VIBRATIONAL EVALUATION OF TENDONS IN SEGMENTAL SECTIONS OF SUNSHINE SKYWAY BRIDGE MAIN SPANS

PROBLEM STATEMENT

The Sunshine Skyway Bridge has, in the past, experienced corrosion failure of external post tensioning tendons in some pier supports, the response to which was extensive examination of all accessible tendons in the bridge. The examination extended beyond prior vibration surveys of the pier supports and high level access spans, to evaluation of the external (that is, not embedded in concrete) lengths of tendons inside the segmental boxes of the main spans of the bridge.[1] The vibration test method consists of lightly impacting an external tendon segment, measuring the resulting vibration spectrum, and from it obtaining a numeric estimate of the force acting on the tendon segment. Low tension and significant differences between the tension at each end of the same tendon are potential indications of mechanical distress that could have resulted from corrosion damage or other sources. Vibration tests offer an independent opportunity to detect anomalies that may escape observation by other assessment techniques.

OBJECTIVES

The objective of this project was to plan, prepare for, and analyze vibrational data acquired from the external tendons in the segmental sections of the Sunshine Skyway bridge main spans. Findings of this project were obtained for the majority of tendons in the main spans of this bridge and conveyed to the Florida Department of Transportation (FDOT) in an interim report dated January 8, 2004. Refined analysis methods developed under the ongoing FDOT Project BC353-44 have been used to expand the number of tendons that could be analyzed and to provide more accurate estimates of the tension of the other tendons. The final report presents those expanded and updated analyses, including evaluation of data from tendons obstructed by contact against other tendons.

FINDINGS AND CONCLUSIONS

Vibrational testing was successfully conducted for about 85% of the tendon segment inventory initially considered for testing. Most of the tendons that were not evaluated were obstructed or too inaccessible for this type of test. Average estimated tension values agreed with those expected from design. Variability of results was comparable to that obtained in previous similar surveys of FDOT bridges. Available results do not show dramatic tension disparities between continuing or directly opposed tendon segments that would be clearly indicative of tendon distress. Relatively low tensions have been obtained for some tendons, but the low values appear to affect evenly several tendons in the same grouping, which suggests systematic causes other than punctual distress. A table of tendons meriting detailed attention in future inspections is provided in the final report.

[1] It is noted for clarification that this project is not concerned with the sloping stay cables visible from the outside of the bridge; FDOT commissions inspection of those components separately.

BENEFITS

This investigation provided an evaluation of the tension condition of critical structural components in a major FDOT bridge. The tasks completed under this project cost just a fraction of the potential replacement cost of one tendon, and the findings will play an important supporting role in technical decision making regarding plans for future action. Furthermore, the present vibration data have been archived and will provide a baseline that can be contrasted with the results of later vibration surveys. Such comparison will allow analysts to determine if, where, and the degree to which tension degradation takes place in the interim.

This research was conducted by A. A. Sagüés, Ph.D., of the University of South Florida. For more information on the project, contact Rod Powers, Project Manager, at (352) 955-6689, rodney.powers@dot.state.fl.us.