

The background features a complex, organic wireframe mesh in a light gray color. A solid blue horizontal band spans the middle of the image, serving as a backdrop for the main text.

Talk Data to Me: Project Success with BIM 360

Audrey Voorhies and Brendan Dillon
BIM Coordinator and BIM Manager

Join the conversation #AU2017

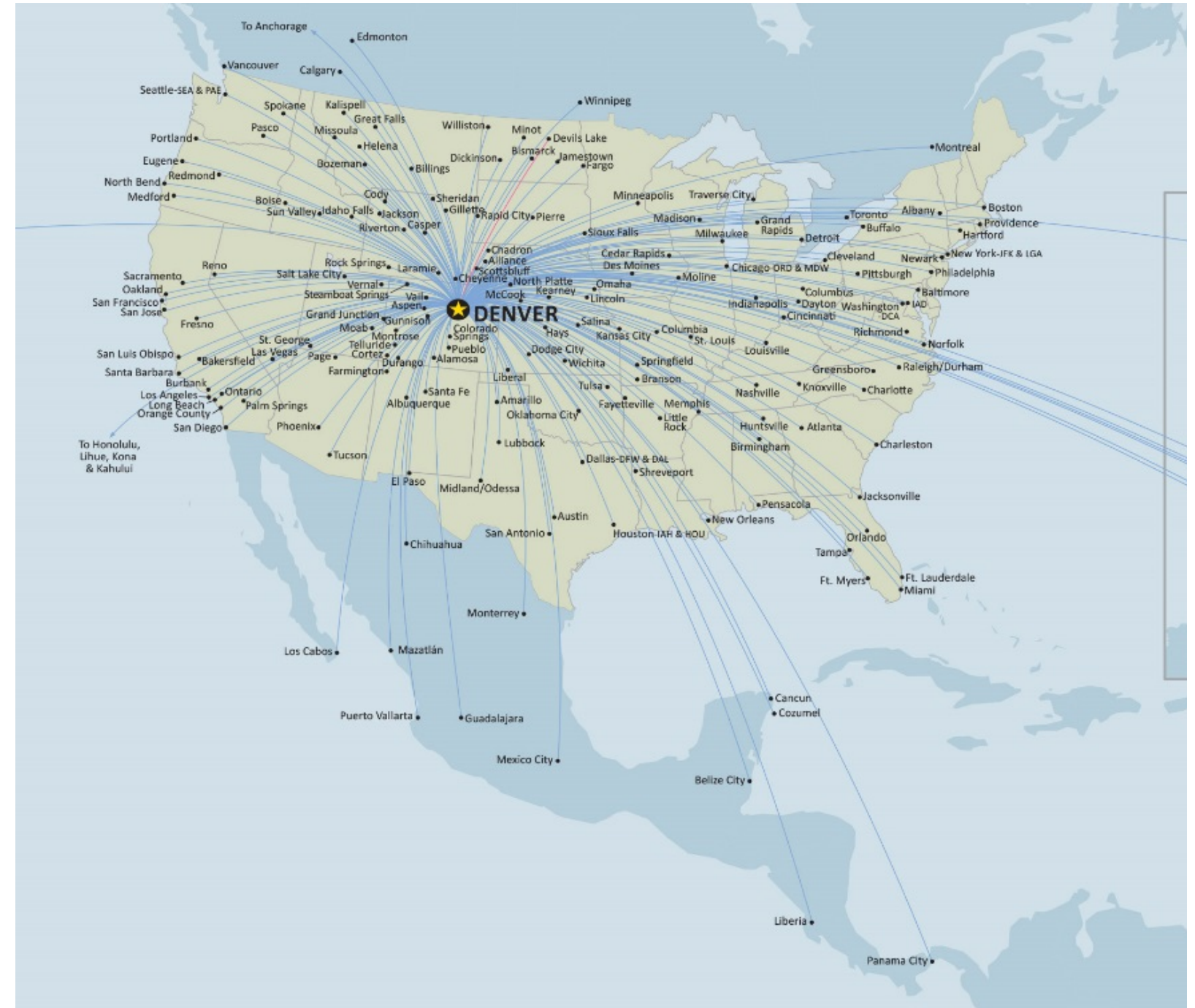
Objectives – DEN Workflow

- BXP (BIM Execution Plan) for large Capital projects
- Create *Project Slice* from Revit to the overall Facility model
- Setup the BIM 360 Team site
- DEN BIM Review process at project submittals at kickoff
(30/60/90/100) DEN BIM Model Review Audit form
- At 60% design submittal review Asset data from Revit models and BIM 360 Glue spatial coordination
- At 100% set-up BIM 360 Field and provide Dynamo scripts for model clean-up
- Warranty tracking

DEN

DEN Facility Overview

- Opened in 1995
- U.S. ranking: 6th busiest by passengers
- 34000+ Employees
- 180 Destinations
- 58.3 million passengers in 2016
- Average daily passengers: 159,000 in 2016
- \$26 billion economic engine
- 53 square miles



DEN Flight Map



WORKFLOW

BXP – BIM Execution Plan

- Clearly defines responsibilities by consultant, and set by a legal contract document
- Binds BIM requirements
- Project Goals/ BIM users by name and establishes model ownership
- BIM Process Design
- BIM & Facility Data Requirements



LIVE LIFE. TRAVEL WELL.

