

5D BIM: Design Costs Analysis

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5D BIM: Design Costs Analysis

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5D BIM: Design Costs Analysis

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The logo for GRAPHISOFT, consisting of the word "GRAPHISOFT" in white capital letters on a dark blue rectangular background. The background of the slide features a faint, grey circuit board pattern.

GRAPHISOFT

5D BIM: Design Costs Analysis

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5D BIM: Design Costs Analysis

Upcoming Events



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5D BIM: Design Costs Analysis

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5D BIM: Design Costs Analysis

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5D BIM: Design Costs Analysis

Course Description

The use of computer technology has allowed designers to explore inspiring and radical design ideas. And, when these ideas are presented to clients the designers are challenged with “Can this world-class architecture be constructed within the project budget?” Surely computer technology can assist designers to monitor predicted construction costs? Surely computer technology can automate the tedious task of measuring, counting and organizing design components for cost estimating? This webinar explores the challenges and successes of using BIM for predicting construction costs through a series of three presentations provided by Beck Technology, Project Time & Cost, Inc. and Vico Software.

5D BIM: Design Costs Analysis

AIA/CES Learning Objectives

Participants will be able to:

1. Discuss the concepts of using BIM for design cost analysis.
2. Describe BIM authoring requirements needed to support cost estimating.
3. Lead a discussion within the firm to consider project workflow requirements to support BIM for cost analysis.
4. Describe the basic data exchange requirements between BIM and cost estimating applications.

5D BIM: Design Costs Analysis

Schedule - Eastern Standard Time (EST)

1:00 – 1:05 Opening Announcements

1:05 – 1:20 Corey Sanders presents

1:20 – 1:35 Kenneth Roberts presents

1:35 – 1:50 Donald Henrich presents

1:50 – 2:00 David Scheer, AIA, moderators the Q&A

5D BIM: Design Costs Analysis

Speakers



Corey Sanders

Business Development Manager
Beck Technology



Kenneth A. Roberts, PMP, CCC

EVP and President Personnel Development
Project Time & Cost, Inc.



Donald Henrich

EVP & Co-Founder
Vico Software, Inc.



David Scheer, AIA

Moderator

5D BIM: Design Costs Analysis

Speaker



Corey Sanders

Business Development Manager
Beck Technology

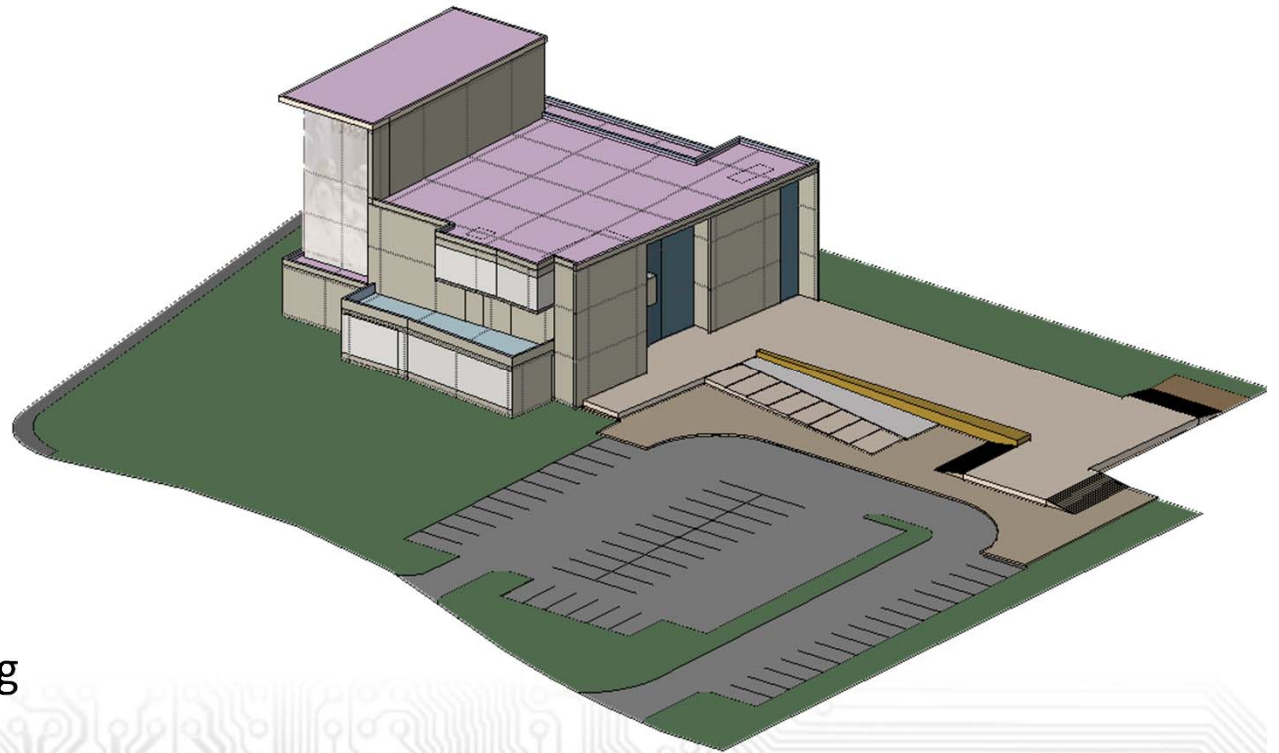
Beck Technology



Macro BIM - Overview

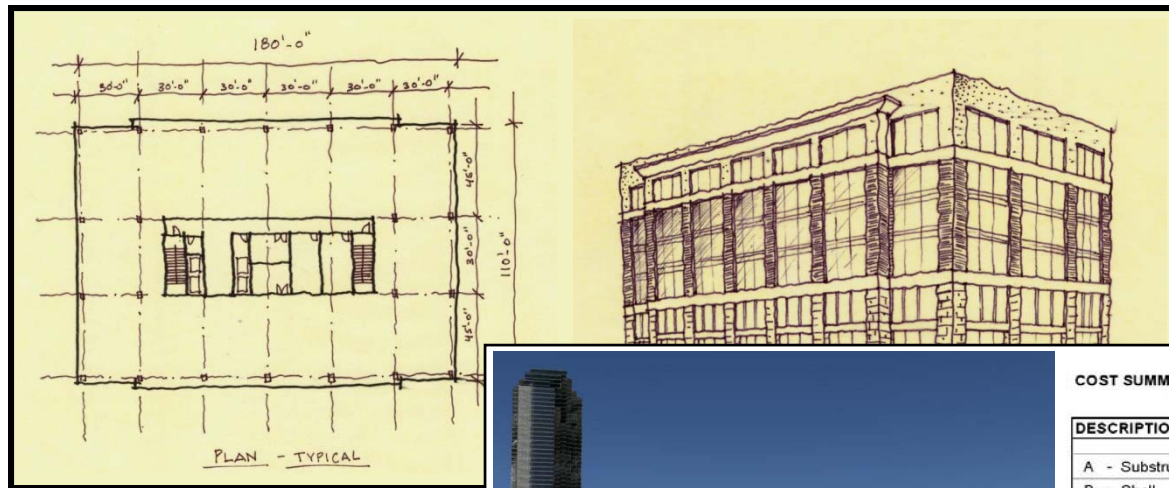
Opportunities for Early Analysis with Macro BIM:

- Visualization
- Space Analysis
- Cut/Fill & Site Analysis
- Phasing/Sequencing
- Energy Performance
- Cost Modeling/Estimating
- Alternative Evaluations – What if's



Accurate Conceptual Cost Modeling

Faster and better information....



COST SUMMARY

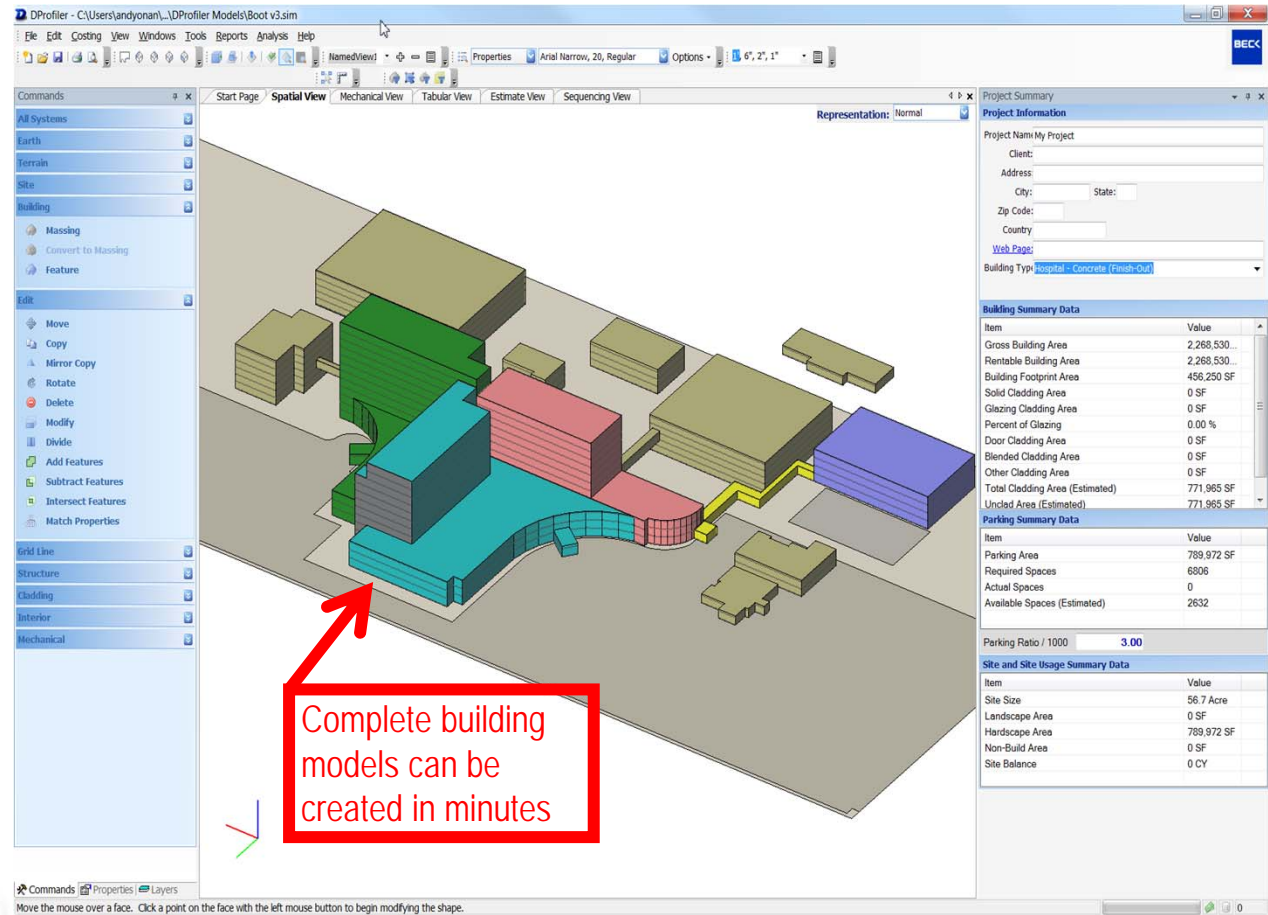
D
Profiler

DESCRIPTION	\$/SF	COST
A - Substructure	\$2.28	\$ 320,628
B - Shell	\$49.73	\$ 6,981,274
C - Interiors	\$12.19	\$ 1,711,453
D - Services	\$39.41	\$ 5,531,915
G - Site Work	\$8.62	\$ 1,210,448
I. SUBTOTAL		\$112.23 \$ 15,755,718
General Conditions	8.00%	\$ 1,260,457
General Liability	1.00%	\$ 157,557
Builder's Risk	1.00%	\$ 157,557
Fee	3.50%	\$ 551,450
II. TOTAL COST		\$127.39 \$ 17,882,739

