DESIGN AND CONSTRUCTION OF TALL WOOD BUILDINGS:
FRAMEWORK FOR QUALITY ASSURANCE OF GLUED WOOD COMPONENTS FABRICATED ON SITE

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ABSTRACT: Sometimes it is not possible to finalize fabrication of structural glued wood components in a manufacturing facility under controlled factory environment, with continuous manufacturing process, and following strict standard qualification and quality control requirements as engineered wood products are currently made. In such cases, on-site fabrication/gluing is likely the only option. However, presently there is no procedure for quality assurance of glued wood components that involves final fabrication on site. This paper presents a framework for quality assurance of such glued wood components whose final fabrication steps occur on construction site. The proposed framework includes qualification and quality control procedures.

KEYWORDS: Structural glued wood component, Qualification, Quality control, On-site fabrication, Bond quality

1 BACKGROUND
Engineered wood products are typically mass-produced in controlled factory environment, under continuous manufacturing processes, and following strict standard qualification and quality control requirements. A product passing the qualification and quality control requirements is expected to meet the minimum performance requirements for such products in service. Such engineered wood products include established structural products like glued-laminated timber, I-joists, laminated veneer lumber, parallel strand lumber, and laminated strand lumber, and newer structural products such as cross-laminated timber.

Structural glued wood components used in construction include engineered wood products. These products are often specified for construction projects by engineers, who rely entirely on the manufacturers to ensure the products meet the minimum quality requirements needed to be assigned design values. Bond quality assessment is part of every quality control procedure for structural glued wood products because strength of a glued wood product relies heavily on bond quality. Due to their use in structural applications, life and property may be at risk if there is no precise control over the manufacturing process and subsequent quality assurance [1]. Bond integrity requires special considerations during storage, handling, erection and the entire service life of a product.

Often times, large and complex structural glued wood components are specified for construction projects. It is always recommended to fabricate such components in controlled factory environment, under continuous manufacturing processes, and following strict standard qualification and quality control requirements. However, given the size, nature, and/or limited number of required components, it may not be possible for the fabricator to carry out the final fabrication steps in a manufacturing facility. In such cases, on-site fabrication is likely the only option. If the component is not mass-produced in a continuous and controlled process, a feasible procedure has to be adopted for qualification and quality control assessment to ensure the component has the quality needed to meet the performance requirements in service.

The framework presented in this paper expands on the concepts presented in chapter 7 of the Technical Guide for Tall Wood Buildings [2].

2 METHODS
In a manufacturing process of a glued wood product, several adhesive-related parameters, substrate-related parameters, and environmental-related parameters have to be controlled to ensure high quality bonds. For example, adhesive spread rate and uniformity, assembly time, pressure level (i.e. adhesive-related parameters), wood quality, moisture content, surface temperature (i.e. substrate-related parameters), ambient temperature and
relative humidity (i.e. environmental-related parameters) are all critical in the manufacturing process of a glued wood product. While such parameters are controlled for products mass-produced in continuous and controlled processes, it is challenging to control all these parameters when the component is manufactured on site.

The purpose of a qualification procedure for structural glued wood components that involves final fabrication on site is to define acceptable limits for the critical parameters, based on the component performance criteria, supplied by the designer or engineer, and the adhesive performance criteria, supplied by the adhesive manufacturer. An acceptable quality range is then defined through preliminary testing by using combinations of the minimum and maximum acceptable limits of the critical parameters. This step can be done in a third party testing facility prior to final fabrication of the actual component on site. The qualification test methods may be similar to those specified in product standards for qualification or quality control of similar engineered wood products.

The purpose of a quality control procedure for glued wood components that involves final fabrication on site is to check if the bond quality is within the acceptable quality range defined during qualification. The quality control procedure involves testing of small coupons taken from inconspicuous parts of the actual structural component whose final fabrication steps occur on site. The quality control test methods should be similar to the tests used for qualification. Testing of the small coupons taken from the actual structural component can be done in a third party testing facility after the manufacture of the actual component on site.

3 RESULTS AND CONCLUSIONS

This paper presents a framework for quality assurance of large and structural glued wood components, whose final fabrication/gluing steps cannot be carried out in a manufacturing facility and have to be carried out on construction site. The proposed framework includes component qualification and quality control procedures.

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REFERENCES
