HARTCROWSER

MEMORANDUM

DATE: January 9, 2002

TO: Jim Thomson, P.E., HNTB

FROM: Barry S. Chen, P.E., and Michael Bailey, P.E., Hart Crowser, Inc.

RE: **Stability Review of RECo 30% Design**
Sea-Tac Third Runway Embankment Project
4978-30

CC: John Sankey, RECo
Rob Millar, HNTB

Hart Crowser has completed our review of the RECo 30 percent design on the NSA, West, and South MSE walls of the SeaTac Third Runway Project. This last part of our review consisted of independent limit equilibrium analyses to verify stability satisfies criteria in the AASHTO design procedure. We calculated the factor of safety for steady state, end-of-construction, pseudo-static, and post-earthquake liquefaction conditions for both global and compound failure modes. This memorandum provides our recommendations on changes of steel thickness and embedment depth for some sections, based on the results of stability analyses.

The limit equilibrium analyses were based on the RECo 30 percent design, and soil parameters as described in Hart Crowser's memorandum "Geotechnical Input to MSE Wall Design." (An update to the August 22, 2000, draft of this memo is being submitted concurrent with this memo). Hart Crowser also used a finite difference computer program (FLAC) to model typical MSE wall sections to provide an independent assessment of wall performance, which is not required by AASHTO. Results of the FLAC modeling are presented separately.

Our analyses follow RECo's assumptions in modeling the reinforcing strip as indicated in the spreadsheet we received with their 30 percent design. This approach enabled Hart Crowser to, equally divide the reinforcement density into two "equivalent" strips for each panel, which we applied to a unit thickness of 1 foot for use in the plain strain analyses. We

calculated the pullout length for each equivalent reinforcing strip based on the same criteria RECo used in the internal stability design, including corrosion reduction of the steel for the design life of the structure. The computer program SLOPE/W assumes a constant force along the reinforcing strip within the section that is governed by the tensile strength of the strip and the force proportionally decreases to zero within the section that is governed by the pullout resistance of the strip. Where Hart Crowser's analyses indicated changes are needed to meet the AASHTO target factors of safety for a few sections, our recommendations for additional embedment assumed the same density of reinforcement at the lowest panel as in the 30 percent RECo design.

Recommended Changes of Reinforcing

Hart Crowser previously provided preliminary recommendations on design changes for the South wall dated November 9, 2000, and June 7, 2001. Additional stability analyses were performed for NSA, West, and South MSE Walls to address review comments from the Embankment Technical Review Board (ETRB) including changes of soil and seismic design parameters. The resulting changes of reinforcing design are provided in the following sections:

NSA Wall

1. Increase the thickness of steel strips in the upper tier of the multiple-tier wall or the single-tier wall from 50x4 mm to 50x6 mm.

2. Add approximately 2.5 feet of embedment with one "equivalent" row of reinforcing strips in the NSA Wall between Stations 46+75 and 51+25.

3. Add approximately 5 feet of embedment with two "equivalent" rows of reinforcing strips in the NSA Wall from Stations 43+12 to 44+70 and from Stations 53+50 to 54+00.

West Wall

1. Increase the thickness of steel strips in the upper tier of the multiple-tier wall or the single-tier wall from 50x4 mm to 50x6 mm.

2. Add approximately 2.5 feet of embedment with one "equivalent" row of reinforcing strips in the West Wall between Stations 178+60 and 180+50.

3. Add approximately 2.5 feet of embedment with one "equivalent" row of reinforcing strips in the West Wall between Stations 183+33 and 184+64.

4. Add approximately 5 feet of embedment with two "equivalent" rows of reinforcing strip in the West Wall between Stations 185+40 and 186+15; or alternatively, add 4 feet of strip length (30 feet in total length) to the West Wall between Stations 185+40 and 186+15.

South Wall

1. Increase the thickness of steel strips in the upper tier of the multiple-tier wall or the single-tier wall from 50x4 mm to 50x6 mm.

Hart Crowser would be pleased to discuss the basis for these recommendations and address any questions from RECo and HNTB.

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