Santa Cruz Industrial Lead
Supplemental Structural Assessment Report

HNTB Responses to comments regarding the June 23, 2006 Report

Comments on Structures Assessment Report from Bill Comfort

General:

- Would you expect your visuals caught everything—how sure are you of your estimates?

    - *Our Scope of Work was to inspect representative elements of the structures to determine the general condition of each structure and evaluate the section loss or condition and to determine the load capacity of structures. And while we looked at nearly every element of each structure we did not perform a detailed inspection of every structural member and element. It is our opinion that HNTB identified most of the structural defects. When the actual design and preparation of the repair plans begins a more detailed inspection will need to be performed to verify the conditions. The estimates are listed within a range of values. HNTB is confident that the range of costs is reasonably accurate for budgeting the recommended repair work and maintenance work as described in Section 9 of the report.*

- Would you expect the actual job to be higher or lower than your estimate?

    - *We would expect the cost to fall within the range that we have indicated for the recommended repair work and maintenance work described in the report.*

- What is the inflation rate you would estimate per year on structural repair projects? (Caltrans uses about 3.5%)

    - *The inflation rate at this point in time should be in the 3.5%-6% range per year.*

- Did you use hardness testing to determine the strength properties of the steels?

    - *Testing of the steel was not conducted for this report. The historical record of steel properties (History of ASTM Structural Steel Specification Stresses), listing A7 steel, dated 1900, with tensile strengths between 60,000 and 70,000 psi having a minimum yield strength of Fy = 35,000 psi or were from (Steel Solutions Center at the American Institute of Steel Construction (AISC)) stating that steel produced between 1887 to around 1933 had yield*

strengths of Fy = 33,000 psi was used to assign strength properties for the steel if sufficient information was found on the review documents. If insufficient supporting information was found then the values were assigned as allowed by the 'AREMA Manual for Railway Engineering' (Yield Strength of Fy = 30,000 psi for open-hearth or Bessemer steel), which is usually on the conservative side for the type of steel used during this time period. It depended on the structure and how much information was available on the documentation reviewed as to which yield strength to use.

- Did you use any nondestructive testing in preparing your report?

  - *No nondestructive or destructive testing of the steel was conducted for the report.*

- Did you look for cracks in the structures?

  - *Yes, during the inspection the structures were checked for the existence of cracks.*

  - If yes, how did you find/evaluate them?

    - *Cracks were not found during our inspection. We physically removed rust in certain locations; we looked in the most likely locations for the type of structure being inspected; and we looked for any breaks or discoloration in structural elements for the evidence that a crack existed. There were some incidences of broken bracing or corroded members that were considered in our evaluation of the structures.*

- Do you know the alloy(s) and heat treatment(s) of the steels used in the various structures from drawings or specifications?

  - *Information reviewed did not contain this information.*

- If I understand your report, the La Selva trestle must be repaired to allow 286,000 pound rail cars, is that correct?

  - *No, that is not case. The load rating in the table is for Normal Rating of the structure at 25 mph. The value of the Normal Rating and the Equivalent Equipment Rating are very close to each other, within 3% which is well within the accuracy of the inspection and calculations procedures. Also, since the line is operating at 10 mph the Normal Rating at a 10 mph speed would give a higher value than the Equivalent Equipment Rating for a 286,000 lb rail car, and therefore would be acceptable. The increase in the load*

rating resulting from the reduction of speed from 25 mph to 10 mph is due to the decrease in the impact loading of the rail equipment live loading for that speed reduction.

Fracture toughness issues:

- If the 0.55*Fy and 0.8*Fy is used, how does that translate, using the RISA algorithms?
  - What is the magnitude of the allowable stress in the structure after going through all of the safety factors etc.?

    - *The Normal Rating establishes the equivalent load that results in the governing structural steel member(s) reaching but not exceeding 55% of their yield stress. The Maximum Rating establishes the equivalent load that results in the governing structural steel member(s) reaching but not exceeding 80% of their yield stress. RISA is a finite element analysis program that is used to calculate the dead load and live load stresses in the bridge members. The Normal and Maximum Load Ratings are calculated as follows:*

      Normal Rating = 0.55xFy-Dead Load Stress x 80 / Live Load Stress of Cooper E-80 Train

      Maximum Rating = 0.80xFy-Dead Load Stress x 80 / Live Load Stress from Cooper E-80 Train

  - Are the listings in Table 6 under the column: *Calculated Normal Load Rating (25 mph)* based on 0.55 Fy except where noted as *Maximum*?