...typically between 2% and 5%

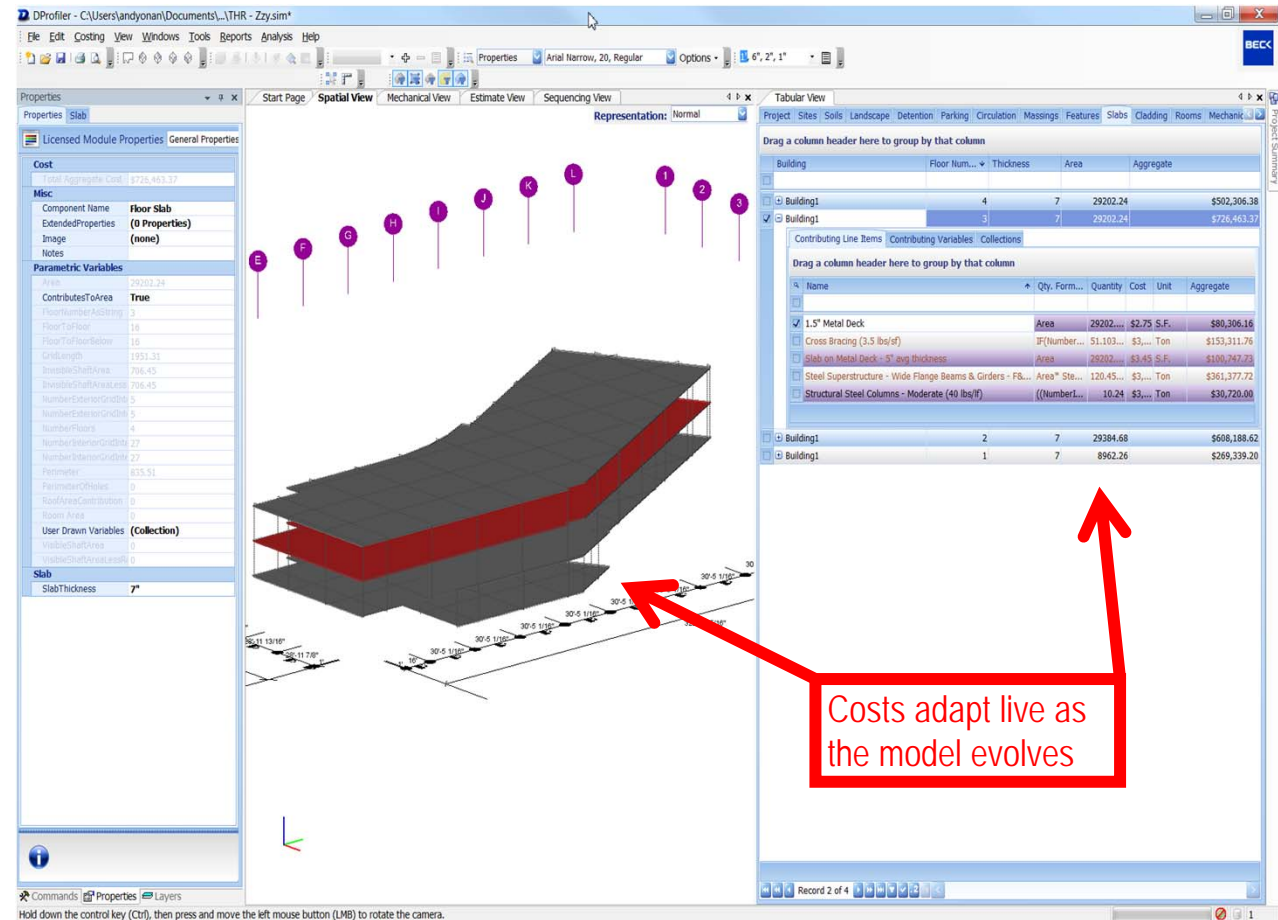
Accurate Conceptual Cost Modeling

High Level Graphical Modeling



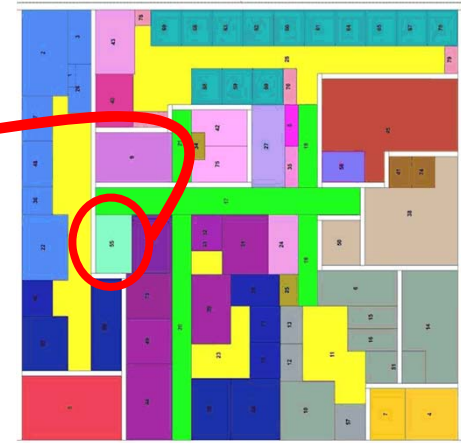
Accurate Conceptual Cost Modeling

Real Time Data Feedback



Macro BIM – Cost Modeling/Estimating

- Conceptual cost modeling for early design
- Eliminate assumption gaps



▶	Offices	1	Office	Student	13'-5"	143.29	\$3,516.20	
Contributing Line Items								
Drag a column header here to group by that column								
🔍	Clas... ▼	I...	Name	Qty. Formula	Quantity	Unit	Cost	Aggregate
🗑								
▶	09910200	B007	Paint Door & Frame	Each	1	Ea.	\$76.00	\$76.00
	09910200	B004	Paint Drywall Partitions	WallArea	644.71	S.F.	\$0.40	\$257.88
	09680800	B002	Carpet - Broadloom - Class B	Area / ConvertToSY	15.921111	S.Y.	\$32.00	\$509.48
	09651200	B001	4" Rubber Base	Perimeter	48.052769	L.F.	\$1.25	\$60.07
	09510760	B001	Acoustical Ceiling Allowance /sf (Tile & gri...	Area	143.29	S.F.	\$3.25	\$465.69
	09250700	B001	1 Layer of 5/8" Type "X" Gyp Board	WallArea	644.71	S.F.	\$1.05	\$676.95
	09250700	B001	Tape & Bed	WallArea	644.71	S.F.	\$0.42	\$270.13
	08210900	B001	Interior Door/Frame/Hardware	Each	1	Ea.	\$1,200...	\$1,200.00

Healthcare Project Example

Initial Budget: ~~\$900 million~~

+\$400 million

30% DD Estimate: \$1.3 billion

...Largest in US today



Healthcare Example - % based skin estimate










Exterior Skin Systems Description 1

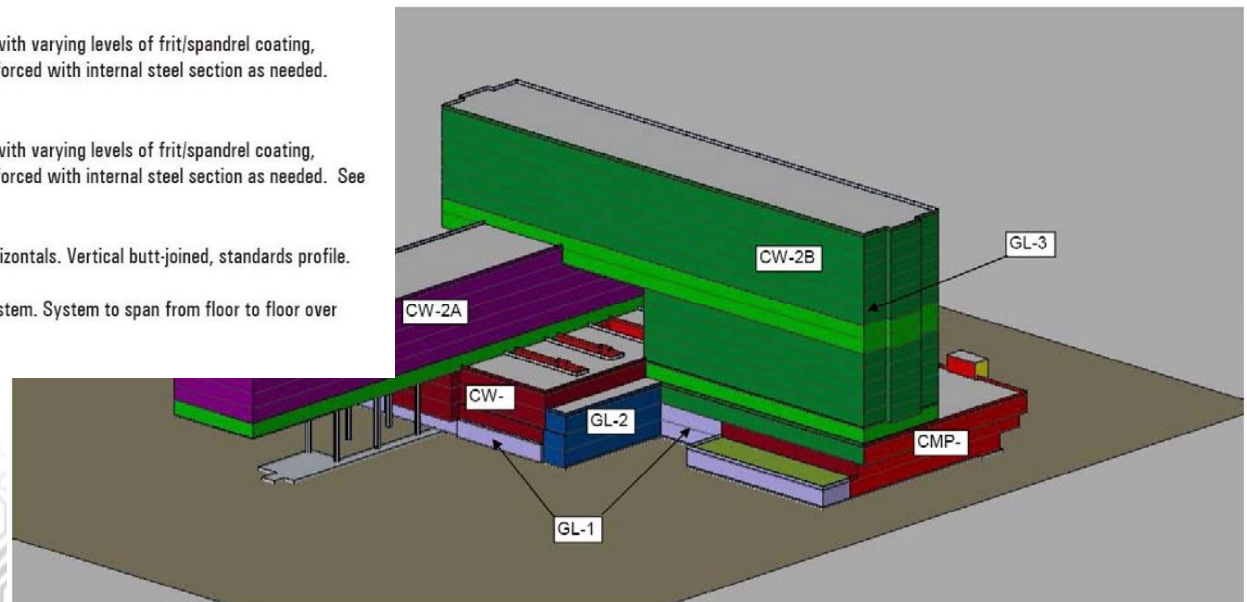
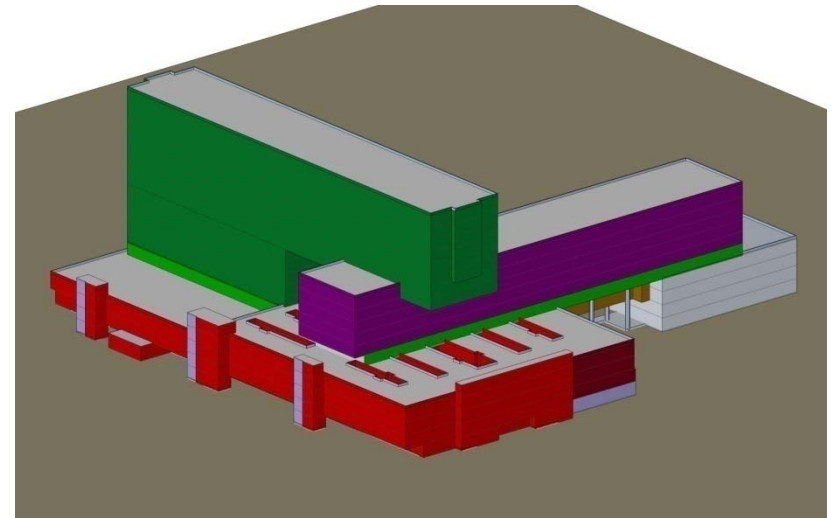
New Parkland Hospital

