Improving Commercial Value Estimates Using a New Cost Model

21st GIS/CAMA Technologies Conference

Tuesday, March 7, 2017 - 1:30 - 3:00 PM

Question

“That’s the way we’ve always done it”

Is this a good reason to keep doing something the same way?

Learning Objectives

Gain an understanding of how cost schedules are constructed

Learn about weaknesses in the cost estimating methods currently being widely used

Learn how weaknesses can be corrected with a modern model and methodology

Recognize that existing methods can always be improved

Why Is The Cost Approach Important?

Obviously, it is one of the *three approaches to value*

It is much more important for commercials & industrials than for residential, which usually have sufficient sales

An active, verifiable sales market that satisfies the USPAP standard is frequently difficult to obtain for C & I

When up-to-date cost models and current, accurate cost sources are available, the cost approach may provide the *only factually verifiable* evidence of value

What are the Benefits of the New Method?

#1 Greater accuracy of cost estimates

#2 More choices of correct shell structure type

#3 More flexibility in configuring interior occupancies

#4 Ability to quality grade shell & interior separately

#5 More flexibility in separately applying depreciation

#6 Much easier to handle changes in occupancy uses

#7 Easier to handle depreciation after remodeling

COST SCHEDULE CONSTRUCTION

Vertical, Horizontal, and Finish Costs

1 Structural Vertical Costs – Exterior Walls

2 Structural Horizontal Costs – Frame, Roof & Floors

3 Finish Vertical Costs – Partitions, Doors, Wall Finish

4 Finish Horizontal Costs – Floor Finish, Ceiling Finish

5 Electrical Requirements for the intended use

6 Plumbing Requirements for the intended use

7 Use Heating, Ventilation, Air Conditioning (HVAC)

COST SCHEDULE CONSTRUCTION

Structural Vertical & Horizontal Costs plus Frame determine the building "Structural Shell Cost"

Interior Finish Vertical & Horizontal Costs, Electrical, Plumbing, and HVAC Costs are determined by the intended use of the building or building section

Nearly any type interior finish for any particular intended use can be placed in any type of Building Shell Structure

Over the past 40 years Building Codes have tightened

Appraisal Cost Approach Estimating vs. Builder Job Cost Estimating

Same Cost Elements Apply:

- Material Cost
- Labor Cost
- Equipment Cost
- Builder Overhead & Profit

What is Different?

- Builder works from a *specific* building *plan*
- Appraiser must work from an abstract *"model"*
  - Which is a representation of what is typical
  - Which includes many assumptions

What is an Appraisal Cost Model?

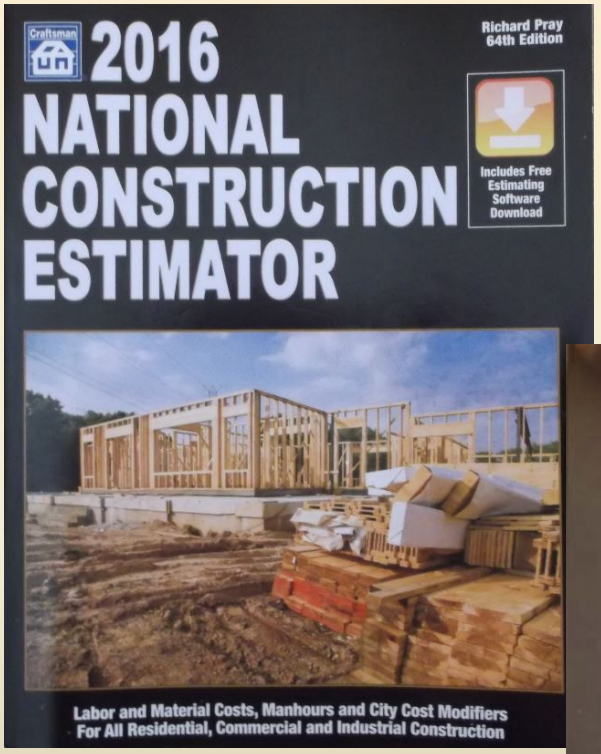
An Appraisal Cost Model is a description of the characteristics of a typical building that most closely resembles a specific or "subject" building

