AASHTOWare™ BRIDGE MANAGEMENT

Caltrans Updated SNBI Element to Component Rating Converter

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2025 Bridge Management User Group Meeting
Providence, RI | September 9-10, 2025

Disclaimer

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What’s a Converter?

The Converter/Translator converts the element inspection data to a correlated component rating.

It is used to improve consistency between inspectors.

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History of the Converter

- Caltrans has been using a converter/translator since 1997
- Initially used the FHWA translator
- Updated the converter in 2014 and 2016.
- Added the ability for the inspector to override the ratings in 2016.
- Latest update in 2024 for compliance with SNBI

CT NBIS Converter

- Used different weighting for different elements but used consistent percentages for all elements or defects.

Bridges:

Q1=∑:(Quantity_State1 * Element Relative Weight)

Q2=∑:(Quantity_State2 * Element Relative Weight)

Q3=∑:(Quantity_State3 * Element Relative Weight)

Q4=∑:(Quantity_State4 * Element Relative Weight)

Relative Sum=Q1+Q2+Q3+Q4

Condition Sum=(1.0*Q1)+(0.67*Q2)+(0.33*Q3)+(0.0*Q4)

Condition Index= 100* Condition Sum/Relative Sum

The NBI rating value is then pulled from the table below.

Condition Index Min	Condition Index Max	NBI Value
-1	-1	N
81	100	7
45	80.999	5
27	44.999	4
0	26.999	3

The following table puts caps on ratings based on percentage of elements in Condition States 2, 3 and 4.

Maximum NBI Rating	Minimum Condition Index	CS1	CS2	CS3	CS4
7	81		>0%-<20%	>0%-5%	
5	45		>=20%	>5 - <20%	>0%- 5%
4	24			>=20%	>5 - <20%
3	0				>=20%

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Problems with our NBIS Current Converter

Bridge Deck Defects

- Defects have different severity.
- A delamination is not equivalent to a crack

Element Fidelity

- Square Foot
- Linear Foot
- Each

Protective Systems

- State 3 cracking remains after treatment causing protective systems to not influence the bridge rating.

Maximum NBI Rating	Minimum Condition Index	CS1	CS2	CS3	CS4
7	81		>0%-<20%	>0%-5%	
5	45		>=20%	>5 - <20%	>0%- 5%
4	24			>=20%	>5 - <20%
3	0				>=20%

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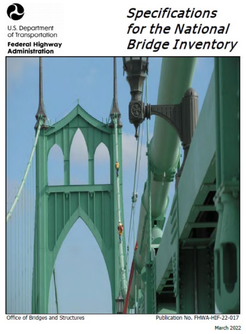

SNBI

The SNBI gives guidance with a direct correlation between the component ratings and the quantity and severity of defects.

Component ratings are defined in Table 20 (Page 240)

Appendix C (Page 331) Defines the Defect Severity

The quantity of defects (Isolated, Some, Widespread) is not specifically defined.

Our converter defines these quantity thresholds.

Table 20. Codes and descriptions for component condition ratings.

Code	Condition	Description
N	NOT APPLICABLE	Component does not exist.
9	EXCELLENT	Isolated inherent defects.
8	VERY GOOD	Some inherent defects.
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	CRITICAL	Major defects; component is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions in order to keep the bridge open.
1	IMMINENT FAILURE	Bridge is closed to traffic due to component condition. Repair or rehabilitation may return the bridge to service.
0	FAILED	Bridge is closed due to component condition, and is beyond corrective action. Replacement is required to restore service.

Table 47. Concrete - defect severity guidance for component condition ratings.

Defect	Minor	Moderate
Delamination, Spalling, Patched Area	Delamination, small spall, or patched area that is sound.	Large spall or patched area that is unsound or showing distress.
Exposed Rebar	Present without measurable section loss.	Present with measurable section loss.
Exposed Prestressing	Present without section loss.	Present with section loss.
Cracking	Unsealed medium width cracks or unsealed medium pattern (map) cracking.	Wide cracks or heavy pattern (map) cracking.
Abrasion, Wear, Scaling	Exposed coarse aggregate, but the aggregate remains secure in the concrete.	Coarse aggregate is loose or has popped out of the concrete matrix.
Efflorescence, Rust Staining	Surface white or leaching with little or no build-up. No rust staining present.	Rust staining or heavy build-up of efflorescence.

