

CONDITION RATING

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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



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Why we need a rating system (cont'd)

- The ratings can be used to:
 - flag safety-related problems
 - identify elements in poor condition
 - assign priorities to repair, maintenance, etc
 - justify budget proposals
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- 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
- provide insight if structure components are functioning as designed

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Types of ratings

- Condition ratings (elements)
- General ratings (summarizes governing elements condition/functionality or hazards of 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, bearings, bridle rail, etc.
 - the major components
 - approach roads, superstructure, substructure, barrel 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 and functionality of the structure components
- Identify maintenance requirements

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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



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Rating System Features

- Not based on
 - Maintenance budgets
 - Crew or contractor availability
 - Standards
- Rating is a measure of:
 - **Condition**
 - **Functionality**



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Condition

- Existing condition of the element taking into account any deterioration from the original new conditions.

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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Rating System

Rating Descriptions

1	}	9	Very Good (New)
		8	
		7	Good
2	}	6	
		5	Adequate
		4	Fair
3	}	3	Poor
		2	Hazardous
		1	Immediate Action

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Rating Systems

- 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 **condition** and **functionality** of components.

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Rating Systems

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

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Rating Systems

- Very Good to Good (9 to 7) range

Rating	Description	Commentary
9	Very good	<ul style="list-style-type: none"> • New conditions • No repairs in foreseeable future
8		<ul style="list-style-type: none"> • Almost new conditions • No repairs required in foreseeable future
7	Good	<ul style="list-style-type: none"> • Could be upgraded to new condition with very little effort • Repairs not required currently or expected in near future

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Rating Systems

- Adequate or Slightly Above or Below Adequate (6 to 4) range

Rating	Description	Commentary
6		<ul style="list-style-type: none"> • Generally good condition • Functioning as designed with no signs of distress or deterioration • No repairs currently required
5	Adequate	<ul style="list-style-type: none"> • Acceptable conditions and functioning as intended. • No repairs currently required
4	Fair	<ul style="list-style-type: none"> • Below minimum acceptable conditions • Low priority for repairs • Maintenance recommendations are not required • Comment and photograph are required

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Rating Systems

- Poor - Immediate Action (3 to 1) range (comments, photos, recommendations req')

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

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Rating Systems

- Special Ratings:

Rating	Description	Commentary
N	Not Accessible	<ul style="list-style-type: none"> • Element cannot be visually inspected (e.g. snow/gravel covered or deep water)
X	Not Applicable	<ul style="list-style-type: none"> • Element is not applicable to structure (e.g. pier elements on single span bridge, longitudinal seams on CSP culvert)

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Maintenance Priority

- 4 is low priority for repair.
 - Recommendation can be made but is not required.
 - If made, then usually 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.
 - Normally involves a reduced inspection cycle until repaired or replaced.
- 1 is immediate action.
 - Follow-up is required.

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Rating Guidelines

- Rate the worst element
- See enough of the element to assign a rating
- Rating must be given for elements partly visible when visible area/section is **4 or less**.
- If an element is not visible, a rating of **N** is assigned. Comments are provided for all **N** ratings explaining why the element could not be rated (e.g. snow or gravel covered, not accessible due to deep water)
- If an element that was previously rated **3 or less** is rated **N** in a current inspection, a comment is added to indicate/alert the previous rating and date for the next inspector (e.g. "P.R. 3 on May 1, 2023)

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Rating Guidelines

- Blank ratings are not allowed and is reason for rejection of inspection report
- If an element is not applicable but is required:
 - rate element X
 - provide comment in Explanation of Condition
 - provide maintenance recommendation

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Rating Guidelines



- If an element is not constructed according to the original design 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

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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 (e.g. timber struts <2 years in culvert barrel)
- Examples:
 - flexbeam guardrail placed over damaged bridgerail
 - pile bent on mudsills placed in front of rotted timber piles or caps

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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 adequate condition and rating of 5
- Examples:
 - new timber or steel cap replacing rotted timber cap
 - shotcrete repair on culvert seam
 - timber or steel culvert struts in place >2 years
 - timber piles repaired with steel splice

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Rating Actions

- Comments (explanation of condition) - use **ONLY** approved abbreviations
- Ratings of 4 need a comment and a photograph
- Ratings of 3 or less need:
 - A comment explaining
 - photographs, sketches, and measurements as required
 - an accompanying recommendation for
 - maintenance including dimensions and quantities
 - Monitoring (used sparingly and must be measurable)
 - other appropriate action.
 - Reduced inspection cycle may be warranted

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Rating Actions

Take appropriate immediate action for condition ratings of **2 or less** for critical elements or hazardous situations.

- For AT managed structures report to the Regional Bridge Manager and Bridge Preservation Specialist including suggested action within 48 hours of inspection.

OR

- For LRA managed structures report to the responsible road authority official including suggested action within 48 hours of inspection
- Reduce the inspection cycle
- Possible warning signs/barricades
- Possible partial closure or posted loading
- Phone authorities within 12 hours if critical element rated 1 or imminent failure

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Rating Actions

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

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General Rating

- Required for all inspection categories
 - approach road
 - bridge superstructure or culvert barrel
 - bridge substructure or culvert U/S and D/S ends
 - 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

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General Rating

- Is a reflection of critical or hazardous 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
 - hazardous situations may have greater influence than load carrying elements
- General rating cannot be higher than lowest critical or hazardous rating
- General rating could be lower than lowest critical rating
 - e.g., Girders rated 3, but ponding on deck causing hazardous situation and Deck Drainage rated 2. Superstructure General Rating = 2

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General Rating

Examples:

- Timber cap or pile rated 3 would result in a General Rating of 3 for the Substructure.
- Curb rated 3 would not impact General Rating of Superstructure but Curb rated 2 due to hazard (severe loss of support under BR post) would.
- Paint/Coating rated 2 not considered hazardous and no affect on Gen Rating

Refer to Section 1.10 in the BIM Manual, and at end of each Manual Section for additional guidance in assigning General Ratings.

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Structural Conditions Rating

- A measure of the structural condition of the entire structure
- Single numerical value expressed in %
- For bridges:
 - The sum of the Superstructure and Substructure General Condition Ratings as a percent of the maximum possible “brand new” ratings

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

For Culverts:

- The Barrel General Condition Rating as a percent of the “as new” rating

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

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Sufficiency Rating

- The sufficiency rating is a single numerical value expressed in %
- Indicates the adequacy of a structure relative to the acceptable standard of a new structure at the same location

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Sufficiency Rating - Bridges

- Calculated automatically by the system 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.

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Sufficiency Rating Calculator	
Bridges (figure 12.1)	
A. Structural Conditions (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 Factor (15%)	Traffic Count (5%)
	Detour Length (10%)
Sufficiency Rating = A + B + C - D	

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Sufficiency Rating - Culverts

- Calculated automatically by the system 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 Calculator

Bridges (figure 14.1)

A. Structural Conditions (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%)
Sufficiency Rating = A + B - C	

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Sufficiency Rating Description

- 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 that 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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Structural Condition & Sufficiency Rating

- Refer to Chapter 12 for Bridge Structural Condition and Sufficiency Rating information.
- Refer to Chapter 14 for Culvert Structural Condition and Sufficiency Rating information

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Questions?



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