Session 1.3

The Revit Theory of Relativity: Understanding Shared Coordinates

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Class Description

Anyone who has used Revit for a while knows that the mere mention of shared coordinates always gets the attention of users both new and old. Let's face it, Revit's way of handling coordinate systems is unique. But unique doesn't make it any less powerful than other software. In fact, Revit's approach is quite powerful indeed. In this lab we will walk through a few file linking scenarios using Shared Coordinates. The goal will be to remove some of the mystery surrounding this sometimes baffling topic. We'll explore common scenarios involving single buildings, multiple buildings and how to both set up coordinates and maintain them as a project progresses. We won't cover every possible approach to using coordinates in this lab. But we will cover solid and reliable ways to use shared coordinates to ensure that your models are always positioned correctly.

About the Speaker:

Paul Aubin is the author of many Revit book titles including the widely acclaimed: The Aubin Academy Mastering Series: and the all new Renaissance Revit and Revit video training at www.lynda.com/paulaubin. Paul is an independent architectural consultant providing Revit® Architecture implementation, training, and support services. Paul's involvement in the architectural profession spans over 20 years, with experience in design, production, CAD management, mentoring, coaching and training. He is an active member of the Autodesk user community, and is a high-rated repeat speaker at Autodesk University, Revit Technology Conference and a national speaker at the BIM Workshops. His diverse experience in architectural firms, as a CAD manager, and as an educator gives his writing and his classroom instruction a fresh and credible focus. Paul is an associate member of the American Institute of Architects and a member of the Institute of Classical Architecture. He lives in Chicago with his wife and three children.

Introduction

Before learning Revit, I was a long-time AutoCAD user. As a long-time AutoCAD user, I found Revit's "apparent lack" of coordinates quite troubling. *How were we ever supposed to place anything precisely when I can't type in 0,0 anywhere?* Perhaps you shared my experience and frustration? After much self-inflicted pain and anguish, I have since come to see things the "Revit way" and gotten over my "AutoCAD-centric" way of thinking... I am feeling much better now... The reality is that while "absolute" coordinates may seem comforting in their finality… and well, "absoluteness" we do not experience the World this way. In "real life" we always have a relative view of the World around us. When you are sitting in your office on the tenth floor of the building, do you have the perception that you are floating high in the air, or rather that you are really just sitting in a chair a few feet from the floor? Our experiences in the World around us are relative. Shouldn't our design software be too? Well in Revit, as you have no doubt discovered, all coordinates, movements, dimensions and measurements are *always* relative to something else. In the topics that follow, we will explore the "Revit theory of relativity" (OK, it's not really called that). If you have let your AutoCAD experience ruin you and have just not been able to get your head around Shared Coordinates, this session is here to help!
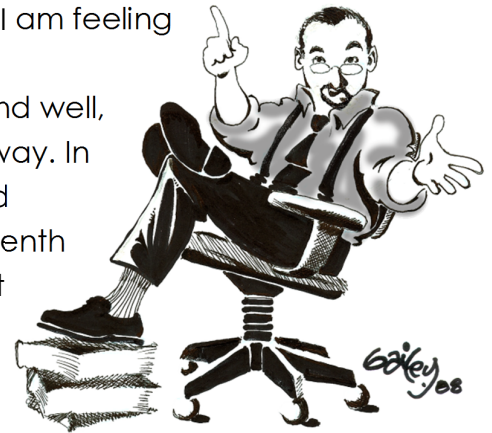
Revit Origin and Base Points

Let's start right in with the question of origin. I am often asked about the origin (or **0,0**) by new users of Revit. So to answer the question: "Does Revit have an origin?" the answer is: **YES**. So the next logical question is, "Where is it?" The simple answer is: "It's in the center of the screen." Satisfied? No? OK, here is a simple exercise to locate it for yourself:

1. Launch Revit and create a new project from the default template.

Note: I have used the Autodesk provided: Default.rte template included with the US Imperial installation. However, I'll reference whole numbers wherever possible.

2. Type **VG** (or on the View tab, click Visibility/Graphics), scroll down to and expand Site and the check (to turn on) **Project Base Point** and then click OK.
3. The Project Base Point appears as a round symbol. Select the icon and the coordinates of this point will report as 0,0,0 onscreen (see Figure 1).
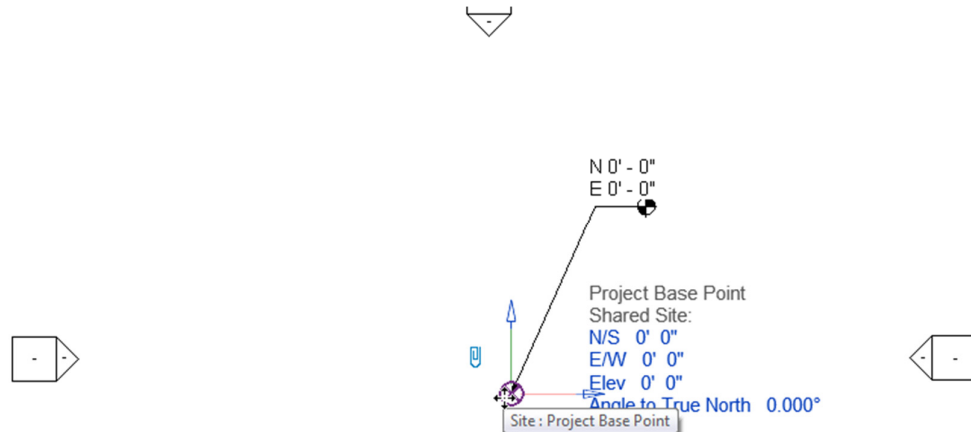
FIGURE 1—TURN ON THE PROJECT BASE POINT USING VISIBILITY/GRAPHICS (VG)

You will also notice that it is basically in the center of the screen (relative to the elevations). There are two alternative ways that you can report coordinate locations onscreen.

4. On the Annotate tab, click the **Spot Coordinate** tool
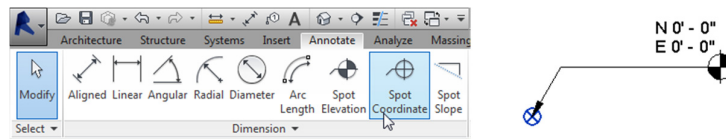5. Add a spot coordinate symbol to the Project Base Point icon (see Figure 2).

FIGURE 2—ADD A SPOT COORDINATE

There is also the **Report Shared Coordinates** tool on the Manage tab.

6. On the Manage tab, on the Coordinates drop-down choose: Report Shared Coordinates.

This command will allow you to click on an object onscreen and it will display the coordinates of the point you select on the Option Bar (see Figure 3).
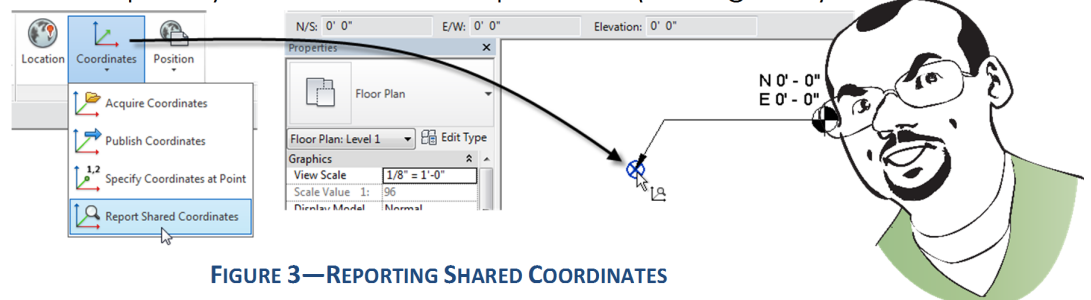

FIGURE 3—REPORTING SHARED COORDINATES

So now we can see that Revit does in fact have an origin and it is approximately at the center of the screen. Feel better now? I thought you might. So if your goal was know where the origin is; congratulations. You are done…

But, not so fast, there's more to the story. The real question is: "so what?" "What does this 0,0 do for us? Well, at the moment; nothing. Recall that, EVERYTHING in Revit is relative. So in order for this Project Base Point that we now have displayed to be meaningful, it has to be defined relative to something else. Only then does it actually become useful.

