
S500 BIM Best Practices: Case Studies

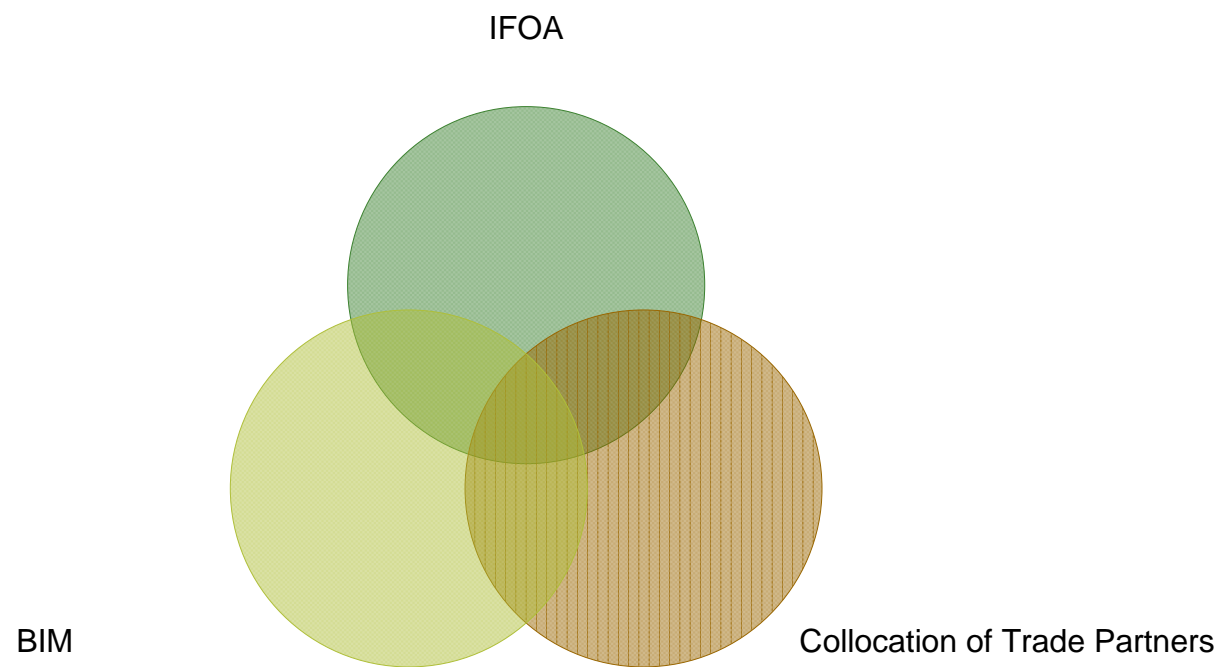
Ecobuild America and AEC-ST Conference
May 22, 2008 Anaheim, CA

Presentation Topics

- Cathedral Hill Hospital Project
- Integrated Form of agreement (IFOA)
- Design Assist Approach
- Project Tools
- Software Tools Used
- Group Training
- Prefab
- Delivery Staging
- Experimentation with BIM

Cathedral Hill Hospital

- New Hospital to be constructed in San Francisco
- Proposed Building Statistics
 - ❑ 865,000 sf
 - ❑ 17 Stories
 - ❑ 555 beds
 - ❑ 24 Labor, Delivery and Rooms
 - ❑ 19 ORs
 - ❑ 34 ER Treatment Rooms



Integrated Form of Agreement

- One agreement signed by OAC
- No separate general conditions
- Provides formation of team elements
 - Core teams
 - Core group for Project
 - Core group for BIM
- Integrated Project Delivery Team (IPDT)
- Senior Management Team
- Incentive Sharing Plan

Design Assist Approach

- Prequalify the subcontractors
 - Do they have VDC capabilities
- Engage the subcontractors on the project early
 - Constructability Review During Design
- Collocation work environment

