



Evaluation of the Cost Impact of Florida's Specific Changes to 2015 I-Codes "Prescriptive Code Changes"

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Research Team

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- Graduate Students

ISSUES

- The proposed research assesses the cost impact of Florida's Specific Changes to 2015 I-Codes that are prescriptive in nature and that have the potential of adding cost to construction.

STATEMENT OF WORK

- **1. Review/analyze the Florida's specific changes to the 2015 I – Codes to identify those code changes/provisions that are prescriptive in nature and have the potential of adding cost to construction.**

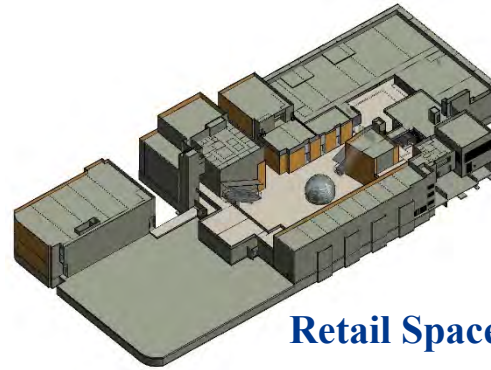
STATEMENT OF WORK

- **2. Use the standard set of baseline residential and commercial building designs previously used to evaluate the I-Codes prescriptive changes to estimate the potential cost of Florida's specific changes.**
 - **Develop modified building information models**
 - **Generate material quantity surveys**

Building Information Models



Small Office



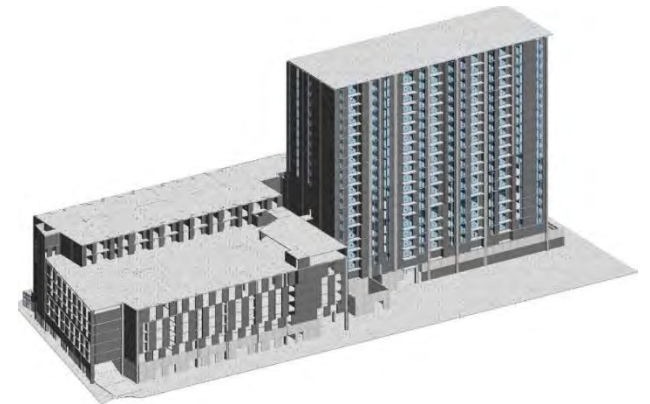
Retail Space



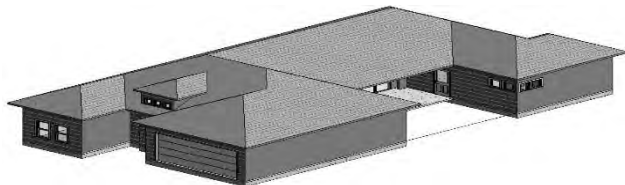
Small Hotel



Elementary School



Mid-Rise Apartments



1-story Residence



2-story Residence

STATEMENT OF WORK

- **3. Estimating the additional construction cost of those provisions that are not covered under (2) using good engineering judgment and feedback from general contractors and consulting engineers.**
 - **Generate cost estimates**
 - **Perform overall cost impact analysis**

DELIVERABLES

- A report providing technical information on the problem background, results and cost implications of the prescriptive Code changes.
- An analysis of individual code changes will also be provided in the Appendix.

Florida Specific Changes to 2015 I-Codes Cost Impact Disclaimer - Probable Construction Costs Opinions

Assumptions

- This Estimate is not a guarantee of Final Bid Cost or of Final Project Cost.
- This is an Opinion of Probable Cost of Mechanical, Electrical, and Piping (MEP) Systems for the proposed buildings.
- The estimate was compiled using documents provided by various sources.
- The estimate is representative of average unit pricing and labor from historical job costs of similar type, cost and labor data from Mechanical Contractors Association of America (MCAA), CostWorks 2015 Qtr. 2 (Change Date and Qtr) by R.S. Means Company Inc, National Electrical Contractors Association (NECA) and Sheet Metal Estimating by Wendes.
- The subcontractor unit rates include the subcontractor's overhead and profit, unless otherwise stated.
- The mark-ups included in the unit prices cover the cost of field overhead, home office overhead and profit, and range from 15% to 25% of the costs of a particular item.
- Since we have no control over the cost of labor, material and equipment, or the contractor's method of carrying out the work and determining the price, or over competitive bidding or market conditions, this opinion of probable construction cost provided is made on the basis of experience and qualifications. This opinion represents our best judgment as professional construction consultants with the Construction Industry. However, we cannot and do not guarantee that proposals, bids or the construction cost will not vary from the opinions of probable cost in this estimate.