Dallas, Texas

February 15, 2010

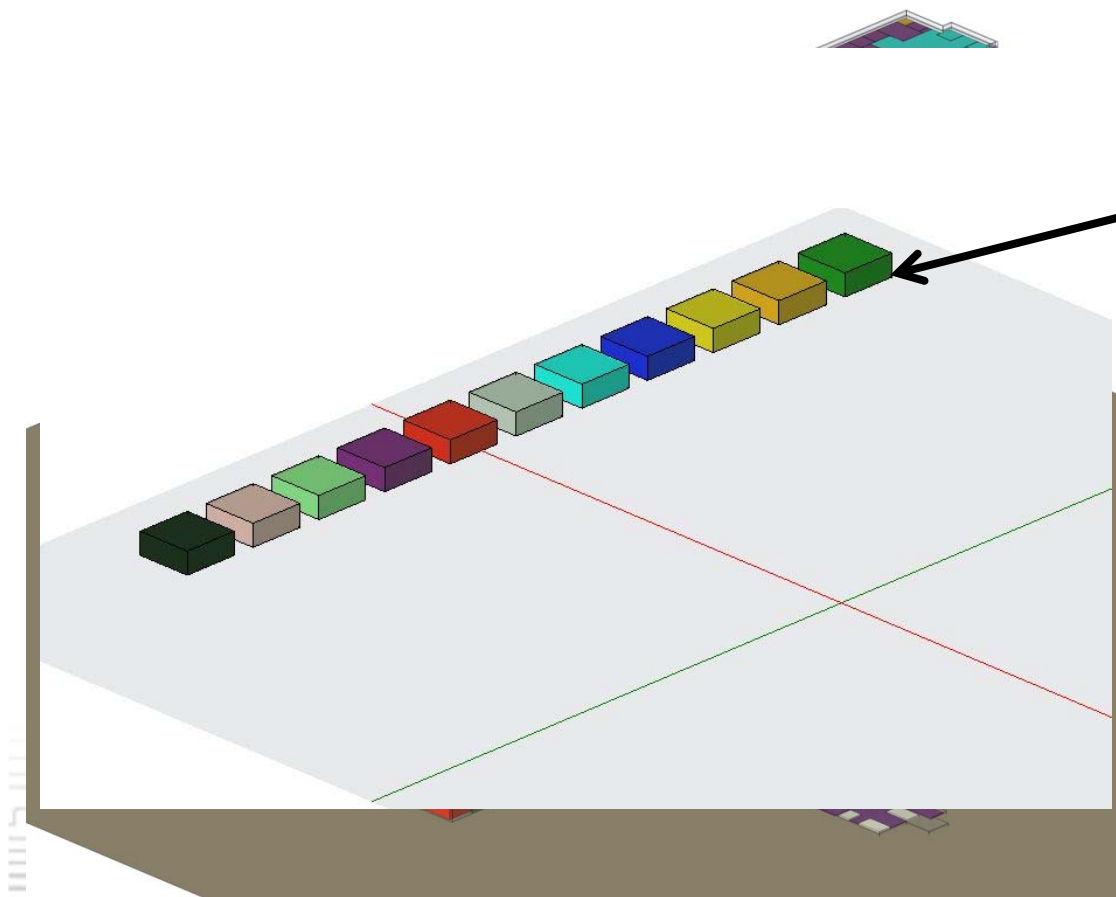


- CMP-1**  Aluminum-faced composite wall panel assembly. Dry rout and return system with a 3-coat fluoropolymer finish with suspended metal flakes. To include components necessary for a complete weathertight system. See Sketch 1.
- GL-1**  1" insulated low iron, low-e, in butt jointed glazing in top and bottom track with 90% vision glass and 10% frit.
- CW-1**  2 way structural silicone 1" insulated glazed aluminum curtain wall system with 75% silkscreened ceramic frit coating. 25% pictorial images created by direct to glass printing. Custom profile horizontal mullions expressed. See Sketch 2.
- GL-2**  Stainless steel cable net curtainwall glazing system at lobby with 1" insulated units. Tension cable system components to be capable of resisting live and dead loads acting upon the system.
- GL-3**  Single pane 1/4" float glass over concrete or concrete masonry unit back-up. Backpainted / frit coated units in line with louvers.
- CW-2A**  1" insulated aluminum curtain wall 4 way structural silicone system with varying levels of frit/spandrel coating, thermally broken with internal weep drainage systems. Mullions reinforced with internal steel section as needed. See Sketch 3.
- CW-2B**  1" insulated aluminum curtain wall 4 way structural silicone system with varying levels of frit/spandrel coating, thermally broken with internal weep drainage systems. Mullions reinforced with internal steel section as needed. See Sketch 4.
- CW-3**  1" insulated, low-e, aluminum curtain wall system with captured horizontals. Vertical butt-joined, standards profile.
- CW-4**  Clear structural channel glass system equal to Pilkington "Profilit" system. System to span from floor to floor over levels 3 and 4.



Healthcare Example

Define Room Types that represent major costs for equipment and finishes



BOH

RR1

OR

Classification	Item Number	Qty. Formula
Floor		
Welded Sheet Vinyl Flooring	Area	S.F.
Sheet Vinyl Integral Cove	Perimeter	L.F.
Ceiling		
Gypsum Board Ceilings	Area	S.F.
Paint Drywall Ceilings	Area	S.F.
Walls		
1 Layer of 5/8" Type "X" Gyp Board	WallArea	S.F.
Lead Lined Gypsum Board	0	S.F.
Tape & Bed	WallArea	S.F.
Paint Drywall Partitions - Epoxy Paint	Perimeter*9	S.F.
Interior Door/Frame/Hardware - 6/0x7/0 w/ vision panels	Each	Opng.
Paint Door & Frame	Each	Ea.
Specialties		
Wall Protection, Corner Guards, stainless steel, 16 ga, 3-1/2" leg	4	L.F.
R/F Shielding (Braden Shielding or similar)	WallArea/4	S.F.
Other		
Uni-strut Medical Equipment Support Allowance	Each	All
In-Wall Blocking - Upper Cabinets	Perimeter/2	L.F.
In-Wall Blocking - Base Cabinets	Perimeter/2	L.F.
In-Wall Blocking - Miscellaneous	Perimeter/2	L.F.
Solid Surface Vanity Top	Perimeter/2	L.F.
Cabinets, wall cabinets	Perimeter/2	L.F.
Cabinets, base cabinets, not including counter	Perimeter/2	L.F.

Healthcare Example



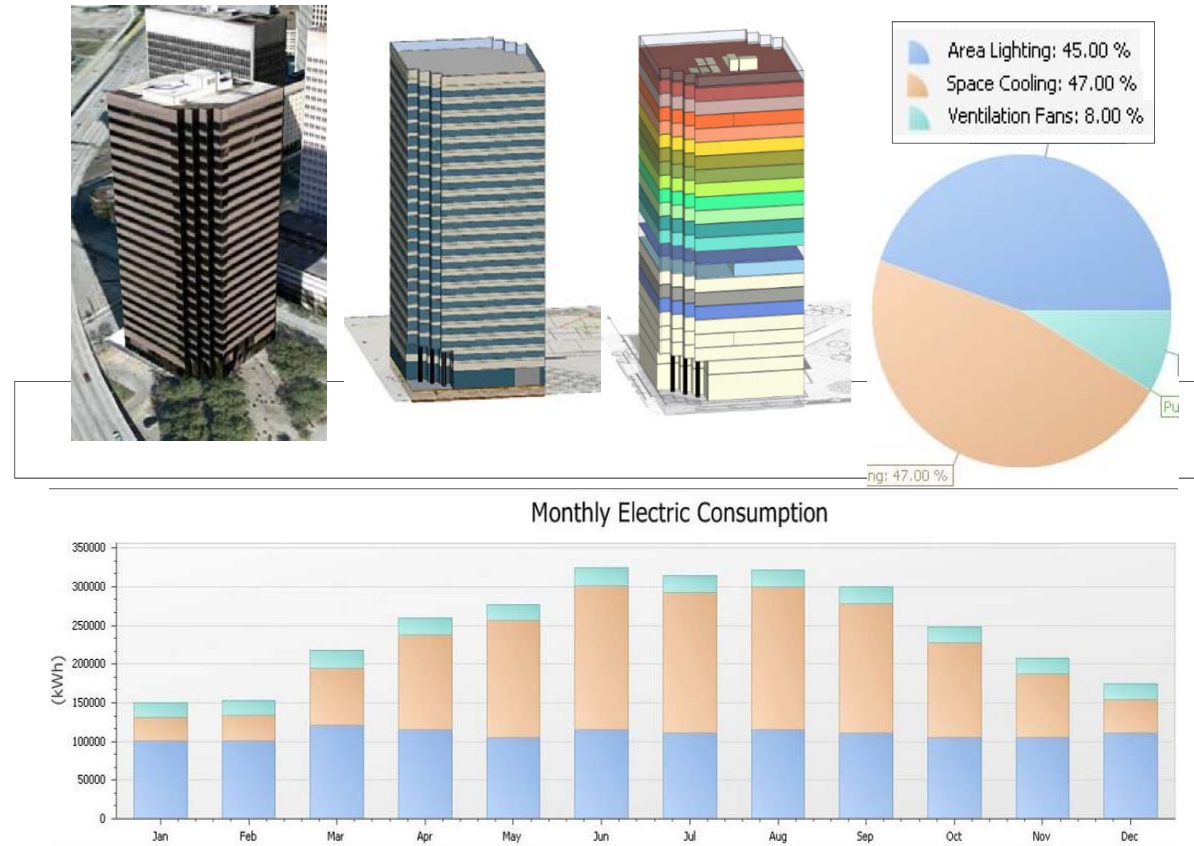
- 1500+ interior spaces
- 2 million SF
- Start to finish in 10 days
- 1.5% Estimate Variance from CM

New budget \$1.27billion

Macro BIM – Energy Analysis

Energy Analysis

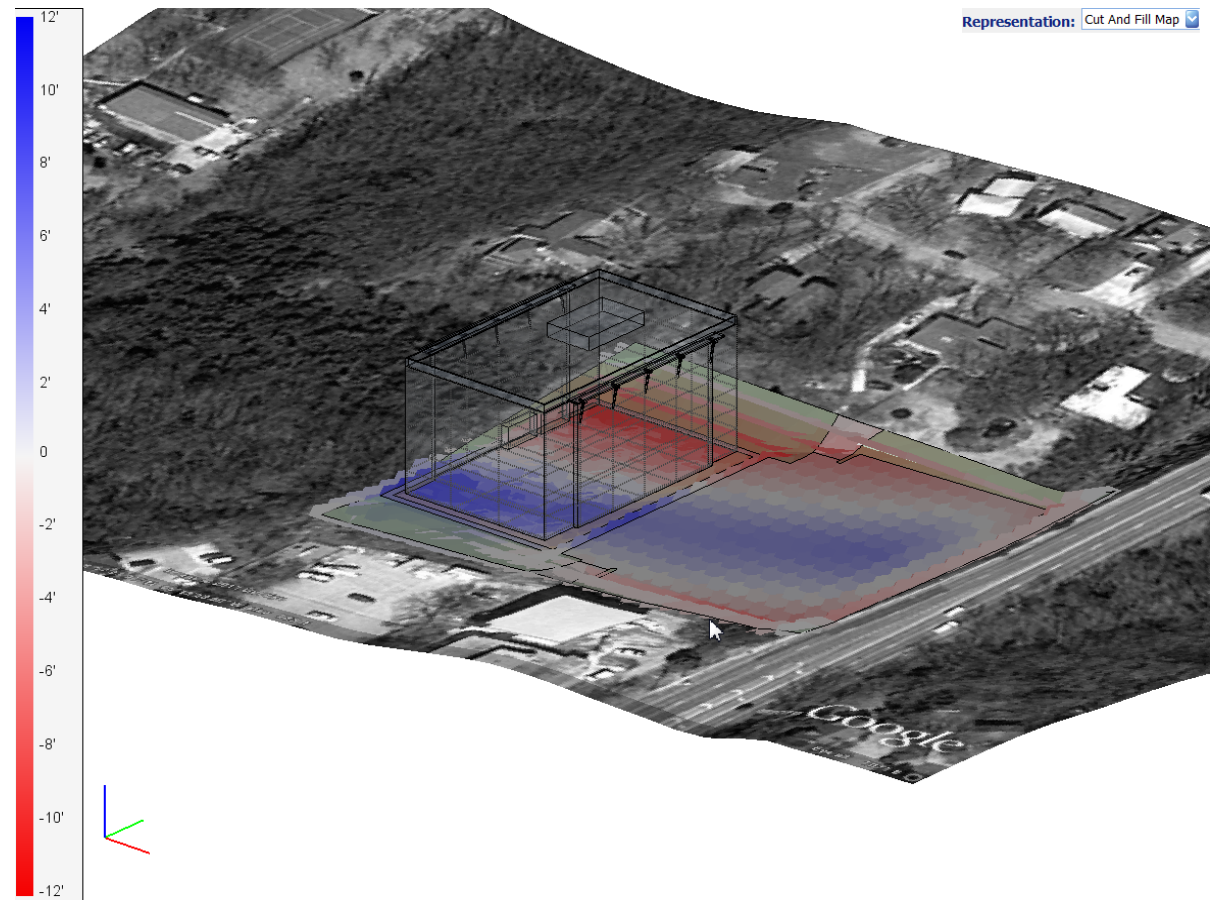
- Order of magnitude impact
- Uses Dept. of Energy DOE2 engine
- Configured to local weather data