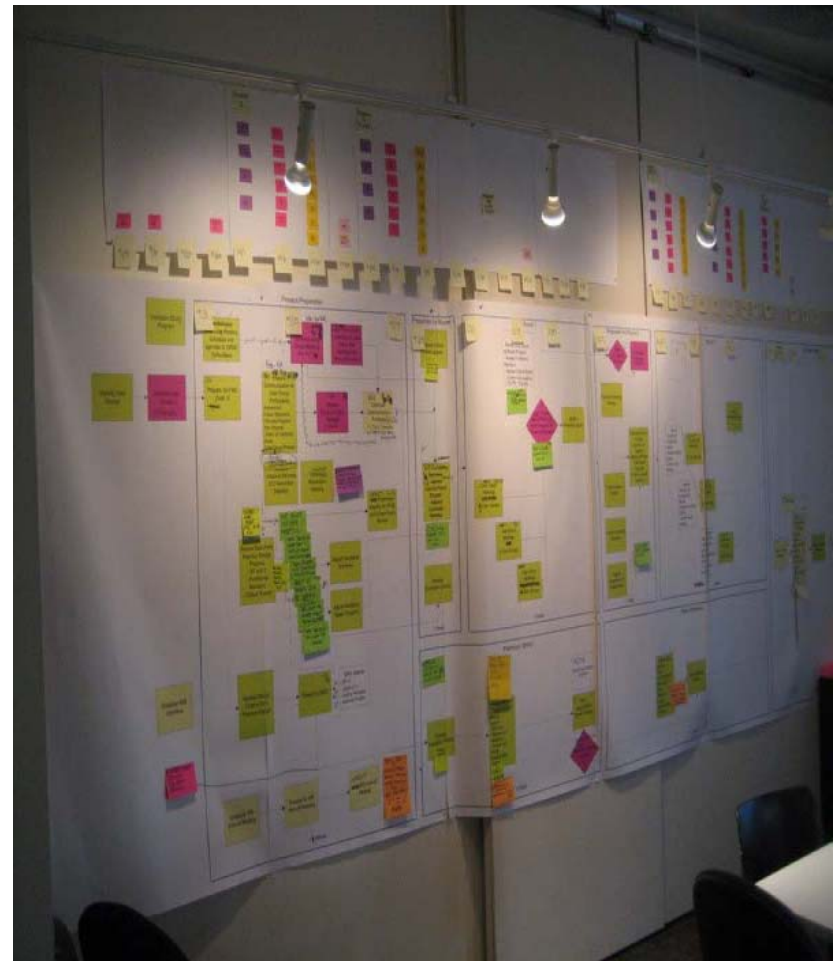
Project Tools

Value Stream Mapping
Last Planner System® (LPS)

