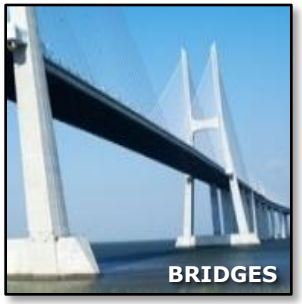
ConstructSim

Bentley®
Sustaining Infrastructure

Solutions


BRIDGES

BUILDINGS

CADASTRE AND LAND DEVELOPMENT

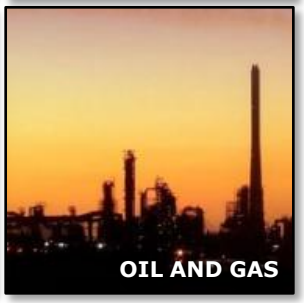
CAMPUSES

COMMUNICATIONS

ELECTRIC AND GAS UTILITIES

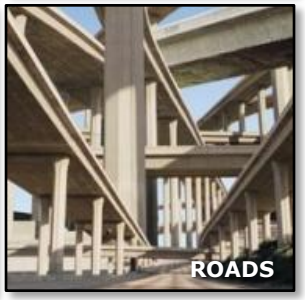
FACTORIES

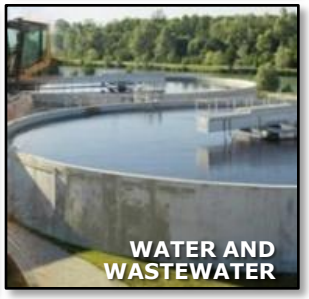
METALS AND MINING


OIL AND GAS

POWER GENERATION

RAIL AND TRANSIT


ROADS


WATER AND WASTEWATER

Introducing ConstructSim

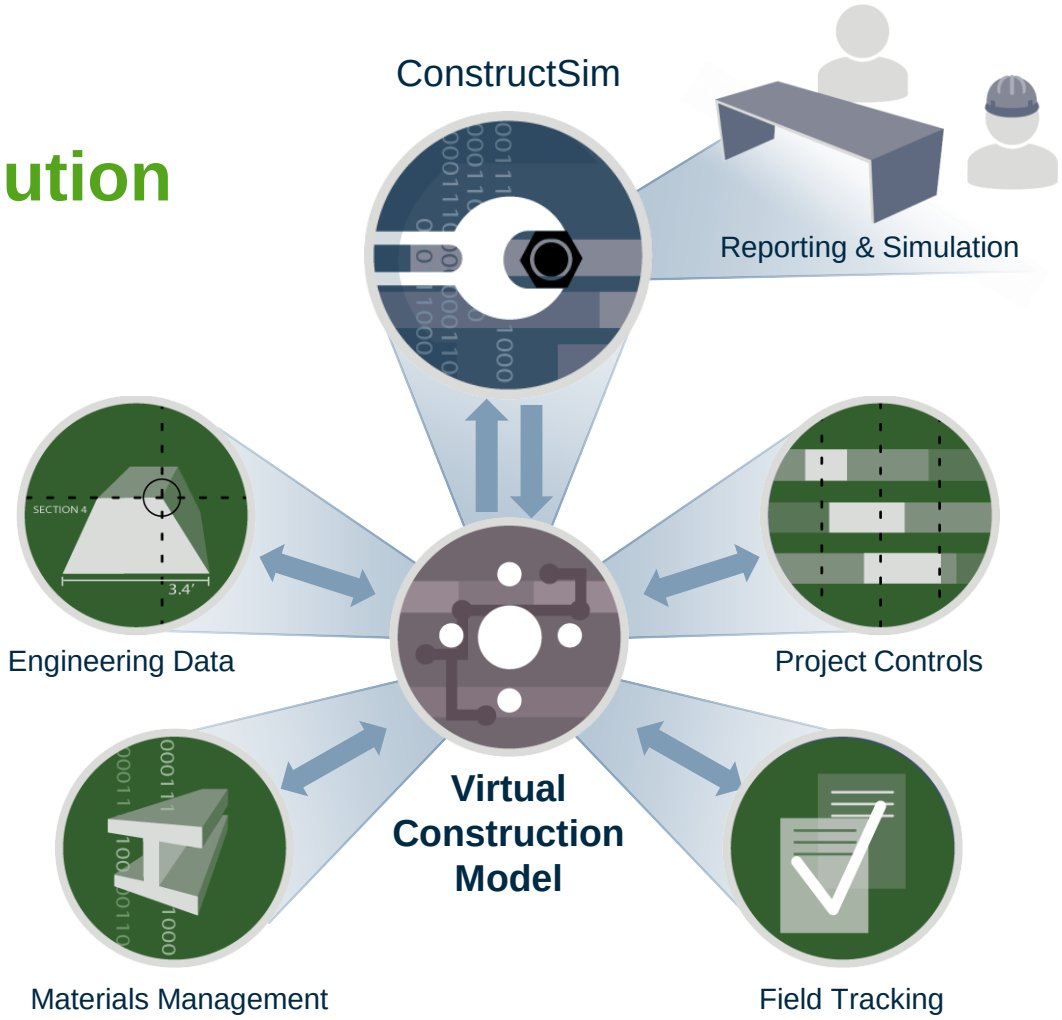
Solves complex planning and execution problems for

For Who?

- Owners
- Construction Managers
- Direct Hire

When?

- Early Planning
- Field Installation
- Turnover / Commissioning



Addresses These Main Issues

Visibility into the planned and current project status

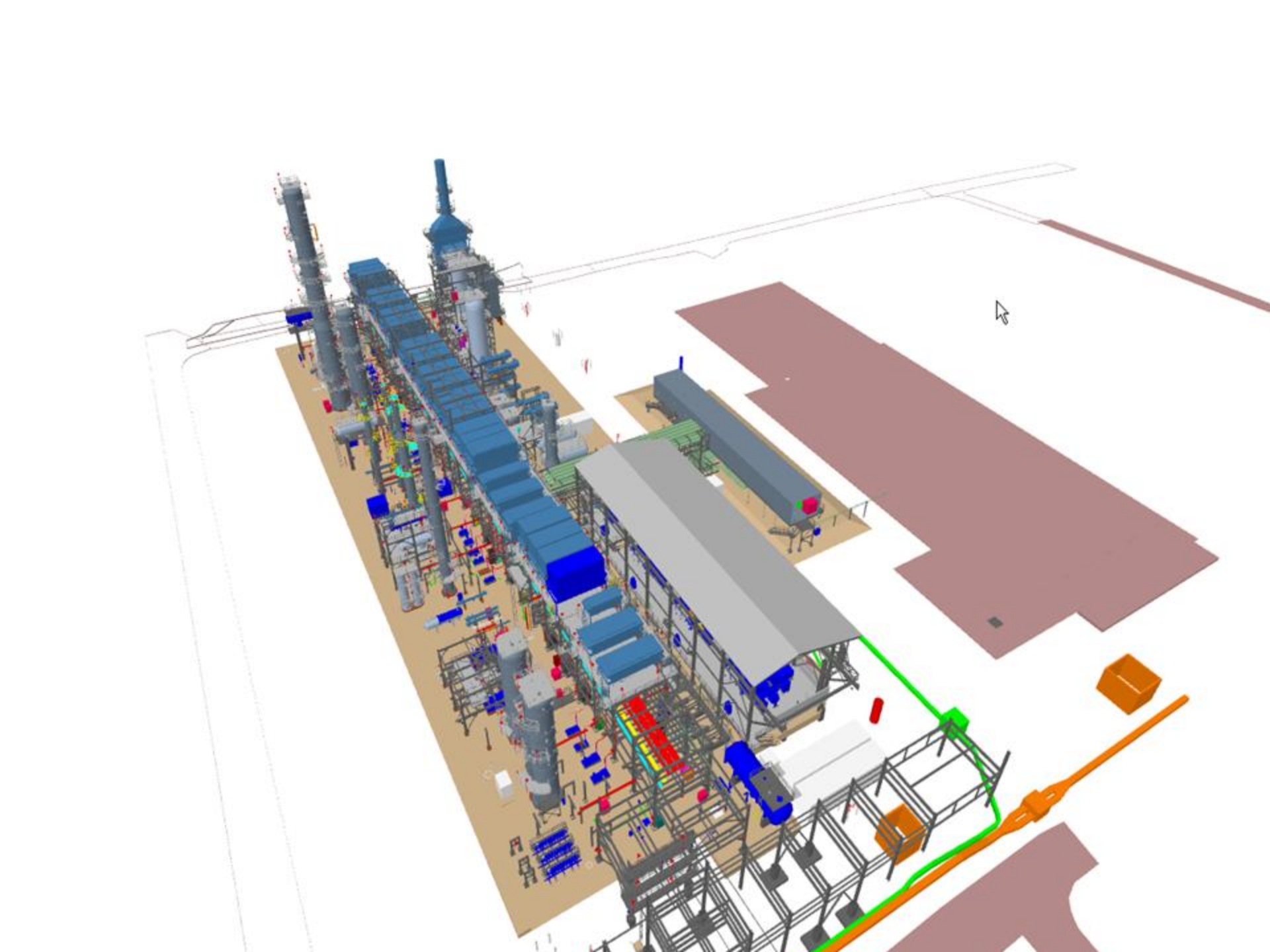
Material availability / engineering drawing production

Cost to complete

Information management / Aggregation

Reactive construction management

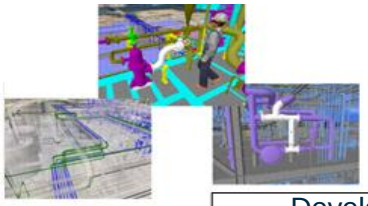
Productivity of field labor



Main Functionality

- Virtual Construction Model – dynamic updated daily with data from engineering and construction
- Auto re-organize engr 3D data for construction tracking
  - **Spools (SpoolGen / IsoGen); Steel Piecemarks, etc …**
- Provide construction views – area & systems (others)
- Work steps that relates to all small pieces (every pipe spool, steel beam) – automatic
- Video game environment to build work packs (detailed planning
  - **Click, click, click -> print reports (spool list, field materials, checklist – aka scorecard – for progressing … i.e. get paid)**
- Status visualization …. See progress in 3D
  - **engineering production / Material availability / installation / testing**
- Integration with schedule
  - **Visually produce schedule early in project**
  - **During project … update schedule weekly with progress (summary reports % complete per schedule)**
  -

Agile Construction Methodology



Develop Construction Plan

Create Crew Level Work Packages

Streamline Materials

Bag & Tag

Review & Sequence Work

The Quality Gate

Execute Work

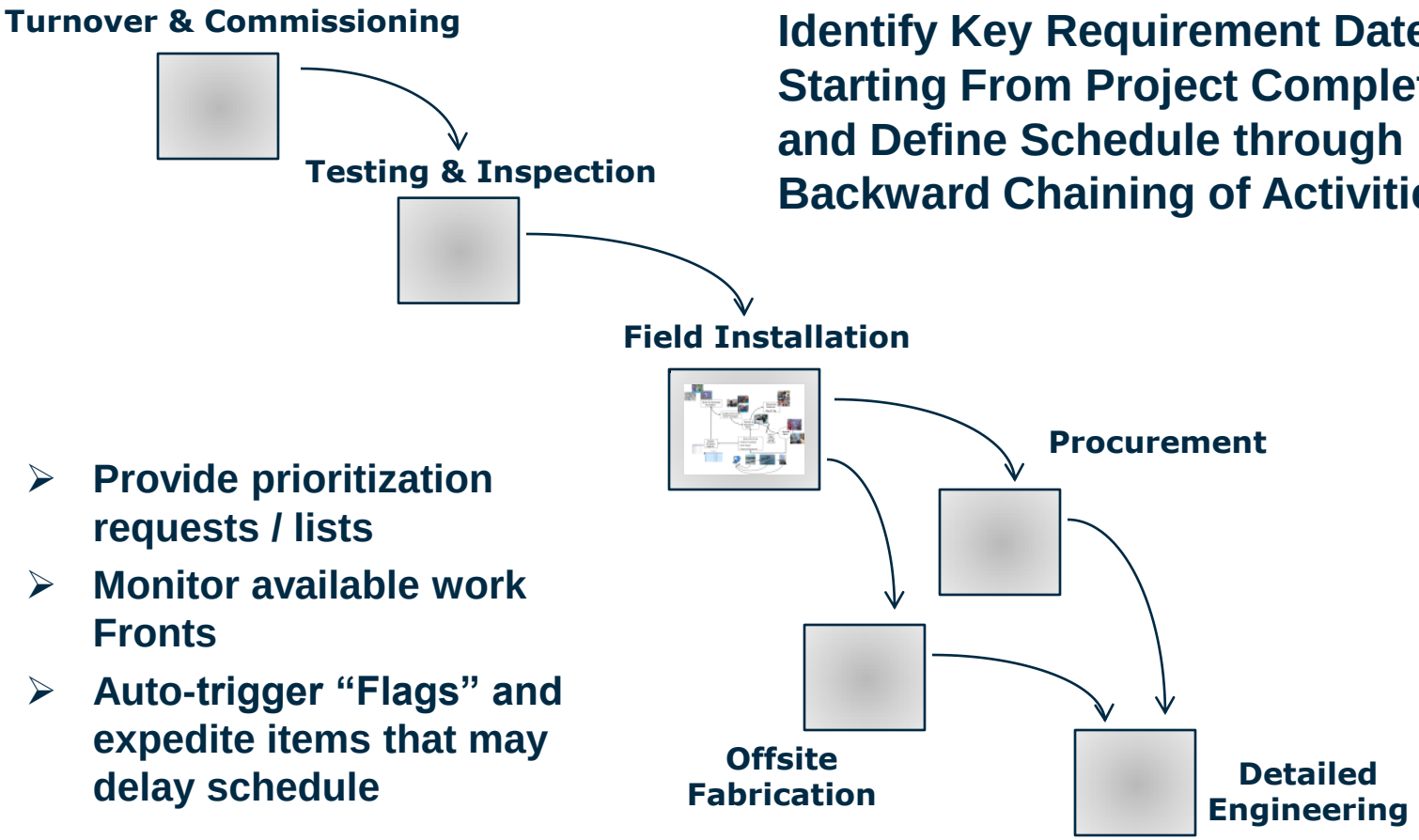
Buffer of Work Packages that are Executable

Status Monitoring

- Material Availability
- Work Status
- Supports/Equipment

Weekly Progress Reports

Agile Construction Methodology



Identify Key Requirement Dates, Starting From Project Completion and Define Schedule through Backward Chaining of Activities

- Provide prioritization requests / lists
- Monitor available work Fronts
- Auto-trigger “Flags” and expedite items that may delay schedule

Case Study – Off Shore Platform

Project Background

- Deepwater Offshore Platform - $150M
- Time and materials contract with Fab Yard
- ConstructSim Pipe purchased by Owner and utilized by module Fab Yard contractor

Project Use-Case

- ConstructSim used to re-baseline schedule, prioritize by TO Systems
  - **Finish project on-time, under budget**
- At “sail away”, only 7 Punch List items (compared to 1000’s)
- Development of crew-level work face plans with ConstructSim

Project Return-On-Investment

Investment	
Software and Services	$1M
Savings	
Reduced project cost from labour efficiency	$17M
Project completes ahead of schedule	3 mo.

Case Study – Diesel Refinery Unit

Project Background

- New Refinery Unit - TIC $320M.
- Lump Sum Contract with Mechanical Sub
- ConstructSim Pipe purchased by Owner and utilized by Construction Management firm

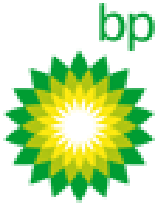
Project Use-Case

- Actual progress not in alignment with progress reported in field ... Switch to progressing through ConstructSim
  - **Project recovers schedule losses to complete on time**
- Excessive change order submitted by Mechanical Sub
  - ConstructSim used to analyze change order and provide visibility to impact on work

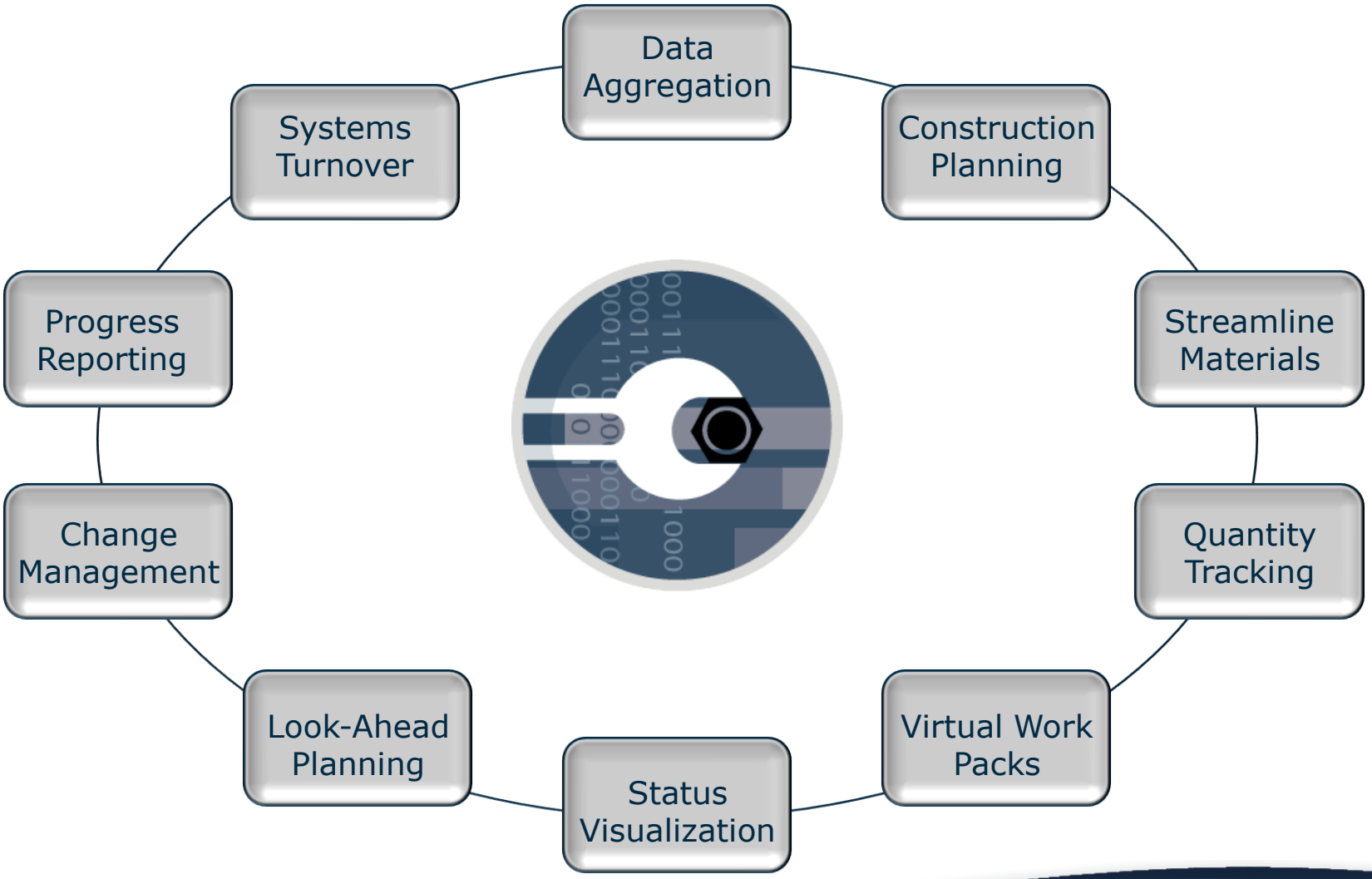
Project Benefits / Savings

Change order reduced from 2.5M to 500K	$2M
Project recovered and completed on-time	