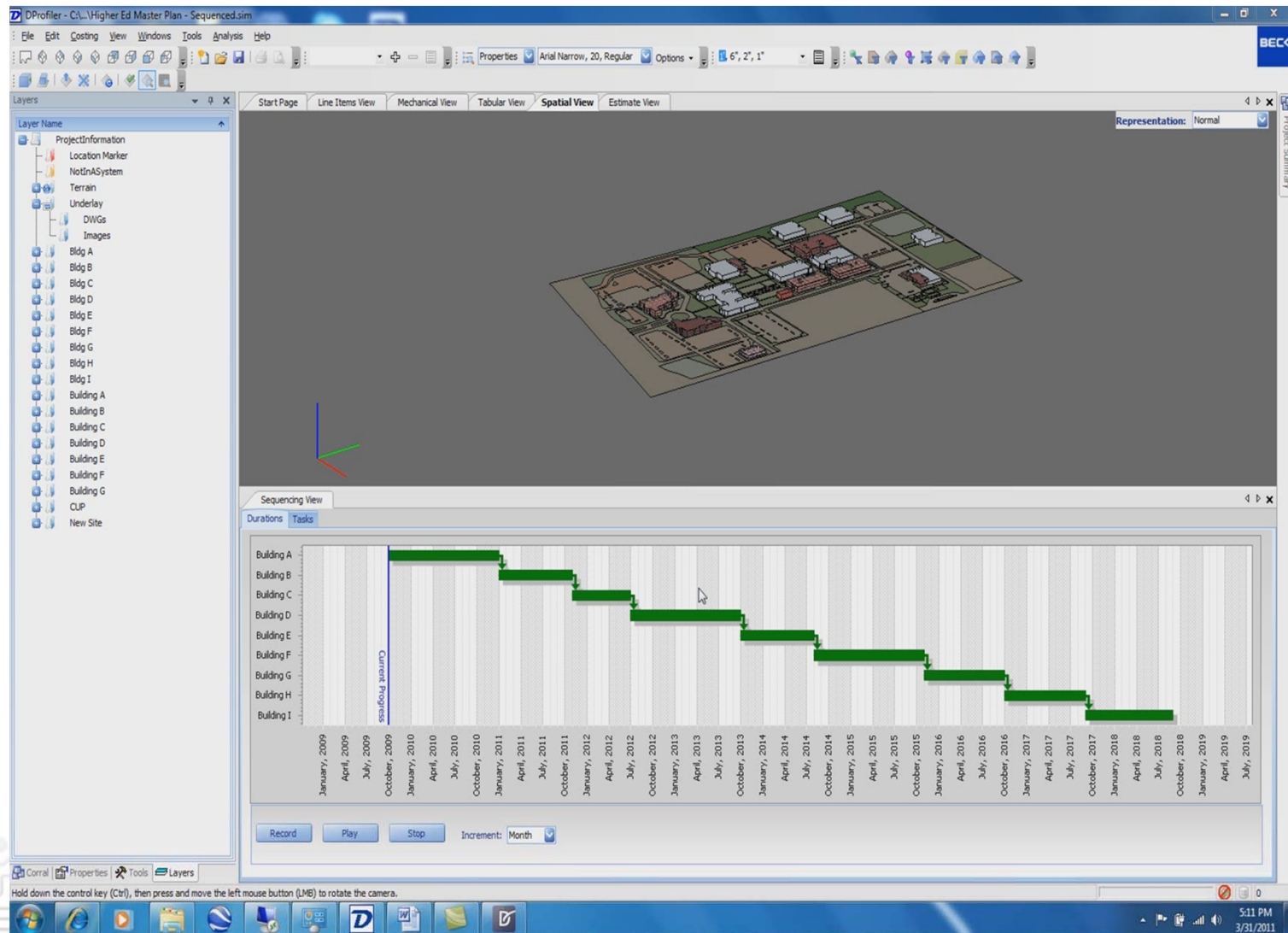
Macro BIM – Site Analysis

Conceptual Sitework Analysis

- For site feasibility studies
- Cut and Fill costs
- Soil strata information and cost calculated if known



Macro BIM – Phasing/Sequencing



Bringing it all Together

Deliverables...

- Detailed Cost Estimate
- Estimate Clarifications
- Use Information Downstream



5D BIM: Design Costs Analysis

Speaker



Kenneth A. Roberts, PMP, CCC

EVP and President Personnel Development
Project Time & Cost, Inc.

5D BIM Design Phase Control Estimates



Tri-Service Automated Cost Engineering Systems

(TRACES)

- **Tri-Service – Army, Navy and Air Force**
- **TRACES**
 - Suite of Cost Engineering Software Applications and Databases
 - Used by Tri-Service Cost Engineering Community, Including its Architecture-Engineering Contractors
- **TRACES Administered by U.S. Army Corps of Engineers**
- **PT&C has held TRACES Support Contract Since 2001**
- **In 2009 Tasked with Developing a BIM Interface**
 - TRACES Detailed Cost Estimating Application Interface with BIM
 - Presentation Focuses on Lessons Learned from this Task

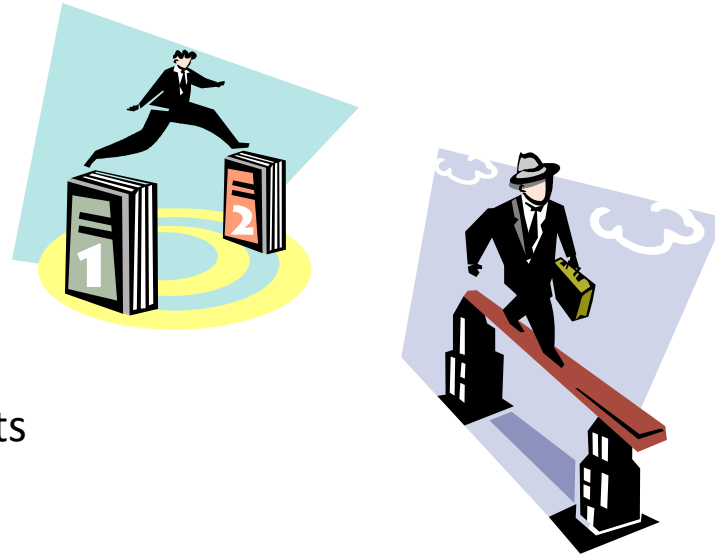


TRACES BIM Interface

Task Overview

- **A Multi-Phased Task**

- Proof of Concept
 - Gap Analysis – Cost Estimate Input Needs vs. BIM Output
 - Closing the Gap
 - Data Export/Import Requirements
 - Interface Prototype
- Prototype Testing
 - Repeat Gap Analysis – Different Facility
 - Closing the Gap
 - Refine Data Export/Import Requirements
- Interface Definitive Design
 - Open Architecture to Maximize Interoperability



Perceived Impact of BIM on Cost Estimating

Fact versus Fiction

“BIM is going to make the cost estimator obsolete – just push a button and out pops an estimate.”

FICTION

“BIM will dramatically increase the accuracy of cost estimates.”

FICTION

“BIM can dramatically increase cost estimating efficiency – the time required to produce an estimate can be cut in half.”

FACT

“BIM can provide a complete quantity take-off to the estimator.”

FICTION

“BIM can improve the accuracy of cost estimates.”

FACT

“To fully reap the benefits of BIM requires better collaboration between designers and cost estimators.”

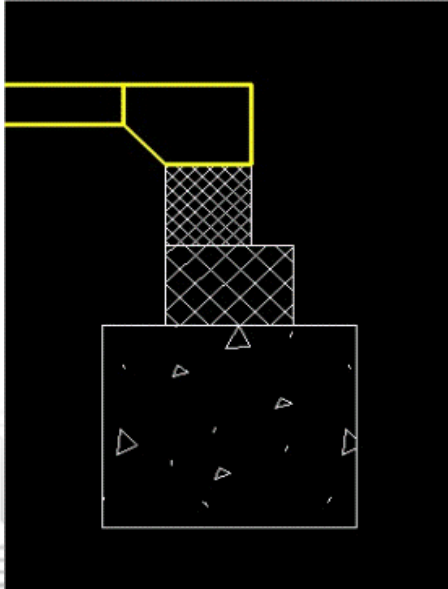
FACT

TRACES BIM Interface

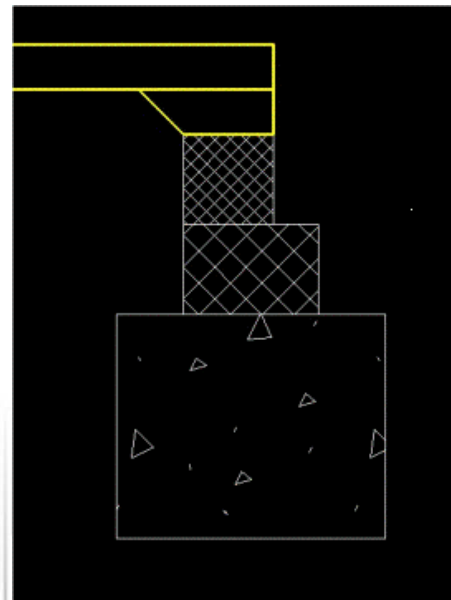
Lessons Learned

- **Model “Quality/Suitability” is Everything**
 - BIM Quantities Must be the **Right** Quantities
 - Design Intent vs. Construct Intent
 - **Example #1**
 - Typical Turndown Slab

As Originally Modeled



As Re-Modeled



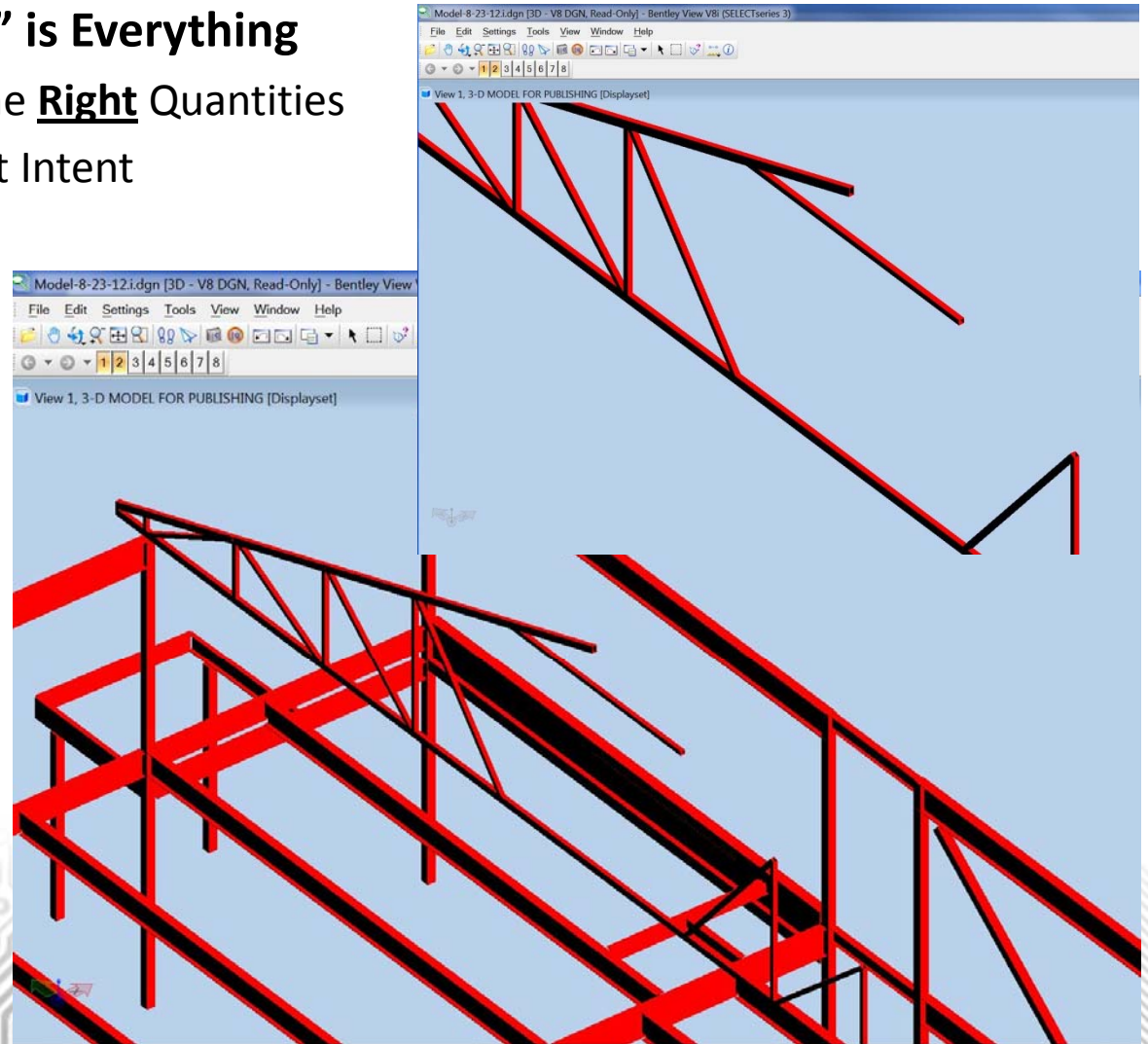
TRACES BIM Interface

Lessons Learned

- **Model “Quality/Suitability” is Everything**
 - BIM Quantities Must be the **Right** Quantities
 - Design Intent vs. Construct Intent
 - **Example #2**
 - Long Span Steel Joist