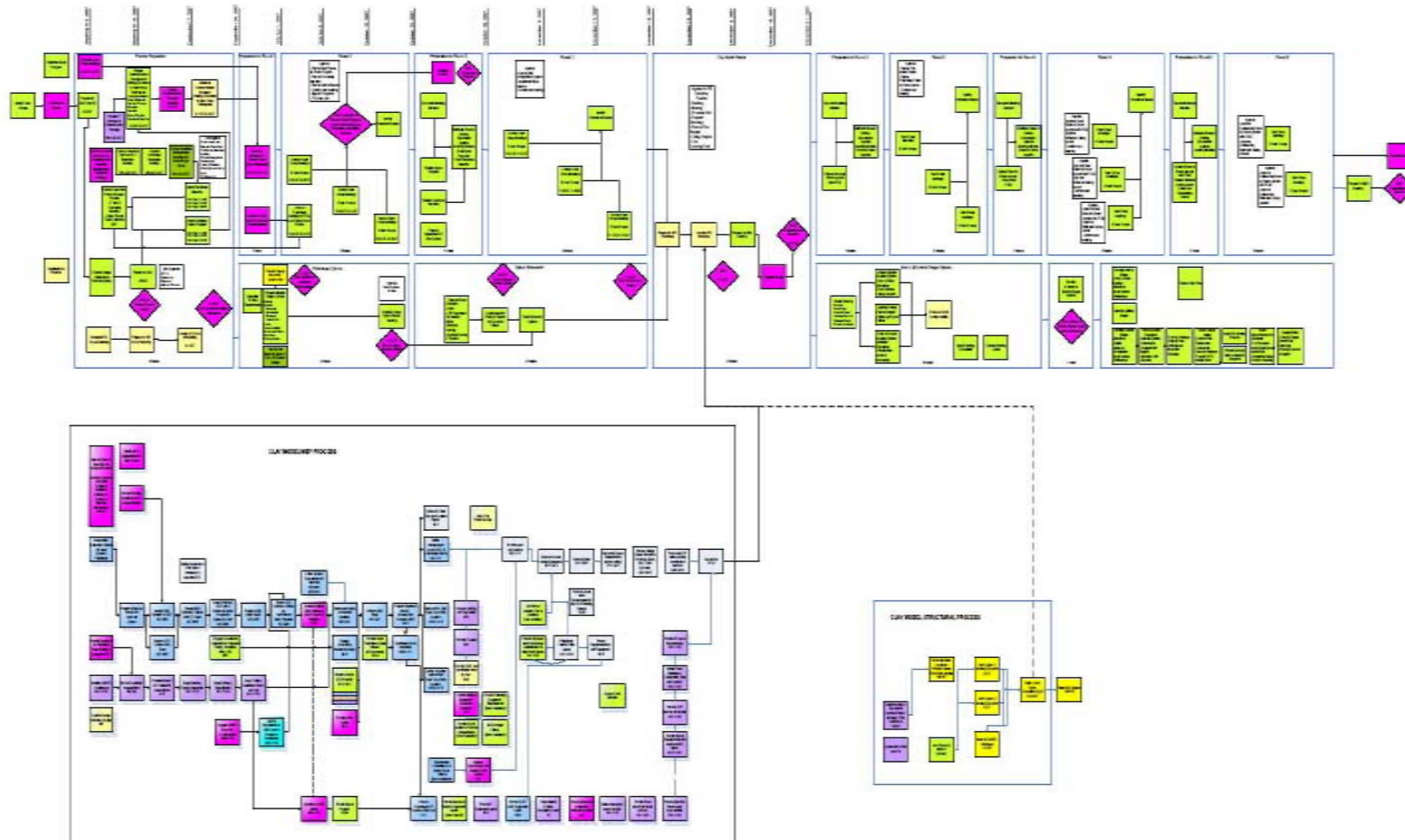
Value Stream Mapping

- It is a Lean technique used to analyze the flow of materials and information currently required to bring a product or service to a consumer.
- Used to identify opportunities for improvement in lead time.
- Capture Current State or Traditional method.
- Create Future State with Emphasis on Removing Waste.

Mapping Sessions



Electronic Capture of VSM



Last Planner System®

- PPC Tracking of Reliable Promises
- Plus / Delta Practice
- Share Learning Across the Project
- One week of work at a time
- Done in a collaborative meeting