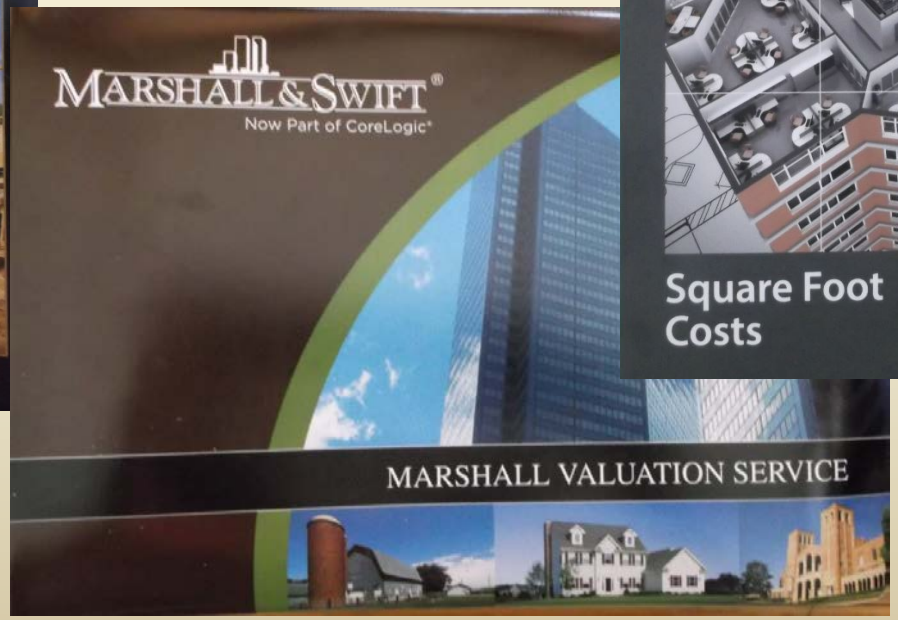
An Appraisal Cost Model contains *assumptions* about what is typical for each building type described

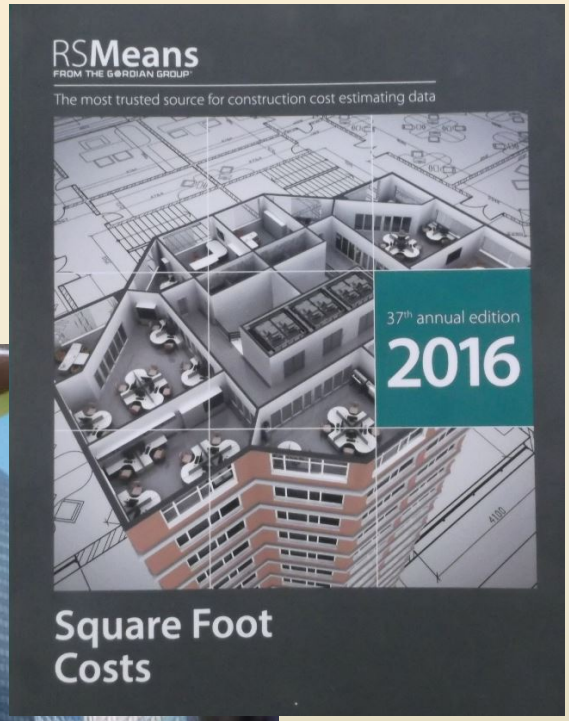
The various described building types must be organized and classified for ease and efficiency of use in appraisal and for accurate association of the building type assumptions with current industry material, labor, and equipment costs

Industry Cost Sources

Where are current industry material, labor, and equipment costs found?







Examples of Published Cost Data

RS Means 2016 Square Foot Costs Book Page 351

Includes Material and Installation Labor Cost Detail (*Transparent costs*)

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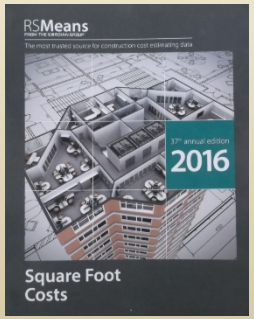
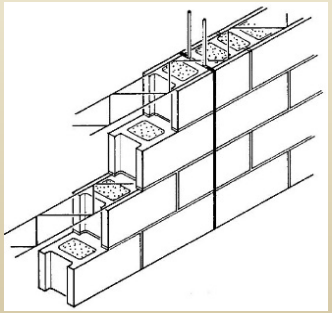




Examples of Published Cost Data

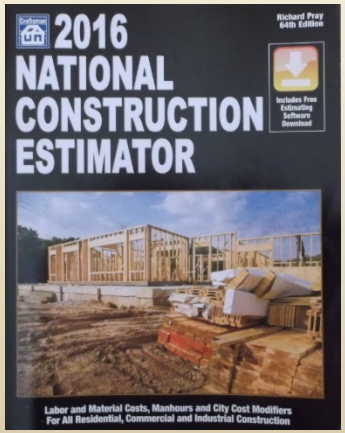
Craftsman 2016 National Construction Estimator Book Page 378

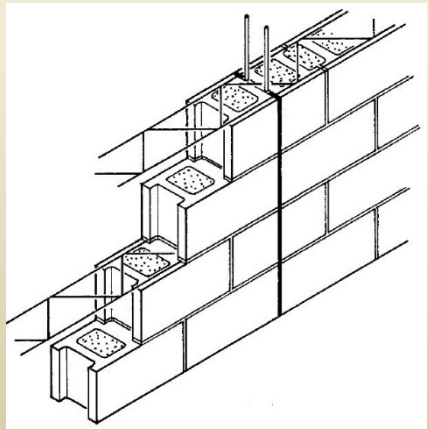
Includes Material and Installation Labor Cost Detail (*Transparent costs*)

Concrete Block Wall Assemblies Typical costs for standard natural gray medium weight masonry block walls including blocks, mortar, typical reinforcing and normal waste. Foundations are not included. For more detailed coverage of concrete block masonry, see *National Concrete & Masonry Estimator*, http://CraftsmanSiteLicense.com

