



Condition Rating

## CONDITION RATING




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Condition Rating

## Why we need a rating system

- A rating system provides:
  - a numerical representation of the condition of bridge elements and inspection categories.
  - a uniform method for describing the condition and functionality of an element
- The ratings can be used to:
  - flag safety related problems
  - identify elements in poor condition
  - assign priorities to repair, maintenance, etc
  - justify budget proposals
  - asses the health of the system
  - measure rates of deterioration to
    - properly time remedial work
    - identify premature failures
  - monitor performance of new materials or practices
  - Allow for various sorting of the numeric values




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## Types of ratings

- Condition ratings (elements)
- General ratings (summarizes respective sections)
- Structural Condition Rating (overall rating of the structure's structural condition in %)
- Sufficiency Rating (overall rating of structure sufficiency in %)
- Load rating




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## Rating System features

- Must rate
  - the individual elements of the structure
    - girders, railing, etc.
  - the major components
    - approach roads, superstructure, substructure, etc.
  - the overall condition of the structure
    - Sufficiency and structural ratings



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## Rating System features

- Identify and flag safety concerns
- Provide measure of condition
- Identify maintenance requirements

## Rating System features

- Logical
- Simple to understand and to use
- Usable in an electronic system
  - numeric
  - easy to input
  - low storage requirement
  - sortable
- Easy to use in the field
  - visual - i.e., rate what you see

## Rating System features

- Not based on
  - Maintenance budgets
  - Crew or contractor availability
  - Standards


## Rating System features

- Rating is a measure of:
  - Functionality
  - Condition


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## Functionality

- The ability of an element to perform as originally designed
- Not measured according to today's standards
- Examples:
  - New timber railing
  - Rotten Timber cap




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## Condition

- The existing condition of the element taking into account any deterioration from the original new condition




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## Rating system

	<u>Rating</u>	<u>Description</u>
	9	----- Very Good (New)
	8	-----
3	7	----- Good
	6	-----
2	5	----- Adequate (fair)
	4	-----
1	3	----- Poor
	2	-----
	1	----- Immediate action
		-----




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## Rating system

- Based on a 1 to 9 numeric system
- Has special characters to denote
  - elements not applicable to a specific structure (X)
  - elements not sufficiently accessible for an adequate visual inspection (N)
- Measures functionality and condition of component



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## Rating system

- The element's current condition and functionality is compared to a range of defined values for
  - ratings
  - a condition
  - that rating is intended to mean
- Table 1.2 in Inspection Manual (page 1-9)
- With this course and field training, inspectors are able to rate elements within "1" point.
- Experience and periodic ongoing training after certification ensures consistency

## Rating system

- Very Good to Good (9 to 7) range

RATING	DESCRIPTION	COMMENTARY
9	Very good.	<ul style="list-style-type: none"> <li>• New condition.</li> <li>• No repairs in foreseeable future.</li> </ul>
8		<ul style="list-style-type: none"> <li>• Almost new condition.</li> <li>• No repairs required in foreseeable future.</li> </ul>
7	Good.	<ul style="list-style-type: none"> <li>• Could be upgraded to new condition with very little effort</li> <li>• No repairs necessary at this time.</li> </ul>

## Rating system

- Adequate (6 to 4) range

RATING	DESCRIPTION	COMMENTARY
6		<ul style="list-style-type: none"> <li>• Generally good condition.</li> <li>• Functioning as designed with no signs of distress or deterioration.</li> <li>• No repairs necessary at this time.</li> </ul>
5	Adequate.	<ul style="list-style-type: none"> <li>• Acceptable condition and functioning as intended.</li> <li>• No repairs necessary at this time.</li> </ul>
4		<ul style="list-style-type: none"> <li>• Below minimum acceptable condition.</li> <li>• Low priority for repairs.</li> </ul>