Weekly Work Plan Page 1

Integrated Project Delivery Team

Weekly Work Plan

CPMC - Cathedral Hill Hospital

Cathedral Hill Hospital 02-21-2008 WWP															
Integrated Project Delivery Team California Pacific Medical Center Cathedral Hill Hospital Preconstruction The last WWP PPC was 74%. The most common Variance is Incorrect Time Estimate				CATEGORIES OF VARIANCE							TOTAL ACTIVITIES			0	
				1	Contracts / Revisions			9	Incorrect Time Estimate			ACTIVITIES COMPLETED			0
				2	Prior Work Not Complete			10	Off Project Demands			PERCENT			N/A
				3	Information Not Available			11	Unforeseen Conditions			PLANNED COMPLETE:			
				4	Poor Task Description			12	Other Project Demands			As Planned			
				5	Staff Not Available			13	I Forgot			Repeat			
				6	Materials Not Available			14				Repeat More than Once			
				7	Conditions of Satisfaction			15				Released at Risk			abcde
				8	Task Sequence Change			16							
SCHEDULE ID NUMBER	REPEAT	ASSIGNMENT DESCRIPTION Criteria for release of assignments Defined - Sound - Proper Sequence - Right Size - Able to Learn	RESPONSIBLE PARTY	STARTING ON			21-Feb-08				PPC ANALYSIS				
				Thu	Fri	Sat	Mon	Tue	Wed	DONE ?					
				21-Feb	22-Feb	23-Feb	24-Feb	25-Feb	26-Feb	27-Feb	YES	NO	Category	REASONS FOR VARIANCE	
Sutter Health / California Pacific Medical Center															
	X	Schedule Meeting with Navigant for Week of Feb 25 (request from SG Planning Team)	Merv D	X											
	X	Follow-up with Carl G on 3rd Party Plan Reviewer Meeting Date	Merv D	X											
		Verify Approval to Distribute Presentation Material to City Planning	Merv D	X	X			X	X	X					
		Request Verification of 96 hr JAHCO Requirement for Emergency Power (vs 72 hrs)	Merv D	X				X	X	X					
		Confirmation that Design Deliverables List Meets Sutter's Expectations to Arlee M	Merv D	X	X			X	X	X					
Degenkolb															
Herrick															
		Put together a ROM for reinforced column wrap	Bob H	X	X			X	X						
		Update the cost model	Bob H		X										
HerreroBoldt															
002574		Submit Draft Construction Data to Marchese	Andy S		X										
		Upload Current Master Schedule to Collaboration Site	Baris L	X											
	X	Create Base Isolation A3 to Core Group	Baris L	X	X										
217105		Issue the PO for DIS prototype testing	Baris L	X	X			X	X						
112400		Interviews for shoring D/B scope	Baris L		X										
581300		Review Drywall Proposals and Schedule Final Interviews	Paul K	X	X			X	X	X					
		Finalize RLWP through May 12, 2008 to CPMC	Paul R	X	X			X	X	X					
322700		Draft RFP for Metal Panel Contractor	Rob P	X	X			X	X	X					
Marchese															
		Provide Update on Access to DBC for SG Acoustic Study	Bob P						X						
Pankow															
		Put together a ROM for reinforced column wrap	Andy B	X	X			X	X						
	X	Provide Schedule Input to Hakan	Lonnie A	X	X			X	X	X					
	X	Confirm Paul K Escalation Spread	Lonnie A						X						
Rosendin Electric Inc															
		Prepare for MEP Focus at TVD Meeting (lighting)	Bob W	X	X			X	X						
		Complete Electrical Portion of Chiller A3	Bob W	X											
Silverman and Light															

Weekly Work Plan Page 2

Integrated Project Delivery Team

Weekly Work Plan

CPMC - Cathedral Hill Hospital

411600	Provide Additional Detail for OSHPD Phased Submittal to Arlee M	Mike G	X	X			X	X	X										
SmithGroup																			
X	Send Scope of Work to SGH to Prepare Proposal	Arlee M	X																
	Finalize RLWP through May 12, 2008 to CPMC	Janette N	X	X			X	X	X										
X	Schedule Turnover of Typical Rooms to MEP	Matt D	X	X			X	X	X										
X	Send Scott Muxen List of lessons learned to be published to the group.	Matt D	X	X															
Southland Industries																			
	Prepare for MEP Focus at TVD Meeting	Mike N	X	X			X	X											
	Complete AHU Manufacturer Interviews	Mike N	X	X			X	X											
Ted Jacob Engineering Group																			
	Confirm layout of P4 tanks and access to inside of tanks for SG	Shulamit R	X	X			X												
411600	Provide Additional Detail for OSHPD Phased Submittal to Arlee M	Shulamit R	X	X			X	X	X										
	Coordinate with Mechanical/Plumbing and Drop Steel at Courtyard	Shulamit R						X											
Integrated Project Delivery Team																			
Core Group																			

