



Cassette Wall System

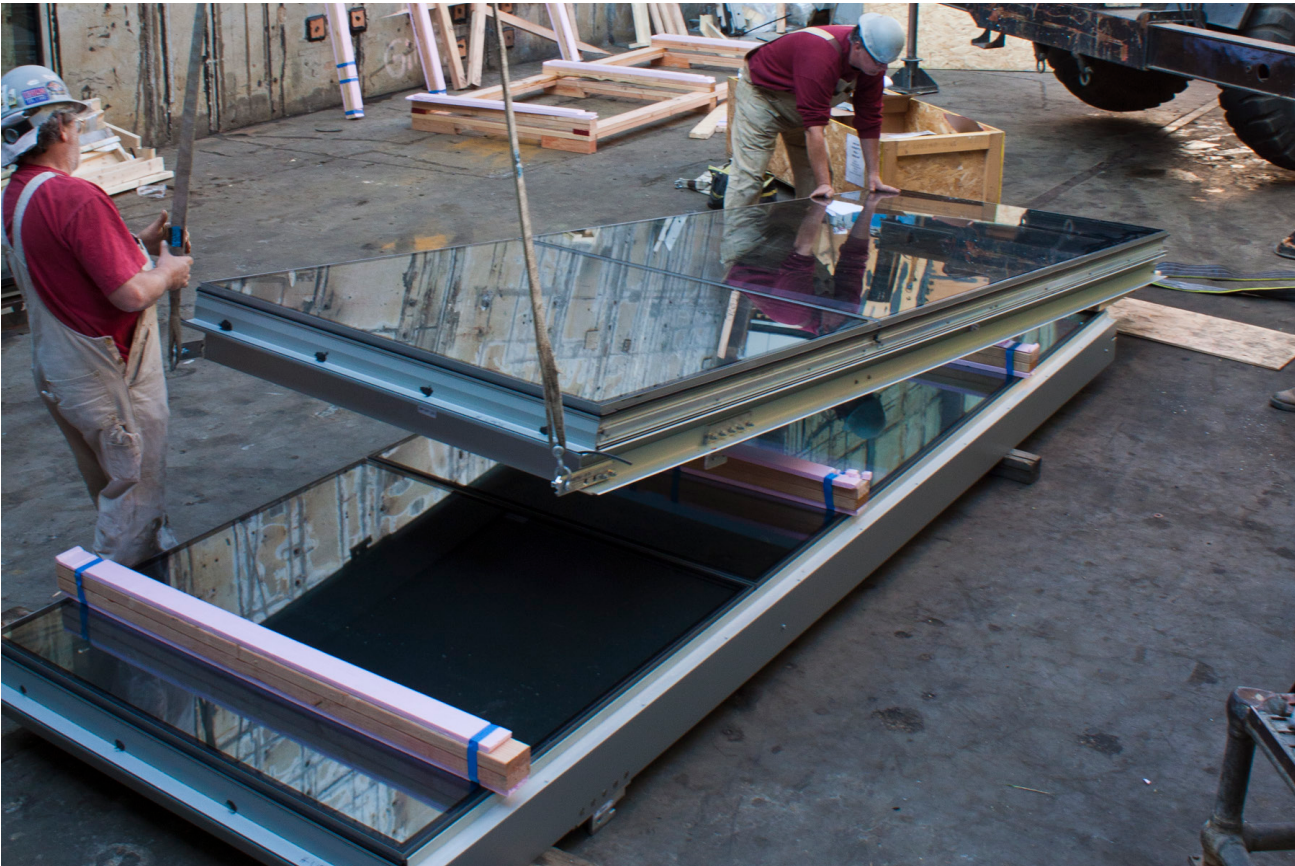
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Modular facade systems represent one attempt to optimize the final assembly of unitized components delivered to the construction site. This facade system – also known as cassette walls – is pre-assembled in modules, ultimately simplifying the final assembly process, easing the inspection of completed units, facilitating just-in-time assembly by synchronizing manufacturing and field activities, and introducing a greater flexibility in the location and size of the final assembly facility.

Curtainwall assembly and glazing processes are constrained by sealant application and structural glazing. These processes dictate the type and size of facility required. They also influence lead times, the amount of work in process, and completed product inventory. The Cassette Wall is designed to de-couple silicone sealant application from the final assembly process.

Completed units maintain the appearance and the behavior of traditional unitized facades but do not require exceptional installation methodology. Cassette systems do not impose design limitations, rather they allow for full customization in size, shape, and finish in interior and exterior applications.

