Mineta's new research data can help transit agencies prioritize, schedule railway bridge repairs and rehab

Free report, recommendations from Mineta National Transit Research Consortium

San Jose, Calif., September 23, 2014 –The Mineta National Transit Research Consortium's latest peer-reviewed study, *Fatigue Evaluation of the Increased Weight Limit on Transit Railway Bridges*, proposes a method to determine remaining "fatigue life" of steel railway bridges for transit lines based on analysis and field testing. For example, heavy freight cars and their bridge-crossing frequency were found to have a significant effect on the critical locations near the supports and short span bridges. This data can help transit agencies and operators to prioritize and schedule repairs and rehabilitation. Principal investigator was Hani Nassif, PhD, PE, working with Kaan Ozbay, PhD; Peng Lou, PhD candidate; and Dan Su, postdoctoral associate. The free report can be downloaded from http://transweb.sjsu.edu/project/1143.html

Dr. Nassif said, "Transit agencies own and operate thousands of bridge structures that undergo repetitive train crossings, leading to what is known as load-induced structural fatigue. The majority of these bridges were built a century ago, and many have exceeded their theoretical fatigue lives, which could cause partial or complete bridge failure."

After the failure of the Minnesota I-35 Bridge on August 1, 2007, left 13 people dead and 145 injured, several transportation and transit agencies have recently begun self-evaluating their bridge stock. This research report offers the advanced tools necessary to catalog thousands of bridge structures with periodic train schedules and weight data. The proposed approach can be applied to existing steel bridges.

Increased weight limits can compound the issue.
The closure time of track lines and obstruction for passengers can be disruptive and costly, especially for lines with only one active track. Furthermore, the recent increase of freight railcar weight limits from 263,000 lbs. to 286,000 lbs. raises additional concerns for transit passenger rail systems bridges if those systems were not designed to withstand the increased weight. It is necessary to assess the impact of the increase in railcar weight on those bridges prior to allowing passenger lines for freight train use.

"The simplest analysis involved a review of the regional passenger and the freight train load data regarding weight, volume, and the number of crossings," said Dr. Nassif. "The next analysis level involved simulation, where stresses on bridge girders and/or components were determined using finite element analysis methods. Results from field tests helped to verify and validate these computer models, and the proposed approaches were applied to existing steel railroad bridges."

Researchers developed a probabilistic model for the fatigue evaluation of railway bridges. They considered various random loading variables, including annual train frequencies, dynamic impact, passenger volume, and freight car loading. The probabilistic fatigue load spectra were derived using the Monte Carlo simulation and the Rainflow Counting method. In terms of resistance, the relevant S-N curves were randomized with constant variance in fatigue strength.

Infrastructure components must be protected and managed.
Infrastructure systems constitute a major part of the national investment and are critical for society's mobility as well as its economic growth and prosperity. The US has invested an estimated $25 trillion in civil infrastructure systems, including all installations that house,

transport, transmit, and distribute people, goods, energy, resources, services, and information. Infrastructure system components, such as bridges, tunnels, traffic systems, road pavement, airports, seaports, dams, and other systems, are considered assets that should be protected and properly managed.

Dr. Nassif said, "Unfortunately, the current degree of deterioration and damage from natural and malicious events leaves the system dangerously vulnerable. Major decisions must be made to allocate limited funds for maintaining and safeguarding the nation's bridges. To maximize long-term cost efficiency, solutions should be based on an integration of various computational models and simulations, as well as on infrastructure deterioration models."

The methodology recommended in the report is a practical tool to perform fatigue analysis for an owner or agency managing hundreds of structures with different regional trainload characteristics. Recommendations for appropriate bridge maintenance are provided, as well, to help operate the bridges safely and cost-effectively.

Tweet this: #Mineta research data can help #transit agencies prioritize and schedule #railway bridge repairs and rehab. http://ow.ly/AAxoI

ABOUT THE PRINCIPAL INVESTIGATOR

Hani Nassif, PhD, is a professor at Rutgers, The State University of New Jersey. He established Rutgers' Bridge Engineering Program, and is working in the research area of structural health monitoring (SHM) and field testing of infrastructure facilities with emphasis on railroad and highway bridges. He is a fellow of the American Concrete Institute (ACI) and past member of its Technical Activity Committee (TAC) and is past president of the New Jersey ACI Chapter. He received various awards including the High Value Research "Sweet Sixteen" Award by the AASHTO Research Advisory Committee (RAC), for project titled: *"Elimination of Weight Restriction on Amtrak, NJ Transit, and Conrail Line"*; Research Implementation Award, 15th NJDOT Research Showcase, 2013; American Council of Engineering Companies Educator of the Year Award and American Society of Civil Engineers Central New Jersey's Educator of the Year Award for excellence in education and his dedication to student learning. Dr. Nassif obtained his BS and ME in civil engineering from The University of Detroit. He received his PhD in structural engineering from the Civil and Environmental Engineering Department and a graduate certificate in intelligent vehicle-highway systems from the Electrical Engineering and Computer Science Department at the University of Michigan-Ann Arbor.

ABOUT THE MINETA NATIONAL TRANSIT RESEARCH CONSORTIUM

The Mineta National Transit Research Consortium (MNTRC) is composed of nine university transportation centers led by the Mineta Transportation Institute at San Jose State University. The Consortium was organized in January 2012 after winning a competition sponsored by the US Department of Transportation (DOT) to create consortia tasked with "Delivering Solutions that Improve Public Transportation." Member universities include Bowling Green State University, Grand Valley State University, Howard University, Penn State University, Rutgers University, San Jose State University, University of Detroit Mercy, University of Nevada Las Vegas, and University of Toledo. Visit transweb.sjsu.edu/mntrc

ABOUT THE MINETA TRANSPORTATION INSTITUTE

The Mineta Transportation Institute (MTI) conducts research, education, and information transfer programs regarding surface transportation policy and management issues, especially related to transit. Congress established MTI in 1991 as part of the Intermodal Surface Transportation Efficiency Act. MTI won national re-designation competitions in 2002, 2006 and 2012. The

Institute is funded through the US Secretary of Transportation's Research and Technology Office, US Department of Homeland Security's Transportation Security Administration, the California Department of Transportation's Division of Research, Innovation and Systems Development, and public and private grants. In 2006 the US Department of Homeland Security selected MTI as a National Transportation Security Center of Excellence. The internationally respected members of the MTI Board of Trustees represent all major surface transportation modes. MTI, the lead institute for the nine-university Mineta National Transit Research Consortium, is affiliated with San Jose (CA) State University's College of Business. Visit transweb.sjsu.edu

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