Florida Specific Changes to 2015 I-Codes Cost Impact Disclaimer - Probable Construction Costs Opinions

General Assumptions:

- "Allowances" are considered to be an allotted sum of money for a particular system or scope of work for which sufficient detail is not available to determine a definitive cost.
- These cost allowances are included to project a final cost to include labor, material, equipment and any subcontractor costs.
- The owner receives the savings for any amount under the allowance and is at risk for any amount over the allowance.
- The estimate is in today's dollars, and has been adjusted to the local area.
- This estimate does not include any fees or permits.
- This estimate is intended to reflect construction costs only.
- This estimate is intended to reflect normal construction schedules only.
- Variations in material costs, labor efficiencies, wage rates, union practices, and bid climate will effect final costs.
- Workers will report to the actual job site.
- Materials delivered to the actual job site will need to be scheduled.
- No premium or overtime has been included.
- No General Construction costs have been included.
- All utilities have sufficient capacity for the added loads.

Excerpts – Florida Specific Changes to 2015 I-Codes Cost Impact Analysis

APPENDIX C - Florida Specific Changes to the 2015 I-Code- Energy Cost Impact Analysis

CODE CHANGE #	FLORIDA SPECIFIC CHANGES TO 2015 I-CODE-ENERGY SUMMARY	ESTIMATED AMOUNT*
EN6573	Raises in Section R402.4.1.2 residential building air leakage rate limit and provides for using air leakage testing standard ANSI/RESNET/ICC 380-2016.	Reduces first costs and maybe also operating costs
EN6782	Change C405.6.3 to read the same as ASHRAE 90.1-2013 Addendum C 8.4.1 Voltage Drop. The conductors for feeders and branch circuits combined shall be sized for maximum of 5% voltage drop total.	Approx. 0.5% construction cost reduction
EN6806	Permit air leakage testing of low-rise R-2 as permitted for commercial by allowing builders to test the entire building as a whole.	Increasing compliance options, may reduce costs

*For prescriptive Code changes only.

Excerpts – Florida Specific Changes to 2015 I-Codes Cost Impact Analysis

APPENDIX C - Florida Specific Changes to the 2015 I-Code- Energy Cost Impact Analysis

CODE CHANGE #	FLORIDA SPECIFIC CHANGES TO 2015 I-CODE-ENERGY SUMMARY	ESTIMATED AMOUNT*
EN7007	Clarifies the "Worst Case" orientation calculation scenario in Section R405.4.2.1 and allows for identical building models to be permitted by documenting that the "Worst Case" requirements have been met.	Cost to comply will be reduced by eliminating confusing or redundant calculations.

*For prescriptive Code changes only.

Building Information Models and Associated Cost Impacts

Table B1. Summary I-Codes Changes Cost Impact Comparison

	Building Type	2012 I-Codes	2015 I-Codes	Change in Cost
1	<i>Small Office</i>	\$ 10,920,905	\$ 11,446,962	4.82%
2	<i>Retail</i>	\$ 23,396,814	\$ 24,025,125	2.69%
3	<i>Elementary School</i>	\$ 7,802,722	\$ 8,446,532	8.25%
4	<i>Small Hotel</i>	\$ 6,947,121	\$ 7,628,069	9.80%
5	<i>Mid-Rise Apartment</i>	\$ 36,076,878	\$ 40,518,001	12.31%
6	<i>1-Story Residence</i>	\$ 217,807	\$ 238,972	9.72%
7	<i>2-Story Residence</i>	\$ 316,621	\$ 348,566	10.09%
Average Change in Cost (Entire Sample):				8.24%

Building Information Models and Associated Cost Impacts

Table B2. Summary I-Codes Changes Cost Impact Comparison

	Building Type	2012 I-Codes	2015 I-Codes + FL Specific Changes	Change in Cost
1	<i>Small Office</i>	\$ 10,920,905	\$ 11,974,429	9.65%
2	<i>Retail</i>	\$ 23,396,814	\$ 25,489,407	8.94%
3	<i>Elementary School</i>	\$ 7,802,722	\$ 8,869,639	13.67%
4	<i>Small Hotel</i>	\$ 6,947,121	\$ 7,996,754	15.11%
5	<i>Mid-Rise Apartment</i>	\$ 36,076,878	\$ 42,408,259	17.55%
6	<i>1-Story Residence</i>	\$ 217,807	\$ 238,370	9.44%
7	<i>2-Story Residence</i>	\$ 316,621	\$ 348,118	9.95%
Average Change in Cost (Entire Sample):				12.04%

Building Information Models and Associated Cost Impacts

Table B3. Summary I-Codes Changes Cost Impact Comparison							
	Building Type	2015 I-Codes	2015 I-Codes + FL Specific Changes	Difference in Cost	Change in Cost	After 80% Insurance Rebate for LPS	
						Difference in Cost	Change in Cost
1	Small Office	\$ 11,446,962	\$ 11,974,429	\$ 526,467	4.61%	\$186,531	1.61%
2	Retail	\$ 24,025,125	\$ 25,489,407	\$ 1,464,282	6.09%	\$448,924	1.86%
3	Elementary School	\$ 8,446,532	\$8,869,639	\$ 423,107	5.01%	\$166,603	2.02%
4	Small Hotel	\$ 7,628,069	\$7,996,754	\$ 368,685	4.83%	\$214,933	2.94%
5	Mid-Rise Apartment	\$ 40,518,001	\$ 2,408,259	\$ 1,890,258	4.67%	\$75,644	0.19%
6	1-Story Residence	\$ 238,972	\$ 238,370	(\$602)	-0.98%		
7	2-Story Residence	\$ 348,566	\$ 348,118	(\$448)	-0.13%		