7. Click on the Project Base Point icon.

Notice that the numerical values that appear to the right of the icon are editable temporary dimensions.

8. Click on and the E/W value and type in a new value such as **20**.

You will actually see the Project Base Point and the surrounding Elevation markers appear to shift onscreen. Think of how such an edit would behave elsewhere in Revit… For example, imagine selecting a wall and then editing the temporary dimension. What would happen? The selected wall would move to a new location based on the value you input correct? In other words, the selected element moves in relation to the element associated with the temporary dimension. *If that's true, then in this case where was the movement measured from?* Look at the current value of the E/W temporary dimension on the Project Base Point. Notice it now reads: 20. But it is still not really clear what the 20 references.

Well, Revit gives us another handy reference point for exactly that purpose. The second point is called the **Survey Point**. You can turn it on with VG as well. The Project Base Point that we have displayed right now represents some known point in our project model. The Survey Point typically represents a "known point in the real world." For example, if you Civil Engineer gives you a survey with some established benchmark or known site point, the Revit Survey Point will represent this location. This will help you establish the proper positioning of the project on its physical site. To see the Survey Point:

9. Type **VG** (or on the View tab, click Visibility/Graphics), scroll down to and expand Site and the check (to turn on) **Survey Point** and then click OK. The Survey Point is triangular in shape.

10. Add a Spot Coordinate to the Survey Point if you like.

By default, both points are in the same location. However, if you are following along here and moved the Project Base Point above, you should now have a space of 20 units (feet) separating your two points.
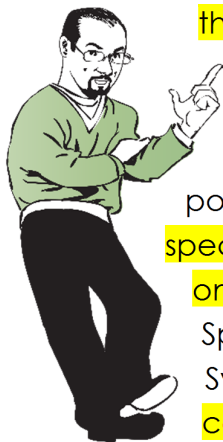
FIGURE 4—TURN ON THE SURVEY POINT USING VISIBILITY/GRAPHICS (VG)

If you select the Survey Point, you will notice that the dimensions are not currently editable. However, the Survey Point icon CAN be moved; doing so would actually shift the coordinate system. *This means the new location of the moved icon **would now be 0,0!*** Naturally you would want to exercise caution here.

11. Try dragging the Survey Point onscreen.

If you still have spot coordinate symbols onscreen, you will see the one on the Project Base Point adjust in real-time. Now that we have both points displayed and having done this simple experiment, you can hopefully start to understand their relationship relative to one another. As noted, the intention of the Survey Point is to "anchor" us in the real World. It represents a real and known benchmark location on the building's site (usually provided on the survey). The Project Base point is simply a known point on the building itself (usually chosen by the project team). Think of the Survey Point as the coordinates in the *World* and the Project Base Point as *local building* coordinates. For example, The Survey Point might be located at the manhole in the middle of the street outside the building or on a utility pole, while the Project Base Point might be at the front door or column line intersection A1. You can choose the point that is most convenient to the project team. What is important is NOT specifically where the two points are, but rather their relationship RELATIVE to one another. This is what we mean by Shared Coordinates in Revit. Specifically, the Survey Point is a known point in the Shared Coordinate System. It is called the Shared Coordinate System because it represents the coordinate system of the World around us and is therefore "shared" by all buildings on the site. The Survey Point defaults to the origin (0,0,0) of the **Shared Coordinate System**, but you can move it to ANY convenient point for your project. There are a few ways to do this.

Likewise, the "Internal Coordinate System" of your building is the building's "local" coordinates which are typically oriented perpendicular and parallel to something meaningful in the building. For example, if the building has a 30° rotation on the site, it is much more convenient to work on the building horizontally and vertically with respect to your screen, the building's major architectural elements and the plotted sheets, rather than at 30°.
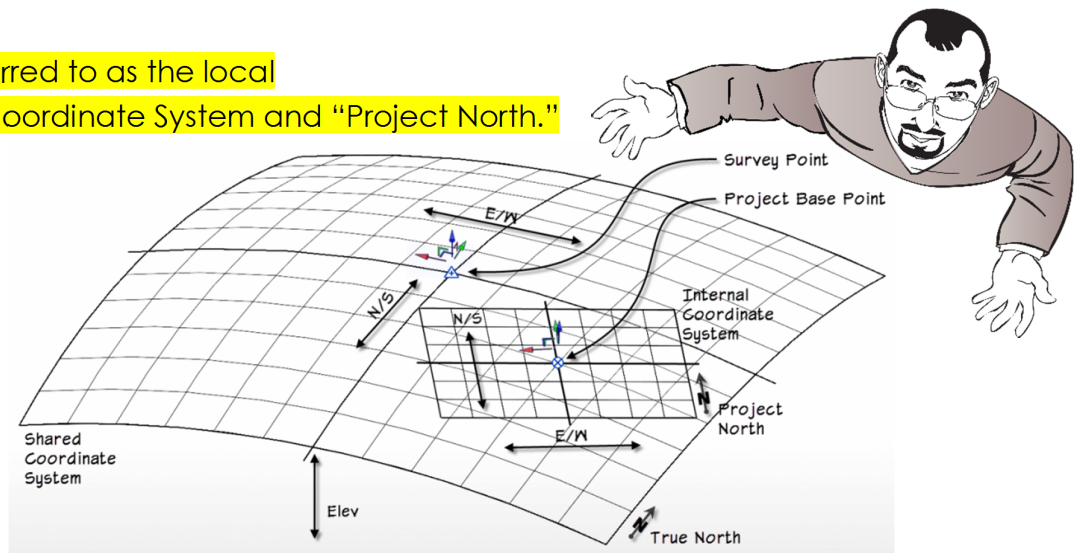
FIGURE 5—VISUALIZING THE RELATIONSHIP BETWEEN INTERNAL AND SHARED COORDINATES

The existence of both coordinate systems lends meaning to the other. If we did not have both, we would be forced to assign arbitrary meaning to coordinate system and its origin and force the building to match the survey or vice/versa. The Revit system allows us to keep both! And more importantly, it allows both to have real-world meaning.

Project Location Tools

As noted above, the Project Base Point and Survey Point can be moved. In other words, while they are located at the origin by default, they do *not* have stay there. There are a few ways to move them. You can move the point icons themselves directly onscreen using the Move tool or temporary dimensions (as we have already seen). There are also some commands on the Manage tab. Moving the points onscreen offers results similar to these commands depending if the icon is **clipped** or not. (Click the small paperclip icon to clip or unclip) Let's look at each option and command.

