## Session 3.4

# Understand Revit's Project Base Point and Coordinate System

**Nicolas Catellier, Revit Pure / Atelier 21 Architects**

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### Class Description

The coordinate system inside Revit seems to be insanely complicated. Did you ever try to export a Revit file to specific coordinates and miserably fail? Did you know there was a secret internal origin that is used by default when exporting a Revit file?

This class will start from the very basic definition of the origin points. You will learn how to integrate the points in your Revit template. You will learn to spot and identify them. You will learn how to use the elevation height value in relation to the base points. You will learn how to set up the true north value.

Then, you will learn how to link, import and export files in relation to the major points. We will then jump to the complex topic of shared sites and shared coordinates. You will learn the best workflow to properly link files together when using a real-world survey data. Finally, you will learn how to properly use the WGS84 lat-long coordinates and how to integrate all coordinates information in your BIM execution plan.

### Class Objectives

1. Learn the difference between all 3 coordinate origin points in Revit.

2. Organize the use of base points, coordinates and true north in your master Revit template.

3. Manage the coordinates when importing, exporting or linking external files.

4. Use a shared site to host multiple buildings.

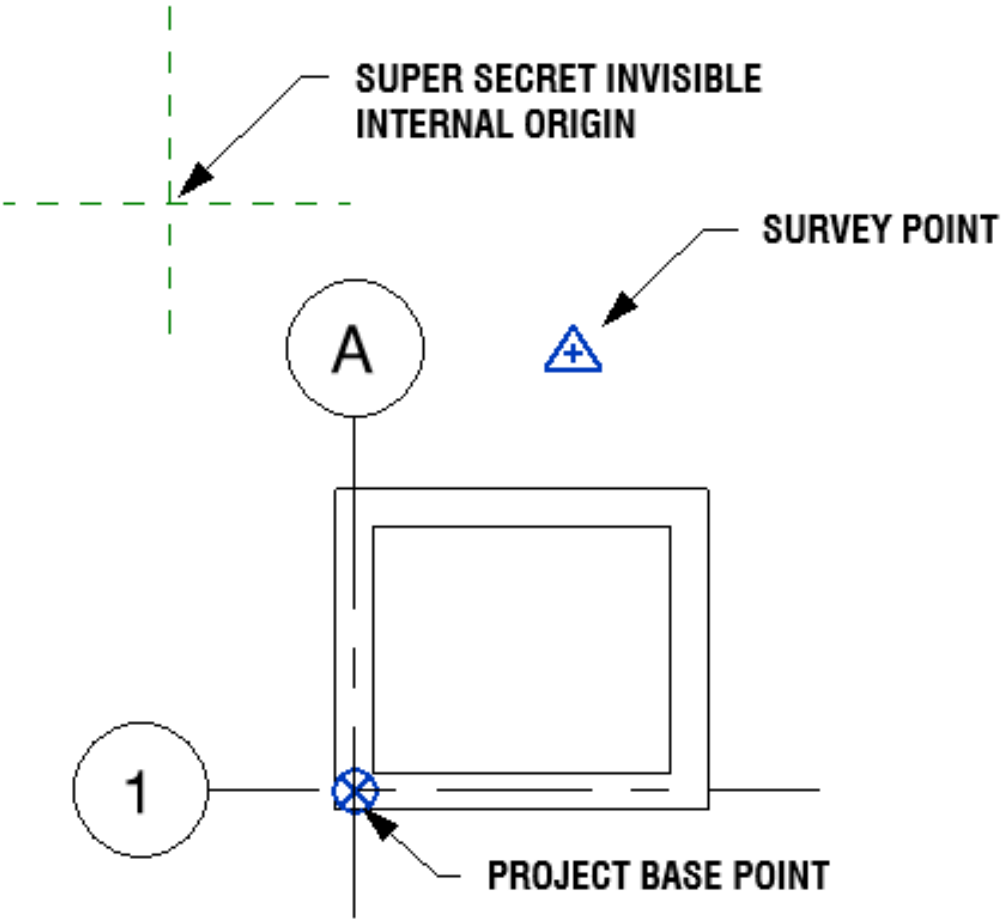
### About the Speaker:

Nicolas Catellier is an Architect, BIM Manager and teacher based in Quebec City, Canada. Nicolas graduated from Université de Montréal in 2011 and has been working and experimenting with BIM ever since. He started the learning website revitpure.com in 2016. The site provides content to help both beginners and advanced users learn Revit in a spirit of fun and simplicity.

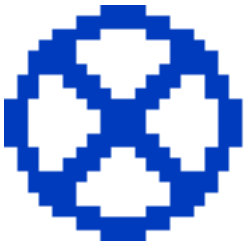
Nicolas also works for Atelier 21 architects, where he engineered the transition from AutoCAD to BIM for the entire office. He also completed projects such as the Valcartier, a 153 rooms hotel and a 70 000 square feet indoor waterpark. Nicolas acted as the lead BIM manager but also as a designer and rendering artist for the project. Bridging the gap between the technical aspect of BIM and the creative process of architecture has always been a major goal for Nicolas.

## UNDERSTAND THE DIFFERENCE BETWEEN ALL 3 COORDINATE ORIGIN POINTS

There is 3 different origin points in a Revit project: the **Project Base Point**, the **Survey Point** and the super secret **Internal Origin**.



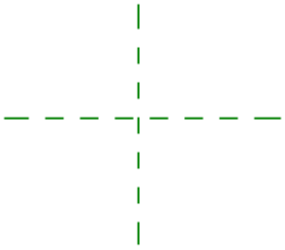

### PROJECT BASE POINT



This point is used almost exclusively for internal purpose. It is used to spot coordinates relatively to the building. It is represented by a blue circle with a cross in the middle. It can also be used to set the angle difference between the True North and the Project North.

### SURVEY POINT

This point is usually used to represent the origin of a "shared coordinates" system among multiple linked Revit or CAD files. That means its location is most useful when exporting and importing files. It is usually placed relatively to a real-world site element such as the intersection of 2 property lines or a geodetic marker.



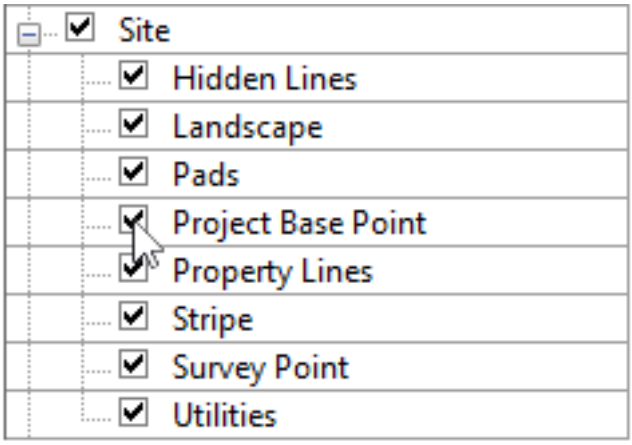
### INTERNAL ORIGIN

This is the tricky one. This point is invisible and cannot be moved. Most users don't even know it exists. By default, importing or exporting a CAD or Revit file will be made relatively to this super secret point, therefore confusing many people.

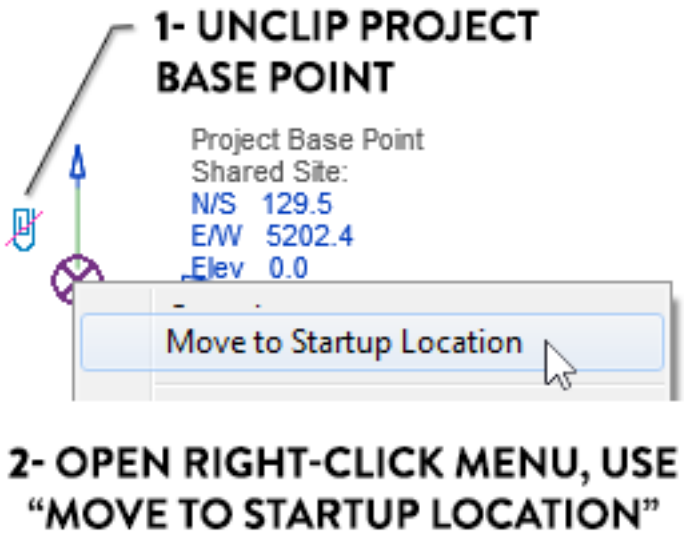
## LOCATE THE INTERNAL ORIGIN

Now that you are aware of this super secret internal origin, you should locate it in a plan view using reference planes. Actually, you should locate it in your Revit Template so you will be able to track its location for all new projects.

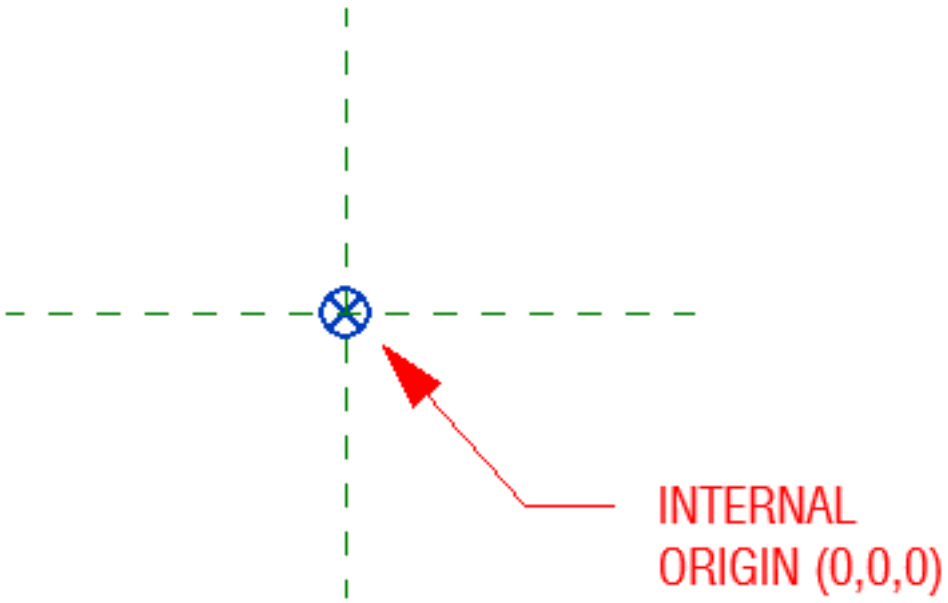
To locate the point, go to your site plan and make sure the Project Base Point is set to visible in the Visibility/Graphics settings.



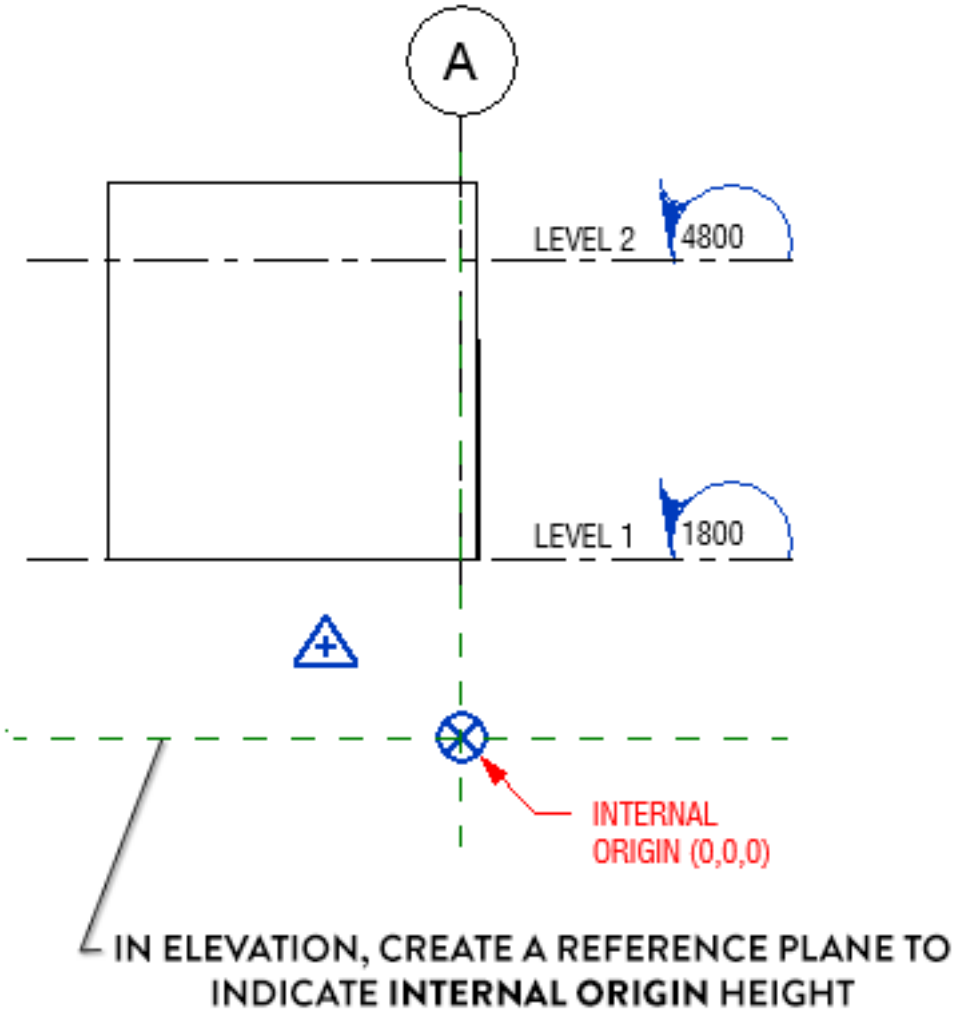

The next step is to select the project base point and click on the clip icon. A red dash should appear on the icon. The next step is to right-click on the project base point and select "Move to Startup Location"




The project base point should now be located at the exact same spot as the Internal Origin. Mark this spot in the project by creating two reference planes that intersect at the point. You should also add a text note to indicate the location to other users. Make sure to pin the reference planes as well as the project base point.

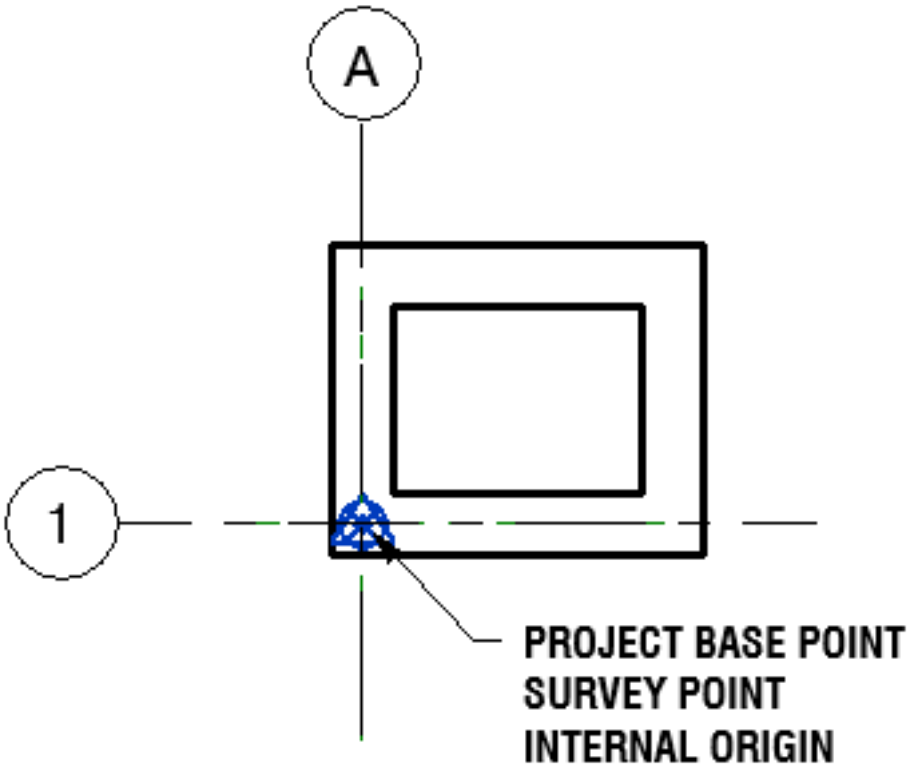



The 3 origin points not only have X/Y coordinates, but also a Z-axis elevation. Therefore, you should open an elevation view and unhide the Project Base Point and Survey Point. Create a third reference plane to indicate the height location of the Internal Origin.