Weekly Work Plan Page 3

Integrated Project Delivery Team

Weekly Work Plan

CPMC - Cathedral Hill Hospital

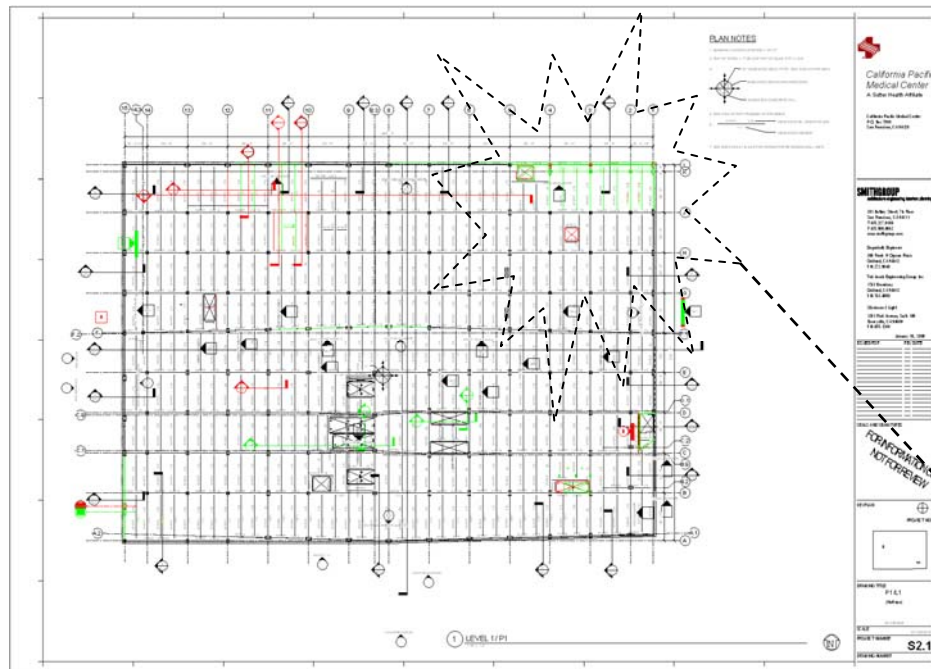
Workable Backlog										
		DESCRIPTION	RESPONSIBLE PARTY	STARTING ON						PPC ANALYSIS
				Mon	Tue	Wed	Thu	Fri	Sat	
				21-Feb	22-Feb	23-Feb	24-Feb	25-Feb	26-Feb	
		Schedule Meeting with SF Fire Marshal	Arlee M							DONE? YES NO Category
		Present on the Function/Interaction of the Core Group at Next Last Planner	David L							
		Prepare Overview of TVD Plan to Tuesday TVD Meeting	John K							REASON'S FOR VARIANCE
		Provide Commissioning Plan Update to Core Group	John K							
		Provide FPD Document Check in to Arlee M	Merv D							
		Follow-up to Expedite Payment Process	Paul R							
		A3 for Aluminum Cable	Paul R							
		Propose to IPDT how Escalation Adjustments will be Handled	Paul R							
		Prepare Subcontract Joining Process with Legal Council	Rob P							
		Scott to provide update on Autodesk proposal engagement timeline	Scott M							
		Provide Utility Rates (water, gas, electric) based on current CPMC utility usage	Tony B							

Meeting Parking Lot		
	DESCRIPTION	ORIGINATOR
	Tunnel construction, which project is it in (Hospital or MOB)?	Chuck K

