Model Based Contracting at NYSDOT

Pilot Project Discussion
BIM for Infrastructure Peer Exchange

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Agenda

- What is Model Based Contracting?
- Proposed Implementation
- Contract Deliverables
- Questions and Discussion
What is Model Based Contracting?

• Specify **contractual work** with relevant 3D CADD models or electronic information

• Reduce or eliminate corresponding 2D plans

By providing all the information that is traditionally contained in the 2D plans with 3D models, the 2D plans become unnecessary.
Proposed Implementation

Pilot Project

Region 8
PIN 8018.46
Rt. 28 over Esopus Creek

Current Project Status
Design Approval: June 2019
Advanced Detail Plans: June 2019
PS&E: September 2019
Letting: January 2020
Construction: 2020 and 2021

Project will be designed In-house by Design Bureau and Structures Design Bureau

NYSDOT plans to pursue more projects with a construction schedule in 2021. Future projects have not been identified yet.
NYSDOT goals for Pilot Project:

1. Create a process to include models as part of the legal contract documents for NYSDOT projects
2. Leverage technology to explore more efficient ways for NYSDOT to do business (design to construction to asset management)
Highway Design – Model Based Contracting Deliverables

Typical Sections – Model
Horizontal Geometry – Model and Data Reports
Vertical Geometry – Model and Data Reports
Superelevation – Data Reports
Miscellaneous Details – Model and or Plan Sheets
General Plans – Model
Notes – Plan Sheets
Miscellaneous Tables – Plan Sheets
Other Plans (WZTC, Traffic Signals, Drainage, etc. – Plan Sheets)
Earthwork – Model
Substructures – Model
Structural Steel (geometry) – Model and Data Reports
Slab Details – Model
Reinforcement Details – Model and Data Reports
Notes – Plan Sheets
Standard Details – Plan Sheets

Superstructure Model is in final deflected position
Proposed Implementation

Required Changes

1. A plan sheet will list all the electronic files identified as plans and notes addressing use of the electronic files.

2. A special note will be added to the proposal modifying the definition of “plans” and providing detailed information on how to utilize models.
Proposed Implementation

Electronic Files Plan Sheet

<table>
<thead>
<tr>
<th>FILE NAME</th>
<th>FILE DESCRIPTION</th>
<th>DATE/TIME</th>
<th>ENGINEER OF RECORD</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIN_FEA_RWY_ALG.XML</td>
<td>ROADWAY ALIGNMENTS</td>
<td>9/28/18 1:14 PM</td>
<td>FIRST MIDDLE LAST</td>
</tr>
<tr>
<td>PIN_CPB_70_CONTRACT.DGN</td>
<td>SUBSTRUCTURE MODEL</td>
<td>10/2/18 2:28 PM</td>
<td>FIRST MIDDLE LAST</td>
</tr>
<tr>
<td>PIN_CPB_70_BAR_REPORT.PDF</td>
<td>SUBSTRUCTURE BAR REPORT</td>
<td>10/5/18 1:03 PM</td>
<td>FIRST MIDDLE LAST</td>
</tr>
</tbody>
</table>

**NOTES:**

1. **THE ELECTRONIC FILES IDENTIFIED AS PLANS FOR THE SUBJECT PROJECT HAVE BEEN COMPLETED IN ACCORDANCE WITH ALL APPLICABLE NYS_DOT STANDARDS AND SPECIFICATIONS. THE PROFESSIONAL SEAL(S) LOCATED HEREFIN APPLY TO ALL FILES IN TABLE 1 WHERE THE ENGINEER OF RECORD IS LISTED.**

2. **THE CONTRACTOR SHALL UTILIZE THE INFORMATION IN ELECTRONIC FORM, OR DETERMINE HOW TO BEST MANIPULATE THE MODEL TO PRINT DESIRED INFORMATION. THE CAD INFORMATION IS GEOSPATIALLY LOCATED USING THE APPROPRIATE STATE PLANE COORDINATE SYSTEM. THE ELECTRONIC FILES IDENTIFIED AS PLANS ARE A PART OF THE CONTRACT DOCUMENTS AND ARE AVAILABLE FOR DOWNLOAD WITH THE OTHER CONTRACT DOCUMENT ELEMENTS. THE ELECTRONIC FILES ARE PROVIDED WITH SUFFICIENT DETAIL TO ALLOW THE CONTRACTOR, SUBCONTRACTORS, FABRICATORS AND SUPPLIERS TO QUICKLY, EFFICIENTLY AND ACCURATELY SHARE INFORMATION NECESSARY TO COMPLETE THE WORK.**
Proposed Implementation
Electronic Files Special Note

The Electronic Files Special Note will address the following:

- Definition of Terms
- Electronic File Content
Proposed Implementation

Electronic Files Special Note

*Contract Document Components.*

... declining order of precedence...

1. Plans.
2. Proposal - Special Notes.

I. Definition of Terms

Current Definition in Section 101-02:

**Plans.** The official contract drawings and applicable standard sheets, which show the location, character, dimensions and details of the work to be performed.

