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## CLT- Assessing the Market Opportunity in North America

Cross-Laminated Timber Symposium

February 8-9, 2011

Vancouver Convention Centre, Vancouver, BC

# Outline

- 1. Manufacturing Costs**
- 2. Competitiveness Analysis**
- 3. Market Opportunity**

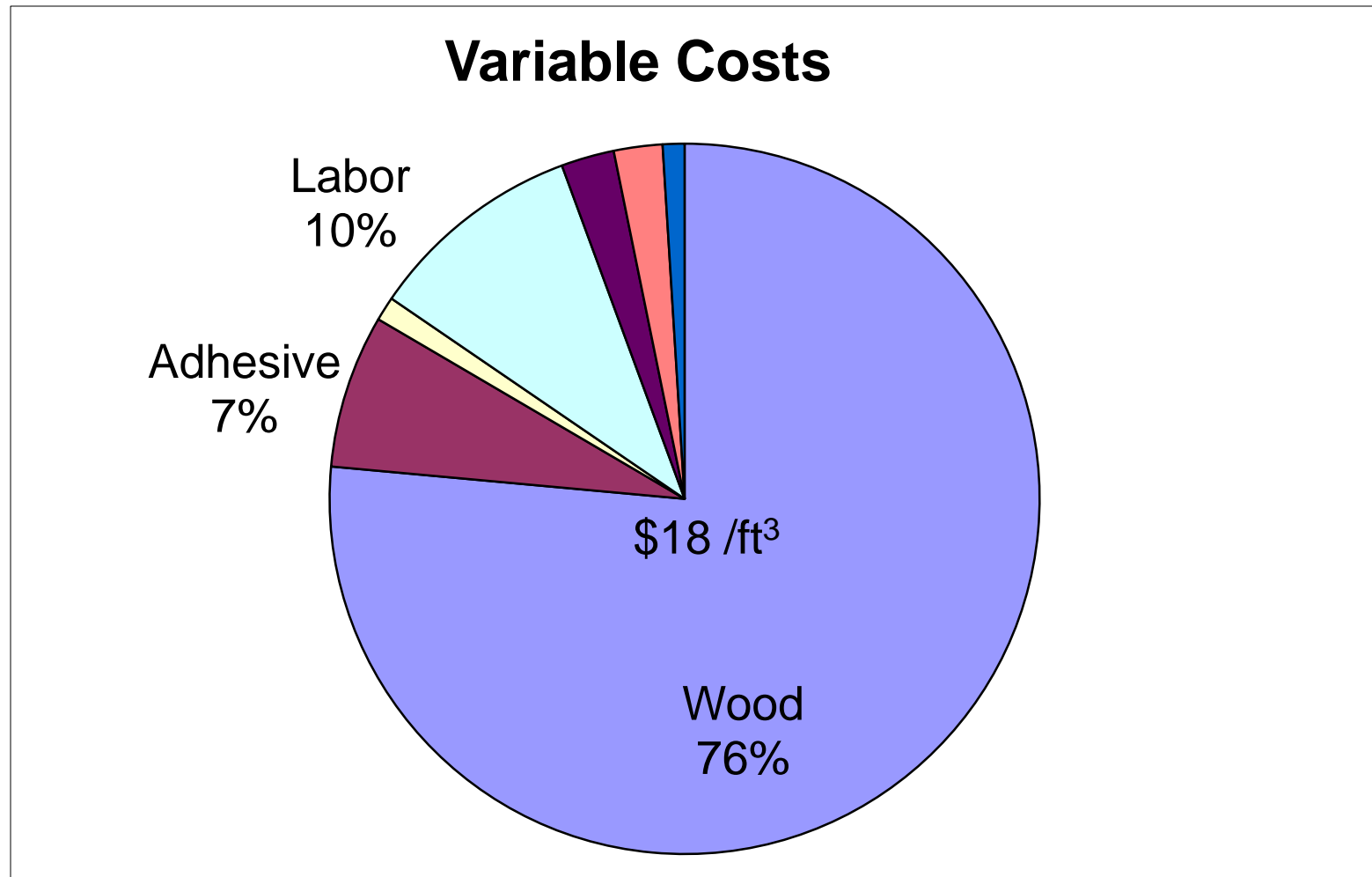
# Manufacturing Costs



## Detailed Cost Analysis

- Large plant in western Canada
- 2 panels (3-ply, 5-ply)
- Parameters:
  - Inputs
  - Capital
  - Labor
  - Energy
  - Delivery
  - Residues

# Manufacturing Costs



Total cost: 20 \$/ft<sup>3</sup> (700 \$/m<sup>3</sup>)