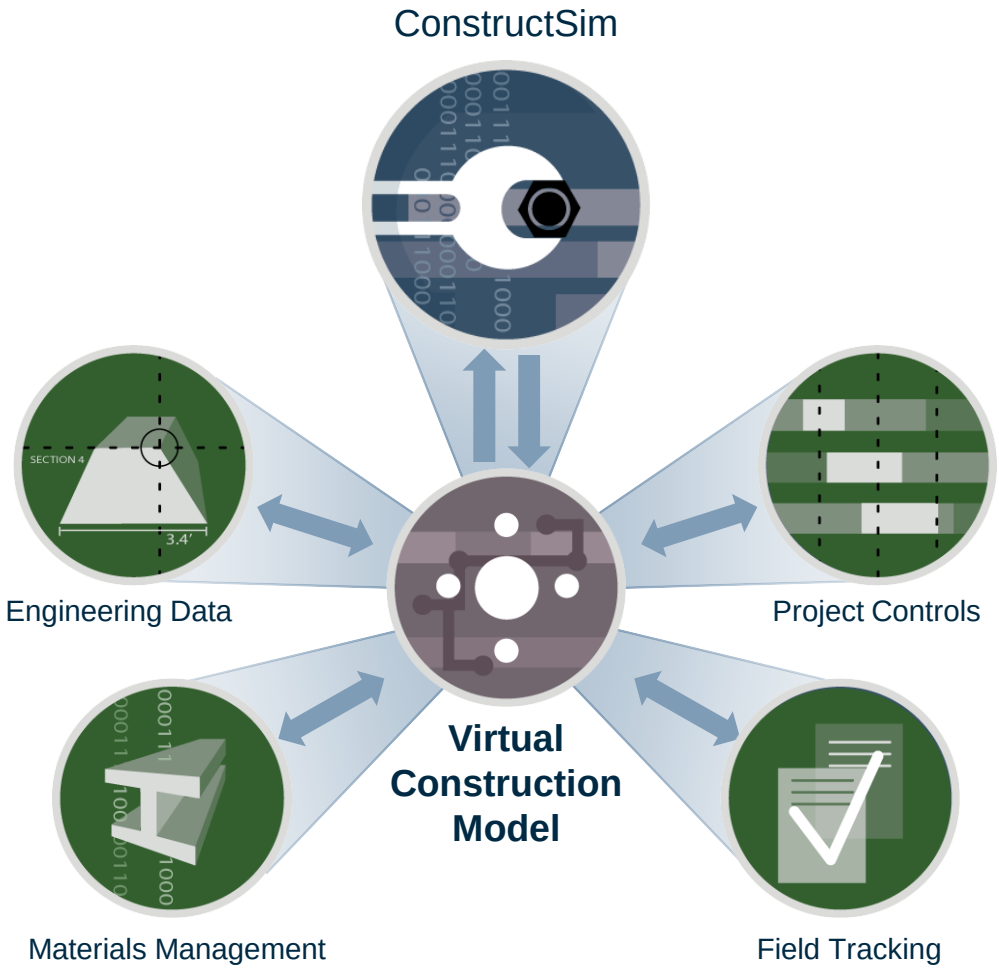
ConstructSim Users



ConstructSim Functionality

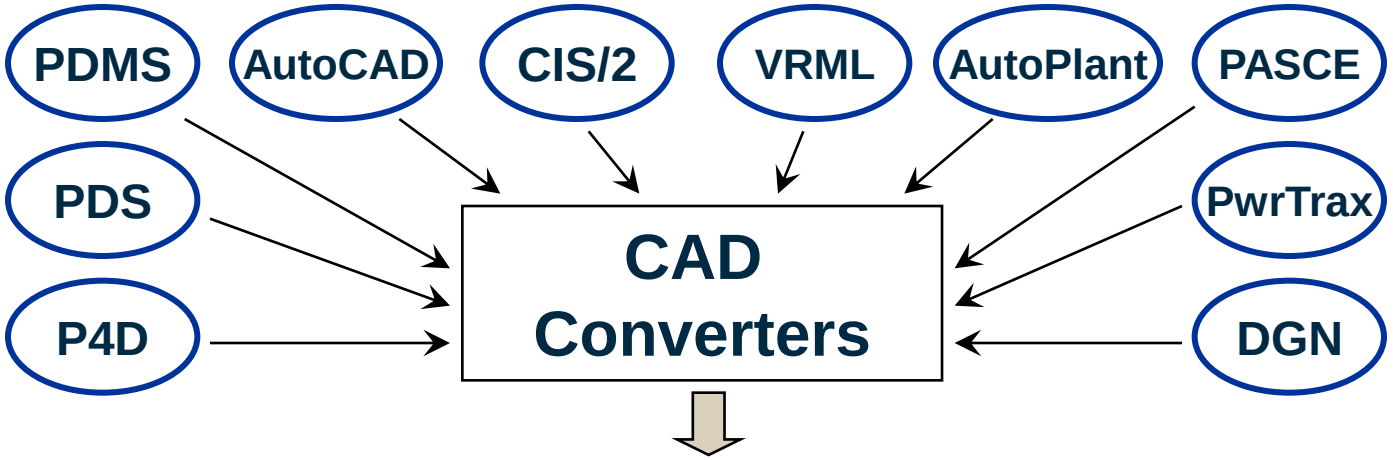


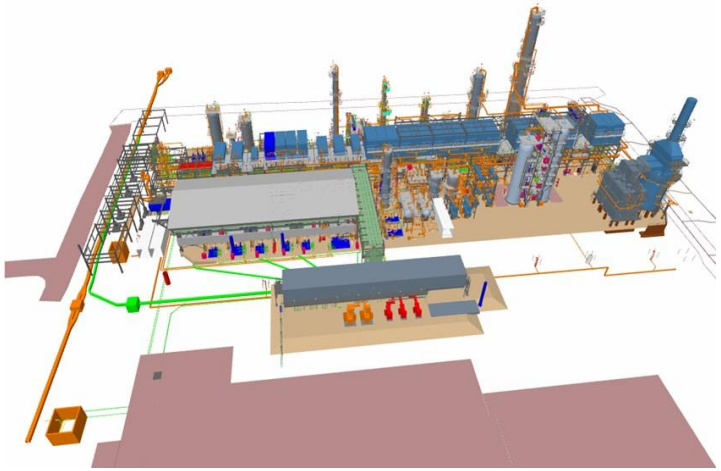
Data Aggregation



Back

Data Aggregation – CAD Adaptors





Bentley
Sustaining Infrastructure

Data Aggregation – Digital ISO Input

ConstructSim reads digital ISO files and correlates them with the 3D CAD model…

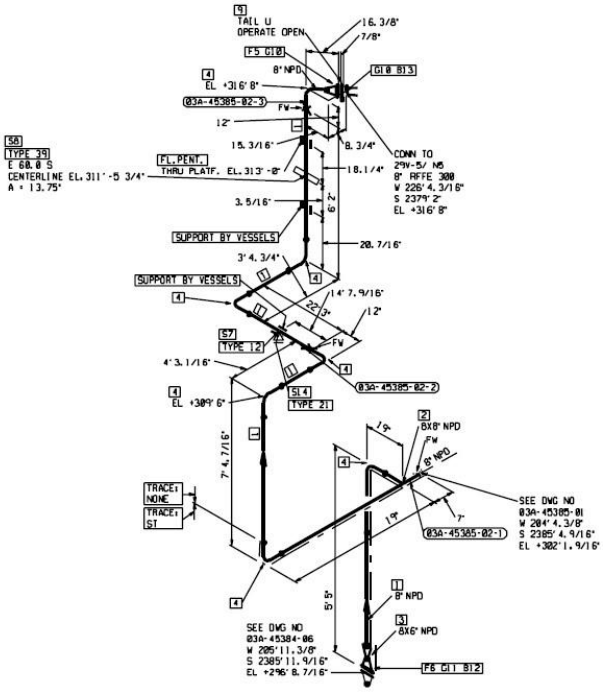
PT NO	DESCRIPTION	DIA (NPD)	CMDTY CODE	QTY
1	PIPE, DE SMLS, S-STD, ASTM A335-P22	8	DT10025	38.8'
	[illegible] A234-WP22 CL1, SMLS	8X8	DT30245	1
	[illegible] BE, S-STD ASTM A234-WP22 CL1, SMLS	8X6	DT302658	1
4	90 DEG ELBOW, BE, S-STD, ASTM A234-WP22 CL1, SMLS	8	DT30215	7
5	FLANGE, WN, ANSI-B16.5 CL300, RFFE, S-STD BORE, ASTM A182-F22 CL3, STD FIN	8	DT20175	1
6	FLANGE, WN, ANSI-B16.5 CL1500, RFFE, S-80 BORE, ASTM A182-F22 CL3, 125-250 RA FIN	6	DT20398	1
	PIPE SUPPORTS			
7	PIPE SUPPORT TYPE 12	8	TYPE12	1
8	PIPE SUPPORT TYPE 39	8	TYPE39	1

FIELD MATERIALS

PT NO	DESCRIPTION	DIA (NPD)	CMDTY CODE	QTY
9	FIG.8 FLG, CL300 RF, ASTM A387 GR 22 CL. 2, B16.48, STD FIN	8	DT8203	1
10	GASKET, RF, CL300, SPIRAL WOUND 304SS W/FLEXIBLE GRAPHITE FILLER, 1/8" THK, 2 1/4CR CR, FLEXITALLIC CG	8	RG125-3	2
11	GASKET, CL1500, RF, SPW 304SS W/FLEXIBLE GRAPHITE FLR, 1/8" THK 2-1/4CR CR & IR, FLEX CGI	6	RGA53-7	1
12	STUD BOLT, FULL THRD, ASTM A193-B7 W/A194-2H HVY HEX NTS, 10.25" BOLT LENGTH	1.3/8	CB7001	12
13	STUD BOLT, FULL THRD, ASTM A193-B7 W/A194-2H HVY HEX NTS, 6.75" BOLT LENGTH	7/8	CB7001	12
	PIPE SUPPORTS			
14	PIPE SUPPORT TYPE 21	8	TYPE21	1

PIECE MARKS

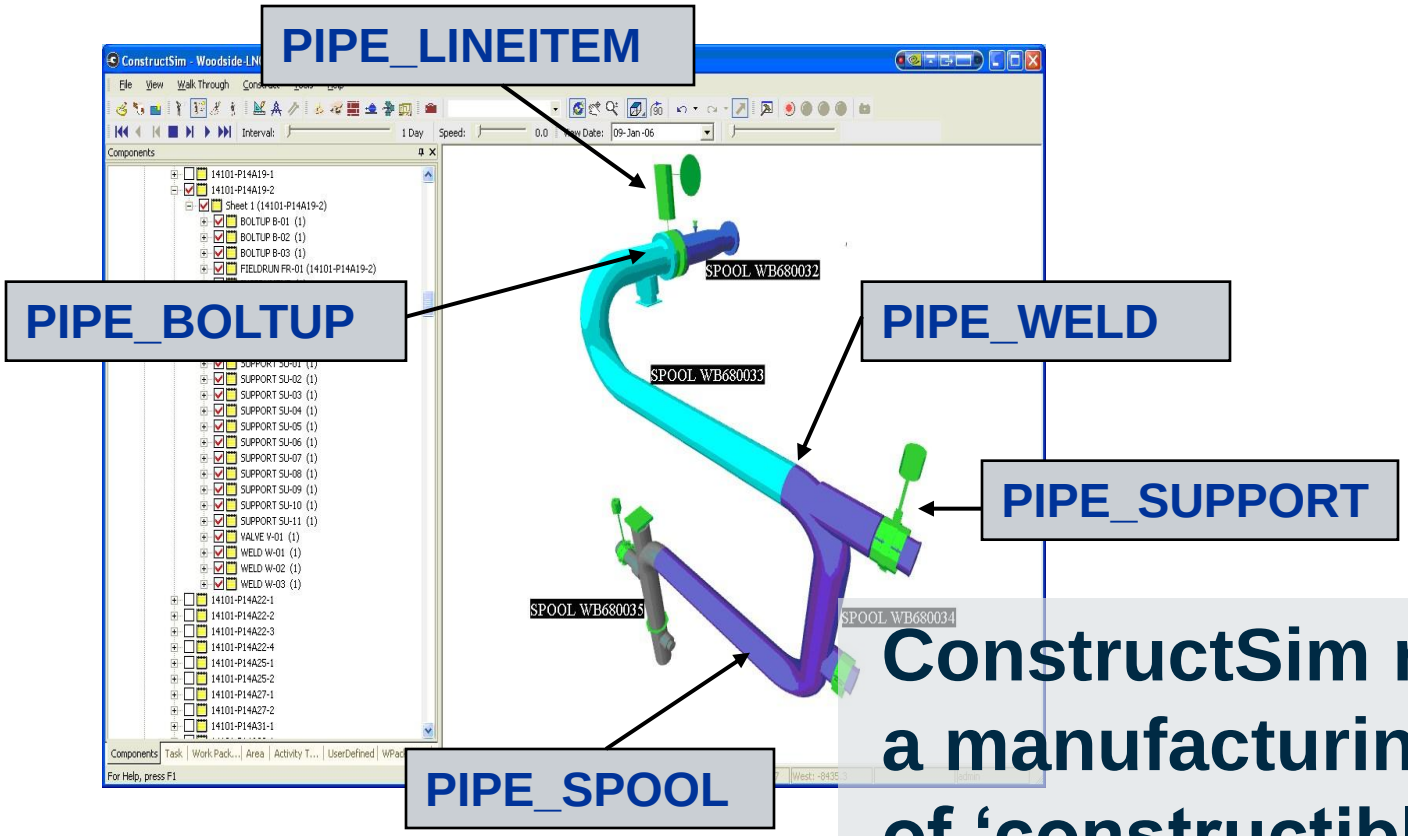
03A-45385-02-1 03A-45385-02-2 03A-45385-02-3



Back

Bentley Sustaining Infrastructure

Data Aggregation – ISO Components



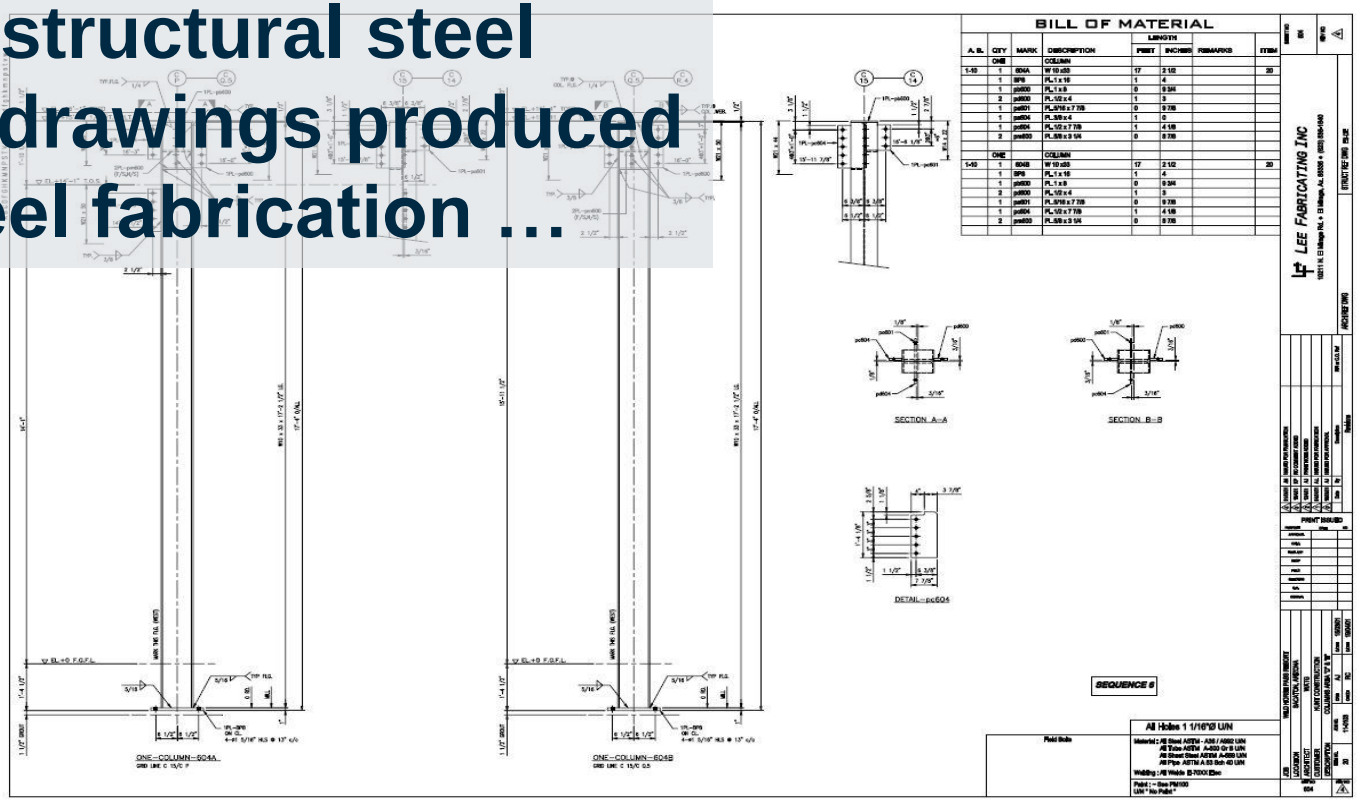
ConstructSim represents a manufacturing model of 'constructible' pipe elements.