SMALL OFFICE BUILDING COST COMPARISON

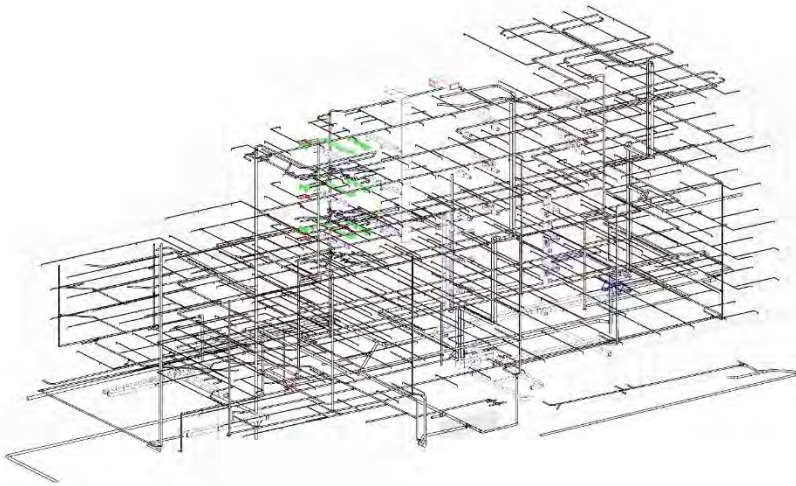
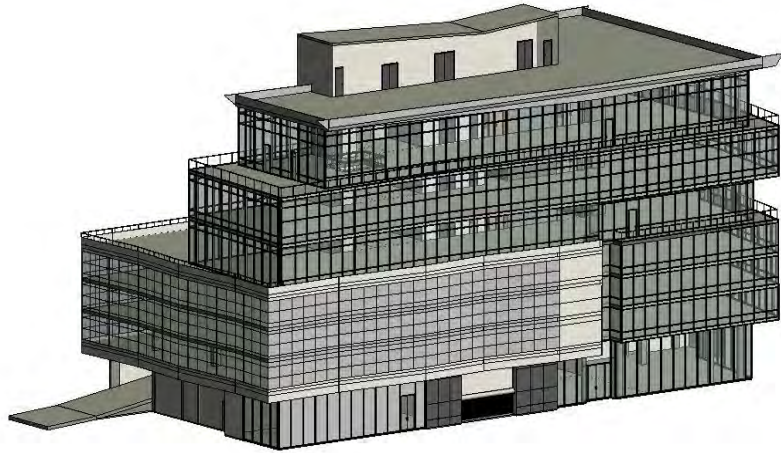


Table A-1. SMALL OFFICE BUILDING (138,715 SF) COST COMPARISON				
	ASTM Uniformat II Levels	2012 I-Codes	2015 I-Codes	2015 I-Codes +FL Specific Changes
A.	Substructure	\$ 310,352	\$ 310,352	\$ 321,690
	A10 - Foundations	\$ 310,352	\$ 310,352	\$ 321,690
	A20 - Basement Constr.	\$ -	\$ -	\$ -
B.	Shell	\$ 4,772,801	\$ 4,772,801	\$ 4,773,816
	B10 - Superstructure	\$ 2,914,531	\$ 2,914,531	\$ 2,914,531
	B20 - Exterior Enclosure	\$ 1,824,162	\$ 1,824,162	\$ 1,825,177
	B30 - Roofing	\$ 34,108	\$ 34,108	\$ 34,108
C.	Interiors	\$ 1,089,086	\$ 1,089,086	\$ 1,089,086
	C10 - Interior Construction	\$ 308,211	\$ 308,211	\$ 308,211
	C20 - Stairs	\$ 199,908	\$ 199,908	\$ 199,908
	C30 - Interior Finishes	\$ 580,966	\$ 580,966	\$ 580,966
D.	Services	\$ 4,748,667	\$ 5,274,724	\$ 5,789,838
	D10 - Conveying	\$ 728,036	\$ 728,036	\$ 728,036
	D20 - Plumbing	\$ 302,556	\$ 302,556	\$ 302,556
	D30 - HVAC	\$ 65,318	\$ 170,743	\$ 170,743
	D40 - Fire Protection	\$ 1,868,315	\$ 1,873,315	\$ 1,873,315
	D50 - Electrical	\$ 1,784,443	\$ 2,200,075	\$ 2,715,188
E.	Equipment & Furnishings	\$ -	\$ -	\$ -
F.	Special Construction	\$ -	\$ -	\$ -
G.	Building Sitework	\$ -	\$ -	\$ -
	Total Cost	\$ 10,920,905	\$ 11,446,962	\$ 11,974,429