The Cassette Wall (patent US2008/0066402 A1) has been fully designed and engineered by Enclos, including a full size mock-up manufactured and tested. This document presents engineering and test data from our own in-house research.



Enclos conducted a full scale cassette wall system mockup.

INTRODUCTION

It is generally accepted that construction has lagged behind other industries in productivity improvements for the better part of a century. The combination of engineered to order (ETO) products and the fragmented nature of the construction industry typically results in waste and inefficiencies along the supply chain involving products and services from several industries.

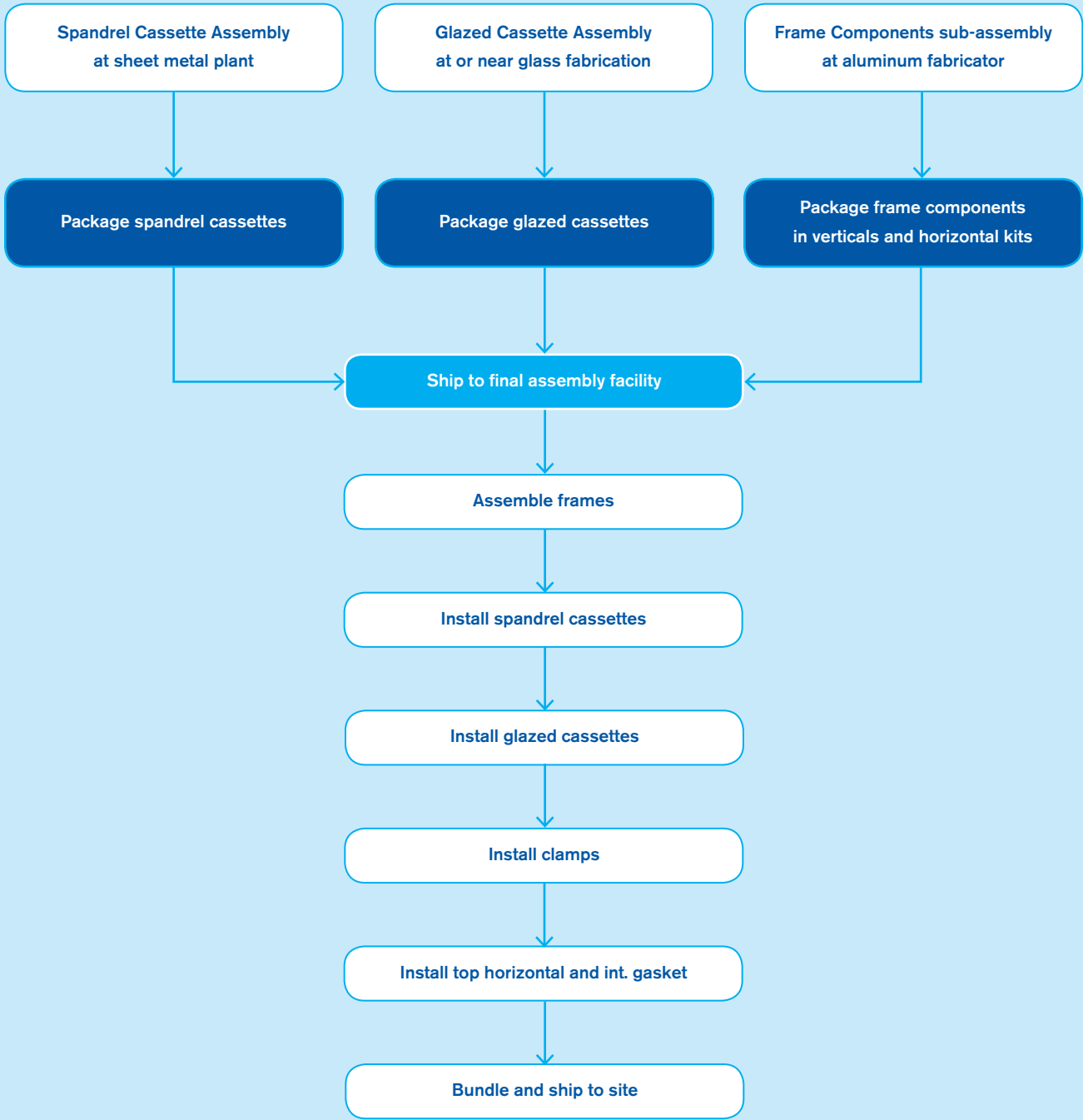
Recent developments in 3D computer modeling, especially the emergence of processes such as Building Information Modeling (BIM) and clash detection, have created opportunities for reducing lead times, thus increasing efficiency and reducing costs on complex construction projects. The ability to compare digital models, check interference and reduce the number of RFIs have increased contrac-

tor’s confidence that engineering and design data will match field conditions, leading directly to an increase in the pre-fabrication and pre-assembly of components delivered to the jobsite. This has been especially noticeable in the electrical and mechanical trades in recent years. In contrast, facade contractors have practiced pre-assembly of units since the 1980s because of the building skin’s interface with interior trade work. If the glazing industry was not impacted by the BIM revolution in terms of pre-assembly, it has undoubtedly changed the way information is managed by using graphics (rather than or in conjunction with data) to manage projects. With unitized curtainwall being a 30-year-old concept, it has since become a commodity to the construction industry.