40,000 m<sup>3</sup>, \$30 M

# Outline

1. Manufacturing Costs
- 2. Competitiveness Analysis**
3. Market Opportunity
4. Final Remarks

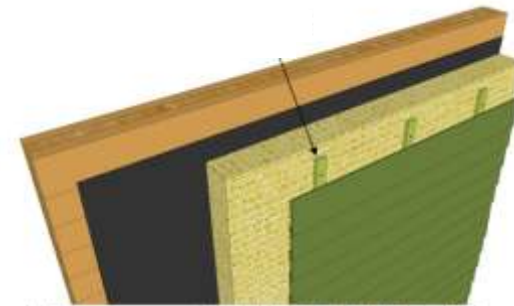


# Competitiveness Analysis: Methodology

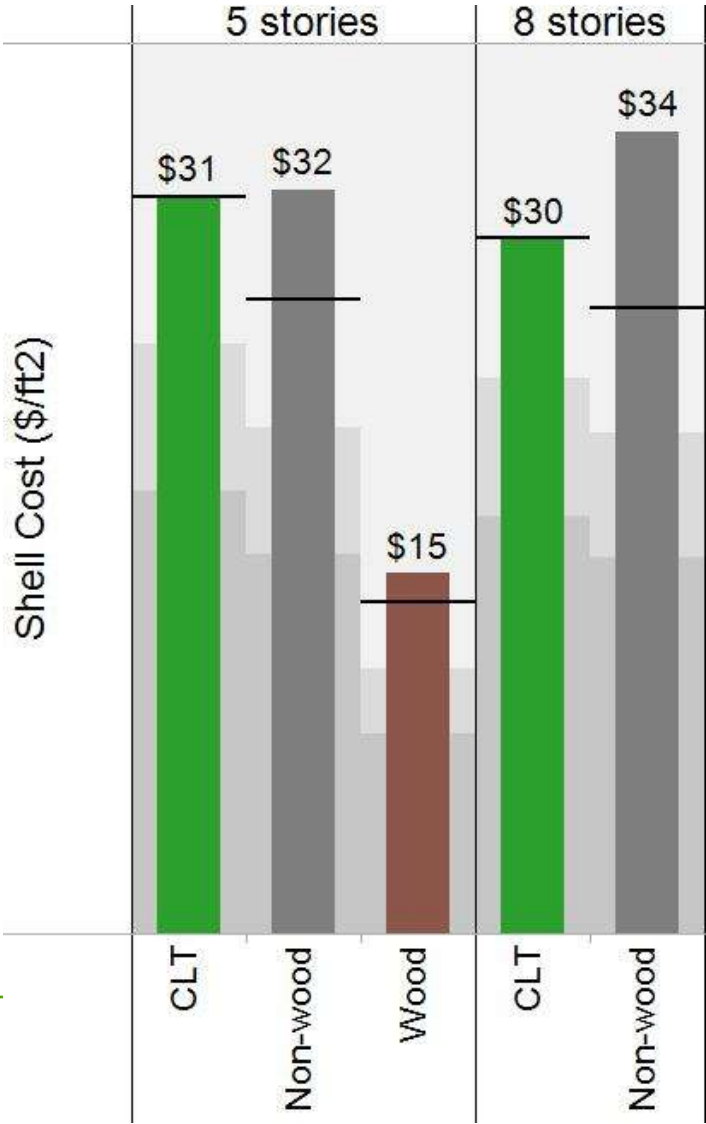
- **Non-residential stats from McGraw Hill**
- **Details by building type from RSMeans**
- **Side by side cost appraisal: CLT vs. non-wood & LWF**

# Competitiveness Analysis: Methodology

		Apartment-5
Description	Stories	5
	Floor Area (SF)	84,000
	Story height (LF)	10.33
Assembly Areas	Partition Walls	87,000
	Elev. Floors	67,000
	Roof	17,000
	Siding-Façade	27,000
\$/SF Shell+Partitions	RSMeans Median	\$31.6
	RSMeans Min	\$26.9
	RSMeans Max	\$34.6
CLT Assembly Config.	Walls	1: 3-ply CLT
	Partitions	6: Drywall on metal studs
	Elev. Floors	2: 5-ply CLT
	Roof	3: Wood truss, 24" OC, 24-29'
	Siding-Façade	3: Vinyl
	Insulation walls	1: 4"EPS R16+2xFR Gypsum
	Insulation partitions	3: 3.5" Fiberglass
	Insulation Elev. Floors	1: Suspended ceiling
CLT \$/SF	\$/SF Shell+Partitions	\$31.3
C-factor		85%



