Development of Smart Bridge Bearing Systems- A Feasibility Study

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This research critically reviews and analyzes various cost-effective (existing as well as emerging) sensing techniques for use in smart bridge bearings. These sensing technologies were reviewed on the basis of cost-effectiveness, implementability, maintenance, technical expertise required for acquisition and analysis of data, and reliability of the technology in field conditions. The central focus of the research was to identify technologies that are cost-effective, low maintenance and robust for field conditions. The final outcome of the research was to demonstrate the feasibility of the "smart bridge bearing" concept and its detailed implementation plan. The research resulted in specific recommendations for production and development of the smart bearings to meet the stated functional objectives.

To identify effective and economic sensing devices that have potential for applications to bridges, information was gathered through an extensive literature review and field surveys of several companies and experienced engineers to obtain feedback about their experience with advanced sensors. Possible instrumentation schemes for implementing smart bearings were then developed. An appropriate technology able to transmit measured data to a display on the bearing surface or to a remote data processing center was also investigated. The design of an instrumentation scheme depends on the possible range of movement expected in a bridge bearing, the typical reaction forces generated at a bearing, and the environmental field conditions experienced by a typical bearing. Data about these factors were collected in collaboration with the NYSDOT and a statistical analysis was conducted to determine an optimal operational range of these factors.

Finally, a feasibility study for producing instrumented bearings was undertaken. This study focused on practical aspects of implementing different instrumentation schemes including identifying the different costs associated with producing, installing, and collecting data from the smart bearings in a bridge. Estimates of the necessary gage costs, expenses related to installing the gages, monitoring equipment costs, manpower needed to monitor the equipment and other related expenses were prepared. An economic and feasible instrumentation plan was prepared through extensive consultations with commercial companies specializing in the manufacturing of sensors and bridge bearings.

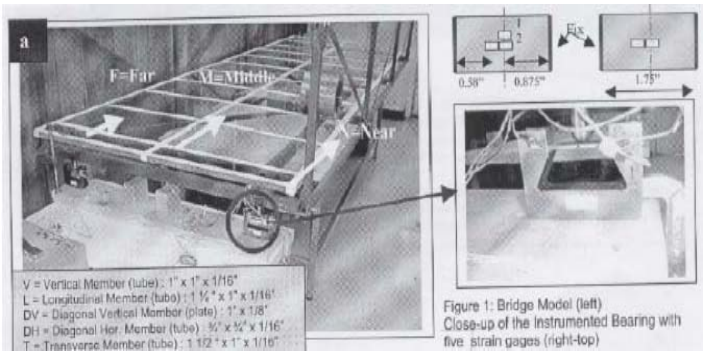

Figure 1: Bridge Model (left)
Close-up of the Instrumented Bearing with five strain gages (right-top)

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