Design Standards Manual

BIM

Denver International Airport
Airport Infrastructure Management

2017

[illegible]

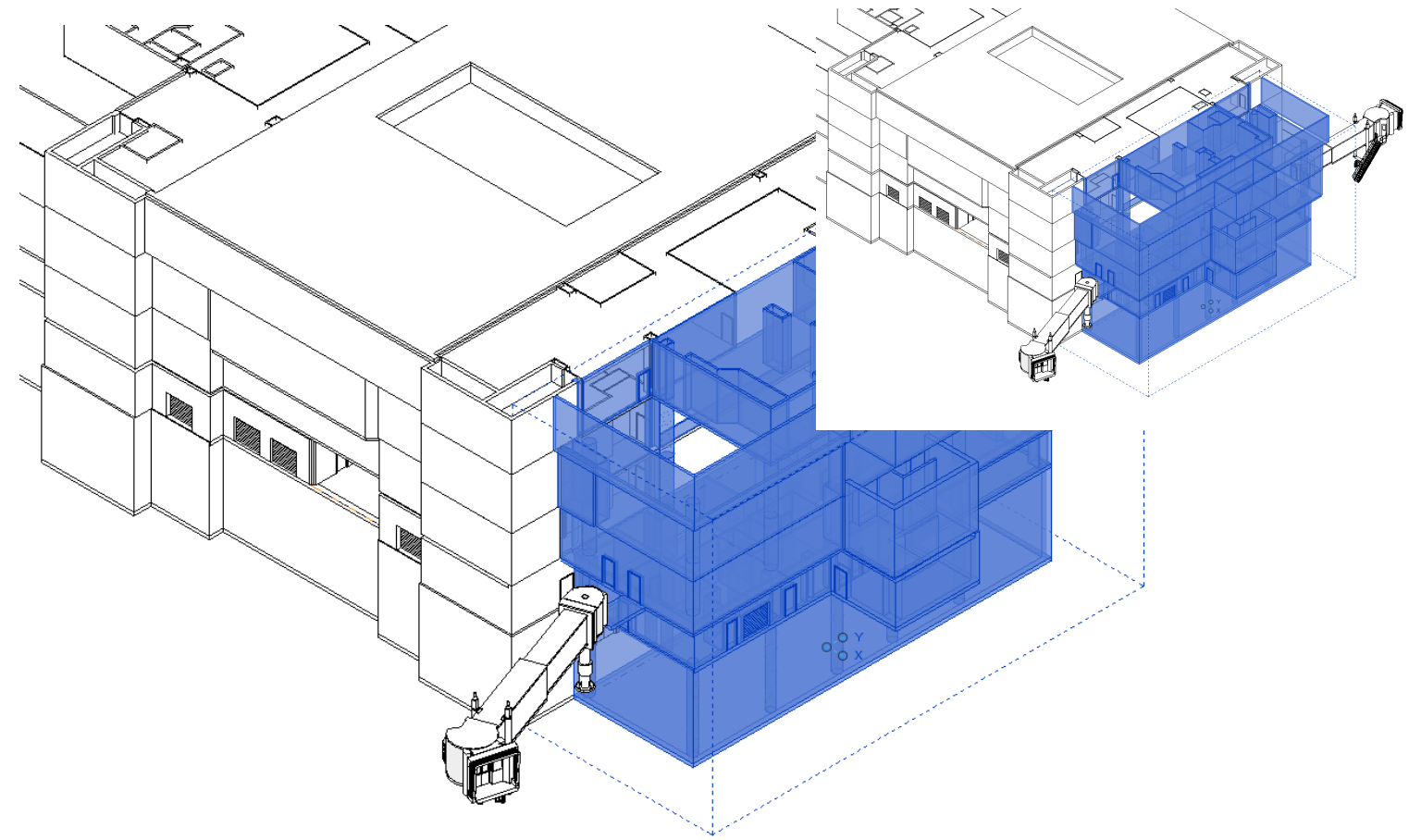
Design Standards Manual 2: Attachment 1 – BIM Project Execution Plan