# Competitiveness Analysis: Apartments



# Competitiveness Analysis: Summary

Building Type	Storey Class	Competitiveness	Market Size
Mid-rise (Res & non-res)	5+	High	Large
Institutional	1-4	High	Large
Retail	1-4	High	Large
Industrial	1	Medium	Large

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# Market Opportunity

- **US & Canada at 15% penetration**

Segment	Floor area (mil. SF)	CLT Volume (mil. m <sup>3</sup> )	Lumber (BBF)
Residential	100	1.7	1.0
Non-residential	200	3.3	2.0
Total	300	5.0	3.0

- **\$4+ billion CLT sales**
- **70 very large plants**

# Market Opportunity by Metro Area



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# Why is CLT an Outstanding Value Proposition for the Canadian Forest Products Industry?

- **Large North American Market**
- **Fits well with Canadian Lumber**
- **Cost Competitive building system**
  - Concrete/Steel
  - Mid-rise all
  - Low Rise: Institutional, Industrial

# It works!!!!!!



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# BACKGROUND DECK






# Savings in Construction Time

Building Type: Industrial			
<b>Material</b>	CMU-Steel	Wood-Concrete Siding	CLT
<b>Location</b>	OH, US	CO, US	Norway
<b>Floor Area (ft<sup>2</sup>)</b>	17,000	16,000	16,000
<b>Stories</b>	1	1	1
<b>Construction Period</b>	Jan 09 – Sep 09: 9 months	Mar 01 – May 01: 14 months	2010, 5 days, 2 persons
			

