SBCA

TPSX File Format Supporting Digital QC

White Paper
SBCA Staff
7/1/20

TPSX File Format Supporting Digital QC

Introduction

In December 2017 the Officers of SBCA's Executive Committee met in Madison, WI to discuss a variety of topics to focus on in the upcoming year. Due to litigation taking place where truss plant quality, truss design and truss repair were key elements being litigated, an area of focus was on the then-current industry standard in-plant quality control process utilizing vellum paper as a semi-transparent overlay to measure manufactured joint accuracy compared to designed intent. The group held an in-depth discussion on the lack of modernization of the traditional in-plant QC process and compelled SBCA staff to envision an alternative that included technology found on cell phones and tablets to photograph joints and electronically compile information as an alternative to paper based methods.

In 2018, SBCA staff commenced researching a variety of potential solutions to enhance in-plant QC and started developing Digital QC. In January 2018, an NAHB Multifamily Council meeting discussed the truss quality issue and how it related to truss performance when there were parties in student housing. Third party engineering firms were attempting to slide pieces of paper and other objects between truss plates and chord/web members in an attempt to indict specific joint quality control. It was during these experiences that SBCA realized it was proceeding in the right direction focusing on a digital form of in-plant QC and CMs were in need of a more advanced, more efficient manner of conducting in-plant QC.

Throughout the process in creating Digital QC, SBCA wanted to incorporate concepts learned from its In-Plant Wood Truss QC program. Combining the benefits from In-Plant Wood Truss QC with the capabilities of digitally capturing QC data provides a very robust management tool for CMs that allows for a more efficient and measurable in-plant QC program. It increases overall quality of manufactured goods while allowing CMs the flexibility to conduct the minimum number of joint inspections required by their QC Manual or easily increase the number of inspections because it is easier to capture data digitally, which then aids in managing their continuous improvement cycle.

Early in the development process for Digital QC, it became overwhelming apparent to SBCA staff that the various truss design software provider's output of their QC information was in many different in a non-standardized formats. Various software vendors include and exclude certain information fields while also enumerating certain values while leaving others freeform. SBCA staff, in an effort to generate forward progress early on, worked with each individual software provider to create work around file outputs capable of creating alpha and beta testing versions of Digital QC. This allowed SBCA to test the Digital QC model with its membership and determine if a marketplace and desire for a more advanced QC program existed amongst CMs.

Through this process, SBCA has learned of Digital QC's overwhelming popularity and appetite for use among CMs. SBCA then had the need to widely offer the program to all CMs that desired to use it as an alternative to traditional in-plant QC methods. As a result, SBCA communicated with various software vendors about the need to standardize an input format for Digital QC that includes information necessary to perform a QC inspection without combining multiple file outputs and parsing together truss details from multiple sources. This resulted in SBCA staff working with individuals from its IT Committee and Strike Force 1 of SBCA's Strategic Planning efforts to produce its TPSX file format.

TPSX Format

In February 2020 at SBCA's Open Quarterly Meeting (OQM) in Miami, FL Strike Force 1 held an open meeting to discuss the status of its Unified Data Standard (UDS). At this meeting, a frank discussion took place between various CMs, software vendors and equipment manufacturers. The discussion led SBCA's Strike Force 1 and SBCA staff to focus on developing a standard input for Digital QC.

The TPSX file format was created to standardize QC data outputs of various component software programs for input into SBCA's Digital QC program. It was based on the existing TPS file output supported by all major software providers to the truss industry and its readability via plain text editors for simplicity. Like the TPS file, the TPSX format includes standard truss details along with required QC information to perform truss inspections digitally from a tablet. With this one format, SBCA has a single integration to manage and implement into Digital QC while providing software suppliers a single output to integrate into their offerings to CMs.

TPSX utilizes a tiered file format incorporated into a compressed ".zip" style format. This allows for a streamlined approach to file output of specific information while also allowing for future use should the format needs of Digital Truss QC expand or other opportunities present themselves, such as but not limited to wall panel QC, field framing QA, and so forth. The data necessary to support a standardized QC format is normalized and broken down into two distinct portions:

- Basic component and layout information of individual trusses
- Specific quality control and quality assurance information

The data is packaged into a single, compressed file to improve organization and handling. A "manifest[1]" or listing, of trusses/components included in the TPSX information is also included. The data itself is in a human and machine readable JSON format. Information for multiple trusses can be included in the compressed TPSX file allowing CMs to determine how many trusses are included in a single TPSX output, whether it is a single truss, a grouping of trusses within a job, an entire job, or even multiple jobs if so desired.

To support the standardization of the TPSX format, SBCA is creating supporting documentation and tools that will be made available to interested parties. Included in this information are a variety of detailed JSON schema that describe the file structures and validation requirements of the TPSX format. This allows for an implementer validator to be created and managed by SBCA to ensure TPSX output is Digital QC compliant for every software vendor, program, and the various versions as they are rolled out and used by CMs.

