DESIGN AND CONSTRUCTION OF TALL WOOD BUILDINGS:
A GUIDE FOR PREFABRICATION AND INSPECTION OF
ASSEMBLIES

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ABSTRACT: Multi-storey wood buildings will not be possible without a large degree of prefabrication and the attendant planning, similar to what is common with structural steel and precast concrete buildings. This paper seeks to establish good practices and standards which can give confidence that what is designed in accordance with the intent of relevant building codes, can in fact be built with confidence in quality and with excellence.

KEYWORDS: Prefabrication, Erection, Inspections

1 INTRODUCTION

With wood, there are many possible means of building, including various forms of solid wood and engineered wood panels, as well as beams and columns. Standard practices for construction, without knowing the details of what may emerge, should thus be broad and performance-based.

The guide presented in this paper expands on the concepts presented in chapter 7 of the Technical Guide for Tall Wood Buildings [1].

2 PERSONNEL

The roles and responsibilities of the personnel vary depending on the type and complexity of the project, experience and expertise of personnel, and available resources. Both the fabricator and erector should prove to have extensive experience with fabrication and/or erection of timber buildings. Both the fabricator and erector should submit evidence of companywide and project-specific quality assurance programs. Such programs should indicate experience of key personnel which should be responsible to address quality and safety concerns in both methods and outcomes, in order to show that the required standards are achievable.

3 DESIGN FOR PREFABRICATED ASSEMBLIES

To allow the fabricator flexibility in achieving innovative and economical solutions, the specifiers should supply a set of design performance criteria that must be met. These criteria should include architectural requirements as well as all climate and environmental criteria, loading and performance expectations, with reference to applicable codes. Well planned and error-free fabrication and erection drawings are key to control the production, logistics and installation of a project. The complexity of modern timber buildings, including tall ones, places excessive demands on 2D drawing methods of the past. Even current 3D tools like Autodesk® REVIT® and other Building Information Modeling (BIM) software packages are not able to provide the data and accuracy required for the production of prefabricated elements. A 3D manufacturing model is required for final design and fabrication (“shop”) drawings. The BIM package used can and should however provide the base data used for the manufacturing model.

Materials and systems testing prior to concealment or completion, where required, include not only the structural aspects of prefabricated assemblies but also fire, acoustic, mechanical/electrical, and envelope details where applicable.

4 SUBMITTALS

Approval drawings are to be generated from the 3D model for submission. The fabricator should submit fully detailed

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and dimensioned layout drawings indicating all aspects of construction of the prefabricated elements. Erection sequence, temporary supports, bracing requirements against all conditions during erection should be clearly indicated on the erection drawings. Lifting connections and locations should be detailed on the erection drawings with indications of the lifting equipment.

5 FABRICATION

Fabrication and prefabrication are always recommended in controlled factory environment, under continuous manufacturing processes, and following strict standard qualification and quality control (QC) requirements. Regardless of whether an assembly is factory-built or site-built, it is the responsibility of the fabricator to make sure the minimum qualification and QC requirements are met which would ensure acceptable performance. Development of appropriate qualification and QC procedures is the responsibility of the fabricator. Qualification and QC data should be documented and approved by the engineer and architect in charge of the project.

Qualification procedures (Quality Assurance Procedures) for generic products, manufactured in controlled factory environment and under continuous manufacturing processes, should follow recognized standard requirements such as CSA O122-06 [2] / O177-06 [3] for structural glued-laminated timber or similar standards for qualification of other products. QC procedures for generic products, which are manufactured in controlled factory environment and under continuous manufacturing processes, follow recognized standard requirements.

Unique components manufactured in limited number and tailored to specific projects whose final fabrication/gluing steps that cannot be carried out in a manufacturing facility and can only be carried out on-site, cannot follow the qualification requirements and quality control procedures in standards or evaluation reports. Such structural components have to follow project specific principles outlined by the engineer and architect in charge of the project. A framework for quality assurance of glued wood components whose final fabrication steps occur on construction site is given in chapter 7 of the Technical Guide for Tall Wood Buildings [1].

As prefabricated, precision made structural elements require a certain degree of protection from the elements, special provisions need to be made to store and transport such elements prior and during erection.

6 EXECUTION

In general, “just in time” delivery of all prefabricated parts and pieces to site is a good strategy. By minimizing material storage on site, it can help to reduce site logistic problems and it decreases the risk of site accidents.

Site modification should be avoided where ever possible. Reality is that site modifications are usually required. They should be pre-planned where possible, identified as such in the planning procedure / fabrication drawings and be approved. Unforeseen site modifications should be approved by the engineer and architect in charge of the project before executed.

Erection of the structure should be carefully planned for quality, durability and safety, and all erection methods should be designed by the erection engineer and strictly followed by the erector.

7 INSPECTION AND RECORDS

The engineer and architect in charge of the project should do the site inspection of the prefabricated assembly so as to take ownership of the inspection.

Where building officials require inspections during construction stage or post-construction stage, special provisions should be made to accommodate this.

8 CONCLUSIONS

Every project has its own unique requirements and that needs to be reflected in the design and specifications. The content presented provides a good basis of which the designers of buildings using prefabricated products can build on and tailor it to fit their needs.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the support of the following individuals: John Boys (Nicola LogWorks), Richard Aarestad (Ledeor), Thomas Leung (TLSE), Robert Malczyk (Equilibrium), Robert Drew (Perkins+Will), Angela Lai (BTY), Jens Hackethal (Styxworks LLC), Kenneth Koo (FPInnovations), Sylvain Gagnon (FPInnovations). The authors would also like to thank Natural Resources Canada (Canadian Forest Service) for the financial support for this work.

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