    - *Yes, generally the Normal Rating used the .55Fy for the basic allowable stress, and the Maximum Rating used the .8Fy for the basic allowable stress. These values may have been modified due to the member shape or loading condition.*

Seismic retrofit issues:

- If you were given the job of specifying the seismic retrofit, would you rely on your visual observations and good practice, or would you perform seismic analysis of the structures using finite element analysis?

    - *The engineer should rely on visual observations, good engineering practice and judgment, and perform calculations or an analysis of the structures to determine the recommendations for seismic retrofitting the structure. Finite element analysis may be required to determine the loading for some of the more complicated structures, however hand calculations could also be used for the simpler structures.*

- If finite element analysis, what assumptions would you make?
  - With and without rail equipment and at various positions on the structure?

  - *A seismic analysis of the structure would generally not consider the live load in the load combinations considered on the structure. Only in rare circumstances is the live load considered in the seismic design or seismic retrofit of structures such as bridges in high rail traffic volume areas, or bridges near yards or terminals where the structure would have a highly likely probability of being occupied during the a seismic event.*

  - What event magnitude would you assume?

  - *There is no direct correlation between event magnitude and the ground motion that would occur at a given location for a structure. Refer to the AREMA Manual for Railway Engineering (2006) for further information and on the procedures used to establish the ground acceleration for a location from the tables and information provided there or a more detailed site-specific procedure may be used to establish the base accelerations for the structure.*

- How important do you consider the location and geology and soil conditions to your current conclusions?
  - A few miles from the epicenter of the Loma Prieta earthquake
  - Sandstone
  - Sand

  - *The location of the bridge and the soil conditions surrounding the structure are an important consideration when considering the seismic influence on a structure. The seismic design accelerations that are applied to the structure during seismic analysis include the effects of soil type and location.*

- The Biggs Cordosa report suggested $100 to $2,000 per foot of bridge as a bounding range for the cost of seismic retrofit (without the "Other Project Costs" included).
  - Do you have any "rules of thumb" for the cost per foot of:
  - Steel bridges?
  - Wood trestles?
  - Concrete bridges?

  - *Each structure has its own unique characteristics and without doing a further study to further refine the cost estimates the range that has been suggested by Biggs Cordosa is a good suggestion.*

Each structure will be influenced by its location, its configuration, its construction material, the soil condition, etc. Some structures will fall into the lower cost range and some will fall within the upper cost range. In the final determination each structure will have its own cost.

- Your report seems to imply that you don't consider seismic retrofits necessary on the wood structures. What basis do you have for this?

  - *The study we performed included the determination of the seismic vulnerability of the San Lorenzo Creek bridges only; therefore we did not investigate the timber structures or make a recommendation on retrofits to timber structures. For further information refer to the AREMA Manual for Railway Engineering (2006) which states in Chapter 9, Section 1.5.4.2; "Timber trestles may be screened and eliminated from further evaluation if they are free of conditions that would require attention in the near future to permit continuation of normal railroad traffic. Seismic evaluation of timber trestles not eliminated by screening should focus on the potential effects of a seismic event on deficient conditions or details".*

  - If you were given the job of specifying the seismic retrofit, would you rely on your current assumptions for wood structures or would you check your assumptions using seismic analysis?

    - *See the response above.*

  - How would you perform a wood trestles seismic analysis?
    - What assumptions would you make?

    - *See the answer above regarding the recommendations of AREMA and the exclusion for performing a seismic retrofit of timber structures. Assumptions, criteria, and type of analysis would typically need to be developed during a preliminary scope phase if a seismic analysis was desired for the timber structures.*

    - With and without rail equipment and at various positions?

    - *Live load from rail equipment is generally not considered in seismic design or retrofit. See response above.*

- The seismic retrofit requirement is based on the probability that members of the public will be present on a structure during a seismic event. I'm very sympathetic to requiring it. Are there legal or professional engineering criteria that specify the degree of exposure and/or this requirement?

- Please specify.

    - *We are not aware of any legal or professional engineering criteria that would require the seismic retrofit of these railroad structures. The AREMA Manual for Railway Bridges provides some guidelines and recommendations for the review, selection, and retrofit of existing bridges in Chapter 9, Seismic Design for Railway Structures, Section 1.5.*

HNTB responses provided on 7/25/06