Back

Bentley Sustaining Infrastructure

Data Aggregation – Structural Details

ConstructSim reads structural steel detail drawings produced for steel fabrication …



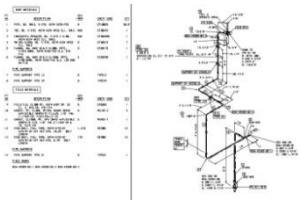
Back

Bentley Sustaining Infrastructure

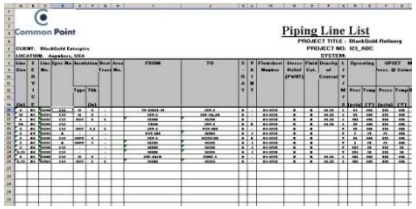
Data Aggregation – Attributes

3D CAD Model

Digital Isometrics

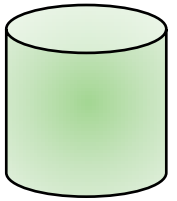


Line List



ConstructSim Take-Off

Other Sources



Attributes for ConstructSim are derived from multiple sources

Attributes for ConstructSim are derived from multiple sources

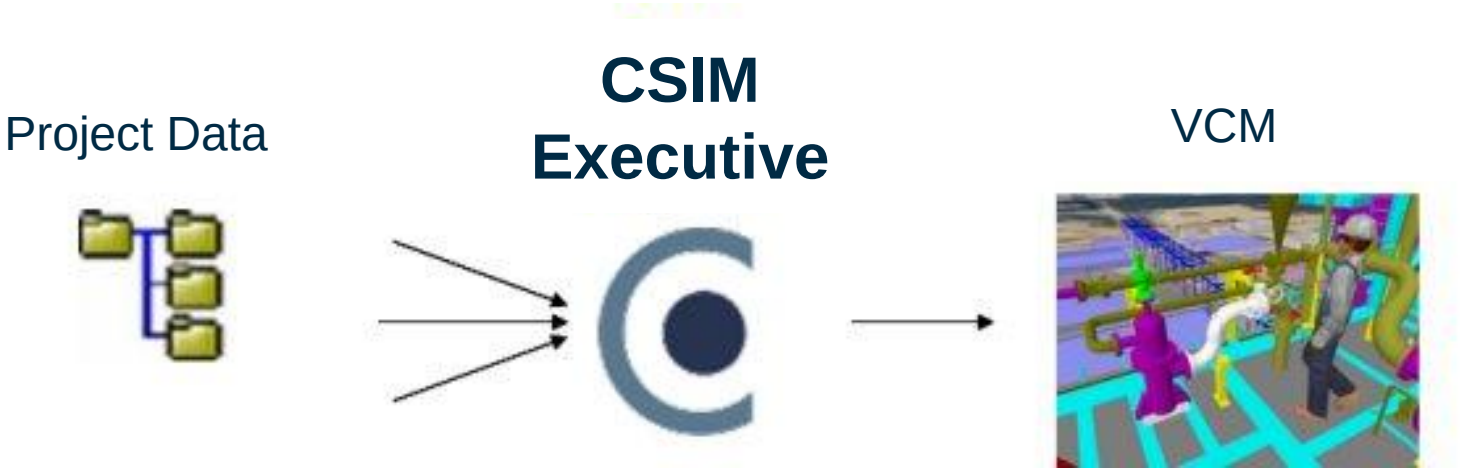
Attributes for ConstructSim are derived from multiple sources

automated task generation

Back

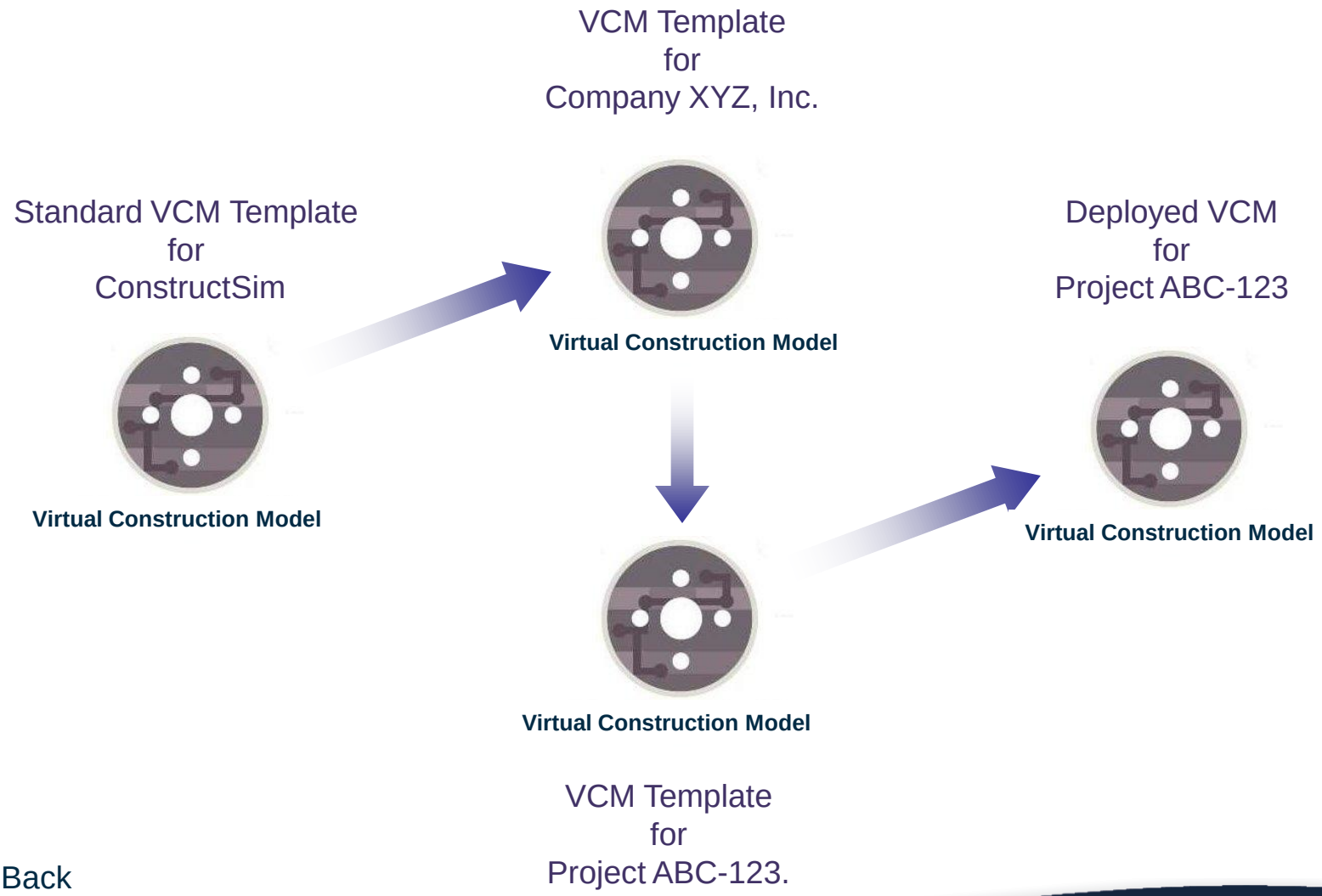
Data Aggregation – CSIM Executive

The *Virtual Construction Model (VCM)* is generated and updated by the ***CSIM Executive*** data processing engine. The ***Executive*** processes the *Project Data* as inputs and updates the *VCM* throughout the course of a construction project.



Back

Data Aggregation – VCM Templates

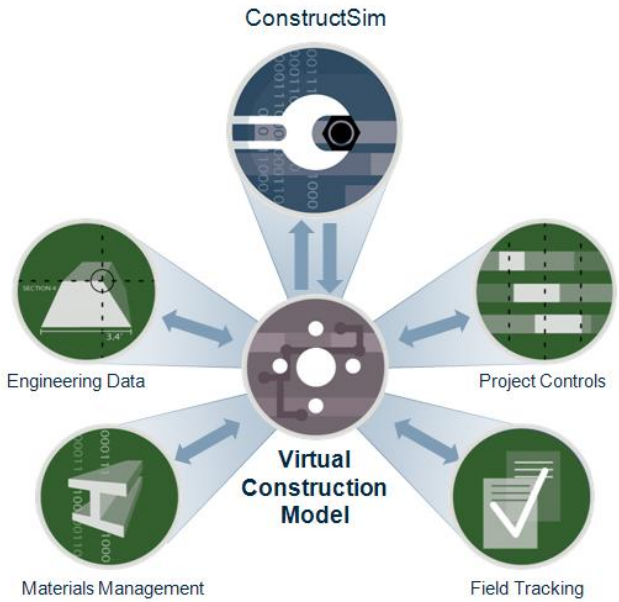


Back

Data Aggregation – Project Data

Typical Project Data input to ConstructSim on a project includes:

- 3D CAD
- Pipe Isometrics
- Structural Detailing Data
- Line List / Equipment List
- Instrument Index / Electrical Lists
- L3 Project Schedule
- Unit Rates/ Rules of Progress
- Offsite Fabricator Status
- Material Availability
- Quantity Tracking (Progress)
- Weld Tracking / NDE
- TO Systems / Completions

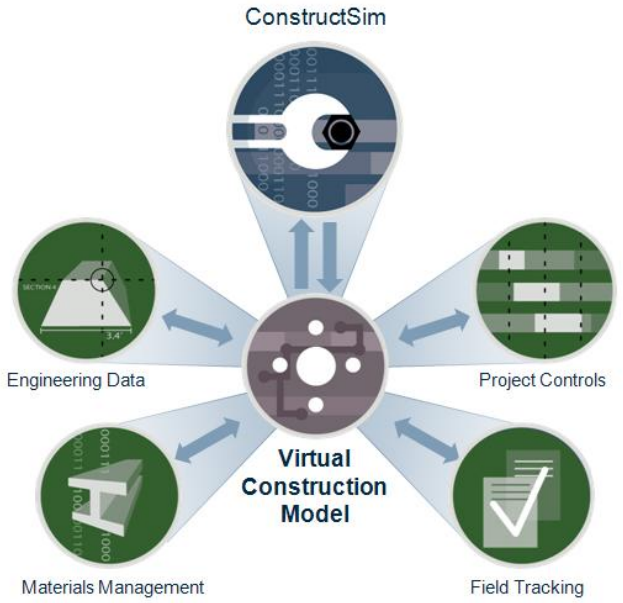


Back

Data Aggregation – Project Data

Typical Progressing Options:

- Use ConstructSim reports and data entry forms to track progress
  - Pipe
    - Receive
    - Fabricate
    - Install
    - Test
  - Steel
    - Receive
    - Install
  - Equipment
    - Receive, Install, MC

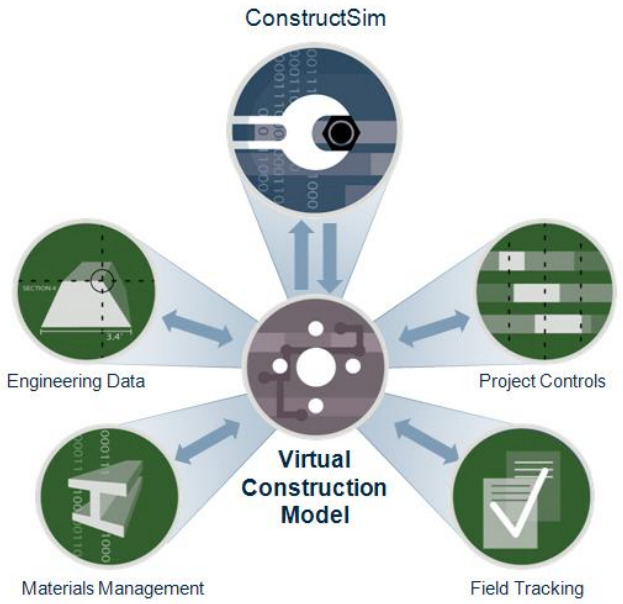


Back

Data Aggregation – Project Data

Typical Progressing Options:

- Interface with other electronic system
  - In-House / 3rd Party Commercial
    - Progressing – QTY Tracking
    - Material System
- Progressing XLS from sub-contractor
  - Validate list is correct
- Use ConstructSim to produce XLS sheet for sub-contractor, ask sub-contractor to submit progress in XLS format
  - Reduces in-acuracies



Back

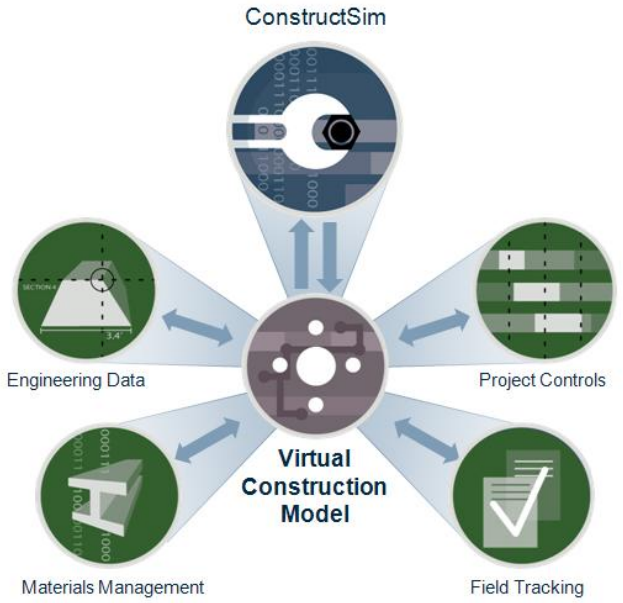
Data Aggregation – Project Data

Typical Progressing Options:

- FUTURE – State-of-the-art active RFID hardware

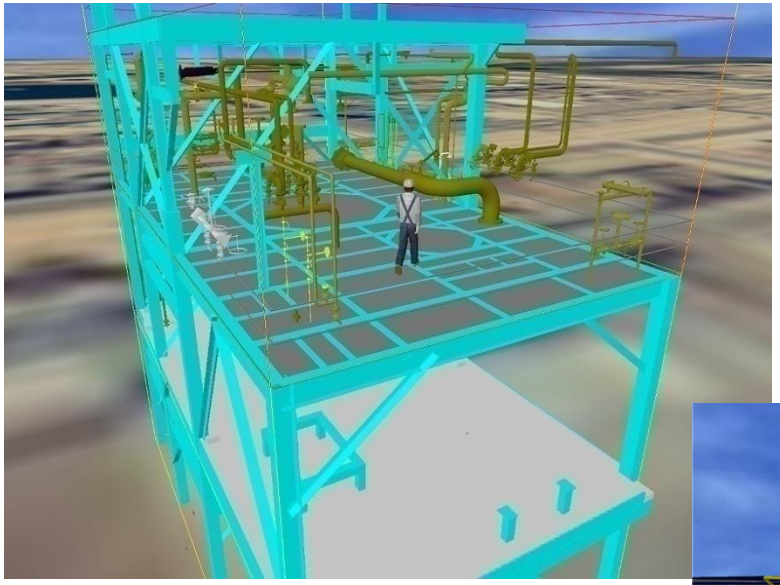
  - R&D Project
    - Waseda University

  - Partner - Intelliwave



Back

Construction Planning – UD Groups

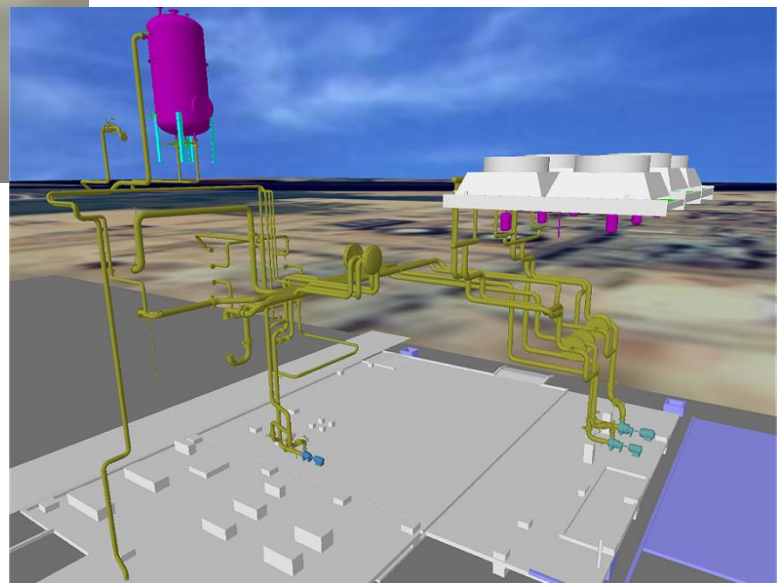


Construction Areas

Unit 1, Level 3

Large Bore, CS

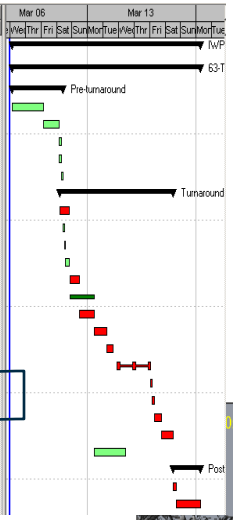
Turnover Systems

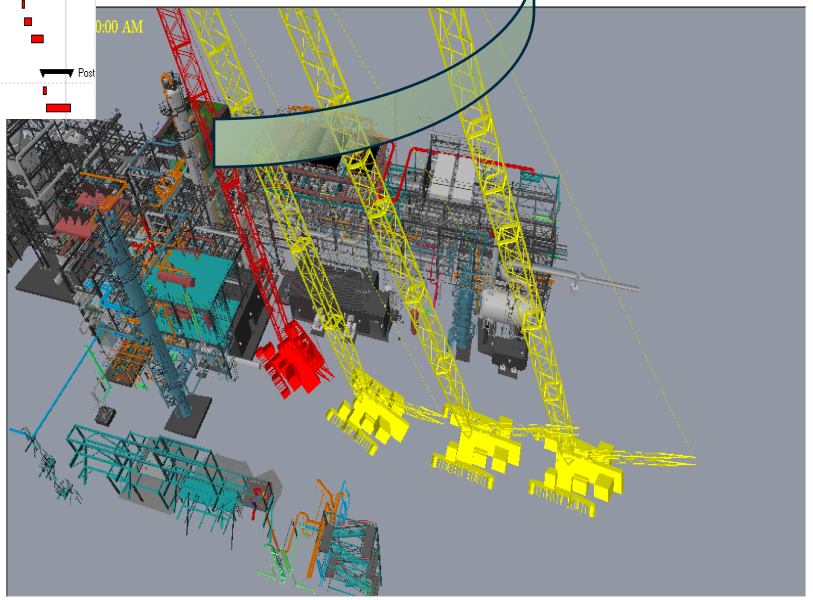


Back

Construction Planning – 4D Playback

Activity Name	Planned Duration	Tie In Point	CSim Activity Type	Resource Instance	Work Space	Labour Force
IWP: 0010	243h					60.00
63-TP-1012	243h					60.00
Pre-turnaround	66h					14.00
Install Temporary Platform	40h	63-TP-1012	Scaffold.Build	Scaffold.01.0010		3.00
Remove Insulation & Install Temporary Cladding	20h	63-TP-1012	1.PreTA		63-TP-1012	4.00
Mark Tie-In Point Location and Confirm Dimensions	4h	63-TP-1012	1.PreTA		63-TP-1012	3.00
Conduct Positive Material Identification	4h	63-TP-1012	1.PreTA		63-TP-1012	2.00
Measure Wall Thickness	2h	63-TP-1012	1.PreTA		63-TP-1012	2.00
Turnaround	149h					39.00
Mobilize (Set Up) Crane	15h	63-TP-1012	Crane.Place	Crane.Crawler.0010		0.00
Gas Free & Safe	2h	63-TP-1012	2.TA.Demo		63-TP-1012	2.00
Lock Out/Tag & Obtain Permits	2h	63-TP-1012	2.TA.Demo		63-TP-1012	0.00
Prepare for Hot Works (Wind Screens & Fire Blankets)	6h	63-TP-1012	2.TA.Demo		63-TP-1012	6.00
Cold Cut and Prep for Welding	10h	63-TP-1012	2.TA.Demo		63-TP-1012	6.00
Crane Lifts	30h	63-TP-1012	Crane.Lift	Crane.Crawler.0010		0.00
Field Fit and Weld or Bolt-Up	20h	63-TP-1012	2.TA.Construct		63-TP-1012	6.00
Visual QA and Tag for X-ray	15h	63-TP-1012	2.TA.Inspect		63-TP-1012	3.00
Post Weld Heat Treatment	10h	63-TP-1012	2.TA.Construct		63-TP-1012	2.00
X-ray, Additional NDT if required	12h	63-TP-1012	2.TA.Construct		63-TP-1012	2.00
Hydro/Carber Test or Waiver/Service Test	2h	63-TP-1012	2.TA.Inspect		63-TP-1012	3.00
De-Blind/De-Tag and Reinstate	4h	63-TP-1012	2.TA.Construct		63-TP-1012	3.00
Final EPC QC Approval and Inspection	10h	63-TP-1012	2.TA.Inspect		63-TP-1012	2.00
Install Temporary Insulation	15h	63-TP-1012	2.TA.Construct		63-TP-1012	4.00
Demobilize Crane	40h	63-TP-1012	Crane.R	Crane.Crawler.0010		0.00
Post-turnaround	34h					7.00
Install Insulation	4h	63-TP-1012			63-TP-1012	4.00
Teardown Temporary Platform	30h	63-TP-1012	TearDown	Scaffold.01.0010		3.00