Murray Grove and Vaxjo: 30% time savings

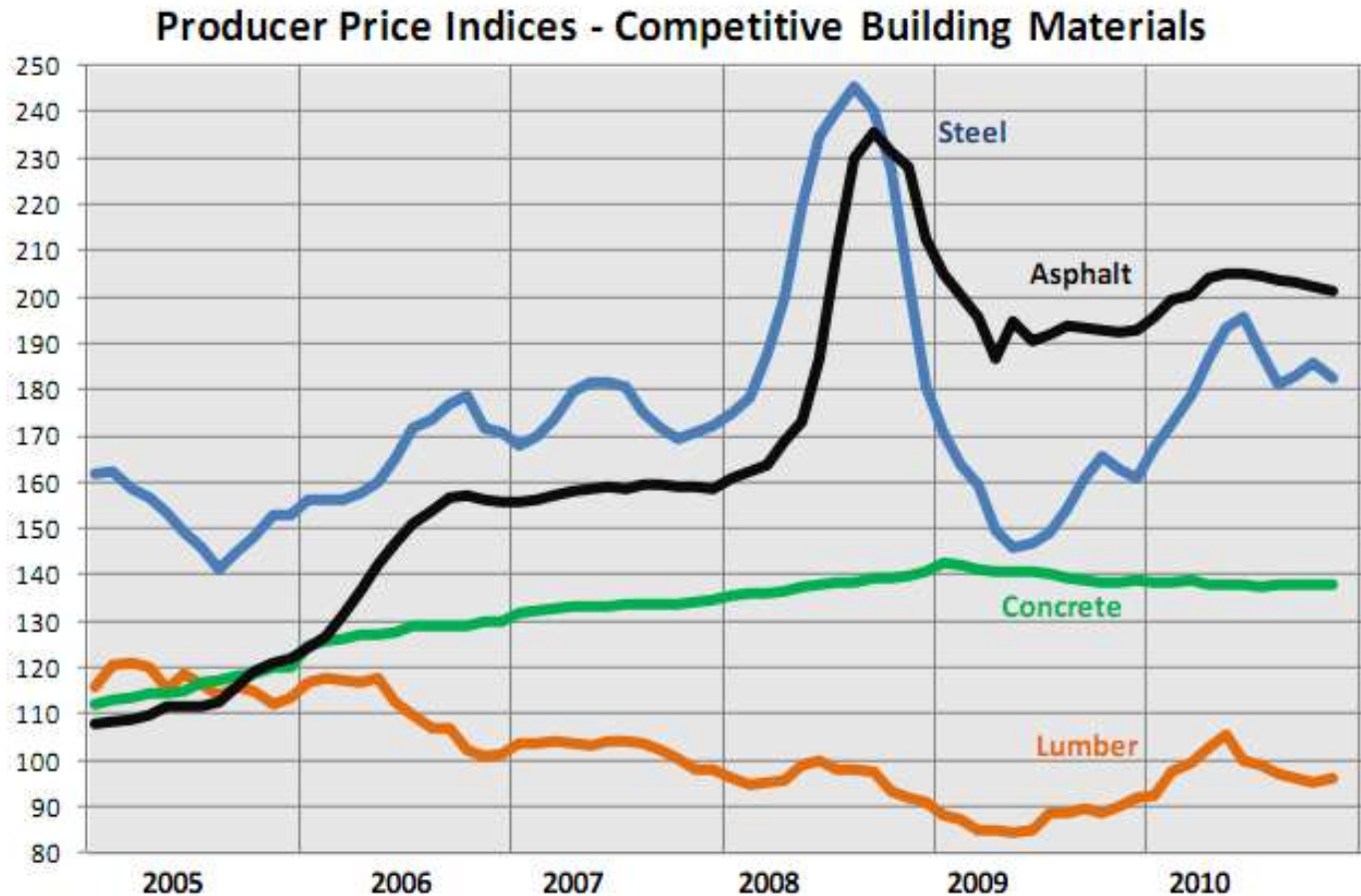
# Savings in Construction Time

<b>Building Type: Residential, Mid-Rise</b>			
<b>Material</b>	Brick	Concrete	CLT
<b>Location</b>	IL, US	CA, US	Vaxjo, Sweden
<b>Floor Area (ft<sup>2</sup>)</b>	111,000	127,000	115,000
<b>Stories</b>	6	10	7
<b>Construction Period</b>	Jul 01 – Aug 02: 13 months	Sep 91 – May 93: 20 months	Shell: 3 days per CLT floor 30% savings, 22 weeks, 2008
			