## BY DEFAULT, KEEP THE BASE POINTS TOGETHER

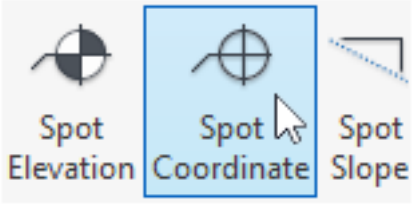
In most small projects, the **Project Base Point**, the **Survey Point** and the **Internal Origin** can all remain in the same spot without any problem. In your template, make sure they all fit together in a corner of your building, at the intersection of grids A and 1. Make sure to pin all these points, reference planes and grids.

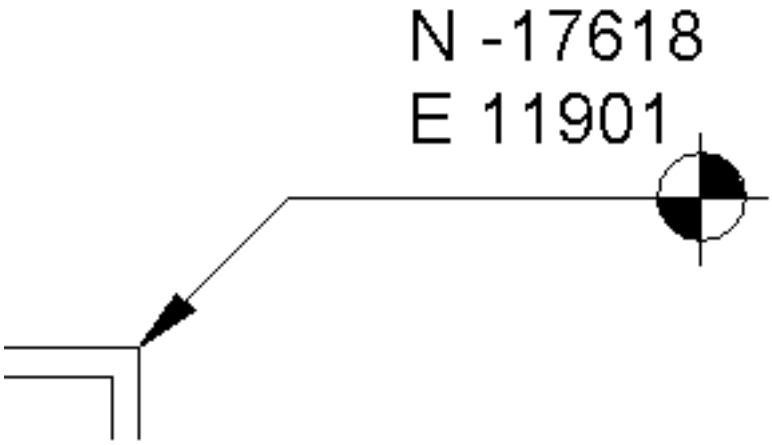



While the default stance is to keep these points together, the next tips will teach you in which case they should be moved.

## CREATE A SPOT COORDINATE FOR EACH ORIGIN

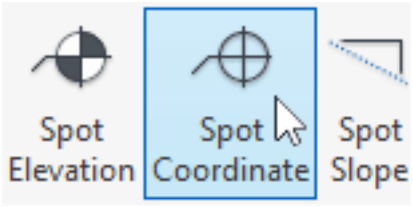
The Spot Coordinate tool is used to specify coordinate relatively to one of the 3 origin. You can find this tool in the Annotate tab.

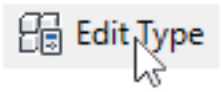


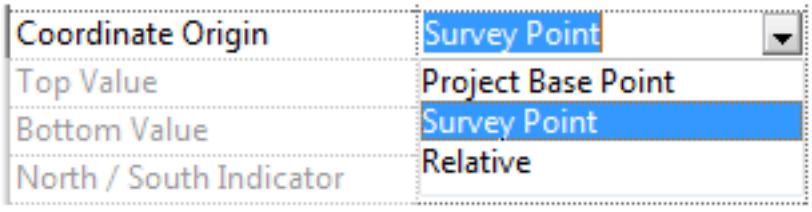

USING THE SPOT COORDINATE TOOL

In your template, it is a smart move to create a Spot Coordinate for each of the 3 origin type. Edit the type of the spot coordinate and use the duplicate tool. Scroll down the settings options and will see the **Coordinate Origin** parameter. Create a different tag for all 3 origins (Survey, Project Base and Internal). Relative refers to the Internal Origin of the project.



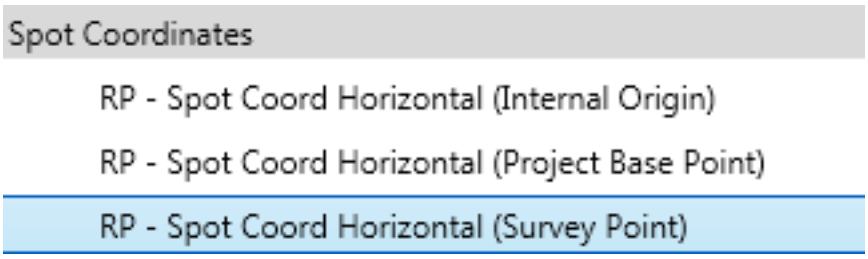




CREATE A NEW SPOT COORDINATE AND CLICK EDIT TYPE

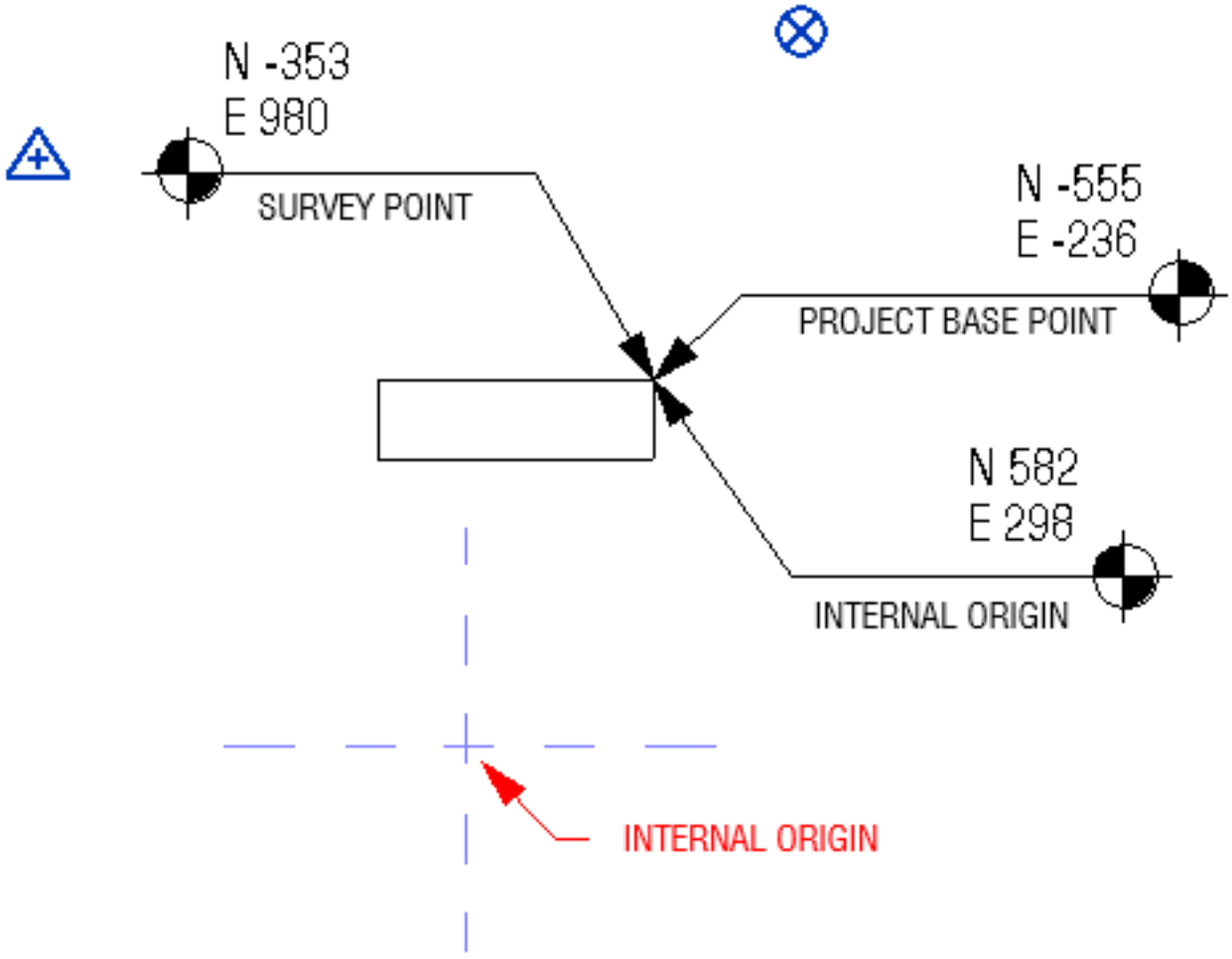



CREATE A TAG FOR EACH COORDINATE ORIGIN

Once you are done, you should have 3 different Spot Coordinate types like in this image.

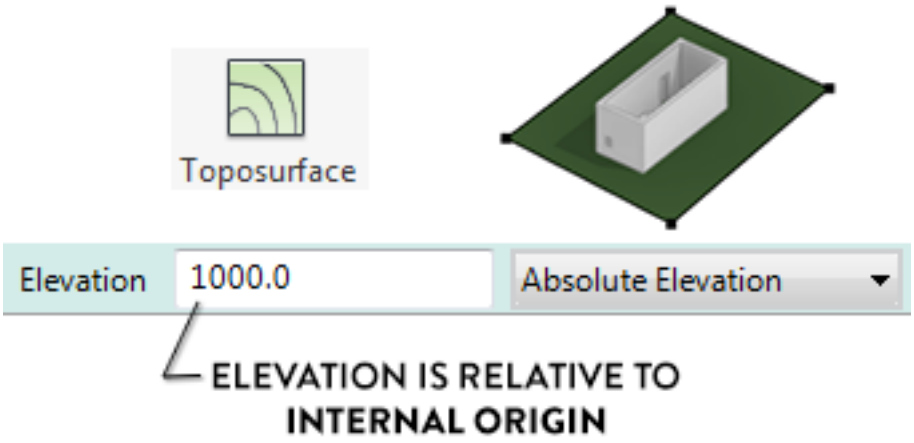



As you can see in the image next page, each spot coordinate is used to spot the same element. However, they indicate different data since they each refer to a different origin. These tags can be useful when you are confused about the location of the origin or of a specific element.




## TOPOSURFACE IS RELATIVE TO THE INTERNAL ORIGIN

The 3 origins points each can have a different elevation value. When creating a toposurface, you have to set values referring to **Absolute Elevation**. This value is relative to the **Internal Origin**.



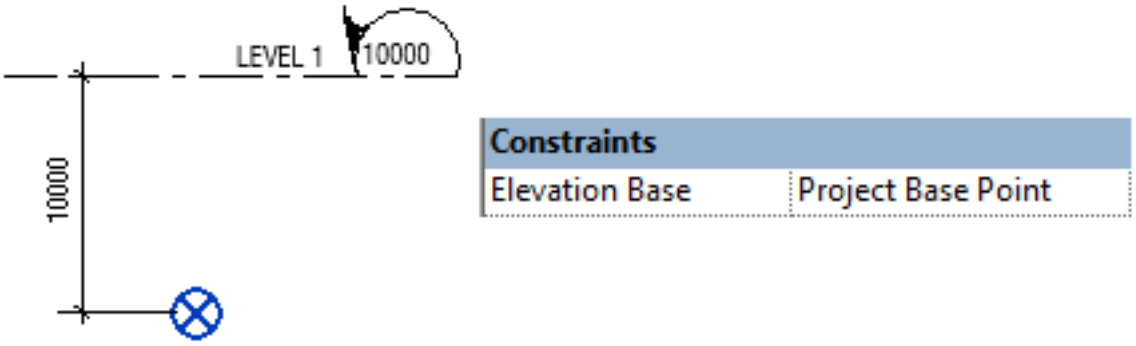

## SET PROJECT LEVELS ELEVATION

There is a serious debate about what elevation the first level should be. That depends on your geographic location, local norms and office standards. The first option is to set the first level at elevation 10 000mm or 100'-0''. The main reason is to avoid negative values for basement levels, which can cause confusion on the construction site.

Many people think this strategy is completely ridiculous and argue that level 1 should be set at elevation 0. In the end, both techniques are viable. Here is how to properly implement them.

### STRATEGY 1: SET LEVEL 1 AT ELEVATION = 10 000mm (100'-0'')

Depending on your geographic location and local norms, you might need set the project first level at 100'-0'' or 10 000mm. This is an arbitrary value that has no relation to the sea level. The best practice is to set this value in relation to the **Project Base Point**. Select a level, click on Edit Type and make sure that the Elevation Base is set to Project Base Point.

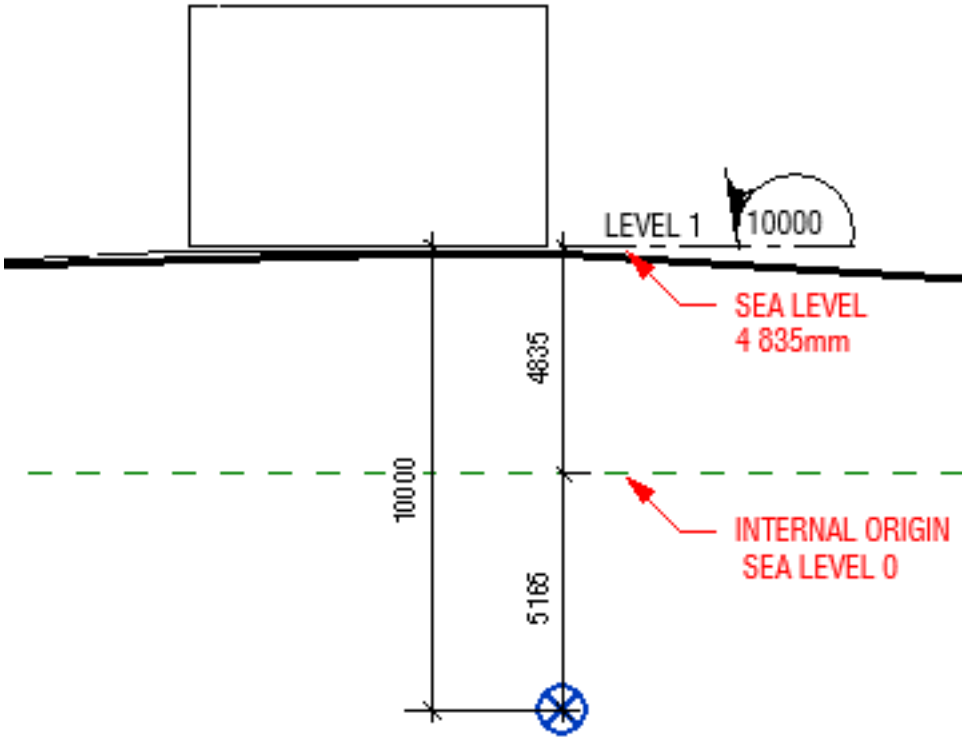


### STRATEGY 2: SET LEVEL 1 AT ELEVATION = 0mm (0'-0'')

## USE INTERNAL ORIGIN AS SEA LEVEL = 0

In a project where you want to spot elements in relation to the sea level, you should use the Internal Origin to represent sea level 0.