RETAIL SPACE COST COMPARISON

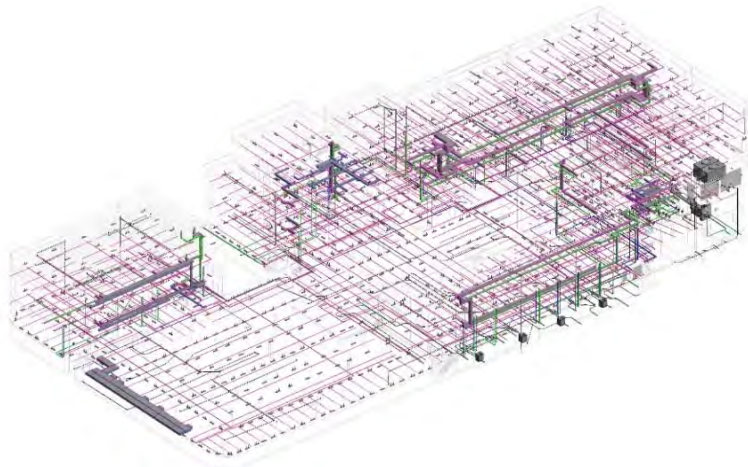
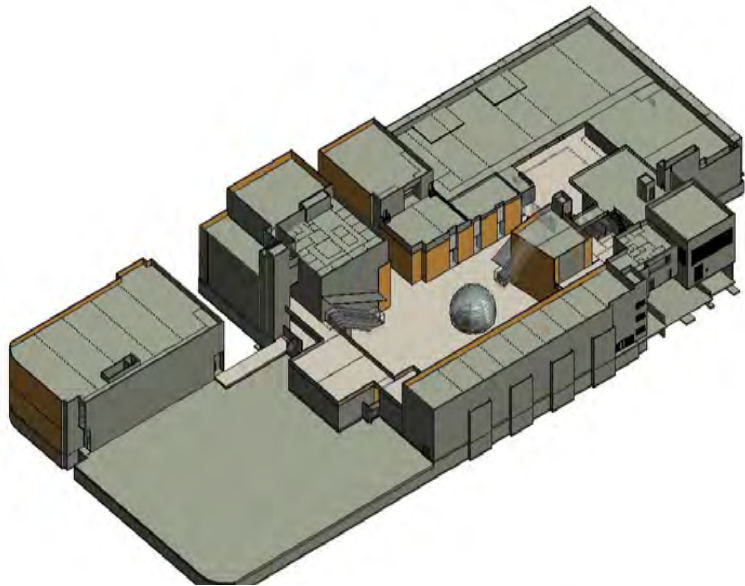


Table B-1. RETAIL SPACE (409,933SF) COST COMPARISON

ASTM Uniformat II Levels	2012 I-Codes	2015 I-Codes	2015 I-Codes +FL Specific Changes
A. Substructure	\$ 2,255,246	\$ 2,255,246	\$ 2,558,734
A10 - Foundations	\$ 2,255,246	\$ 2,255,246	\$ 2,558,734
A20 - Basement Constr.	\$ -	\$ -	\$ -
B. Shell	\$ 10,897,059	\$ 10,897,059	\$ 10,977,723
B10 - Superstructure	\$ 9,041,350	\$ 9,041,350	\$ 9,041,350
B20 - Exterior Enclosure	\$ 1,770,425	\$ 1,770,425	\$ 1,851,089
B30 - Roofing	\$ 85,283	\$ 85,283	\$ 85,283
C. Interiors	\$ 1,424,925	\$ 1,424,925	\$ 1,424,925
C10 - Interior Constr.	\$ 411,821	\$ 411,821	\$ 411,821
C20 - Stairs	\$ 443,168	\$ 443,168	\$ 443,168
C30 - Interior Finishes	\$ 569,936	\$ 569,936	\$ 569,936
D. Services	\$ 8,819,585	\$ 9,447,896	\$ 10,528,027
D10 - Conveying	\$ 853,948	\$ 853,948	\$ 853,948
D20 - Plumbing	\$ 974,524	\$ 982,908	\$ 982,908
D30 - HVAC	\$ 698,993	\$ 951,202	\$ 950,202
D40 - Fire Protection	\$ 5,987,616	\$ 5,992,616	\$ 5,992,616
D50 - Electrical	\$ 304,504	\$ 667,222	\$ 1,748,353
E. Equipment & Furnishings	\$ -	\$ -	\$ -
F. Special Construction	\$ -	\$ -	\$ -
G. Building Sitework	\$ -	\$ -	\$ -
Total Cost	\$ 23,396,814	\$ 24,025,125	\$ 25,489,407