Airport Infrastructure Management

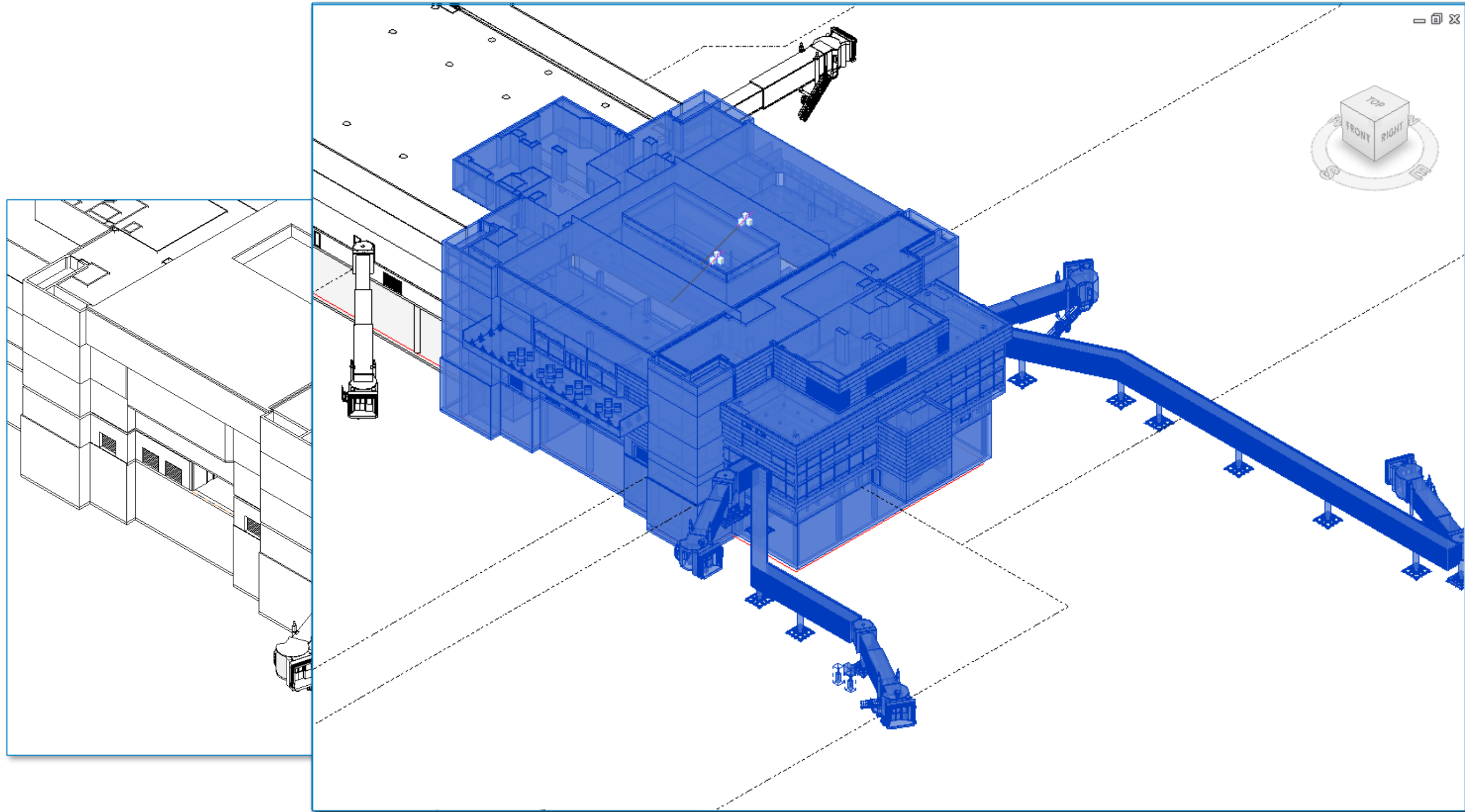
PROJECT SLICE

Project Slice

- Define Scope in Model
- Create Model Group
- Convert Group to Linked Model
- Transfer Project Standards/Views/ Families
- Project Magic Happens!
- Bind Link
- Cleanup











Project Slice



BIM 360 Team

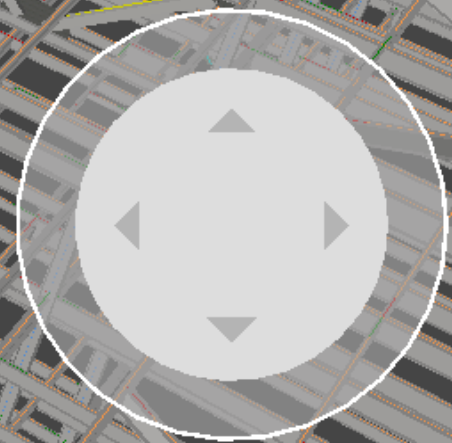
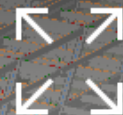
BIM 360 Team

- Collaborate with C4R (Collaboration for Revit)
- Access to model progress outside of the BIM group
- Design review
- More efficient workflow with off-site consultants
- Mobile / tablet access
- Create markups

B Team DEN BIM		
PINNED ALL OWNED BY ME SHARED WITH ME		
Create Project		
Name	Created By	Created On
 CCA_West_Expansion	Brendan Dillon	Mar 6, 2017
 CCB_East_Expansion	Sonepraseuth Thammasine	Apr 10, 2017
 CCB_West_Expansion	Brendan Dillon	Mar 22, 2017
 CCC_East_Expansion	Brendan Dillon	Mar 6, 2017
 Concourse Life Safety	Sonepraseuth Thammasine	Mar 13, 2017
 CPT_1, 3, 4 Boilers Design	Audrey Voorhies	Aug 21, 2017
 DEN Test	Brendan Dillon	Jan 27, 2017
 TML-Great Hall	Brendan Dillon	Jan 27, 2017



TML_DEN-S_Central.rvt



DEN BIM Review

DEN BIM Model Review Audit – Project Process

- Kickoff 30/60/90/100
- Interim Reviews
- Leveraging past model reviews for future reviews

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	
1												1.2 DEN Template used	1.6 CAD files must be LINKED and not imported	1.7 No Exploded .DWG files	1.11 Project Location - LDP Coordinates	2.1 Model all designed elements	2.2 All modeled elements tagged correctly	2.7 Systems Connected	2.8 All Assets Identified	2.9 Asset Design Information Complete	2.11 All rooms/space placed/Enclosed/numbered	2.12 Spatial Coordination	2.13 Model Reconciliation	3.7 Schedules natively generated (no drafting views, links, imports or detail groups)	7.1 Meets Revit Family File naming conventions	
2	Project	Consultant	Prime	DISC	Date	REV	BIM Co	PM	PKG	OA Grade	Crit Grade	54%	71%	75%	75%	63%	75%	25%	6%	6%	0%	####	####	50%	63%	
3									100	50%	29%	1	2	2	2	2	0	0	0	0	0	na	na	0	0	
4									100	67%	58%	1	2	1	2	2	2	2	0	0	0	na	na	0	2	
5									100	67%	46%	0	2	2	2	2	2	1	0	0	0	na	na	0	0	
6									60	65%	75%	2	1	2	2	2	2	na	1	1	na	na	na	0	2	
7									90	80%	63%	2	2	2	2	1	2	0	1	1	0	na	na	2	2	
8									30	68%	70%	0	2	2	2	2	2	0	na	na	0	na	na	2	2	
9									30	80%	70%	2	2	2	2	0	2	0	na	na	0	na	na	2	2	
10									100	64%	50%	1	2	1	2	0	2	na	0	0	0	na	na	2	1	
11									100	84%	71%	2	2	2	2	2	2	1	0	0	0	na	na	2	2	
12									90	78%	63%	2	0	2	2	2	2	2	1	0	0	0	na	na	2	2
13									30	0%	0%	0	0	0	0	0	0	0	na	na	0	na	na	0	0	
14									30	0%	0%	0	0	0	0	0	0	0	na	na	0	na	na	0	0	
15									90	95%	82%	2	2	2	2	2	2	na	0	0	2	na	na	2	2	
16									30	70%	67%	0	1	2	2	2	2	na	0	0	0	na	na	2	2	