## Rating system

- Poor to Immediate Action (3 to 1) range

RATING	DESCRIPTION	COMMENTARY
3	Poor	<ul style="list-style-type: none"> <li>• Presence of distress or deterioration.</li> <li>• Not functioning as intended.</li> <li>• Need for replacement, repair, and/or signing.</li> </ul>
2		<ul style="list-style-type: none"> <li>• May require continued observation until work is completed.</li> <li>• High priority for replacement, repair, and/or signing.</li> </ul>
1	Immediate Action	<ul style="list-style-type: none"> <li>• Danger of collapse and/or danger to users.</li> <li>• Bridge closure, replacement, repair, and/or signing required as soon as possible.</li> </ul>

## Rating system

- Special Ratings:

RATING	DESCRIPTION	COMMENTARY
N	Not Accessible	• Element cannot be visually inspected.
X	Not Accessible	• Element not applicable to this bridge.

## Maintenance Priority

- **4 is low priority for repair.**
  - Repair is added to list of more immediate repairs or if the bridge is to be rehabilitated.
- **3 is medium priority, repair before next inspection.**
  - Next inspection date may be on a shortened inspection cycle due to critical nature of element.
- **2 is high priority, repair within next 3 to 6 months.**
  - Reduce inspection cycle to end of intended repair date.
- **1 is immediate action.**
  - Follow-up is strongly recommended.

## Rating Guidelines

- Rate the worst element
- See enough of the element to assign a rating
- Rating must be given for elements partly visible but what is visible is 4 or less.
- Blank ratings are not allowed
- If an element is not applicable but is required:
  - rate element X
  - provide comment in Explanation of Condition
  - provide maintenance recommendation

## Rating Guidelines

- If an element is not constructed according to design or standards rate 4 or less
- Intended to flag rare and unusual situations that may be significant to the structure
- Does not apply to minor deviations from standard practice

## Temporary Repairs

- Intended to be in place for less than two years
- Do not affect the element rating
- May be difficult to determine if repair is temporary or permanent
- Temporary repair may also be a special feature and require a condition rating
- Examples:
  - flexbeam guardrail strapped over damaged bridgerail
  - pile bent on mudsills

## Permanent Repairs

- Intended to be in place more than two years
- Consider the effect of the repair when assigning a rating
- Complete replacement of element may increase rating to 9
- Simple repair may restore element to an acceptable condition and a rating of 5
- Examples:
  - steel cap replacing timber cap
  - shotcrete repair on culvert seam
  - equivalent timber stringer inserted beside broken stringer
  - steel banding of timber piles

## Rating actions

- Ratings of 4 or less need an explanation of condition.
- Ratings of 3 or less need:
  - an explanation of condition
  - photographs, sketches and measurements as required
  - an accompanying recommendation for
    - maintenance
    - monitoring
    - other appropriate action.
  - Reduced inspection cycle may be warranted
- Take appropriate immediate action condition ratings of 2 or less for critical elements.
  - report to the Regional Bridge Manager including suggested action
  - report to the responsible road authority official including suggested action
  - erect warning signs
  - close bridge
  - Reduce the inspection cycle
  - Suggest follow-up with authorities if extreme hazard.

## Rating actions

- Recommendations for maintenance need
  - a detailed explanation of the recommendation
  - a photo showing damage to be repaired
  - Recommended repair year
  - a list of required maintenance materials showing dimensions and quantities.
    - routine or minor maintenance
    - reasonably obtainable during a Level 1 inspection

## General Rating

- Required for all inspection categories
  - approach road
  - superstructure
  - substructure
  - channel or grade separation
- Provided by the inspector after rating the individual elements in the category
- Ratings are done in accordance with same numerical rating system used for condition rating of elements
- Used to calculate
  - Structural Condition Rating
  - Sufficiency Rating