ELEMENTARY SCHOOL COST COMPARISON

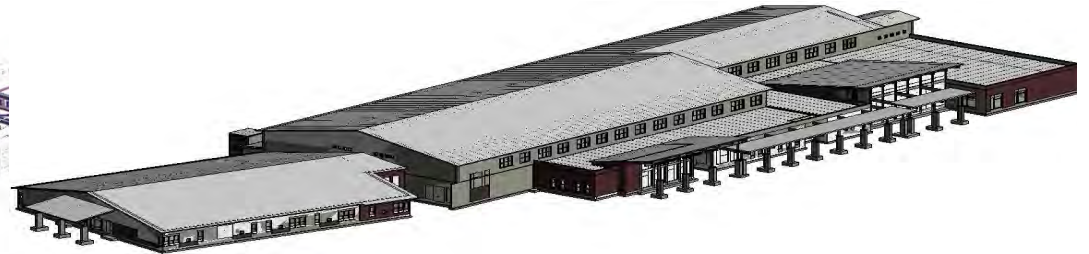
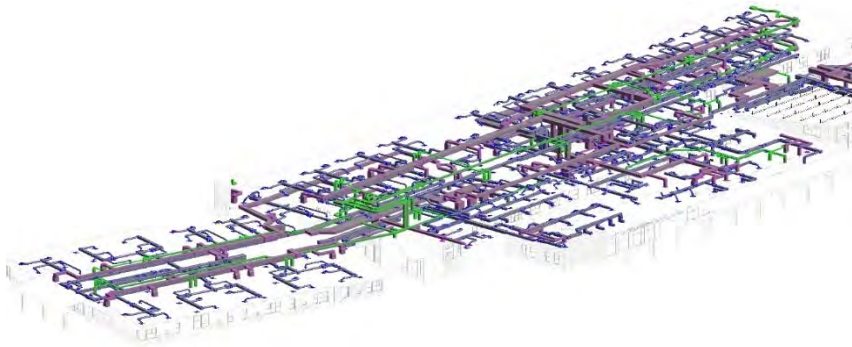


Table C-1. ELEMENTARY SCHOOL (90,726 SF) COST COMPARISON				
	ASTM Uniformat II Levels	2012 I-Codes	2015 I-Codes	2015 I-Codes +FL Specific Changes
A.	Substructure	\$ 700,228	\$ 700,228	\$ 743,241
	A10 - Foundations	\$ 700,228	\$ 700,228	\$ 743,241
	A20 - Basement Constr.	\$ -	\$ -	\$ -
B.	Shell	\$ 3,737,916	\$ 3,737,916	\$ 3,737,916
	B10 - Superstructure	\$ 1,636,810	\$ 1,636,810	\$ 1,636,810
	B20 - Exterior Enclosure	\$ 1,260,650	\$ 1,260,650	\$ 1,260,650
	B30 - Roofing	\$ 840,456	\$ 840,456	\$ 840,456
C.	Interiors	\$ 1,276,392	\$ 1,276,392	\$ 1,276,392
	C10 - Interior Constr.	\$ 584,401	\$ 584,401	\$ 584,401
	C20 - Stairs	\$ 79,310	\$ 79,310	\$ 79,310
	C30 - Interior Finishes	\$ 612,681	\$ 612,681	\$ 612,681
D.	Services	\$ 2,088,186	\$ 2,731,996	\$ 2,970,565
	D10 - Conveying	\$ 64,985	\$ 64,985	\$ 64,985
	D20 - Plumbing	\$ 634,069	\$ 634,069	\$ 634,069
	D30 - HVAC	\$ 317,914	\$ 719,128	\$ 719,128
	D40 - Fire Protection	\$ 607,906	\$ 612,906	\$ 612,906
	D50 - Electrical	\$ 463,313	\$ 700,909	\$ 1,081,003
E.	Equipment & Furnishings	\$ -	\$ -	\$ -
F.	Special Construction	\$ -	\$ -	\$ -
G.	Building Sitework	\$ -	\$ -	\$ -
	Total Cost	\$ 7,802,722	\$ 8,446,532	\$ 8,869,639