- **Position>Relocate Project**—This command moves your project relative to the Shared Coordinate System. You can use it in plan or elevation views and it works just like the Move command; you first click a start point, then a new point. The result will be a change in the numerical offsets reported by the Project Base Point and is basically identical to the result achieved above by editing the temporary dimension of the **clipped** Project Base Point.
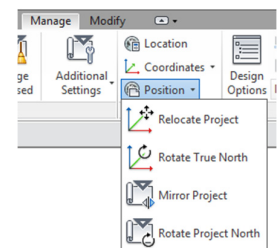
- **Position>Rotate True North**—This command changes the orientation of True North relative to the orientation of the building. (Revit understands both True North; North with respect to the actual site and Project North; "up" relative to the screen (or plotted sheet) and usually set parallel or perpendicular to major building geometry). To use this command, you must be in a plan view and the plan view must have its Orientation parameter (on the Properties palette) set to: **True North**. It behaves just like the normal Rotate command but the result impacts the orientation of the entire building relative to the site. After rotating True North, you can see the results on the Project Base Point and Survey Point icons (see Figure 6).
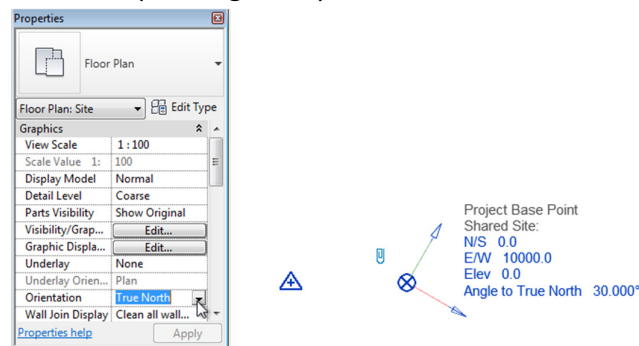

FIGURE 6—ROTATE TRUE NORTH IN A PLAN WHOSE PROPERTIES ARE SET TO TRUE NORTH

Note: You can also rotate True North by using the temporary dimension on the Project Base Point icon. This method does not require that you first change the orientation of the plan view.

- **Position>Mirror Project**—This command mirrors (flips) the project with respect to the Shared Coordinate System. Please note that all aspects of the project "flip". So if you flip left to right and you started with an elevation on the right named East, the elevation that ends up on the right following this command will be named West! *(I recommend avoiding this command if at all possible)*.

- **Position>Rotate Project North**—After adjusting coordinate systems, sometimes the plans and other views don't fit as nicely on the sheets. For example, if your building is much taller than it is wide, you might wish to rotate Project North. This offers several pre-sets like rotate 90° or 180°. You can also rotate arbitrarily if necessary. You can easily avoid this command by planning your building orientation to match the proportions of your monitor and/or plotted sheets. Project North and Project Base Points are meant to be convenient. Don't make you work harder by assigning unnecessarily complex meaning to these items. Keep it simple. With a little pre-planning, you will rarely need this command.

- **Coordinates>Specify Coordinates at a Point**—This command allows you to click on an object at a point, an edge or a surface. You can also click on your Survey Point with this command. A dialog will display with editable fields where you can input known values for the selection you made. You would acquire appropriate values to input from your survey file or Civil Engineer. <mark>Using this command, you can achieve the same results as most of the other commands listed here but in a single step</mark>. In most cases, this is the most reliable way to establish your "real-world" coordinates (see Figure 7).
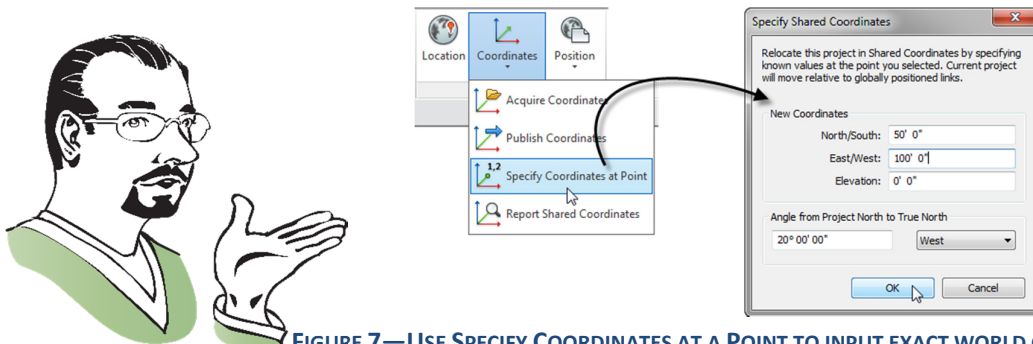

FIGURE 7—USE SPECIFY COORDINATES AT A POINT TO INPUT EXACT WORLD COORDINATES

- **Coordinates>Report Shared Coordinates**—This command was mentioned above. Use it to get a read out (on the Options Bar) of any point on a selected element onscreen. The read out will display the Shared Coordinate values for the selection.

Let's try Specify Coordinates at a Point. This command is helpful when you get coordinate information from your Civil Engineer.

12. On the Manage tab, click the Coordinates drop-down and choose: Specify Coordinates at a Point.
13. Click directly on the Survey Point icon (triangle) and then input values for N/S and E/W. Any value is fine such as: **50** and **100**.

Notice how the Survey Point moves off screen (lower left) and the coordinates of the Project Base Point adjust in response.

14. Zoom in on the Survey Point.

Notice that is still reads 0,0. It moved off screen and stayed at 0,0 because it is still clipped. The result is different if you unclip.

15. Undo the last change
16. Select the Survey Point icon and then **unclip** it (see Figure 8).
17. Repeat the Specify Coordinates at a Point command. Use the same numbers.

Notice that this time the Survey Point stays in the same location, but its coordinates change to match our input. The Project Base Point also adjusts.

FIGURE 8—CLIPPED AND UNCLIPPED ICONS BEHAVE DIFFERENTLY

Understanding Location

So far we have limited our discussion to just a single file. What happens with coordinates when you begin linking other files (CAD or Revit) into the current file? This is where Shared Coordinates really gains its fullest value. Since Revit understands the notion of a global (or World) coordinate system, it is pretty easy for us to "share" this coordinate system with more than one project. All of the projects will "share" the same basis for their positioning in the World—thus the name "Shared Coordinates." To fully understand the concept, let's introduce another new concept called: **Location** and **Shared Sites**.
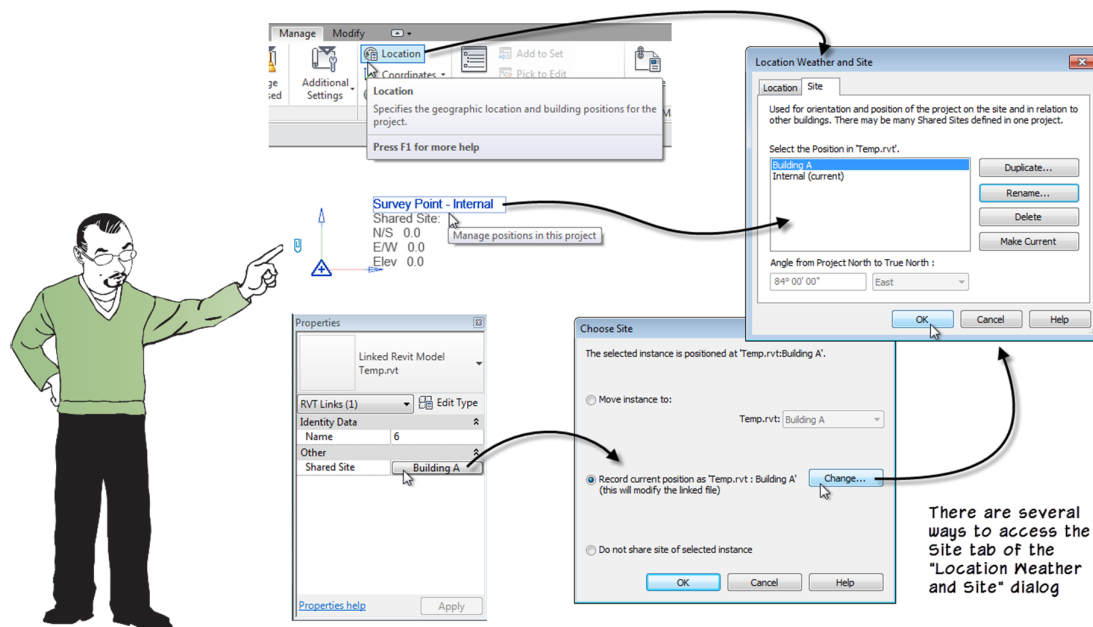

FIGURE 9—ACCESS THE "LOCATION WEATHER AND SITE" DIALOG IN SEVERAL WAYS

To fully describe where an object sits in 3D space (its location), we need three dimensions East/West position (X coordinate), North/South position (Y coordinate) and elevation (Z coordinate). We also need the rotation angle East or West of True North. These four bits of information uniquely position our building on the site and with respect to a known benchmark and other buildings. Further, we can assign a unique name to the collection of these four bits of data. This

named collection of coordinates is referred to in Revit as a: **Shared Site**. To manage our Shared Sites, we use the Site tab of the "Location Weather and Site" dialog. To get here, you can use the Location tool on the Manage tab, and then click the Site tab. Alternatively, you can access the Site tab directly from the Survey Point icon or from the Shared Site item on the Properties palette when a linked file is selected (see Figure 9).

