NCHRP 08-71

Workshop and Webinar

Methodology for Estimating Life Expectancies of Highway Assets

DATE: Thursday, March 10, 2011
TIME: 8:30 AM – 3:00 PM
MEETING FORMAT: Direct meeting between Research Panel, Research Team, and Invited Guests, and Webinar.

ATTENDANCE:
Facilitators: Dr. Andrew Lemer, NCHRP Staff.
Panel Members: Mark Nelson, Minnesota DOT (Chair); Dr. Andrew Lemer, NCHRP Staff; Don Clotfelters, Washington State DOT; Dr. Nastaran Saadatmand, FHWA Liaison; Dr. Nadarajah “Siva” Sivaneswaran, FHWA; Raymond Tritt, California DOT (via webinar).
Invited Participants: Dr. David Luhr, Washington DOT; Tanveer Chowdhury, Virginia DOT; Dr. Aaron Horton; Maryland DOT; David Chan, New York State DOT.
Webinar Participants: Wade Casey, FHWA; Dr. Elizabeth Harris, North Carolina State University; Martin Kidner, Wyoming DOT; Tim Lattner, Florida DOT; Ginger McGovern, Oklahoma DOT; Ocic Adams and James Horn, Alaska DOT; Bert Hartman, Oregon DOT; Greg Roby, Maryland SHA; Dr. Jean Nehme, Arizona DOT; David Solsrud, Dustin Thomas, and Thomas Martin, Minnesota DOT; Scott Lagace, New York State DOT; Scott Richrath, Colorado DOT.
Other Guests: Mohammad Dehgani, Virginia Polytechnic Institute and State University.
Research Team: Dr. Samuel Labi; Paul Thompson; Arun Shirole; Kevin Ford; Mohammad Arman, Dr. Kumares Sinha (via webinar).
Absent with Apologies: Panel Members - Dr. Gerardo Flintsch, Virginia Polytechnic Institute and State University; Michael Plunkett, PowerPlan Consultants; Frank Lisle, TRB Liaison; Lacy Love, AASHTO Monitor and North Carolina DOT; Eric Pitts, Georgia DOT; Martine Micozzi, TRB Liaison.

MEETING PROCEEDINGS:
The meeting began with opening remarks by Dr. Lemer. Then, Mr. Shirole welcomed everyone on behalf of Purdue research team and briefly described the workshop objectives. He reminded the meeting that the purpose of the workshop was to develop methodologies for life expectancy estimation. He stated that estimates of life expectancy, as shown in the Guidebook examples, were intended only as outcomes of demonstrations of the methodologies. He then described each of the six sessions for the workshop.

Mr. Paul Thompson then presented the first session on how agencies could use the Guidebook effectively in their business processes. During the part of the presentation that enumerated the potential uses of the Guidebook methodologies, Mr. Mark Nelson commented that the developed methodologies
would be very useful in deciding at what point it would be worthwhile for the agency to take inventory of the condition of the assets.

In Session 2, Mr. Paul Thompson spoke on the plan for implementing the Guidebook. In response to a question by Mr. Dehgani on the state of practice of asset vulnerability assessment, Mr. Shirole explained how the practice of assessing asset vulnerability had evolved from a subjective practice to one that incorporated objective measurements of performance. Also, Mr. Lemer inquired about the assessment of unknown hazards, particularly regarding less-studied assets such as LED lights and signs. He suggested that the research team should include a brief discussion on how vulnerability of such assets to unknown hazards, could be identified and quantified in the Guidebook. Dr. Sivaneswaran suggested that the life expectancy models for traditional assets could, as much as possible, incorporate dynamic forces such as changes in technology.

In the third session, Mr. Thompson presented techniques on how agencies could establish the framework for life expectancy estimation. Dr. Sivaneswaran raised the philosophical question regarding the definition of “end-of-life” and he suggested consideration of economics, especially life cycle cost analysis (LCCA) and cost-effectiveness concepts, in defining what an “endpoint” should be. He also suggested that the terminology “asset life” should be changed to “asset replacement time”. Mr. Luhr suggested that the concept of LCCA should be introduced in Chapter 3 and efforts to define end-of-life or asset replacement life could draw on concepts from the field of industrial engineering. Dr. Sadatmand emphasized that it is necessary to recognize the terminological difference between “end of life” and “end of service life”. Mr. Chowdhury stated that the concept of Remaining Service Life was introduced in the field to address philosophical differences associated with the issue of service life. Mr. Ocie Adams stated that there was no single answer to the question of what constitutes asset life, and that the end-of-life criteria or threshold are (and should be) typically based on a number of considerations such as agency objectives and policy, environment, and user expectations.

