Building the Death Star: The Autodesk® Way!

Lee Mullin – Autodesk

CR2165-P A long time ago in a galaxy far, far away, Autodesk didn't exist, but if it did then the fate of the Death Star and the Empire would not have been determined by those pesky rebels. Using Autodesk Revit®, Autodesk® Navisworks®, and Autodesk® BIM 360 software, as well as Microsoft® Project, Darth Vader and his project team could have built the Death Star more quickly, more safely, and with more information for important decision making, such as whether to destroy Tattooine and just be done with it. This class will cover advanced workflows and tips for using Autodesk products for more than just the basics, turning you from a naive Jedi padawan to an efficient Sith overlord in just an hour.

Learning Objectives

At the end of this class, you will be able to:

About the Speaker

Lee Mullin is the Navisworks Subject Matter Expert for Product Support in Autodesk Global Services. Working with Navisworks for over seven years, Lee has worked in support, contributed towards Documentation and QA. Following Autodesk's acquisition of Navisworks in 2007, Lee took on the role of leading the Navisworks support effort, training the growing worldwide team and ensuring the customer's voice is heard by everyone from Product Design, Product Management, QA and Development. Currently studying Construction Project Management and running the Autodesk 'Beyond Design' blog, Lee's current role in Global Services is multi-faceted, requiring understanding of interoperability workflows across the Autodesk portfolio; working with development to help prioritize features and defects; working with QA to improve test coverage of common workflows; creating and delivering training; and helping build up the Autodesk Construction user community
lee.mullin@autodesk.com

## Using Revit Construction Parts to build an accurate schedule

Use constructionparts_tractorbeam.zip

Export Navisworks file from Revit and create NWF
1. Open tractor_beam.rvt in Revit
2. Select 'For Navisworks' view
3. On the Properties panel change 'Parts Visibility' setting in View to 'Show Parts'
4. Click Add-ins > External Tools > Navisworks 2013 > Navisworks Settings > File Readers > Revit
   a. Check 'Convert Construction Parts'
   b. Check 'Divide File into Levels'
   c. Change 'Export' to 'Current View'
5. Export NWC, load into Navisworks
6. Create some suitable views
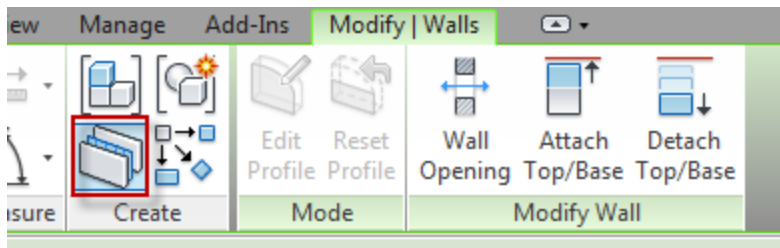7. Save as TractorBeam.NWF

Create a basic schedule
8. Open Timeliner (Ctrl + F3)
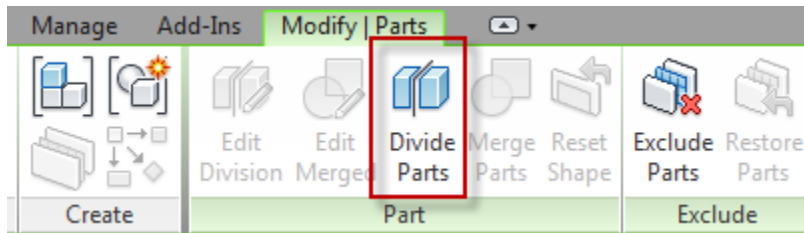9. Auto-Add tasks for every top most item
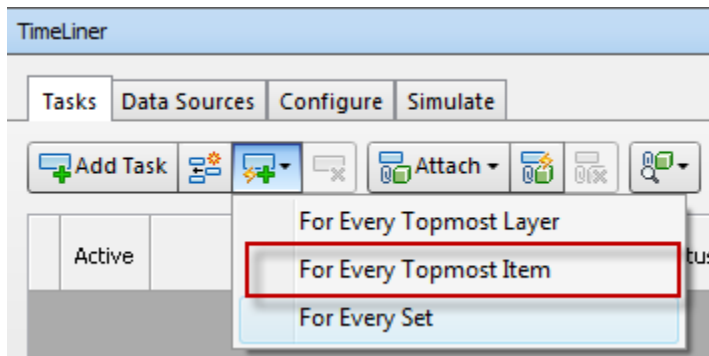
Run simulation; see that 35 storeys of walls and 23 storeys of columns appear at once
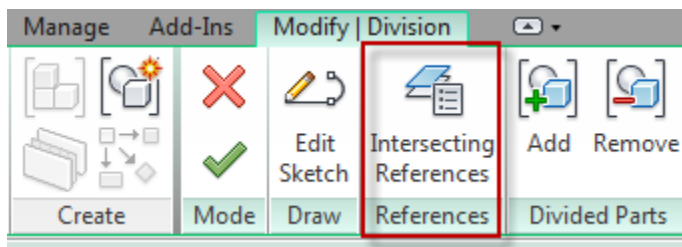
Create Construction Parts
10. Go back to Revit
11. Select 6 walls and the column in 3D view
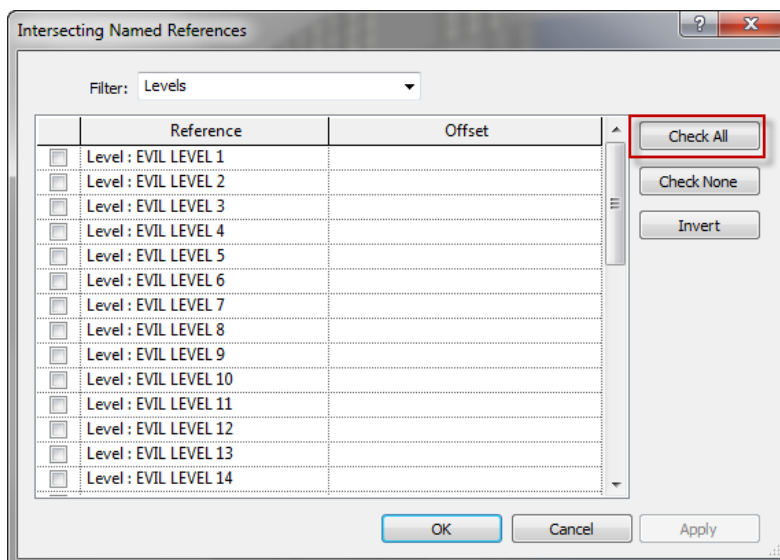12. Select Create Parts on Modify Parts tab