A Shared Site is how we describe **where** our building sits and **how** it is oriented on the property. A project CAN have more than one Shared Site saved in the "Location Weather and Site" dialog. By default, each project has only one Shared Site which is named: "Internal" by default. This name simply describes the fact that the default for any project is its "internal" local coordinate system. As you begin to save Shared Sites, it is highly recommended that you name them more descriptively.

In many situations, you will only require a single Shared Site for each project file, however there may be situations where multiple Shared Sites are appropriate and desirable. For example, in a condominium development, the same building design may be sited multiple times in a subdivision. You could use a single Revit file and copy the link multiple times. Each copy would be given its own Shared Site thereby allowing each instance of the linked file to have its own unique location in the larger Shared Coordinate system.
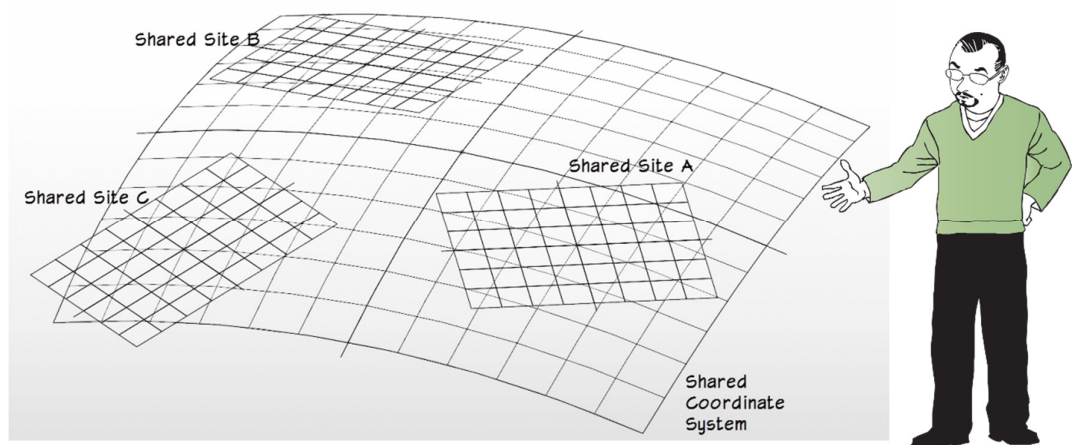

FIGURE 10—VISUALIZING MULTIPLE SHARED SITES IN A SHARED COORDINATE SYSTEM

Scenarios

There are potentially many ways that you can set up any given project. There are also several tools and a few approaches available to approach the setting up of Shared Coordinate systems. We have discussed many tools, but for a little more hands-on look, I have chosen two simple scenarios.

- Scenario 1—a single pair of files. (For example one building on its property)
- Scenario 2—a multi-file setup. (For example a single property with many buildings)

Scenario 1—A Single pair of files

In this scenario, we assume two project files that need to be linked together. (However this process would work nearly the same with linking CAD files, but for simplicity here, I will only be discussing Revit linking). The essential process is simple. Create each project file with an orientation and location that is convenient and logical for THAT file. Do not choose a location, origin or orientation based on the site file or any other building in the campus. Remember, everything in Revit is relative. So determine the best orientation and location for the project file you are in and then use that orientation and location to build your model. In other words, convenient for the project team, i.e. perpendicular and parallel to the screen and the sheets. I have provided a very simple file.

1. Open the file called: *Simple Building.rvt*.
2. Open the *Site* plan view.

This file was created with the default template and the two site points are already displayed in the *Site* plan view and both occur at the origin.

3. On the Insert tab click the **Link Revit** button and locate the *Terrain.rvt* file.

For each pair of files that you link, you have to perform the basic setup. That means that the first time, you can choose any option you like for Positioning. I recommend just using **Auto – Center to Center**. We will be repositioning in the next step.

Tip: *Again, this is the place where it is best to forget about the AutoCAD past and just focus on the "Revit way" to do this. In other words, though you are tempted to use Origin to Origin (which is the default in 2016), it is often not the best option when linking a building to its site. Origin to Origin is best when linking between disciplines. For example, linking the MEP or Structural files to the Architectural.*

Next you will move and/or rotate the linked file into the correct relative position. The most important thing to remember in this step is that we will not be moving the building geometry, but rather we will be moving the linked terrain model.

4. Select the linked file, and move it down **30** and then to left **15**.
5. Rotate the file 20°.

This positions it in plan, but we also need to position it in the vertical direction in an elevation view.

6. Open the *South* elevation and using the Align tool, align Level 1 in the linked file with Level 1 in the host (see Figure 11).
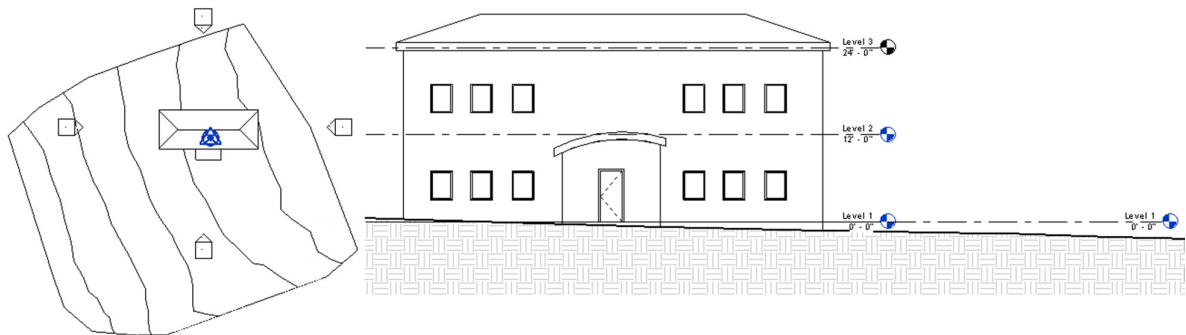

FIGURE 11—POSITION THE LINKED FILE CORRECTLY RELATIVE TO THE BUILDING

Finally you will **save** the Shared positioning and **assign** it to a Shared Site. There are a few ways to do this.

7. Open the *Site* plan view.

Notice that both site points are currently at 0,0.

8. On the Manage tab, click the Coordinates drop-down and choose: **Acquire Coordinates** and then select the linked *Terrain* file.

Notice how the Survey Point moves.

