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Memorandum

to: Teresita Alvarez, Rudy Powell - FDOT **date:** March 9, 2006

From: Eldon Abbott; Robert Rawnsley

subject: Port of Miami
Responses to Concessionaire
Comments/Proposed Additional
Subsurface Exploration Program

Cc: Jeff Parker - JPA

The general concept of the subsurface exploration program is to provide adequate subsurface information for the Concessionaires to provide reasonable bids and to minimize the likelihood of the Concessionaire needing to obtain additional subsurface information in the channel. Interpretation of the subsurface data provided and the development of design parameters are planned to be the responsibility of the Concessionaire's design team. It is likely that different teams will have different interpretations of the data and will also require different design parameters depending on their chosen means and methods and final design decisions. To this end, subsurface investigations have focused on obtaining data that would be useful in addressing major underground issues. Specifically, soil and rock testing has focused on petrographic analysis, permeability testing (both insitu and laboratory) and some unconfined compression tests. In addition to the drilling and sampling of test borings, a grouting program and geophysical program have been performed.

Future subsurface investigations are planned to focus on improving the quality rock samples, increase the per cent of rock recovery and confirming the absence of major (sand filled) voids. Ten borings are planned for the channel, 6 are currently planned to be continuous rock cores and 4 are planned to be continuous SPT holes. Drilling of the first 6 holes is planned to begin in late March. The final 4 holes are expected to be drilled after the short listing of bidders to allow detailed input from the bidders as to what they would prefer for information. Currently it is planned that laboratory testing will include petrographic analysis, unconfined compression tests and unit weights at ten foot intervals in the rock core holes as sample recovery and quality permit. In the SPT holes, laboratory sampling is scheduled to include grain size analysis and mineralogy testing on all sand samples. Prior to drilling the core borings in the channel, 2 or 3 land borings are planned to better assess sampling methods in the rock to maximize sample recovery and quality.

On February 2/23/06, we received a list of subsurface information one potential bidder would expect to be provided. We forwarded this information to our designers for their review and comment. Following are their responses:

Comment

1a. All parameters for lining design as follows:

- Elastic Modulus (Youngs)
- Stiffness Modulus (Oedometer Modulus)
- Effective Unit weight (Saturated and unsaturated)
- K_h horizontal earth pressure value

Response

Unit weights have been provided and additional unit weights will be provided. The modulus can be obtained from unconfined tests and the soil stiffness may be estimated from blow count data. The value of K_h is a design parameter to be determined by the final designer.

Comment

1b. All parameters for the Geotechnical analysis of the tunnel face stability as follows:

- Effective cohesion
- Effective friction angle
- Un-drained shear strength

For rock, the parameters mentioned above may possibly be estimated from the Hoek-Brown criteria, using the GSI index.

Response

The parameters listed can be estimated from the blow count data, core logs and UCS test results.

Comment

1c. All parameters for the estimation of the TBM progress (advance rates, cutting tool wear, etc) such as the following:

- Permeability

- Grain size distribution curves
- Rock quality index numbers (RQD and RMR or alternatively Q-Barton)

Response

We intend to provide available grain size curves for the soil materials and permeability data. However, interpretation of these data is left to the Concessionaire's designers.

RQD is being provided, however it should be noted that this typical rock indexing parameter is not applicable for the subsurface materials being encountered. RQD was developed for solid intact pieces of rock and not for vuggy limestone as is found in South Florida.

Comment

1d. From the cross hole VSP results, geophysical testing, seismic reflection, seismic refraction, we expect to receive detailed knowledge about the following:

- Interpretation of the geotechnical parameters mentioned above in the ground sections between bore holes
- Information about the voids of various sizes within the bed rock, as well as location of zones of high porosity
- Differentiation between the different rock and soil layers
- Three dimensional (3D) model of the ground

Response

The geophysical report will be provided to the bidders.

Comment

2. We recommend that some of the proposed additional bore holes, if not already drilled, should be ideally located in the cross passage zones in both the channel and land zones. In the event that the holes are drilled we recommend a minimum quantity of three additional boreholes be done one in each cross passage zone.

Response

Review of the data collected to date indicates that borings have been drilled in the vicinity of the cross passage ways located on Watson and Dodge Island. Future channel borings are located in the vicinity of the channel passage way. It is preferred not to drill immediately above the passage way as this would create a potential void and/or flow path. Should detailed information be desired

by the Concessionaire, it is suggested that they consider including horizontal drilling from the completed tunnels.

Comment

3. Pressure meter tests should be carried out in the maximum quantity of the existing and future boreholes to determine the stiffness of the ground. Tests should be carried out at different levels according to the different ground conditions and soils detected.

Response

Both our in-house geologists and PSI agree that the subsurface conditions are not appropriate for this type of testing. Specifically, it is anticipated that the irregular surface of the wall of the bore hole will result in misleading information. It is for this same reason that we do not think that Packer Pressure testing for permeability testing of the rock mass is valid if the packers are placed against the borehole wall and the packer inflated to create a seal. We suspect that the hole will not seal and leakage will result in misleading permeability information. It is suggested that if a Concessionaire finds that this data is essential for final detailed design then they should plan on including these tests in their scope.

Comment

4. In relation to the grouting tests already undertaken we await the results and interpretation in regard to whether additional testing may be required.

Response

The grout tests will be provided. However, as noted previously, it is the general intent of the subsurface investigation program to provide data only and leave the data interpretation to the Concessionaire's designers.

Comment

5. We would expect to be informed of any artificial obstacles, like building foundations, unfilled / filled bore holes, etc within the zone of influence of the suggested alignment.

Response

It is intended to provide foundation information on the bulkhead and shed located above the tunnel at the Dodge Island shore line. Records of project-related boring locations, depths and backfilling will be provided in the Geotechnical data reports. Utility information will be provided as available.

Comment

6. We suggest that all of these parameters are gathered together in tabulated form in one geotechnical longitudinal cross section of the tunnel such that a responsible geological, and geotechnical specialist is able to define homogeneous sections interpolating the data between bore holes. In this case, at this stage, no additional bore holes would be considered necessary.

Response

A subsurface profile will be developed and included as part of the RFP as well as subsurface data collected to date. However, it is the intent of the subsurface investigation to date, is to provide only data with data interpretation the responsibility of the Concessionaire. It is not the intent to provide the Concessionaire with all of the subsurface data that a designer may wish to have as that requirement will vary based on means and methods and design selected by the Concessionaire. However, due to time constraints/permitting issues, we are attempting to obtain as much data as possible in the channel to minimize the likelihood that a Concessionaire will require additional information in the channel.

Currently FDOT plans on delaying the drilling the last four borings following selection of the short listed teams to allow detailed input on remaining information the Concessionaire's designers may prefer to see.

Comment

7. All investigations and laboratory testing results should be summarized in a comprehensive geological and geotechnical baseline report.

Response

Currently, it is anticipated that a GBR will be provided for bidding purposes and will likely include an indication of the physical nature of the materials likely to be encountered. The details of this report are still under development. However, since each Concessionaire is likely to be proposing different means and methods as well as different designs, the GBR will likely contain baseline geotechnical data without much analysis or written information on the ground behavior because that behavior will vary based on the selected construction means and methods. The GBR will include a summary of subsurface data collected to date.