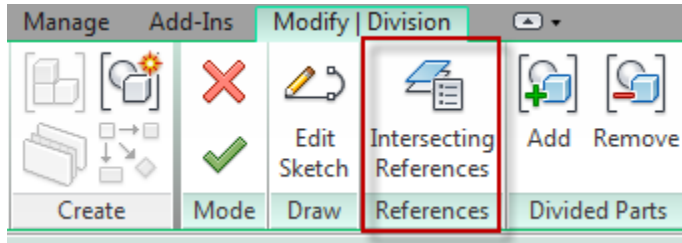13. Select Part > Divide Parts on Modify Parts Tab

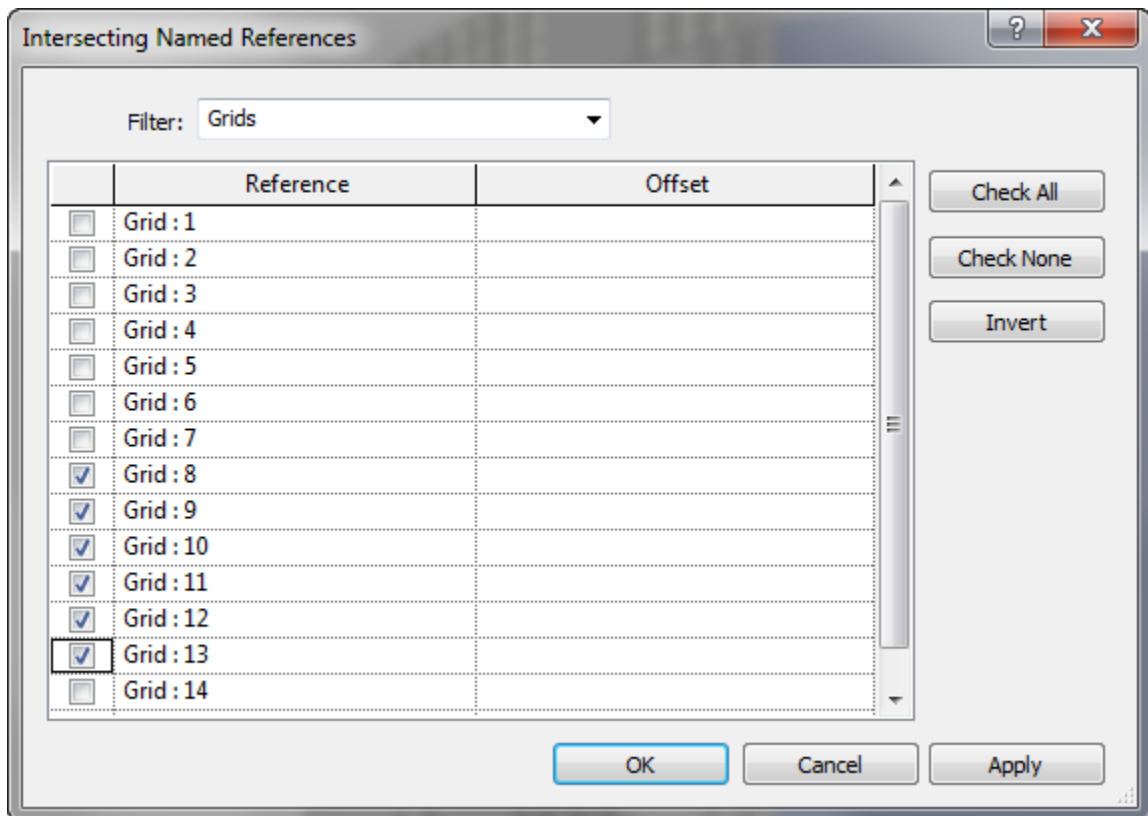

14. Select Intersecting References

15. Select Check All Levels

16. Click Apply > OK
17. Select Intersecting References

18. Select Grids from drop down
19. Select Check Grids 8 - 13

20. Click Apply > OK
21. Click Finish Edit Mode
    Should now have walls and columns split into levels
    Load 'tractor_beam_levels_grids.rvt' to get to this point
22. Export NWC to replace existing NWC
23. Refresh NWF in Navisworks, which will load newer version of NWC
24. Delete all Timeliner tasks

25. Hide Timeliner

Create Search Sets to find items on each level
26. Open Find Items
    a. Use drop downs to search for
       Element > Base Level > = > Level "EVIL LEVEL 2" #2794
       Item > Layer > = > EVIL LEVEL 2
    b. Repeat this for all levels by changing properties manually
       OR
       Duplicate Search 33 times, Export the XML, modify the XML to include new
       search set name, and modify the search, make sure you include the correct
       unique identifiers
       OR
       load 'tractor_beam.xml' provided
27. Create EVIL LEVEL 1 search (this needs to discount the other parts on Level 1)
    Item > Layer > = > EVIL LEVEL 1