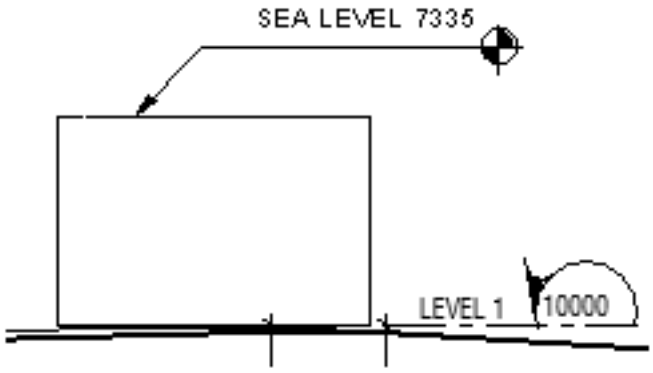
In this example, the 10 000mm project level fits the 4 835mm sea level. That means we have to move the Project Base Point so it is 5 165mm below the Internal Origin base elevation.




Creating a separate linked Revit model for the site might be a good idea, especially for larger projects.

If you want to spot any element in your project in relation to the sea level, create a new Spot Elevation tag that use **Relative** as the **Elevation Origin**.


| | |
|---|---|
| Elevation Indicator | SEA LEVEL |
| Elevation Origin | Relative |




CREATE "**RELATIVE**" SPOT ELEVATION TO INDICATE SEA LEVEL ELEVATION

Placing the Project Base Point relatively to the Internal Origin should be your first move when starting a project. Else, you won't be able to model the site using the sea level elevation values.

In a project where the site and project are already modelled without using the sea elevation, the solution is to use the Survey Point as the sea level origin.

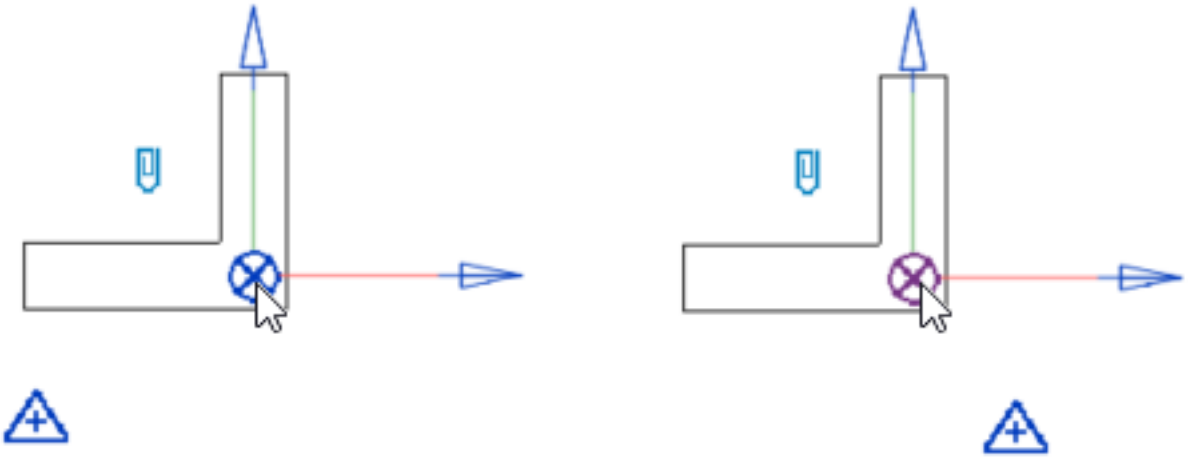
Finally, it is often a good idea to create a separate linked Revit site model, especially in larger projects. This way, you can modify the site independently from the building. The building height position can easily be adjusted. To learn more about linked site model workflow, see page 12.

## MOVING THE PROJECT BASE POINT AND SURVEY POINT

Be extremely careful when moving the origin points. Both the Project Base Point and Survey Point have a clip icon next to them when selected. You need to fully understand what effect this clip has on the points before actually moving them. Click on the clip icon to clip/unclip the Project Base Point or Survey Point.

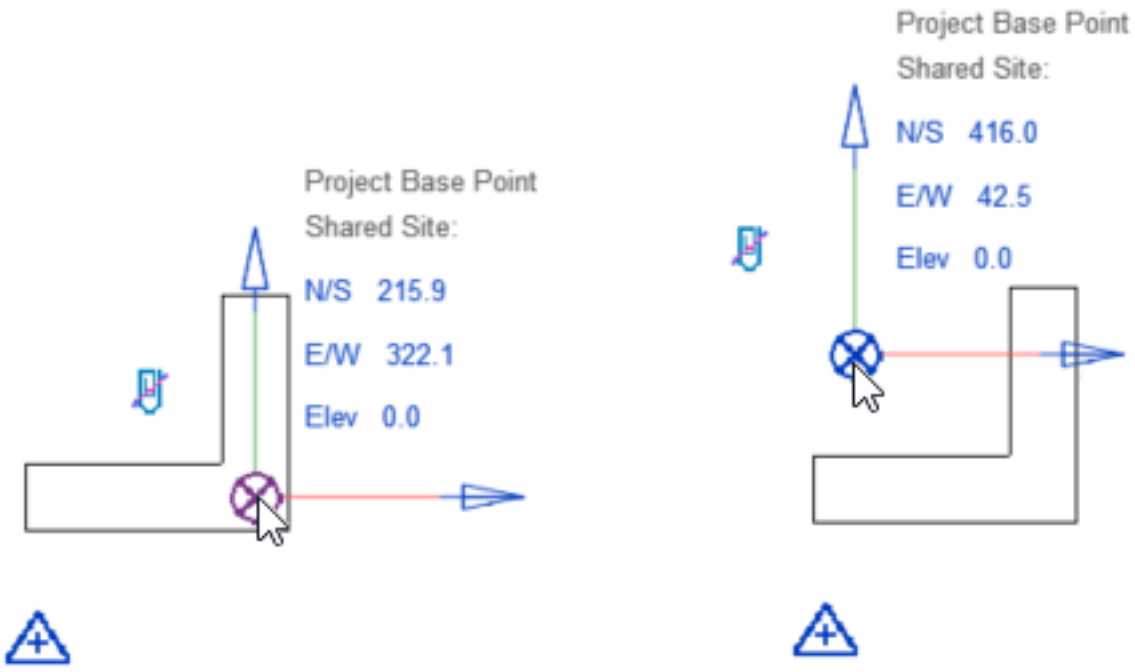

## AVOID MOVING CLIPPED PROJECT BASE POINT

Be careful: moving a clipped Project Base Point will move the entire project (including the internal origin) except the Survey Point. The effect is the same as moving a clipped Survey Point. Avoid this strategy unless you want to modify the building origin relative to the site.




## UNCLIP PROJECT BASE POINT BEFORE MOVING IT

While you default stance should be to keep the Internal Origin and the Project Base Point together, there are some good reasons to move the Project Base Point. First, **unclip** the Project Base Point. Move it to the proper emplacement, then clip it again. As you see, the coordinates will be changed: the N/S and E/W coordinates are always relative to the Survey Point.

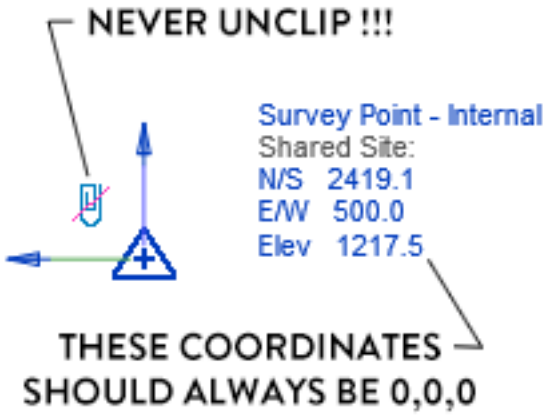



MOVING AN UNCLIPPED PROJECT BASE POINT

## NEVER UNCLIP THE SURVEY POINT

While unclipping the project base point is the standard procedure before moving it, you should never unclip the Survey Point. If you unclip and move the Survey Point, you will cause a lot of pain, horror and confusion for people working in your model.

The only thing that moving an unclipped survey point will do is to move the icon representation of the survey point, not the survey point itself. If you click a survey point and you see something else than 0,0,0 coordinates, that means someone messed up and decided to move an unclipped survey point. Simply change the values back to 0,0,0.

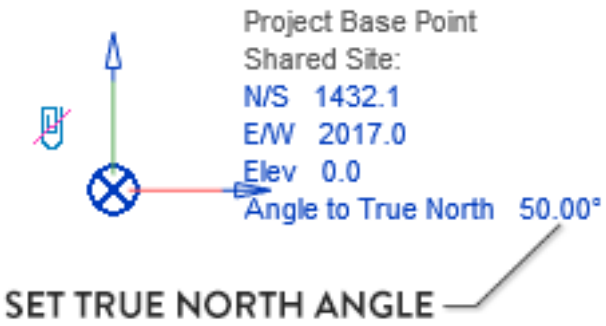


### ALTERNATE TAKE: IT'S OK TO MOVE AN UNCLIPPED SURVEY POINT

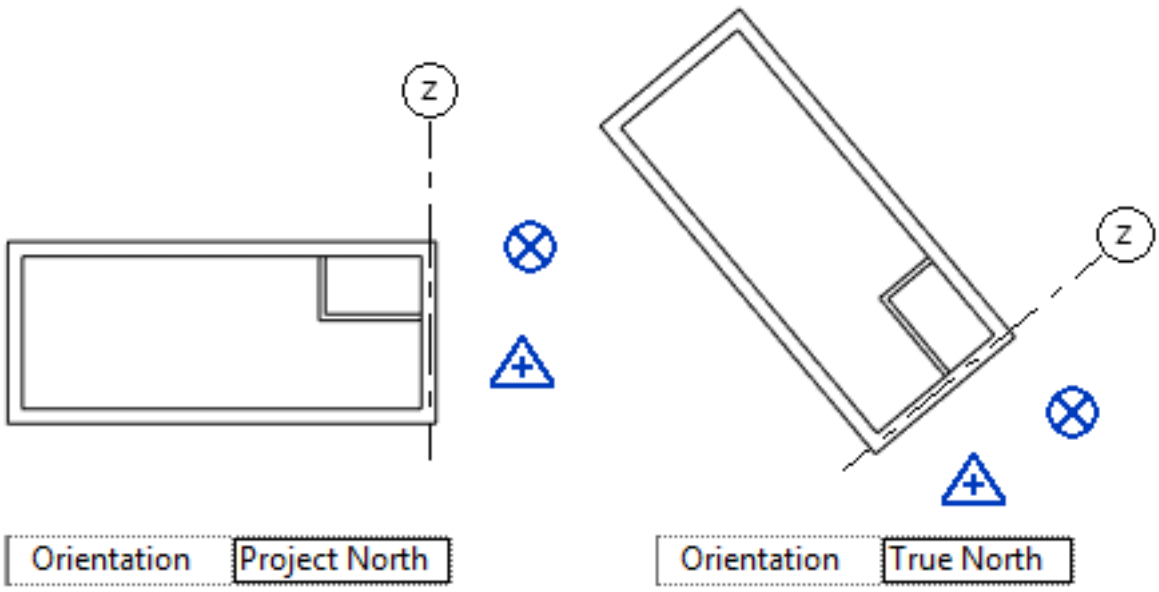
While I stand by the idea that moving an unclipped a survey point is a terrible idea and should be avoided, there is some people that think it is actually a good idea. When the site origin is located 20+ miles away from your project, the survey point triangle might be too far to be visible. Therefore, some BIM managers recommend to unclip the point and move it to a closer location that can be seen from your site plan. It can cause problems thought. More on that on page 28.

## USE PROJECT BASE POINT TO SET THE TRUE NORTH

Each project contains a Project North and a True North. The Project North is a virtual orientation used to model your project so it is orthogonal to your screen. The True North is a real-world north used to properly locate the orientation of your building. To set a True North value, select the Project Base Point and enter the angle.




In the view properties of each view, you can specify the orientation you want to use. In almost all cases, Project North will be used.

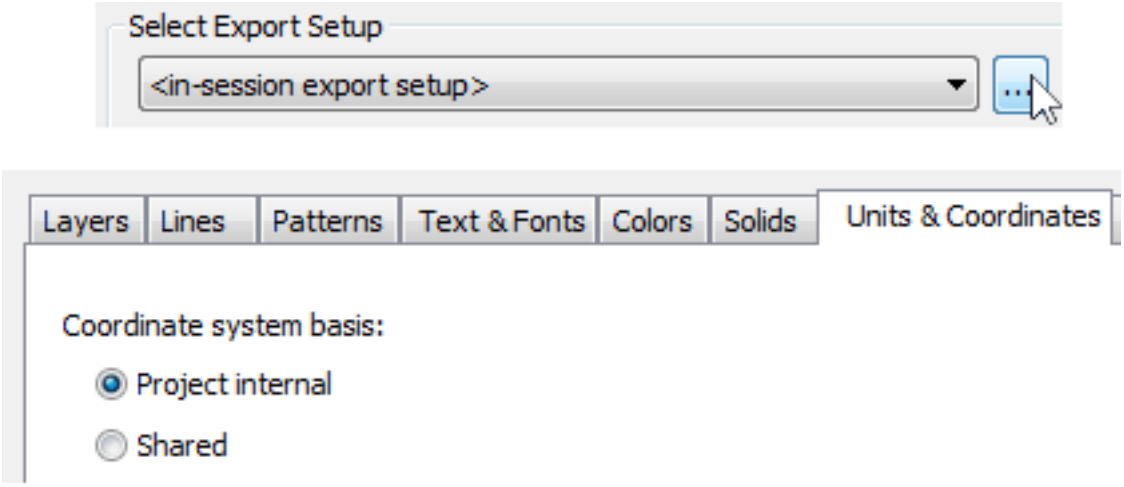


### BE CAREFUL: TRUE NORTH VALUE IS ACTUALLY EMBEDDED IN THE SURVEY POINT

Although the True North value is set in the Project Base Point, the value is actually embedded in the Survey Point. Even weirder: you can have multiple Survey Points in a project. That means you can have many multiple True North values in a single project. More on that later.