5						C	C	C		C	C	Standards are being reviewed		
6						F	F	F		F	F	Standards are not followed, project accuracy and performance are not impacted		
7												Critical, project accuracy and performance are impacted		
8						BIM Audit - Central File								
9						File Name								
	Item #	Item Description	Crit	Reference	9/5 Example	90% CD	60% CD	90% CD	100% CD	FA CILITY	Total Fails	Details	Comment	
10														
11		Score			70%	n/a	n/a	n/a	n/a	n/a	70%			
12		Pass			32	0	0	0	0	0	32			
13		Caution			0	0	0	0	0	0	0			
14		Fail			14	0	0	0	0	0	#			
15	1. Model Setup													
16	1.1	Project File Name (meets standards)			P						0			
17	1.2	DEN Template Used	X		F									
18	1.3	Phases			P									
19	1.4	Worksets			P									
20	1.5	Correct Project Information			P									
21	1.6	CAD files must be LINKED and not imported	X		F						6			
22	1.7	No Exploded .DWG files	X		F						6			
23	1.8	Browser Organization			P									
24	1.9	Links Pinned in Place			P									
25	1.10	Revit Links - Set to Overlay & Relative Pathing			P									
26	1.11	Project Location - LDP Coordinates	X		F									
27	2. Modeling													
28	2.1	Model all designed elements	X		F						1			
29	2.2	All modeled elements tagged	X		F									
30	2.3	All modeled elements numbered (Type Mark & Mark)			P									
31	2.4	Model content from DEN Library			P									
32	2.5	No In-Place modeled content			P									
33	2.6	No unapproved Generic Models			P									
34	2.7	Systems Connected	X		F									
35	2.8	All Assets Identified	X		F									
36	2.9	Asset Design Information Complete	X		F									
37	2.10	Minimal Use of Groups - Model groups should not be used, Detail groups should be avoided.			P									
38	2.11	All rooms/space placed/Enclosed/numbered	X		F									
39	2.12	Spatial Coordination	X		F									
40	2.13	Model Reconciliation	X		F						1			
41	3. Model Views													
42	3.1	Use Schedule: _View List to keep views organized			x	x	x	x	x	x			The Schedule: _View List schedule will allow you to view a complete list of all views in the model and organize them quickly	
43	3.2	Number of Views			238									
44	3.3	Number of Views not on sheets			87									
45	3.4	View and Schedule Naming - Sheet views in ALL CAPS, working views in Title Caps			P						0			
46	3.5	Browser organization - Views (01 All) - Organized by Discipline>Category>Sub-Discipline>Associated Level			P						0			
47	3.6	Proper use of Scope boxes			P									
48	3.7	Schedules natively generated (no drafting views, links, imports or detail	X		F									
49	3.8	Navis Export View Setup			P						0			
50	4. Drawing Sheets													
51	4.0	General Sheet Comments			X	X	X	X	X	X				
52	4.1	Number of Sheets			207									

DEN BIM Model Review Audit – Overview

- 47 Total Line Items
 - Model Setup, Modeling, Model Views, Drawing Sheets, Annotation, Revit Families & QAQC
- 18 **Critical Items**
- Asset Data Requirements
- Pass / Fail / Caution

[illegible]

Critical Model Requirements – Facilities

- 1.1 DEN Template used
- 1.3 Phasing
- 1.6 CAD files must be LINKED and not imported
- 1.7 No Exploded .DWG files
- 1.11 Project Location – LDP Coordinates
- 2.1 Model all designed elements
- 2.2 all modeled elements tagged correctly
- 2.7 Systems Connected
- 2.9 All Rooms / Spaces
- 2.10 Spatial Coordination
- 2.11 Model Reconciliation
- 3.1 All Assets Identified
- 3.2 Asset Design Information Complete
- 4.6 Schedules natively generated (no drafting views, links, imports or detail groups)

Critical Model Requirements – Civil

- DEN Templates used
- Project Location – LDP coordinates
- Model all designed elements as objects: (panels, manholes, pipes, etc.)
- Used required layers, DEN and FAA
- Use Object Data Tables per FAA
- System Networks Connected
- All Assets Identified
- Spatial Coordination
- Model Reconciliation
- Schedules (Tables) natively generated (no drafted schedules)

ASSETS

A 3D rendered image of an industrial facility. The scene is filled with a complex network of large, smooth pipes. Most of the pipes are a vibrant green, while a few are a light blue. These pipes are connected to various pieces of industrial machinery, including large cylindrical tanks and rectangular processing units. The environment is a spacious, well-lit interior with a checkered floor and concrete pillars. The lighting is soft and even, highlighting the metallic textures of the pipes and machinery. The overall impression is one of a modern, efficient industrial system.