The facade concept presented herein primarily targets processes ahead of field installa-

tion: procurement, fabrication, sub-assembly, final assembly and glazing. Our Cassette Wall research is based upon sub-assembling major framing components and producing pre-glazed, pre-assembled glass and infill systems that can be later assembled without the use of sealants at a final assembly site. This extended pre-assembly process dramatically reduces unit assembly time and space requirement, something especially effective when the facade incorporates numerous materials from multiple sources. For example, glass can be pre-glazed to aluminum cassettes in or near a glass fabrication facility while insulation is being pre-applied into spandrel cassettes at a sheet metal facility. An early eye on the quality control of modular components and reduction on assembly time also facilitates just-in-time final assembly, reducing storage requirements while improving flexibility and change management.

PRODUCTION FLOW CHART



Because **modular systems** separate cassettes and kitted framing components, **freight can be reduced by more than 500%.**

MODULAR DESIGN

The type of modular assembly described in the previous section has been common practice in the aerospace, automotive and ship building industry for many years. Through unique design concepts the practice can also be extended to the facade industry by using the principles of modular design: the product is partitioned, various modules have well defined interfaces, and components can be separated and recombined (to increase flexibility). As a curtainwall application, the focus is on optimizing final assembly – reducing the number of components and designing processes around known interfaces, thus reducing motion waste. As a result, transportation waste is also minimized.

OBJECTIVES OF THE CASSETTE WALL

Shipping fully assembled and glazed units can be expensive, especially if units are shipped from overseas. Compounding this is the fact that shipping containers limit the size and number of units that can be delivered. Because modular systems separate cassettes and kitted framing components, freight can be reduced by more than 500%.

Large, heavy and bulky components should be handled as little as possible. The cassette

wall design offers the possibility of performing assembly tasks in line with the manufacturing of infills. Cassettes can be attached to glass, terracotta can be attached to an infill panel, and insulation can be installed on sheet metal backpans at the sheet metal manufacturing facility. This reduces material handling and motion waste at the curtainwall assembly plant.

Final assembly only requires screw guns, reducing labor to 1-2 man-hours, minimizing the need for multiple assembly lines and work-in-process. Final assembly is closer to the field erection sequence, where specialized, mobile assembly facilities can be designed with minimal space requirements. Pre-assembly can then be performed in low labor cost areas.

Cassette Wall design is particularly adapted to facades using a large number of infill types, and a “dry” final assembly insures better weather seal quality. However, with major components being pre-assembled during throughout the process, the need to inspect components early on increases to reduce the risk of disrupting quality issues and rejected components.

CURTAINWALL TYPOLOGY

The AAMA Aluminum Curtainwall Design Guide Manual classifies wall systems by five different types. As far as field installation is concerned, Cassette Walls fall under the Unitized Systems classification.

Stick Systems: Individual fabricated components and infills are installed on site with no or little pre-assembly.