## EXPORTING TO CAD

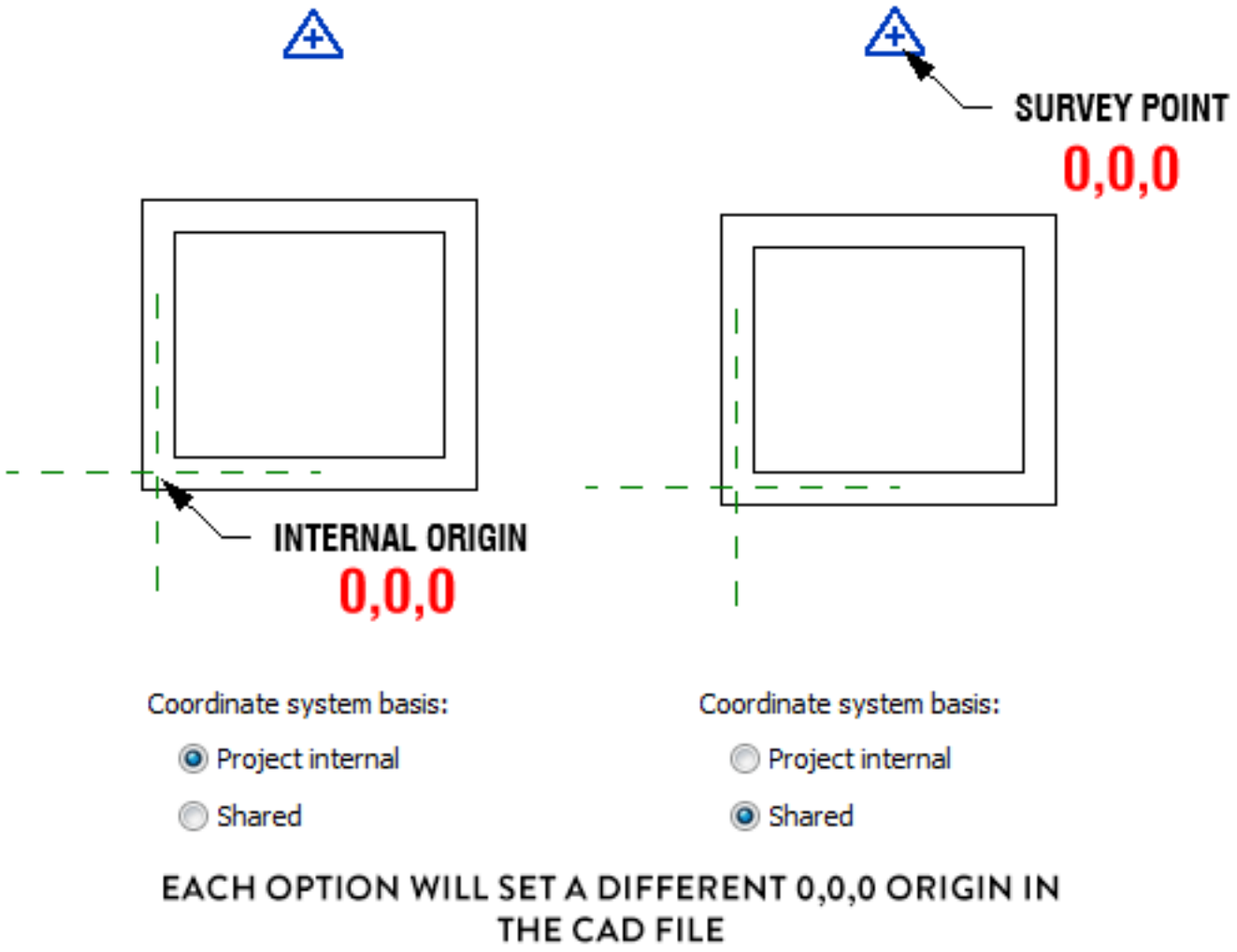
Most users are confused about the project origin when exporting to CAD. The reason is that the Internal Origin is used by default. You can access the exportation options by going to File/Export/CAD Format and by clicking the 3 small dots next to the Select Export Setup menu. Go to the Units & Coordinates tab.



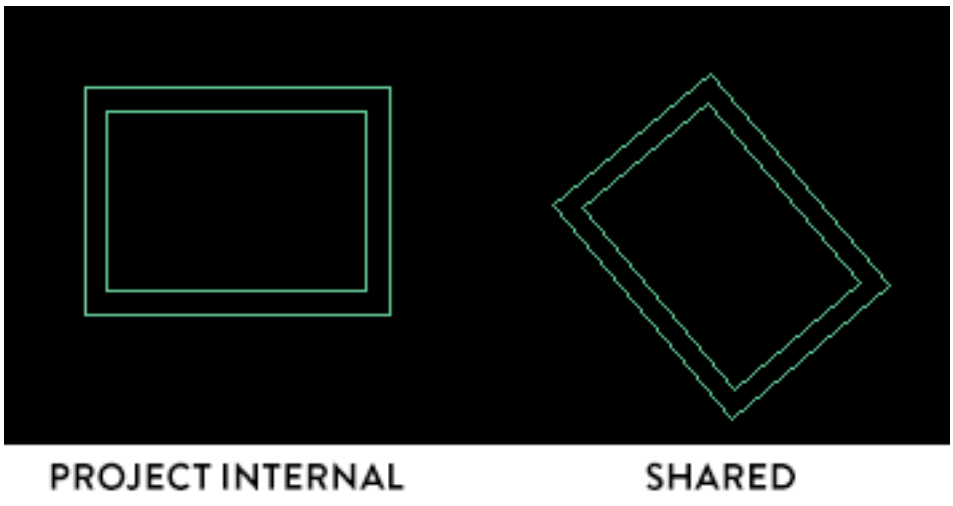

ACCESS COORDINATES OPTIONS IN THE EXPORT SETTINGS

If you export a Revit view to DWG, the default setting is **Project Internal**. That setting will use the **Internal Origin** as the 0,0,0 point location in AutoCAD.

The other option is called **Shared**. This will use the **Survey Point** as the 0,0,0 point in AutoCAD.

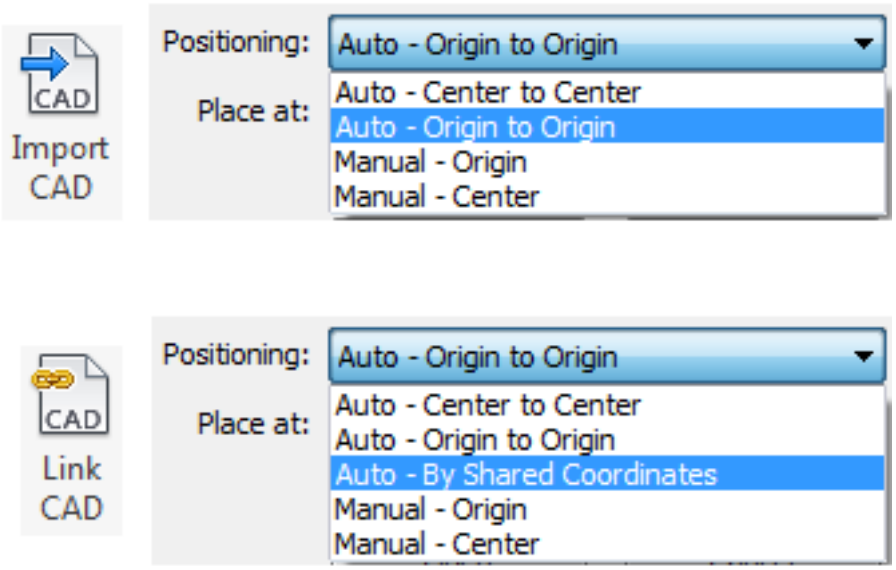



**Watch out**: If you are using the Shared setting and you entered an angle value for the True North, the project will appear rotated once opened in AutoCAD. To avoid this issue, you can export the sheet where the view is placed instead of exporting the view, although the shared site coordinates will be ignored.



## HOW TO IMPORT / LINK CAD

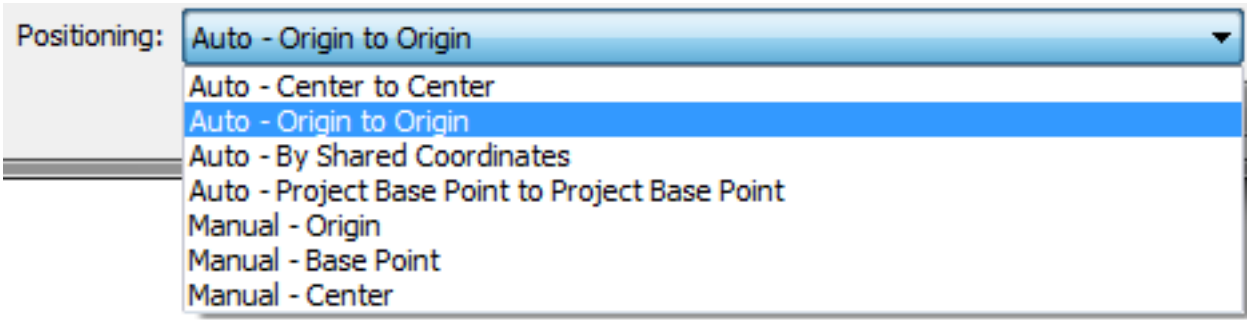
The Link CAD tool has more positioning options available than Import CAD. If you want to use the Survey Point as the origin for the CAD file, you have to use **Link CAD** and select **By Shared Coordinates**. Else, the **Origin to Origin** option will match the Revit file Internal Origin to the DWG 0,0,0 point.




USE **LINK CAD** TO PLACE A CAD FILE ORIGIN TO THE PROJECT BASE POINT

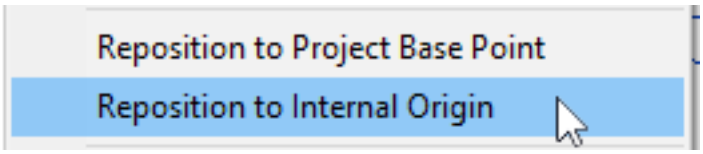
## HOW TO LINK REVIT FILES

Revit offers a fancy "Shared Site" and "Shared Coordinates" system to link Revit files. In most cases, the **Origin to Origin** tool works perfectly fine. This option will match the models Internal Origins. It is the best option when linking multiple disciplines together.



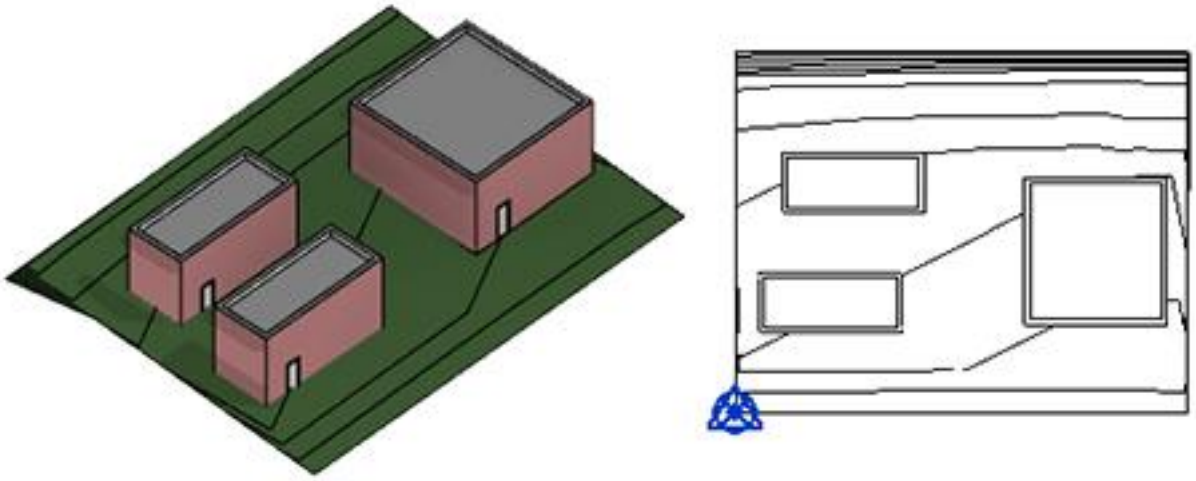

POSITIONING OPTIONS FOR LINKED REVIT FILES

When linking a model, it is a wise move to PIN it immediately. If it moves around by mistake, right-click the model and use the "**Reposition to Internal Origin**" tool.

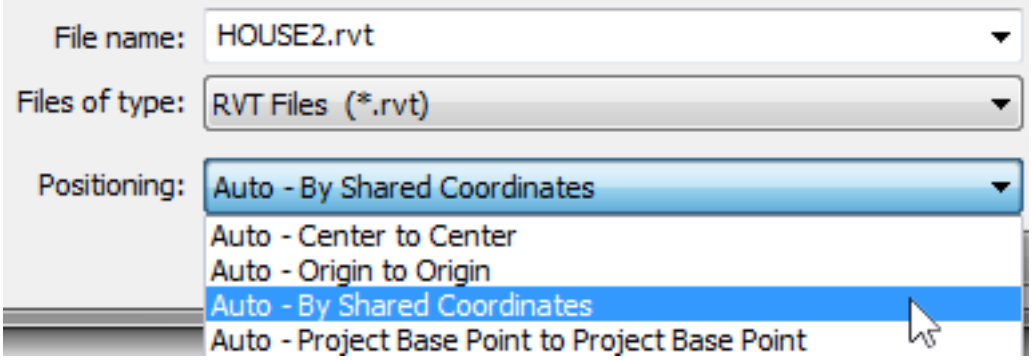



## USING SHARED SITES

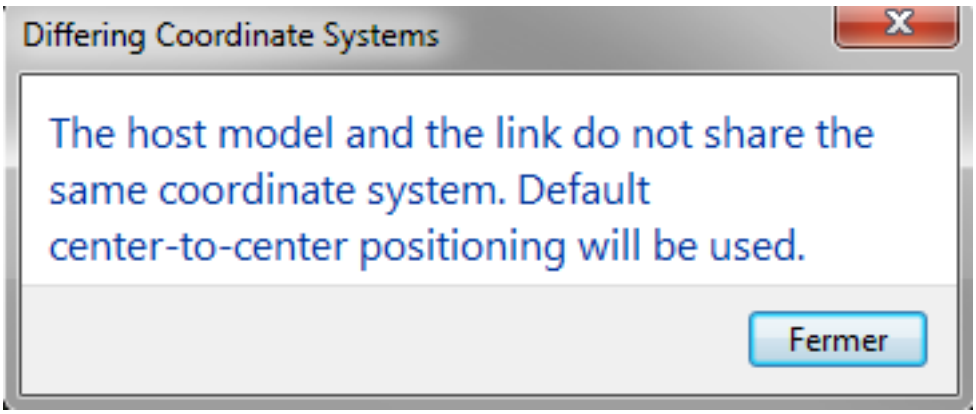
A shared site basically means a Survey Point that is shared among multiple models. Why would you use this "shared site" feature? In a case where you want the survey points and the coordinates to be the same on multiple models. In the example below, we have 4 Revit models: a site model, a big house model as well as 2 instances of a smaller house model.



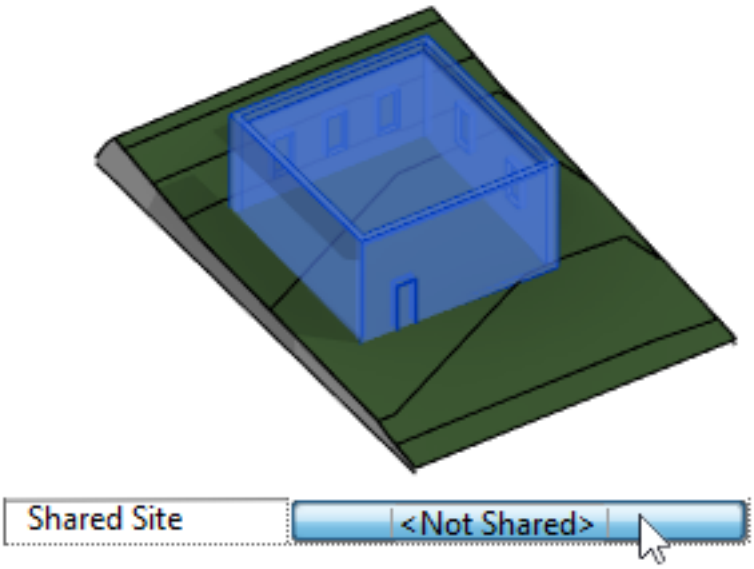
In this case, we want all the houses model to acquire the coordinates from the site model. First, link one of these models inside the site model. You can pick the Shared Coordinates option if you want, but since the models are not coordinated yet, you will receive a warning and the center to center option will be used anyway.