Software Tools Used

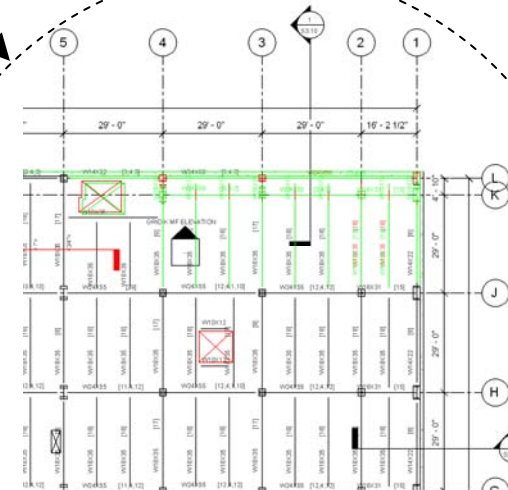
- Revit
 - Architectural
 - Structural
- AutoCAD
 - Third Party
- NavisWorks
- Innovaya
- TimberLine Estimating
- Desktop Take Off
- Primavera P6
- Free Software
 - Autodesk Design review
 - NavisWorks Freedom Viewer

Sample of Design Review Usage



Wall Material Takeoff					
Family and Type	Description	Width	Material: Area	Material: Volume	Count
Basic Wall: 10" Damper	VISCOUS WALL DAMPER	0' - 10"	12982 SF 13353 SF	10819.34 CF 1302.71 CF	172
Basic Wall: 12" Concrete	CONCRETE SHEAR WALL	1' - 0"	2185 SF	2156.06 CF	11
Basic Wall: Exterior - 6" Concrete	STEP FOR LOWERED DECK	0' - 6"	756 SF 756 SF	361.02 CF 352.50 CF	15
Basic Wall: Retaining - 12" Concrete	CONCRETE RETAINING WALL	1' - 0"	15240 SF 14828 SF	15214.83 CF 13502.57 CF	17
Basic Wall: Retaining - 16" Concrete	CONCRETE RETAINING WALL	1' - 4"	22324 SF 22191 SF	29763.61 CF 28763.53 CF	4
Basic Wall: Retaining - 18" Concrete	CONCRETE RETAINING WALL	1' - 6"	27219 SF	40828.12 CF	2