    Element > Name > not equals > Part
    Element > Base Level > = > Level "EVIL LEVEL 1", #355
    Use OR condition on last line by right clicking condition and select Or Condition

Category	Property	Condition	Value
Item	Layer	=	EVIL LEVEL 1
Element	Name	not equals	Part
+ Element	Base Level	=	Level "EVIL LEVEL 1", #355

Create Timeliner Schedule based on Construction Parts
28. Open Timeliner (Ctrl + F3)
29. Auto-Add tasks for Every Set

TimeLiner

| Tasks | Data Sources | Configure | Simulate |

Add Task   Attach ▾

Active

For Every Topmost Layer
For Every Topmost Item
For Every Set
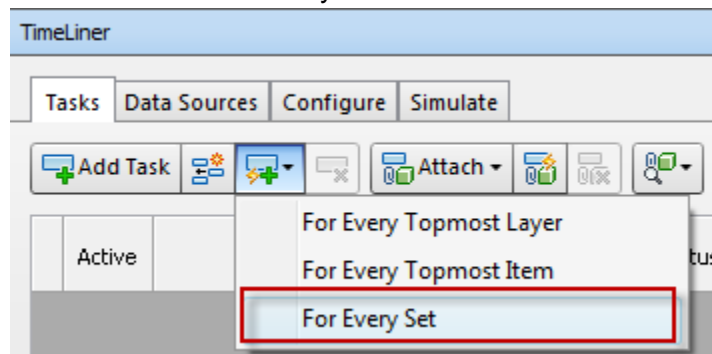
30. Find Uncontained Items
31. Tractor Beam Machinery

32. Add Task rename to 'Tractor Beam'
33. Change Planned Start Date and End date to after the column is complete
34. Change task type to 'Construct'
35. Either right click 'Attach Current Selection'
    OR
    Create a Search Set looking for
    Item > Name > = > EVIL TRACTOR BEAM
    then drag and drop Search Set onto Task

Run Simulation on Simulate task, it should show the walls build up level by level

Contingency planning using Navisworks and Microsoft Project
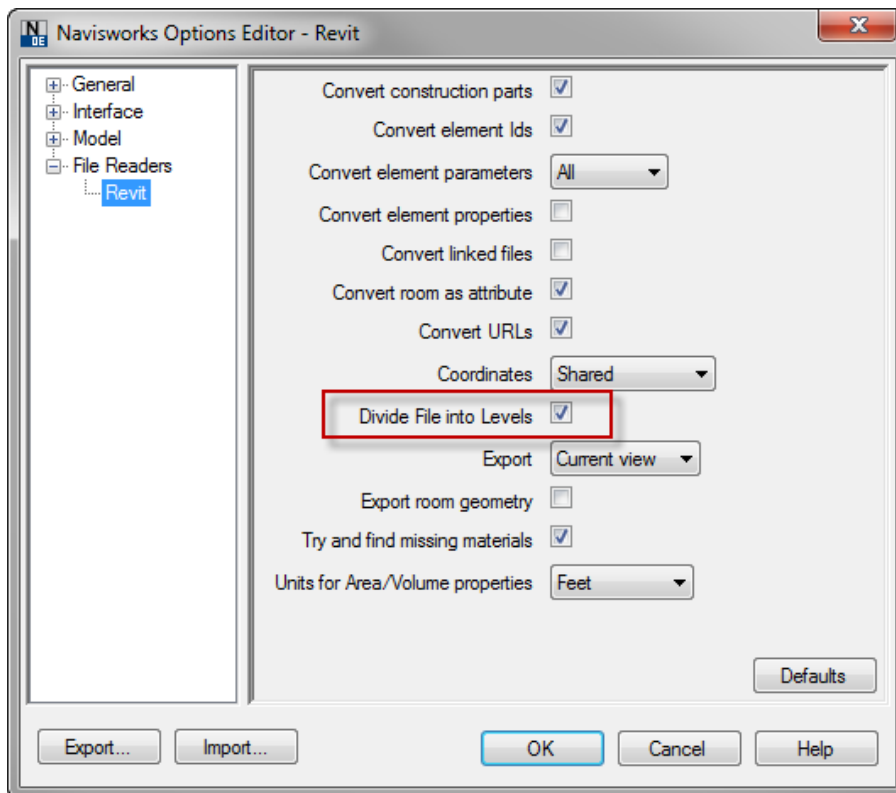
Use contingency_deathstarstructure.zip
Microsoft Project 2007 or 2010 required

