ARCH 2431. Building Technology III

Building Information Modeling with Revit Day 05

Steel Connections Details Assignment Column Base Plates, Beam Connections



DESIGN · CONNECT · OPTIMIZE

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Steel Connection Detail Development



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Steel Column Baseplate



Day 05 Connection Details

New 3D Familie

- W24 x 162 Baseplate
- Independe Baseplate
- Connection
 Videos
- Detail Drawings
- Photos Bolts & Screws
- Concrete Footing Cone Shaped V Threaded Rod Nut & Washers Assemble
- Load into Project
- Add Slab
- Develop Details
- Fin & Splice Connections
- Notched Beam to Beam
- Project File Sheet
- Assignment Next Steps

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Creating a new 3D Family File

- We will repeat this for each component of the Steel Connection Assembly
- Create a new Family
 - File > New > Family
 - Generic Model Template
- Save and Name the File
- Select an appropriate directory
- Name the files as follows:
 - Initials- Description
 - PK Steel W 24 x 162 baseplate
 - PK Steel baseplate
 - PK Steel Fin
 - *PK Steel splice double*
 - PK Steel Notched Beam

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Add Base Plate to Wide Flange W 24 x 162

• Open family Create 4 reference planes – PK – Steel W 24 x 162 • 4" from the corners of the • Save-as column for the baseplate PK – Steel W 24 x 162 baseplate Create > Extrusion > Rectangle & lock to the reference planes 8 H · / · A 8 · • E % 8 · = Autodesk Revit 2020 - Educational V View Manage Add+Ins Modify | Place Reference Plane • Front View > Reference Plane @ 1" 12 Cut . ST - 🖧 • niol 🞝 Pick Lines • Edit Extrusion to snap to Ref. Level 리리X and Reference Plane for 1" Thickness Offset: 0' 4" X (3D) Ref. Level Base Plate Ref. Level X 8 80 g g ້ວ ō Select the N Ň new extrusion g g Ref. Level 4. EQ EQ Create a rectangular EQ Lock the Base EQ Create 4 reference extrusion locked to Plate to a reference planes 4" from the 1'-11" '-11" the reference planes plane 1" below corners of the column Ref. Level -50

Baseplate uses parameter formulas



- The base plate is 4" beyond the corners of the column and uses parameter formulas
 - BasePlate Depth = Depth + 0' 8" 2' 1" + 8" = 2' 9"
 - BasePlate Width = Widtch + 0' 8" 1' 3" + 8" = 2' 1"

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Day 05 **Connection Details**

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Add holes for anchor bolt to footing connection



Load new column with baseplate into project

X



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• Load into Project Т • Select the lower W 24 x 162 on Level 1 • Replace W 24x162 with the new family W 24x162 baseplate Load into Load into Project Project and Close • The height will revert to 12'-0". Change it back to 15'-0" • Be certain your 3d View is not cropped and baseplate is visible! **Family Editor** Properties x PK - Steel W 24 x 162 PK - Steel W 24 x 162 Baseplate ø ~ 🛱 Edit Type Structural Connections (1) Constraints PK - HSS Round 10 x .5 Level 1 Level PK - HSS Round 10 x .5 Host Level : Level 1 Offset from Host 0' 0" PK - HSS Square 10 x 10 x .5 Replace Moves With Nearby E... W 24 x 162 PK - HSS Square 10 x 10 x .5 Structural with the new PK - Steel W 21 x 62 Beam Rebar Cover Rebar Cover 1 <0' - 1"> family with Dimensions PK - Steel W 21 x 62 Beam 2' 9" the baseplate BasePlate Depth PK - Steel W 24 x 162 **BasePlate Width** 1' 9" Depth 2' 1" PK - Steel W 24 x 162 Height 15' 0" PK - Steel W 24 x 162 Baseplate Width 1' 1" 5.35 CF Volume PK - Steel W 24 x 162 Baseplate Identity Data PK - Steel W 24 x 162 Baseplate Image Change Height W 24 x 162 Baseplate Comments back to 15'-0" Mark Phasing are 10 x 10 x .5 Phase Created New Construction x 62 Beam Phase Demolished None **Properties help**

Day 05 **Connection Details**

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- Video Detail Drawings
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Ref. Level

Create 4

reference

planes

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Depth

Add

Dimensions

Add

G

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× (3D)

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Creating an *independent base plate* with parameters

G (BD)

EQ

Width = 2' - 0"

EQ

1.0

H

- New Family > Generic Model
- Create > Reference Planes for edge of baseplate Add Parameters for Width and Depth
- Create > Solid Extrusion > lock to Reference Planes

Ref. Level

- Create > Reference Planes 2" in from edges
- Create > Void Forms > 1" Dia. Holes > lock to reference planes

Ref. Level

X I (BD)

B

Q

14

5

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Depth

Mirror / Copy to create all 4 holes

Width = 2' - 0"

EQ

EQ



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Add independent base plate for Square Column

- Make Leve 1 Structure the Current View
- Drag New Independent Baseplate close to the square column
- Locate it off-center to facilitate alignment
- Use <u>Align</u> to lock the baseplate to the center reference planes of the square column
- From side view align and lock to bottom of column







Day 05 **Connection Details**

- New 3D Famil

- Connect

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- Add Sla
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Use the parameters to modify the baseplate size

- Repeat the process and add a baseplate for the round column
- Align it with the center of the round column and lock it
- Resize the baseplate to be 4" larger on both sides (10"+4"+4"=18" [1'-6"])

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lico Connections		Depth 3' 0"		Depth 1' 6"	
fice connections		Width 2' 0" -		Width 1' 6"	
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Columns with base plates

Be certain your 3d View is not cropped and baseplate is visible!