# Savings in Construction Time

Building Type: Residential, Mid-Rise			
<b>Material</b>	Brick	Brick, CMU	CLT
<b>Location</b>	NY, US	PA, US	London, UK
<b>Floor Area (ft<sup>2</sup>)</b>	23,800	41,000	25,300
<b>Stories</b>	5	5	1 concrete + 8 CLT
<b>Construction Period</b>	Feb 94 - Mar 95: 13 months	Nov 92 – Feb 94: 15 months	Shell: 3 days per CLT floor <b>30% savings, 22 weeks</b>
			

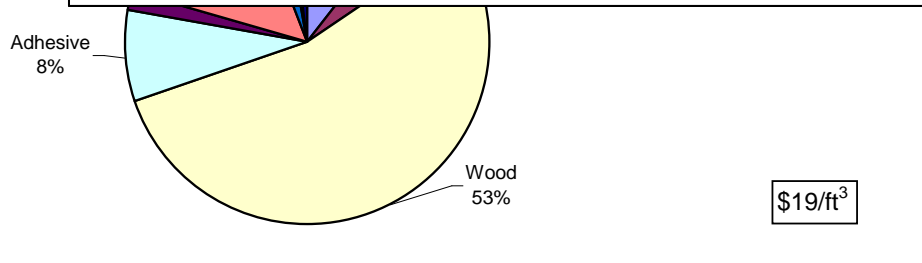
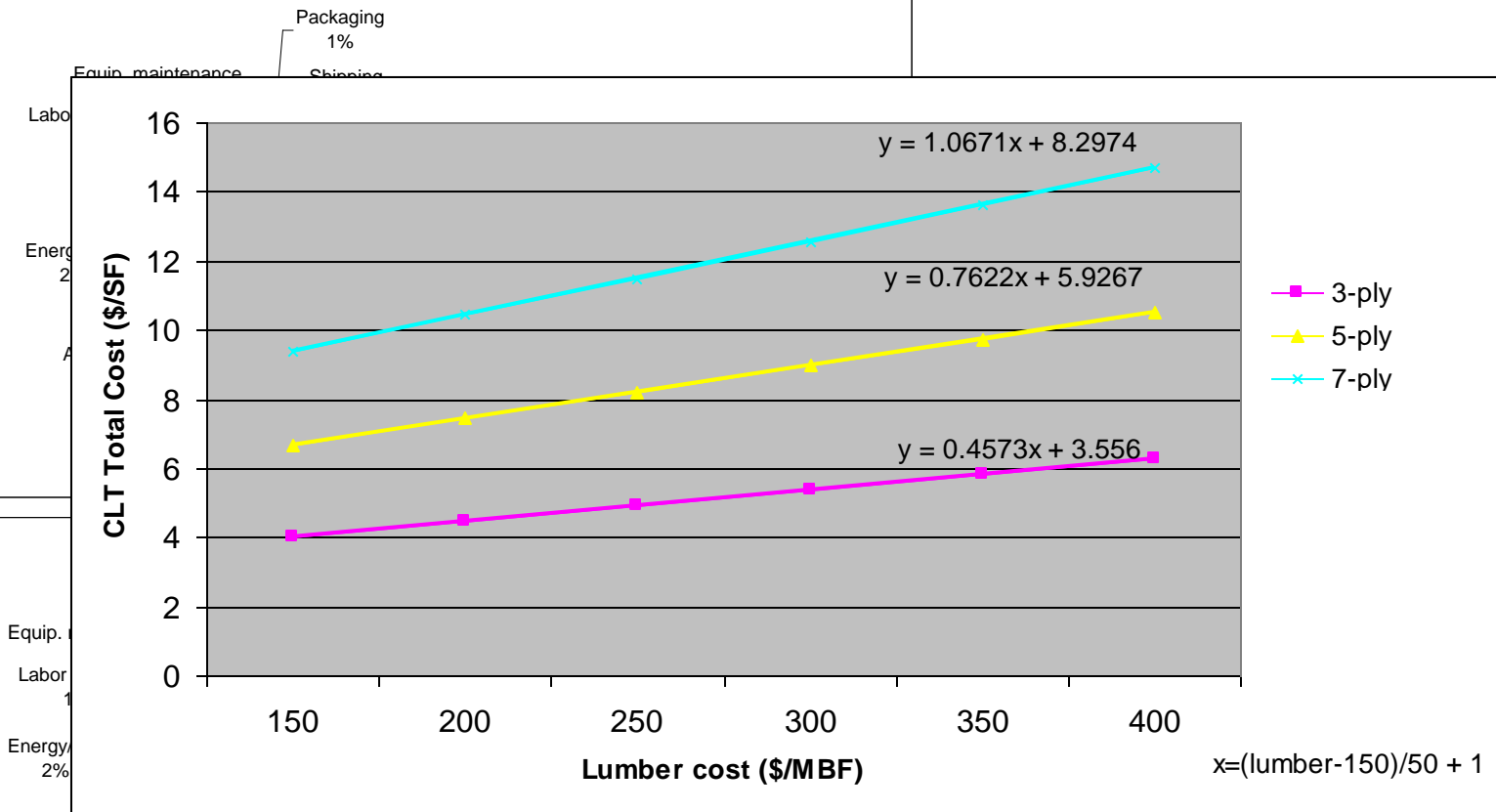
# Material Pricing – US Bureau of Labour Stats.



