

BART Agreement Number: 6M8145

Approval Date: 11/06/2020

Work Plan: No. A.04-04 – Updated Retrofit Design Ground Motions for the Transbay Tube

Scope:

Tasks

- A. Develop TBT Model 57-Tube Model
 - 1. Recover and prepare 57-Tube (TBT-only) model
 - 2. Condition eleven (11) ground motions to ensure compatibility with software and to ensure numerical stability.
 - 3. Split, interpolate and apply new ground motions at appropriate nodes along the TBT model.
 - 4. Perform Quality Assurance check
 - 5. Repeat for remaining ground motions

- B. Perform Non-linear Time-History Analysis 57-Tube Model
 - 1. Perform non-linear time-history analysis using ADINA, a general-purpose simulation software package.
 - 2. Perform for the two sets of soil springs (upper-bound and lower-bound) as used previously.
 - 3. Post process results
 - 4. Perform QA check
 - 5. Repeat for remaining ground motions
 - 6. Prioritized cases (max 11 cases) will be analyzed and processed first.
 - 7. Total analyses: 22
 - 8. Provide results (plots, digital data)

- C. Complete Calculation Book for 57-Tube Model according to project QA requirements.

- D. Develop TBT Model 15-Tube Model
 - 1. Recover and prepare 15-Tube (TBT-only) model
 - 2. Modify the FE model to be effective for 15-Tubes
 - 3. Condition eleven (11) ground motions to ensure compatibility with software and to ensure numerical stability.
 - 4. Split, interpolate and apply new ground motions at appropriate nodes along the TBT model.
 - 5. Perform Quality Assurance check
 - 6. Repeat for remaining ground motions

- E. Perform Non-linear Time-History Analysis 15-Tube Model
 - 1. Perform non-linear time-history analysis using ADINA, a general-purpose simulation software package.
 - 2. Perform for the two sets of soil springs (upper-bound and lower-bound) as used previously.
 - 3. Post process results
 - 4. Perform QA check
 - 5. Repeat for remaining ground motions
 - 6. Prioritized cases (max 12 cases) will be analyzed and processed first.
 - 7. Total analyses: 44
 - 8. Provide results (plots, digital data)

- F. Complete Calculation Book for 15-Tube Model according to project QA requirements.

- G. Prepare and present draft results.

- H. Assumptions

The associated budget and schedule are dependent on the following assumptions:

- 1. The TBT model does not include the San Francisco Transition Structure (SFTS) or the Oakland Transition Structure since the focus of this study is away from the Seismic Joints. Additionally, studies have shown the effects of the SFTS can be reduced if boundary conditions are set properly.
- 2. Soil conditions will not change – the KMCs used previously will be used for this analysis.

3. Ground motion time delays at each location will be provided by Fugro.
4. The ground motions will not include lateral spread effects.
5. The critical polarity of ground motions will be determined by Fugro. It is assumed that a single polarity will be used.
6. Upper and lower soil properties previously used as defined by BART, will be used for this study.
7. The same ADINA model used for previous TBT analyses will be used for this task
8. The structural cross section of the TBT will not change from what was used in previous (2011) studies.
9. All new ground motions will be provided together at one time and the format will be consistent with what was provided previously.
10. Maximum of 11 priority cases
11. Eleven (11) new ground motions will be provided for use with both (2) soil properties, 1 polarity and both the 57-Tube and the 15-Tube model. Total of 44 analyses.
12. The Quality requirements for the calculations are similar what was provided previously. If the Quality standard requires more significant effort, this will require additional negotiation.
13. The cost estimate does not include a contingency for unforeseen issues. If such issues arise, additional budget may be needed.

Prime: Jacobs

Subconsultant	Amount	DBE (Y/N)	SBE (Y/N)
SC Solutions, Inc.	\$ 415,032	N	N

Total Work Plan Value: \$ 438,030