	Properties		>
	Multi	iple Families Selecte	ed ▼
	Structural Connec	tions 🗸 🗟 Edit Ty	/pe
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	Host	Level : Level 1	
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	Image		
	Comments		
	Mark		
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Steel Connections Bolts and Fasteners



Day 05 **Connection Details**

New 3D Famil

Connect Vide

- Detail Drawings
- Pho **Bolts & Screws**
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Steel Column and Beam Connection Videos



<u>Column Base</u> Plate to *Foundation*

Beam to Column Fin Plate **Connection**





<u>Beam to Column</u> **Connection**



https://www.steelconstruction.info/Simple_connections#Joint_considerations

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Steel Connection Drawings and Isometrics





Connection Photographs

Photos by Paul King – NYC Seaport





https://en.wikipedia.org/wiki/Washer (hardw

Concrete Footing to Baseplate Connection



Day 05 **Connection Details**

- New 3D Famili
- W24 x 162 Baseplat Independent Basepla

Depth -4"

Depth

- Connect
- Drawings
- ts & Screws
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Concrete Isolated Footing with Hold Down Bolts



Day 05 **Connection Details**



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Concrete Isolated Footing with Hold Down Bolts



- Planes & Lock at 4"
- Create > Void Blend
 - Top ¾" Radius
 - Base 3/8" Radius
 - First End O'-O"
 - Second End 7 ½"





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Create Threaded Rod, Nut and Washers - Import

- Create > Extrusion (1' rod)
- Transfer Project Standards
- (Copy from your project file)
- Import Materials Library
- Select "Rod" and set Material Category
- Steel ASTM A992

Generic Models (1) v 114 6014	ype			
Extrusion End	-1' 0'				- 11
Extrusion Start	0. 0.				
Workmane	Level : Ret. Level				
Graphics		2			- 11
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Solid/Void	Solid				
1/4" 1'	Radius Tall				



and detail correctly

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Section 1 Ref. Level X Front

Steel Nut

6 -





Create Threaded Rod, Nut and Washers - Import

- Steel Washer
- ½" radius with ¼" radius hole x 3/8" high ¾" radius with 5/16" radius hole x 1/8" high







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Assemble Components in Concrete Footing Family

• Load the Threaded Rod, Nut & Washer into the Concrete Footing Family



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B А roperties - Steel Baseplate Adjustable Edit Type Structural Connections (1) Level Level 1 Level : Level 1 UP 2" Offset from Host 0" 2" Moves with Nearby Liemen... Work on Structure Level 1 Structural Rebar Cover Rebar Cover 1 <0' - 1"> Add Footings Dimensions Depth 1' 6" Align & Lock Width 1' 6" Volume 0.19 CF • Top of Footing is at Level 1 2 4 Intentity Data Properties hel

Align and Lock the Concrete Footing to the Columns

- Base plate of column must be raised 2" to allow for shims and grout
- Column must be 2" shorter (from 15'-0" down to 14'-10")

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Draw a concrete floor slab on Level 1 Structural



Modify Base Plate Elevations as needed – add details

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Develop a detail of the footing condition
Top of Footing can also be recessed to allow for finish flooring to cover





50

40

40

beam

centre line

Holes @ 70 pitch

Fin & Splice Plate Connections



Section XX



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Supported beam

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Fin Plates & Splice Plates for Column Connections

Fin Plate

- Welded to columns or beams for connecting beams
- Slotted holes allow forhorizontal adjustment

Splice Plates

- Used for vertical connections from column to column
- Holes allow for bolted connections



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Notched Beam with Bolting Plate

When beams support floors or roofs the tops of the beams need to be in alignment

> A bolting plate welded to the end allows the beam to be secured Beam with Notched end with welded bolting

A notched beam allows the smaller beam to slip below the top web of the larger beam

Use W 18 x 119 Notched Beam with Bolting plate

	Designation Imperial <i>(in x Ib/ft)</i>			Web Thickness	Flange Thickness	Sectional Area	Weight	Static Parameters			
		Depth	Width					Moment	of Inertia	Elastic Sect	ion Modulus
		h (in)	w (in)	(in)	(in)	(in²)	(lb _f /ft)	Ι _x (in ⁴)	l _y (in ⁴)	S _x (in ³)	S _y (in ³)
	W 27 x 178	27.8	14.09	0.725	1.190	52.3	178	6990	555	502	78.8
	W 27 x 161	27.6	14.02	0.660	1.080	47.4	161	6280	497	455	70.9
I	W 18 x 11	9 19	11.27	0.655	1.060	35.1	119	2190	253	231	44.9
1	VV 18 X 10	0 18.7	11.Z	0.590	0.940	31.1	100	1910	220	204	39.4
	W 18 x 97	7 18.6	11.15	0.535	0.870	28.5	97	1750	201	188	36.1

Depth = 19'' Web .655'' Width=11.27 Flange = 1.060''

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Isometric Views of the Project File



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Updated Sheet - Add Additional Sheets



- Create additional sets of 4 views of connections & develop details
- Annotate with Notes & Leaders, Dimensions, Hatch & Detail Items

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Building Information Modeling with Revit Day 05

Steel Connections Details Assignment Column Base Plates, Beam Connections



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