9. Select the Survey Point, note its orientation and coordinates and then select the Project Base Point and note its coordinates (see Figure 12).
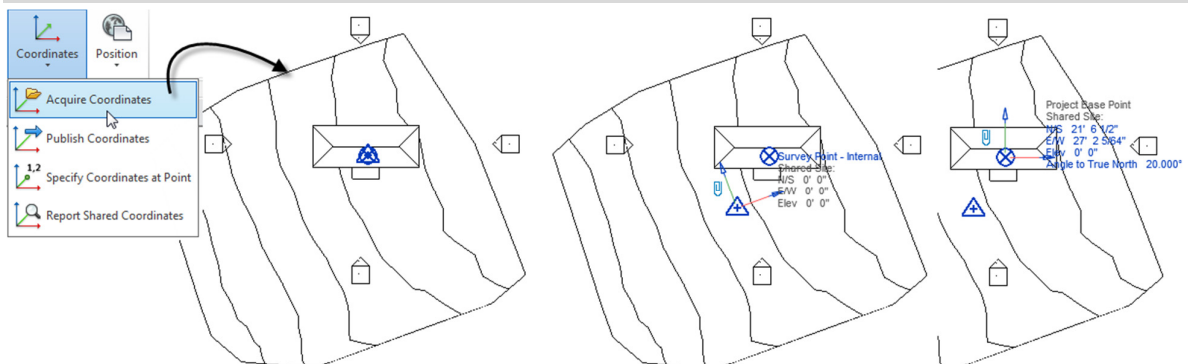

FIGURE 12—USING THE ACQUIRE COORDINATES TOOL

That's it. But the most important step is to save.

10. Save the current file.

Since we used "Acquire," this host file adopted the coordinate system of the linked terrain file. Once you have established the relationship, Revit will maintain

it for you. You can open the other file and link in reverse, this time choose the **Auto – By Shared Coordinates** option and the file will know exactly where to go!

11. Close the current file and then open the *Terrain.rvt* file. Open the *Site* plan view.

Since we acquired coordinates above, this file remains unchanged. It still has both Project Base and Survey points in the middle of the screen. Note also that the orientation of the terrain is parallel to the screen.

12. Link the *Simple Building.rvt* file. This time, for Positioning, choose: **Auto – By Shared Coordinates** (see Figure 13)
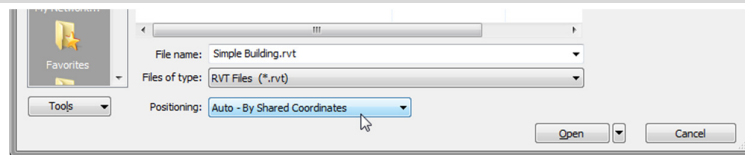

FIGURE 13—LINK USING SHARED COORDINATES

Notice that the file went to exactly the right location and orientation (see Figure 14).
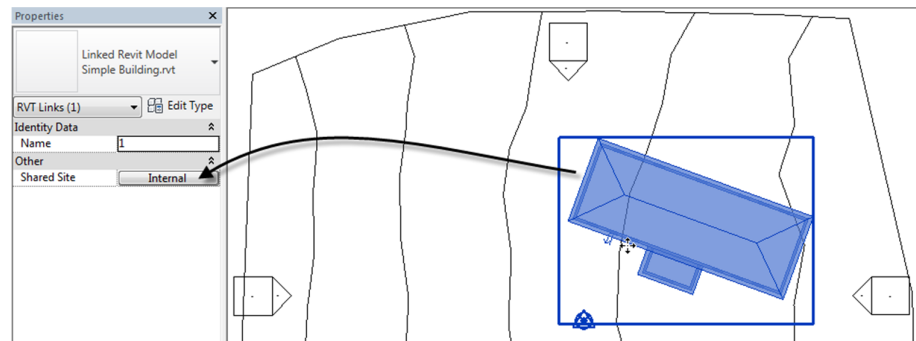

FIGURE 14—WHEN USING THE ACQUIRE COORDINATES TOOL, THE SHARED SITE DEFAULTS TO INTERNAL

13. Select the building linked file onscreen. Note the name of the Shared Site on the Properties palette.

Since we used the Acquire Coordinates tool, Revit simply used the default site which is typically named: "Internal." For a simple pair of buildings like these here in this example, this is perfectly suitable. However, I prefer to rename the Internal site to something more descriptive. Of course this is completely optional. Rather than rename it now, we will look at naming the sites in the next scenario. For now this completes the basic setup. So when linking two files bi-directionally,

14. Close any open files.

Set up Shared Coordinates from the Properties palette

Using the Acquire Coordinates tool is a quick and easy way to set up the shared coordinates. However, when you want to change the defaults, (such as

modifying the shared site that is used), you can use the Properties palette to establish your shard coordinate setup instead.

1. Open the *Building A.rvt* project file. (Make note of where the Project Base and Survey Points are). Close the file without saving.
2. Open the *Terrain (Start).rvt* project file.
3. Open the *Site (Project North)* plan view and then Link in the *Building A* project using: **Auto – Center to Center**.

Note: If you forget to change the Positioning, Revit will warn you that the two files do not share coordinates and use Center to Center anyhow.

The building will link in too low and appear below the terrain. Only the two grid lines in the file will show in this view. Open the *South (Full)* elevation view to see and move the file vertically.

4. Move and/or Rotate the *Building* linked file to make the building sit properly on space provided in the *Platform 1* view. Align works well for this. Use girds A and 1 in plan and the Platform 1 level in elevation.

Let's look at an alternative way to establish the shared coordinates.

5. Select the linked file and on the Properties palette, next to Shared Site, click the **<Not Shared>** button (see Figure 15).
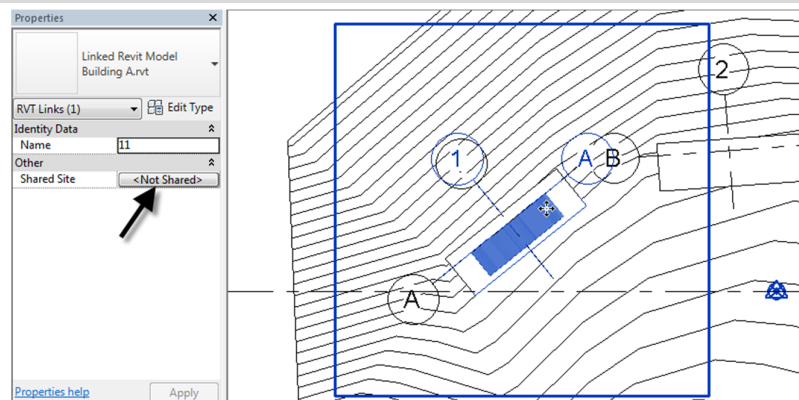

FIGURE 15—ON THE PROPERTIES PALETTE CLICK THE SHARED SITE BUTTON

In the "Shared Coordinates" dialog that appears, you will be given the option to either Publish or Acquire the coordinates. There is a description of each option in the dialog that appears. What it essentially boils down to is that you are synchronizing the Shared Coordinate System between the two files. In other words, before this command, the two files know nothing of each other's coordinates. After the command, they will SHARE the same coordinates. So, which file's current coordinate system do you want to use for both files? Do you want the current host file to share its system with the linked file? Or would you

prefer the linked file to share its system with the host? <mark>Typically I like to let the site file's coordinates to become the overall Shared Coordinates.</mark> So in this case, since I am currently *in* the Site project and it is hosting the Building project, I would want to "Publish" the coordinates to the Building project (replacing its Shared Coordinate system and making it match the site host file). Please note that regardless of which option you choose, NO changes are made to either file's local internal coordinates. What we are doing right now is simply recording how we want the two files to coexist physically in 3D space.

6. Choose the Publish option.

You could simply click the Reconcile button here to complete your choice. This would use the default site name: Internal as we did above. However, as noted above, <mark>I highly recommend that you take the additional step of renaming or copying the Shared Site</mark>.