Modeled Using a Steel
Tube Object

Provided the Desired
Visual, but NOT the
Needed Quantification



TRACES BIM Interface

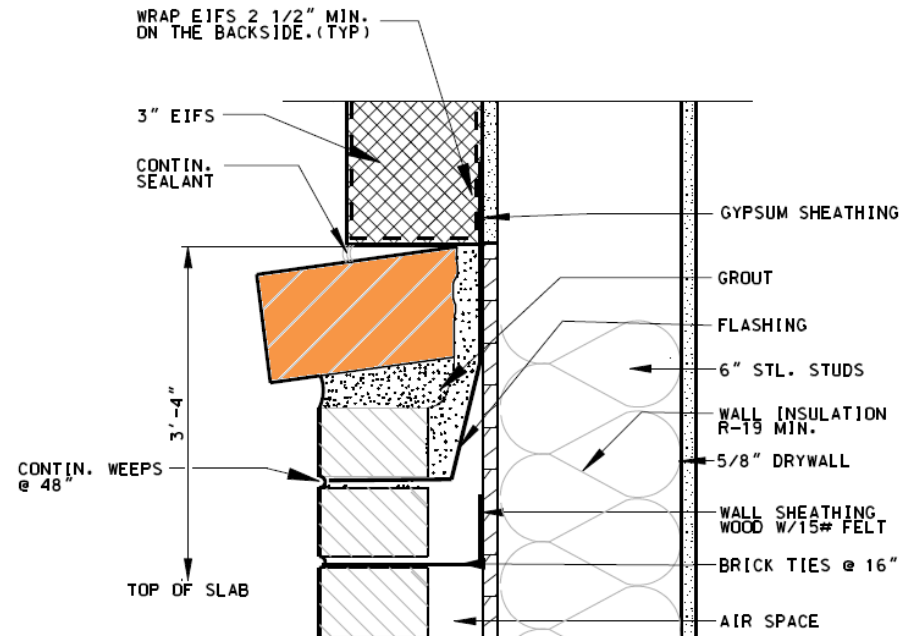
Lessons Learned

- **Model “Quality/Suitability” is Everything**
 - BIM Quantities Must be the **Right** Quantities
 - Design Intent vs. Construct Intent
 - **Example #3**
 - Cast Stone Window Sill

Modeled Using a
Structural Precast
Beam Object

Provided the Desired
Visual, but NOT the
Needed Quantification

Important to Use the
“Right” Object for Unique
Linking to Cost Items



DETAIL
NTS

2
A-302 | A-301

TRACES BIM Interface

Lessons Learned

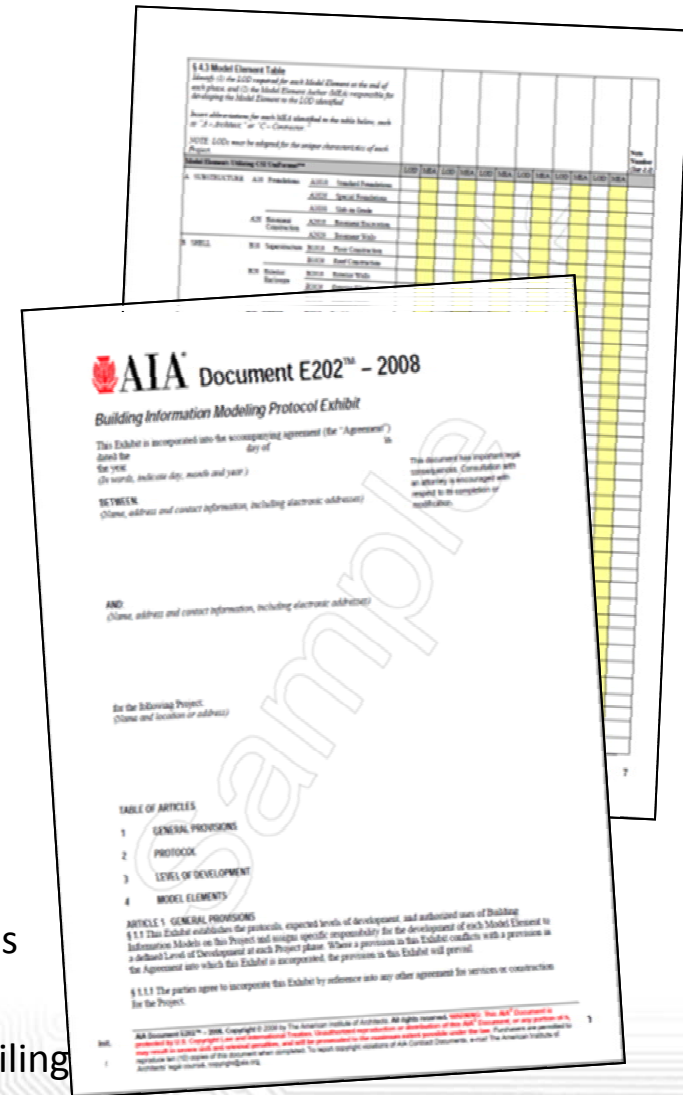
- **Model Granularity**

- What Isn't Modeled?

- Reinforcing Steel
 - Waterproofing
 - Finishes
 - Wiring
 - Formwork
 - Etcetera, etcetera, etcetera

- Level of Definition (LOD)

- AIA E202 Building Information Modeling Protocol Exhibit
 - LOD 100 - Overall Building Massing
 - LOD 200 - Generalized Systems/Assemblies
 - LOD 300 - Specific Assemblies (Detailed)
 - LOD 400 - Fabrication, Assembly and Detailing
 - LOD 500 – Actual Constructed Assemblies



TRACES BIM Interface

Lessons Learned

- **Object Definition & Association with Cost Items/Assemblies**
 - What's Important?
 - Non-Geometric Data
 - Uniqueness/Differentiation
 - Construction Means & Methods
- **Standardization**
 - Required In Order to Fully Reap Benefits
- **Workflow Modifications**
 - Important for Designer and Cost Estimator to Collaborate



Mounting Height?

Site Equipment Attributes		BuildingDataGroup	
Window Attributes		BuildingDataGroup_01_0	
Door Attributes		BuildingDataGroup_01	
Attributes	Building Designer Attribute	ODBC Driver Attribute	
MasterFormat	Classification MasterFormat	ClassificationMasterFormat	
OmniClass Table 21	Classification OmniClass	ClassificationOmniClass	
UniFormat1	Classification UniFormat	ClassificationUniFormat	
Frame Depth	Dimension Frame Depth	DimensionFrameDepth	
Frame Depth Match Wall	Dimension Frame Depth Match Wall	DimensionFrameDepthMatchWall	
Frame Thickness	Dimension Frame Thickness	DimensionFrameThickness	
Height	Dimension Height	DimensionHeight	
Leaf Thickness	Dimension Leaf Thickness	DimensionLeafThickness	
Width	Dimension Width	DimensionWidth	
(new property)	Door IsEgress	DoorIsEgress	
(new property)	Glazing Size	GlazingSize	
(new property)	Louver Notes	LouverNotes	
(new property)	Louver Size	LouverSize	
Door Finish	Door Finish	DoorFinish	
Door Fire Rating	Door Rating	DoorRating	
Door Material	Door Material	DoorMaterial	
Door Type	Door Type	DoorType	
Door Undercut	Door Under Cut	DoorUnderCut	
Frame Finish	Frame Finish	FrameFinish	
Frame Material	Frame Material	FrameMaterial	
Frame Notes	Frame Notes	FrameNotes	
Frame Type	Frame Type	FrameType	
Glazing	Glazing	Glazing	
Glazing Notes	Glazing Notes	GlazingNotes	
Hardware Electrical Rqs	Hardware Elec. Requirements	HardwareElecRequirements	
Hardware Finish	Hardware Finish	HardwareFinish	
Hardware Notes	Hardware Notes	HardwareNotes	
Hardware Set	Hardware Set Manufacturer	HardwareSetManufacturer	
Hardware Type	Hardware Type	HardwareType	

5D BIM: Design Costs Analysis

Speaker



Donald Henrich
EVP & Co-Founder
Vico Software, Inc.

COST PLANNING with BIM from a GC's perspective

- **Company Introduction**
- **Focus of GC/CM & Use of Model**
- **Benefits of Visual Costing**
- **Technology Solution**
- **Importance of Standards, Libraries, and Data**
- **Call to Action**

Vico Software

- Truly Exploit the Benefits of BIM for Construction



- 5D BIM Software and Services:



- Most Integrated Virtual Construction Solution on the Planet
- Most Experienced Virtual Construction Team

- Our Customers: **Owners / A / E / CM / GCs / S**



USA

UK

UAE

HU

FIN

+11 WW
Partners

Technology Partners

Over 400
customers world wide



Andy Ball, CEO, Webcor Builders:

California Academy of Science
Courtesy: Webcor Builders

“Vico’s software and services are revolutionizing the way we plan projects... leading to huge reductions in the inefficiencies, waste, and rework that plague our industry.”

Focus of GC is on Quality, Cost, and Schedule

DESIGN

Architects

- Program
- Design

Engineers

- Performance

Owner

CONSTRUCTION

General Contractors

- Quality
- Schedule
- Cost

Subcontractors

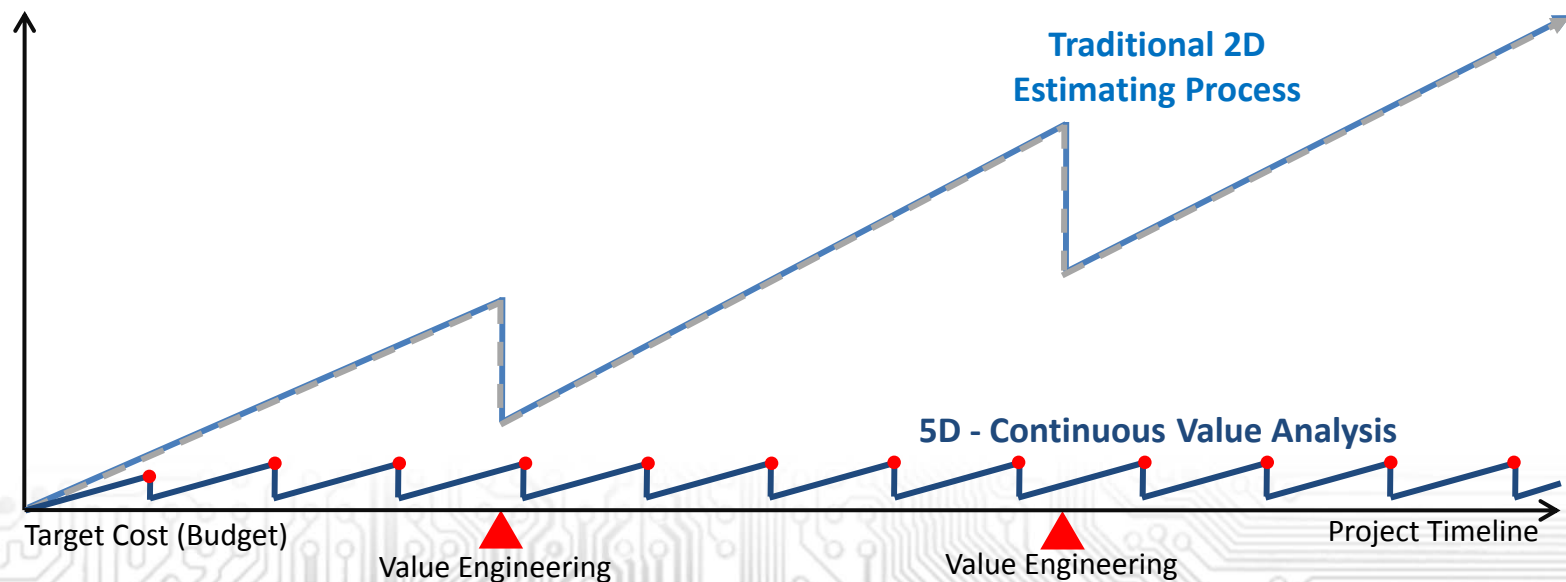


Benefit to Owner / Designer

5D: Cost Planning – Budget Control

Continuous and Proactive Cost Control

Cost target set with Design team + owner per system and per departments



AIA Technology in Architectural Practice

Owners and Designers

Decision Support & Superior Interaction



Visual Cost Planning

Vico Office Development Version - Demo Project

Mini TOM 3D View Cost Planner

X-ray Mode Outline Mode Painting Mode Selection Mode Navigation Mode Measure Length Measure

1 Project

- View Dashboard
- Define Settings
- Select Module
- Import from Excel
- Compare & Update
- Define Targets

2 Content

- Edit Tags

3 Model Management

- Manage Models

4 Takeoff

- Takeoff Model
- Manage Takeoff

5 Cost Planning

- Plan Cost
- Explore Cost

6 Reports

- Create Reports

Model Manager & 3D New ViewSet(1)