Walls constructed with 8" x 16" blocks laid in running bond

4" thick wall	M1@.090	SF	2.40	4.19	6.59
6" thick wall	M1@.100	SF	2.95	4.66	7.61
8" thick wall	M1@.120	SF	3.49	5.59	9.08
12" thick wall	M1@.150	SF	5.12	6.99	12.11





Examples of Published Cost Data

July 2016 Marshall Valuation Service Book Section 55 Page 3

Does Not Include Material and Installation Labor Cost Detail (*Opaque costs*)

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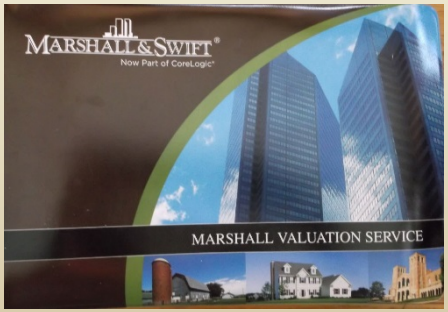

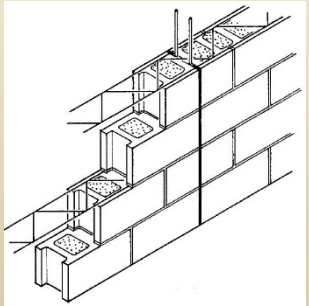

Examples of Published Cost Data

Reinforced Concrete Block Wall Costs from These 3 Publications

8" Block Per Sq. Ft. of Wall:	*Material*	*Labor*	*Total*	*With O & P*
RS Means Sq. Ft. Costs	4.13	7.55	11.68*	14.60
Craftsman NCE	3.49	5.59	9.08*	11.35
Marshall Valuation Service	n/a	n/a	8.59 to 12.50**	

* Does not include architect fees, builder overhead & profit (O & P), add 25%

** Includes normal builder overhead & profit, but not architect fees (Section 1 p 8)

Example Wall Cost Model Calculation

For Various Wall Heights and Exterior Wall Cover Types

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Putting It All Together For The Cost Table

The Traditional Way of Creating A Cost Table

All assemblies and components of a "typical" building of a *particular type, such as office*, are calculated as done in the previous slide for walls

The individual costs are totaled for a representative size or multiple sizes (Sq Ft areas) of the building type being studied, *including the office interior finish in this case*

The total building cost for the office use *with finish* is then divided by the size to determine the base cost per Sq Ft

Example for a 7000 SF Office Building

Width x Length	**50 x 140**
Area	**7,000**
Perimeter	**380**
Wall Height	**12’**
Vertical shell cost, 380 LF @ $368.15 (wall)	**139,900**
Horizontal shell cost, 7000 SF @ $21.46	**150,220**
Office Use Finish 7000 SF @ $43.82 + Entry	**311,040**
General, Overhead & Profit, Architect @ 25%	**150,290**
Total Building Cost	**751,450***
Cost per Square Foot	**$107.35***

*** New Model with Craftsman 2016 National Cost Estimator**

Costing Results
Three 2016 National Publications

7,000 SF Office Building, 50 x140, 12’ WH, 380 Perimeter

RS Means Square Foot Costs Book, p. 174	**$1,252,300**
Craftsman Nat’l Building Cost Manual p. 140	**$1,157,500**
Marshall Valuation Service Book, Sec 15 p. 17	**$ 809,850***

*** Class C, Average Quality, .9635 combined multipliers**

NOTE: The above costing results are based on Square Foot rates by Type of Use

New Cost Model using direct calculation (prior slide) $ 751,450

Traditional Cost Manual Organization

First Organizational Level: **Use/Occupancy of Building**

Second Organizational Level: **5 Classes of Construction**

Third Organizational Level: **Quality of Construction**

Further Adjustments: **Perimeter/Area Factor**
Wall Height Factor
Month/Year Adjustment

Why?

Traditional Cost Manual Organization

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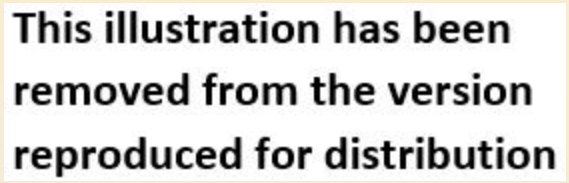
Traditional Cost Manual Organization

Descriptive Specifications



Notes:

The quality TYPE within class actually describes the *type of wall & frame*

Notice that the building structure type changes with quality

In mass appraisal, quality "grade" has a somewhat different meaning

Weaknesses of the Traditional Cost Manual Organizational Approach

Traditional cost manual organization is not logical when you consider modern building construction methods:

- **The building shell structure is built first using one structural type, *then***
- **One or more interior finishes are applied based on the intended uses**

From the traditional cost manual, square foot rates are applied to the building or use area that include all costs: vertical, horizontal, use finish

- **Multipliers are applied in an attempt to compensate for method errors**
- **Too few structure types (classes) are available for precise costing**
  Existing classes actually contain a mixture of structural types
- **Many buildings have multiple uses (occupancies) creating complications**

The traditional cost manual approach was devised before computerization

Is There a Better Method of Costing?

