

ATTACHMENT B Requirements for Structural Elements

I. Overview

The main structural elements of the project are as follows:

- Pedestrian bridge located at the Five-Points Intersection of Cleveland Avenue, Chapel Street and Margaret Street
- Large Earth Retaining Structure located in the vicinity of Paul Run.
- Observation tower located at a selected location along the trail alignment

Your engineering study will include the preliminary design (50% submission) of the pedestrian bridge and the conceptual design (25% submission) of the trail retaining structure and observation tower.

The level of engineering and design required for all structural elements should be sufficient to:

- Clearly demonstrate the suitability, adequacy, economy, durability, maintainability and constructability of the structure types, materials and systems that you have selected.
- Be consistent with and complementary of other site design features and site constraints.
- Provide information necessary for a preliminary estimate of probable construction cost.
- Demonstrate how the preliminary structure designs will be context sensitive to the project surroundings along the trail alignment.
- Provide recommendations to the owner on the scope of the required geotechnical investigations for substructure and foundation design of the pedestrian bridge and retaining wall.
- **ALL plans, reports and calculations must be back-checked and initialed by a “designer” and a “checker”. No exceptions.**

II. Pedestrian Bridge

As part of the proposed multi-use trail, the Newark Park Commission, in conjunction with DelDOT wants to investigate the feasibility of constructing a pedestrian bridge at the five-points intersection of Cleveland Avenue, Chapel Street and Margaret Street. The objective is to provide a “grade separated” trail crossing at this major intersection for exclusive use by pedestrians. In close coordination with the transportation and civil members of your firm, prepare the preliminary design of a new pedestrian bridge at this intersection in accordance with DelDOT Bridge Design Manual, AASHTO Guide Specifications for Design of Pedestrian Bridges and the AASHTO Standard Specifications for Highway Bridges. The preliminary bridge design must adhere to the following project design constraints:

- Design must provide aesthetically pleasing appearance.
- Minimize environmental impacts, conflicts with existing utilities, including existing and/or proposed traffic signals, and right-of-way requirements.
- Timber bridges will not be permitted.
- Design must be ADA compliant.

The preliminary engineering design includes the preparation of the following three (3) deliverables:

A. Concept Study Report – Due: December 3, 2007.

For the owner’s progress meeting, prepare a concept study report that summarizes three (3) possible structure type options for the pedestrian bridge crossing. The report should clearly discuss the advantages and disadvantages of each structure alternate with respect to cost, aesthetics, durability and constructability. This report is to be no longer than five (5) pages in length.

B. TS&L (Type, Size and Location) Plans – Due: April 23, 2008.

Prepare TS&L plans for the selected bridge type. The following information shall be shown on the plans:

- (1) Plan View, including controlling horizontal clearances, trail stationing, skew angle, approach ramp layout, substructure type, substructure layout, and substructure locations and drawing scale.
- (2) Elevation View showing controlling vertical clearances, span lengths and total structure length, substructure labels, approach ramp length, existing and finished ground line and drawing scale.
- (3) Typical Section showing superstructure type, truss or girder/beam type and spacing (if applicable), out-to-out dimensions, deck

width, deck type and thickness, bridge railing type and drawing scale.

- (4) Standard DeIDOT Title Block that identifies bridge and structure type.
- (5) Horizontal Curve Data and Vertical Curve Data for the trail, as required. (**This requires close coordination with the Transportation Discipline.**)
- (6) General Notes that list design specifications, design dead loads, design live loads and design methodology.
- (7) Proposed Core boring layout and location table. (As reference material, a geotechnical report will be furnished to you.)
- (8) Structure Details of the bridge approach ramps and railings. (Structural details should reflect 100% level of design submission effort.)

C. TS&L Study – Due: April 23, 2008.

As part of the Preliminary Engineering Report, prepare a TS&L Study that summarizes alternate studies (three structure options considered and presented in December 2007) and provides justification for the recommended bridge type and foundation type. In addition, include a discussion on the following:

- a) Constructability
- b) Future Maintenance
- c) Opinion of Probable Cost
- d) Discussion of Proposed Foundation System and Subsurface Investigation Requirements (As reference material, a geotechnical report will be furnished to you).
- e) Final Recommendation

Provide the following information in the Appendix of your Preliminary Engineering Report:

- (1) Summary of geometric design criteria, including calculation of proposed horizontal and vertical clearances. (**This requires close coordination with the Transportation Discipline.**)
- (2) Preliminary structure calculations, including span/depth ratio checks, calculation of design dead load and design live loads.
- (3) Detailed design calculations for the bridge approach ramp and railing. Design calculations are to be hand-written.
- (4) Opinion of Probable Cost Estimate, including unit prices and preliminary quantities, for the selected bridge type.