3D View

Palettes

Code	Description	Unit	Type
Quantity			Value
	X1010_10_Gross area zone		(3)
	A1031_001_Slab on Grade-ID		(1)
	A1012_003_Pile Cap-ID		(54)
	A1021_001_CIP RC Pile-ID		(223)
	B1012_005_CIP RC Slab-ID		(4)
Count		EA	4.0
Edge Perimeter		FT-IN	1312
Hole Count		EA	0.0
Hole Perimeter		FT-IN	0
Bottom Surface Area		SQ FT	23,980.0
Top Surface Area		SQ FT	23,980.0
Edge Surface Area		SQ FT	9,743.7
Hole Surface Area		SQ FT	0.0
Net Volume		CU YD	592.1
Gross Volume		CU YD	592.1
Split Horizontal Surface Area		SQ FT	0.0
Split Vertical Surface Area		SQ FT	0.0
Split Count		EA	0.0
	B1012_046_CIP RC Column-ID		(168)
	B1012_069_CIP RC Beam-ID		(198)
	B2011_010_Ext Metal Wall Panel-ID		(18)
	B2021_020_External Window-ID		(435)

Code	Description	Source Q.	Consump.	Units	Quantity	Unit	Unit Cost	Total Price	Waste/Fa.	CostType	Status	Uniformat.	Uniformat.	Uniformat.	Uniformat.	CSI 1
000	Demo Project	1.0	1.0	-	1.0	-	2,177,713.72	2,177,713.72	1.0							
A	SUBSTRUCTURE	1.0	1.0	-	1.0	-	613,737.21	613,737.21	1.0							
B	SHELL	1.0	1.0	-	1.0	-	1,348,357.78	1,348,357.78	1.0							
B10	Superstructure	34,370.5	1.0	-	34,370.5	-	21.13	726,311.84	1.0							
B1010	Floor Construction	1.0	1.0	-	1.0	-	726,311.84	726,311.84	1.0			B	B10	B1010	B1011	
B1012_005	CIP RC Slab-ID	23,980.0	1.0	-	23,980.0	SF	18.58	445,537.50	1.0			B	B10	B1010	B1011	
03.11.00.370.0	Erect Forms to CIP Concrete - Slab	24,854.7	1.0	SF/SF	24,854.7	SF	6.76	168,017.56	1.0							03
LCON003	Formwork Carpenter	24,854.7	0.1	HR/SF	2,982.6	HR	48.00	143,162.89	1.0	Labor						
M03.11.00...	Erect Forms - Slab - Materials	24,854.7	1.0	SF/SF	24,854.7	SF	1.00	24,854.67	1.0	Material						
03.11.00.371.0	Strip Forms to CIP Concrete - Slab	24,854.7	1.0	SF/SF	24,854.7	SF	1.10	27,439.55	1.0							03
03.21.00.370.0	Reinforcement Steel to - CIP RC Slab	592.1	0.2	TON/CY	88.8	TONS	1,797.50	159,644.68	1.0							03
03.31.00.370.0	Casting Concrete in place to - Slab	592.1	1.0	CY/CY	592.1	CY	143.63	85,040.21	1.0							03
03.35.00.370.0	Concrete finishing to - CIP RC Slab	23,980.0	1.0	SF/SF	23,980.0	SF	0.23	5,395.50	1.0							03
B1012_046	CIP RC Column-ID	1,568.0	1.0	-	1,568.0	FT	58.65	91,965.94	1.0			B	B10	B1010	B1011	
B1012_069	CIP RC Beam-ID	3,584.0	1.0	-	3,584.0	LF	52.98	188,808.40	1.0			B	B10	B1010	B1012	
B20	Exterior Enclosure	16,012.1	1.0	-	16,012.1	-	38.85	622,045.95	1.0							
D	SERVICES	1.0	1.0	-	1.0	-	215,618.73	215,618.73	1.0							
D20	Plumbing	34,370.5	1.0	-	34,370.5	-	0.12	4,256.52	1.0							
D30	HVAC	34,370.5	1.0	-	34,370.5	-	6.15	211,362.21	1.0							
D3040	Distribution Systems	1.0	1.0	-	1.0	-	52,162.21	52,162.21	1.0			D	D30	D3040		
D3041_015	Duct_Supply_Prim	572.3	1.0	-	572.3	FT	51.00	29,184.75	1.0							
D3044_045	Duct_Supply_Sec	603.4	1.0	-	603.4	FT	28.00	16,895.46	1.0							

Cost Planner

AIA Technology in Architectural Practice

Vico Office

Cost Planner 3D View

New Component New Subcomponent Activate Assemble

Up Add Note Down Add Row Delete

Reference Descriptions and Consumptions Only Include Formula Include Quantities

Import Export

ABC ABC From Project From Reference

TOQ Filter Quantity Cost Margins Variance

Manage Save Version Manage Versions

Show Add Activate Divide Undivide Markup Values

Assemblies and Components References Navigate Auto Complete View Controls and Layout Presets Cost Versions Add-Ons & Markup

LBS Manager

- Project
 - View Dashboard
 - Define Settings
 - Select Module
- Content
 - Edit Tags
- Model Management
 - Manage Models
- Task and LBS
 - Manage Tasks
 - Manage Location Systems
 - Manage Locations
- Schedule
 - Plan Schedule
 - Manage Versions
 - View Schedule
 - Manage Crews
- 4D Simulation
 - Explore 4D Simulation
- Reports
 - Create Report

Task Manager - Modified 3D View

Code	Name	Quantity	Unit
0001	Soldier Piles		
31.34.00.050.0	Soldier Piles	2,503.39	LF
0002	Excavation & Lagging		
31.34.00.030.0	Lagging	7,891.59	SF
0003	Piles		
31.62.00.010.0	Precast RC Pile	156.00	EA
LPIL001	Piling Labor	234.00	HR
M31.62.00.010	Precast RC Pile - Materials	156.00	EA
0004	Pile Caps		
03.11.00.060.0	Erect Forms to CIP Concrete - Pile Cap	5,082.65	SF
03.21.00.060.0	Reinforcement Steel to - Pile Cap	32.80	TON
03.31.00.060.0	Casting Concrete in place to - Pile Cap	328.00	CY
0005	Basement Wall		
03.11.00.360.0	Erect Forms to CIP Concrete - Perimeter Basement Wall - Side 1	4,772.55	SF
03.11.00.362.0	Erect Forms to CIP Concrete - Perimeter Basement Wall - Side 2	4,772.55	SF
03.21.00.360.0	Reinforcement Steel to - CIP Perimeter Basement Wall	28.21	TON
03.31.00.360.0	Casting Concrete in place to - Perimeter Basement Wall	352.67	CY
0006	Columns		
03.11.00.520.0	Erect Forms to CIP Concrete - Column	44,061.69	SF
03.21.00.520.0	Reinforcement Steel to - CIP RC Column	127.73	TON
03.31.00.520.0	Casting Concrete in place to - Column	851.56	CY
0007	Beams		

fx [A1021_002_Precast RC Pile-ID.Count

Code	Description	Source Quant.	Consump.	Units
000	SUFFOLK CONSTRUCTION_8500 BURTON WAY...	1.0	1.0	
A1012_003	Pile Cap-ID	328.0	1.0	-
A1021_002	Precast RC Pile-ID	156.0	1.0	-
31.62.00.005.0	Layout Driven Piles	156.0	1.0	EA/EA
31.62.00.010.0	Precast RC Pile	156.0	1.0	EA/EA
31.62.00.011.0	Precast RC Pile - length	4,755.0	1.0	FT/FT
A1026_001	Mat-slab Foundation-ID	174.5	1.0	-
A1032_001	Structural Slab on Grade-ID	589.8	1.0	-
A2013_003	Lagging-ID	789.1	1.0	-
A2013_005	Soldier Piles-ID	100.0	1.0	-
A2021_007	Perimeter Basement Wall-ID	789.0	1.0	-
B1011_005	CIP RC Slab-ID	113,355.9	1.0	-
B1011_046	CIP RC Column-ID	5,906.0	1.0	-
B1011_069	CIP RC Beam-ID	1,610.3	1.0	-
B1014_001	CIP RC Ramp-ID	6,901.9	1.0	-
B1021_002	CIP RC Roof Slab-ID	4,010.4	1.0	-
B2011_020	Ext Plaster Stucco-ID	4,286.8	1.0	-
B2015_010	External Railing (Object)-ID	1,291.3	1.0	-
B2016_010	MWP Canopy Soffit-ID	1,374.5	1.0	-
B2021_020	External Window-ID	755.0	1.0	-
B2032_012	External Door-ID	4.0	1.0	-

Task Manager View

Cost Planner

3D View

Explore and Compare Versions

Vico Office - BUILDING EXTENSION

Cost Explorer

Range Settings Filter Selected

Cost Planner Cost Explorer & Cost Planner Cost Explorer & 3D Model Manager Cost Plan + 3D New ViewSet(1)

1 Project View Dashboard Define Settings Module Selector Define Targets

2 Viewers Edit Tags

3 Model Management Manage Models

4 Cost Planning Takeoff Model Manage Takeoff

5 Cost Planning Plan Cost Explore Cost

6 Reports Create Report

Cost Explorer 10/16/2...

Cost Comparison Range Settings

Too High More than 120 %

At Risk Between 100 % And 120 %

Within Budget Between 80 % And 100 %

Too Low Less than 80 %

Restore Defaults Save Cancel

#	Date	User	Comments
0	October 15, 2009	9...	All Current Version
Cost Versions			
7	October 16, 2009	1...	CliveJo... LOD100+PND200
6	October 16, 2009	1...	CliveJo... LOD100+UNIFORMAT II...
5	October 16, 2009	1...	CliveJo...
4	October 16, 2009	1...	CliveJo...
3	October 15, 2009	9...	CliveJo...
2	October 15, 2009	9...	CliveJo...
1	October 15, 2009	9...	CliveJo...
Target Versions			

CostUnit	Price	Variance	CostType	Markup	MarkupValue	BidPrice	AddOn
E...	210.00	13,553,886.36	-96,113.64	0.15 %	20,045.18	15,132,628.47	1,558,696.93
Description				Margin %	Margin		Value
				9.00 %	1,219,849.77	Divided	Divided
				2.50 %	338,847.16	Divided	Divided
S/...	19.00	1,237,215.45	-21,307.15	1.62 %	20,045.18	1,257,260.63	142,279.78
U...	9.97	528,826.53	80,490.16	3.00 %	15,864.80	544,691.32	60,815.05
	2,295.00	447,463.67	323,533.67	Self Perform	3.00 %	13,423.91	460,887.58
	1,400.00	254,789.37	0.00	Self Perform	3.00 %	7,643.68	262,433.06
	1.00	2,525.10	0.00	Self Perform	3.00 %	75.75	2,600.85
	145.00	184,722.30	0.00	Self Perform	3.00 %	5,541.67	190,263.97
	0.50	5,426.90	0.00	Self Perform	3.00 %	162.81	5,589.71
A1010_002	8.90	81,362.86	55,766.40	Self Perform	3.00 %	2,440.89	83,803.74
03.21.00.010	1,400.00	44,666.00	0.00	Self Perform	3.00 %	1,339.98	46,005.98
03.11.00.010	1.00	2,876.01	0.00	Self Perform	3.00 %	86.28	2,962.29
03.31.00.010	145.00	32,382.85	0.00	Self Perform	3.00 %	971.49	33,354.33

Cost Planner

Technology – Create Take Off Items (TOIs)

The screenshot displays the Vico Office - LAB BUILDING software interface. The main window is titled "Vico Office - LAB BUILDING" and shows a "Mini TOM & 3D View".