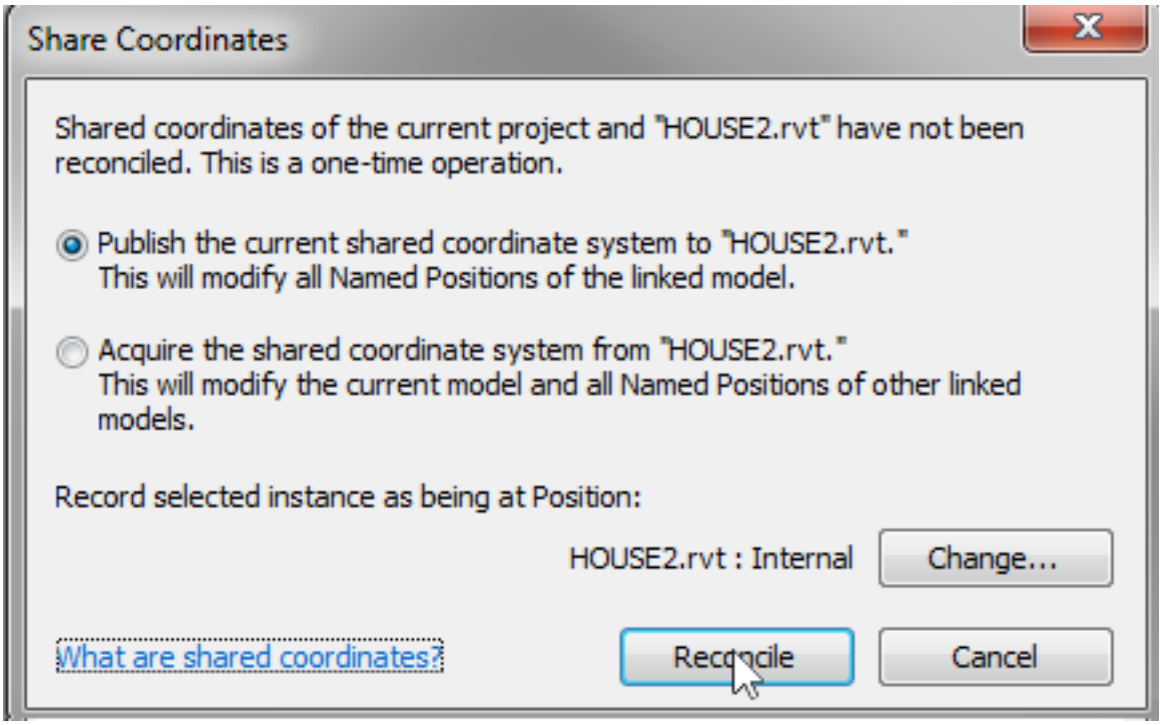
Below is the warning you receive by default. This Shared Coordinates positioning option is basically useless because you can assign the shared coordinates with any other positioning option later anyway.



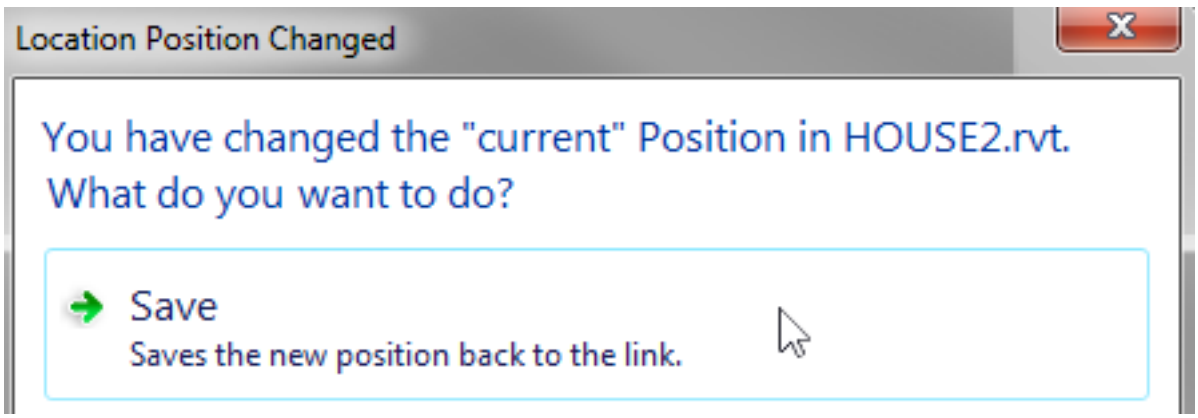

Find the proper position you want for your linked building model inside the site model. Pin your model. Once it is done, select the linked model and click "Shared Site" in the properties.



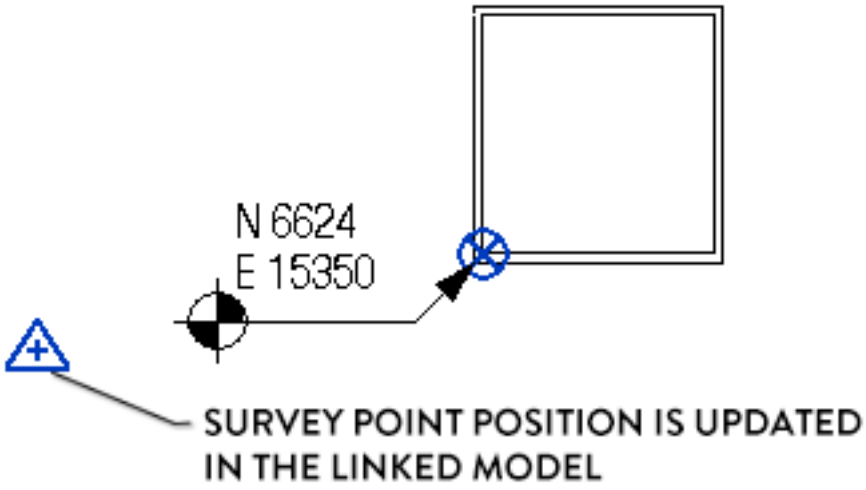

When clicking Shared Site, here are all the options available to you:




In this case, you should pick the first option: you want to publish the coordinates from the Site model to the House model. Basically, this will move the survey point in the House model to be in the same position as the site model. The operation will only be complete once you close the Site model: you will be asked what to do with the linked house model position. Select the first option, which will update the survey point in the model.

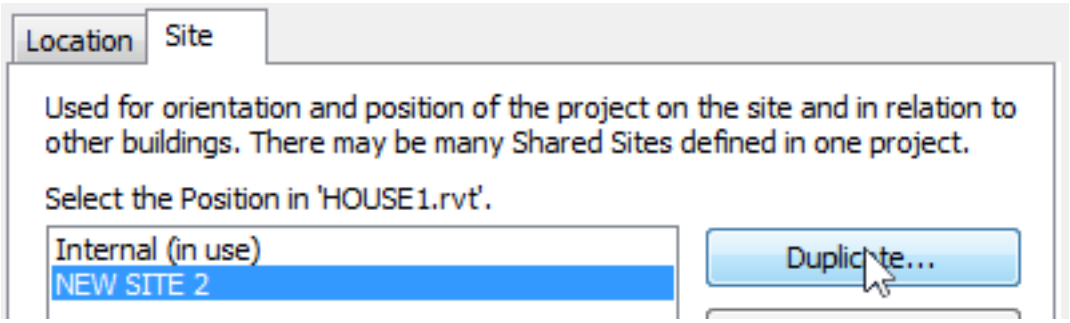



Try opening the house model: the survey point position will be updated to fit the same position as in the site model. That means you can use the spot elevation and spot coordinates tool (with the survey point option) that will match the linked site model.

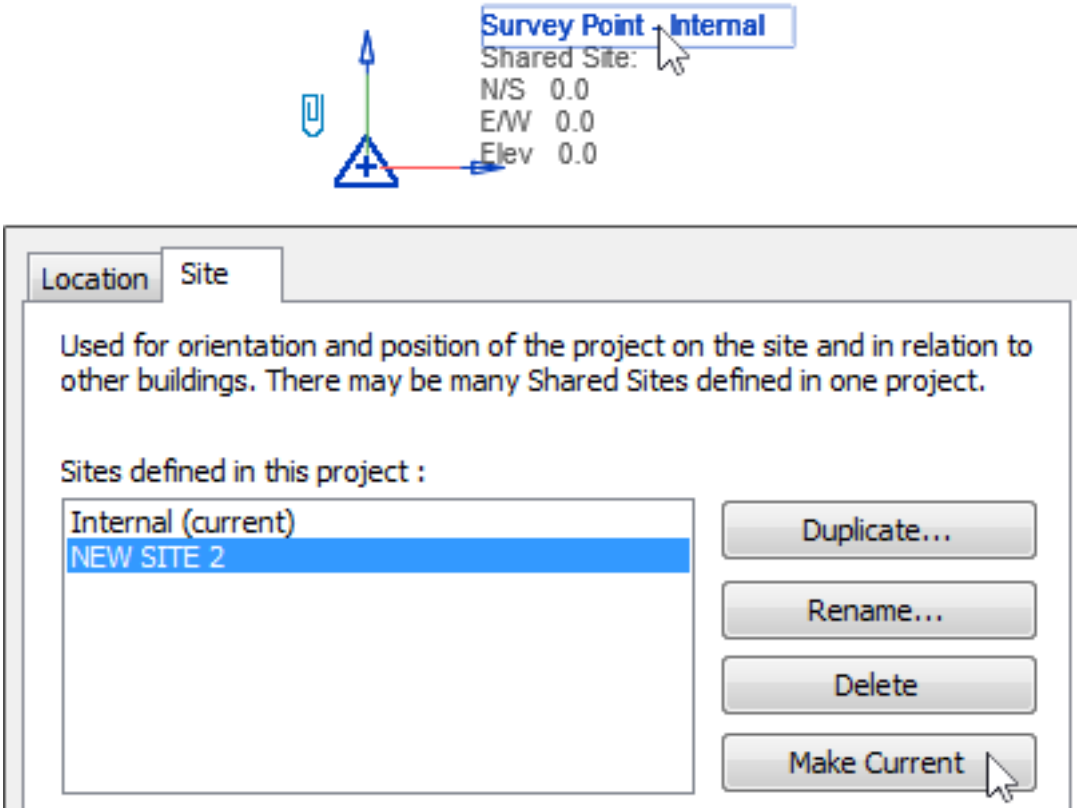



## CREATE MULTIPLE SHARED SITES IN A MODEL

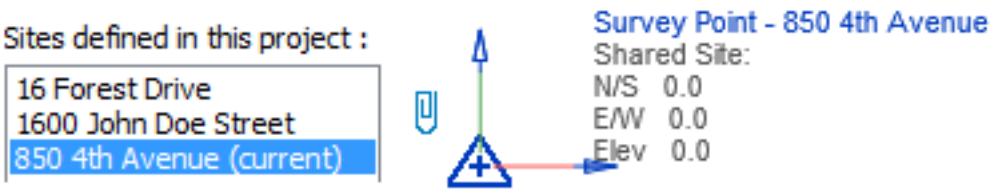
Let's say you are prefab house manufacturer and you want to reuse the same house Revit model on multiple sites. Revit gives you the ability to use multiple Shared Sites within the same model. When publishing coordinates from the site plan to the house model, click duplicate to create a second site.




Save and close the site model, then open the pre-fab house file. Find the Survey Point and double click on the blue text "**Survey Point - Internal**". Select the site you currently wish to use and click "**Make Current**". The survey point location in the file will move to the correct coordinates.

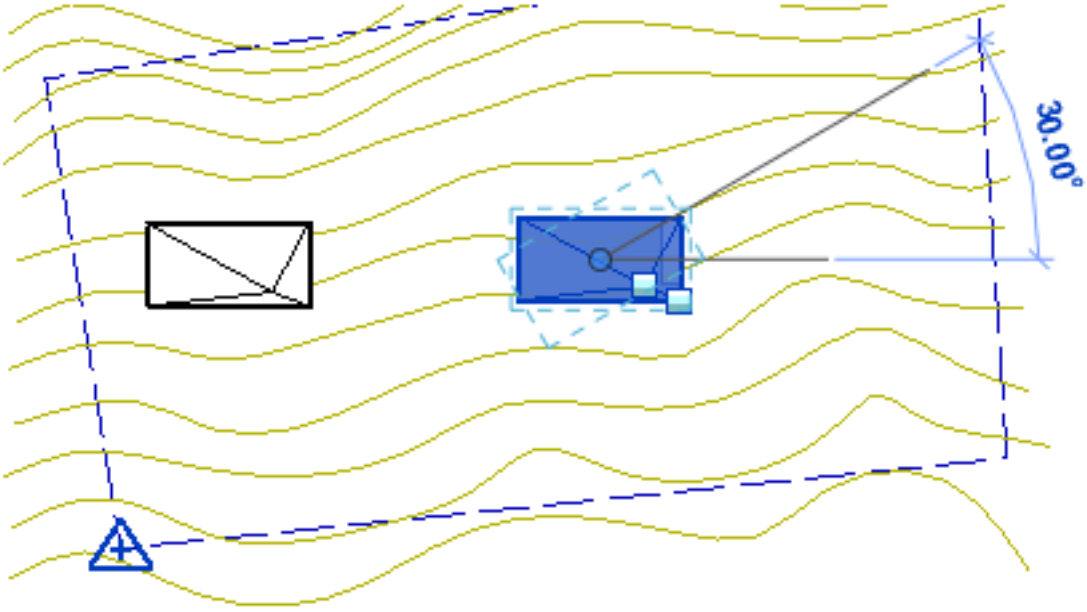



In the end, you could have a pre-fab house model with 200 associated sites that you can activate whenever you want. In the example below, we have multiple address. The survey point indicates the current active one.