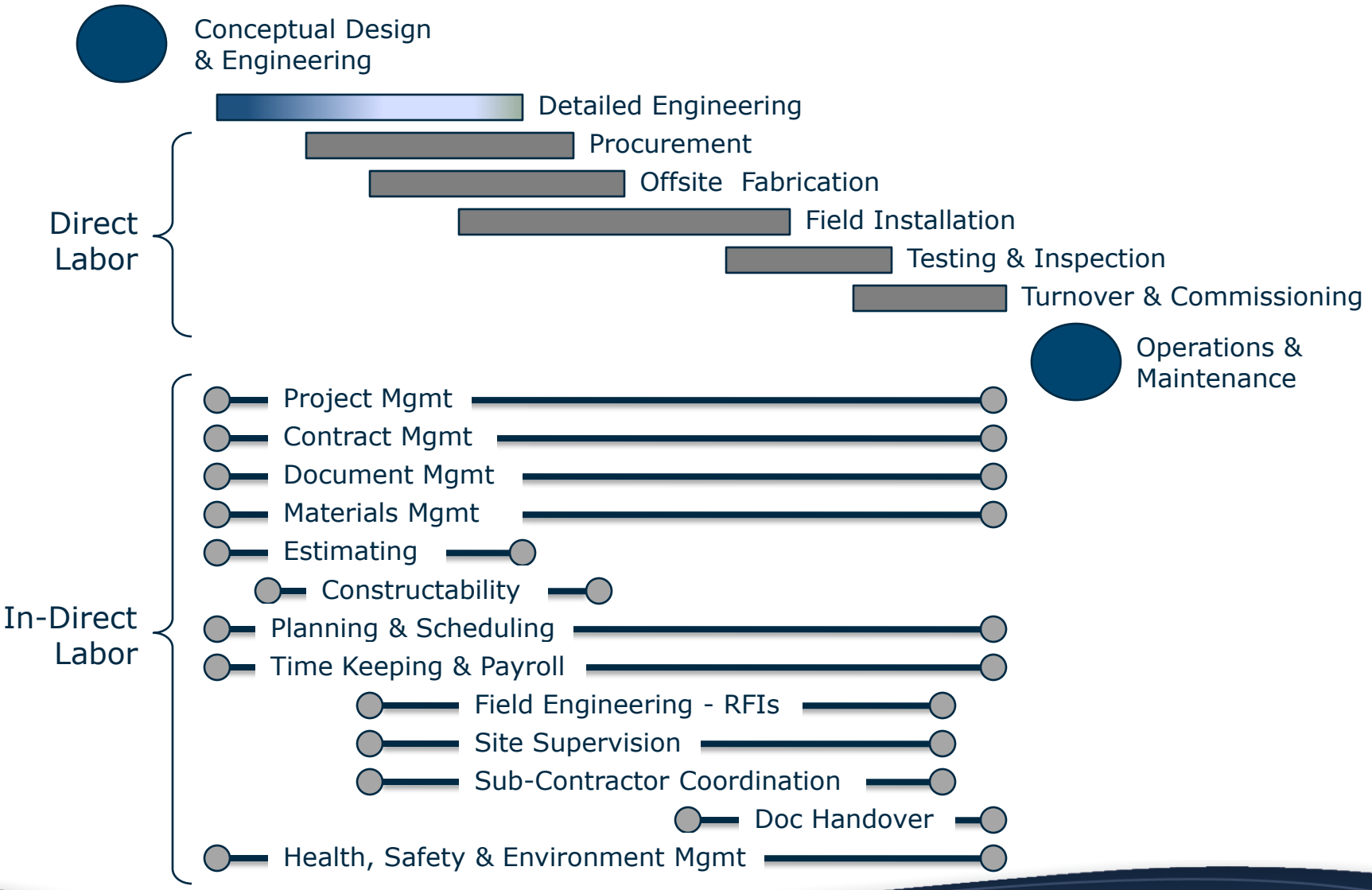




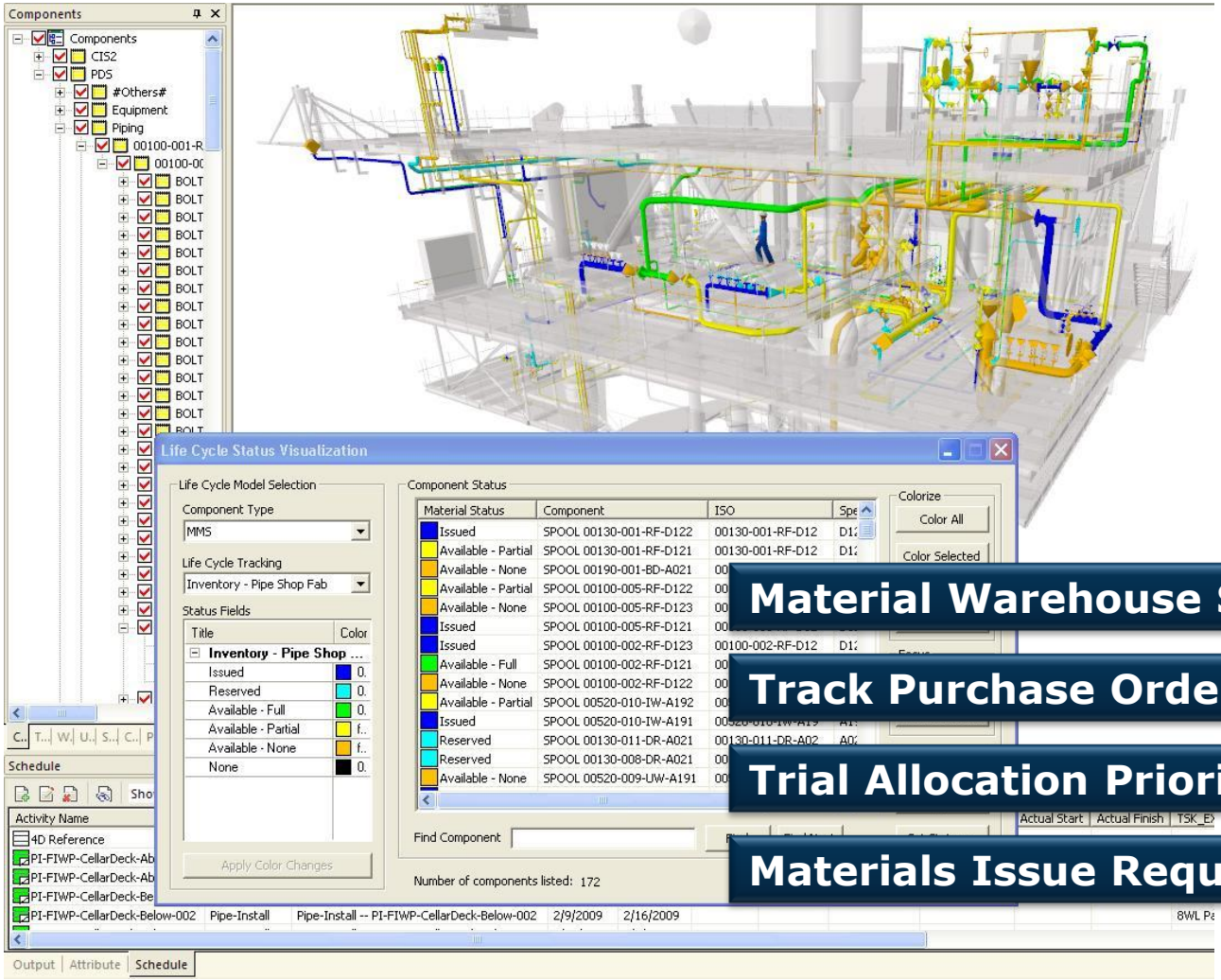
Back

Bentley Sustaining Infrastructure

Construction Planning – Activities



Streamline Materials



Material Warehouse Status

Track Purchase Orders / ETAs

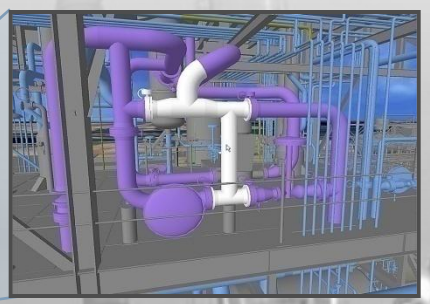
Trial Allocation Priorities

Materials Issue Request

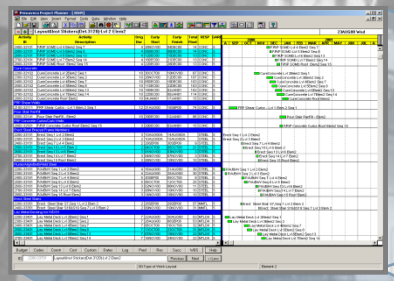
Back

Bentley Sustaining Infrastructure

Quantity Tracking

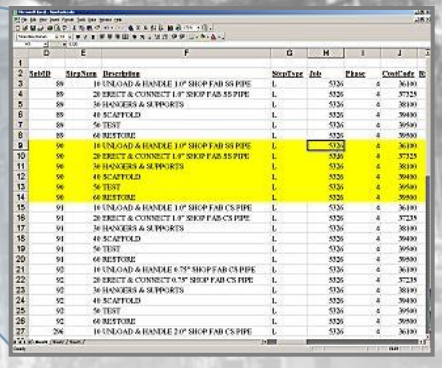


MTO
From CAD +
Isometric Documents



Schedule

ConstructSim



Labor Rates &
Rules of Progress

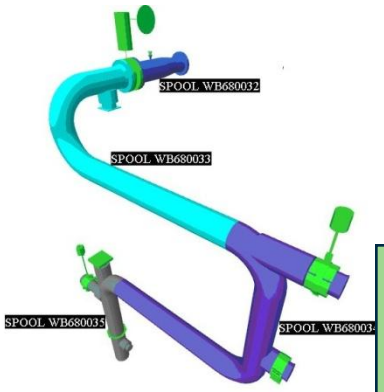
Work Steps

Back

Bentley Sustaining Infrastructure

Quantity / Labor Tracking – Tasks

Tasks grouped by “activity type” and “component type”



PIPE_SPOOL

Procure → Fabricate → Install → Test → Turn-over

Fabricate Work Steps

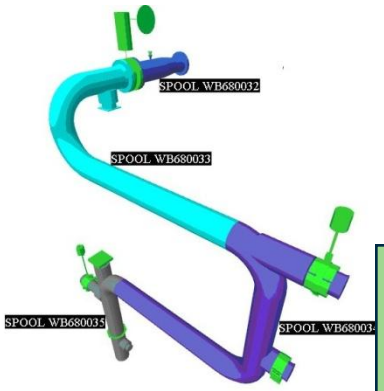
Cut → Fit-Up → Weld → PWHT → NDE → Paint

Back

Bentley Sustaining Infrastructure

Quantity / Labor Tracking – Tasks

Tasks grouped by “activity type” and “component type”



PIPE_SPOOL

Procure → **Fabricate** → **Install** → **Test** → **Turn-over**

Install Work Steps

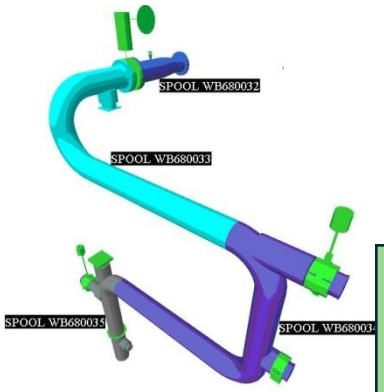
Stage → **Erect** → **Connect**

Back

Bentley Sustaining Infrastructure

Quantity / Labor Tracking – Tasks

Tasks grouped by “activity type” and “component type”



PIPE_WELD

Procure → **Fabricate** → **Install** → **Test** → **Turn-over**

Install Work Steps

Tack → **Complete**

Back

Bentley Sustaining Infrastructure

Levels of Planning & Scheduling

L3 - Schedule Activity

Example – A/G Piping Field Installation – Area 3A

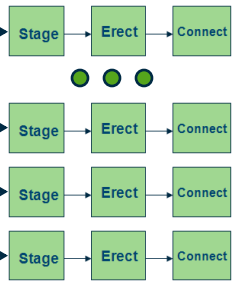
ConstructSim "**Auto-links**" Model Components to L3 Activities By Attribute Matching Rules

L4 – Crew Work Packs

Example – One "shift" of work (~1-2 weeks), includes scope identified with associated L5 tasks

Work face planner **"Builds"** optimal path of construction using ConstructSim

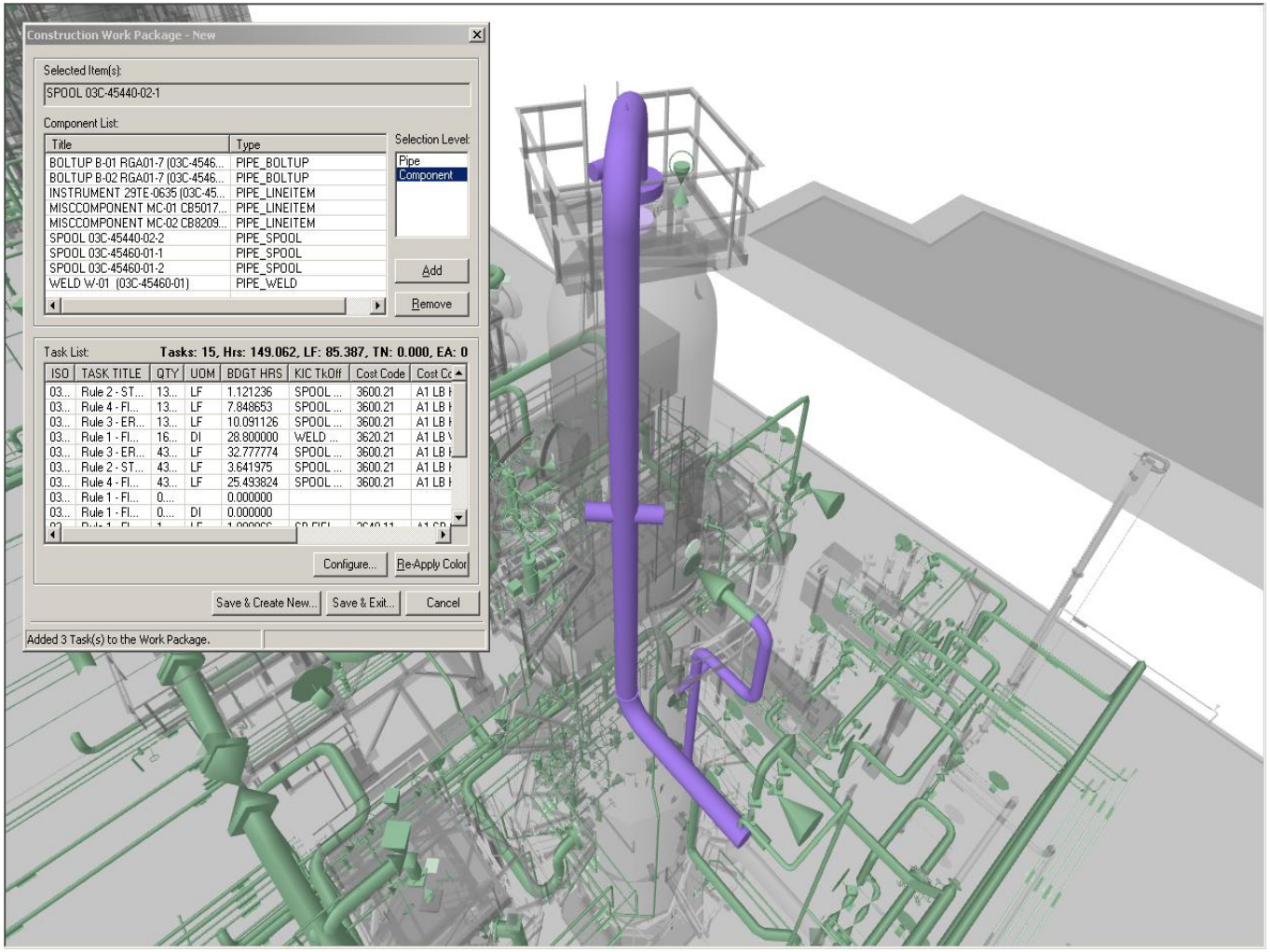
L5 - Tasks



Example – Spool 101-A Erect, Fit-Up, Connect

ConstructSim "**Auto-Generates**" L5 Tasks from Template "Rules of Progress"

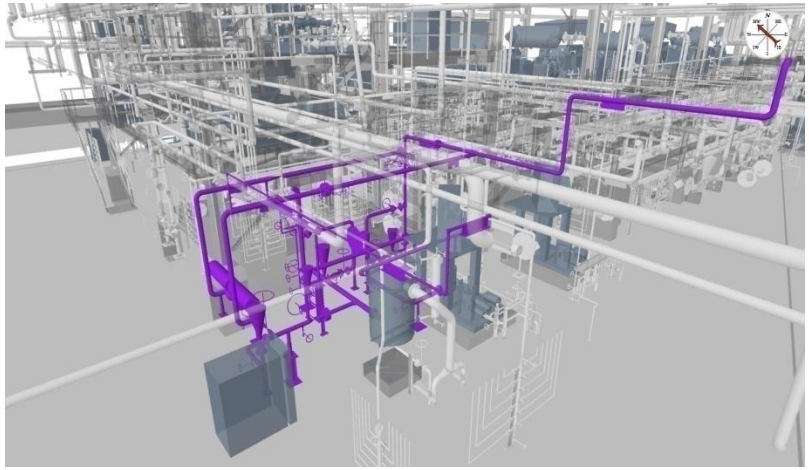
Virtual Work Packs

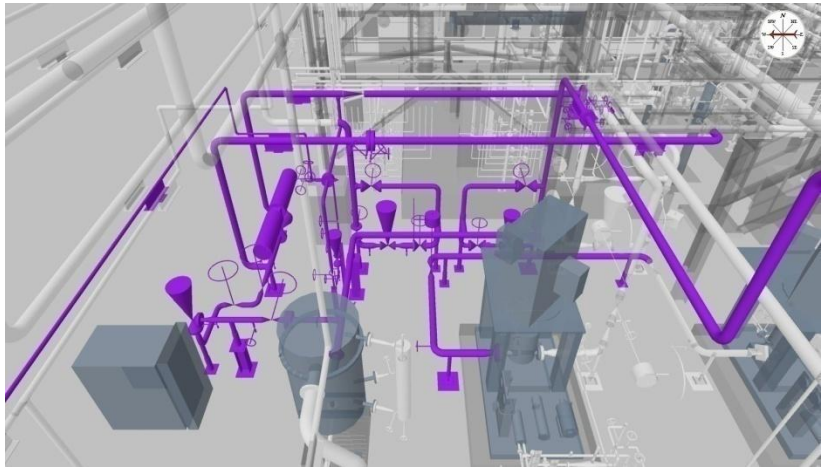


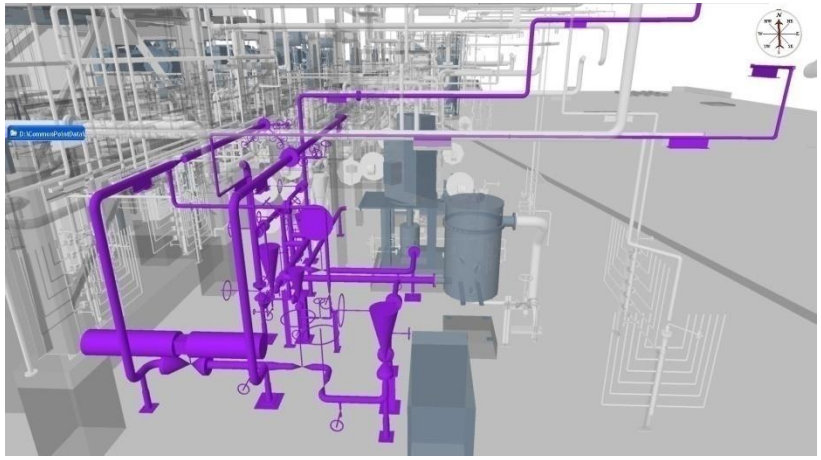
Back

Bentley Sustaining Infrastructure

Virtual Work Packs – 4 Views







Back

Bentley Sustaining Infrastructure

Virtual Work Packs - Reports

ConstructSim - Work Package Execution Reports

Set Work Pack Type: Pipe::Install

Work Package: PI-FIWP-CellarDeck-Above-004

Document Type

Reports To Print

4/8/2009

Filter Work Pack List:

Set Report Type: Field Materials

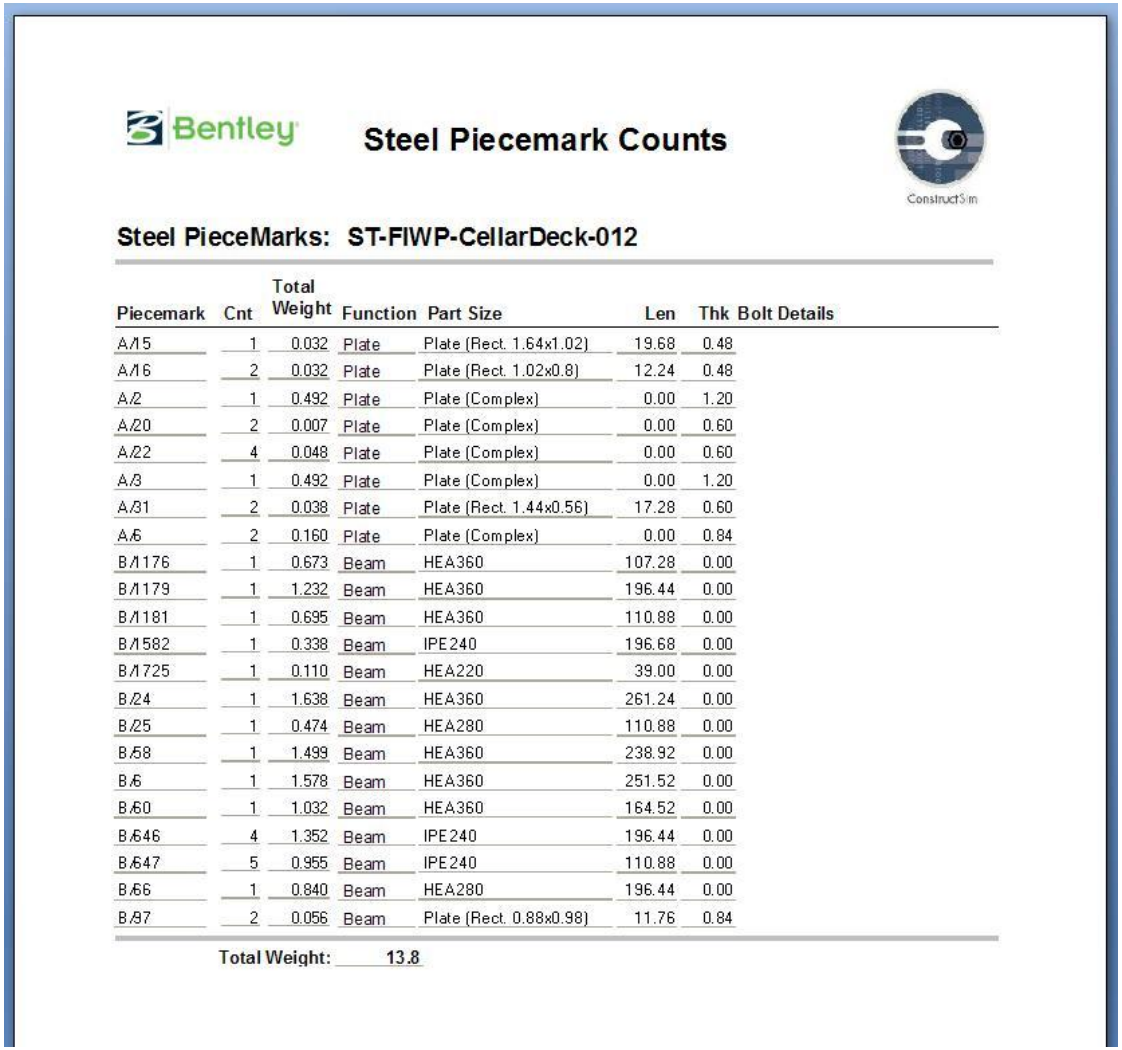
- PI-FIWP-CellarDeck-Above-001
- PI-FIWP-CellarDeck-Above-002
- PI-FIWP-CellarDeck-Above-004
- PI-FIWP-CellarDeck-Above-005
- PI-FIWP-CellarDeck-Below-001
- PI-FIWP-CellarDeck-Below-002
- PI-FIWP-CellarDeck-Below-003
- PI-FIWP-MainDeck-Below-001
- PI-FIWP-MainDeck-Below-002
- PI-FIWP-Wellhead-001
- PI-FIWP-Wellhead-002
- PI-FIWP-Wellhead-003
- PI-FIWP-Wellhead-004
- PI-FIWP-Wellhead-005
- PI-FIWP-Wellhead-006
- PI-FIWP-Wellhead-007
- PI-FIWP-Wellhead-008

ISO	Mat'l Code	Material Description	Bore	Mat'l	Qty
00120-031-GY-A19	I4023191	STUD BOLTS & 2 HEAVY HEX. NUTS ASME B18.2.1 / ASME B18.2.2, 95.0MM BOLT LENGT	4	LTCS	8
00120-031-GY-A19	I2575937	CAP ASME B16.11 FTE	0.75	LTCS	0.04
00120-031-GY-A19	I3155766	SPIRAL WOUND GASKET ASME B16.20 RFTBE	4	LTCS	1
00120-031-GY-A19	BUG SCREEN FL	PIPING SPECIALTY	4	LTCS	1
00540-002-DR-A02	I2242408	STUD BOLTS & 2 HEAVY HEX. NUTS ASME B18.2.1 / ASME B18.2.2, 85.0MM BOLT LENGT	2	CS	16
00540-002-DR-A02	I3155567	SPIRAL WOUND GASKET ASME B16.20 RFTBE	2	CS	4
00540-002-DR-A02	00540-LT-110	PIPING SPECIALTY	2	CS	1
00550-016-DR-A02	I2242408	STUD BOLTS & 2 HEAVY HEX. NUTS ASME B18.2.1 / ASME B18.2.2, 85.0MM BOLT LENGT	2	CS	16
00550-016-DR-A02	I3155567	SPIRAL WOUND GASKET ASME B16.20 RFTBE	2	CS	4
00550-016-DR-A02	00550-LT-110	PIPING SPECIALTY	2	CS	1
00550-016-DR-A02	I3155590	VALVE BALL FLANGED ENDS LONG PATTERN API 6D SPLIT BODY / REDUCED BORE / FI	2	CS	1
00550-017-DR-A02	I2242408	STUD BOLTS & 2 HEAVY HEX. NUTS ASME B18.2.1 / ASME B18.2.2, 85.0MM BOLT LENGT	2	CS	16
00550-017-DR-A02	I3155567	SPIRAL WOUND GASKET ASME B16.20 RFTBE	2	CS	4
00550-017-DR-A02	00550-LT-120	PIPING SPECIALTY	2	CS	1
00550-017-DR-A02	I3155590	VALVE BALL FLANGED ENDS LONG PATTERN API 6D SPLIT BODY / REDUCED BORE / FI	2	CS	1

Back

Bentley Sustaining Infrastructure

Virtual Work Packs - Reports



Bentley

Steel Piecemark Counts

ConstructSim

Steel PieceMarks: ST-FIWP-CellarDeck-012

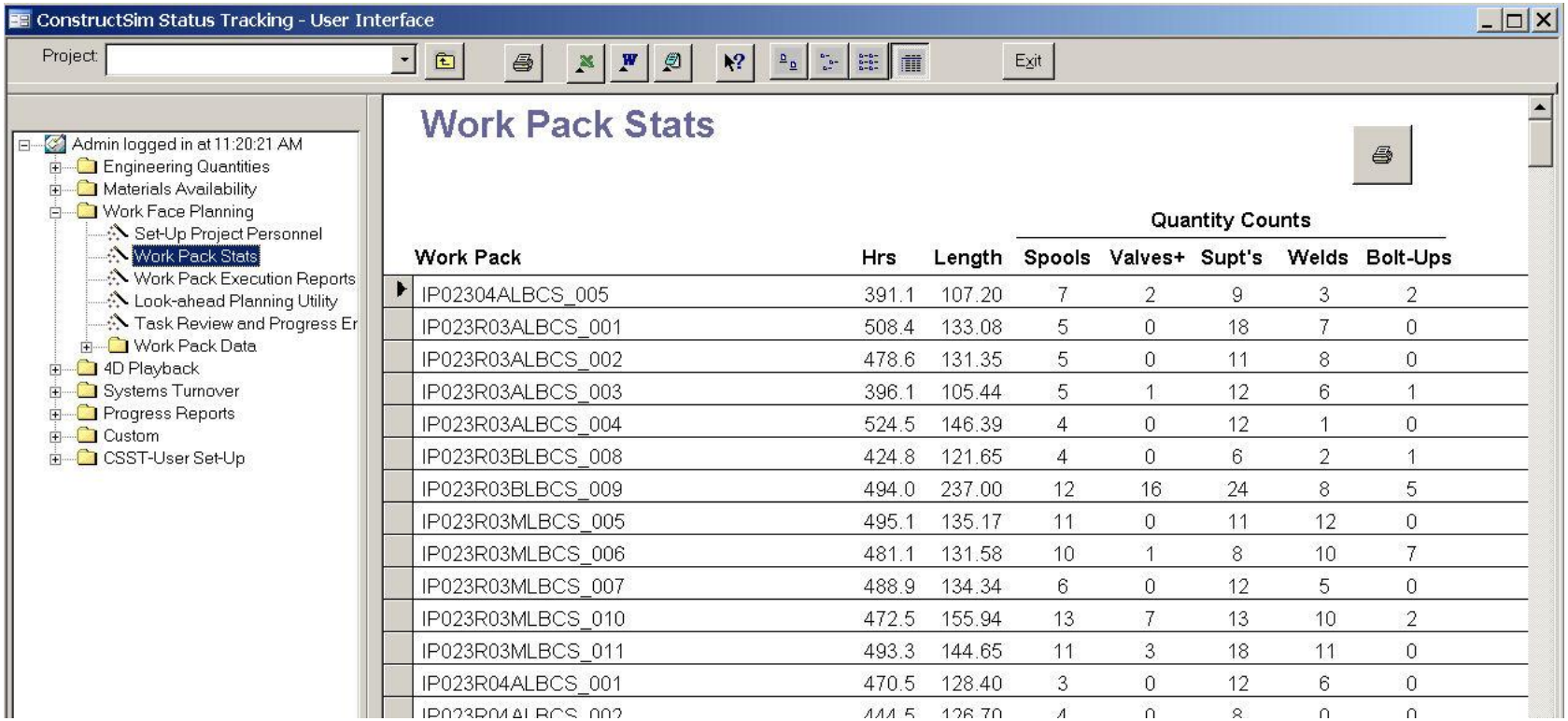
Piecemark	Cnt	Total Weight	Function	Part Size	Len	Thk	Bolt Details
A/15	1	0.032	Plate	Plate (Rect. 1.64x1.02)	19.68	0.48	
A/16	2	0.032	Plate	Plate (Rect. 1.02x0.8)	12.24	0.48	
A/2	1	0.492	Plate	Plate (Complex)	0.00	1.20	
A/20	2	0.007	Plate	Plate (Complex)	0.00	0.60	
A/22	4	0.048	Plate	Plate (Complex)	0.00	0.60	
A/3	1	0.492	Plate	Plate (Complex)	0.00	1.20	
A/31	2	0.038	Plate	Plate (Rect. 1.44x0.56)	17.28	0.60	
A/6	2	0.160	Plate	Plate (Complex)	0.00	0.84	
B/1176	1	0.673	Beam	HEA360	107.28	0.00	
B/1179	1	1.232	Beam	HEA360	196.44	0.00	
B/1181	1	0.695	Beam	HEA360	110.88	0.00	
B/1582	1	0.338	Beam	IPE240	196.68	0.00	
B/1725	1	0.110	Beam	HEA220	39.00	0.00	
B/24	1	1.638	Beam	HEA360	261.24	0.00	
B/25	1	0.474	Beam	HEA280	110.88	0.00	
B/58	1	1.499	Beam	HEA360	238.92	0.00	
B/6	1	1.578	Beam	HEA360	251.52	0.00	
B/60	1	1.032	Beam	HEA360	164.52	0.00	
B/646	4	1.352	Beam	IPE240	196.44	0.00	
B/647	5	0.955	Beam	IPE240	110.88	0.00	
B/66	1	0.840	Beam	HEA280	196.44	0.00	
B/87	2	0.056	Beam	Plate (Rect. 0.88x0.98)	11.76	0.84	

Total Weight: 13.8

Back

Virtual Work Packs - Reports

Work Pack Stats displays a list of all the work packages, with quantities and associated hours.



Work Pack Stats

Work Pack	Hrs	Length	Quantity Counts				
			Spools	Valves+	Supt's	Welds	Bolt-Ups
IP02304ALBCS_005	391.1	107.20	7	2	9	3	2
IP023R03ALBCS_001	508.4	133.08	5	0	18	7	0
IP023R03ALBCS_002	478.6	131.35	5	0	11	8	0
IP023R03ALBCS_003	396.1	105.44	5	1	12	6	1
IP023R03ALBCS_004	524.5	146.39	4	0	12	1	0
IP023R03BLBCS_008	424.8	121.65	4	0	6	2	1
IP023R03BLBCS_009	494.0	237.00	12	16	24	8	5
IP023R03MLBCS_005	495.1	135.17	11	0	11	12	0
IP023R03MLBCS_006	481.1	131.58	10	1	8	10	7
IP023R03MLBCS_007	488.9	134.34	6	0	12	5	0
IP023R03MLBCS_010	472.5	155.94	13	7	13	10	2
IP023R03MLBCS_011	493.3	144.65	11	3	18	11	0
IP023R04ALBCS_001	470.5	128.40	3	0	12	6	0
IP023R04ALBCS_002	444.5	126.70	4	0	8	0	0

Back

Bentley Sustaining Infrastructure

Status Visualization

Status information from task progress or from external data sources

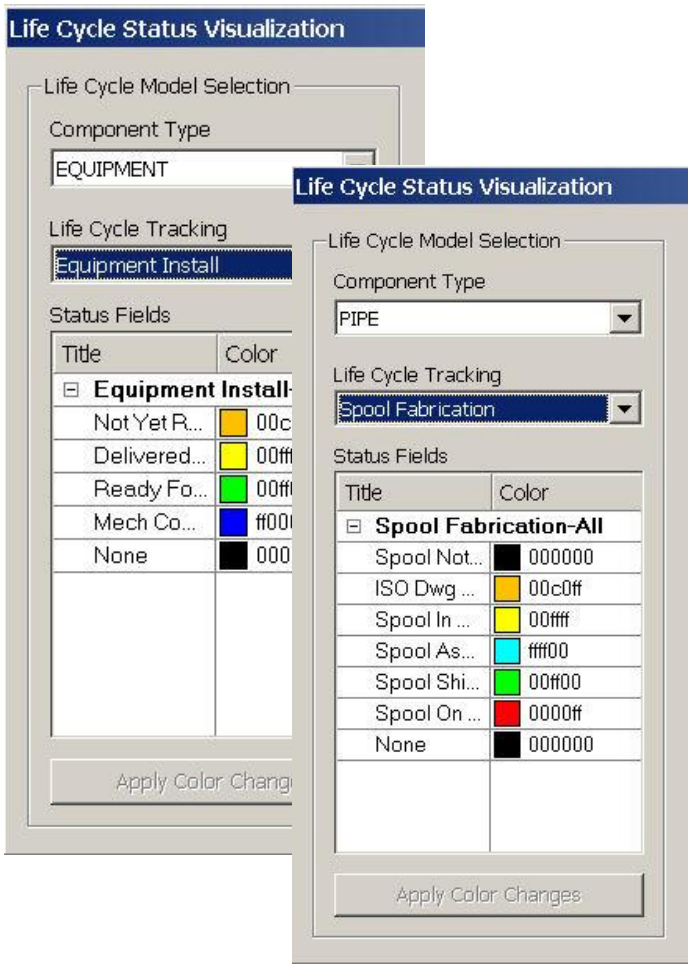
No Progress	
Received	
Staged	
Erected	
Final Complete	
Punch Complete	

Back

Status Visualization – Standard Modes

- Spool fabrication
- Equipment installation
- ISO release status
- Pipe material availability
- Advance revision notices
- Work step tracking
- Test pack status
- QA/QC status
- Work package constraints

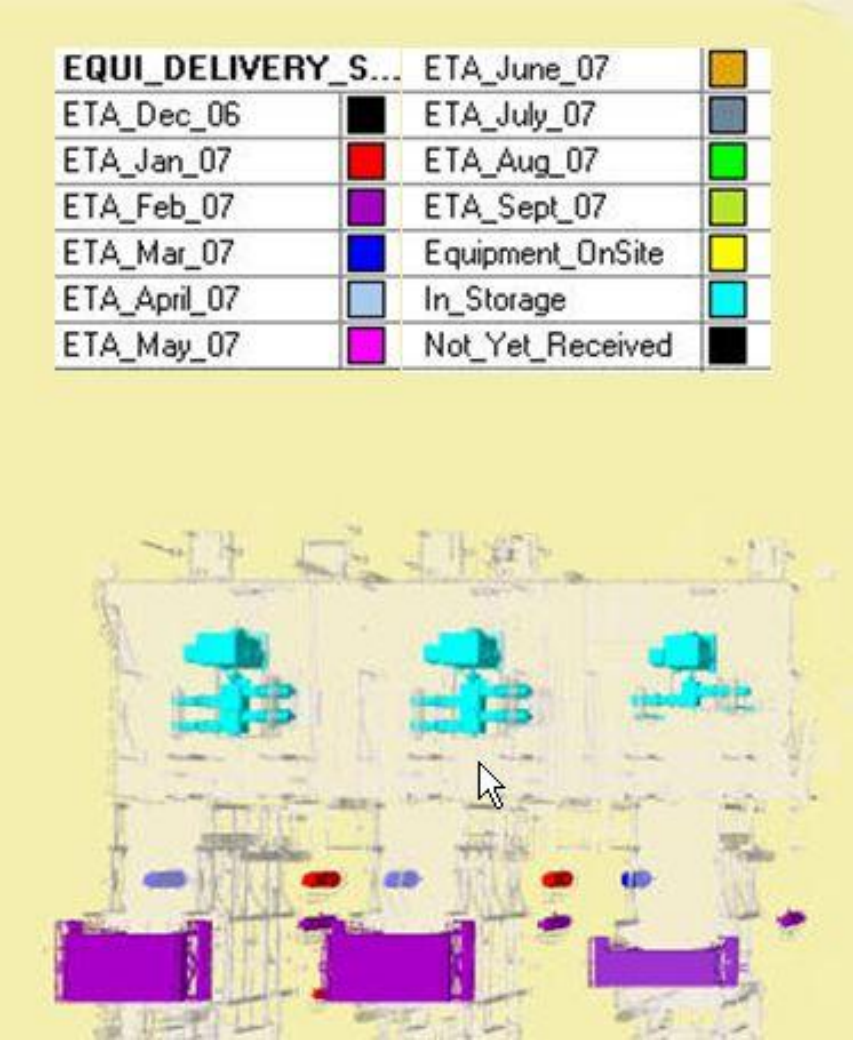
Project / user specific status modes can also be created.