New SNBI Converter

- The new converter strives to modernize our converter to the SNBI but also to correct the deficiencies of the existing converter.
  - Defect severity
  - Element Fidelity
  - Protective Systems
- New converter has a 2 different algorithms for Deck and Super, Sub, and Culvert Ratings.
- The Deck Component Rating is calculated in 2 parts.
  - The General Deck Defects
  - The Spalling/Delamination Defect
- Then uses the lowest of the 2 calculations for the Deck Component Rating.

Deck Rating Converter

- 1st, the Allowable Defect Area is calculated.
- Does not allow defects to count in areas of the deck with polyester/methacrylate in State 1.

- Allowable Defects = 100 – (% Prot. Sys. St 1)

  Ex. 90% of the deck area has protective system in St. 1. Allowable area is 10%.

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Deck Rating Converter

Deck General Defect Table				
Min. % Defects	CS1	CS2	CS3	CS4
8	100			
7		0	0	
6		50	1	
5			10	
4			55	0

Deck Delamination Defect Table				
Min. % Delam/Ex. Rebar	CS1	CS2	CS3	CS4
8				
7	100	0		
6		10	0	
5			5	
4			10	0

General Deck Defects	
0%	isolated
10%	some
50/55%	widespread

*Allowable Defect Area only applies to general calculation.

Delamination/Exp. Rebar	
0%	isolated
5%	Some Spalling
10%	Widespread Spalling

Example

- Bridge has 75% of its methacrylate protective system in St.1
- 60% St3 Deck Cracking and 4% St3 Spalling.

- Allowable Defect of 100-75=25%.
- Cracking limited to 25% St3 – General Rating 5.
- 4% St3 Spalling – Delam Rating 6
- Deck Component Rating is 5.

Deck General Defect Table				
Min. % Defects	CS1	CS2	CS3	CS4
8	100			
7		0	0	
6		50	1	
5			10	
4			55	0

Deck Delamination Defect Table				
Min. % Delam/Ex. Rebar	CS1	CS2	CS3	CS4
8				
7	100	0		
6		10	0	
5			5	
4			10	0

Superstructure, Substructure, and Culvert Ratings

- Looks at each element CS's and assigns each element its own rating based on General Defect Thresholds.
- Then takes the lowest element rating for the Super, Sub, or Culvert Rating
- Different percentages for Each and Linear Foot Elements.

Super/Sub/Cul General Defect Table **Each**				
Min. % Defects	CS1	CS2	CS3	CS4
8	100			
7		0	0	
6		50	10	
5			20	
4				0

Super/Sub/Cul General Defect Table **LF**				
Min. % Defects	CS1	CS2	CS3	CS4
8	100			
7		0	0	
6		50	5	
5			10	
4				0