7. In the "Share Coordinates" dialog, next to *Building A.rvt: Internal* (as the bottom), click the Change button.

This opens the "Location Weather and Site" dialog to the Site tab. You can **Duplicate** or **Rename** the default shared site here. If you only require one shared site, simply rename it. Otherwise, choose Duplicate. Choose a good descriptive name. You are describing the building's location on the site here. "Preferred Site," "Alternate A" or "North Quadrant" are some examples. In this case, we'll call it: Platform 1.
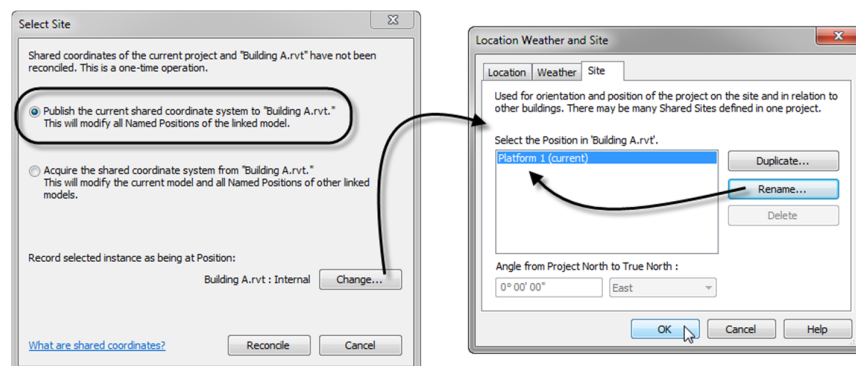

FIGURE 16—CHANGE THE SAVED POSITION AND RENAME IT MORE DESCRIPTIVELY

15. Rename the site to: Platform 1 and then click OK. Back in the "Select Site" dialog, click the **Reconcile** button.

16. Finally as before, to make all the changes "stick" we must save. Click the Save icon on the QAT (or press CTRL + S).

Above we only needed to save the host file. This was because we acquired the coordinates. In this case, we are publishing the coordinates. This means that we

are changing the linked Revit file. So we must actually save both files. A dialog
will appear to enable you to do this.

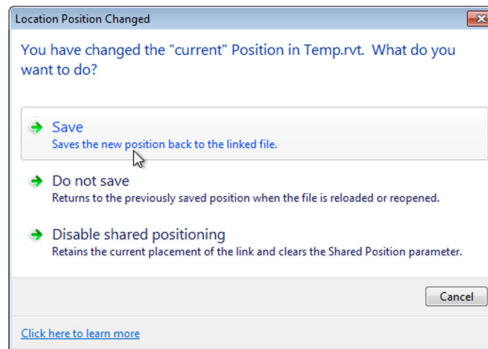17. In the "Location Position Changed" dialog, click the Save option at the top.

FIGURE 17—SAVING ALSO PROMPTS YOU TO SAVE THE LINKED FILE AND ITS SITE(S)

The first option: Save is the *only* good choice. If you choose either of the other
two options it negates the changes you have made. So neither is a good
choice. The final step is to test what you have done. You can do this by opening
the other file and linking again. (You cannot have both projects opened at the
same time, so close the current project first).

18. Close the *Terrain (Start).rvt* project and open the *Building A* project.

Notice that the Project Base Point and the Survey Point are now offset from one
another. Notice also if you click on them or query their coordinates that the
values reflect the changes made in the other file. If you open the *Level 1* plan
view, you will notice that the building file remains oriented horizontally and
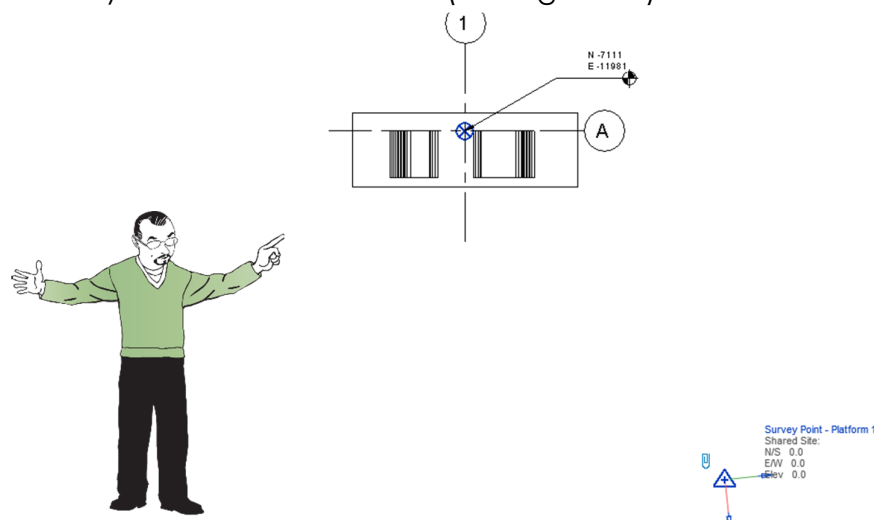vertically relative to the screen (see Figure 18).

FIGURE 18—OPEN THE LINKED FILE TO SEE THE RESULTS

19. Link in the *Terrain (Start)* file. This time, choose: **Auto – By Shared Coordinates**.

Notice that the site file comes in exactly in the correct location and orientation. <mark>Part of the beauty of Shared Coordinates is that you only need to set them up once.</mark> From then on, both files will "know about" each other. So now we have two methods to set up a pair of files. In the next sequence we will some add additional files to make a more complex setup.

20. Close and save all files.

Scenario 2—A Multi-File Project

A multi-building project typically has a single site file with many buildings on it. Each building might be a separate Revit project, or you may also find the need to use the same Revit model in more than one location on the site (this was mentioned briefly above).

A multi-file project includes the same considerations as a single building project but has the extra added complexity of coordinating multiple building models with respect to one another. Each pair of files is set up the same way as above. <mark>The difference is that, the Shared Coordinate System is now shared amongst ALL the files, not just the pair.</mark> Therefore, you should consider carefully which file you wish to execute the process from. In most cases, the Site file will be the obvious choice. But this is not required. Let's look at an example with some VERY simple files.

Siting copies of the same linked file

Establishing multiple shared site locations can be very useful. There are two basic scenarios: the first involves using more than one copy of the same project file on the site (this was mentioned above with the example of a condominium layout). The other scenario is the establishment and saving of alternate site locations for a single building. The set up process for either scenario is similar.

1. Reopen the *Terrain (Start)* file, select the linked file, copy it to a new location.
2. Adjust the positioning of the file (Move, Rotate or Align) as required to place it at Platform 2.
3. Select the copied linked file. On the Properties palette, note that the Shared Site is reset back to <Not Shared>. Click this button.
4. In the "Choose Site" dialog, choose the "Record current position" (second choice) radio button and then click the Change button.
5. In the "Location Weather and Site" dialog, click Duplicate and name the new site: Platform 2.

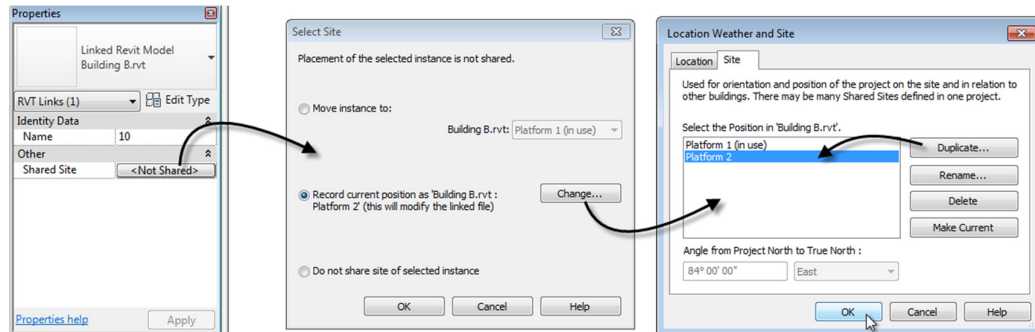6. Click OK twice to dismiss the dialogs and save the file (see Figure 19).