Back

Bentley Sustaining Infrastructure

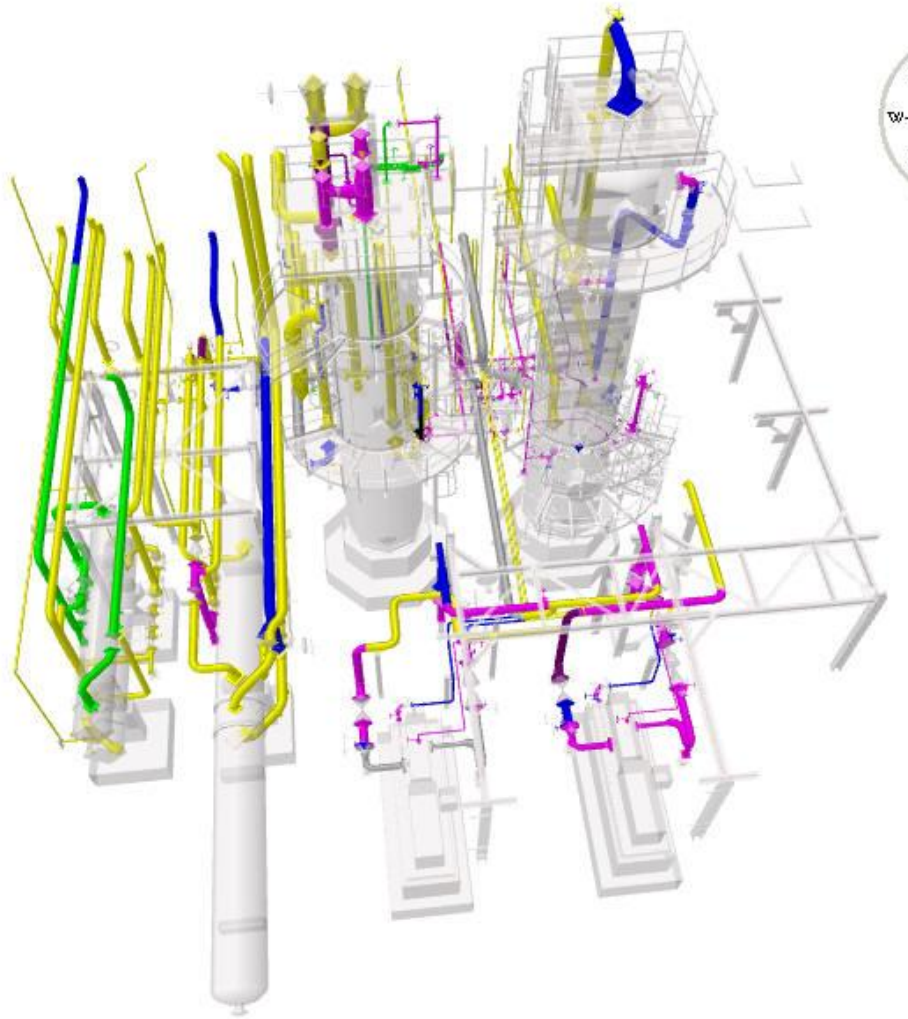
Status Visualization – Equip Delivery

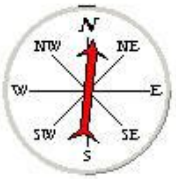


Back

Bentley Sustaining Infrastructure

Status Visualization – Pipe Fab





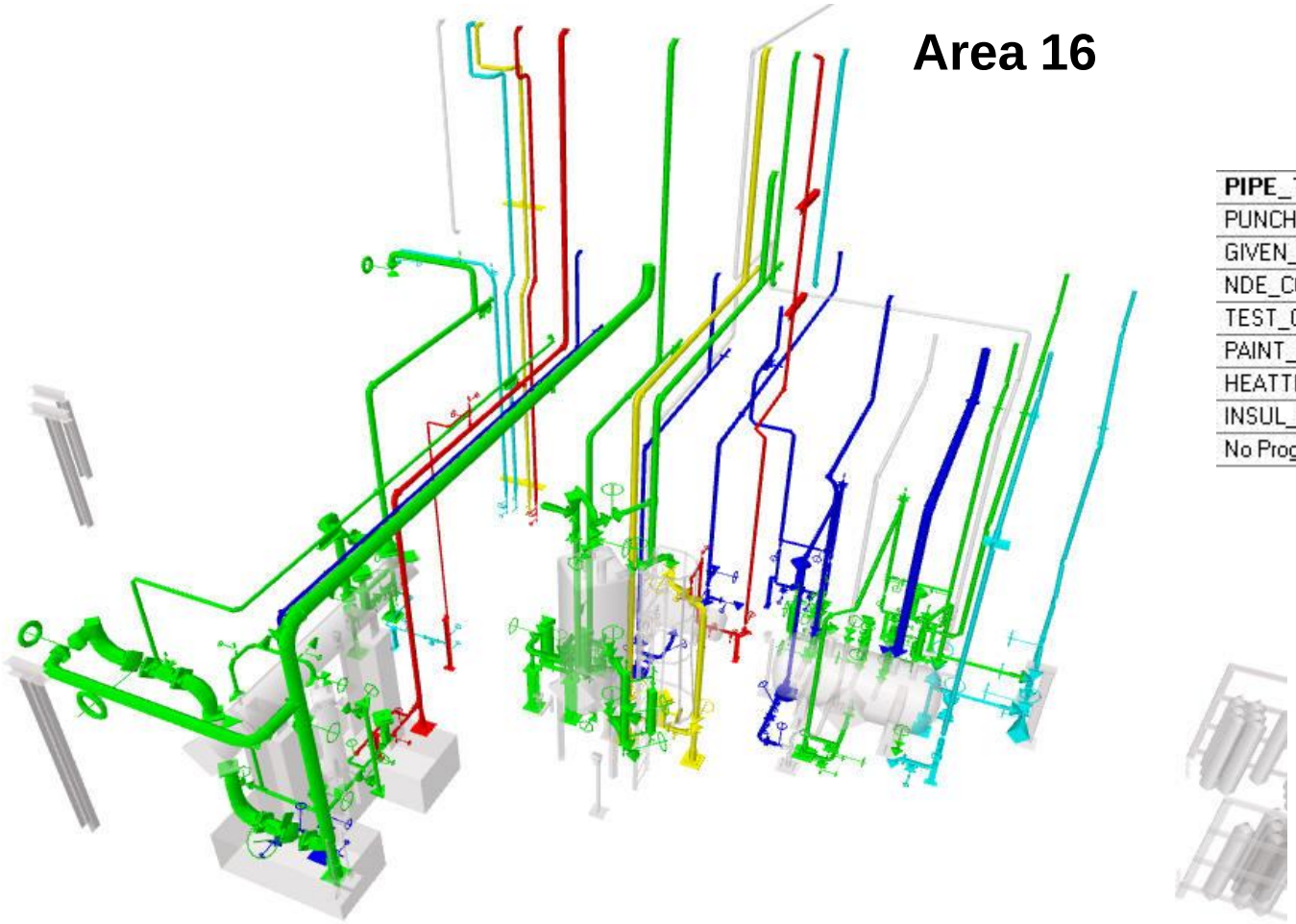
Area 15

SPOOL_Delivery_St...	
ETA_3+WEEKS	
ETA_2WEEKS	
DUE	
PASS_DUE_2WEE...	
PASS_DUE_3+WE...	
SHIPPED	
ONSITE	
ON_HOLD	
NO_DATE	

Back

Bentley Sustaining Infrastructure

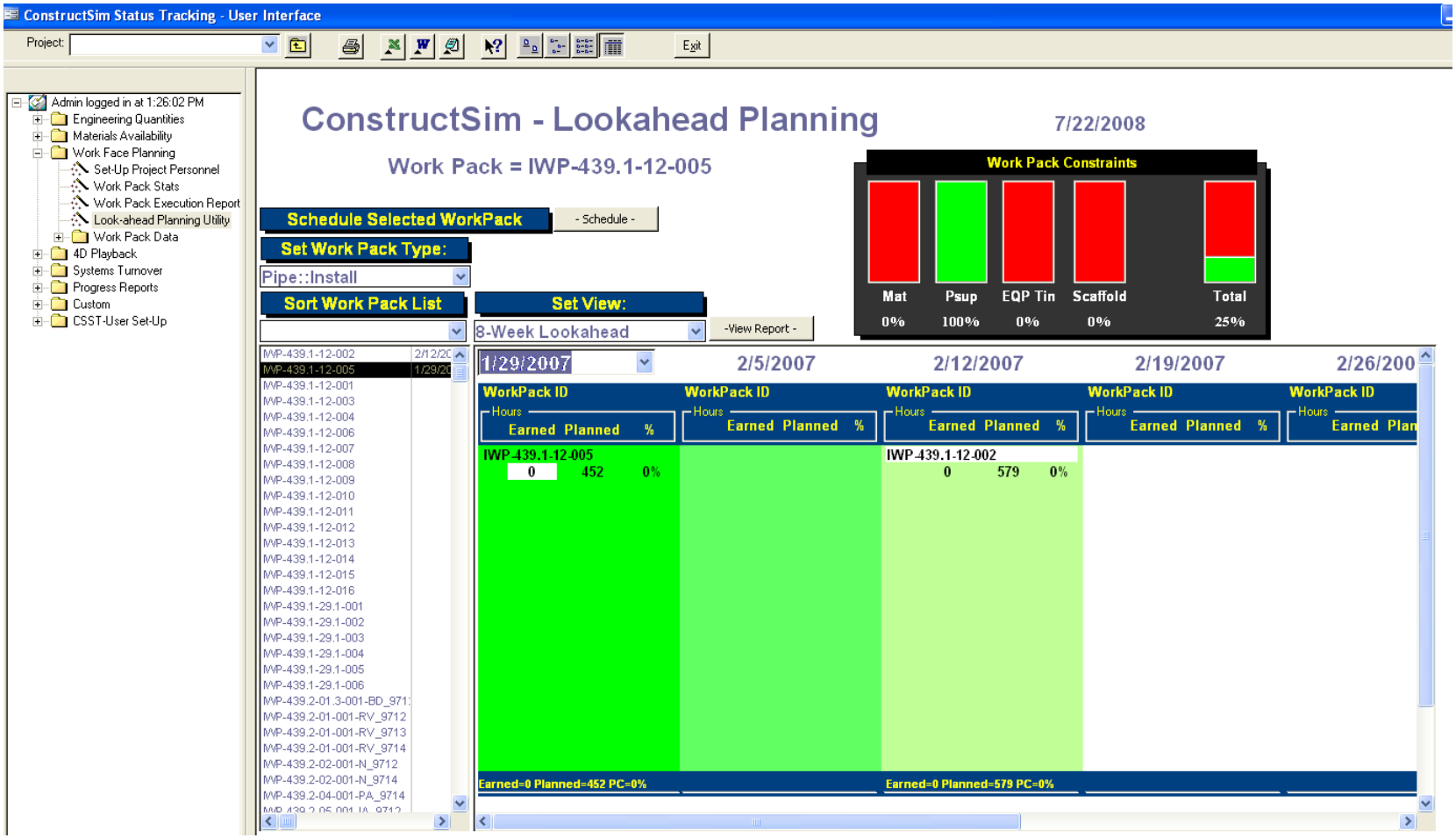
Status Visualization – Test Status



Back

Bentley Sustaining Infrastructure

Look-Ahead Planning

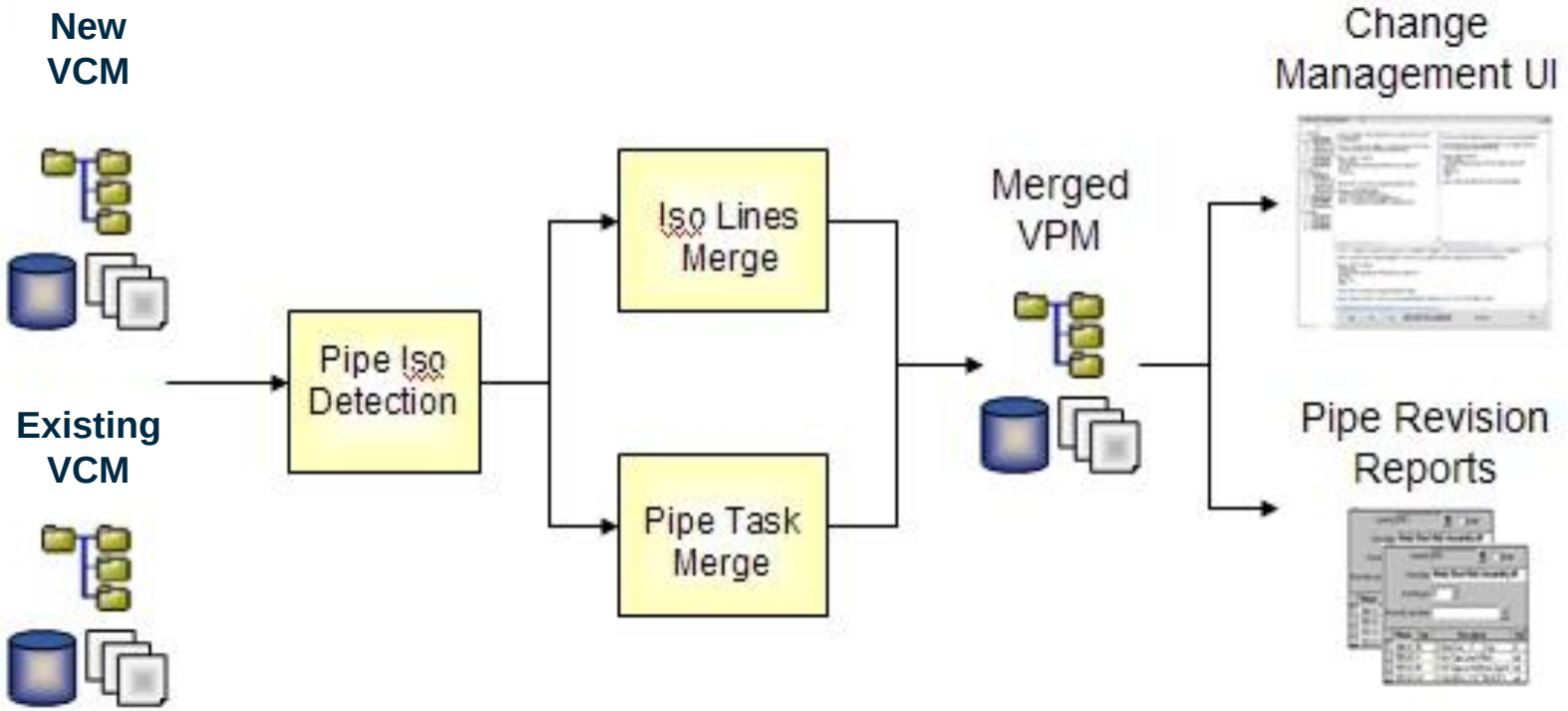


Back

Bentley Sustaining Infrastructure

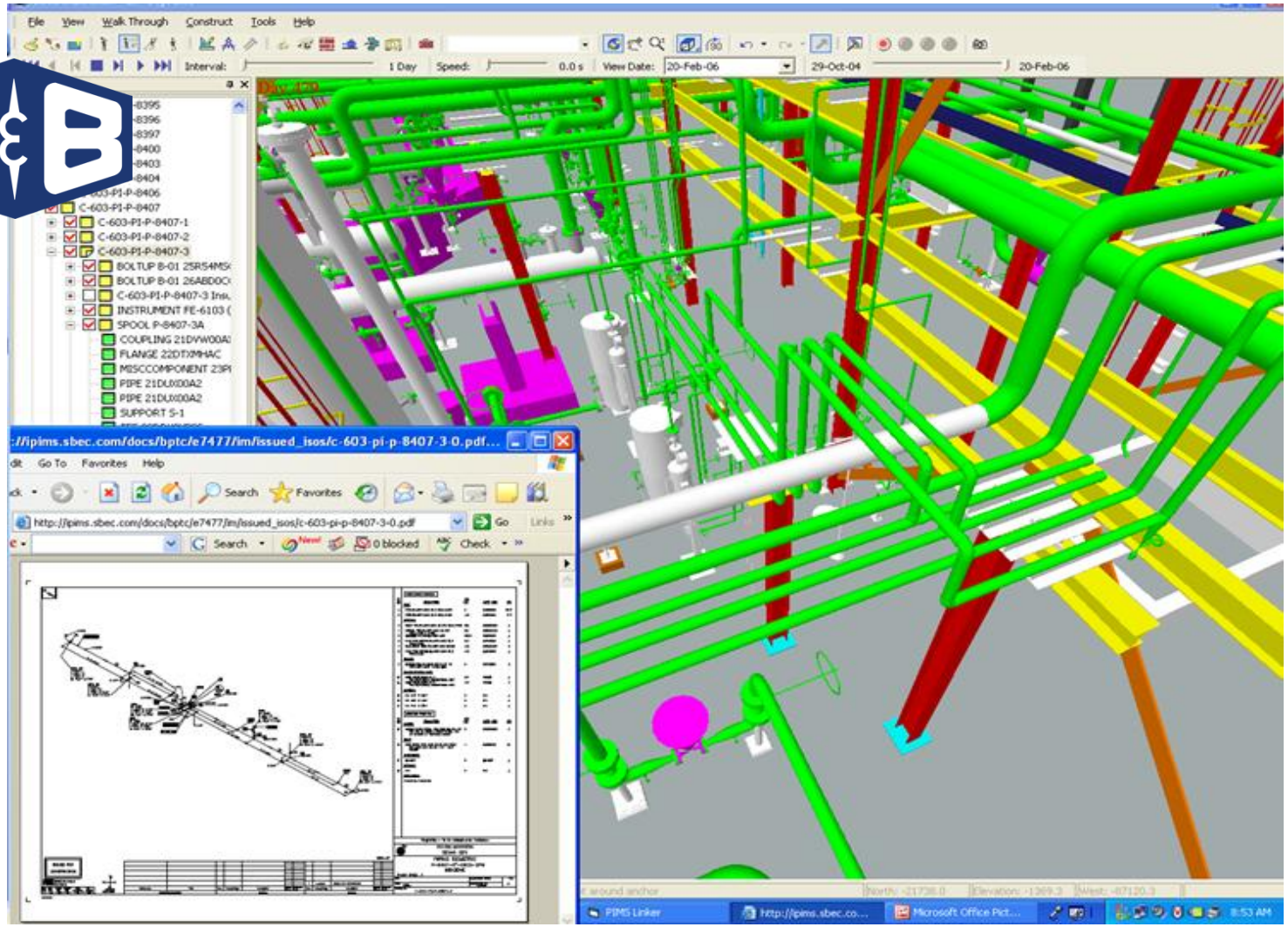
Change Management

ConstructSim keeps track of the changes in pipe isometrics and propagates the changes throughout the Virtual Construction Model