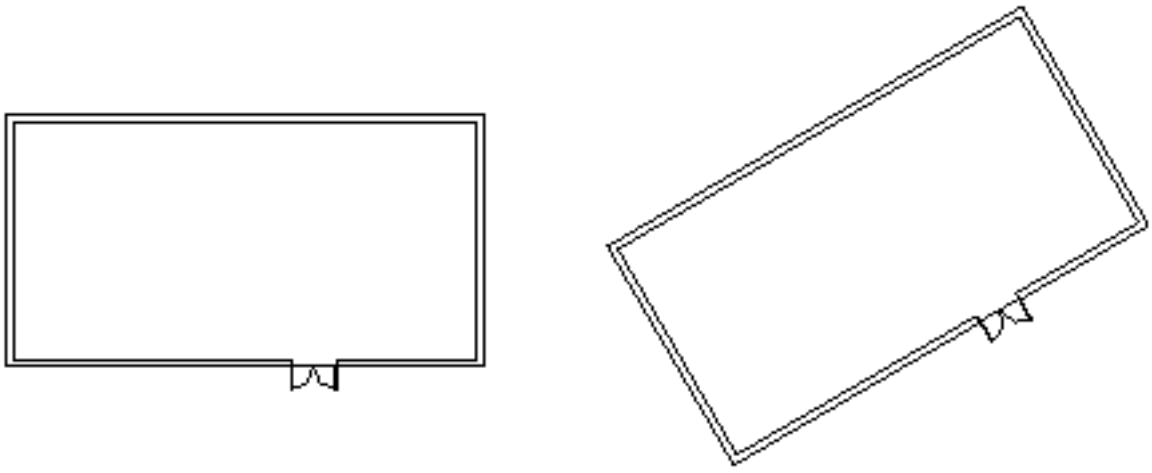

## ROTATING A LINKED BUILDING MODEL IN A SITE MODEL

Let's say you are using the same pre-fab house multiple times on the same site. You rotate one of the instances of the house and publish the new coordinates into a shared site. When you open the house model, the true north will be modified to match the rotation you've used in the site model.




ROTATE LINKED HOUSE MODEL INSIDE SITE MODEL

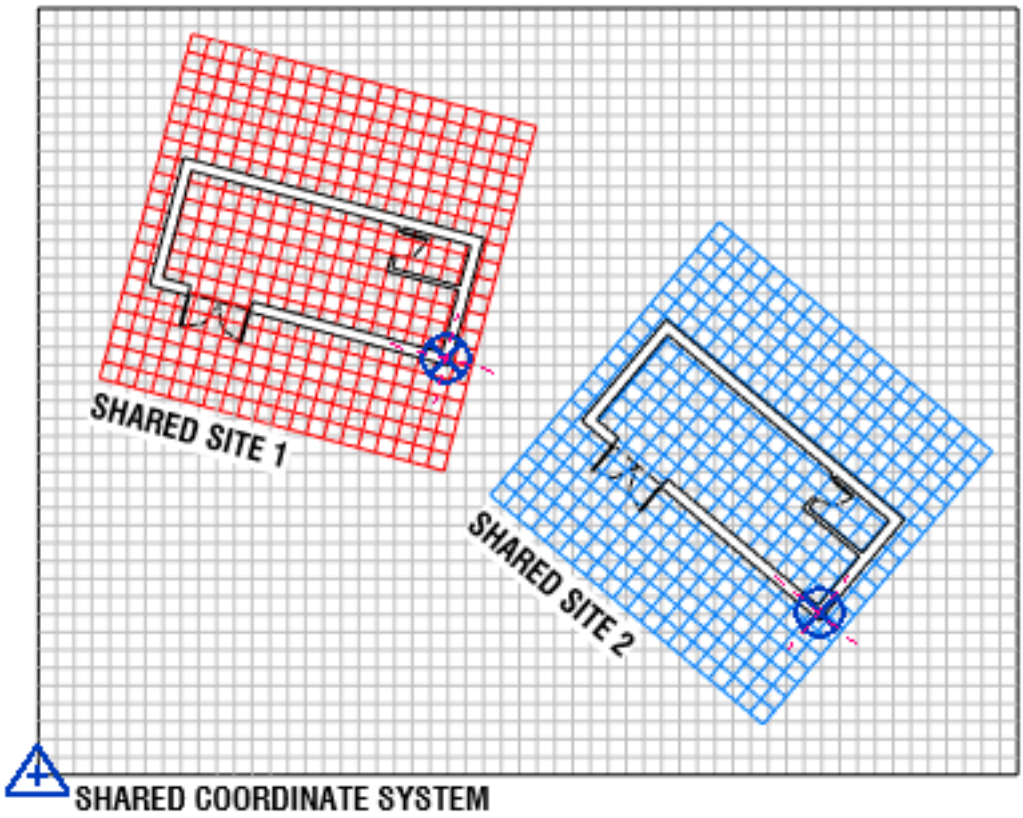
In the image above, the house is rotated in the site model. Publish the coordinate to a new Shared Site. Close the site file and open the house model. Choose the correct Shared Site and open a view set to True North. As you see, the project has the angle that match the rotation you've used in the site model.




CHANGE SHARED SITE IN A "TRUE NORTH" VIEW TO VISUALIZE THE ANGLE SET IN SITE MODEL

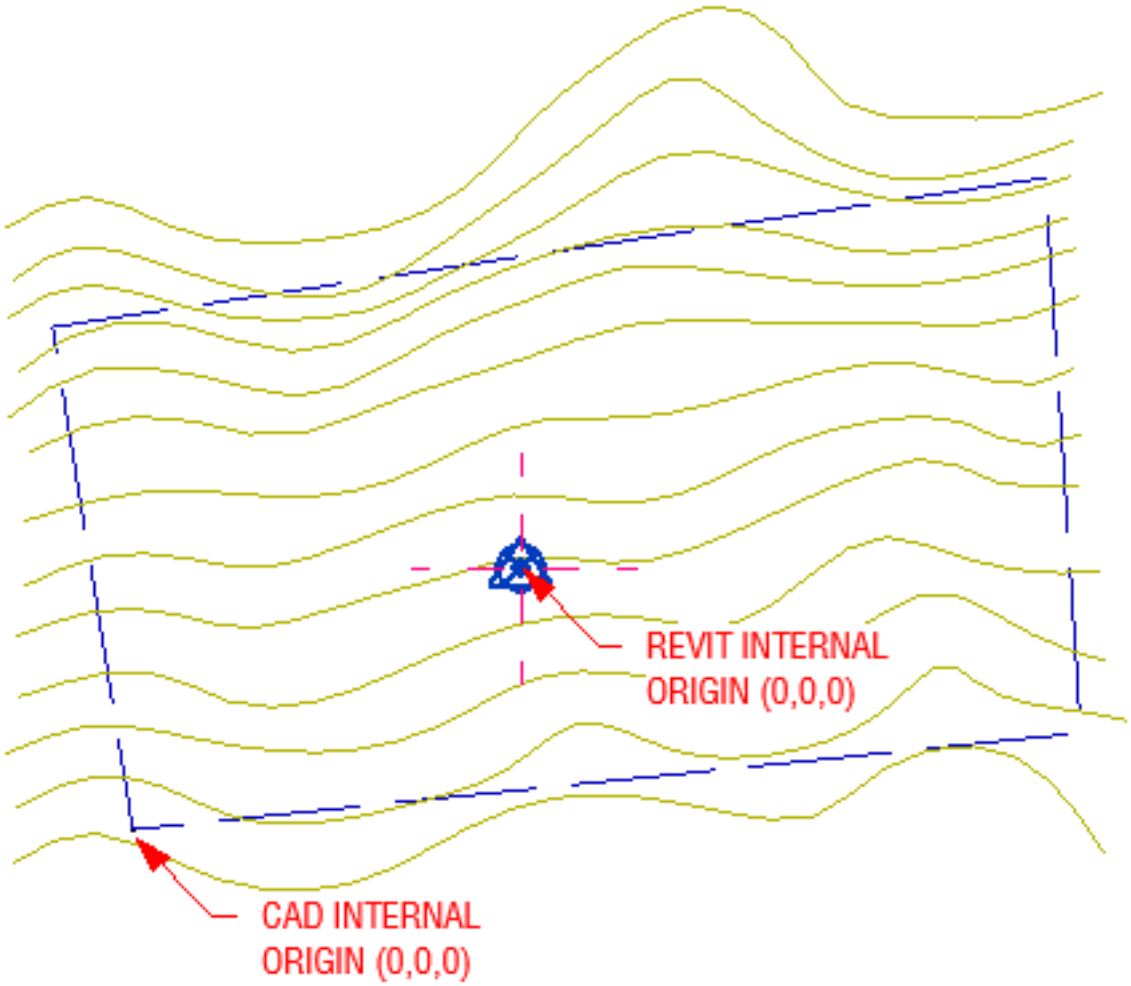
## THE DIFFERENCE BETWEEN SHARED SITE AND SHARED COORDINATES

Shared Coordinates and Shared Sites are not the same thing. In the examples provided in the previous pages, we created multiple shared sites on a unified shared coordinate system. As you can see in the image below, the survey point is always at the same spot for all models, but each instance of the building model has its own project base point and rotation value between true north and project north. Each instance of the building model has a unique shared site.



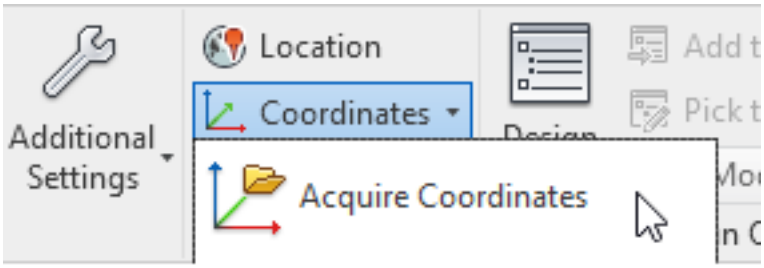

## ACQUIRING SHARED COORDINATES FROM A CAD FILE

When creating a site in Revit, you might have to use a surveyor CAD file with a specific origin location to be used by all disciplines. If that's the case, make sure to link the CAD file inside Revit. The importation positioning options are not very important for the moment because we will acquire coordinates anyway. The CAD origin is located at the corner of the property lines, while the default Revit origins are all at the same spot.



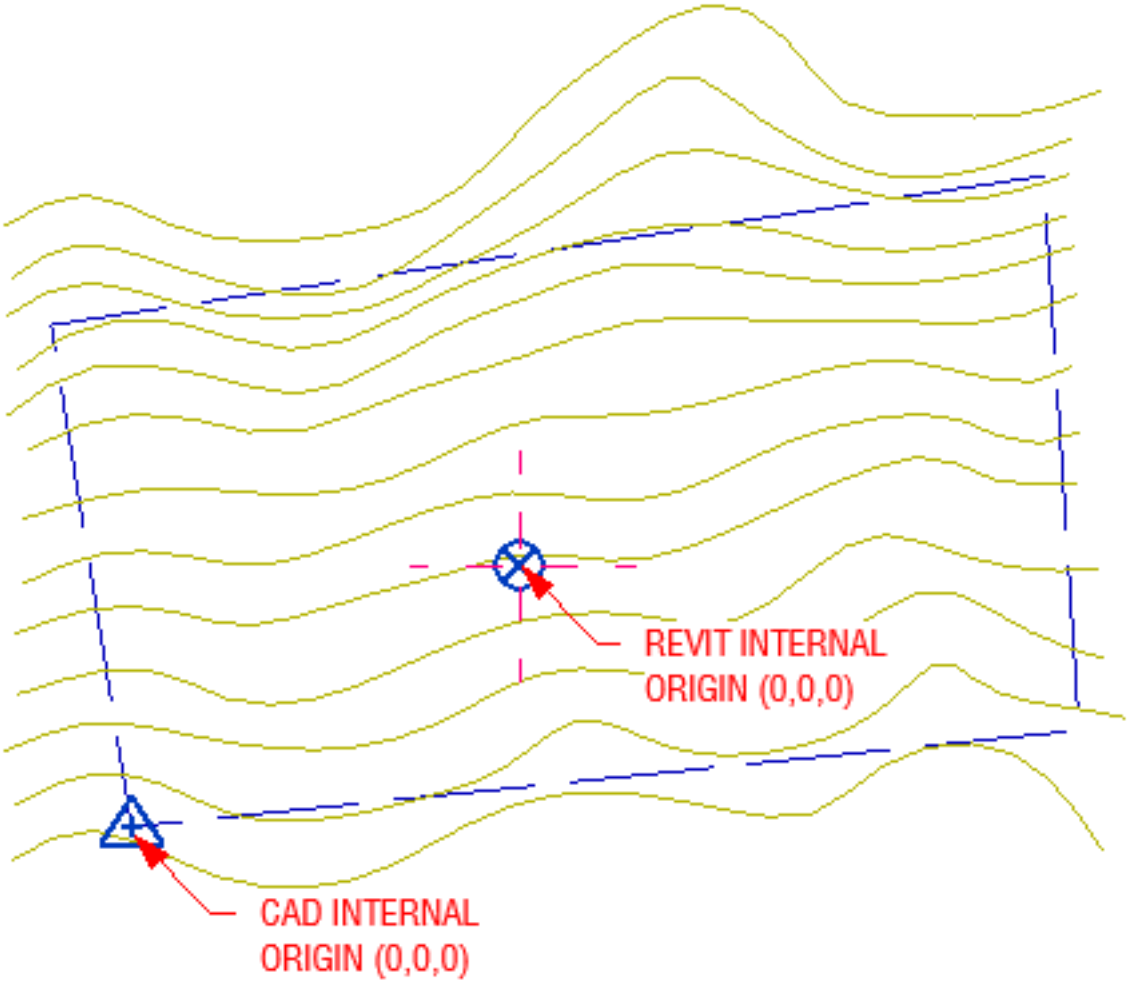

**LINK CAD INTO REVIT FILE**

The next step is to use the Acquire Coordinate tool located in the Manage tab. Then, click on the CAD link.




**USE "ACQUIRE COORDINATES" TOOL IN MANAGE TAB**

The Survey Point of the Revit file will automatically be moved to the CAD origin.



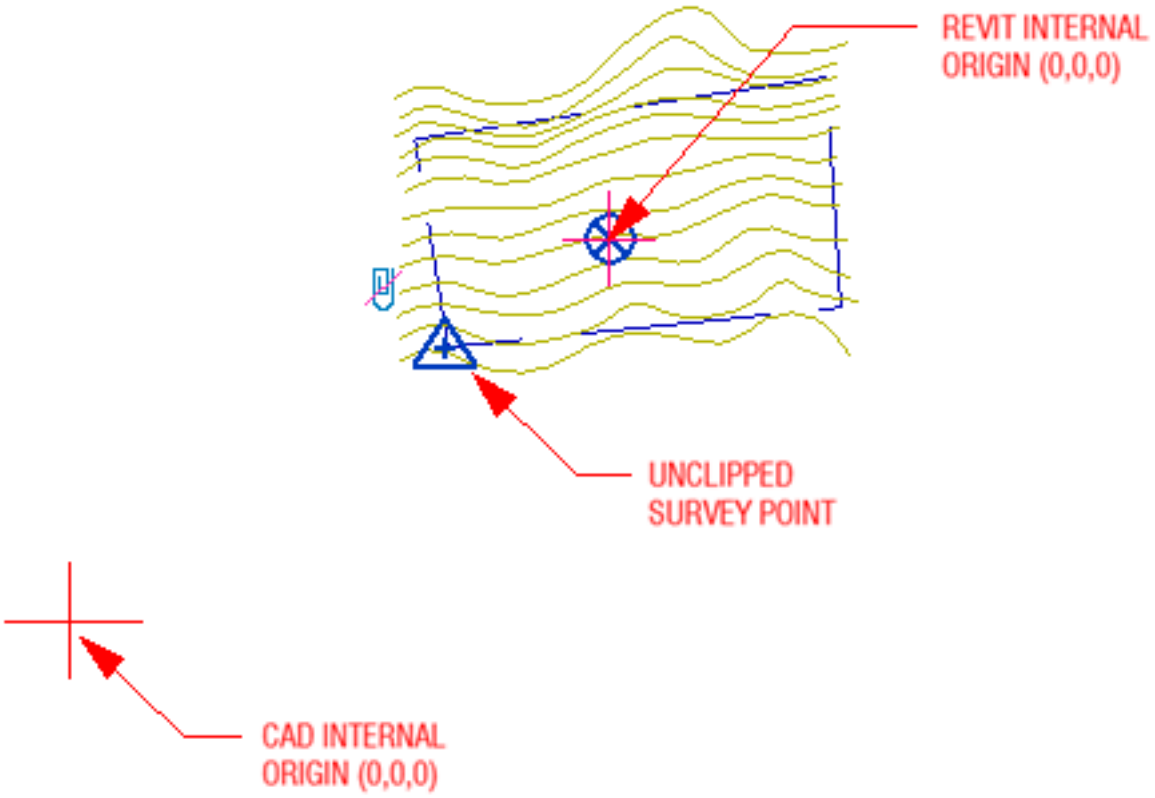

THE REVIT SURVEY POINT IS MOVED TO THE CAD ORIGIN

As you can see, the Survey Point (shared site) is moved to the CAD origin. However, the Revit Internal Origin and the Project Base Point remain in their original location.