Grand total: 224
80705 SF
99141.97 CF

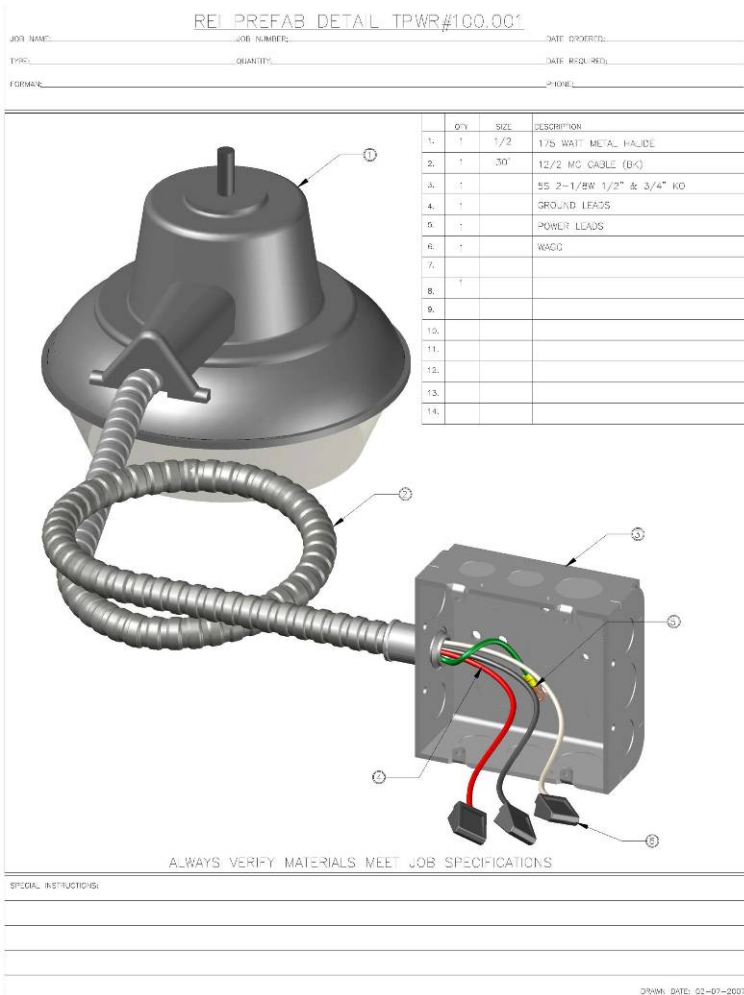


Group Training

- Software Training with Multiple Companies
 - Split cost
 - Fill class
- Class for Project Managers
- Train the Trainers
- What we have done so far

Using the Model for Prefabrication

Production Planning
CNC Part Cutting
Fabrication of Assemblies
Staging Delivery to Field



 Southland Industries <i>Design • Build • Maintain</i>		Job Name: _____		Date Due on Job: _____		Download Number: _____				Square to Round Pattern #0 Color: Brown Building Level: 1st FLOOR Building Area: _____ SE			
		Camino Medical Group		AM		001							
		Job Number: 0616373		Detailer Name: Jerry Shephard		Field Foreman Name: Jim Burrows							
		Sheet Number: _____		Detailer Phone Number: 590-0202		Foreman Phone Number: 408-210-1208							
770 Commercial Street Red Lake, CA 96112 (916) 468-0700/3777 (F) 1 402 970-3776		Shop Instructions: Order loose DMWard from shop		Shipping Instructions: Ship with factory fields.		Clean and Bag Level: None		Exposed: _____		Weld: _____		Seal: _____	

Qty	Mat.	Ga.	Spec	Wt@D	Dia	S1	S2	C1	C2	Length	O	TU	Seam	Insp	Stiffener	Notes	Tag #
1	GALV	26	+2" Round (M213in diag)	15x15	16	0.75	3	S&D	Col-SE	12	0	4	Stch-Wld	-			14
1	GALV	26	+1" 2" Rect. (M213in diag)	12x8	6	0.75	3	S&D	Col-SE	12	-3	-1	Stch-Wld	-			16
2	GALV	26	+1" 2" Rect. (M213in diag)	20x17.5	18	0.75	3	S&D	Col-SE	12	-1	0.3	Stch-Wld	-			19
1	GALV	24	+1" 4" Rect. (M213in diag)	12x8	8	0.75	3	S&D	Col-SE	22	-2	6	Stch-Wld	-			21
1	GALV	26	Not Set	14x12.5	14	0.75	3	S&D	None	12	0	0.7	Stch-Wld	-			23
1	GALV	26	+1" 2" Rect. (M213in diag)	20x12	18	1.5	3	Ward	Col-SE	36	2	11.5	Stch-Wld	-			26
1	GALV	26	+1" 2" Rect. (M213in diag)	12x10	12	0.75	3	S&D	Col-SE	12	0	1	Stch-Wld	-			27
1	GALV	26	+1" 2" Rect. (M213in diag)	20x17.5	18	0.75	3	S&D	Col-PS	12	-1	0.3	Stch-Wld	-			27
1	GALV	26	+1" 2" Rect. (M213in diag)	14x12.5	14	1.5	3	S&D	Col-SE	12	0	0.7	Stch-Wld	-			30
1	GALV	26	+1" 2" Rect. (M213in diag)	16x15	16	1	3	S&D	Col-SE	12	0	0.5	Stch-Wld	-			31

Q. C. in Shop By: _____	Date: _____	Loaded By: _____	Date: _____	Received at Job Site By: _____	Date: _____
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Prefabrication Sheets Directly from the 3d Model.

Above: Sheet Metal for CNC Cutting
Left: Electrical Prefabrication

Model Used for Automatic Part Creation

Today's current practice uses CNC control for automatic cutting of part



Upper: Structural steel cutter.

Lower: Sheet metal cut from a plasma cutter.