1 Separate the building shell costing from use finish costing

2 Use more building structure types that are more precise

The most commonly applied construction class is too broad:

Requires masonry walls but allows wood floor & roof joists

Lumps too many structure types into one classification

Results in an average cost applied to many different types

3 Make use of the computer's capacity to handle detail

Compute exterior wall costs directly based on length & height

Allow greater and more precise selection of exterior wall type

4 Allow user to select from many interior uses to define interior

Allow unlimited number of uses in any structure classification

Allow separate structural shell and interior finish depreciation

New Building Structure Types

	CLASSIFICATIONS		
	FEMA	**IBC**	**MVS**
1 - Light wood or steel stud frame (residential)	W1	V	**D**
2 - Heavier wood or steel stud frame (light commercial)	W2	V	**D**
3 - Unreinforced masonry walls, wood joists (both residential & commercial)	URM	III	**C**
4 - Reinforced masonry walls, metal joists, decks w/concrete fill	RM2	IIA	**C**
5 - Pre-cast tilt-up concrete wall buildings, metal joists, decks w/conc fill	PC1	IIA	**C**
6 - Engineered wood post frame (called pole buildings 30 years ago)	W1A	IV	**D**POLE
7 - Pre-engineered steel frame	S3	IIB	**S**
8 - Structural steel frame with fire resistant coatings	S1	IB	**A/B**
9 - Steel reinforced concrete frame, highly fire resistant, nearly fireproof	C1	IA	**A/B**

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Type 1: Light wood or steel stud frame (residential)

1-Light wood or steel stud frame (residential)

These buildings are single or multiple family dwellings of one to three stories in height. Building loads are light and the framing spans are short. Floor and roof framing consists of wood joists or rafters on wood studs spaced 16 inches apart. The first floor framing is supported directly on the foundation, or post and beam supports. The foundation consists of spread footings constructed with cast-in-place concrete or concrete masonry block. Lateral forces are resisted by wood frame diaphragms and shear walls. Floor and roof diaphragms consist of straight or diagonal lumber sheathing, tongue and groove planks, oriented strand board, or plywood. Shear walls consist of exterior plywood or oriented strand board sheathing with a wide variety of exterior cover materials such as vinyl, wood, hardboard, fiberboard, metal, stucco, including masonry veneers such as brick and various types of stone. Interior partitions are sheathed with gypsum board.

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Type 2: Heavier wood or steel stud frame (light commercial)

2-Heavier wood or steel stud frame (light commercial)

These buildings are usually commercial or industrial with larger floor areas. There are few, if any, interior load bearing walls. The floor and roof framing consists of wood or steel trusses, glulam or steel beams, and wood posts or steel columns. Lateral forces are resisted by wood diaphragms and exterior stud walls sheathed with plywood, oriented strand board, stucco, plaster, straight or diagonal wood sheathing, or braced with rod bracing. Wall openings for storefronts and garages, when present, are framed by post-and-beam framing.

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Type 3: Unreinforced masonry walls, wood joists (both residential & light commercial)

3-Unreinforced masonry walls, wood joists (both residential & commercial)

These buildings have perimeter bearing walls that consist of unreinforced masonry, frequently concrete block. Interior bearing walls, when present, also consist of unreinforced masonry. Floors consist of structural panel or plywood sheathing rather than lumber sheathing. The diaphragms are flexible relative to the walls. When they exist, ties between the walls and diaphragms consist of bent steel plates or anchors embedded in the mortar joints and attached to framing. Foundations consist of concrete-spread footings.

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Type 4: Reinforced masonry walls, metal joists, decks w/concrete fill

4-Reinforced masonry walls, metal joists, decks w/concrete fill

These building have reinforced masonry load bearing walls and floors that consist of metal deck with concrete fill, precast concrete planks, tees, or double-tees, with or without a cast-in-place concrete topping slab, and are stiff relative to the walls. The floor and roof framing is supported on interior steel or concrete frames or interior reinforced masonry walls.

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Type 4: Reinforced masonry walls, metal joists, decks w/concrete fill

4-Reinforced masonry walls, metal joists, decks w/concrete fill

These building have reinforced masonry load bearing walls and floors that consist of metal deck with concrete fill, precast concrete planks, tees, or double-tees, with or without a cast-in-place concrete topping slab, and are stiff relative to the walls. The floor and roof framing is supported on interior steel or concrete frames or interior reinforced masonry walls.

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Type 5: Pre-cast tilt-up concrete walls with metal joists, concrete filled decks

5-Pre-cast tilt-up concrete wall buildings, metal joists, decks w/conc fill

These buildings are one or more stories in height and have precast concrete perimeter wall panels that are cast on site and tilted into place. Floor and roof framing consists of precast elements, cast-in-place concrete, or metal deck with concrete fill, and are stiff relative to the walls. Framing is supported on interior steel columns and perimeter concrete bearing walls. Lateral forces are resisted by the precast concrete perimeter wall panels. Wall panels may be solid, or have large window and door openings which cause the panels to behave more as frames than as shear walls. Foundations consist of concrete-spread footings or deep pile foundations.