2002=100

# 1. In house: Simulation of Manufacturing Costs

**Variable Cost of CLT**



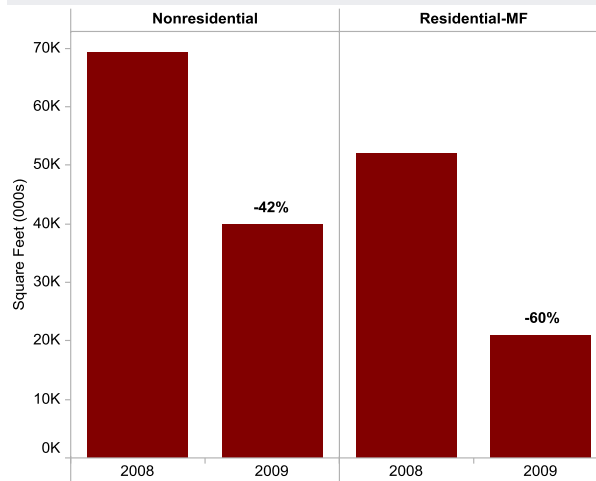
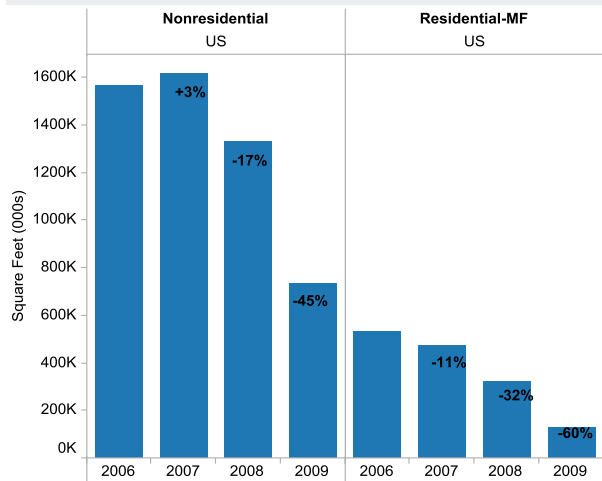
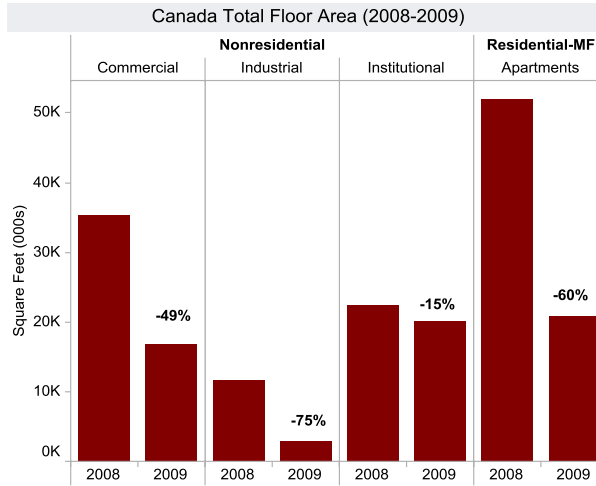
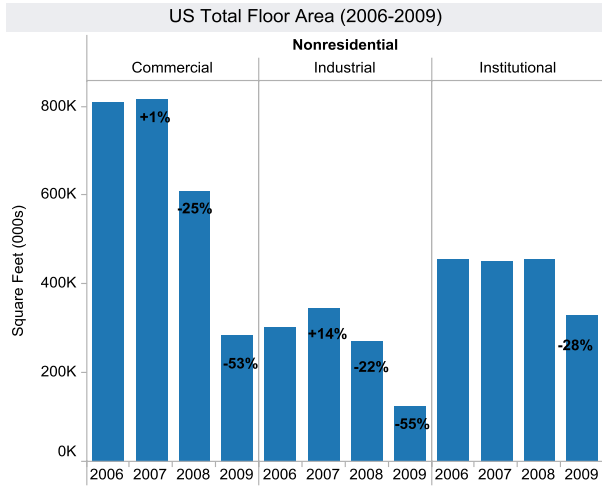
# Lumber Cost, West Mill