Takeoff Manager Sidebar:

- 1 Project**
 - View Dashboard
 - Define Settings
 - Select Module
- 2 Model Management**
 - Manage Models
- 3 Takeoff**
 - Takeoff Model
 - Manage Takeoff
- 4 Reports**
 - Create Report

Mini TOM & 3D View Table:

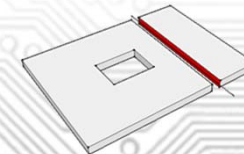
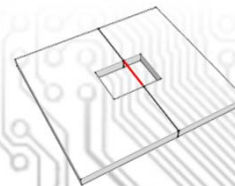
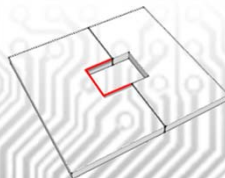
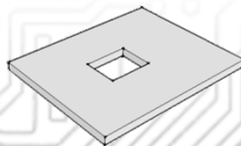
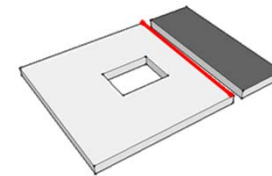
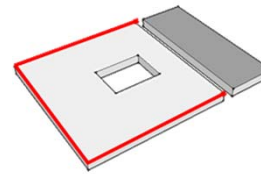
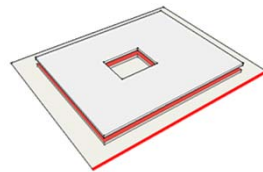
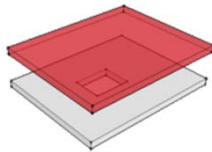
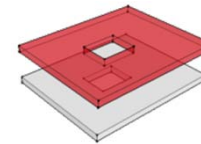
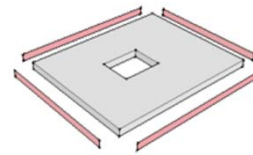
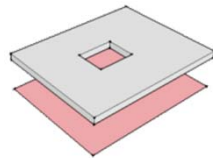
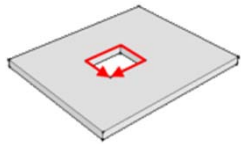
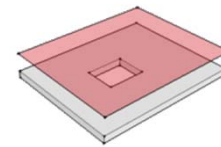
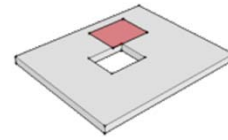
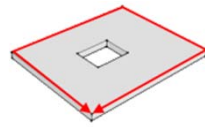
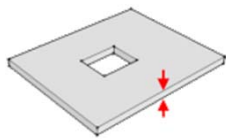
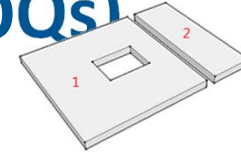
Code	Description	Unit	Type
	Quantity	Unit	Value
	3500 lbs		(0)
	45 Degree		(20)
	60 Degree		(3)
	600 CFM		(3)
	A1011_001_CIP Continuous Footing-ID		(88)
	Count	EA	88.00
	Length	FT-IN	856'-2 2...
	Reference Side Surface Area	SQ FT	1,621.40
	Opposite Reference Side Surface Area	SQ FT	1,509.40
	Top Surface Area	SQ FT	5,527.50
	Bottom Surface Area	SQ FT	5,527.50
	Ends Surface Area	SQ FT	1,520.37
	Reference Side Opening Surface Area	SQ FT	0.00
	Opposite Reference Side Opening Surface Area	SQ FT	0.00
	Net Volume	CU YD	540.09
	Gross Volume	CU YD	540.09
	A1011_002_CIP Stem Wall-ID		(4)
	A1012_001_CIP Pad Footing-F1		(5)
	A1012_001_CIP Pad Footing-F2		(11)
	A1012_001_CIP Pad Footing-F3		(6)
	A1012_001_CIP Pad Footing-F4		(1)
	A1012_001_CIP Pad Footing-F5		(12)
	A1012_001_CIP Pad Footing-F6		(2)
	A1012_001_CIP Pad Footing-ID		(0)
	A1021_002_Precast RC Pier-ID		(40)
	A1021_006_Drilled Pier-ID		(3)
	A1031_002_SoG Step-ID		(5)
	A1031_003_Thickened SoG-ID		(14)
	A1031_004_SoG Edge Thickening-ID		(37)
	A1032_001_Structural Slab on Grade-ID		(17)
	A1032_003_Structural Thickened SoG-ID		(64)
	A1034_001_Equipment Pad (lowest floor slab)-ID		(2)
	A1034_003_Pit Slab-ID		(5)
	A1034_004_Pit Wall-ID		(11)
	B1011_001_Slab on Deck-ID		(21)
	B1012_003_Reinforced Concrete Topping-ID		(1)
	B1012_004_Equipment Pad-ID		(33)
	B1012_015_Built-up Concrete Slab-ID		(8)
	B1012_025_CIP RC Wall-ID		(16)

3D View: A 3D model of the building structure is shown, with various components highlighted in yellow. The model includes a large central slab, several walls, and a series of stairs. The background is a blue sky with white clouds.

Right Panel: A list of building components with corresponding icons:

- Unknown
- Beam Profiled
- Beam Rectangular
- Column Profiled
- Column Rectangular
- Curtain Wall
- Curtain Wall Frame
- Curtain Wall Panel
- Door
- Light Fixture
- Duct Rectangular
- Duct Round
- Pipe and Conduit
- Equipment
- Object
- Roof
- Room
- Slab
- Stair
- Surface
- Wall
- Window

Technology - 'Create Construction Caliber' Take Off Quantities (TOQs)



Technology – Create Quantities (TOQs) / by Location

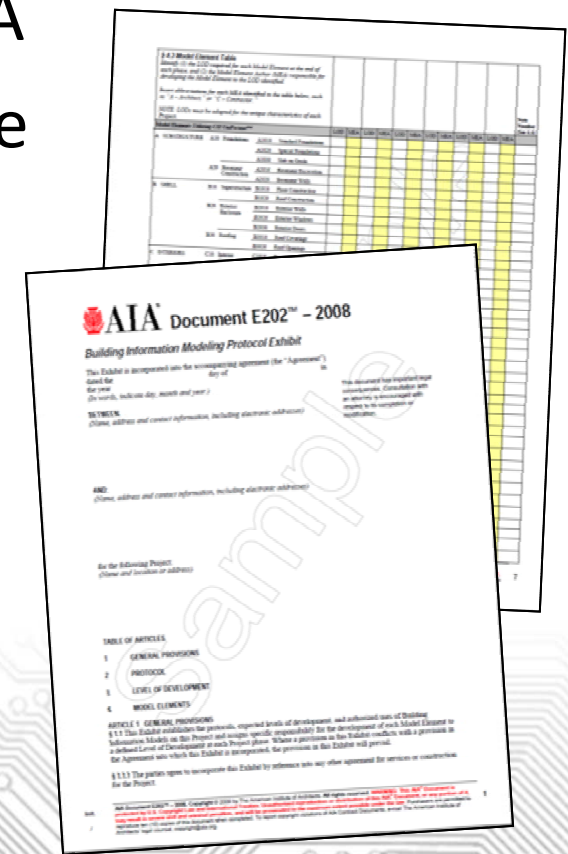
The screenshot displays the Vico Office Takeoff Manager software interface. The top menu bar includes 'Office Tools' and 'Takeoff Manager'. The 'Takeoff Manager' toolbar contains icons for 'New TOI', 'New TOQ', 'Add New Tag', 'Add Tag Value', 'Add Note', 'Restore Quantities', 'Delete Selected', 'Highlight Selected', 'Isolate Selected', 'Unselected Translucent', 'Show Tag Colors', and 'Default Mode'. The left sidebar shows a 'Cost Planner' with sections for 'Project', 'Content', 'Model Management', 'Takeoff', 'Cost Planning', and 'Reports'. The main window displays a table of quantities for three different pile types: 'Pile Cap-Type A-26'-0"x17'-0"x72"', 'Pile Cap-Type C-12'-0"x12'-0"x72"', and 'Pile-Concrete-24" Diameter x 60''. The table columns include 'Quantity', 'Unit', 'Project', 'Foundations', and six zones (Zone 1 to Zone 6). The data is organized into rows for various surface areas, perimeters, volumes, and counts.

Quantity	Unit	Project	Foundations	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Pile Cap-Type A-26'-0"x17'-0"x72"									
Bottom Surface Area	square f...	3978.00	3978.00	0.00	442.00	1768.00	1768.00	0.00	0.00
Hole Surface Area	square f...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Edge Surface Area	square f...	4646.66	4646.66	0.00	518.77	2063.89	2064.00	0.00	0.00
Top Surface Area	square f...	3978.00	3978.00	0.00	442.00	1768.00	1768.00	0.00	0.00
Edge Perimeter	feet and...	774'-5 21/64"	774'-5 21/64"	0'	86'-5 17/32"	343'-11 25...	344'	0'	0'
Hole Perimeter	feet and...	0'	0'	0'	0'	0'	0'	0'	0'
Gross Volume	cubic yard	884.00	884.00	0.00	98.22	392.89	392.89	0.00	0.00
Net Volume	cubic yard	884.00	884.00	0.00	98.22	392.89	392.89	0.00	0.00
Hole Count	count	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Count	count	10.00	10.00	0.00	2.00	4.00	4.00	0.00	0.00
Pile Cap-Type C-12'-0"x12'-0"x72"									
Bottom Surface Area	square f...	1210.00	1210.00	242.00	242.00	121.00	605.00	0.00	0.00
Hole Surface Area	square f...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Edge Surface Area	square f...	2640.00	2640.00	528.00	528.00	264.00	1320.00	0.00	0.00
Top Surface Area	square f...	1210.00	1210.00	242.00	242.00	121.00	605.00	0.00	0.00
Edge Perimeter	feet and...	440'	440'	88'	88'	44'	220'	0'	0'
Hole Perimeter	feet and...	0'	0'	0'	0'	0'	0'	0'	0'
Gross Volume	cubic yard	268.89	268.89	53.78	53.78	26.89	134.44	0.00	0.00
Net Volume	cubic yard	268.89	268.89	53.78	53.78	26.89	134.44	0.00	0.00
Hole Count	count	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Count	count	10.00	10.00	2.00	2.00	1.00	5.00	0.00	0.00
Pile-Concrete-24" Diameter x 60'									
Top Surface Area	square f...	1410.89	1410.89	143.59	121.74	262.20	524.40	62.43	296.54
Vertical Surface Area	square f...	170126.40	170126.40	17313.74	14679.04	31616.43	63232.82	7527.72	35756.66
Hole Surface Area	square f...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bottom Surface Area	square f...	1410.89	1410.89	143.59	121.74	262.20	524.40	62.43	296.54
Height	feet and...	27120'1/64"	27120'1/64"	2760'	2340'	5040'	10080'	1200'	5700'
Gross Volume	cubic yard	3135.32	3135.32	319.08	270.53	582.67	1165.34	138.73	658.97
Net Volume	cubic yard	3135.32	3135.32	319.08	270.53	582.67	1165.34	138.73	658.97

MPS: A Brief History

- Model Progression Specification – written by Vico and Webcor
- MPS => E202 Incorporated by AIA
- MPS 2.0 => Custom Project Usage
- MPS 3.0 => Prepared Datasets for modeling, cost, and schedule

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Site Preparation	100	100	100	200	200
Sub Structure	100	200	200	300	400
Superstructure	100	100	200	200	300
Exterior Enclosure	100	100	200	200	200
Interior Build Out	100	100	150	100	200
MEP Systems	100	100	100	100	200
Site Improvements	100	100	100	100	200
Logistics	100	100	200	200	200



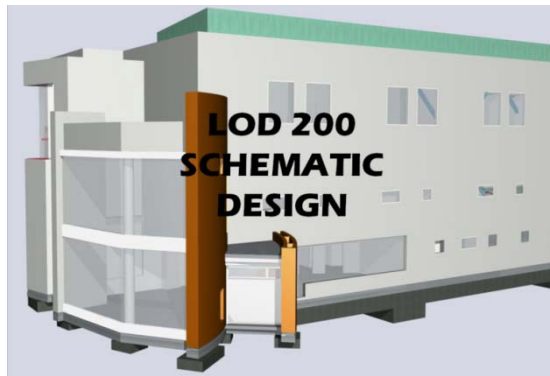
MPS usage:

Evolutionary Estimating Using Various Levels Of Detail (LOD)

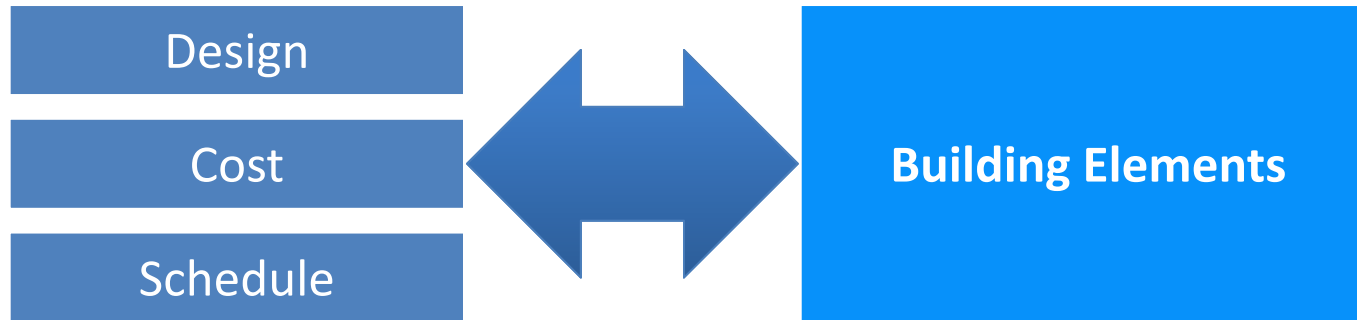


Key Points

1. Planning in advance with entire team makes this easier
2. LOD's can be mixed
3. Rich datasets can automate much of the estimating and scheduling when using a model