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Type 6: Engineered wood post frame (called pole buildings 30 years ago)

6-Engineered wood post frame (called pole buildings 30 years ago)

These buildings feature large, solid sawn posts or laminated columns instead of wood studs, steel framing, or concrete masonry. Post-frame construction is an engineered wood-frame building system that meets UBC and IBC standards. They transfer loads to the ground or surface-mounted to a concrete pier or masonry foundation, and may use plastic barrier systems for enhanced protection of wood and concrete posts or piers. Post-frame structures are more quickly erected than other kinds of buildings. Because the larger posts and the interlocking frame can handle greater loads than stud-wall construction, fewer structural materials are needed, which saves time and other costs. Also, because posts are spaced farther apart than studs, post-frame buildings feature an exceptionally large wall cavity and provide ample room for insulation, lowering heating and cooling costs through the life of the building. Almost any type of exterior façade may be installed on post-frame buildings, which can be designed to meet the highest standards for quality and aesthetics. Post-frame construction is an efficient and economical option for low-rise applications and is now the construction method of choice for any number of commercial, industrial, municipal, residential, religious, and agricultural projects.

Type 7: Pre-engineered steel frame

Pre-engineered steel frame

These buildings are pre-engineered and prefabricated with transverse rigid steel frames. They are one story in height. The roof and walls consist of lightweight metal, fiberglass or similar panels. The frames are designed for maximum efficiency and the beams and columns consist of tapered, built-up sections with thin plates. The frames are built in segments and assembled in the field with bolted or welded joints. Lateral forces in the transverse direction are resisted by the rigid frames. Lateral forces in the longitudinal direction are resisted by wall panel shear elements or rod bracing. Diaphragm forces are resisted by untopped metal deck, roof panel shear elements, or a system of tension rod bracing.

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Type 8: Structural steel frame with fire resistant coatings

Structural steel frame with fire resistant coatings

These buildings consist of a frame assembly of steel beams and steel columns. Foundations consist of concrete-spread footings or deep pile foundations. Floor and roof framing consists of cast-in-place concrete slabs or metal deck with concrete fill supported on steel beams, open web joists, or steel trusses. Lateral forces are resisted by steel moment frames that develop their stiffness through rigid or semi-rigid beam-column connections. When all connections are moment-resisting connections, the entire frame participates in lateral force resistance. Diaphragms consist of concrete or metal deck with concrete fill and are stiff relative to the frames. A steel building's structural members are expected to have fire resistance to prevent structural failure for a determined period of time to give the building occupants more time to escape and allow the fire service to control it. The required fire resistance periods for the different steel building types are found in local building codes. The structural steel needs to be protected against fire using the proper insulating materials and methods to protect the structural steel members and allow them to resist weakening for longer periods. Recent research has been conducted resulting in several fire-resistant steels with better strength levels developed. These steels represent a notable improvement over conventional steels in terms of elevated temperature yield strength. Exterior walls consist of metal panel curtain walls, glazing, brick masonry, or precast concrete panels. When the interior of the structure is finished, frames are concealed by ceilings, partition walls, and architectural column furring.

Type 9: Steel reinforced concrete frame highly fire resistant, nearly fireproof

Steel reinforced concrete frame, highly fire resistant, nearly fireproof

These buildings consist of a frame assembly of cast-in-place concrete beams and columns. Floor and roof framing consists of cast-in-place concrete slabs, concrete beams, one-way joists, two-way waffle joists, or flat slabs. Lateral forces are resisted by concrete moment frames that develop their stiffness through monolithic beam-column connections. Modern frames in regions of high seismicity have joint reinforcing, closely spaced ties, and special detailing to provide ductile performance. This detailing is not present in older construction. Exterior walls consist of metal panel curtain walls, glazing, brick masonry, or precast concrete panels. Foundations consist of concrete-spread footings or deep pile foundations.

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Nine Exterior Cover (Cladding) Groups

Nine Exterior Cover (Cladding) Groups

Group 1	Vinyl, Hardboard, T-1-11, OSB, Plywood panels, and similar cost cladding
Group 2	Galvanized steel siding, fiber cement siding, and similar cost cladding
Group 3	Alum siding, pine siding, stucco, and similar cost cladding
Group 4	Cedar shingles, Nailite thermoplastic resin siding, redwood siding, log cabin siding
Group 5	Adobe block or concrete block , replacing stud wall
Group 6	EIFS - Exterior Wall Insulation and Finish System
Group 7	Brick veneer cladding or curtain wall
Group 8	Stone veneer or glass cladding or curtain wall; solid log load-bearing walls
Group 9	Solid stone cut blocks such as limestone 18" thick

Combining Structure Type with Exterior Cladding Group

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Greater Precision Cost Approach Estimating

Combining the choice of 9 building structure types with 9 possible exterior cover types for an unlimited number of wall segments of different wall heights produces greater cost estimating accuracy

The new method uses the same data that has always been collected for commercial costing: Square foot area, perimeter, wall height & type

The accuracy improvements come from having more refined structure type classifications, more choices of wall material, and direct computation of wall cost rather than converting wall cost to sq. ft. area and use of multipliers

WHAT DATA IS NEEDED FOR NEW MODEL?