If you select the CAD file, you will notice that the Shared Site instance parameter will display the shared site name. If you move a clipped survey point, the CAD file will also follow.

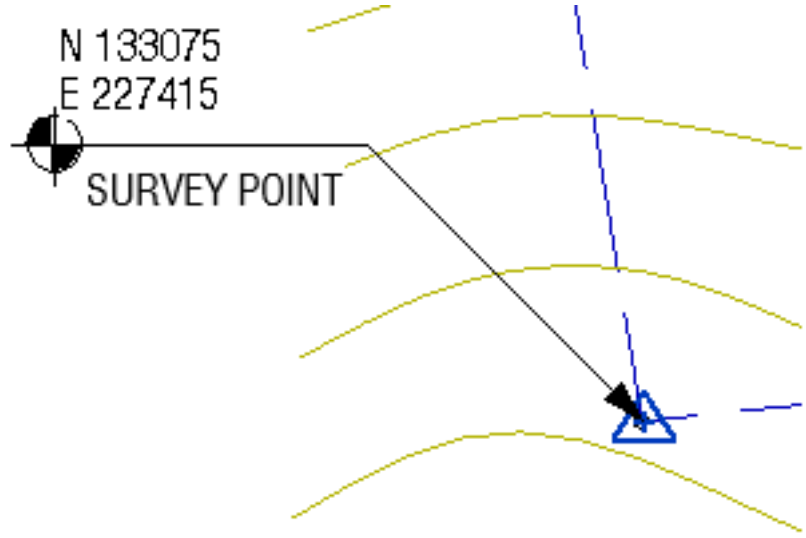
## SURVEY POINT NOT THE SAME AS THE SHARED SITE?

What if the CAD survey file origin point is super far from everything? Like 200 miles away? Some BIM expert think that you should unclip the Survey Point and manually move it to a reasonable origin, like the corner of the property lines. Check out the image next page.




**UNCLIPPED SURVEY POINT WHEN USING SHARED SITE (NOT RECOMMENDED)**

In the image above, the Survey Point (unclipped blue triangle) and Shared Site (CAD origin) are used differently. I personally do not recommend this strategy as it is very risky and confusing. When using the Survey Point spot coordinate feature, the coordinates will refer to the 0,0,0 origin of the survey point (shared site), not the unclipped blue triangle. The distinction between Survey Point and Shared Site can get messy. Unclipping the survey point is just not a good idea, unless your civil engineer specifically asks for it.

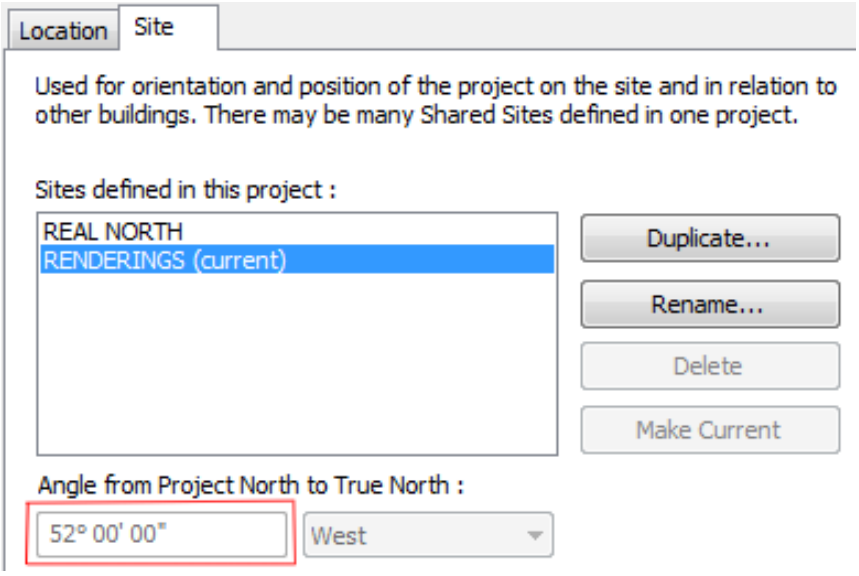



**SURVEY POINT SPOT COORDINATE DOESN'T LOCATE UNCLIPPED SURVEY POINT**

## CREATE A MODEL WITH MULTIPLE TRUE NORTHS

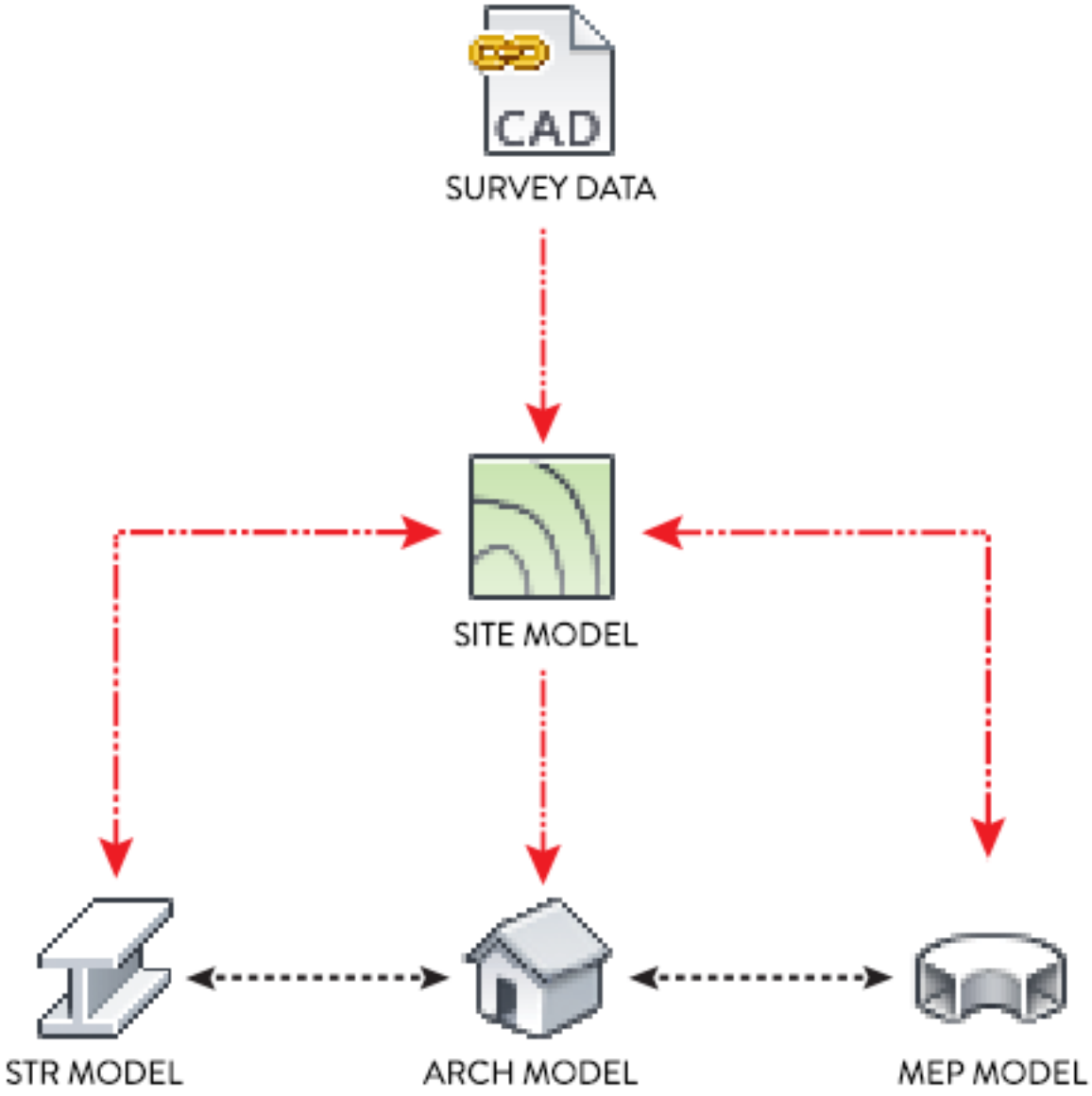
As mentioned earlier, the true north value is changed in the Project Base Point but is embedded in the Survey Point. That means you can have many true norths for the same project. This can be useful if you want to create renderings using a certain north for lighting that is different from the real world north.

In this case, create a second site in your survey point menu. Change the true north value in the Project Base Point. As you can see below, each site has its own angle from Project North to True North. When creating renderings, activate "RENDERINGS" site. When printing the plans to PDF, use the "REAL NORTH" site.



# 6 STEPS TO CREATE SHARED COORDINATES FOR MULTIPLE REVIT MODELS

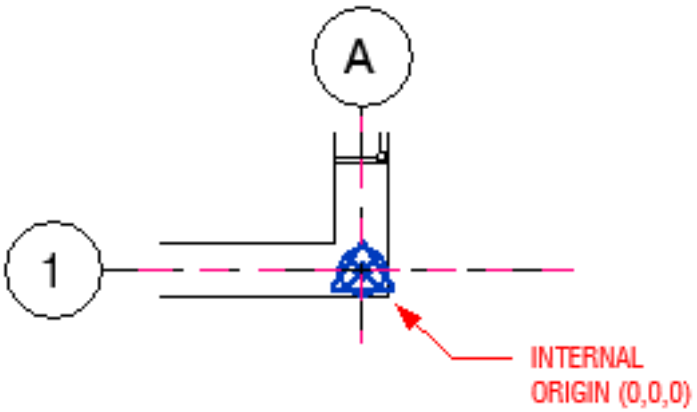
If you are working on a project where real-world coordinates are important, you will need a proper workflow to avoid problems. On the example below, we have a project containing models for architecture, MEP and structure. The Survey Data from your civil engineer might or might not be available when you start your project. It doesn't matter. You can add the site model and the survey data at any moment in the project, when it is ready. The first step is always to create an architecture model.



## 1- CREATE ARCHITECTURE MODEL, LOCATE IMPORTANT GRIDS INTERSECTION AT INTERNAL ORIGIN

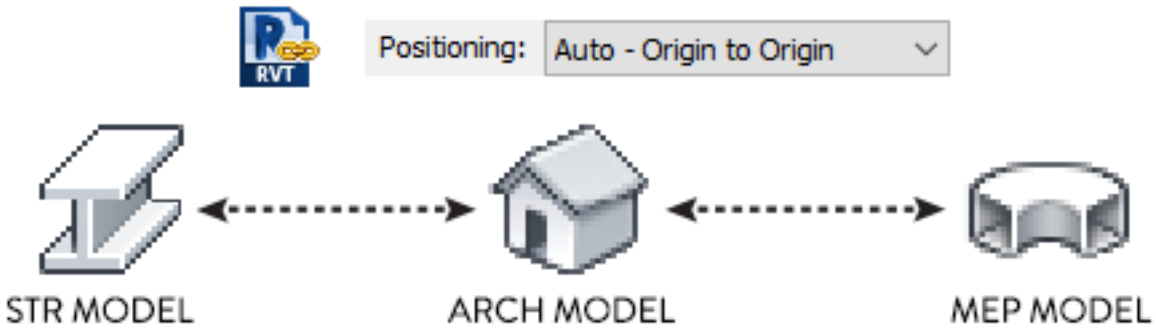
The first step is to create the main architecture model. Orient the views for convenience and ignore the true north for the moment. Don't model the site. That will be done later.

The most important step is to place the building in relation to the internal origin. Usually, that means at the corner of your building, where two major grids might intersect. Don't mess up this step. You cannot relocate the internal origin of the project.

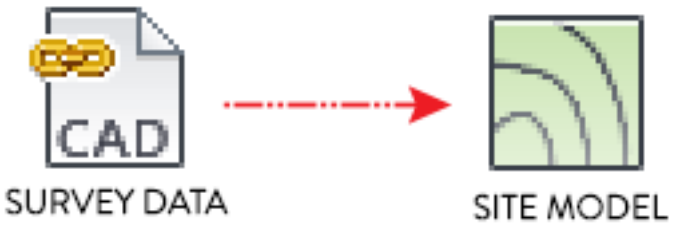



## 2- LINK REVIT MODELS FROM ALL DISCIPLINES USING "ORIGIN TO ORIGIN"

If you have MEP and Structure models ready, you can link all the Revit files together. Use the **Auto – Origin to Origin** option. Always use this option and you will never have positioning problems when linking multiple disciplines. Don't worry about shared coordinates for now.



## 3- CREATE SITE MODEL, LINK CAD SURVEY DATA, ACQUIRE COORDINATES




Once you have the Survey Data from your civil engineer or surveyor in hand, create a new Revit site model. Make sure the internal origin in the CAD file containing the survey data is where it needs to be. Then, use **Link CAD** to insert the file. The positioning option doesn't really matter. Just make sure the CAD file isn't too far from the Revit model internal origin. Use the Acquire Coordinates feature like you've learned in page 25. The Survey Point position should now match the CAD survey origin.

You can now start modeling a toposurface. Remember that all elevation values entered are relative to the Revit Internal Origin.