Mr. Ford then gave the session 4 presentation that covered how to develop foundation tools for estimating asset life. On the part of Mr. Ford’s presentation that involved asset functional obsolescence considerations, Mark Nelson opined that future functional obsolescence or changes in asset standards and specifications were not easily predictable and thus might be difficult to use as a criterion for establishing end of asset life. As such, he stated that such future conditions were related more to policy planning than to asset management. Mr. Shirole suggested that the model functional form could be amended to incorporate possible future changes in technology, and could be calibrated as and when the requisite data became available. Dr. Lemer emphasized that the objective of the study was to find out the time when an asset required intervention and use of that information was not the main objective. Dr. Sivaneswaran argued that the potential application of asset life expectancy was critical as it provided a rationale for the study. Mr. Chowdhury asked about the limitations of the “simple average” estimates of asset life. In response, Dr. Labi explained the pitfalls of mere averaging of asset life from different atypical asset data and suggested this could be voided by clustering the assets on the basis of asset characteristics such as material type, construction techniques, and environment, and then the average estimates could be found in each cluster. Mr. Lemer suggested that the Guidebook could include a brief discussion and demonstration of the benefit of collecting and incorporating more data into the model. Dr. Labi suggested that an example could be included to demonstrate the cost and benefit implications of different sample sizes. Mr. Chowdhury stated that the Guidebook could include an explicit discussion of the merits and limitations of the different modeling techniques. In response to a question by Mr. Chowdhury, the Research Team informed the meeting that there is no fixed guideline for the relative sizes of the calibration and validation datasets. Dr. Sivaneswaran inquired how the models incorporated
the effects of maintenance as an explanatory variable. Mr. Ford responded that this could be done in any one of two ways: developing separate life expectancy models for assets that received separate levels of maintenance, or including maintenance application status or intensity as an explanatory variable in the datasets. With regard to outlying observations, Dr. Labi stated that there was no clear-cut rule on their usage: a school of thought argues for their inclusion while another states that they should be excluded. He stated that exclusion of 5-10% of outlying data, with justification, could be appropriate. Mr. Chowdhury suggested that the research team could include a discussion on treatment of outliers in the models. Mr. Luhr from WSDOT noted that the limitations of the ordinary regression model could be expressed in the Guidebook and that correlation between the explanatory variables could be discussed explicitly. Also, Dr. Sivaneswaran stated that the issue of correlation between explanatory variables could be discussed in the Guidebook. Mr. Nelson suggested that Table 4.1 of the Guidebook could be developed into a matrix or flowchart to help agencies to ascertain what type of modeling to adopt, on the basis of asset type, data availability and other considerations. Mr. Solsrud of Minnesota DOT, sharing his experiences with culvert maintenance/replacement, expressed his opinion that the Guidebook should discuss the issue of end-of-life criteria with greater detail.

Mr. Arman, speaker of the 5th session, gave a presentation on how to applying life expectancy estimates in decision-making processes. Mr. Lemer expressed his opinion that the LCCA applications in the guidebook could be modified to better reflect the real life scenario where the systems do not remain the same for 40/50 years (as was used in the examples). He explained the need to identify investment options that may translate into longer asset life and superior economic feasibility but may not necessarily be financially feasible. He also suggested that a paragraph or two could also be added to discuss the uncertainty of change in demand due to change in population, traffic, technology, etc. In his contribution on the subject, Mr. Chowdhury stated that maintenance budgets are typically allocated on a year-to-year basis; as such, long-term planning periods (such as 20 and 30 years as was used in the example) might not be appropriate. He proposed that the Guidebook could focus on illustrations that utilize short-term strategies. Mr. Luhr suggested that the research team should include concepts of user cost and agency cost into the examples. Dr. Labi agreed, but cautioned that this would lead to the longstanding conundrum of the relative weight between the two cost categories. Dr. Lemer suggested that a paragraph or two should be added to discuss the life expectancy applications in the context of agency cost only (financial analysis) and both agency and user cost (economic analysis). Dr. Sivaneswaran expressed agreement with such an inclusion. At this point, Mr. Shirole reminded the meeting that the objective of the research was not LCCA; nevertheless, the research team would add appropriate sections to address these issues as raised by the panel members. Dr. Lemer and Mr. Nelson suggested that LCCA examples could be moved to the appendix; to that suggestion, Dr. Sivaneswaran demurred, arguing that such applications were central to the motivation for the research project and the user would be better served if such analysis featured prominently in the main text of the Guidebook. Mr. Chowdhury suggested that the distinction of user cost and agency cost in the LCCA examples could be avoided. As a compromise measure, Dr. Sivaneswaran and Mr. Luhr opined that the research team could include a brief discussion on user cost and agency cost.

In the 6th session, Mr. Ford spoke on the necessity of accounting for risk and uncertainty in asset life prediction, how to quantify such uncertainty, and the potential impact of such uncertainty on asset replacement planning. The panel suggested that the Guidebook could include a comprehensive definition of the term “risk” with real life examples accompanying this and other definitions.

In the last session, Mr. Thompson discussed the potential threats to implementation of the life expectancy models and how they could be overcome. In response to a question by Mr. Lemer on how to
measure the extent of implementation, Mr. Thompson stated that at the beginning of the process, the agency should have a diagnostic test and fix a target. Then, on the basis of the target, the agency could choose to wait several years before it conducts the test again. Dr. Lemer commented that finding the changes in few years may be difficult as benefits of asset management program would take long to be perceived.

Dr. Sivaneswaran and Dr. Lemer suggested that the Guidebook should include default service life estimates of a few classes of highway assets. That way, agencies will acquire some realistic a-priori expectations of such estimates as they set out to use the methodologies to establish the lives of assets in their jurisdictions. Dr. Labi assured them that final version of the Guidebook would include such information.

Dr. Sadatmand inquired about skill level required of agency personnel who will be charged with implementing the asset life expectancy estimation methodologies. Mr. Thompson responded that the Guidebook lists a few sequential steps that have been suggested to facilitate implementation. Dr. Sadatmand commented that further training may be necessary to teach the personnel the specific tools of the Guidebook, and Mr. Nelson stated that the current study lays the foundation for proceeding in this direction. Dr. Chowdhury suggested that the application should be developed keeping in mind the end-users so that they could plug in the data and get the results without in-depth knowledge about the models. However, Dr. Sadatmand and Mr. Chan argued that the limitations should better be conveyed to the end-users. Dr. Lemer suggested that NHI or similar training programs could be arranged to help agencies implement the processes prescribed in the Guidebook.

Dr. Lemer and Mr. Shirole provided email addresses so that the participants could convey their suggestions, comments, and questions at a later period.

The Facilitator thanked all participants and adjourned the meeting at 2:45PM.