FIGURE 19—COPY A LINKED FILE AND THEN DUPLICATE THE SHARED SITE TO MAKE IT UNIQUE

You may have noticed that this time we were not asked to publish or acquire. This is because the relationship between the host and link is already established—the two files already share a coordinate system. Here we are simply establishing a second location within the current shared coordinate system. You can only use each saved shared site locations one time. So if you make three copies of the file, you will need at least three named sites. You can have as many named sites as you like. If you need multiple copies of the building on the site (like the condominium example) you are finished. We now have two copies of Building A on the site each in its own named location. Let's see how that works back in the Building A file.

7. Close and save the *Terrain (Start)* file. You will be prompted to save *Building A* again. Be sure to click Save.
8. Open *Building A* and then open the *Site* plan view.
9. On the Properties palette, change the Orientation to: **Project North**.

Note how the building is now oriented to match the screen. However, notice that the site is still oriented as if the building were at the Platform 1 location.

10. On the Manage tab, click the Location button. In the "Location Weather and Site" dialog, click the Site tab.

Notice the two Sites with the names you assigned. One will have the label (Current) next to it. This is the currently active Site location.

11. Select Platform 2 and then click the Make Current button. Click OK.

Remember our basic thesis in this class? It's all relative. Notice what has happened. Since we are in the building file and looking at a view that is set to Project North, the building orientation and location is unchanged. What happened is that the linked terrain file adjusts as required to show us the correct position *relative* to the now current Platform 2 location! Very cool!

Siting multiple linked files

The previous example is how you would set up the condominium example noted above. If instead, you want to be able to consider the same building at different locations on the site, we can simple delete the copied instance of *Building A* and then we are free to move the remaining instance to either the Platform 1 or 2 site—as long as it is not currently in use.

1. Close and save *Building A* and return to the *Terrain (Start)* file.
2. Delete the instance of the linked *Building A* file at Platform 2.
3. Select the other linked file and on the Properties palette, click on the button next to Shared Site (it will be named Platform 1).
4. In the "Choose Site" dialog, click the Move instance to radio button (at the top) and then choose: **Platform 2** from the list.
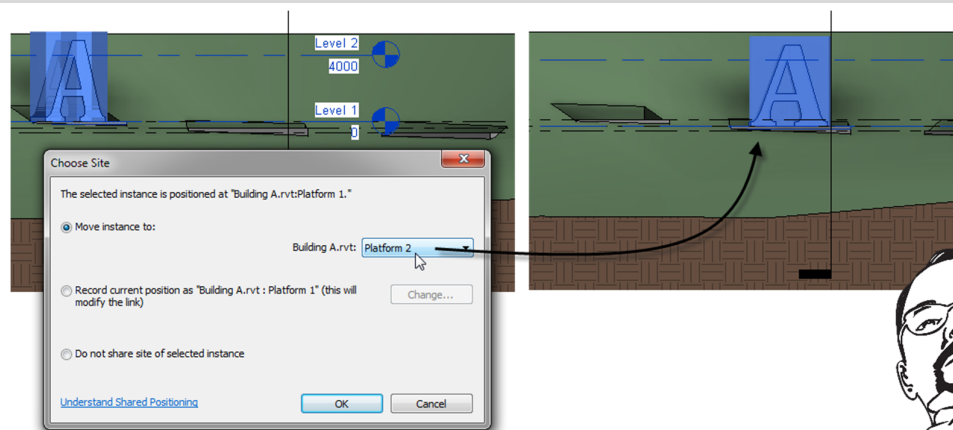5. Click OK to see the results (see Figure 20).

FIGURE 20—MOVE AN INSTANCE OF A LINK TO A DIFFERENT SHARED SITE

Notice how the building moves to the other location and orientation.

Multiple Buildings

Now let's add a few more buildings.

1. In Windows Explorer, make a copy of the *Building A* file and name it: **Building B**. Open it and change the geometry a little. (Since this is just model text, change the text to: B) and then close and save the file.

Now let's link the new file. Since you copied it from the original, it will already have the same shared coordinates and the two saved sites. (A copy of the file is included called: *Building BB* if you want to skip the previous step).

2. Link the copied file into the *Terrain (Start)* project.
3. Use: **Auto – By Shared Coordinates**.

The "Location Weather and Site" dialog will appear displaying the two saved sites. Notice that one of them will be labeled as (Current). This is the site that you chose as current when you last had this file open. It does not matter which is current, you can choose either one when linking (see Figure 21).
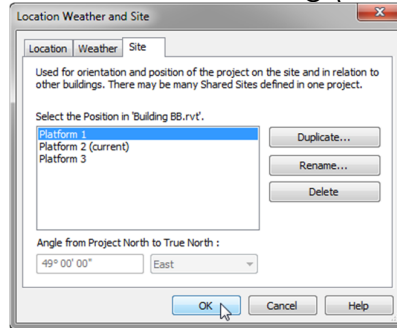
4. Choose the site that does not currently have a building on it and click OK.

You can repeat this process as many times as you need to. Copying and renaming the file in Windows Explorer is convenient early in the project before any building geometry is established. However, if this is not practical, simply link an existing file instead (not a copy). You will then have to repeat the steps above to establish the shared coordinates the first time. Remember, each pair of files must have the initial setup performed the first time. From then on, you can use By Shared Coordinates in linking either file.

Cross Linking

At this point you have a *Site*, and *Building A* and *Building B*. One of the biggest benefits of this whole process is that all three of these files all share the same coordinates. So you can link Building A to B and vice versa without doing any further setup!

5. Close the *Terrain (Start)* project and open *Building B*.
6. Link in *Building A* By Shared Coordinates.
7. When prompted choose your preferred site.

Very cool!

You can take it a step further by adding multiple sites to each file. Then you can select any one of the links, click the Shared Site button on the Properties palette and move it to a different site. In this way you can try different siting options for each building on the site (see Figure 22).
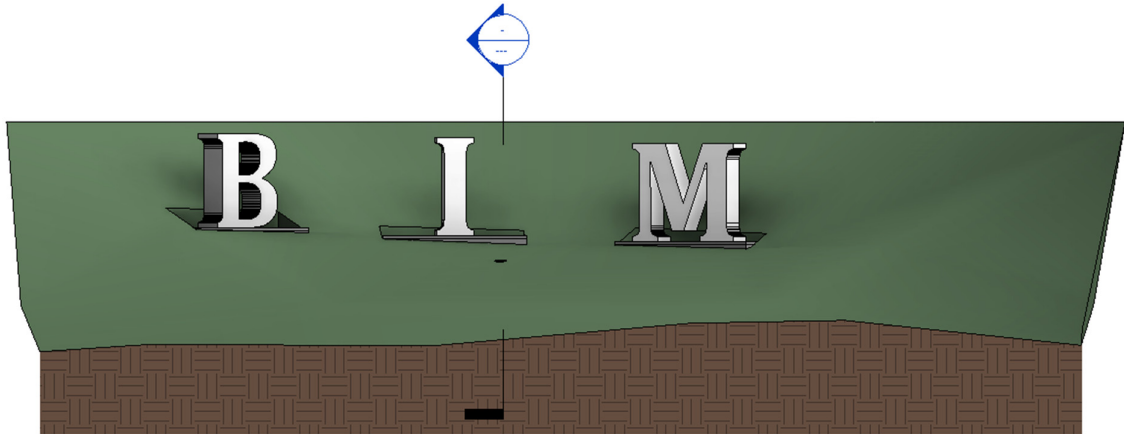
Maintaining your Coordinates

I'd like to address two final topics. First, what happens when the coordinates change, and second how to ensure that they export to other programs properly.