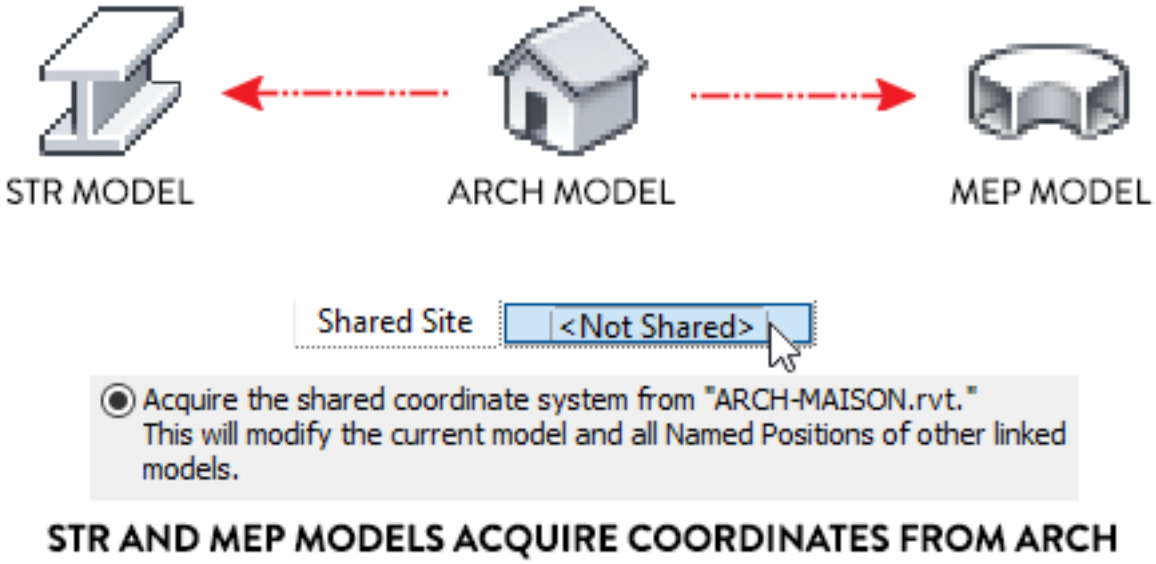
## 4- POSITION ARCHITECTURE MODEL ON THE SITE, PUBLISH COORDINATES


In your Revit site model, link the architecture model using any positioning parameter. Manually position the model, both in plan view and in elevation to match the topography. When you are done, **publish** the coordinates from the Site Model to the Architecture Model (see page 20). Both models now share the same coordinate system. You can close the site model.

When linking the site model inside the architecture model, make sure to use the "**Auto – By Shared Coordinates**" option. The survey point from the arch model should match the survey point from the site model.

## 5- STRUCTURE AND MEP MODELS ACQUIRE COORDINATES FROM ARCHITECTURE MODEL

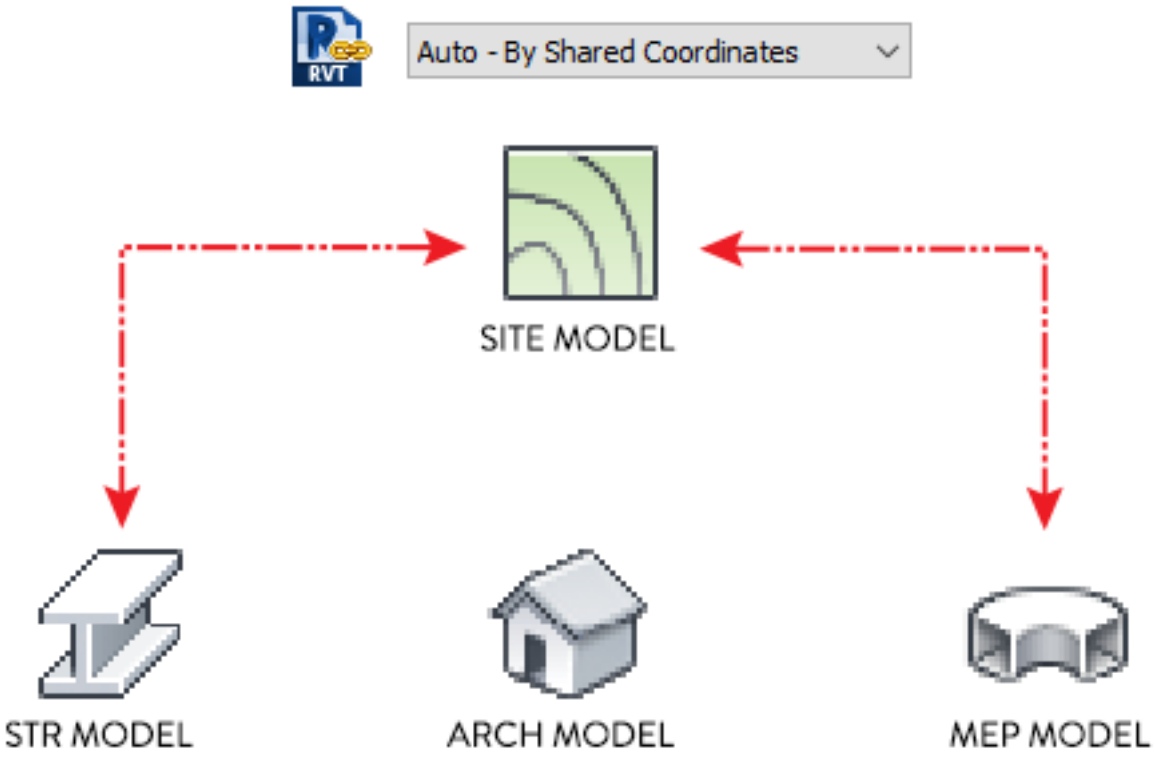
Now, time to propagate the shared coordinates to the Structure and MEP Models. The Architecture model should already be linked in the other disciplines' files. Make sure to get the latest arch model that includes the shared coordinates. Then, acquire the coordinates from the architecture model. Don't use the Acquire Coordinates tool from the manage tab. Instead, click on the Arch Revit link. In the instance properties, click on <Not Shared> in the Shared Site instance parameter. Select the "Acquire Coordinates" option. The survey point in the MEP and Structure file should be updated.



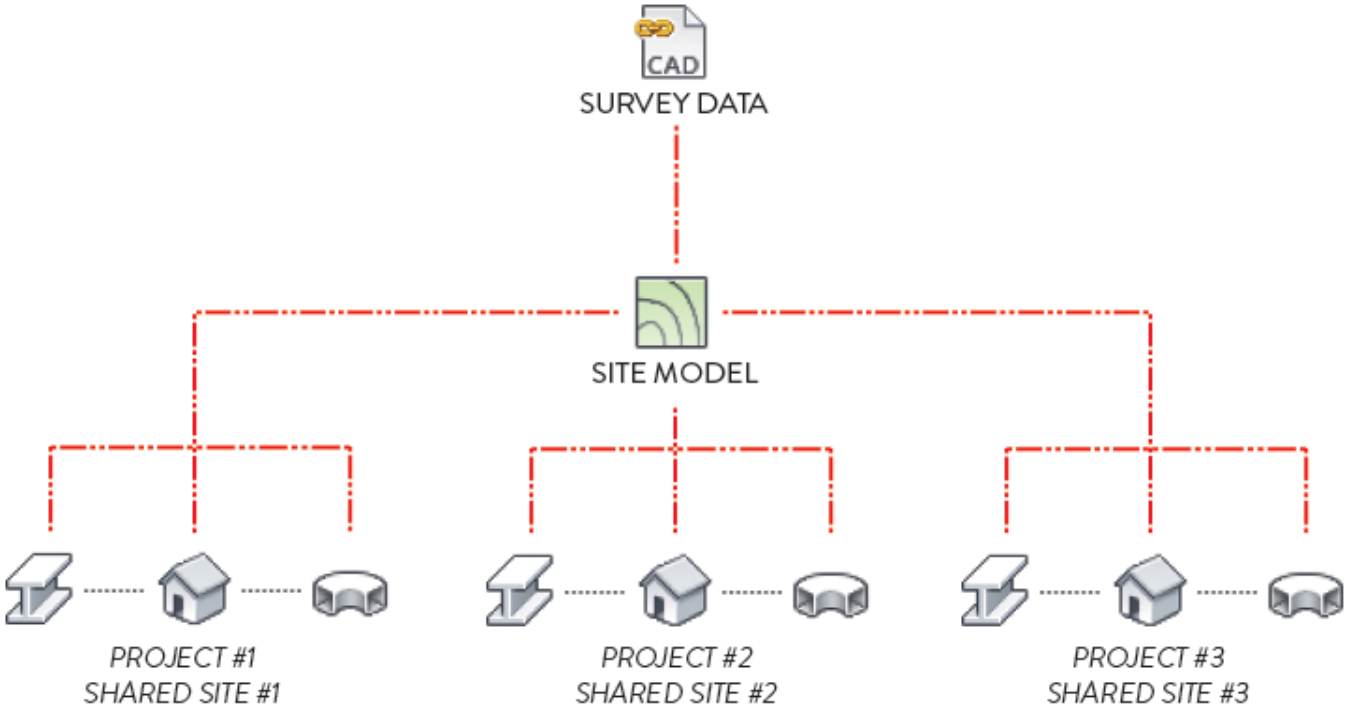

STR AND MEP MODELS ACQUIRE COORDINATES FROM ARCH

## 6- LINK SITE MODEL INTO STRUCTURE AND MEP MODELS USING "BY SHARED COORDINATES"

All the Revit files now share the same coordinate system. That means if you use the **Spot Coordinate – Survey Point** annotation tool you will get the exact same result on any model. It also allows you to spot elevation values referring to the sea level. Link the site inside the structure and MEP models if required. Make sure to use the **Auto – By Shared Coordinates** positioning tool.




On a site containing multiple projects, the chart might look like this:



## WORKING WITH WGS84 (LATITUDE-LONGITUDE) COORDINATES

The Revit 2018 update allows you to use real world coordinates. Select the survey point and look at the instance properties. You will see properties for latitude and longitude.

| Identity Data | |
|---|---|
| N/S | 0.0 |
| E/W | 0.0 |
| Elev | 0.0 |
| **Geolocation** | |
| Lat | |
| Lon | |

SURVEY POINT CONTAINS GEOLOCATION INSTANCE PROPERTIES

However, you can't manually fill up the information. You must acquire the coordinates from a linked CAD file that uses real world WGS84 coordinates. In the image, you link a surveyor CAD file that has been geolocated and acquire the coordinates. If you select the Survey Point, you can see the geolocation data has been updated.

| Identity Data | |
|---|---|
| N/S | -470182957.6 |
| E/W | 2147319663.0 |
| Elev | -10000.0 |
| **Geolocation** | |
| Lat | 46.77° |
| Lon | -71.24° |

ACQUIRE COORDINATES FROM GEOLOCATED CAD FILE: GEOLOCATION DATA WILL FILL UP

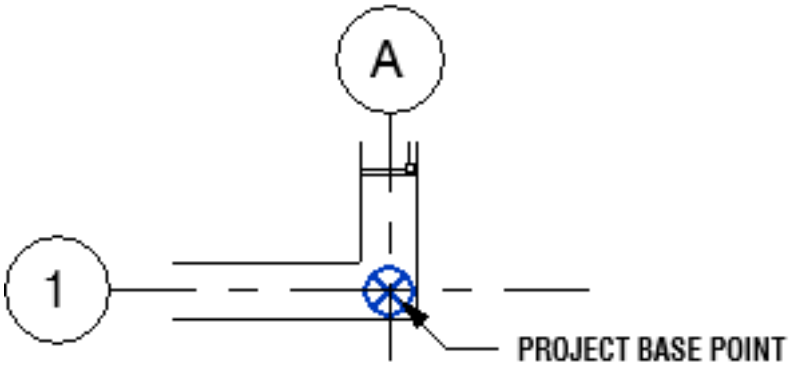
Another thing to notice: the survey point didn't move. That is because the site extents are so big (470 km x 2 147km) that the survey point can't manage to get to the origin. Be careful with huge sites.

# INTEGRATING COORDINATES INFORMATION IN A BIM EXECUTION PLAN

When writing a BIM execution plan, you should list all the important coordinate points and include a screen shot. Make sure to list the internal origin, the project base point and the survey point of the linked site model (if applicable). Make sure to also indicate the elevation values. It should look like this:

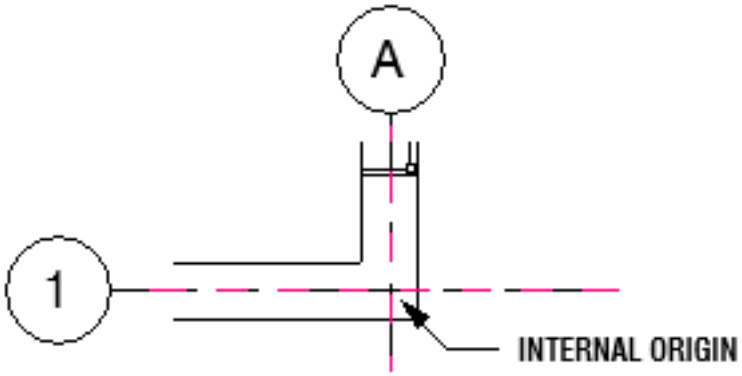
### *PROJECT BASE POINT:*

*The project base point of the architecture model is located at the intersection of grids A and 1.*



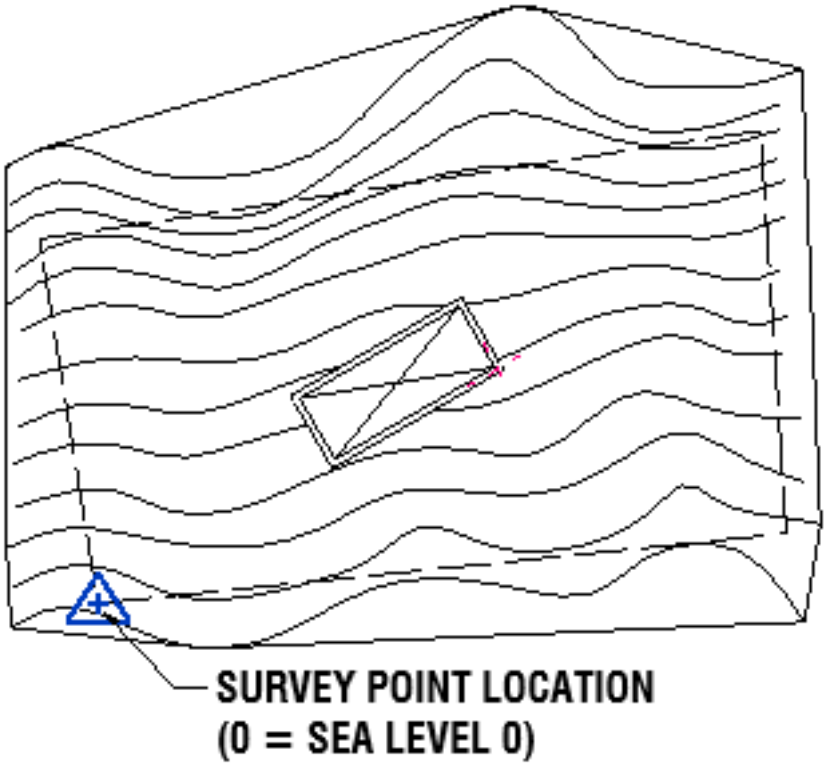

### *INTERNAL ORIGIN:*

*The internal origin is also located of the grids A and 1, intersecting in height with level 1.*



***SURVEY POINT:***

*The survey point of the linked Revit site model is located at the south-west property line intersection. The elevation at height 0 refers to the sea level.*




After setting up these coordinate points, they should be pinned and never moved again.

***FURTHER READINGS:***

Steve Stafford's Revit Op-Ed blog has a lot of posts about coordinates. Check it out here:
http://revitoped.blogspot.com/2012/05/shared-coordinate-post-summary.html

Paul Aubin Revit Coordinates guide:
http://paulaubin.com/_downloads/2015_RTC/Aubin_Revit_Coordinates_2016.pdf

Revit Pure original blog post about coordinates:
https://revitpure.com/blog/13-tips-to-understand-revit-base-points-and-coordinate-system