Engineering Content to Review in Digital Deliverables

Design Manual
Chapter 20
Project Automation Information
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Reviewing the engineering content of digital contract deliverables is important to ensure consistent data is being delivered to our customers. The criteria of what engineering content should be reviewed in the digital files, outlined in this document, can be done in methods described in sections 20B-73; however, those methods are not the only means of reviewing the engineering content of digital files. Other methods can be used as long as the reviewing criteria outlined in this section are met.

Reviewing Content of Digital Files

The Special Provision for Digital Contract Documents calls out three sets of files associated with digital plan deliverables: geometry, terrain models, and three dimensional CADD. The format and naming conventions of these files is discussed in Section 20B-71. The data contained in all of these files supplied to customers must be in agreement with each other and the printed plans.

Geometry Digital Files

Geometry digital files (LandXML) should be reviewed to ensure elevations, Northing & Eastings, and curve information (horizontal & vertical) match the Engineer of Record's intended design and the printed plan sets. This should be done both visually and numerically.

- Visual Check Methods:
  - Plot alignment(s) from LandXML file and compare to georeferenced plan sheets or aerial images looking for deviations. Ensure that all of the alignments tie together correctly. Look for misalignments or odd equations.
- Numerical Check Methods:
  - Compare alignment geometry report of native software to alignment report of LandXML file for differences.

Terrain Model Digital Files

Terrain model digital files (LandXML) should be reviewed at spot locations elevations, Northings, and Eastings. The terrain models should also be reviewed for holes or busts in the terrain model surface, improper triangulation, and extra triangles, points, or break lines, and to ensure the surface is a match to the printed cross sections sheets. This should be done both visually and numerically.

- Visual Check Methods:
  - Plot contours of the subgrade and top of pavement surfaces with intervals based on Specification accuracy (Article 2109.03, A, 10 of the Standard Specifications), which is 0.05 foot, and visually look for:
    - Elevation breaks.
    - Elevation spikes.
    - Anomalies based on extra triangles around boundaries.
  - Plot surface LandXML file on proposed cross sections to look for differences between the XS elements and the surface.
  - Visualize flow arrows and analyze flow direction. It is a good idea to include the existing surface with the proposed when doing a flow arrow review to ensure that the design drains properly.

- Numerical Check Methods:
  - Plot LandXML surfaces on cross sections to check elevations at key locations to confirm that they are within Specification tolerances (0.05 foot vertically for subgrade, see Article 2109.03, A, 10 of the Standard Specifications, 0.10 foot vertically outside subgrade hinge point) compared to the mathematical value based on profile.

    Surfaces should be plotted against all cross sections used for plan development and checked visually but, at a minimum, the elevations should be checked at key stations as defined below:

    - Key breaks in surface at Structures:
      - Check elevations at subgrade locations at tie ins to bridge approaches:
        - CL, LT&RT EOP (and other lane breaks as apply), EOS, and SUB_SET (Refer to 21B-224 for point name definitions).
      - Check elevations at subgrade locations at large structures (RCB or Bridge) locations:
        - CL, LT&RT EOP (and other lane breaks as apply), EOS, SET, and Hinge.
    - Tie ins to existing ground:
      - Check elevations at the tie ins to the existing pavement/grading surface at beginning & end of project:
        - CL, LT&RT EOP (and other lane breaks as apply), and EOS.
      - Check elevations at side road tie ins to existing pavement/grading surface:
        - CL, LT&RT EOP (and other lane breaks as apply), and EOS.
    - Construction staking locations:
      - Plot surface into cross sections with intervals based on Article 2526.03, A, 3 of the Standard Specifications, which is, at a minimum, every 1000 feet for grading and every 500 feet for paving surface, as well as key transition points such as PC's, PT's, super elevation points, and any other critical points. Check elevations along subgrade surface against the mathematical solutions based on the profile & template.
  - Run station/elevation/offset report on LandXML surface to give elevation every 25 feet along centerline, and check against mathematical elevation based on profile. Round both mathematical values and report values to three decimals before comparing.

Three Dimensional CADD Files

Three dimensional break line CADD files (DGN) should be reviewed at spot locations for elevations, Northings, and Eastings. The three dimensional CADD files should also be reviewed to ensure they are a match to the corresponding terrain models. This should be done visually and numerically.

- Visual Check Methods
  - Visualize the previously reviewed terrain model from LandXML and compare the DGN break lines with the terrain model visualized as:
    - Break lines
    - Triangles
    - Contours
- Numerical Check Methods
  - Review critical locations (same criteria as terrain models) in the same manner as break lines and compare the Northing, Easting, and elevation with that of the corresponding mathematical solution based on horizontal & vertical geometry.

Chronology of Changes to Design Manual Section:

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