Asset Management Overview

- Maximo and data systems administrators for AIM
- Maintenance planning support
- Facility condition assessment program
- Warranty and commissioning
- Division KPI analysis, audit and support
- BIM & Civil CAD support airport wide



Asset Data Requirements

- What DEN defines as an Asset is broken down and specified by DEN Asset Type and DEN Functional Area in the attached Appendix C, of the Design Standard Manual. Assets must be identified by the 60 percent deliverable. In general, these asset types include but are not limited to:
 - Airfield panels
 - Electrical Equipment/Runway lighting
 - Manholes, drainage, and conveyance structures
 - Mechanical Equipment and Fixtures
 - Plumbing Equipment and Fixtures
 - Water line equipment and

Asset Data Requirements

- Asset Information
 - Location (door label) QR code
 - Asset Type
 - Manufacturer
 - Model
 - Serial Number
 - Etc.

Asset ID	
QR Code	
Description	AHU3
Location	PTC_03_17W_322
Asset Type	AIR HANDLING UNIT
Functional Area	HVAC
Status	Designed
Manufacturer	
Model	
Serial #	
Purchase Price	
Install Date	
Expected Life	
Condition	
Warranty End Date	
Vendor	

A screenshot of a web-based asset management application. The interface includes a top navigation bar with links like 'Browsers (0)', 'Go To', 'Reports', 'Start Center', 'Profile', 'Sign Out', and 'Help'. Below this, there are several sections: a search area with filters for 'Site: DIA', 'Type:', 'Status: OPERATING', and 'set Template: >>'; an 'Attachments' section with a red box around the 'Attachments' link; a 'Details' section with fields for 'Parent:', 'Maintain Hierarchy?', 'Location: TML_01_10W', 'Bin:', 'Rotating Item:', 'Condition Code:', 'Meter Group:', 'Usage:', 'Created By: 127378', 'Adams, Anthony - DIA', and 'Fuel Force?'; an 'Onboarding' section with checkboxes for 'PM Required?', 'Contract Required?', 'Spare Parts Required?', 'Safety Plan Required?', and 'Install Required?'; a 'Purchase Information' section with a red box around the 'Purchase Information' link, containing fields for 'Vendor:', 'Manufacturer: 0000091838-0', 'Serial #: 000089', 'Model: POO-450-XXX', 'Contract?', 'Installation Date: 9/2/15', 'Retired?', 'Retire Type:', 'Retire Date:', and 'PO: >>'; a 'Costs' section with a table showing 'Purchase Price: 1,750.00', 'Replacement Cost: 0.00', 'Total Cost: 0.00', 'YTD Cost: 0.00', 'Budgeted: 0.00', and 'Inventory: 0.00'; and a 'Last Changed By' section showing 'Changed By: ADAMSA' and 'Changed Date: 9/4/15 12:58:37'. The bottom of the screen has a 'Downtime' and 'Condition' section.

Asset Data Requirements

- Assets Identified at 60%
- Asset Information by 90%
- Schedules built into the DEN template
- DEN Asset Types and Functional Area listed in BIM Design Standard Manual

402.2 Asset Data

Asset data is generated throughout the project process by multiple parties. When a party adds new data, they are also responsible for validating the existing data associated with that Asset. Below are the fields required for the successful population and execution of the DEN Asset Management program.

By the 60 percent Deliverable, all DEN assets must be identified using the Asset Yes/No schedule and Asset Yes/No - Mass - Fire Alarm Zones.

By the 90 percent Deliverable, all DEN assets must have the following information entered by the design team in the BIM model using the fields required in the DSM. This information must be maintained as current through the remainder of the project and the data made accessible to the builder through the DEN Autodesk BIM 360 Field platform. This data can be checked in the Revit models using the DEN Revit template in the Schedule _Asset Data Checker - 03 DESIGN and _Asset Data Checker - 03 DESIGN-Zone Masses.

<_Asset Data Checker - 03 DESIGN>						
A	B	C	D	E	F	G
90% DESIGN DELIVERABLE						
Asset?	Family	Mark	ASSET_ASSETTYPE	Functional Area	Location	Status
Level 1						
<input checked="" type="checkbox"/>	232123-SUMPPUMP-Elevator	SP-1/2	INDUSTRIAL SUMP PUMP	PLUMBING	FAIL	OPERATING
<input checked="" type="checkbox"/>	233416-CNTFAN-Rectangular Inline Direct Drive	SF-2	EXHAUST FAN	HVAC		OPERATING
<input checked="" type="checkbox"/>	238239-UNTHTR-Cabinet Electric	UH-1	CABINET UNIT HEATER	HVAC		OPERATING
<input checked="" type="checkbox"/>	238239-UNTHTR-Cabinet Electric	UH-2	CABINET UNIT HEATER	HVAC		OPERATING