Changing a saved location

It is best practice to set up your links and there coordinates and saved sites as early in the life of the project as possible. But that does not mean that the setup can't or won't change as the project progresses. It is pretty easy to manage changes to your saved coordinates. But you need to save the change to both file. Think of it this way: saving shared coordinates is establishing a relationship between two files. Therefore, if something changes, it will naturally affect the relationship. So both files need to be saved to conform to any changes in location. Perhaps the biggest issue here is what to do when you do not have access rights to both files to make the change. In such a case, you will need to coordinate with the owner of the other file to ensure that the new positions are saved.

To see how it works, simply move one of your linked files. You will immediately be alerted that the change affects the shared coordinates and be offered to save the change. You can click the Save Now button to save immediately, or click OK to postpone. Later you can open Manage Links to save the positions. Also when you save the host file, you will be prompted to save the link file as well. So regardless of when you execute the save action, Revit will be quite insistent that you do save, otherwise it will disable the shared coordinates.
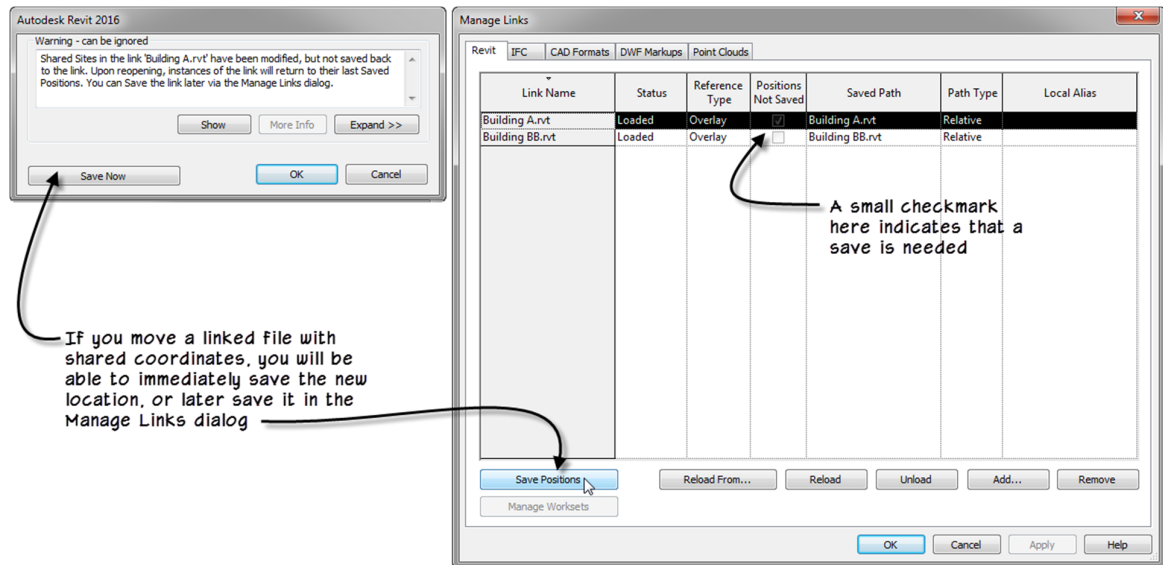
FIGURE 23—WHEN MOVING A LINKED FILE, YOU MUST RESAVE THE SHARED POSITIONS

Exporting Shared Coordinates

If you export your Revit project with shared coordinates to CAD or Navisworks, there is an important setting to ensure that correct coordinates are saved with the exported file. In both cases, you want to make sure that you are exporting Shared coordinates and not Project Internal. The settings are configured as you export.

- **Export to CAD**—You can get to the CAD export options from the Application menu. From the Application menu, choose: **Export > Options > Export Setups DWG/DXF**. In the "Modify DWF/DXF Export Setup" dialog, you can edit the current setup or create a new one. Click on the Units & Coordinates tab and click the Shared radio button. Click OK to complete the setup (see Figure 24).
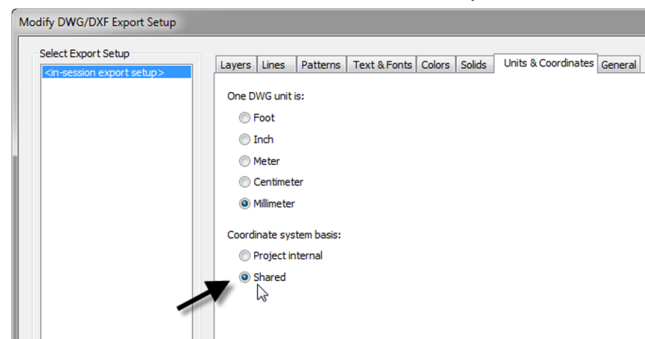

FIGURE 24—CHOOSING TO EXPORT SHARED COORDINATES TO CAD

- **Export to Navisworks**—From the Application menu, choose: **Export > NWC**. In the "Export scene as" dialog, at the bottom, click the Navisworks settings

button. In the "Navisworks Options Editor", click the File Readers > Revit option on the left, and then for Coordinates, choose: **Shared** (see Figure 25).
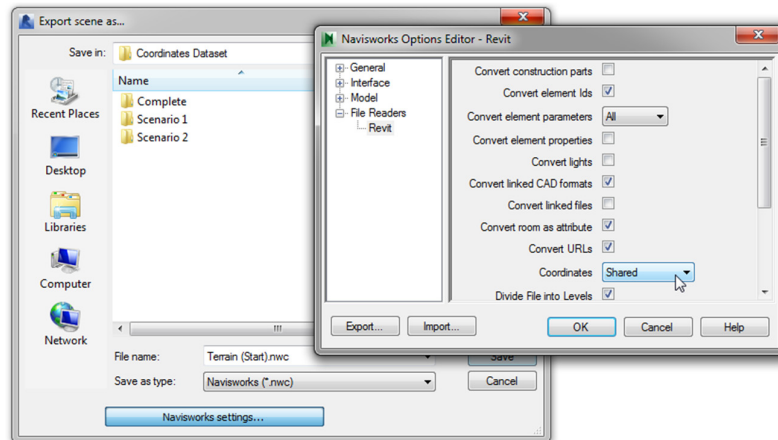

FIGURE 25—CHOOSING TO EXPORT SHARED COORDINATES TO NAVISWORKS

Please feel free to experiment further. Thank you for attending.

Further Study

You can find more information and tutorials in my books and video training. Please visit my website at: **www.paulaubin.com** for more information on my books.

I also have Revit video training available at:

www.lynda.com/paulaubin. I have several courses at lynda.com including: *Managing Location Coordinates with Revit*. This course explores many of the same topics covered in this paper and session. In addition, you can check out my other courses like: *Revit Essential Training*, *Revit Family Editor* and *Revit Architecture Rendering*, *Advanced Modelling in Revit Architecture*, *Formulas and Curves* and *many more*.

If you have any questions about this session or Revit in general, you can use the contact form at **www.paulaubin.com** to send me an email.

Follow me on twitter: **@paulfaubin**

In addition to my books and videos, there are many other resources available online, in blogs, books etc. My good friend Steve Stafford (also a speaker here) has a very popular Revit blog at: http://revitoped.blogspot.com

He has also taught on the subject of Shared Coordinates and his paper on the subject is well worth a read. You can find it posted here: http://revitoped.blogspot.com/2012/05/shared-coordinate-post-summary.html

Another useful resource is recorded classes at Autodesk University. This one by David Baldacchino is quite good: http://au.autodesk.com/au-online/classes-on-demand/class-catalog/2013/revit-for-architects/ab1412

Thank you for attending. Please fill out your evaluation.