Overview of the 2012 ASBI Durability Survey

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In the fourth edition of the American Segmental Bridge Institute's (ASBI's) *Durability Survey of Segmental Bridges*,[1] released in 2012, the performance of 363 segmental bridges is compared to that of 373,670 bridges built within the same period. The results were favorable, as discussed in this summary.

The study began by pulling the National Bridge Inventory (NBI) data from 2011, which included 604,426 bridge condition ratings throughout the United States. Since durability is a time-dependent function and segmental bridges first debuted in the early 1970s, the 2011 NBI data set was filtered to eliminate all bridges built prior to 1970. The new data set contained 373,670 bridges. To increase the accuracy of the segmental bridge data, the NBI data set was supplemented by inspection data received directly from participating states. Thus, condition ratings were provided for segmental bridges up to 2 years beyond that reported within the filtered NBI data set.

The modified NBI data set was then broken down into two bridge types as defined in the Federal Highways Administration's publication *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*.[2] Based on this breakdown, steel bridges built since 1970 were about 26% of all bridge types. Concrete bridge types make up 71% of the bridges built since 1970, with all other types making up the remaining 3%. Segmental bridges were then identified, separated from the data set for comparison, and supplemented and corrected with data from the ASBI master inventory list. The master list identified over 450 segmental bridges, of which 363 had condition ratings available within the 2011 NBI data set—which represents 0.11% of bridges in the data set (Fig. 1).

With the 2011 NBI data set broken down, an analysis was run on the filtered 2011 data set to identify structurally deficient and functionally obsolete bridges across all bridge types. This revealed that 24% of all bridges in the set were classified as structurally deficient or functionally obsolete, with 11% of bridges in the data set classified as structurally deficient and 13% classified as functionally obsolete. The next task was to identify the percentage of each bridge type represented in the overall 11% structurally deficient number. Steel bridges accounted for 43% of the structurally deficient bridges while, within this same data set, concrete structures (71% of the total bridges built) accounted for only 39% of the deficient bridges (Fig. 2). Timber bridges, while representing only 2.8% of the total bridges built, represent 17.5% of the structurally deficient bridges.

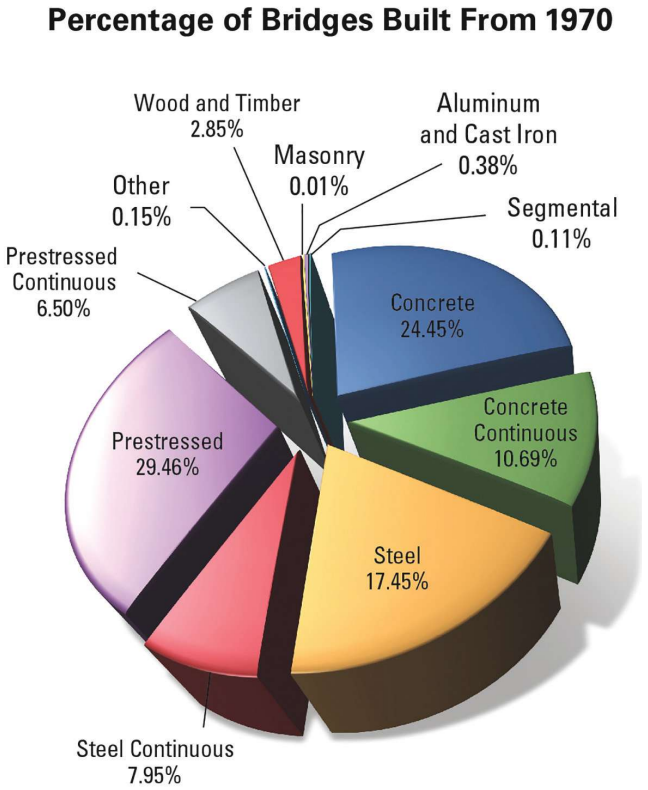

Figure 1. Percentage of bridges by type that were built since 1970.

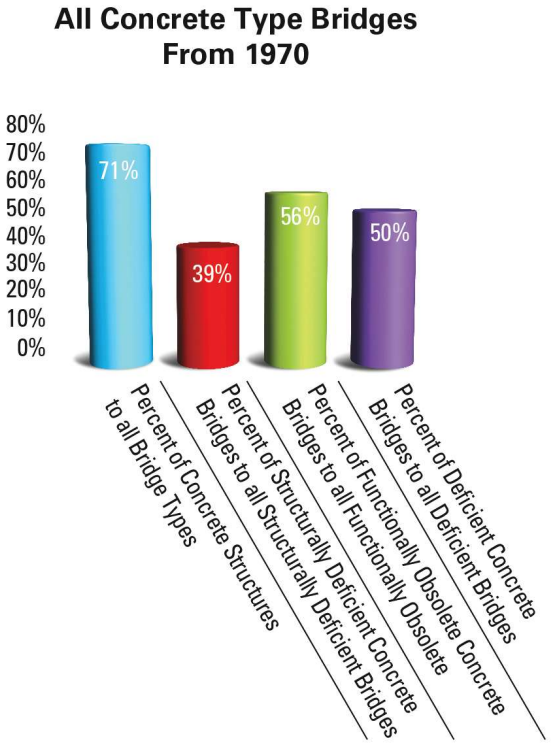

Figure 2. Concrete bridges by type that were built since 1970.

