

Modular Construction

Modular construction is a complete structure with high level of prefabrication. Major efforts are placed in the preconstruction and planning process to take into account all aspects of construction, such as structural design engineering, manufacturing, transportation and electrical and mechanical engineering.

Most of modular plants in Canada are members of the Canadian Home Builders’ Association (CHBA) - Modular Construction Council or BOCA (*Créneau Bois Chaudière Appalaches*) in Quebec. With guidance from CHBA and BOCA, outreach was made to modular plants across Canada with a general survey in 2019-2020 and more detailed survey to selected modular plants in 2020-2021.

All modular plants deploy digital AutoCAD type of drafting for building design and modeling. Output are available for the assembly of modules. Although assembly of final modules is mostly manual, all plants do manufacture its own components, such as roof and floor trusses as well as floor and roof panels.

Modular Plant Manufacturing

As previously mentioned, all modular plants manufacture their own roof and floor trusses. All the plants contacted are engaging MiTek software which can provide building design, layout and manufacturing. It can link most truss manufacturing operations such as automated saws with exception of physical web placements and pressing of truss plate.



Figure 1. Truss manufacturing (Courtesy: Royal Homes) *Figure 2. Roof truss system (Courtesy: Quality Homes)*

From the feedback of the outreach, modular plants preferred prefabricated panel to be the next area of automation for the industry. This is currently a manual process at most plants except for two plants having semi-automated operation. The software supplier did confirm its software can create and transfer digital files to certain panelized manufacturing equipment.

Equipment, such as saws and material handling equipment, are already engaged for panel manufacturing. An automated nailing bridging system capable of communicating with a design/manufacturing design

software will be the recommended equipment. Plants should also consider whether existing jiggging tables are compatible with new panel manufacturing equipment.



Figures 3 and 4. Panel jiggging table (Courtesy: Royal Homes)

Recommendation

Modular plants in Canada can increase the efficiency by adopting semi-automated manufacturing process for prefabricated panels. It is noted that plant truss software can provide structural designs, AutoCAD type 3-D rendering with the ability of communicating with panel manufacturing machinery. One modular plant supplies prefabricated panels directly to the industry as another business opportunity.

Further improvements can be developed for adoption of advanced robotics in the manufacturing process. This will increase production efficiency as full automated process is now possible as fully automated lines are not needed for the modular industry at this time.

Panelized Industry

Panelized construction is a two-dimensional non-volumetric construction of building elements such as walls, floors and ceilings. It is more flexible with trade-off that substantial on-site work is required to complete the buildings.

At present, there is no panelized construction association in Canada although it is gaining support in Canada. Currently, there are two automated panelized plants in Canada. The semi-automated panelized production is generally part of a truss fabrication operation across Canada. There are five (and Quebec) provincial truss fabricators associations in Canada representing the truss industry. The association in Ontario and Quebec have since re-branded themselves to include panelized products and engineered wood products (EWP). In 2019-2020, outreach was made to a few selected panelized plants in Canada with a general survey. In 2020-2021, outreach was made to all associations across Canada with a detailed survey.

All panelized plants deploy a digital AutoCAD type of drafting for building design and modeling. However, there are differences between automated and semi-automated operation in areas of machinery and software.

Panelized Plant Manufacturing

Automated manufacturing lines are more advanced in Europe like Sweden’s Randek BauTech and Germany’s Weinmann. The software can link seamlessly to machinery by full computer-aided design (CAD) or computer-aided manufacturing (CAM) capability. At least two Canadian home builders installed the fully automated lines as dedicated panelized manufacturing plants in Ontario and Alberta. It should be noted that customization is required for Canadian application to meet local building codes and construction details.



Figures 5 and 6. Automated panelized production line (Courtesy: H+ME Technology)

As semi-automated panelized lines are usually a part of truss fabrication operation, the plants use proprietary software supplied by the truss industry in North America, such as MiTek or Alpine/ITW. The software is an extension of wood truss software and, as a result, it can design the framing with layout, generate shop drawings and, in some instance, can provide digital instructions to electronic saws and jigging.



Figures 5 and 6. Semi-automated panelized line (Courtesy: ZyTech Building Systems)

Manufacturing equipment for semi-automated operation can be from either Europe or North American as there are some digital data transfer between certain software and machinery. Detailed information will be reviewed this year.

Recommendation

Currently, there is no distinction between site-built or factory-built panels with software design, production machinery and in-plant quality control. Panelized product is a value-added product and should be recognized and acknowledged. Further improvement in material handling and material flow within the plant can increase efficiency. Like modular plants, adoption of advanced robotics should increase the efficiencies of manufacturing process.

For more information

Dorian P. Tung | Ph.D. – Manager, Building Systems
dorian.tung@fpinnovations.ca

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