Create and Export file from Revit
1. Open structure.rvt in Revit 2013
2. Open Navisworks 3D view
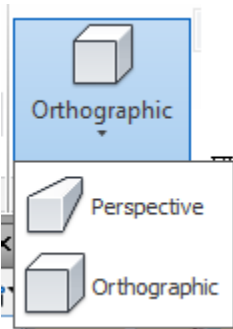3. In Revit go to Add-ins > External Tools > Navisworks 2013
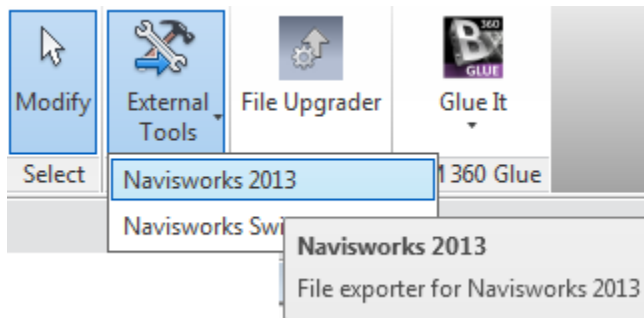
4. Open Navisworks Settings > Switch on 'Divide File into Levels'

5. Save NWC as structure.nwc in a new folder

Create a basic construction schedule

6. Open NWC in Navisworks 2013 (*or open structure.nwc in zip file*)
7. Save As deathstartimeliner.nwf
8. On Viewpoint tab change from Orthographic to Perspective Mode

9. Zoom out to entire building using Zoom All (Page Up)
10. Save Viewpoint on the Viewpoints Tab and rename Main View
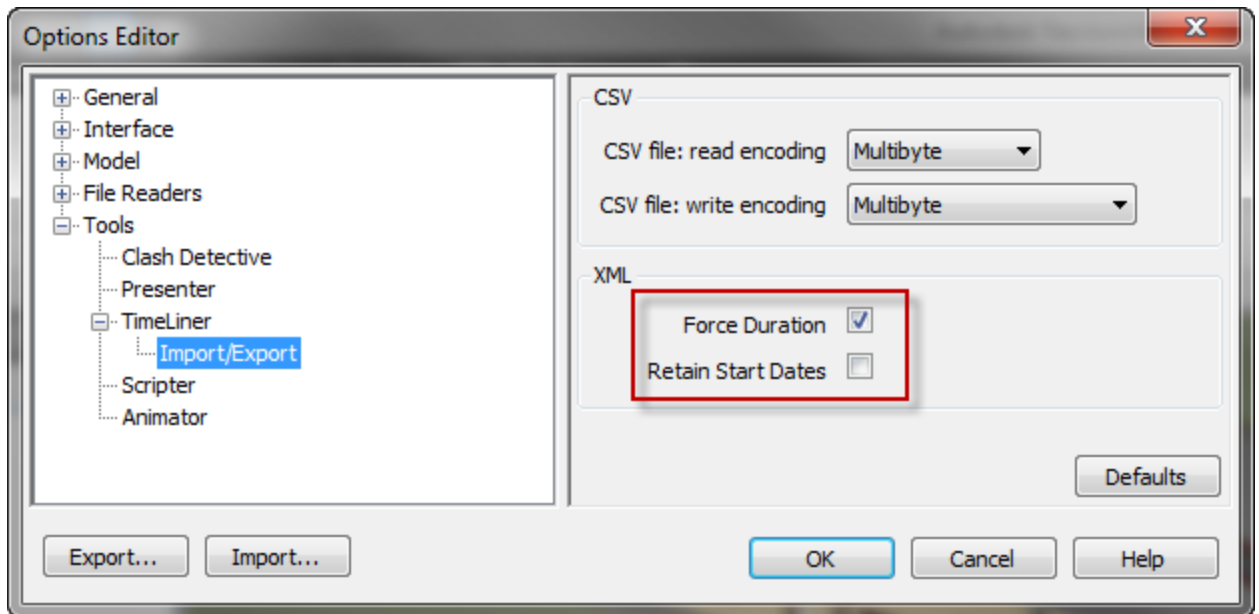