Proposed Definition in Special Note:

The official contract drawings and applicable standard sheets, which show the location, character, dimensions and details of the work to be performed. The Plans will also include any electronic files identified as Plans. This may include engineering models, spreadsheets, CAD files or other electronic files used to convey design intent.
Proposed Implementation

Electronic Files Special Note

The contract will utilize both traditional 2D plans and electronic files to convey the required work.

Each element of work will be provided in only one format! “Plans” or “Electronic Files Identified as Plans”
Proposed Implementation

Electronic File Content

For each component of work with electronic files identified as plans, descriptions and explanations are provided so that the contractor knows how to access the information.

Provide the same level of information given on traditional plans in an electronic format (models, spreadsheet, or report)

Example: Substructure Concrete

Each pour of substructure concrete is modeled as one solid 3D element. The level name coincides with the pour number. The 3D solid element is geospatially located using the appropriate State Plane Coordinate System.
Proposed Implementation

Electronic File Content
Example: Substructure Concrete

The following can be directly obtained from the 3D solid model:

- Elevations
- Northing/Easting coordinates
- Component lengths
- Distances between points
- Volume of pours
- Surface areas

The following is not contained in the 3D solid model:

- Keyway details
- Waterstop details
- Chamfer details

This information can be found on the project plan sheets:
Contract Deliverables:

What should be provided to the contractor?

New Software
• Open Bridge Modeler
• Open Roads Designer
• gINT – Geotechnical Software

New Terminology
• i-model (Bentley)
• Item types (Bentley)
• Federated Model
Contract Deliverables: i-Model

What is an i-Model?

Specialized Container for Exchanging Infrastructure Information

Share information-rich models securely, accurately and in a relevant context for all stakeholders, providing a complete multidisciplinary view of projects, as well as serving as a reliable means to capture feedback from project participants.

Benefit to the i-Model is that it is a read only file.
Communicating Information within Model

How do we deliver the traditional 2D plan information in the model?

- **Item Types**
  - Extended element information (100% Customizable)

- **Saved Views**
  - Preset views to call attention/showcase

- **Embedded Documents**
  - .pdf’s/.doc/.xls, etc.
### Item Types - Example

#### Properties

<table>
<thead>
<tr>
<th>General</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element Description</td>
<td>TOP</td>
</tr>
<tr>
<td>Level</td>
<td>XGCTOP1_P</td>
</tr>
<tr>
<td>Color</td>
<td>ByDefault</td>
</tr>
<tr>
<td>Line Style</td>
<td>ByDefault</td>
</tr>
<tr>
<td>Weight</td>
<td>ByDefault</td>
</tr>
<tr>
<td>Class</td>
<td>Primary</td>
</tr>
<tr>
<td>Template</td>
<td>(Name)</td>
</tr>
</tbody>
</table>

#### Geometry

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Vertices</td>
<td>6273</td>
</tr>
<tr>
<td>Faces</td>
<td>6156</td>
</tr>
<tr>
<td>Edges</td>
<td>12309</td>
</tr>
<tr>
<td>Hidden Edges</td>
<td>73</td>
</tr>
<tr>
<td>Boundary Edges</td>
<td>3</td>
</tr>
<tr>
<td>Interior Edges</td>
<td>12309</td>
</tr>
<tr>
<td>Surface Area</td>
<td>174749.491 Sq.</td>
</tr>
<tr>
<td>Plane</td>
<td>No</td>
</tr>
</tbody>
</table>

#### Material

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attached Material</td>
<td>Asphalt: Top Course</td>
</tr>
</tbody>
</table>

#### Feature

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feature Definition</td>
<td>XGCTOP1_P</td>
</tr>
<tr>
<td>Feature Name</td>
<td>TOP</td>
</tr>
</tbody>
</table>

#### Pavement Items

<table>
<thead>
<tr>
<th>Item #</th>
<th>Item Desc.</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>402.126103</td>
<td>12.5 F1 TOP COURSE HMA, 60 SERIES COMPACTION</td>
<td>1.5&quot;</td>
</tr>
</tbody>
</table>
Saved Views – Example #1
Saved Views – Example #2

- cph_begin_approach (Highway Section at Begin...)
- cph_pier1_reinforcement (Pier 1 reinforcement)
Embedded Documents - Example
i-Model Workflow

Structures Files
- 801846_fea_brd_70_supplemental_girders_obm.dgn**
- 801846_fea_brd_70_supplemental_bridge.dgn**
- 801846_fea_brd_70_contract_obm.i.dgn*
- D264xxx_fea_brd_70_contract_obm.i.dgn*
- D264xxx_fea_brd_70_contract_bridge.i.dgn*

Geotech Files
- 801846_fea_geo_supplemental_gint.dgn**
- D264xxx_fea_geo_contract_gint.i.dgn*

Highway Files
- 801846_fea_rwy_supplemental.dgn**
- D264xxx_fea_rwy_contract.i.dgn*

Create Saved Views
Create Item Types
(Appplies to all .dgn files)

Create Embedded Links

801846_mbc_federated.dgn**

801846_mbc_federated.i.dgn**

*Contractual
**Supplemental Info
Questions and Discussion