Structure type (class)

Square feet of floor area

Perimeter

Wall height

Exterior wall cladding (cover) group

Square feet of use area(s) = interior finish

The same data that has always been collected

Costing An Actual New Mega Warehouse Completed in 2015 in Louisville KY

Dimensions: 450’ x 700’ Area: 315,000 SF

Perimeter: 2,300 LF Wall height: 32 ft

Structure Type 5: Tilt-up concrete panel wall

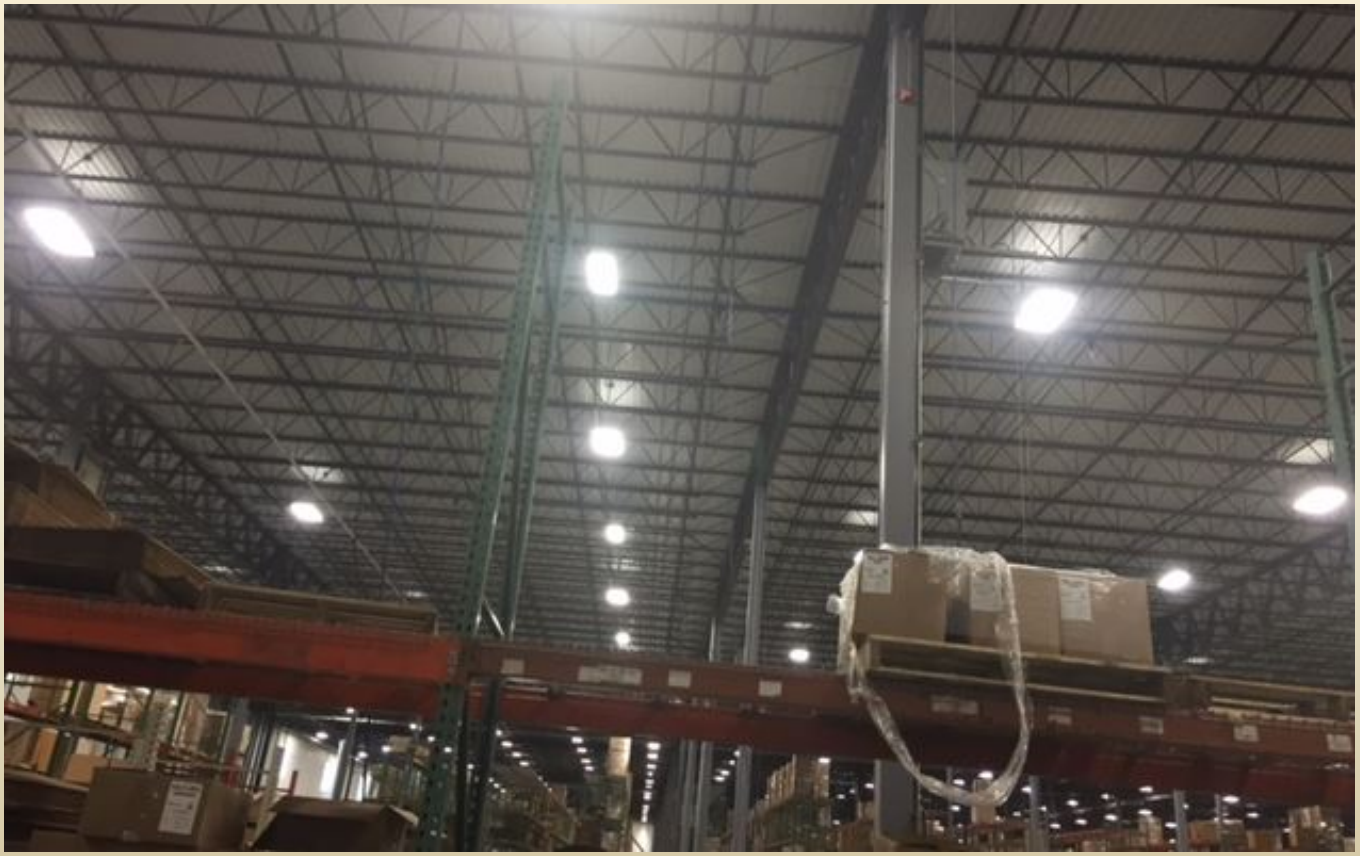
Costing An Actual New Mega Warehouse

Completed in 2015 in Louisville KY - Interior

Dimensions: 450’ x 700’ Area: 315,000 SF

Perimeter: 2,300 LF Wall height: 32 ft

Structure Type 5: Tilt-up concrete panel wall



Cost Estimates By 3 National Publications

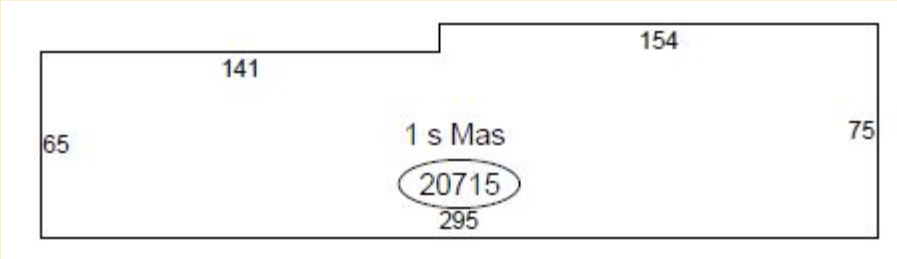
	2016 RS MEANS Square Foot Costs		2016 Craftsman NBC Manual	Low	High/Good		2016 Marshall Valuation Service	Low	High/Good
Base 24'	101.45	Base 20'	38.87	33.97	44.21	Base 20'	36.19	24.03	55.10
+ 8' WH	3.60	+ 12' WH	4.56	4.56	4.56	+ 12' WH	14.84	9.85	22.59
	105.05		43.43	38.53	48.77		51.03	33.88	77.69
Size Adj .894	93.91	Size Adj				PAR Adj	-7.65	-5.08	-11.65
	29,583,131					(mult = .85)			
						Current Cost	-1.53	-1.02	-2.33
Cost per SF	93.91		43.43	38.53	48.77	(Central)	41.84	27.78	63.71
		Heating	3.50	2.34	4.66		2.45	2.45	2.45