## KD W SPF 2x6 2&Btr RL

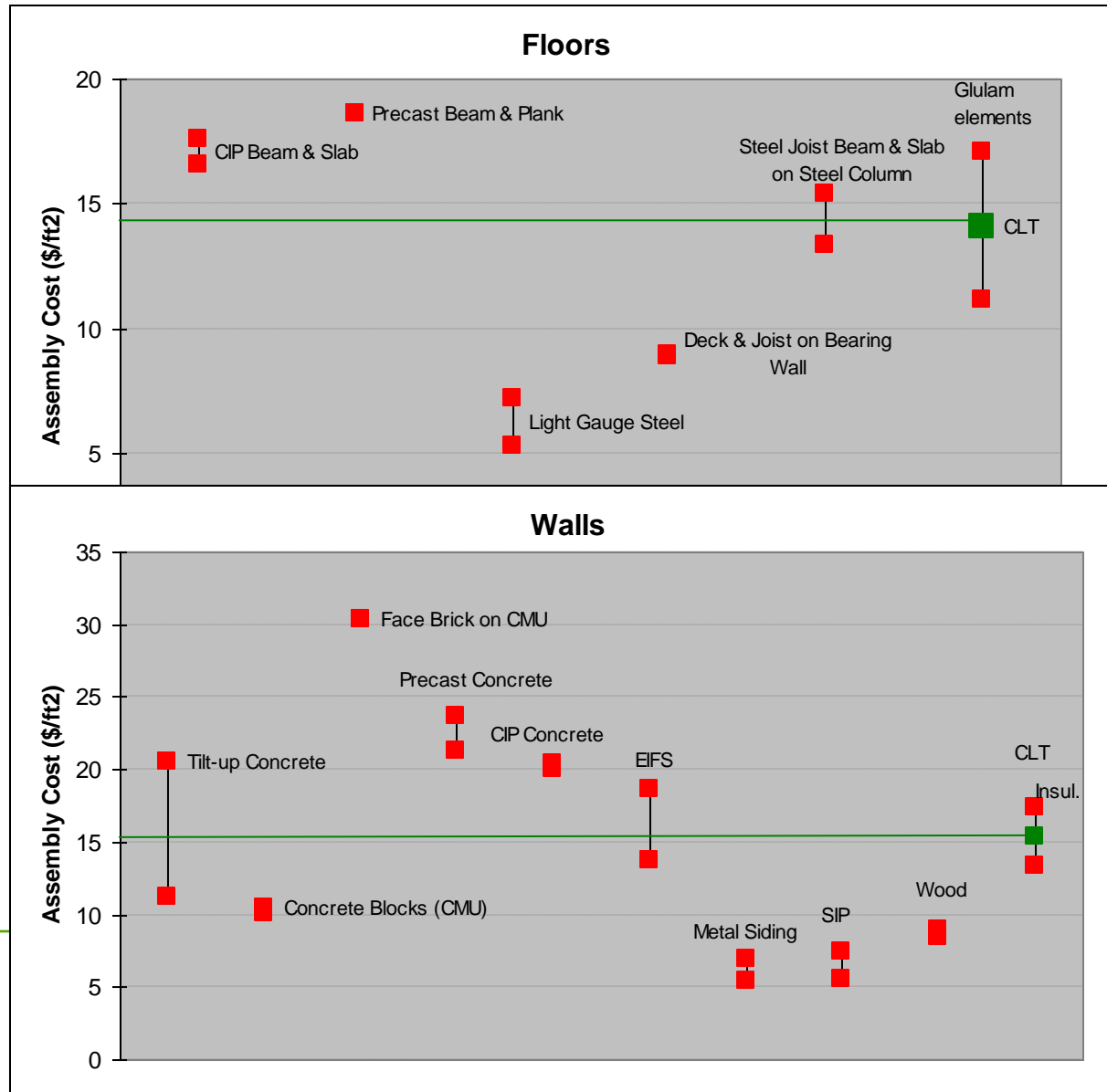


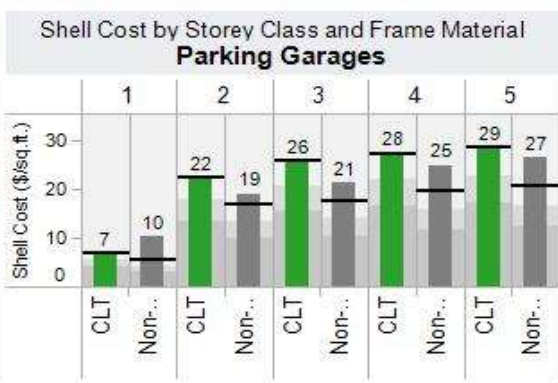
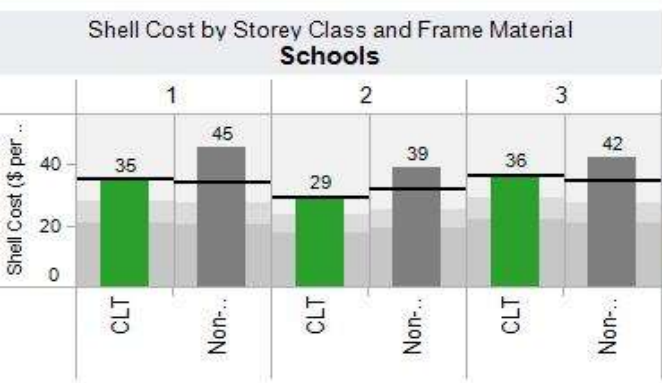
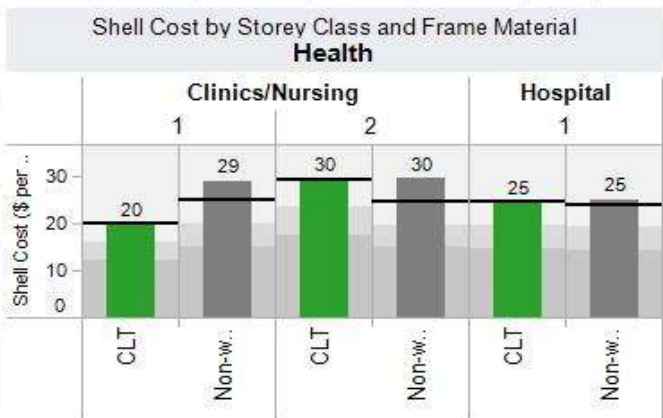
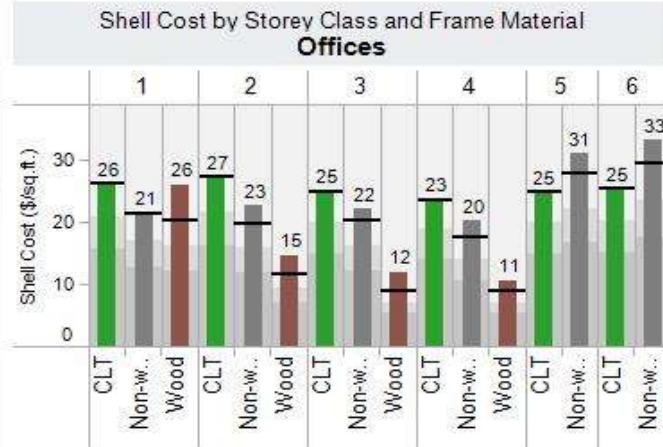
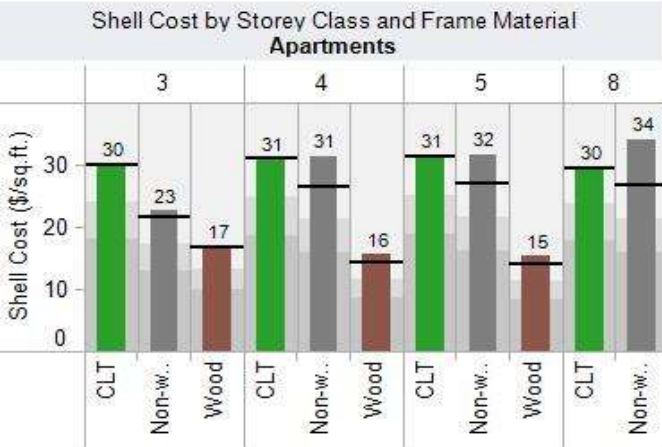
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# Stats – Floor area



