

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
 - assess 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

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

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

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

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

Condition

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

Rating system

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

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

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

Rating system

- 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 necessary at this time.
5	Adequate.	<ul style="list-style-type: none"> • Acceptable condition and functioning as intended. • No repairs necessary at this time.
4		<ul style="list-style-type: none"> • Below minimum acceptable condition. • Low priority for repairs. • Maintenance recommendation is not required

Rating system

- Poor to Immediate Action (3 to 1) range

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		<ul style="list-style-type: none"> • May require continued observation until work is completed. • 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.

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.**
 - Recommendation is not required
 - If made, then 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 when visible area/section 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 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

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 splice repair 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 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
- Refer to Section 1.10 in the BIM Manual, and also at end of each Manual Section

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 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.

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%)
Sufficiency Rating = A + B + C + D	

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.

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%)
Sufficiency Rating = A + B - C	

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.

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.

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