Total rate	**93.91**	**Total rate**	**46.93**	40.87	53.43		**44.29**	30.23	66.16
	29,583,131		**14,782,950**	12,874,050	16,830,450		**13,952,257**	9,523,548	20,839,335
	p 228		p 224 & 239				Section 14		
See note p 228							Page 25		
on reported							Feb 2016		
project costs							584 - Mega Warehouse		
from low of	39.65						Form 1003.1		
to high of	158.30								
Low total cost	**12,489,750**								
High total cost	**49,864,500**								

Cost Estimate Using The New Cost Model

	SHELL COST						2016 NEW MODEL
	Vertical Cost Type Description (Walls)	Floor Level		14' Wall Ht Rate	adj per +/- 1'	WH Rate	COST
Type 5	Conc tilt-up wall w/unf inner side, total cost per LF	First	1500	418.14	16.18	728.28	1,675,044
	Horizontal Cost Type (Floors & Roof)		**Load Bearing**	**Horizontal Costs/Sq Ft**	**Frame Cost/Sq Ft**		
Type 5 -	Pre-cast/CIP/tilt-up concrete panel wall buildings	First	Walls	31.21	0.00		9,831,150
	FINISH USE TYPE COSTS						
			IFC Interior Finish Cost per SF	**PC Perimeter add Cost per LF**	**EFC Entrance Flat Cost**	**OFC Other Flat Cost**	
649	Warehouse - Storage	WHSESTOR	18.44	18.90	2250.00	0.00	5,810,850
	TOTAL Building Cost				**Avg Quality**		**17,317,044**
	Cost per Sq. Ft.					**per SF**	**54.97**
					Low Quality	0.85	**14,719,487**
						per SF	**46.73**
					Good Quality	1.30	**22,512,157**
						per SF	**71.47**