# Competitiveness Analysis: Assembly Level





Bold line: Lower limit, Solid bar: Median cost (4-6 choices) Source: RSMeans 2010  
 City Factors: US Average: 1.0  
 Vancouver, BC = Quebec, QC = Ottawa, ON = Montreal, QC: 1.07  
 Calgary, AB = Toronto, ON = Edmonton, AB: 1.10

# Architects' Survey

## Value Factor Analysis (VFA)

The VFA resulted in a 57% advantage for CLT over Concrete (Figure 3)

### Value Factor Analysis for CLT

Quality Attributes		Customer importance	CONCRETE		CLT	
			Satisfaction	Benefit	Satisfaction	Benefit
1	Fire Performance	4.5	4.8	21.7	3.9	17.7
2	Dimensional stability	4.7	4.3	20.2	4.2	19.4
3	Moisture resistance	4.6	3.5	16.0	3.5	16.0
4	Thermal insulation	4.2	2.8	11.9	3.8	16.3
5	Acoustic insulation	4.0	3.7	14.9	3.8	15.2
6	Vibration Performance	3.9	3.7	14.2	3.7	14.5
7	Seismic Performance	4.1	3.8	15.7	4.0	16.4
8	Weight	4.0	2.6	10.2	4.0	15.8
9	Load resistance	4.0	4.1	16.4	4.1	16.3
10	Appearance	4.4	3.4	14.9	4.2	18.3
11	Livability	4.2	3.1	13.0	4.1	17.3
12	Construction time	4.1	3.0	12.3	4.1	25.0
<b>Total Quality Benefits</b>				<b>181</b>		<b>208</b>
Cost Attributes		Customer importance	CONCRETE		CLT	
			Expense*	Cost	Expense*	Cost
1	Material cost	4.4	1.7	7.3	1.4	6.1
2	Construction cost	4.5	1.9	8.4	1.3	5.8
3	Crane cost	3.7	2.2	8.3	1.3	4.9
4	Training Cost	3.7	1.9	6.9	1.6	5.8
<b>Total Costs</b>				<b>31</b>		<b>23</b>
<b>VALUE FACTOR=BENEFIT/COST</b>				<b>5.9</b>		<b>9.2</b>
* Reversed						<b>57%</b>

Figure 3. Value Factor Analysis

# IBC

GROUP		TYPE OF CONSTRUCTION								Wood	
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V		
		A	B	A	B	A	B	HT	A	B	
		Hgt(feet) Hgt(S)	UL	160	65	55	65	55	65	50	40
Residential R-1	S	UL	11	4	4	4	4	4	3	2	
	A	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000	
R-2 <sup>a</sup>	S	UL	11	4	4	4	4	4	3	2	
	A	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000	
R-3 <sup>a</sup>	S	UL	11	4	4	4	4	4	3	3	
	A	UL	UL	UL	UL	UL	UL	UL	UL	UL	
R-4	S	UL	11	4	4	4	4	4	3	2	
	A	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000	
Storage S-1	S	UL	11	4	3	3	3	4	3	1	
	A	UL	48,000	26,000	17,500	26,000	17,500	25,500	14,000	9,000	
S-2 <sup>b, c</sup>	S	UL	11	5	4	4	4	5	4	2	
	A	UL	79,000	39,000	26,000	39,000	26,000	38,500	21,000	13,500	
Utility&Misc. U <sup>c</sup>	S	UL	5	4	2	3	2	4	2	1	
	A	UL	35,500	19,000	8,500	14,000	8,500	18,000	9,000	5,500	

# Relative construction costs of concrete vs. wood

