# Wood-Frame Modular for Multi-Family: Increasing Speed-to-Market for Developments

Presented by Dean Dovolis

DJR

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



#### **Course Description**

Modular construction is touted as an opportunity to combat rising interest rates and construction prices through greater efficiency, address skilled labor shortages, and reduce jobsite waste. However, some architects and engineers are hesitant to embrace the modular approach because they don't want their designs to be compromised, and they don't think it has the flexibility or functionality to execute certain project typologies. Through the lens of West 7<sup>th</sup> Apartments, a 7-story woodframe modular multi-family project in St. Paul, MN, this session will take a close look at modular wood-frame multi-family project design. Topics covered will include unique design considerations for modular, detailing and sourcing techniques, and how to navigate project approvals and coordination between design team, manufacturer and contractor.

#### **Dean Dovolis**

Dean worked with firms in the Twin Cities and Boston prior to founding DJR Architecture in 1985. Dean's range of experience brings diversity of projects and designs to urban design and master planning, residential planning, commercial and retail design, and public project initiatives. His expertise at quickly recognizing significant planning opportunities and helping clients to effectively focus their energy has proven to be invaluable, and his work as an expert witness has helped many organizations.



# **Learning Objectives**

- 1. Define modular wood construction and illustrate the various levels of implementation.
- 2. Discuss the role of architects and engineers in the success of off-site construction techniques.
- 3. Review potential cost and schedule savings realized through the use of off-site wood construction.
- 4. Highlight how pre-planning and coordination between the design team and modular component manufacturer can lead to efficiencies in the fabrication and installation process for wood-frame projects.

#### **Modular Projects**



MOD42



The Alvera



Public Housing Scattered Sites



**Stinson Apartments** 



St. Michael Apartments

**Glenwood Avenue Apartments** 

10 Projects – Steel Modular

**UN World Bank - Africa** 

### **Benefits of Modular Construction**

- Speed to Market
- Cost Savings
- Consistent Quality
- No Change Orders
- Less Disruption to Neighborhoods
- Healthy Work Environment
- Diverse Workforce



#### Why Developers & Builders Are Choosing Modular

ASSEMBLY LINE PROCESS IN CONTROLLED ENVIRONMENT			OFFSITE INSPECTIONS & QUALITY CONTROL		LONG-TERM END-USER BENEFITS	
QUALITY	OVERSIGHT	SAFETY	CONCURRENT SCHEDULE	ENVIRONMENT	COST	SOUND
Repeatable tasks and systematic quality ensuring consist ency and quality.	Facility-based 3 <sup>rd</sup> party inspection streamlines the construction process guarantying quality control.	When compared to on-site- built projects, modular builds report 80% lower accident rates on average.1	Manufacturing occurs simultaneously in a controlled environment with sitework.	Less than 5% waste compared to 15% in typical construction for a more energy- efficient build.	In the right environment, modular construction can reduce costs by as much as 20%.	Modular built units feature enhanced acoustics due to double floor- ceilings and wall assemblies.

(1) Source: WSP – Modular Construction for Affordable Housing (February 2018)

### **Speed to Market**

- Construction occurs simultaneously with the site work and foundation.
- Can result in up to 30-50% reduction of time in construction schedule.
- In the right environment, modular construction can cut costs by as much as 20%.



Project Is Designed Using Modern Digital Technology Modular Units are Manufactured Inside Climate Controlled Factory Modules Are Transported to the Construction Site

Modules Are Stacked and Assembled At The Construction Site Multi-Family and Hospitality Buildings Are Finished Onsite

## **Speed to Market**

	Assumpt	ions	
	Assumpt	10115	
# of Units	200	Stick Construction P	eriod 18 months
Gross Square Ft	200,000	Stick Built IRR	20.0%
Total Development Costs	\$39,000,000	Rent	\$2.25 / SF
Cost/Ft	\$195	Net Margin	65%
Cost/Unit	\$195,000		
		Exit 18 months after	<sup>-</sup> C.O.
Debt	70%		
Equity	30%		
Rate	5.0%		
Term (mths)	360		