---

[1] A manifest is a file that describes version information as well as a description of the other data expected to be in the file

TPSX Truss Details

- Truss ID
- Truss Quantity
- Software
  - Program
  - Version
- Job ID
- Job Description
- Truss Name
- Truss Type
- Truss Description
- Truss Creation Time Stamp
- Camber
- Lumber
  - ID
  - Material Type
  - Material Description
  - Width
  - Treatment
- Plates
  - ID
  - Name
  - Manufacturer
  - Description
  - Type
  - Width
  - Length
  - Gauge
  - Teeth Per Square Unit
- Members
  - Label
  - Type
  - Vertices
  - Bevels
    - Base Cuts
    - End Cuts
  - Orientation
- Plating
  - Plating ID
  - Plate ID
  - Plate Label
  - Truss Face
  - Plate Center
  - Vertices
  - Slot Orientation
- Bearings
  - Bearing ID
  - Width
  - Thickness
  - Center (location)
- Sequencing
- QC Standard
- Truss Dimensions
  - Span
  - Height
  - Left Overhang
  - Right Overhang
- Joint QC
  - Joint QC ID
  - Joint Label
  - Joint Stress Index
  - Joint Type
  - Joint Description
  - Joint Center (location)
  - Joint Member IDs
  - Plating ID
  - Fabrication Tolerance
  - Zero Tolerance Polygon (location)
  - Rotation Tolerance (min/max)
  - Area Method
  - Non-Standard Steel Tension
  - Tooth Counts
  - Member ID
  - Required Teeth
  - Required Area
- Member QC
  - Member ID
  - Member Unique Label
  - Max Combined Stress Index

Digital QC Status

As of late June 2020, Digital QC remains in beta testing with over 70 CM locations actively using the program for their day-to-day in-plant QC inspections. In recent weeks, a number of CMs locations have been on boarded for SBCA staff to better understand the process CMs go through when integrating Digital QC into their existing in-plant QC process with hopes of streamlining the process and offering improvements for an exceptional CM experience.

Beta User Feedback

Throughout this process, CMs engaged with Digital QC have provided SBCA staff with feedback and guidance to improve the software, which were subsequently integrated into next version releases of the software. One area of feedback that SBCA is not able to affect relates to how the truss detail information, and ultimately the TPSX file, is produced in each individual supplier's component software suite and made available for Digital QC. SBCA has received general feedback, from CM users, that this process is relatively cumbersome and typically requires multiple parties within a CM location to produce the needed files to have digital QC function properly. This includes but is not limited to, a truss technician creating QC files, uploading into the digital QC program, a QC inspector using the program to inspect, and so forth. If multiple trusses need to be inspected, the current multiple user process takes more time and effort than CM users expect it to.

CMs would like to see this process streamlined with their various software providers to limit the number of individuals required to produce a TPSX file and to limit risk exposure to existing production ready component files. SBCA stands ready to facilitate this dialogue and work directly with Digital QC beta testers and individual software supplier staff to create a solution that is efficient for CMs to use while maximizing the use of Digital QC. SBCA encourages software vendors to proactively embrace the interactions CMs have with their software to produce Digital QC outputs, including TPSX files. This will ensure CMs have a positive experience with Digital QC and increase the likelihood of additional inspections reducing risk for CMs and subsequently their plate and engineering suppliers.

Additional Considerations

Occasionally in the Digital QC beta testing process SBCA has discovered errors and/or miscalculations in the supplier software programs. SBCA intends to establish a protocol with the various software suppliers in how to handle these types of situations should they occur in the future. It is in the industry's best interest to collaborate on any software errors that SBCA and/or CMs may become aware of once Digital QC is widely used in the component industry. SBCA realizes this information constitutes intellectual property and a proper transfer process needs to be established to manage the confidential nature of this type of feedback.

Another item to address is a review process and update cycle to manage any changes and/or additions to the TPSX format. While there may be a need for an emergency update in a rare instance, a regularly planned and established schedule is desired to manage expectations for all involved. A key consideration is how to best plan around various software releases so there is the least disruption possible for all parties involved with the TPSX format. SBCA anticipates working with TPI's Digital QC Programming Committee to establish this review and update cycle, whether it's in 12 or 24 month increments or something different that works for all involved.

Future of Digital QC

CMs remain eager to implement Digital QC and SBCA expects a thorough rollout of the program once it is ready for a production release. The goal of a production release remains SBCA staff's singular focus in the near term. However, a number of ideas have been discussed that may offer additional opportunities to offer Digital QC to others in the supply chain or expand it to other products such as wall panels. The TPSX format was developed with future considerations in mind so that there is flexibility to adapt to new needs and ideas as they arise.

SBCA staff is also working on a management dashboard, whose intent is to provide a feedback loop that facilitates continuous improvement and training components.

Additionally, CMs have indicated they have the desire to vigorously expand the number of QC inspections they perform with the help of Digital QC. Traditionally, CMs perform three QC inspections per week, per shift, per line which may be a very small representation of the number of trusses actually produced. Digital QC allows CMs to adjust their QC inspection frequency to a statistically relevant representation of their production while simplifying the ongoing process and saving inspection time in the process.

Conclusion

SBCA's Digital QC is a powerful tool for CMs to improve their in-plant QC inspection process, the quality of the products they produce and ultimately their businesses. It modernizes a process that has not seen significant improvements in a number of years and is built around technology readily available to CMs. As part of this improved process for CMs, a standardized information input is necessary across multiple software platforms used by CMs to normalize the input process for CMs, make customer service easier for everyone involved software use related to digital QC and make all future developments more cost effective for everyone. The SBCA Board of Directors, SBCA's Executive Committee, QC Committee, IT Committee, Strike Forces and staff remain upbeat and confident regarding the acceptance and use of Digital QC and subsequent adoption of TPSX in the component industry.

For continued updates on the file TPSX File Format and to view sample files, schema and other supporting documents as they become available, visit www.sbcindustry.com/tpsx (not yet live).

For questions or comments, please reach out to SBCA staff:

Jess Lohse
jlohse@sbcindustry.com
(406) 945-1491