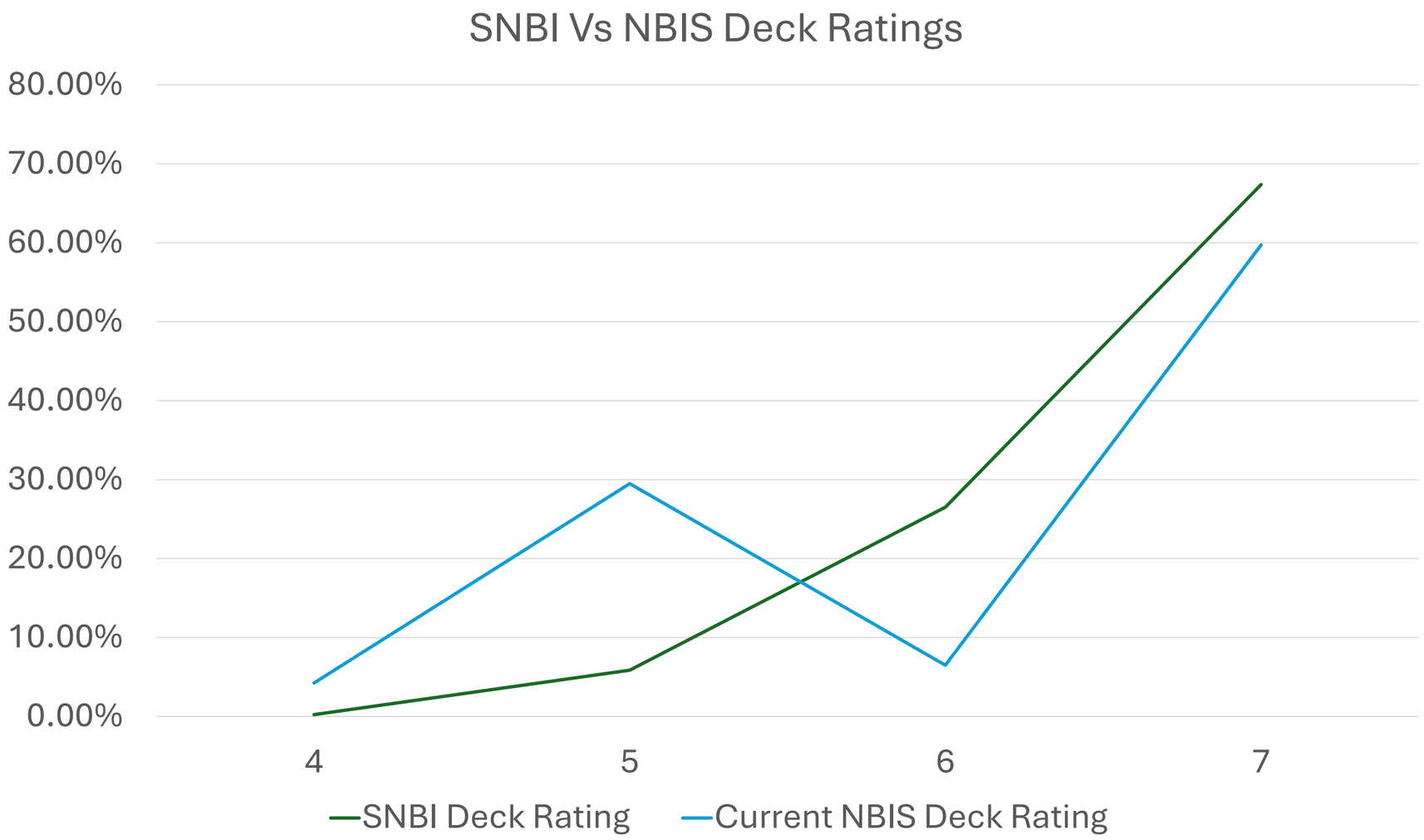
Example

- 50% columns have St. 2 cracking.
- Abutment has 15% of length with a St 3 Crack.
- Columns Rating of 6
- Abutment Rating of 5
- Substructure Component Rating is 5.

Super/Sub/Cul General Defect Table **Each**				
Min. % Defects	CS1	CS2	CS3	CS4
8	100			
7		0	0	
6		50	10	
5			20	
4				0

Super/Sub/Cul General Defect Table **LF**				
Min. % Defects	CS1	CS2	CS3	CS4
8	100			
7		0	0	
6		50	5	
5			10	
4				0

Results


SNBI Vs NBIS Deck Ratings
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
4
5
6
7
SNBI Deck Rating
Current NBIS Deck Rating

Key Takeaways

- Bridge Inspectors are still allowed to override the condition rating if needed.
- Calibrated for California's typical bridge inventory.
- Protective Systems now can improve a bridges condition rating.
- Initiates a defect level analysis rather than element level.
- Helps correct irregularities due to different element quantities (SF, EA, LF).

Questions?