

Systems approach in the inspection of suspension bridges

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over a period of 4 months. The authors were in the team of 11 Registered Professional Engineers and 10 Structural Engineers. The inspection was conducted for the New York State and New York City Departments of Transportation.

As the train tracks are located on the outer portions of the bridge, the eccentric train loads penalize the stiffening trusses and floor systems with torsional effects. During the inspection more

than 1200 defects were recorded and 615 of them were flagged demanding immediate attention. Prompt corrective actions were taken by the New York City Department of Transportation in terms of performing emergency repairs, reviewing the load rating and temporarily closing of one lower roadway lane and two tracks of NYC transit, pending repairs. Some of the major defects are highlighted in the bridge cross-section in Figure 2

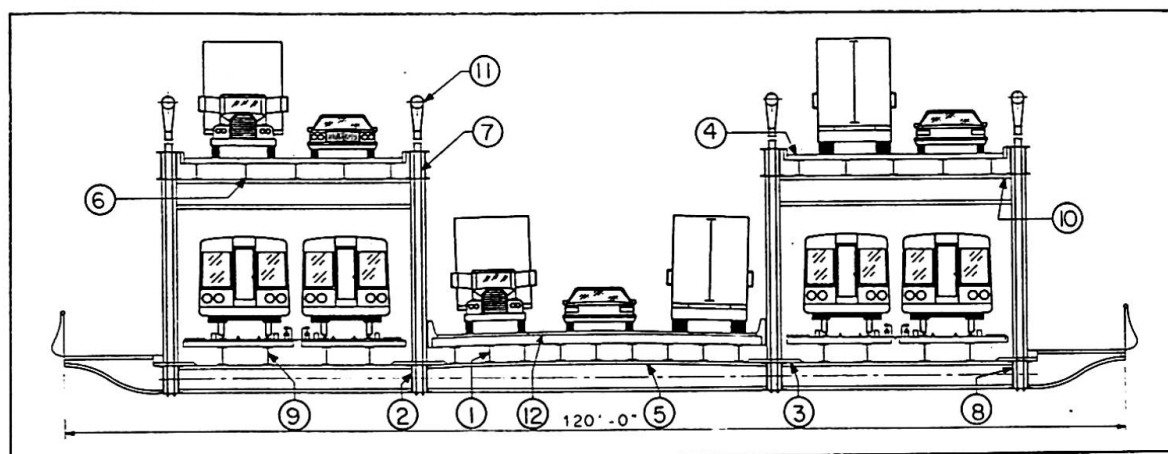


FIGURE 2: CROSS SECTION OF MANHATTAN BRIDGE, NEW YORK - Major Defects Reported

- | | | |
|------------------------|----------------------------|---|
| 1. Cracks in stringers | 5. Corrosion of top flange | 9. Track Stringer Brg.- Displaced/cracked |
| 2. Corrosion | 6. Uplifted Stringer brg. | 10. Cracked floorbeam end |
| 3. Cracked continuity | 7. Suspender wear/angle | 11. Corroded Cable Wrapping at lower saddle |
| 4. Deck defects | 8. Cracked chord splice | 12. Leaky deck joints |

4.0 INSPECTION INFORMATION SYSTEM (IIS)

A system of collecting, preparing and representing a comprehensive database from the data collected in the field became a powerful tool for decision making on issues like traffic limiting, planning for rehabilitation, etc. This database included past and present condition ratings of various elements, classified listings of hazardous conditions demanding immediate action, respective actions taken, etc. New York State Department of Transportation has developed a system of quantitative rating of elements based on the residual capacity and functionality of the element instead of using terms like "Sound", "Fair", "Satisfactory", etc. On a scale of 7 (new condition) to 1 (hazardous condition), a rating of 3 denotes "serious deterioration and not functioning as originally designed." Usage of this system led to drastic reduction in the subjectivity of the rating between inspectors.

For the Manhattan Bridge, a database of defects and flagged defect conditions was prepared. It also included the condition ratings of over 30,000 elements of the bridge. Defects observed during the previous inspection were also reviewed and checked whether repaired or not.

With all the above information when organized and mapped, the contour of even rated elements revealed a pattern of deficiencies on the bridge. Individually, this information could not have revealed the complete picture. For example, the flagged condition would identify a serious defect, but would not present any information about adjoining members, without which the overall condition of the bridge could not be visualized. In one particular instance, the owners of the Manhattan Bridge decided to close one lane of vehicular traffic after observing a concentration of low ratings on the floor system of the lower roadway. It was this systematic and logical approach that eased the process of decision making.

5.0 CONCLUSION

The potential of IIS is multifarious. It can act not only as a management tool to attend to immediate needs, but also can improve forecasting and the process of selective rehabilitation to match the available funding. IIS will become more and more valuable, particularly in metro areas, as the existing older bridges will gain more prominence due to the impracticality of replacing them.