SMALL HOTEL COST COMPARISON

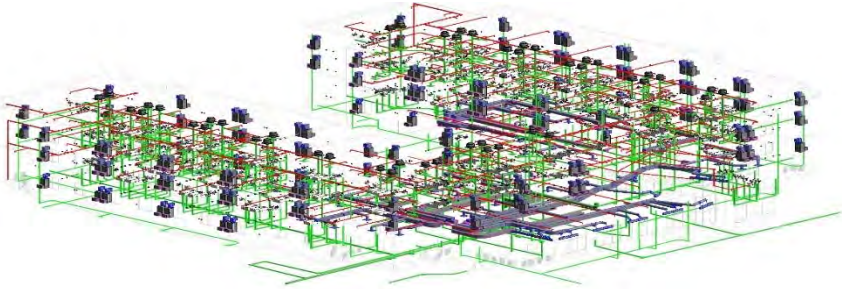


Table D-1. SMALL HOTEL (72,024 SF) COST COMPARISON

ASTM Uniformat II Levels	2012 I-Codes	2015 I-Codes	2015 I-Code +FL Specific Changes
A. Substructure	\$ 260,286	\$ 260,286	\$ 278,388
A10 - Foundations	\$ 260,286	\$ 260,286	\$ 278,388
A20 - Basement Constr.	\$ -	\$ -	\$ -
B. Shell	\$ 1,980,038	\$ 1,980,038	\$ 1,987,358
B10 - Superstructure	\$ 1,098,060	\$ 1,098,060	\$ 1,098,060
B20 - Exterior Enclosure	\$ 808,987	\$ 808,987	\$ 816,307
B30 - Roofing	\$ 72,991	\$ 72,991	\$ 72,991
C. Interiors	\$ 1,416,588	\$ 1,416,588	\$ 1,416,588
C10 - Interior Constr.	\$ 802,456	\$ 802,456	\$ 802,456
C20 - Stairs	\$ 64,134	\$ 64,134	\$ 64,134
C30 - Interior Finishes	\$ 549,998	\$ 549,998	\$ 549,998
D. Services	\$ 3,290,208	\$ 3,971,156	\$ 4,314,419
D10 - Conveying	\$ 165,710	\$ 165,710	\$ 165,710
D20 - Plumbing	\$ 553,339	\$ 553,339	\$ 553,339
D30 - HVAC	\$ 979,430	\$ 1,162,767	\$ 1,162,767
D40 - Fire Protection	\$ 865,972	\$ 870,972	\$ 870,972
D50 - Electrical	\$ 725,758	\$ 1,218,368	\$ 1,561,631
E. Equipment & Furnishings	\$ -	\$ -	\$ -
F. Special Construction	\$ -	\$ -	\$ -
G. Building Sitework	\$ -	\$ -	\$ -
Total Cost	\$ 6,947,121	\$ 7,628,069	\$ 7,996,754

MID-RISE APARTMENT BUILDING COST COMPARISON

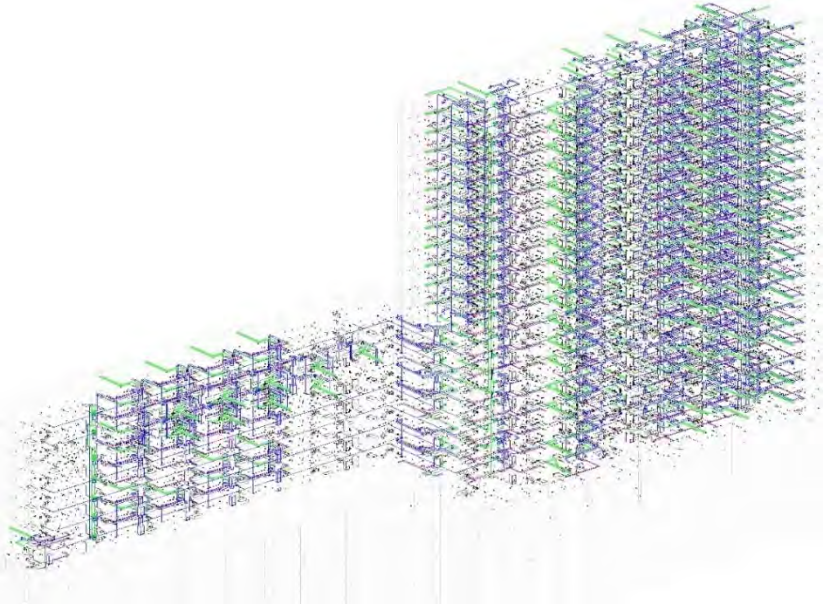
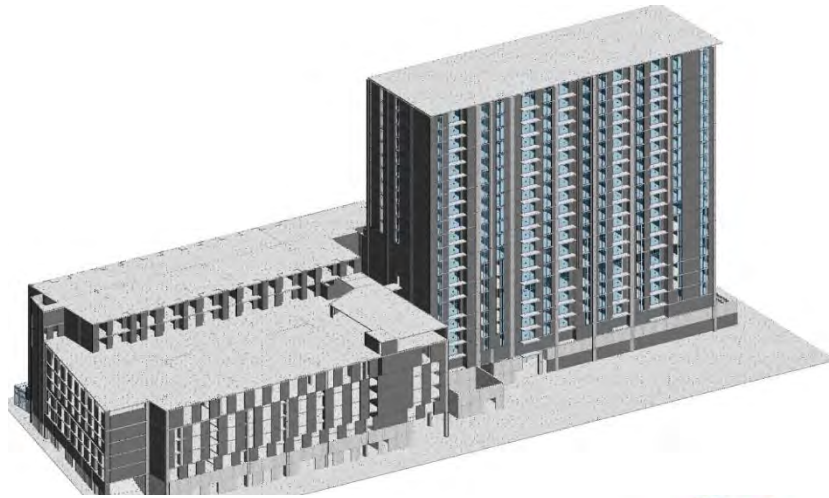