Bentley Sustaining Infrastructure

Document Linker



Bentley Sustaining Infrastructure

Progress Reports

Pipe Progress Tracking By Area

ConstructSim - Pipe Progress By Area

1/17/2006

ConstructSim

Drop Filter Fields Here

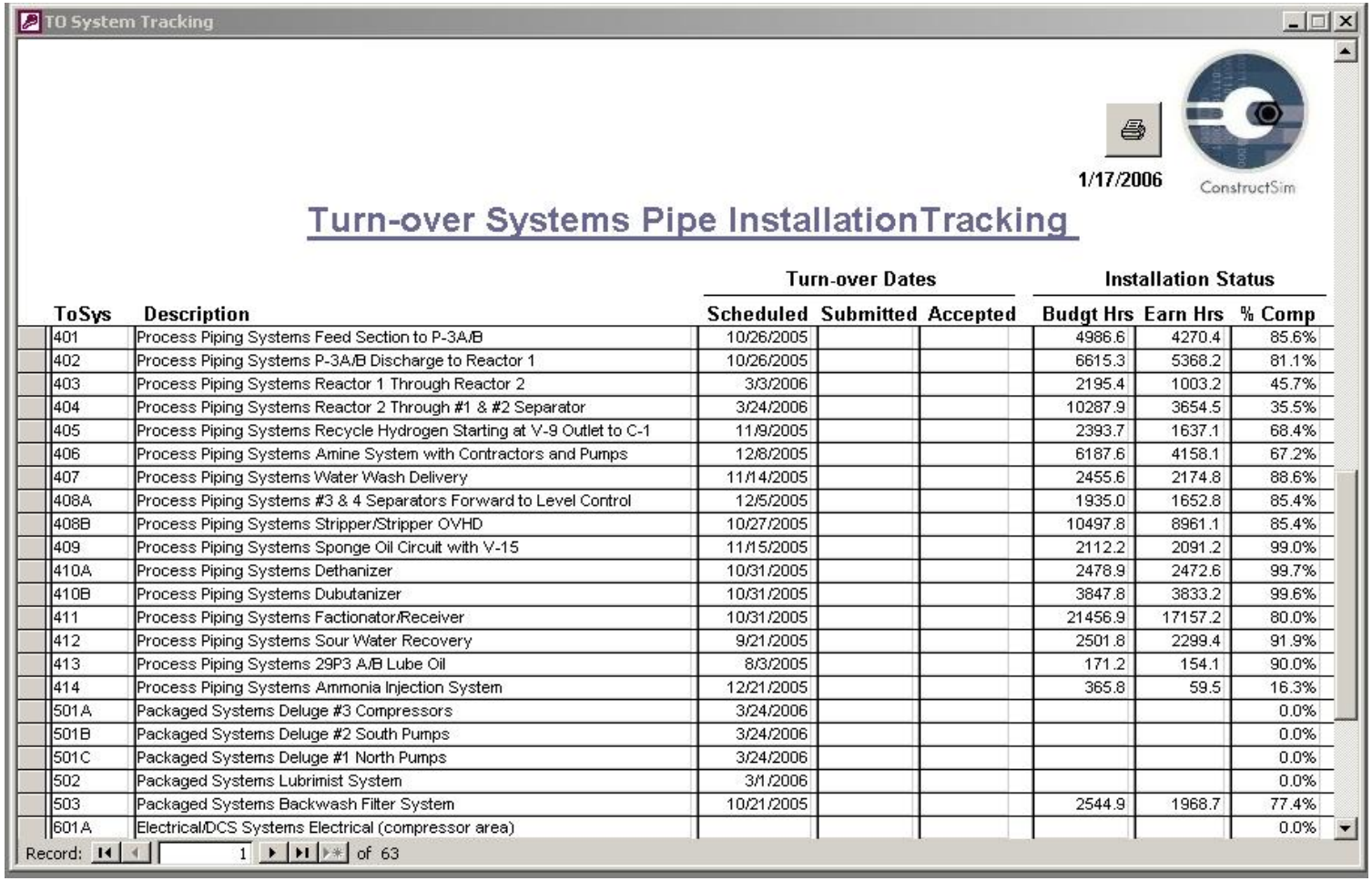
Drop Column Fields Here

AREA	Matl	Size	LF-Bdgt	LF-Earn	Welds-Bdgt	Welds-Earn	BoltUp-Bdgt	BoltUp-Earn	Supp-Bdgt	Supp-Earn	Valve-Bdgt	Valve-Earn	SpItem-Bdgt	SpItem-Earn	Instr-Bdgt	Instr-Earn	Bdgt-Hrs	Earn-Hrs
⊟01A	⊞(Blank)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00
	⊞CS		4,672.00	3,869.51	516.00	457.40	563.00	442.70	227.00	198.03	24.00	21.90	0.00	0.00	13.00	11.80	7835.18	6,706.25
	⊞SS		549.00	490.90	256.00	230.40	47.00	39.60	42.00	24.30	0.00	0.00	0.00	0.00	0.00	0.00	1594.568	1,361.60
	Total		*5,221.00*	*4,360.41*	*772.00*	*687.80*	*610.00*	*482.30*	*269.00*	*222.33*	*24.00*	*21.90*	*0.00*	*0.00*	*13.00*	*11.80*	*9429.748*	*8,067.86*
⊞02A			3,248.00	974.60	675.00	252.10	407.00	39.60	137.00	9.90	14.00	0.00	1.00	0.00	32.00	6.30	5859.222	1,443.06
⊞02B			2,071.00	1,451.80	1,124.00	831.60	592.00	335.30	136.00	67.70	34.00	20.70	0.00	0.00	11.00	8.10	6175.871	4,417.29
⊞03A			1,923.00	1,043.80	797.00	232.20	339.00	157.80	111.00	42.60	19.00	2.70	0.00	0.00	5.00	2.80	5170.759	2,106.60
⊞03B			2,703.00	1,304.31	750.00	192.00	393.00	135.30	88.00	44.10	31.00	10.10	0.00	0.00	12.00	5.60	4844.726	2,217.65
⊞03C			3,914.00	1,704.60	918.00	373.50	420.00	183.60	161.00	70.20	43.00	17.10	1.00	0.00	13.00	4.50	7018.475	3,286.24
⊞04A			6,163.00	4,462.30	588.00	514.80	1,056.00	662.40	237.00	187.20	46.00	36.90	19.00	10.80	12.00	6.30	10188.762	7,929.86
⊞04B			2,574.00	1,683.90	196.00	164.70	406.00	354.60	143.00	99.00	24.00	21.60	7.00	6.30	3.00	1.80	4372.483	3,015.67
⊞04C			2,783.00	1,564.90	222.00	151.20	452.00	297.00	144.00	68.40	24.00	13.50	7.00	4.50	3.00	1.80	4654.137	2,622.26
⊞04D			2,804.00	1,605.30	200.00	123.30	342.00	162.00	136.00	59.40	20.00	8.10	5.00	0.90	3.00	0.00	4537.145	2,484.25
⊞04E			753.00	621.70	146.00	131.40	49.00	44.10	52.00	46.80	18.00	16.20	0.00	0.00	3.00	0.90	1391.979	1,244.36
⊞04F			5,218.00	4,129.60	929.00	823.90	373.00	285.00	417.00	217.20	20.00	18.30	6.00	5.40	7.00	4.50	10089.007	7,884.35
⊞04G			1,388.00	1,170.80	118.00	106.20	264.00	237.60	30.00	25.20	11.00	9.90	4.00	3.60	1.00	0.90	2103.347	1,818.14
⊞05A			16,932.00	13,800.70	3,900.00	2,939.50	1,433.00	1,108.00	1,160.00	832.40	70.00	57.00	0.00	0.00	7.00	6.30	35992.431	28,187.92
⊞06A			3,030.00	2,448.40	295.00	252.40	518.00	503.00	127.00	113.20	40.00	38.90	2.00	2.00	10.00	8.90	4748.588	4,330.17
⊞06B			1,298.00	1,129.70	199.00	181.50	364.00	324.60	68.00	51.60	22.00	19.80	2.00	0.00	5.00	4.50	2501.447	2,173.56
⊞07A			3,920.00	2,288.60	1,116.00	779.70	956.00	700.50	173.00	117.70	31.00	21.80	5.00	2.00	11.00	8.30	7858.459	5,009.40
⊞07B			1,961.00	1,288.00	412.00	226.20	245.00	166.60	61.00	35.10	14.00	12.40	3.00	2.00	3.00	0.90	3417.825	2,271.66
⊞07C			2,840.00	2,462.80	314.00	286.40	489.00	451.70	118.00	103.90	30.00	27.90	7.00	6.30	8.00	6.60	4970.018	4,370.65
⊞08A			2,287.00	2,133.80	131.00	122.90	250.00	244.60	115.00	109.60	23.00	22.40	2.00	2.00	5.00	4.80	3845.625	3,613.22
⊞08B			1,739.00	1,668.20	192.00	187.50	282.00	276.60	77.00	74.90	21.00	20.50	1.00	0.90	7.00	6.90	3033.407	2,926.49
⊞08C			3,694.00	3,499.10	582.00	555.60	654.00	636.80	148.00	140.20	38.00	37.10	9.00	8.70	11.00	10.60	6602.699	6,275.63
⊞09A			3,231.00	2,838.50	462.00	394.80	883.00	809.70	174.00	158.10	55.00	50.00	4.00	3.70	20.00	18.10	5934.656	5,512.81
⊞09B			2,975.00	2,453.90	457.00	412.50	333.00	304.20	82.00	72.60	28.00	26.00	0.00	0.00	11.00	9.90	4767.925	4,311.47
⊞10A			4,335.00	3,014.90	393.00	329.20	603.00	523.20	157.00	118.40	31.00	27.60	3.00	2.90	13.00	10.80	6239.189	5,078.62
⊞11A			703.00	633.30	102.00	91.80	0.00	0.00	55.00	49.50	0.00	0.00	0.00	0.00	0.00	0.00	1298.68	1,169.62
Grand Total																		

Back

Bentley Sustaining Infrastructure

Progress Reports



Turn-over Systems Pipe InstallationTracking

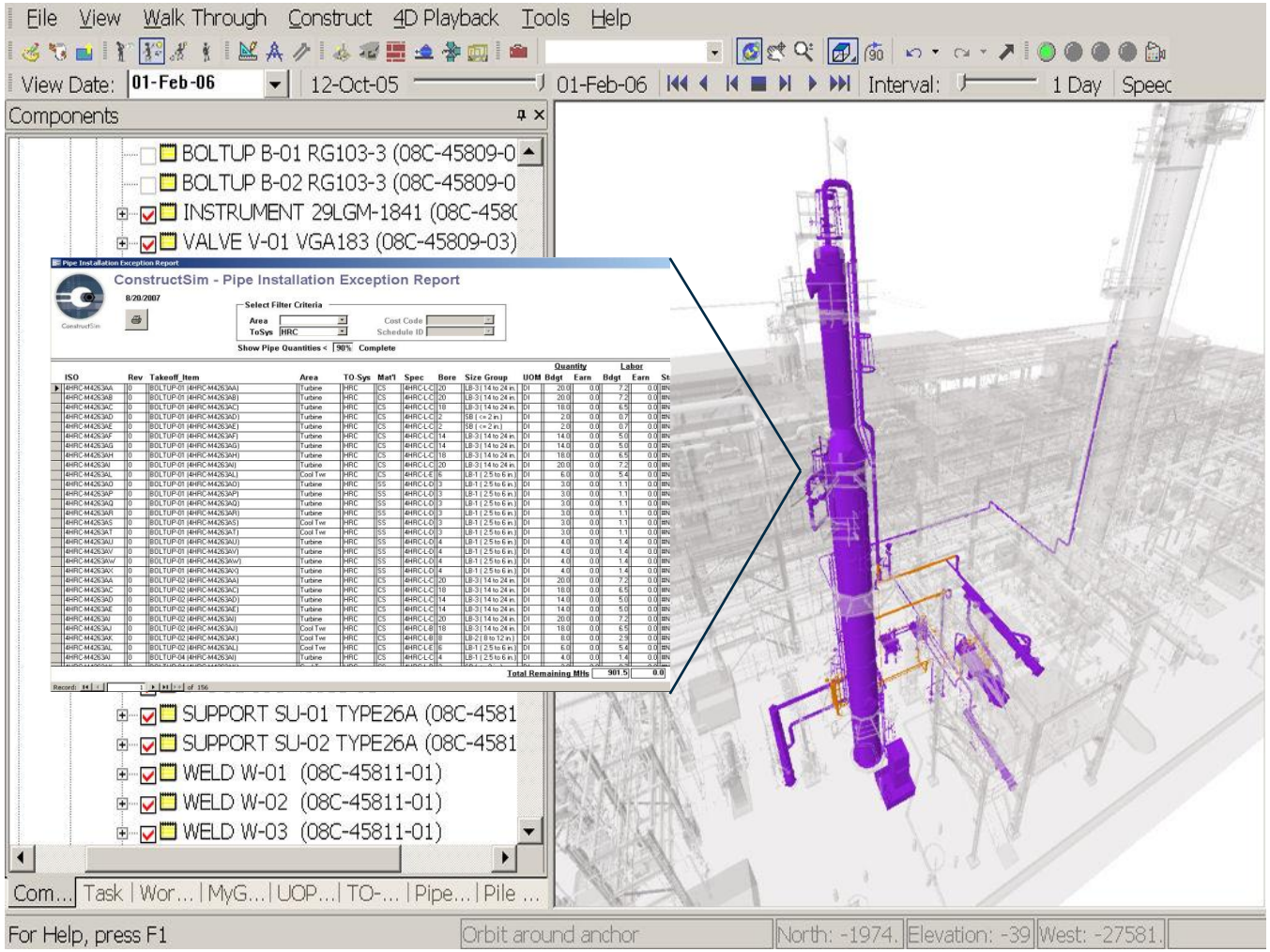
			Turn-over Dates			Installation Status		
	ToSys	Description	Scheduled	Submitted	Accepted	Budgt Hrs	Earn Hrs	% Comp
	401	Process Piping Systems Feed Section to P-3A/B	10/26/2005			4986.6	4270.4	85.6%
	402	Process Piping Systems P-3A/B Discharge to Reactor 1	10/26/2005			6615.3	5368.2	81.1%
	403	Process Piping Systems Reactor 1 Through Reactor 2	3/3/2006			2195.4	1003.2	45.7%
	404	Process Piping Systems Reactor 2 Through #1 & #2 Separator	3/24/2006			10287.9	3654.5	35.5%
	405	Process Piping Systems Recycle Hydrogen Starting at V-9 Outlet to C-1	11/9/2005			2393.7	1637.1	68.4%
	406	Process Piping Systems Amine System with Contractors and Pumps	12/8/2005			6187.6	4158.1	67.2%
	407	Process Piping Systems Water Wash Delivery	11/14/2005			2455.6	2174.8	88.6%
	408A	Process Piping Systems #3 & 4 Separators Forward to Level Control	12/5/2005			1935.0	1652.8	85.4%
	408B	Process Piping Systems Stripper/Stripper OVHD	10/27/2005			10497.8	8961.1	85.4%
	409	Process Piping Systems Sponge Oil Circuit with V-15	11/15/2005			2112.2	2091.2	99.0%
	410A	Process Piping Systems Dethanizer	10/31/2005			2478.9	2472.6	99.7%
	410B	Process Piping Systems Dubutanizer	10/31/2005			3847.8	3833.2	99.6%
	411	Process Piping Systems Factionator/Receiver	10/31/2005			21456.9	17157.2	80.0%
	412	Process Piping Systems Sour Water Recovery	9/21/2005			2501.8	2299.4	91.9%
	413	Process Piping Systems 29P3 A/B Lube Oil	8/3/2005			171.2	154.1	90.0%
	414	Process Piping Systems Ammonia Injection System	12/21/2005			365.8	59.5	16.3%
	501A	Packaged Systems Deluge #3 Compressors	3/24/2006					0.0%
	501B	Packaged Systems Deluge #2 South Pumps	3/24/2006					0.0%
	501C	Packaged Systems Deluge #1 North Pumps	3/24/2006					0.0%
	502	Packaged Systems Lubrimist System	3/1/2006					0.0%
	503	Packaged Systems Backwash Filter System	10/21/2005			2544.9	1968.7	77.4%
	601A	Electrical/DCS Systems Electrical (compressor area)						0.0%

Record: 1 of 63

Back

Bentley Sustaining Infrastructure

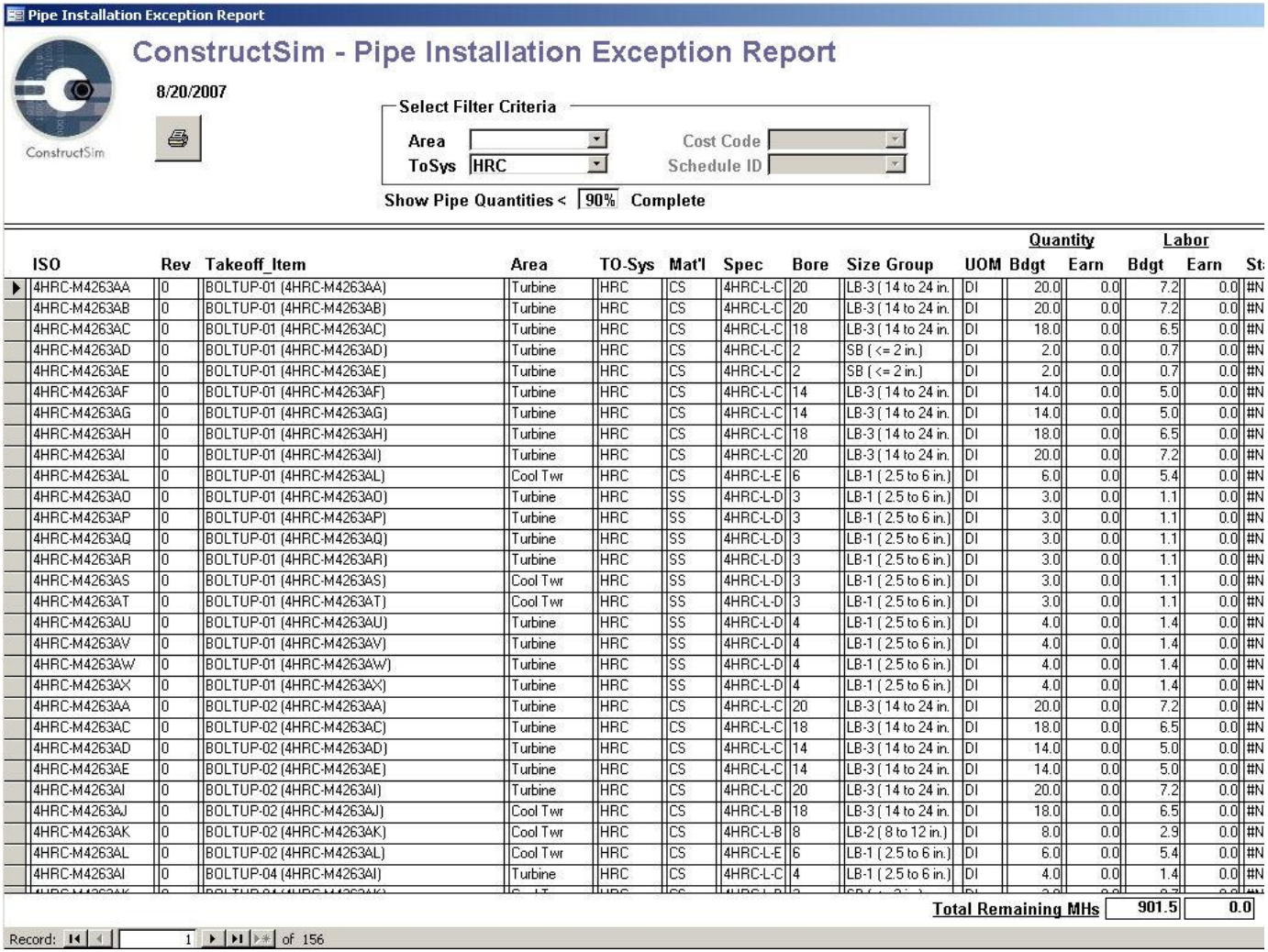
Systems Turnover



Back

Bentley Sustaining Infrastructure

Systems Turnover – Incomplete Work



Pipe Installation Exception Report

ConstructSim - Pipe Installation Exception Report

8/20/2007

Select Filter Criteria

Area: | Cost Code:
ToSys: HRC | Schedule ID:

Show Pipe Quantities < 90% Complete

										Quantity		Labor		
ISO	Rev	Takeoff_Item	Area	TO-Sys	Mat'l	Spec	Bore	Size Group	UOM	Bdgt	Earn	Bdgt	Earn	St
4HRC-M4263AA	0	BOLTUP-01 (4HRC-M4263AA)	Turbine	HRC	CS	4HRC-L-C	20	LB-3 (14 to 24 in.	DI	20.0	0.0	7.2	0.0	#N
4HRC-M4263AB	0	BOLTUP-01 (4HRC-M4263AB)	Turbine	HRC	CS	4HRC-L-C	20	LB-3 (14 to 24 in.	DI	20.0	0.0	7.2	0.0	#N
4HRC-M4263AC	0	BOLTUP-01 (4HRC-M4263AC)	Turbine	HRC	CS	4HRC-L-C	18	LB-3 (14 to 24 in.	DI	18.0	0.0	6.5	0.0	#N
4HRC-M4263AD	0	BOLTUP-01 (4HRC-M4263AD)	Turbine	HRC	CS	4HRC-L-C	2	SB (<= 2 in.)	DI	2.0	0.0	0.7	0.0	#N
4HRC-M4263AE	0	BOLTUP-01 (4HRC-M4263AE)	Turbine	HRC	CS	4HRC-L-C	2	SB (<= 2 in.)	DI	2.0	0.0	0.7	0.0	#N
4HRC-M4263AF	0	BOLTUP-01 (4HRC-M4263AF)	Turbine	HRC	CS	4HRC-L-C	14	LB-3 (14 to 24 in.	DI	14.0	0.0	5.0	0.0	#N
4HRC-M4263AG	0	BOLTUP-01 (4HRC-M4263AG)	Turbine	HRC	CS	4HRC-L-C	14	LB-3 (14 to 24 in.	DI	14.0	0.0	5.0	0.0	#N
4HRC-M4263AH	0	BOLTUP-01 (4HRC-M4263AH)	Turbine	HRC	CS	4HRC-L-C	18	LB-3 (14 to 24 in.	DI	18.0	0.0	6.5	0.0	#N
4HRC-M4263AI	0	BOLTUP-01 (4HRC-M4263AI)	Turbine	HRC	CS	4HRC-L-C	20	LB-3 (14 to 24 in.	DI	20.0	0.0	7.2	0.0	#N
4HRC-M4263AL	0	BOLTUP-01 (4HRC-M4263AL)	Cool Twr	HRC	CS	4HRC-L-E	6	LB-1 (2.5 to 6 in.)	DI	6.0	0.0	5.4	0.0	#N
4HRC-M4263AO	0	BOLTUP-01 (4HRC-M4263AO)	Turbine	HRC	SS	4HRC-L-D	3	LB-1 (2.5 to 6 in.)	DI	3.0	0.0	1.1	0.0	#N
4HRC-M4263AP	0	BOLTUP-01 (4HRC-M4263AP)	Turbine	HRC	SS	4HRC-L-D	3	LB-1 (2.5 to 6 in.)	DI	3.0	0.0	1.1	0.0	#N
4HRC-M4263AQ	0	BOLTUP-01 (4HRC-M4263AQ)	Turbine	HRC	SS	4HRC-L-D	3	LB-1 (2.5 to 6 in.)	DI	3.0	0.0	1.1	0.0	#N
4HRC-M4263AR	0	BOLTUP-01 (4HRC-M4263AR)	Turbine	HRC	SS	4HRC-L-D	3	LB-1 (2.5 to 6 in.)	DI	3.0	0.0	1.1	0.0	#N
4HRC-M4263AS	0	BOLTUP-01 (4HRC-M4263AS)	Cool Twr	HRC	SS	4HRC-L-D	3	LB-1 (2.5 to 6 in.)	DI	3.0	0.0	1.1	0.0	#N
4HRC-M4263AT	0	BOLTUP-01 (4HRC-M4263AT)	Cool Twr	HRC	SS	4HRC-L-D	3	LB-1 (2.5 to 6 in.)	DI	3.0	0.0	1.1	0.0	#N
4HRC-M4263AU	0	BOLTUP-01 (4HRC-M4263AU)	Turbine	HRC	SS	4HRC-L-D	4	LB-1 (2.5 to 6 in.)	DI	4.0	0.0	1.4	0.0	#N
4HRC-M4263AV	0	BOLTUP-01 (4HRC-M4263AV)	Turbine	HRC	SS	4HRC-L-D	4	LB-1 (2.5 to 6 in.)	DI	4.0	0.0	1.4	0.0	#N
4HRC-M4263AW	0	BOLTUP-01 (4HRC-M4263AW)	Turbine	HRC	SS	4HRC-L-D	4	LB-1 (2.5 to 6 in.)	DI	4.0	0.0	1.4	0.0	#N
4HRC-M4263AX	0	BOLTUP-01 (4HRC-M4263AX)	Turbine	HRC	SS	4HRC-L-D	4	LB-1 (2.5 to 6 in.)	DI	4.0	0.0	1.4	0.0	#N
4HRC-M4263AA	0	BOLTUP-02 (4HRC-M4263AA)	Turbine	HRC	CS	4HRC-L-C	20	LB-3 (14 to 24 in.	DI	20.0	0.0	7.2	0.0	#N
4HRC-M4263AC	0	BOLTUP-02 (4HRC-M4263AC)	Turbine	HRC	CS	4HRC-L-C	18	LB-3 (14 to 24 in.	DI	18.0	0.0	6.5	0.0	#N
4HRC-M4263AD	0	BOLTUP-02 (4HRC-M4263AD)	Turbine	HRC	CS	4HRC-L-C	14	LB-3 (14 to 24 in.	DI	14.0	0.0	5.0	0.0	#N
4HRC-M4263AE	0	BOLTUP-02 (4HRC-M4263AE)	Turbine	HRC	CS	4HRC-L-C	14	LB-3 (14 to 24 in.	DI	14.0	0.0	5.0	0.0	#N
4HRC-M4263AI	0	BOLTUP-02 (4HRC-M4263AI)	Turbine	HRC	CS	4HRC-L-C	20	LB-3 (14 to 24 in.	DI	20.0	0.0	7.2	0.0	#N
4HRC-M4263AJ	0	BOLTUP-02 (4HRC-M4263AJ)	Cool Twr	HRC	CS	4HRC-L-B	18	LB-3 (14 to 24 in.	DI	18.0	0.0	6.5	0.0	#N
4HRC-M4263AK	0	BOLTUP-02 (4HRC-M4263AK)	Cool Twr	HRC	CS	4HRC-L-B	8	LB-2 (8 to 12 in.)	DI	8.0	0.0	2.9	0.0	#N
4HRC-M4263AL	0	BOLTUP-02 (4HRC-M4263AL)	Cool Twr	HRC	CS	4HRC-L-E	6	LB-1 (2.5 to 6 in.)	DI	6.0	0.0	5.4	0.0	#N
4HRC-M4263AI	0	BOLTUP-04 (4HRC-M4263AI)	Turbine	HRC	CS	4HRC-L-C	4	LB-1 (2.5 to 6 in.)	DI	4.0	0.0	1.4	0.0	#N

Total Remaining MHs: 901.5 | 0.0

Record: 1 of 156

Back

Bentley Sustaining Infrastructure

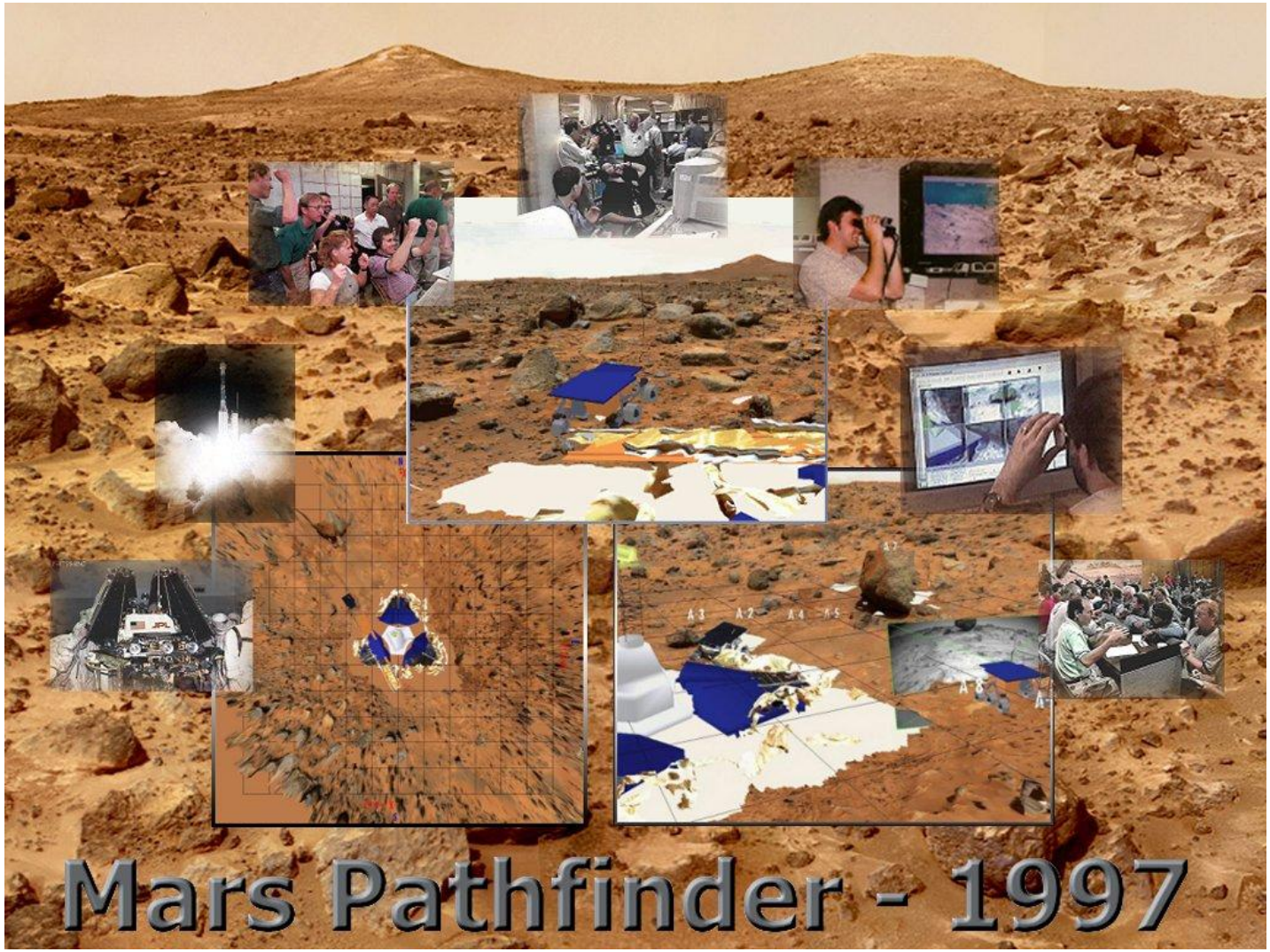
Work Process Topics

- Engineering Inputs
- Path of Construction
- Work Pack Development
- Sub-contractor coordination
- Lookahead Planning
- Equipment Planning & Tracking
- Shop Fabrication – Modular Construction
- Streamline Materials
- Progressing & Reporting
- Revision Management
- Turnover Systems
- Revision Analysis

Construction Driven Engineering

- **Pull Driven Scheduling**
  - Prioritization / monitoring of engineering & fabrication
- **Defining data requirements**
  - Engineering to construction handovers
  - Specifications
  - Contractual Terms
- **Technology Approach**
  - Federated Information Workflows

NASA Heritage

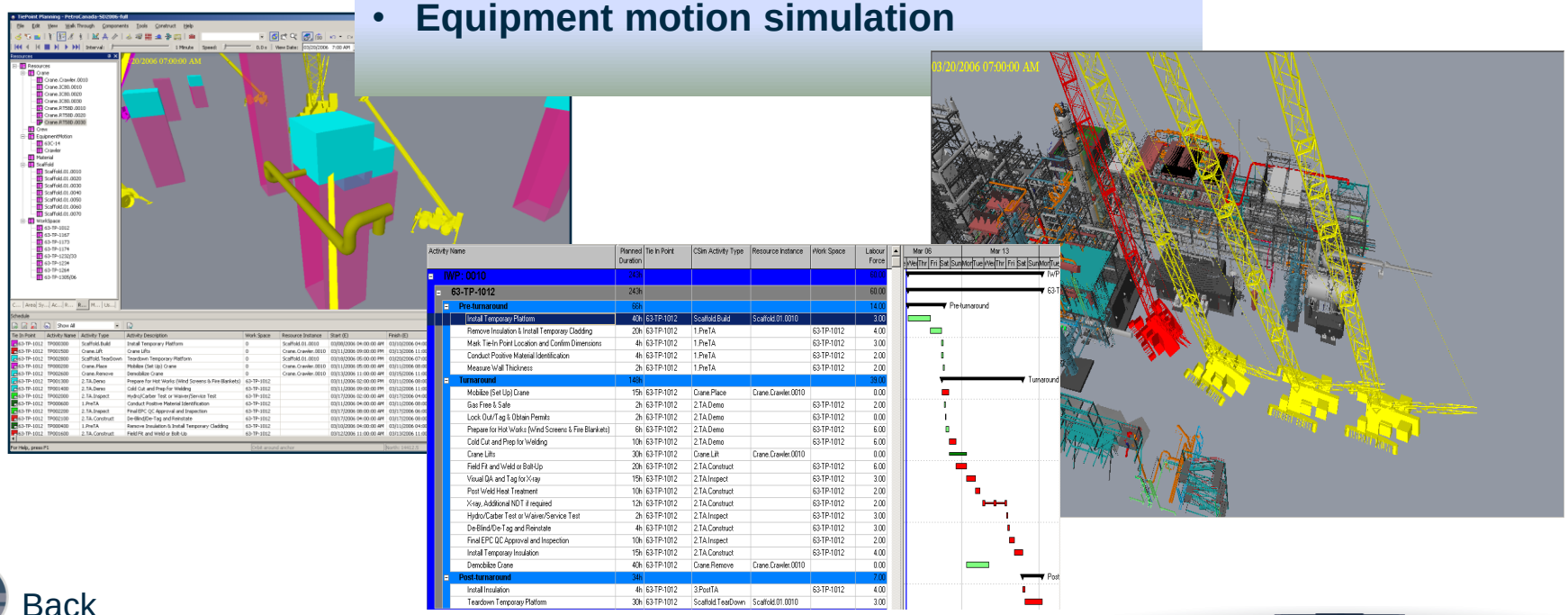


Back

Bentley Sustaining Infrastructure

Beta - Scaffold / Crane Resource Module

- Dynamic link to P3E
- Automated link to Tie-in List (XLS format)
- User specifies placement of
  - Cranes
  - Scaffold / Temp Work Platforms
  - Crew workspaces
- Crew Density Analysis
- Equipment motion simulation

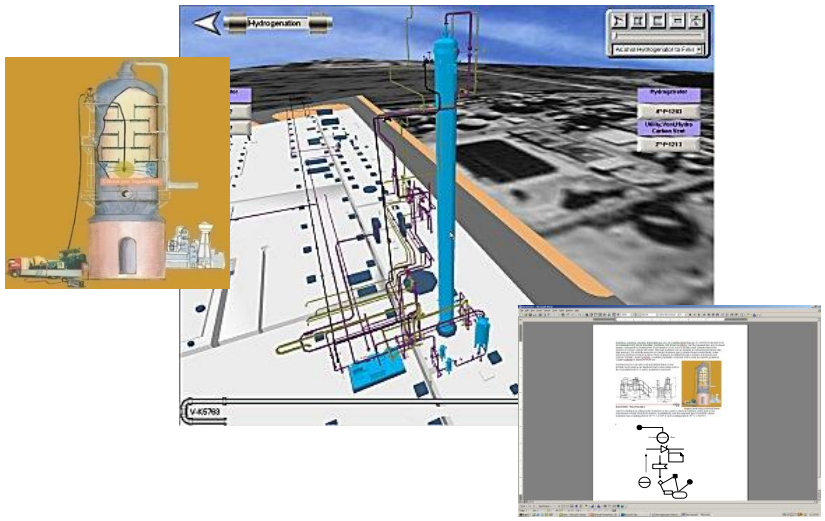


Activity Name	Planned Duration	Tie In Point	CSim Activity Type	Resource Instance	Work Space	Labour Force
IWP: 0010	240h					60.00
63-TP-1012	240h					60.00
Pre-turnaround	60h					14.00
Install Temporary Platform	40h	63-TP-1012	Scaffold Build	Scaffold.01.0010		3.00
Remove Insulation & Install Temporary Cladding	20h	63-TP-1012	1.PreTA		63-TP-1012	4.00
Mark Tie-In Point Location and Confirm Dimensions	4h	63-TP-1012	1.PreTA		63-TP-1012	3.00
Conduct Positive Material Identification	4h	63-TP-1012	1.PreTA		63-TP-1012	2.00
Measure Wall Thickness	2h	63-TP-1012	1.PreTA		63-TP-1012	2.00
Turnaround	140h					39.00
Mobilize (Set Up) Crane	15h	63-TP-1012	Crane Place	Crane.Crawler.0010		0.00
Gas Free & Safe	2h	63-TP-1012	2.TA Demo		63-TP-1012	2.00
Lock Out/Tag & Obtain Permits	2h	63-TP-1012	2.TA Demo		63-TP-1012	0.00
Prepare for Hot Works (Wind Screens & Fire Blankets)	6h	63-TP-1012	2.TA Demo		63-TP-1012	6.00
Cold Cut and Prep for Welding	10h	63-TP-1012	2.TA Demo		63-TP-1012	6.00
Crane Lifts	30h	63-TP-1012	Crane Lift	Crane.Crawler.0010		0.00
Field Fit and Weld or Bolt-Up	20h	63-TP-1012	2.TA Construct		63-TP-1012	6.00
Visual QA and Tag for X-ray	15h	63-TP-1012	2.TA Inspect		63-TP-1012	3.00
Post Weld Heat Treatment	10h	63-TP-1012	2.TA Construct		63-TP-1012	2.00
X-ray, Additional NDT if required	12h	63-TP-1012	2.TA Construct		63-TP-1012	2.00
Hydro/Caiber Test or Waiver/Service Test	2h	63-TP-1012	2.TA Inspect		63-TP-1012	3.00
De-Blind/De-Tag and Reinstate	4h	63-TP-1012	2.TA Construct		63-TP-1012	3.00
Final EPC QC Approval and Inspection	10h	63-TP-1012	2.TA Inspect		63-TP-1012	2.00
Install Temporary Insulation	15h	63-TP-1012	2.TA Construct		63-TP-1012	4.00
Demobilize Crane	40h	63-TP-1012	Crane Remove	Crane.Crawler.0010		0.00
Post-turnaround	34h					7.00
Install Insulation	4h	63-TP-1012	3.PostTA		63-TP-1012	4.00
Teardown Temporary Platform	30h	63-TP-1012	Scaffold.TeaDown	Scaffold.01.0010		3.00

Back

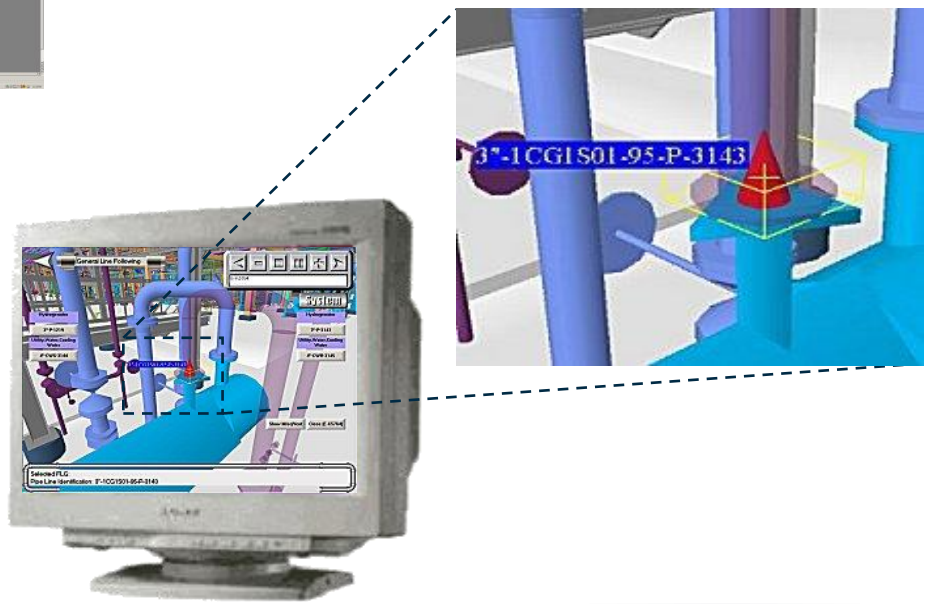
Bentley Sustaining Infrastructure

OpSim Insight



- Perform systems analysis and training in a virtual model
- Drive the Virtual Model from PowerPoint training slides
- Capture operator knowledge and experience digitally in the virtual model

Enable a better trained workforce in a safer work environment.



Back