Army Corps of Engineers has a large inventory of roller dam gates that were designed and constructed at navigation and power dam facilities. Being able to rely on roller dam gates as an operating component to maintain the upper pool and as a flood-control device is critical to navigation along entire stretches of river. To aid in the planning and budgeting for maintenance and rehabilitation of these aging facilities, a series of REMR Management Systems are being developed. These computerized maintenance management systems help provide a more effective means of monitoring facility conditions. (See REMR Technical Note OM-MS-1.1 (U.S. Army Engineer Waterways Experiment Station 1998a)).

Overview

A REMR Management System has been developed for roller dam gates. Like previous REMR Management Systems, this one is a collection of standardized condition inspection and rating procedures and personal computer-based database management. The software produces a variety of reports for work planning and budgeting.

Condition Index Rating

As with other REMR Management Systems, the primary driving element is the condition rating process. The condition ratings follow the standard REMR Condition Index (CI) scale from 0 to 100. As described in REMR Technical Note OM-CI-1.2 (USAEWES 1998b), the CI is used to group structures into three zones. The numbers and zones indicate the relative need to perform REMR work because of deterioration of the functional and structural characteristics of the structure. The CI calculation is based primarily on objective field measurements, with some dependence on subjective observations of problems.

Application of the management system begins with an inspection of a roller dam gate according to standard procedures. A series of critical measurements are made on each gate, each related to one of the distresses in Table 1. The CIs for the individual distresses are combined by a weighted average to give the overall condition of the gate.

Table 1 Roller Dam Gate Distresses	
Distress	
Noise/jump/vibration	Abnormal noise, jumping, or vibration while operating the gate
Vibration with flow	Vibration of gate while water flows under or over it
Torsional misalignment	Twisting of the gate due to torsional forces present under normal operation
Rack deterioration	Deterioration of the rack components and anchorage connections
Rim deterioration	Deterioration of the rim components and connections
Seal/end shield damage	Damage to the side or bottom seals or the end shield
Cracks	Breaks in structural steel components
Dents	Disfiguration of structural steel components
Corrosion/erosion	Loss of steel due to interaction with the environment
Downstream deflection	Flexural deflection of the gate in the downstream direction

Functional CI

The functional CI is based on field measurements and observation of structure defects. It includes both safety and serviceability considerations. These field measurements are related to 10 functional distresses, listed in Table 1. As an example, a torsional misalignment, X , of 152 mm (6 in.) could be measured. If the limiting value of this movement, X_{max} , is 229 mm (9 in.) ($X/X_{max} = 1.7$ mm (0.67 in.)), observation of Figure 1 gives a functional CI near 54. This is a Zone 2 condition in which an economic analysis of different repair alternatives is recommended. A similar procedure is used for the other distresses in Table 1. The CIs for the individual distresses are then combined by a weighted average to give the overall functional condition of the roller dam gate.

Structural Considerations

The effect of structural deterioration on safety is difficult to account for in classic structural analysis techniques and is not easily quantified. Therefore, expert opinion is used to develop rating rules that assess structural condition based on subjective safety requirements. This means that rating rules were developed to

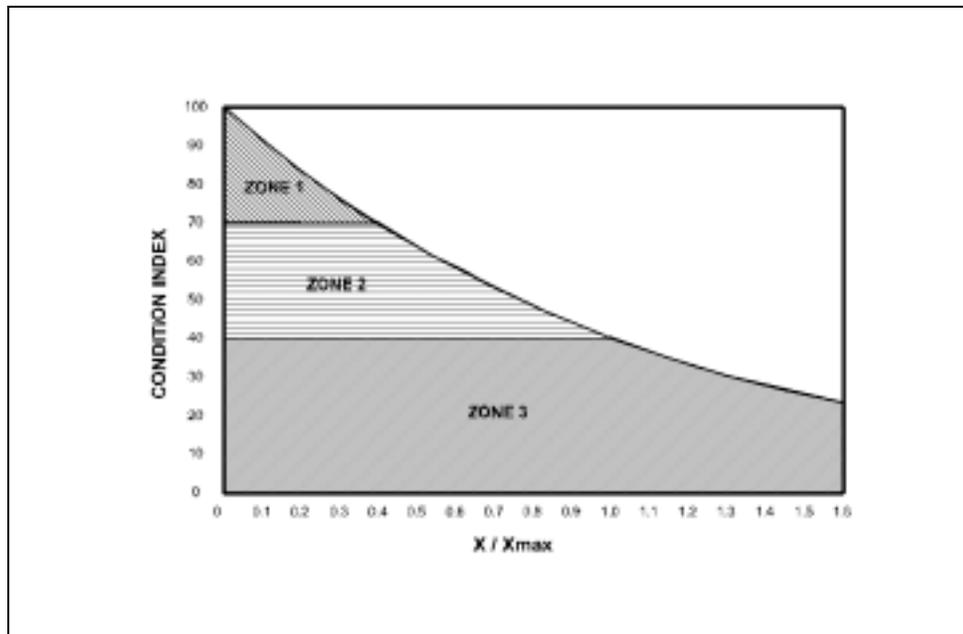


Figure 1. Condition index related to X/X_{max}

simulate an experienced engineer making safety judgments based on inspection notes or data. Certain distresses characterize the structural adequacy and safety more than others. These distresses are more critical to the overall safety of the structure and are called structural distresses.

To alert an engineer to a potential safety problem or to an already existing problem, structural notes are attached to the structural distresses under certain circumstances. Structural notes act as warning flags and appear if the torsional misalignment CI is less than 55, evidence of relative movement between the rack and pier is recorded, teeth are damaged, a crack exists in a critical component, or the downstream deflection CI is less than 40. Structural notes simply state that the given structural distress may indicate that a serious structural problem exists and further investigation is strongly advised.

Benefits/Savings

This computerized REMR Management System provides procedures for performing condition surveys, consistent and quantitative condition assessment, and database management. Combined with economic analyses, these procedures allow efficient maintenance and repair (M&R) budget planning through the evaluation of current conditions. The ultimate goal is to achieve the best possible condition for roller dam gates at any funding level.

The collection of consistent, uniform condition assessment data will allow the generation of typical curves reflecting rates of deterioration. The combination of

historical condition data and expert opinion should allow prediction of changes in the CI based on maintenance history, operating conditions, and applied M&R policies.

Status

The REMR Management System for roller dam gates has been tested and is being implemented throughout the U.S. Army Corps of Engineers. Training sessions for Corps personnel have been completed, and the program will undergo updates and revisions as necessary. A technical report, REMR-OM-18 (Greimann et al. 1997), has been published to document the procedures used. The most current REMR software is available on the Internet at **<http://www.cecer.army.mil/fl/remr/remr.html>**.

References

- Greimann, L., Stecker, J., Kraal, T., and Foltz, S. (1997). A Condition rating procedures for roller dam gates, Technical Report REMR-OM-18, U.S. Army Construction Engineering Research Laboratory, Champaign, IL.
- U.S. Army Engineer Waterways Experiment Station. (1998a). AREMR management systems for civil works structures, REMR Technical Note OM-MS-1.1. *The REMR Notebook*. Vicksburg, MS.
- _____. (1998b). The REMR condition index: condition assessment for maintenance management of civil works facilities, REMR Technical Note OM-CI-1.2. *The REMR Notebook*. Vicksburg, MS.