11. Delete 3D views folder
12. Open Timeliner (Ctrl + F3)
13. On the Tasks Tab > AutoAdd Tasks > For every Topmost Layer
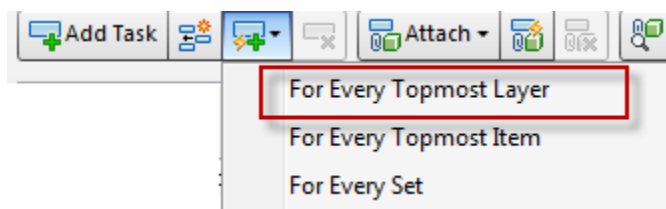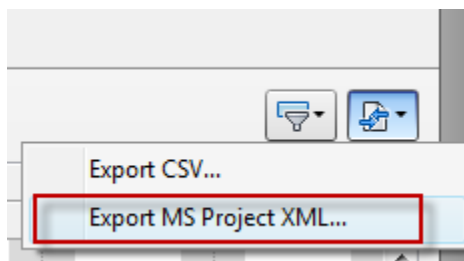

14. Open the Options through the Application button (*F12*) > Tools > Timeliner > Import/Export > check Force Duration, switch off Retain Start Dates and press OK

15. On the Task tab of Timeliner at the right hand side Export the schedule > Microsoft Project XML

16. Save the file as deathstar.xml
17. Save your Navisworks session.

Add detail to the schedule in Microsoft Project

18. Open Microsoft Project
19. Load deathstar.xml, if asked open 'As a New Project'
20. Go to 'Add New Column' go to the drop down and select one of the text fields (Text 1 for example)
21. Right click in the column header and select custom fields, rename the field 'Task Type'
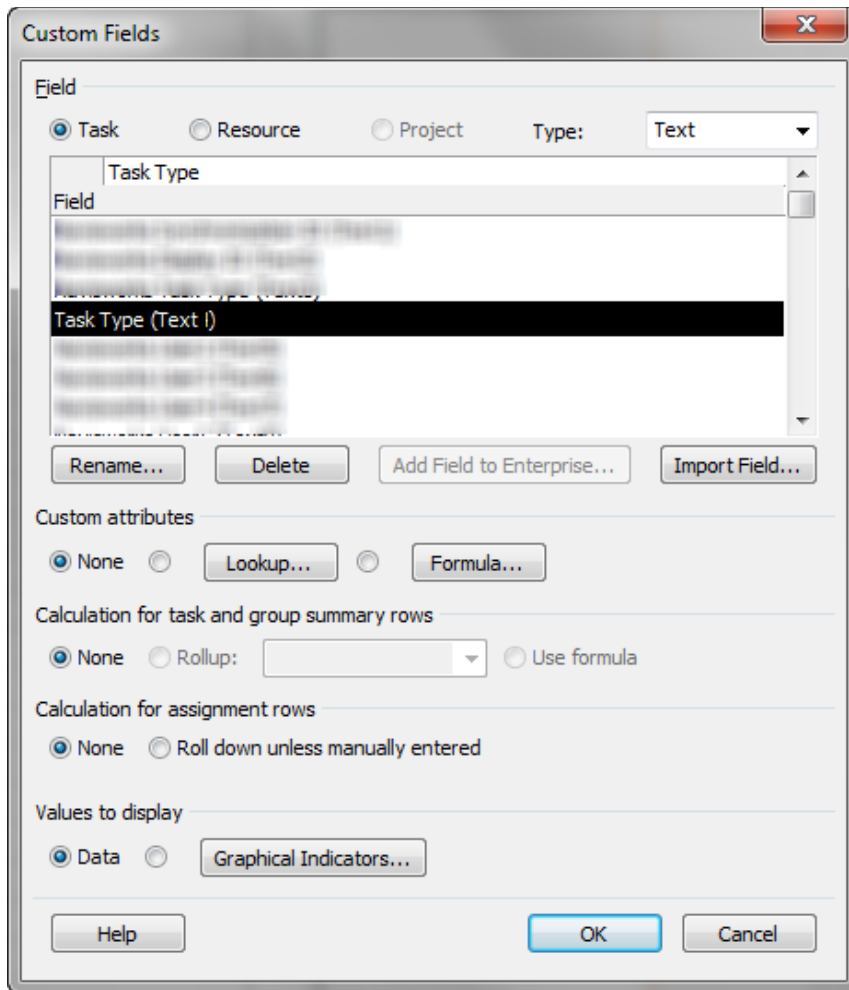
22. Add Construct to the first task and use the drag tool to add this to all the tasks (like in Excel)