Model Used for Prefabricated Assembly of Parts

Use of cut sheets to assemble parts



Above: Electrical fab
Upper right: Structural steel fab.
Lower right: Sheet metal fab.



Using the Model to Stage Deliveries to Project



VDC Glossary

- 3d: Computer graphics that use 3 dimensional representation of an object having length, width and height.
- ADT: is a version of Autodesk's flagship product, AutoCAD, with tools and functions specially suited to architectural work. The product line was renamed to AutoCAD Architecture in 2008.
- AEC: Architecture, Engineering and Construction
- AIA: American Institute of Architects
- AutoCAD: AutoCAD is a CAD software application for 2D and 3D design and drafting, developed and sold by Autodesk, Inc.
- BIM: Stands for both Building Information Model and Building Information Modeling. It is the process of generating and managing a building information model throughout the life cycle of a building.
- BuildingSMARTalliance: Formerly IAI. To create a format for open interoperability and full lifecycle implementation of building information models.
- CAD: Computer Aided Drafting
- CADD: Computer Aided Design and Drafting
- GSA: General Services Administration. An independent agency of the United States government, established in 1949 to help manage and support the basic functioning of federal agencies. The GSA supplies products and communications for U.S. government offices, provides transportation and office space to federal employees, and develops government wide cost-minimizing policies, among other management tasks.
- IAI: International Alliance for Interoperability.
- IFC: Industry Foundation Classes. Data model that is a neutral and open specification that is not controlled by a singular vendor or group of vendors. It is an object oriented file format with a data model developed by the International Alliance for Interoperability (IAI) to facilitate interoperability in the building industry, and is a commonly used format for Building Information Modeling.
- IFOA: Integrated Form of Agreement Master Contract Agreement used on Sutter Health Projects signed by OAC.
- Integrated Practice or Integrated Project Delivery: Leveraging intellectual and physical resources using the best available tools to produce the highest quality product. It requires everyone on the team to share their knowledge with one another.
- LCI: Lean Construction Institute. Visit www.leanconstruction.org.
- LPS: Last Planner System®. System introduced by LCI to create and improve predictability of workflow on a project.

VDC Glossary

- Level of Detail: The amount of data carried with in the modeled object.
- MEP: Mechanical, Electrical and Plumbing
- MEP-FP: Mechanical, Electrical, Plumbing and Fire Protection
- Navis: NavisWorks JetStream is a 3D design review package for Microsoft Windows currently developed by Autodesk. JetStream allows users to open and combine 3D models, navigate around them in real-time and review the model using a set of tools including comments, redlining, viewpoint, and measurements. A selection of plug-ins enhances the package adding interference detection, 4D time simulation, photorealistic rendering and PDF-like publishing.
- NCS: National CAD Standards. Standards for CAD drawn files.
- NBIMS: The National Building Information Model Standard project
- *nD*: Beyond 3d.
- NIBS: National Institute for Building Sciences
- NIST: National Institute of Standards and Technology
- OCA: Office of Chief Architect
- PBS: Public Buildings Service
- Revit: Autodesk Revit is architectural BIM software for Microsoft Windows, currently developed by Autodesk, which allows the user to design with parametric modeling and drafting elements. BIM is a new CAD paradigm that allows for intelligent, 3D and parametric object-based design. In this way, Revit provides full bi-directional association. A change anywhere is a change everywhere, instantly, with no user interaction to manually update any view.
- VBE: Virtual Building Environment. See VDC, same as.
- VBR: Virtual Builders Roundtable. A group of construction practitioners that are committed to the development of virtual building process and technology within the construction environment.
- VDC: Virtual Design and Construction. The use of integrated multi-disciplinary performance models of design-construction projects, including the Product (i.e., facilities), Work Processes and Organization of the design - construction - operation team in order to support explicit and public business objectives. "VDC models are virtual because they show computer-based descriptions of the project." (Kunz & Fischer 2007)
- Virtual Building: See VDC, same as.

Questions