#### **IRR Impact of Faster Delivery and Cost Savings**

			Cos	t Savings		
		0.0%	2.5%	5.0%	7.5%	10.0%
	3	22.2%	24.2%	26.1%	28.0%	29.9%
	4	23.0%	25.1%	27.1%	29.1%	31.0%
Months	5	23.9%	26.0%	28.1%	30.2%	32.2%
	6	24.9%	27.0%	29.2%	31.3%	33.4%
	7	25.9%	28.2%	30.4%	32.6%	34.8%
	8	27.0%	29.3%	31.7%	34.0%	36.2%
	9	28.2%	30.6%	33.0%	35.4%	37.7%







### **Speed to Market**

#### **Estimated Timeline Changes**

#### **Conventional construction schedule**

Design	Permitting	Foundation	On-Site Construction
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#### **Offsite construction schedule**

Design	Permitting	Foundation	On-Site Construction	Time Saved
	C	III-Site Construc	tion	<ul> <li>Time saved on many projects could be 8 months or more</li> <li>This translates to less neighborhood disruption and the ability to generate revenue from projects much sooner</li> </ul>

#### **Schedule Enhanced Solutions**

#### **Volumetric Modular Shortens Construction Timelines**

MODULAR BUILD



#### **Cost Savings**



Assumptions Incre No. Of Units 200 Square Feet Ti 200,000 Sav (Mo

emental Revenue						
		Total	Per Unit	Per SF		
	3	\$1,000,350	\$5,002	\$5.00		
	4	\$1,333,800	\$6,669	\$6.67		
ime	5	\$1,667,250	\$8,336	\$8.34		
vings	6	\$2,000,700	\$10,004	\$10.00		
onths)	7	\$2,334,150	\$11,671	\$11.67		
	8	\$2,667,600	\$13,338	\$13.34		
	9	\$3,001,050	\$15,005	\$15.01		
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#### Incremental Net Operating Income

		Total	Per Unit	Per SF
	3	\$650,228	\$3,251	\$3.25
	4	\$866,970	\$4 <i>,</i> 335	\$4.33
Time	5	\$1,083,713	\$5 <i>,</i> 419	\$5.42
Savings	6	\$1,300,455	\$6 <i>,</i> 502	\$6.50
(Months)	7	\$1,517,198	\$7,586	\$7.59
	8	\$1,733,940	\$8 <i>,</i> 670	\$8.67
	9	\$1,950,683	\$9 <i>,</i> 753	\$9.75

Construction Interest Savings							
Constructio	n in	Total	Per Unit	Per SF			
	3	\$119,665	\$598	\$0.60			
	4	\$159,100	\$796	\$0.80			
Time	5	\$198,695	\$993	\$0.99			
Savings	6	\$239 <i>,</i> 330	\$1,197	\$1.20			
(Months)	7	\$279,123	\$1,396	\$1.40			
	8	\$318,201	\$1,591	\$1.59			
	9	\$358 <i>,</i> 996	\$1,795	\$1.79			

# **Consistent Quality**

- Indoor, controlled environment protects people and materials
- Repeat tasks ensures consistency and quality
- Systematic quality monitoring throughout manufacturing process
- Enhances structural integrity which minimizes damage during transportation
- Facility-based inspections streamlines construction process
- Precise manufacturing results in tighter tolerances



#### Inspections

- Rigorous certification ensures manufacturing to state requirements
- Communication critical for inspectors to research projects
- State inspectors visit manufacturing facility and inspect while being built
- Every project subject to inspection at any time



### Inspections

- Stations have a tracking protocol inspectors see what modules have been produced
- Plumbing and electrical inspections done at the manufacturing facility as well as on the job site
- City inspections occur once modules are delivered and being installed
- Inspectors are learning where does their jurisdiction start and stop



#### **Barriers and Reactions**

- Officials realize requirement to understand how to inspect modular
- Local officials cautious of new process
- Difficulty with plan reviewer and specialized on-site inspectors
- Officials see how modular simplifies their risk
- Eventually become a supporter of new technology



### **Design Considerations For Modular**

- Requires Up-Front
   Considerations
- Supply Chain Can Create Barriers to Construction Timing
- Design Must Be Final Before Any Modular Units are Built
- Onus on Architects / Engineers / Developers to Develop Schedule



#### **Sample Layout**



This illustration provides an example of the endless possibilities for design and layout.

Defining room types and organizing them by module size allows incredible flexibility in configuring space requirements that best meet programming intentions.