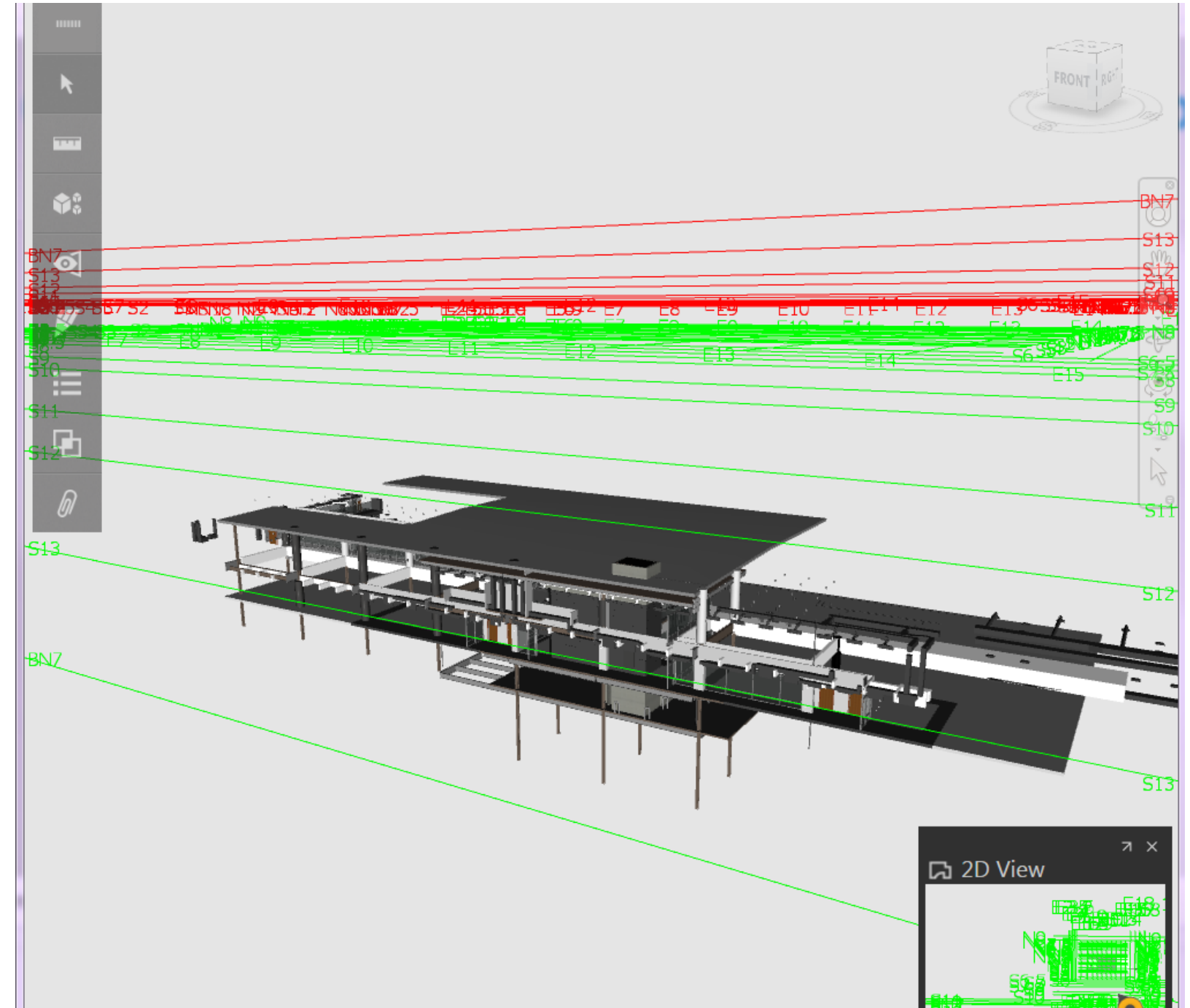
Schedules/Quantities

- __View List
- __Asset Data Checker - 00 ASSET
- __Asset Data Checker - 01 FAMILY
- __Asset Data Checker - 02 TYPE
- __Asset Data Checker - 03 DESIGN**
- __Asset Data Checker - 04 FINAL
- __Asset Data Checker - 05 EXPORT
- __Asset Yes/No
- DRAWING INDEX

BIM 360 Glue

Spatial Coordination


- Coordination begins prior to 60% CD (or equivalent)
- Coordination meetings run by the lead designer
- Attended by and with feedback from DEN BIM and Project Manager
- Coordination must be finished by 100% CD
- Signoff by DEN required



BIM 360 Field

BIM 360 Field









- Asset Equipment List
- Populated as Equipment is installed
- Verified by Inspectors
- Additional DEN uses of Field



AUTODESK™ BIM 360™ FIELD

DEN-HTC-CE95003 ▾

Equipment

Search Equipment

Close

+

 Add

✎

 Edit

✖

 Delete

🖨

 Print

⚙

 More Actions ▾

Filter

All Equipment ▾

Name

Type

all ▾

Description

Location

all ▾

Include sub-locations?

☒

Status

all ▾

Custom Properties

Area

Manufacturer

Manufacturer Bar Code

Model Number

Advanced Search

Checklists

Issues

Open Checklists

Open Issues

4-17BL4

SSCP package equ

See attachments

Branch Panel

4-17BL1

SSCP package equ

See attachments

Branch Panel

4-17AL5

SSCP package equ

See attachments

Branch Panel

4-17BL6A

SSCP package equ

See attachments

Branch Panel

4-17BL5

SSCP package equ

See attachments

Branch Panel

4-17AEH2A

SSCP package equ

See attachments

Branch Panel

4-17AT1

SSCP package equ

See attachments

Transformer

4-17AL6

SSCP package equ

See attachments

Branch Panel

4-17AT2

SSCP package equ

See attachments

Transformer

4-17AL1

SSCP package equ

See attachments

Branch Panel

4-17AE1

SSCP package equ

See attachments

Branch Panel

4-17BT1

SSCP package equ

See attachments

Transformer

4-17ADI

SSCP package equ

See attachments

Distribution Board

FSD-10359 RM#1401

See Penthouse FSI

See Penthouse FSI

FIRE DAMPER

FSD-10398 RM#1488

See Penthouse FSI

See Penthouse FSI

FIRE DAMPER

FSD-10360 RM#1402

See Penthouse FSI

See Penthouse FSI

FIRE DAMPER

FSD-10397 RM#1487

See Penthouse FSI

See Penthouse FSI

FIRE DAMPER

EF-220

Future

Future

ENVIRONMENTAL FAN

EF-222

Future

Future

ENVIRONMENTAL FAN

SEF-200

Future

Future

SUPPLY FAN

FSD-10462 RM#302

Couldn't access (B

N/A

FIRE DAMPER

FSD-10466 RM#302

Couldn't access (B

N/A

FIRE DAMPER

FSD-10464 RM#302

Couldn't access (B

N/A

FIRE DAMPER

FSD-10473 RM#312

Access door in the

Access door in the

FIRE DAMPER

SPF-205

Access door broker

13593972

SMOKE CONTROL FAN

Access door brok

PTAC-200

010646

IK22407696

PACKAGED TERMINAL AIR CONDITIO

1-17AL1B

010645

See attachments

Branch Panel

K5EC

010644

See attachments

Branch Panel

Inside the cabinet

5-17BH2 (SMP-2)