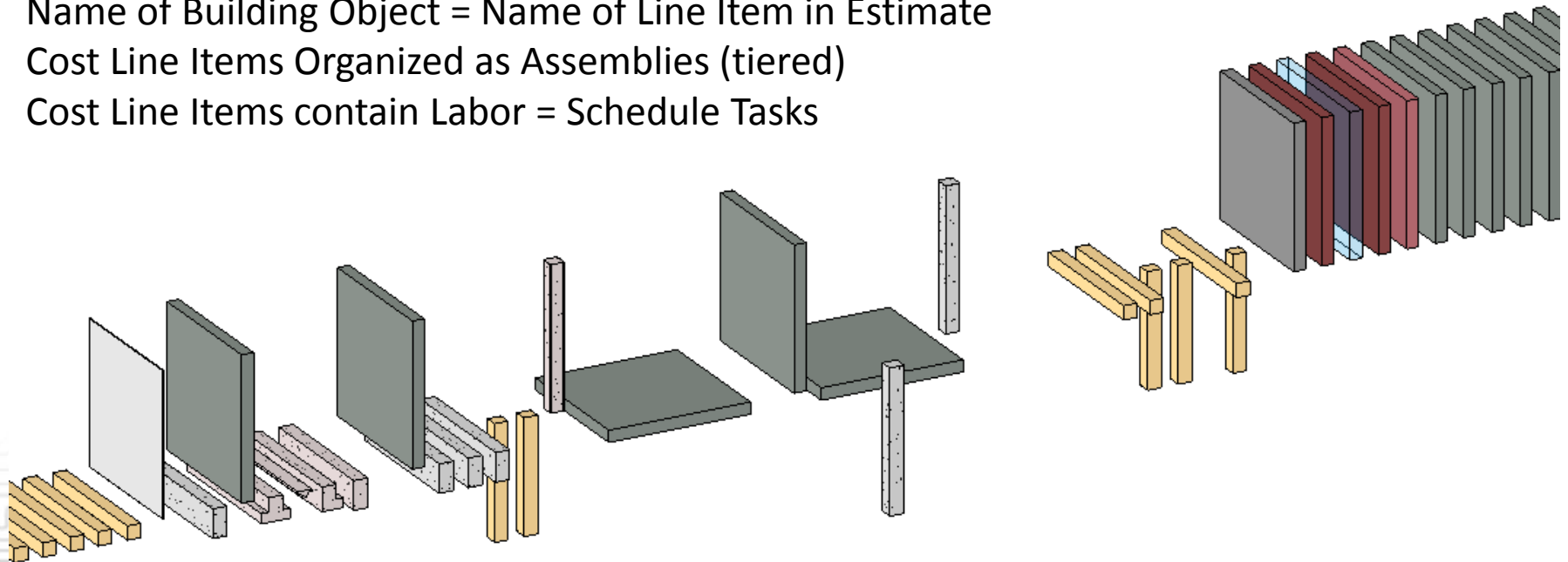
MPS 3.0 - Goal: Tool Kit for Project Teams



Name of Building Object = Name of Line Item in Estimate

Cost Line Items Organized as Assemblies (tiered)

Cost Line Items contain Labor = Schedule Tasks



MPS 3.0 – Aspects, Classes, and LOD's

ASPECTS AND CLASSES			MPS MATRIX			
ASPECTS	CLASSES	DESCRIPTION	TARGET LOD	ASPECTS		
MODEL 'M'	M0	No Model		M	E	S
	M1	Building/Spatial/Room Massing	000	M0	E1	S1
	M2	Building elements with approximate dimensions (SD)	050	M0	E2	S2
	M3	Building elements with design dimensions (DD)	100	M1	E2	S2
	M4	Construction Model (CD)	200	M2	E3	S3
	M5	Fabrication / Virtual Mockup	300	M3	E3	S3
	M6	As Built	400	M4	E4	S3
COST 'E'	E1	Division Level Ranges	450	M4	E5	S4
	E2	Massing Driven Ratios & Ranges	500	M5	E5	S4
	E3	Element Driven - Assumption Based - Resource Level & Ranges	550	M5	E5	S5
	E4	Element Driven - Specification Based - Resource Level	600	M6	E6	S6
	E5	Element Driven - Subcontractor Based - Resource Level				
	E6	Actual Cost				
TIME 'S'	S1	Milestone Schedule				
	S2	Element Based – average production rates				
	S3	Phase Schedule – activity based using resource hour estimates				
	S4	Phase Schedule – subcontractor production commitments				
	S5	Weekly Workplans				
	S6	Actual Progressed Schedule				

Design

Cost

Schedule

An Example of a tiered cost plan

fx B1012_025_CIP RC Wall-ID.Net Reference Side Surface Area							
	Code	Description	Source Quantity	Consump..	Quantity	Unit	Ur
	+	B1012_016 Raised Concrete Floor-ID	0.0	1.000	0.0	SF	
	+	B1012_017 Concrete Plenum Slab-ID	0.0	1.000	0.0	SF	
	+	B1012_019 Steel Joist Floor Structure-ID	0.0	1.000	0.0	SF	
	+	B1012_020 Steel Frame Access Floor-ID	0.0	1.000	0.0	SF	
	+	B1012_021 Wood Joist Floor Structure-ID	0.0	1.000	0.0	SF	
	+	B1012_022 Wood Frame Access Floor-ID	0.0	1.000	0.0	SF	
	+	B1012_024 CIP RC Shear Wall-ID	0.0	1.000	0.0	SF	
	-	B1012_025 CIP RC Wall-ID	0.0	1.000	0.0	SF	
	-	03.11.00.460.0 Erect Forms to CIP Concrete - Wall	0.0	1.000	0.0	SF	
		LCON003 Formwork Carpenter	0.0	0.150	0.0	HR	
		M03.11.00.460 Erect Forms - Wall - Materials	0.0	1.000	0.0	SF	
	-	03.11.00.461.0 Strip Forms to CIP Concrete - Wall	0.0	1.000	0.0	SF	
		LCON003 Formwork Carpenter	0.0	0.023	0.0	HR	
		M03.11.00.461 Strip Forms - Wall - Materials	0.0	1.000	0.0	SF	
	-	03.21.00.460.0 Reinforcement Steel to - CIP RC Wall	0.0	0.085	0.0	TON	
		LCON004 Rodman	0.0	16.000	0.0	HR	
		M03.21.00.460 Re Steel - CIP RC Wall - Materials	0.0	1.000	0.0	TON	
	-	03.31.00.460.0 Casting Concrete in place to - Wall	0.0	1.000	0.0	CY	
		LCON001 Concrete Pourer	0.0	0.750	0.0	HR	
		M03.31.00.460 Concrete - Wall - Materials	0.0	1.000	0.0	CY	
	-	03.35.00.460.0 Concrete finishing to - CIP RC Wall	0.0	1.000	0.0	SF	
		LCON001 Concrete Pourer	0.0	0.005	0.0	HR	
		M03.35.00.460 Finishing to - CIP RC Wall - Materials	0.0	1.000	0.0	SF	
	+	B1012_026 CIP RC Elevator Core Wall-ID	0.0	1.000	0.0	SF	
	+	B1012_027 CIP RC Stair Core Wall-ID	0.0	1.000	0.0	SF	
	+	B1012_028 CIP RC Shaft Wall-ID	0.0	1.000	0.0	SF	
	+	B1012_029 CIP RC Upstand Wall-ID	0.0	1.000	0.0	SF	

Easily show cost variance between design alternatives

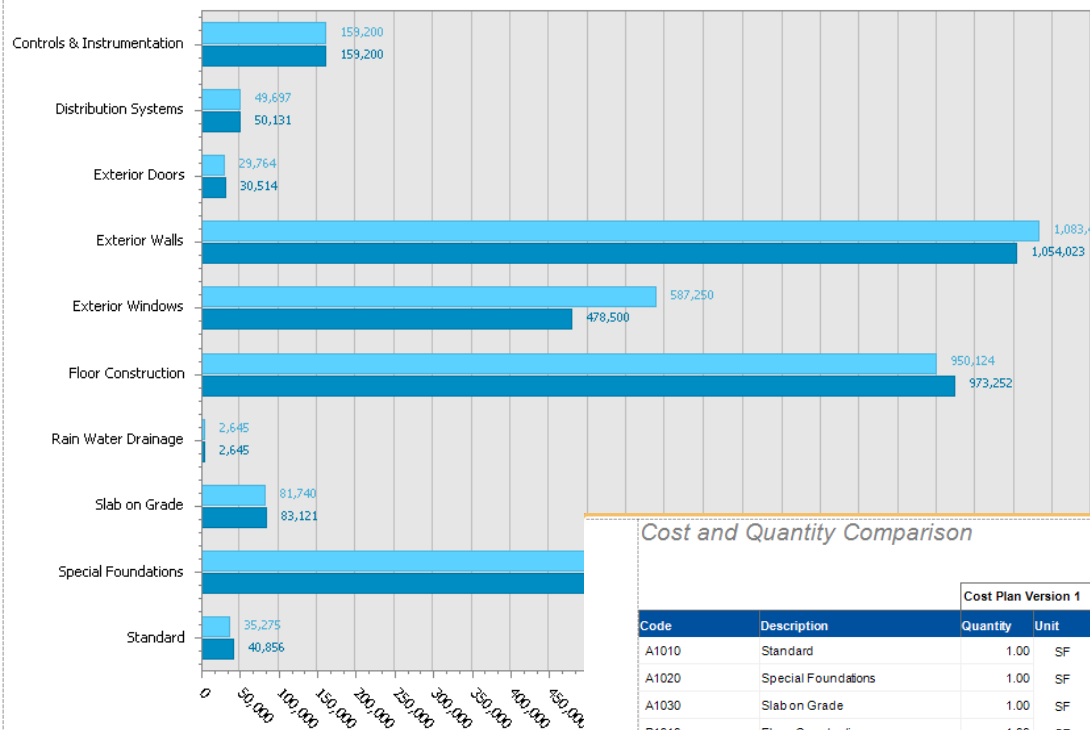
Cost Plan Variance Report

Quantity and cost comparison between version 1 and version 2 of the project cost plan.

Version 1: 4_Cost Plan v04

Version 2: 0_Current Version

Graphical Cost Comparison



Cost and Quantity Comparison

Code	Description	Cost Plan Version 1			Cost Plan Version 2			Variance	
		Quantity	Unit	Price	Quantity	Unit	Price	Quantity	Unit
A1010	Standard	1.00	SF	40,855.90	11,999.17	SF	35,275.16	11,998.17	-
A1020	Special Foundations	1.00	SF	495,600.03	11,999.17	SF	495,600.03	11,998.17	-
A1030	Slab on Grade	1.00	SF	83,121.41	11,999.17	SF	81,739.80	11,998.17	-
B1010	Floor Construction	1.00	SF	973,251.67	35,970.00	SF	950,123.62	35,969.00	-
B2010	Exterior Walls	1.00	-	1,054,022.80	1.00	-	1,083,451.61	0.00	-
B2020	Exterior Windows	1.00	-	478,500.00	1.00	-	587,250.00	0.00	-
B2030	Exterior Doors	1.00	-	30,514.35	1.00	-	29,764.35	0.00	-
D2040	Rain Water Drainage	1.00	-	2,645.29	47,969.17	-	2,645.29	47,968.17	-
D3040	Distribution Systems	1.00	-	50,130.71	47,969.17	-	49,696.71	47,968.17	-
D3060	Controls & Instrumentation	1.00	-	159,200.00	47,969.17	-	159,200.00	47,968.17	-

5D BIM: Design Costs Analysis

Speakers



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Beck Technology



Kenneth A. Roberts, PMP, CCC

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David Scheer, AIA

Moderator

5D BIM: Design Costs Analysis

Thank you for joining us.

This concludes the AIA/CES Course #T12009.

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