Table E-1. MID-RISE APARTMENT BUILDING (589,555 SF) COST COMPARISON			
ASTM Uniformat II Levels	2012 I-Codes	2015 I-Codes	2015 I-Code +FL Specific Changes
A. Substructure	\$ 1,498,735	\$ 1,498,735	\$ 1,545,295
A10 - Foundations	\$ 1,498,735	\$ 1,498,735	\$ 1,545,295
A20 - Basement Constr.	\$ -	\$ -	\$ -
B. Shell	\$ 12,849,079	\$ 12,849,079	\$ 12,870,467
B10 - Superstructure	\$ 10,084,546	\$ 10,084,546	\$ 10,105,934
B20 - Exterior Enclosure	\$ 2,693,593	\$ 2,693,593	\$ 2,693,593
B30 - Roofing	\$ 70,940	\$ 70,940	\$ 70,940
C. Interiors	\$ 8,145,259	\$ 7,354,169	\$ 7,354,169
C10 - Interior Constr.	\$ 2,300,013	\$ 2,300,013	\$ 2,300,013
C20 - Stairs	\$ 64,001	\$ 64,001	\$ 64,001
C30 - Interior Finishes	\$ 4,990,156	\$ 4,990,156	\$ 4,990,156
D. Services	\$14,374,895	\$ 18,816,017	\$ 20,638,327
D10 - Conveying	\$ 1,456,072	\$ 1,456,072	\$ 1,456,072
D20 - Plumbing	\$ 5,983,803	\$ 7,440,747	\$ 7,440,747
D30 - HVAC	\$ 2,332,483	\$ 3,642,044	\$ 3,641,044
D40 - Fire Protection	\$ 181,170	\$ 236,170	\$ 236,170
D50 - Electrical	\$ 4,421,366	\$ 6,040,985	\$ 7,864,295
E. Equipment & Furnishings	\$ -	\$ -	\$ -
F. Special Construction	\$ -	\$ -	\$ -
G. Building Sitework	\$ -	\$ -	\$ -
Total Cost	\$36,867,967	\$ 40,293,514	\$ 41,980,629

1-STORY RESIDENCE COST COMPARISON

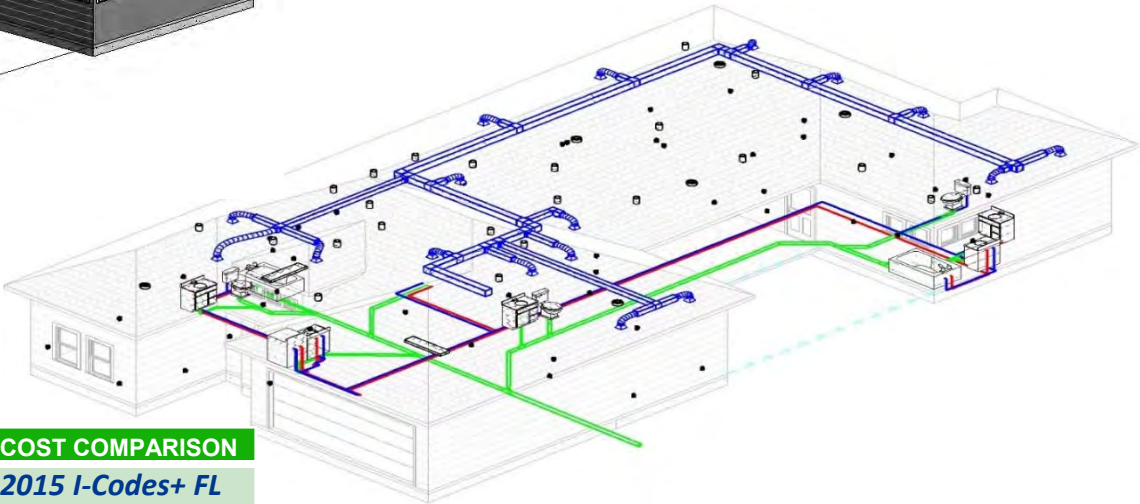
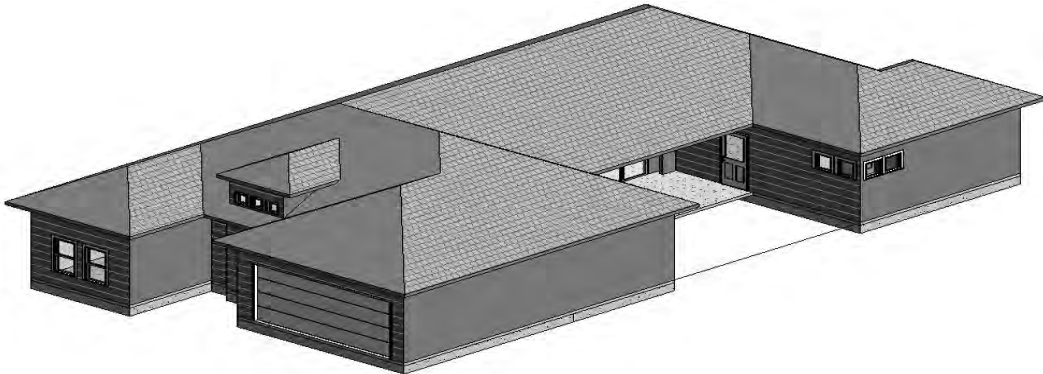