III. Retaining Structure

Due to the steep slopes and topographic features of the existing site, a large earth retaining structure is required to support the construction of the multi-use trail in the vicinity of Paul Run as illustrated on the trail alignment mapping. Assume the retaining structure will be supported on a shallow foundation. In close coordination with the structural, civil and environmental members of your firm, prepare the conceptual design of this retaining wall near the Paul Run outfall.

The conceptual engineering design includes the preparation of the following two (2) deliverables:

D. Concept Plans (Pre-TS&L Submission) – Due: April 23, 2008

Prepare a Concept Plan that establishes the controlling geometrics of your team's proposed retaining wall. The plan shall contain the following information:

- (1) Plan View, including controlling horizontal clearances, trail stationing, wall layout and locations and drawing scale.
- (2) Elevation View showing controlling horizontal clearances, the length and height of each wall segment, total wall length, existing and finished ground lines and drawing scale.
- (3) Typical Section of your selected retaining wall system, specifying structural system and materials, proposed wall height(s), wall thickness, trail typical section and dimensions, pedestrian railing type and drawing scale.
- (4) Standard DelDOT Title Block that identifies structure type.
- (5) General Notes that list design specifications, design codes, design dead loads, design live loads and design methodology.
- (6) Proposed Core boring layout and location table.

E. Pre-TS&L Study – Due: April 23, 2008

As part of the Preliminary Engineering Report, prepare a Pre-TS&L Study that summarizes structure alternates studied and justification for the recommended retaining structure type. In addition, include a discussion on the following:

- a) Constructability
- b) Future Maintenance
- c) Opinion of Probable Cost
- d) Discussion of Proposed Foundation System and Subsurface Investigation Requirements
- e) Final Recommendation

Provide the following information in the Appendix of your Preliminary Engineering Report:

- (1) Preliminary structure calculations. Provide hand-written calculations. These calculations should include factor of safety check for the wall against overturning.
- (2) Preliminary estimate of probable cost, including unit prices and preliminary quantities for the selecting retaining structure type. Cite references to support your estimate.

IV. Observation Tower

The Newark Park Commission has received a \$400,000 grant for the construction of an observation tower. The purpose of this tower is to provide City of Newark residents, UD students and trail users an observation point to view the environment and setting of the White Clay Creek watershed.

Prepare the conceptual design of this observation tower. Select the location of this tower that provides the best “viewing opportunity” along the trail alignment. The height and width of the structure will depend on other issues in the project including cost, site utilization, aesthetics, zoning and building code limitations, and the owner’s preferences. The minimum height of the proposed tower must be at least 10 feet higher than the existing tree line. The observation platform at the top of the tower must be able to accommodate a minimum of 20 people. The construction cost cannot exceed the grant amount (\$400,000).

Your design should address (but you need not engineer) code-required features such as egress systems, pedestrian access, railings, and fire suppression.

The conceptual design of the observation tower will require close coordination between the structural, transportation, civil and environmental disciplines.

Prepare the conceptual design for the superstructure and foundations of the observation tower. Assume the tower will be supported by shallow foundations and the allowable bearing pressure of the in-situ soil is 2 TSF. The in-situ soil stratum is classified as coarse grained soil without silt. Your conceptual design should include the following deliverables:

A. Concept Structure Plans – Due: April 23, 2008

- Plan view of observation tower that shows location of the structure with respect to the trail alignment. Show general layout of observation platform. Include drawing scale.
- Elevation of observation tower. Specify tower height. Specify structural type, including structural system and material type(s) for the observation tower. Include drawing scale.

- Typical Section of observation tower. Specify main structural elements and dimensions. Include drawing scale.
- A foundation plan and section. Specify foundation type (i.e. spread footings, mat slab, etc.) and basic dimensions. Reinforcement details are not required. Include drawing scale.
- General notes that list design specifications and codes.

B. Preliminary Structures Study – Due: April 23, 2008

As part of the Preliminary Engineering Report, prepare a preliminary structures study that summarizes your team's design approach and adherence to the project's objectives. The report shall include the following:

- Project overview and objectives
- The rationale and justification for the selected structural system and specify lateral load resistance mechanism.
- Discussion of pedestrian access for the tower.
- Discussion of proposed foundation system and subsurface exploration requirements
- A preliminary estimate of probable construction cost. Cite references to support your estimate.

Provide the following information in the Appendix of your Preliminary Engineering Report:

- Provide the following hand-written calculations:
 - (1) Determine Design Dead Loads, Live Loads and Wind Loads for the proposed structure.
 - (2) Check stability of tower. Calculate FS against overturning and FS against sliding for the tower foundation.
 - (3) Check bearing pressure of proposed foundation.