23. Add Start dates, Durations and Predecessors, LEVEL 18 should be first then LEVEL 17 and LEVEL 19 are dependent on LEVEL 18. Levels 16 and 20 are dependent on 17 and 19, and so on.
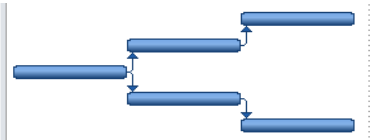
8			EVIL LEVEL 16	5 days	Sun 12/2/12	Fri 12/7/12	9	
9			EVIL LEVEL 17	5 days	Tue 11/27/12	Sun 12/2/12	10	
10			EVIL LEVEL 18	5 days	Thu 11/22/12	Tue 11/27/12		
11			EVIL LEVEL 19	5 days	Tue 11/27/12	Sun 12/2/12	10	
12			EVIL LEVEL 20	5 days	Sun 12/2/12	Fri 12/7/12	11	

24. Once complete save the file as 'deathstar.MPP'

Link the detailed schedule to Navisworks

25. Open 'deathstartimeliner.nwf ' in Navisworks again
26. Delete all the tasks from Timeliner
27. Open the Data Sources tab and go to Add > Microsoft Project 2007-2010
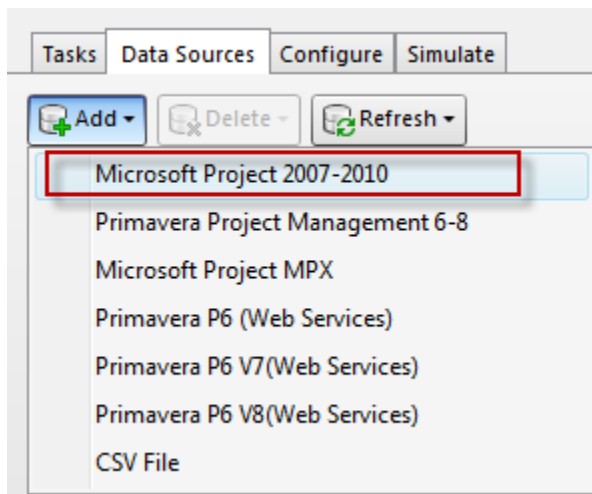
28. Navigate to deathstar.mpp *(one available in sample files)*
29. Select columns to merge to: -
     a. add Task Type > Text 1 *(Text 3 if using sample, or whichever one was used in Project)*
     b. Planned Start > Start

c. Planned End > Finish
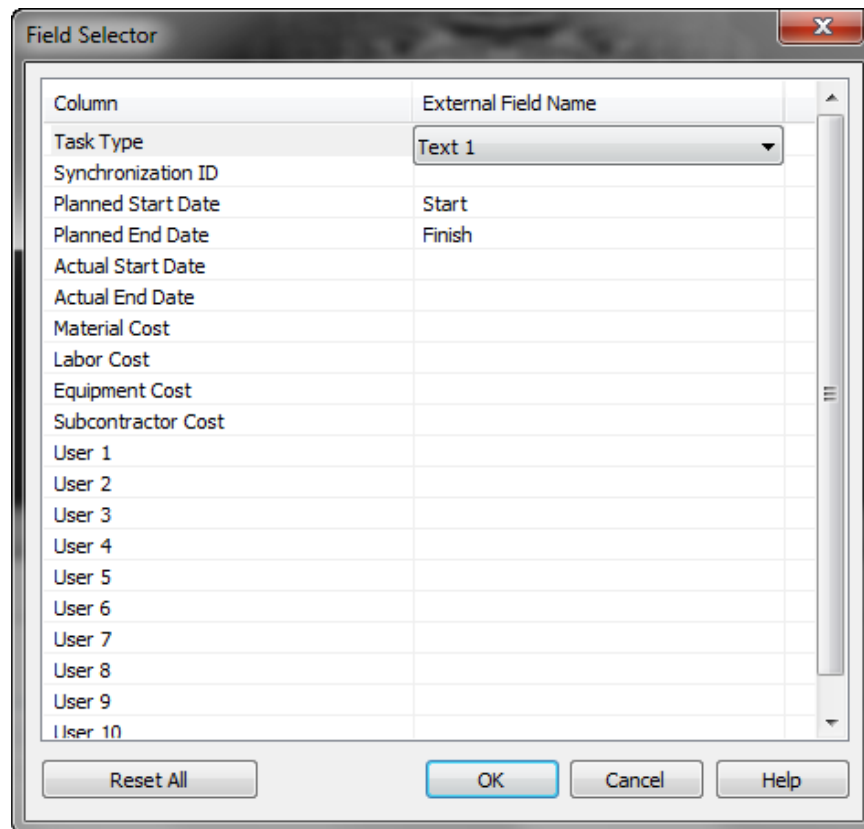
30. Right click the new Data Source > Rebuild Task Hierarchy
31. Go to the Tasks Tab > Auto Attach Using Rules
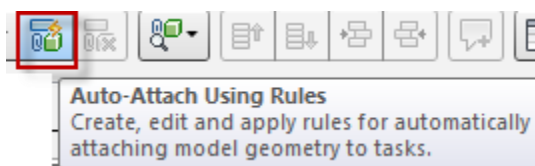
32. Check 'Map Timeliner Tasks from Column Name to Layers with the same name, Matching case' > then 'Apply Rules'
33. Right Click a task name, Find > Unattached/Uncontained items, nothing should be unattached
34. Go to Simulate Tab and Run the animation

