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

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)
	8	
3	7	Good
	6	
2	5	Adequate (fair)
	4	
1	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.	• New condition. • No repairs in foreseeable future.
8		• Almost new condition. • No repairs required in foreseeable future.
7	Good.	• 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		• Generally good condition. • Functioning as designed with no signs of distress or deterioration. • No repairs necessary at this time.
5	Adequate.	• Acceptable condition and functioning as intended. • No repairs necessary at this time.
4		• Below minimum acceptable condition. • Low priority for repairs.

Rating system

- Poor to Immediate Action (3 to 1) range

RATING	DESCRIPTION	COMMENTARY
3	Poor	• Presence of distress or deterioration. • Not functioning as intended. • Need for replacement, repair, and/or signing.
2		• May require continued observation until work is completed. • High priority for replacement, repair, and/or signing.
1	Immediate Action	• 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 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 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 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

•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

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

  - For Culverts:
  - The Barrel General Condition as a percent of the "as new" rating

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

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

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.

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