## General Rating

- Is a reflection of the critical element ratings in the category
- **BUT**
- Is not the average of the ratings of the individual elements
- Must consider the condition of key elements and their impact on the structural integrity and safety of the bridge
  - load carrying members have greater influence than non load carrying members
- General rating cannot be higher than lowest critical rating
- General rating could be lower than lowest critical rating

## General Rating

### Examples:

- A timber cap with a rating of 3 would result in a general rating of 3 for the substructure
- Curbs with a rating of 3 do not impact the general rating for the superstructure to the same degree

## Structural Condition Rating

- A measure of the structural condition of the entire structure
- Single numerical value
- For bridges:
  - The average of the superstructure and substructure General Condition Ratings as a percent of the “as new” rating
- For Culverts:
  - The Barrel General Condition as a percent of the “as new” rating

$$\text{Structural Condition Rating} = \frac{(\text{Superstructure Rating} + \text{Substructure Rating})}{18} \times 100\%$$

$$\text{Structural Condition Rating} = \frac{(\text{Barrel General Condition Rating})}{9} \times 100\%$$

## Sufficiency Rating

- The sufficiency rating is a single numerical value
- It indicates the adequacy of a structure relative to the acceptable standard of a new structure at the same location

## Sufficiency Rating - Bridges

- Calculated automatically by the computer from inspection and inventory data then printed on the last page of the form.
- Uses 4 major impact categories
  - Structural Condition
  - Load Carrying Capacity (strength)
  - Operational and Safety
  - Traffic Reduction Factor
- Major categories are further divided into a total of 10 categories.
- Categories weighted in accordance with their relative importance.

## Sufficiency Rating Calculation Bridges (page 12.1)

A. Structural Condition (35%)	Superstructure (20%)
	Substructure (15%)
B. Strength (20%)	Load Rating (20%)
C. Operational & Safety (45%)	Approach Road (12%)
	Bridge Width (10%)
	Vertical Clearance (8%)
	Channel Adequacy (10%)
	Safety Features (5%)
D. Traffic Reduction Factors (15%)	Traffic Count (5%)
	Detour Length (10%)
<b>Sufficiency Rating = A + B + C - D</b>	

## Sufficiency Rating - Culverts


- Calculated automatically by the computer from inspection and inventory data then printed on the last page of the form.
- Uses 3 major impact categories
  - Structural Condition
  - Operational Features
  - Reduction Factor
- Major categories are further divided into a total of 10 categories.
- Categories weighted in accordance with their relative importance.




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### Sufficiency Rating Calculation Culverts (page 14-1)

A. Structural Condition (55%)	Upstream End (7.5%)
	Barrel Section (40%)
	Downstream End (7.5%)
B. Operational Features (45%)	Approach Road (15%)
	Channel Section (5%)
	Waterway Adequacy (25%)
C. Traffic Reduction Factors (15%)	Traffic Count (5%)
	Detour Length (5%)
	Vertical Clearance (5%)
	Environmental (10%)
<b>Sufficiency Rating = A + B - C</b>	




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## Sufficiency Rating Descriptions

- Ranges from 0% to 100 %
- 100% represents a bridge that is in excellent condition and provides the best possible level of service.
- 50% represents a bridge that is in adequate condition and provides an acceptable level of service.
- Lower ratings indicate a bridge that is in poor condition and/or provides a below minimum level of service.
- Lower ratings also indicate need for replacement, rehabilitation or maintenance.




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## Sufficiency Rating Uses

- Provides a rational basis for bridge management.
- Evaluates the present adequacy to serve public needs.
- Identifies structures with deficiencies which can be corrected at minimum cost to provide acceptable levels of service.
- Provides data to evaluate the cost of upgrading a structure to provide an acceptable level of service.




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## Sufficiency Rating Cautions

- Should not be used as the only basis for bridge management decisions.
- Does not include or identify:
  - cost/benefit analysis
  - social factors
  - economic factors
  - environmental factors
  - alternatives
  - optimal solutions
  - timing constraints
  - budgetary constraints



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