If you want to make changes to the schedule in Project, Save the file then right click the data source in Navisworks and Synchronize, this will update the task dates

Creating Time Based Clashes for temporary works

Use *timebasedclash_dockingbay.zip*

Create a path for the vehicle in Animator
1. Open Dockingbay.nwf
2. Open Animator (Ctrl + F5)
3. Add a scene and name it 'Xwing'
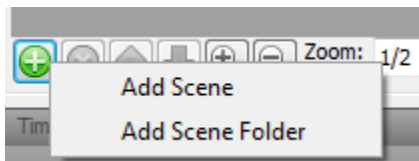
4. Select Xwing in the Sets window
5. Select Xwing and right click in the Animator window > Add Animation Set > Use Current Search/Selection Set > Rename to 'Xwingtodockingbay'
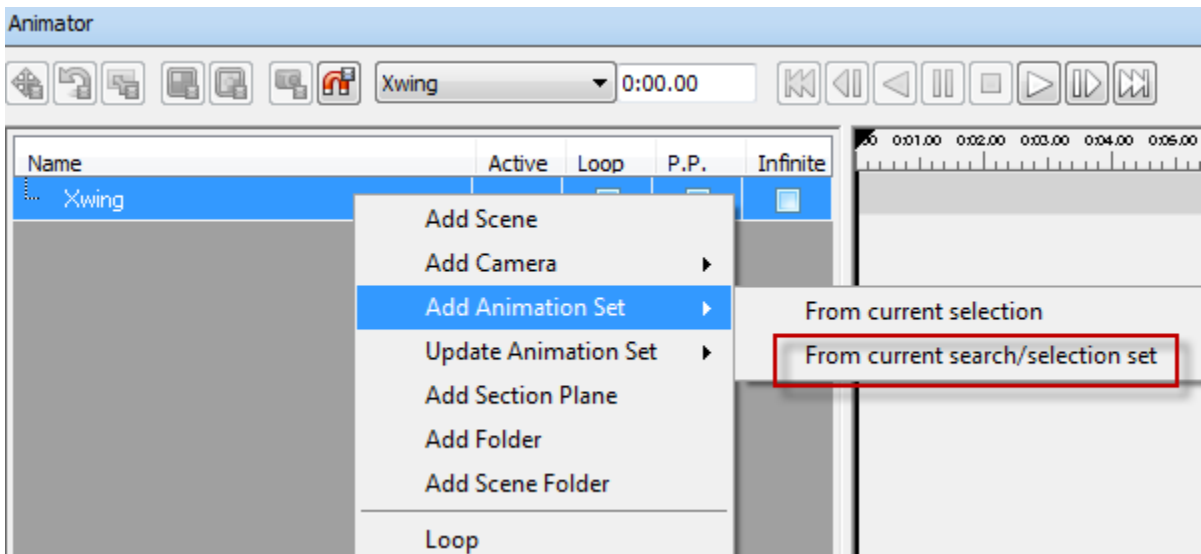
6. Capture keyframe using camera button