010643

See attachments

Branch Panel

North wall of the c

K5EB

010642

See attachments

Branch Panel

East wall of rm#5

CUH-209

010641

03214613-5588

CABINET UNIT HEATER

CUH-214

010640

03214613-5593

CABINET UNIT HEATER

EWB-205

010639

1414R000062

WATER HEATER (ELECTRIC)

EWB-204

010638

1414R000060

WATER HEATER (ELECTRIC)

IRH-203

010637

1401-027-080-0078

INFRARED RADIANT HEATER

IRH-201

010636

1401-027-060-0066

INFRARED RADIANT HEATER

DWET-200

010635

286747

EXPANSION TANK

DWET-900

010634

286748

EXPANSION TANK

EWB-900

010633

1414R000039

WATER HEATER (ELECTRIC)

DWET-203

010632

286749

EXPANSION TANK

Filters


New ▾

Edit

Remove

1000 items

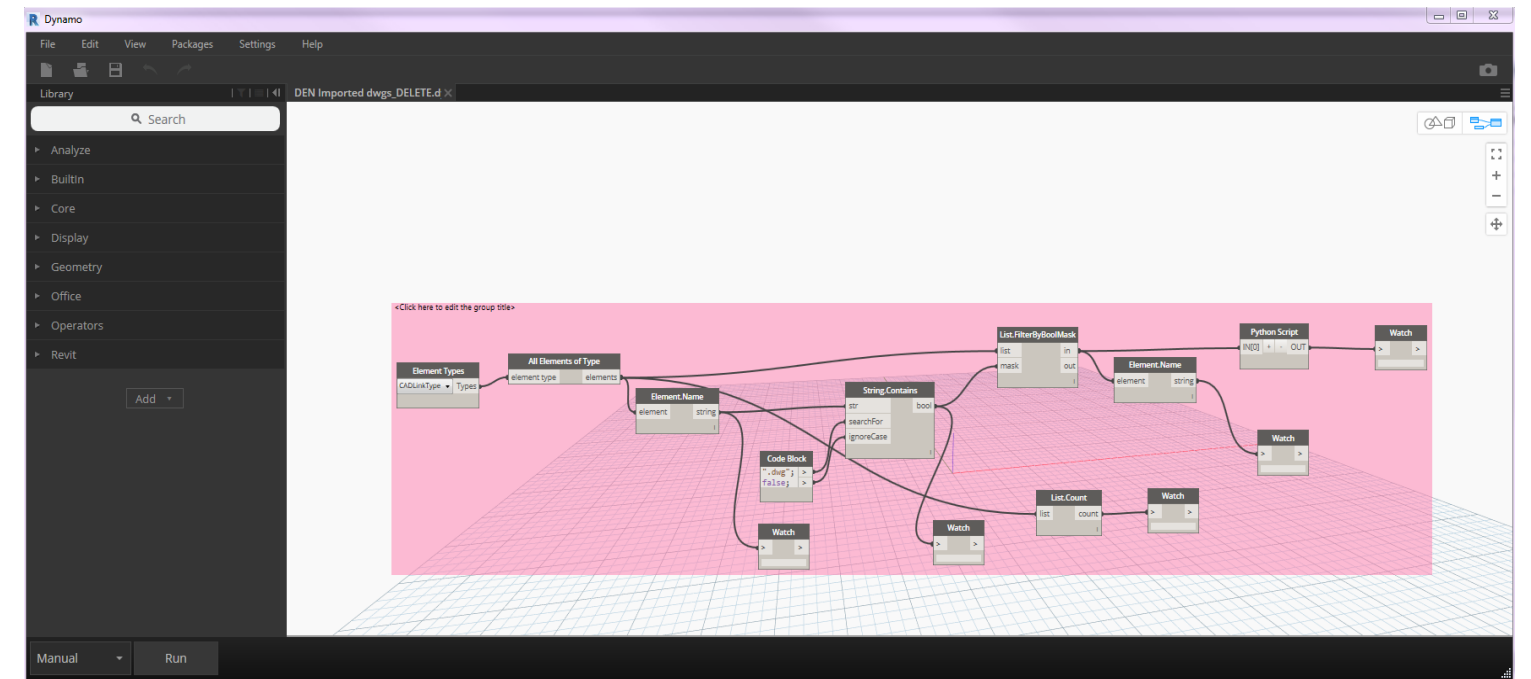
Filter: All Equipment



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Resources & Model Clean-up

- Provide consultants with resources
 - **Kit of Parts** which include: templates, families, titleblocks, shared parameter file
- Dynamo Scripts for model cleanup
 - Imported AutoCAD files
 - Imported Line Patterns