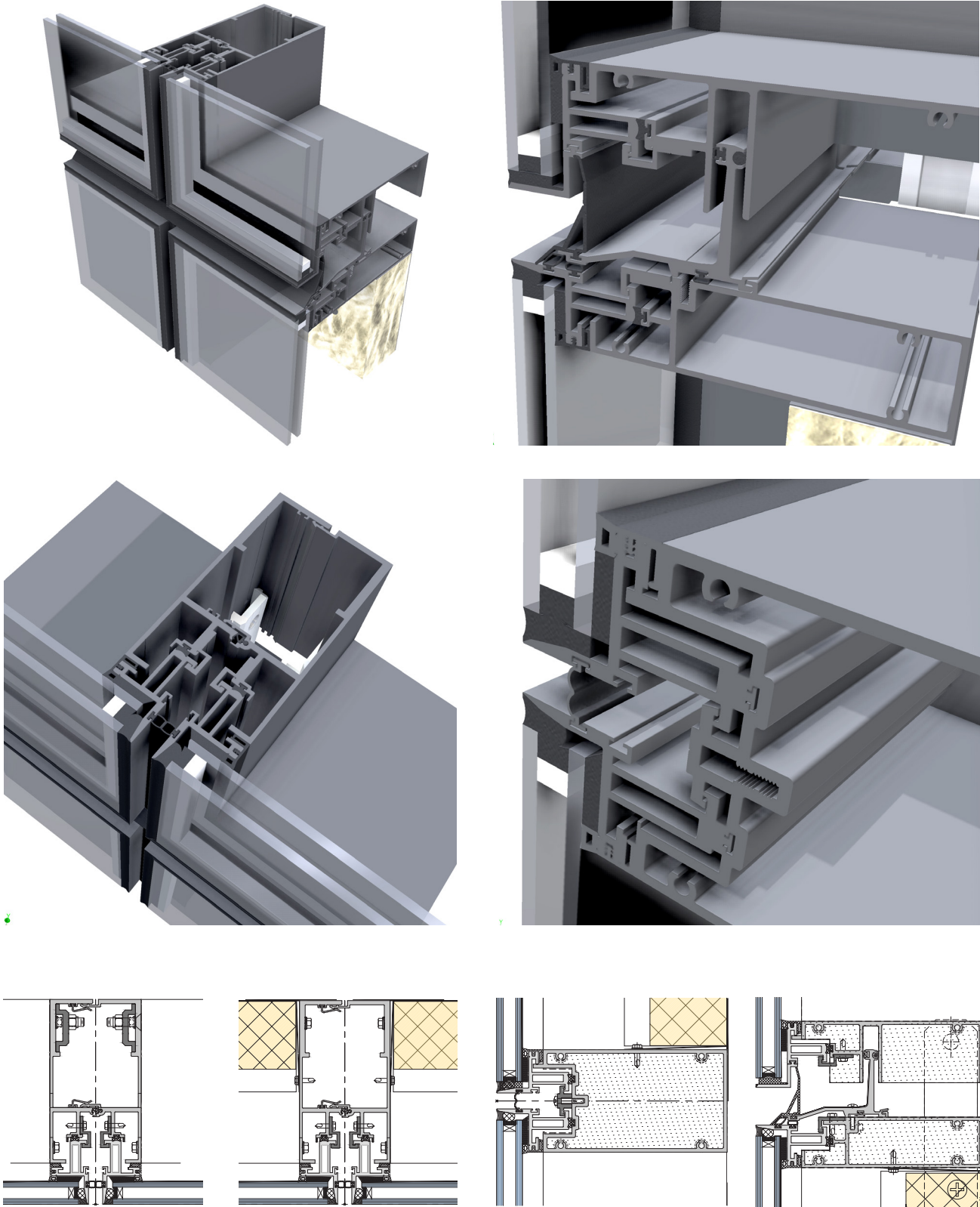
Unitized Systems: Facade modules are shop assembled and glazed to the highest level of quality, with complete panels being shop built.

Unit & Mullion Systems: Hybrid compositions consisting of sticks (mullions) that are erected as a first layer with pre-assembled and glazed units later attached.

Panel Systems: A variation of the unitized system with sheet metal or castings replacing the unit frame.

Column Cover & Spandrel Systems: Pre-assembled units used to cover columns and spandrel areas, with glass units or stick systems installed at the vision areas.

Figure 1 (opposite): The “dry” cassette system reduces labor costs and insures better weather performance.



FLEXIBLE MODULAR ASSEMBLY



CONCEPT ONE: MOBILE ASSEMBLY FACILITY



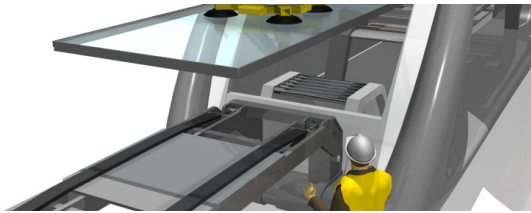
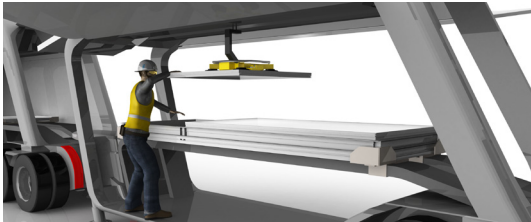
MODULAR FACILITY STORAGE UNIT



The modular assembly is compacted for initial transport and expands upon arrival at the job site. The assembly has a maximum storage capacity of 20 units.



CONCEPT TWO: SINGLE MODULE FACILITY



CONCEPT THREE

Concept three offers the option to expand the assembly station's work area by linking additional modules together.