Cost Estimates – Neighborhood Shopping Center

Type 4 Reinforced masonry walls, steel joists, 16' wall ht, 730 LF perimeter

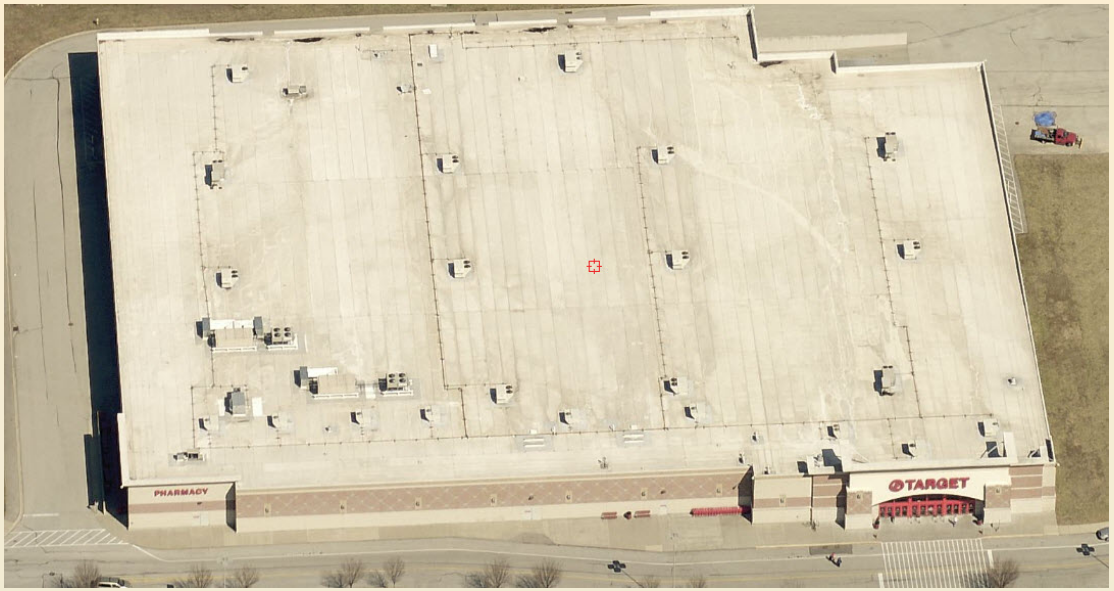


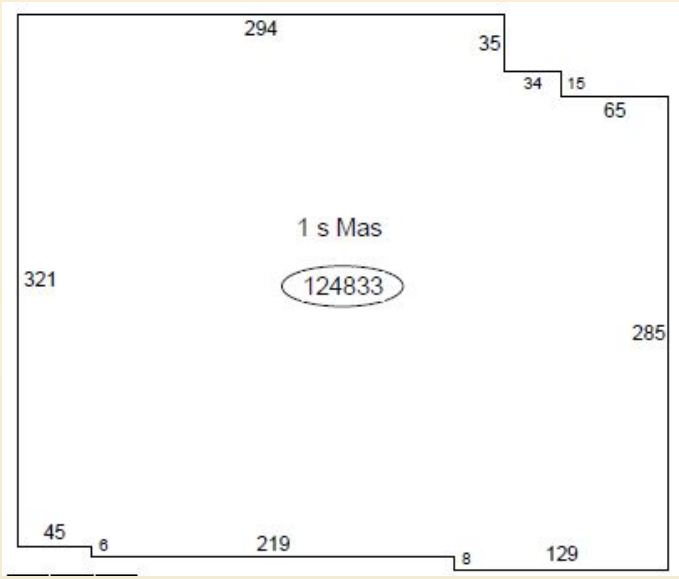
Source	Typical/Avg	Low	Good/Higher
RS Means	$2,270,400	$1,338,200*	$4,652,600*
Craftsman NBC	$1,564,400	$1,309,600	$1,778,600
Marshall& Swift	$1,922,000	$1,539,600	$2,294,600
New Cost Model	$1,782,000	$1,514,700	$2,316,500

* Total cost range of all projects reported to RS Means

Cost Estimates – Discount Dept Store (Big Box)

Type 4 Reinforced masonry walls, steel joists, 22’ wall ht, 1456 LF perimeter



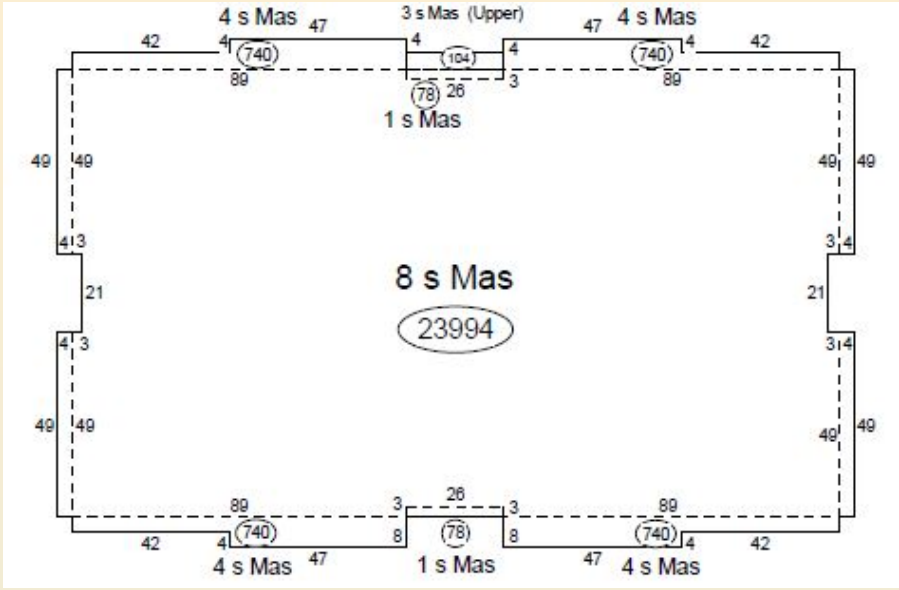


Source	Typical/Avg	Low	Good/Higher
RS Means	$14,280,900	$7,995,600*	$19,898,400*
Craftsman NBC	$ 9,242,600	$7,751,900	$10,498,700
Marshall& Swift	$ 8,925,900	$6,995,900	$10,997,900
New Cost Model	$ 8,717,700	$7,410,000	$11,333,000

* Total cost range of all projects reported to RS Means

Cost Estimates for 8-Story Office Building

Type 9 Steel reinforced concrete frame, wall 17' 1st, 14' upper, 734 perimeter



Source	Typical/Avg	Low	Good/Higher
RS Means	$35,214,400	$17,586,800*	$51,698,200*
Craftsman NBC	$31,472,500	$27,283,100	$34,058,100
Marshall& Swift	$30,881,500	$24,384,400	$41,214,600
New Cost Model	$24,168,700	$20,543,400	$31,419,300**

* Total cost range of all projects reported to RS Means

** Quality grade listed as "Good" by staff = +30%

What are the Benefits of the New Method?

#1 Greater accuracy of cost estimates

#2 More choices of correct shell structure type

#3 More flexibility in configuring interior occupancies

#4 Ability to quality grade shell & interior separately

#5 More flexibility in separately applying depreciation

#6 Much easier to handle changes in occupancy uses

#7 Easier to handle depreciation after remodeling

Q & A

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