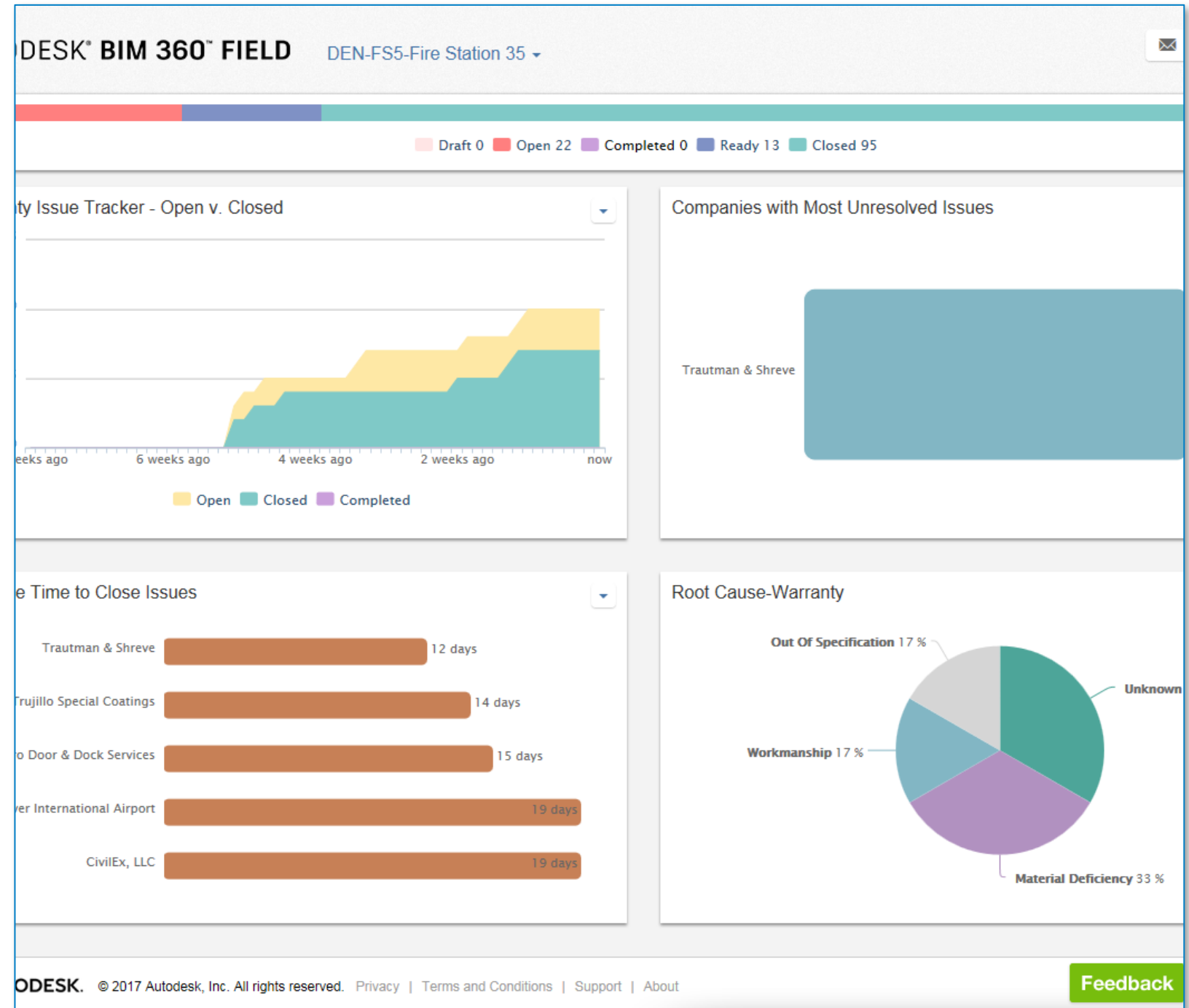


The DEN attitude

Warranty Tracking

Warranty Tracking

- Final inspections done with Field
- Asset Data Finalized
- Construction
 - Final Formatted O&Ms
 - Asset Data Finalized
- DEN
 - Final Data load to IBM Maximo



Warranty Tracking

DEN-FS5-Fire Station 35
Issues
All Locations

Search
Reset

Close
 Add
 Edit
 Void
 Print
 More Actions

Filter
All Issues

ID

Description

Company
all

Location
all

Include sub-locations?
☒

Date Created
From
To

Status
all

Type
Warranty

Advanced Search
Has Attachments

Has Comments

		ID	Description	Company	Location Path	Type	Status	Aut
<input type="checkbox"/>		WR006	HVAC questionable in Capt	Trautman & Shreve	P13>1>FS5-DR04	Warranty	Open	tim
<input type="checkbox"/>		WR010	Radiant heater 2nd from we	Trautman & Shreve	P13>1	Warranty	Closed	tim
<input type="checkbox"/>		WR002	CUH-2 appears to be contin	PCL	P13>1>FS5-CR36	Warranty	Closed	tim
<input type="checkbox"/>		WR009	Kitchen hood fire bottle is no	Trautman & Shreve	P13>1>FS5-KN39	Warranty	Ready to Inspe	tim
<input type="checkbox"/>		WR011	UH#1 is not activating. Unit i	Trautman & Shreve		Warranty	Closed	tim
<input type="checkbox"/>		WR004	Overhead light in apparatus	PCL	P13>1>FS5-SR22	Warranty	Closed	tim
<input type="checkbox"/>		WR012	CUH#1 found to be inoperat	Trautman & Shreve	P13>1>FS5-CR41	Warranty	Open	tim
<input type="checkbox"/>		WR003	South bay automatic bi-fold	PCL		Warranty	Closed	tim
<input type="checkbox"/>		WR007	Door key spins but will not o	PCL	P13>1>FS5-DR06	Warranty	Closed	tim
<input type="checkbox"/>		WR008	Gas pressure to the kitchen	Denver Internationa	P13>1>FS5-KN39	Warranty	Closed	tim

Filters
New
Edit
Remove

10 items
Filter: All Issues

Show: 50
Previous
Next

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