### Alvera

- **TYPE:** Modular Multi-Family
- LOCATION: St. Paul, MN
- **PROJECT TYPE:** Market-Rate
- **CONSTRUCTION DURATION:** 12 months
- NUMBER OF MODS: 155
- NUMBER OF UNITS: 192
- **PROJECT STATUS:** Completed 2021





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Signage



#### Site Location — 2015 vs. 2018



Aerial from St. Paul Interactive Map - 2015

Aerial from St. Paul Interactive Map - 2018

#### Site Location — 2015



# Site Location — 2018

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Aartal Photo Lesiking West



Aerial Photo Looking East



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7TH ST

![](_page_27_Picture_1.jpeg)

![](_page_28_Picture_0.jpeg)

![](_page_30_Picture_0.jpeg)

### **Barriers to On-Site Construction**

- Budget proforma did not work
- Schedule was 18-24 months
- Tight urban site cranes and scaffolding would have been incredibly challenging
- Logistics there wasn't an area near the site for staging or material storage
- Quality onsite would have required sheer walls and gypcrete
- Modular offered higher acoustical and insulation ratings

![](_page_31_Picture_7.jpeg)

![](_page_32_Figure_0.jpeg)

#### Offsite floor plan — L2

![](_page_32_Figure_2.jpeg)

#### Onsite floor plan — L7 Charles we ge 0 25.20 . 10 HER. 000 OPERATO I $\odot$ ٩ 0 0.3 (1)---ine m 20.17

![](_page_33_Figure_1.jpeg)

![](_page_34_Figure_0.jpeg)

#### A STICK FRAME FLOOR PLAN 1" = 30"-0"

![](_page_34_Figure_2.jpeg)

![](_page_34_Picture_3.jpeg)

#### **Unit Plan Considerations**

![](_page_35_Figure_1.jpeg)

![](_page_35_Figure_2.jpeg)

Studio Unit Plan - Onsite Construction

Studio Unit Plan - Offsite Construction
#### **Unit Plan Considerations**







# **Design Process: Offsite Construction**





**Design Process: Offsite Construction** 

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# **Manufacturing Process**



# **Manufacturing Process**



# **Manufacturing Process**



### Alvera

#### Mod Layout and Setting Sequence



### Alvera

Mod layout and setting sequence



### **Module Transport**

#### **Dimensional considerations**



# **City Collaboration**

- Invited city officials to tour modular plant to a quality control and inspections in action
- Also offered a 30, 60, 90-percent drawing review
- Invited inspectors to be onsite to witness the modules being set
- Once local inspectors and officials saw how a modular approach simplifies risk, they became more supportive of the process





# The Route – Leaving the Plant



## The Route – Leaving the Plant



# **Module Staging - Entering**



# **Module Staging – To Jobsite**





## The Route – Leaving the Plant



#### The Route – to Jobsite



#### EXHIBIT "D"

NOTES: - 580 Too Hydro Grane - 34' face of building to Center Pivot of Grane - Opus to de-energize Smith Street Power during west half of set - 2 liets, East first and West second - Strip Bones at remote Maging area

#### Two Set Plan Assuming the Following: Crane set split at approximately building centerline





222

# Transportation and Site Delivery Plan

coo

Picking Location 1





RISE Modular Staging Plan 337 West 7th St, St. Paul 55102

Component Pick Locations 5 Axle Stepdeck Transport Configuration 95 Long x 15 Wide





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6/29

6/20

200

Group 1.

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# **Neighborhood Impact**

- Construction timeline is 60% of a site-built project
- Foundation to full structure in a three weeks
- Delivery trucking for materials is substantially LESS than site-built projects
  - Less traffic
  - Less parking in the neighborhood
  - Less noise
  - One lane was closed for only 3 weeks





# Alvera

- Alvera is the tallest and largest modular building in MN standing 85-feet tall
- Five stories of modular wood construction over two stories of concrete construction
- Gallery, artist-in-residence and WFH space
- Mechanized car-stacking system with 102 semi-automated stalls
- High-density 192 units on 0.61 acres (316 units/acre)
- Project is significant in providing a solution to attainable housing as well as visually transforming and engaging the neighborhood




















## Alvera

- Modular maximized site to achieve unit count to make the project happen
- Timeline reduced from 24 to 14 months
- Modular worked with a tight site developer did not have to invest in multiple staging sites
- Neighborhood impact less with a 22-day mod-set, less workers on site, less traffic and a significantly shorter construction timeline
- Quality of the project was improved units have better noise and insulation
- Modular maintained high aesthetic of Alvera's design



## > QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

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