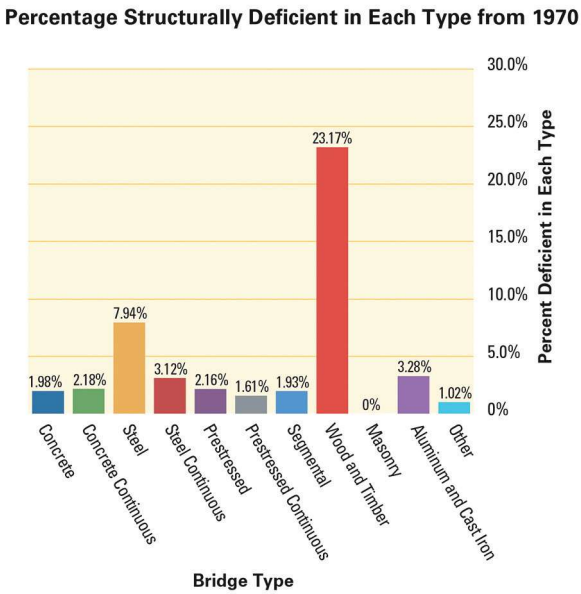

Figure 3. Percentage of bridges that were rated as deficient within each bridge type that were built since 1970.

These results clearly show that, while representing almost three quarters of the bridges built in the representative time frame, concrete bridges only represent slightly more than a third of the structurally deficient structures. Alternatively, steel structures represent a little more than a quarter of the bridges built in this period and represent nearly 45% of the structurally deficient structures. Segmental bridges, while representing only 0.11% of structures, represented merely 0.06% of structurally deficient bridges. The study further identifies comparable ratios for the functionally obsolete and overall deficient structures, with similar results showing superior performance among the concrete structures.

The report further broke down each bridge type as structurally deficient, functionally obsolete, and overall deficient. Figure 3 graphically depicts the percentage of each bridge type that is structurally deficient. To better illustrate this, the figure shows that for the concrete bridge classification built from 1970, 1.98% are classified as structurally deficient. From this chart it can also be seen that 23.17% of wood and timber bridges built from 1970 are structurally deficient. Again, in this analysis, all concrete structure categories outperformed their steel counterparts.

Segmental Bridge Performance

Looking specifically at segmental bridge performance, the report breaks down the 40 years of segmental bridge condition ratings into 5-year increments categorizing the performance averages in this period for superstructure, substructures, and deck (Fig. 4). With this information plotted, trend lines were applied to each of the components. From the slope of the trend lines, a projected service life of over 100 years was extrapolated based on past performances of these components.

In conclusion, the 2012 Durability Report shows that 98% of the segmental bridges have a condition rating of 6—"Satisfactory"—or better, which is consistent with the previous durability studies performed in 1994, 1999, and 2007. Based on their past performance, the service life of segmentally constructed bridges can be extrapolated at over 100 years utilizing slopes of the trend lines taken from the 5-year average declination of the superstructure, substructure, and deck condition ratings. Segmental bridges have also outperformed their bridge "peers" (defined as "bridges built with equal span range, capacity, age, and environmental condition") over the last 40 years. Concrete segmentally constructed bridges are the original accelerated bridge construction method, providing a quick and durable solution along with a best value bridging solution in many applications. Finally, as a byproduct, this report shows the superior performance of concrete structures in the area of durability based on the condition assessments found within the filtered NBI 2011 data set.

Reference

1. Pielstick, Brett H. and Leo Offredi. 2012. *ASBI Durability Survey of Segmental Bridges*. Fourth Edition, American Segmental Bridge Institute (ASBI), Buda, Tex.
2. Federal Highway Administration (FHWA). 1995. *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges.* Report No. FHWA-PD-96-01., FHWA, Washington, D.C.

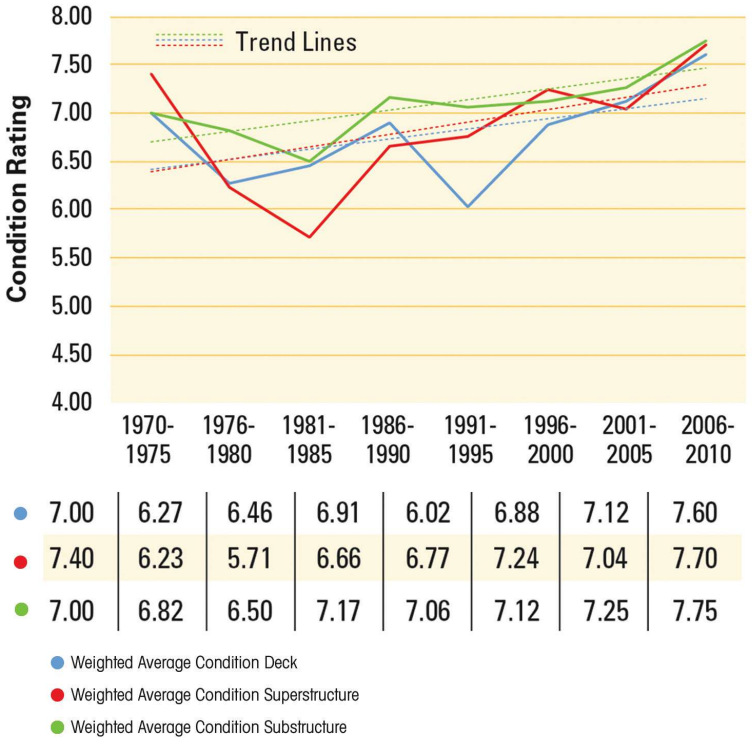

Figure 4. Component condition ratings of segmental bridges with trend lines.