Table F-1. 1-STORY RESIDENCE (2242 SF LIVING; 385 SF GARAGE) COST COMPARISON

	<i>2012 I-Codes</i>	<i>2015 I-Codes</i>	<i>2015 I-Codes+ FL Specific Changes</i>
Site Work	\$ -	\$ -	\$ -
Foundations	\$ 15,719	\$ 15,719	\$ 17,312
Framing	\$ 41,260	\$ 41,260	\$ 41,260
Exterior Walls	\$ 40,084	\$ 40,084	\$ 40,084
Roofing	\$ 18,782	\$ 18,782	\$ 18,782
Interiors	\$ 32,642	\$ 32,642	\$ 32,642
Specialties	\$ -	\$ -	\$ -
Mechanical	\$ 56,482	\$ 76,595	\$ 75,595
Electrical	\$ 12,837	\$ 13,890	\$ 12,695
Total Cost	\$ 217,807	\$ 238,972	\$ 238,370

2-STORY RESIDENCE COST COMPARISON

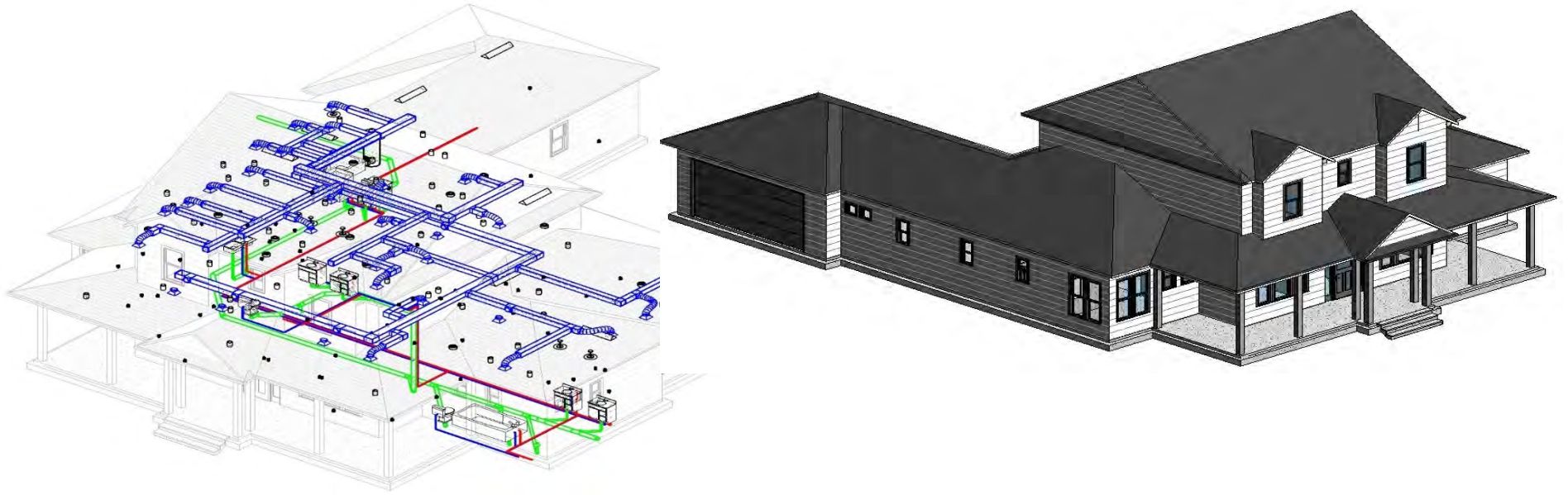


Table G-1. 2-STORY RESIDENCE (4459 SF LIVING; 521 SF GARAGE) COST SUMMARY

		<i>2012 I-Codes</i>	<i>2015 I-Codes</i>	<i>2015 I-Codes+ FL Specific Changes</i>
1	Site Work	\$ -	\$ -	\$ -
2	Foundations	\$ 28,776	\$ 28,776	\$ 31,071
3	Framing	\$ 40,309	\$ 40,309	\$ 40,309
4	Exterior Walls	\$ 58,812	\$ 58,812	\$ 58,812
5	Roofing	\$ 27,578	\$ 27,578	\$ 27,578
6	Interiors	\$ 67,536	\$ 67,536	\$ 67,536
7	Specialties	\$ 1,431	\$ 3,291	\$ 3,291
8	Mechanical	\$ 68,704	\$ 98,789	\$ 97,789
9	Electrical	\$ 23,475	\$ 23,475	\$ 21,732
	Total Cost	\$ 316.621	\$ 348.566	\$ 348.118

FUTURE WORK

- Future research should focus on the **use of the developed models and estimates to evaluate future code changes.**
- Conduct **workshops** to introduce and encourage designers, builders and other code change petitioners **to use the models** to prospectively evaluate the cost impact of their proposed code changes.
- Model **other type of buildings** to develop an even more diverse set of code change cost impact benchmark building models.

QUESTIONS ?