7. Drag the top diamond to 10 seconds in

Name		Active	Loop	P.P.	Infinite	
⊟ xwing			☐	☐	☐	
⋯⋯xwingtodockingbay		☑	☐	☐		

8. Select the Translate Animation Set button

		Scene 3	0:00.00	

9. Move the model using red axis to well inside docking bay, use the 'Inside docking bay' Viewpoint to guide the X-Wing if needed.
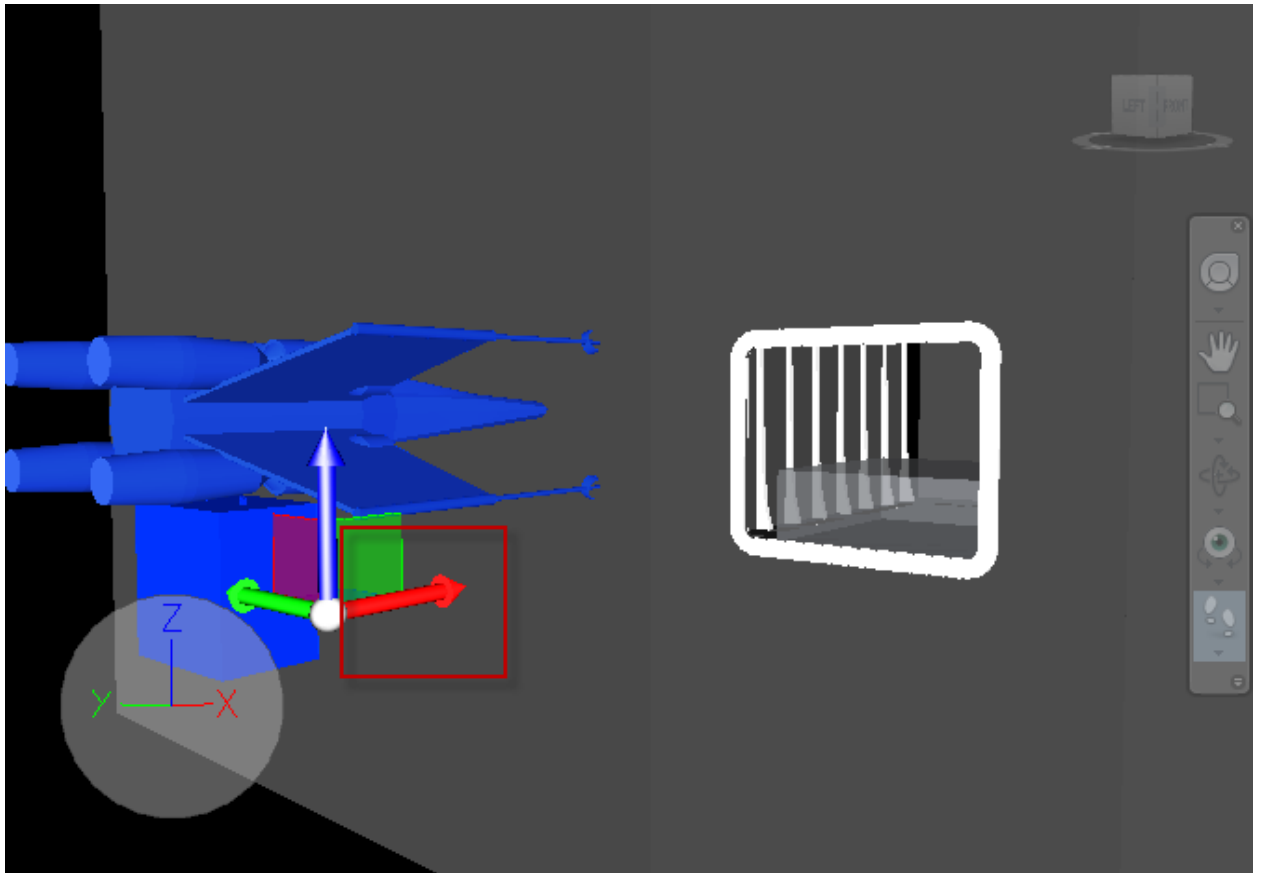
10. Capture a new keyframe, a diamond should appear at the new location

Name	Active	Loop	P.P.	Infinite
⊟ xwing		☐	☐	☐
⋯⋯xwingtodockingbay	☑	☐	☐	

11. Rewind animation and run to be sure this is working

Clash detect path against surrounding building
12. Open Clash Detective (Ctrl + F2)
13. Add a test, and rename to 'xwingvsdockingbay'
14. Open Rules tab, ensure 'Ignore items in previously found pair of composite objects' is checked
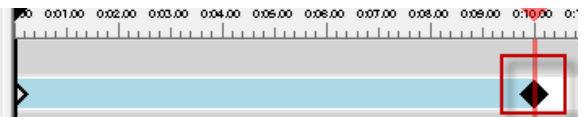15. Open the Sets tab for Selections A and B, select 'Death Star' on left, and 'xwing' on the right
16. Set the Clash Settings as
    a. Hard clash
    b. Tolerance = 0.01m (or 0.01in)
    c. Link 'xwing' this is your animation
    d. Step (sec) = 0.1
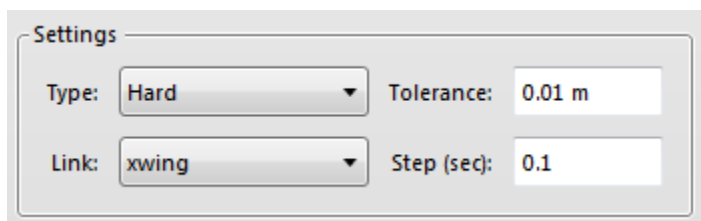
17. Run the test, 2 clashes should display, against the interior and exterior of the docking bay entrance being hit by the X-Wing
18. Hide 'xwing' Search Set in the Sets window and unhide 'tiefighter' using the buttons on the Home tab. (Ctrl + H)
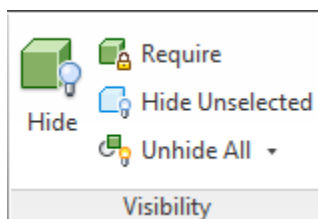
19. Create a new Scene, Animation Set and Clash Test by following steps 1 to 17 with the Tie fighter. The Clash Test should give no results; the decision is made to use the tie fighter

Create Task Types in Timeliner

20. Unhide the 'EVIL BREAKDANCE AREA' Search Set from the Sets window (Ctrl + H)
21. Open Timeliner (Ctrl + F3)
22. Open Configure tab > Add task type, name this 'Model' and set to 'Model Appearance' for Planned Start and End, and the Simulation Start Appearance
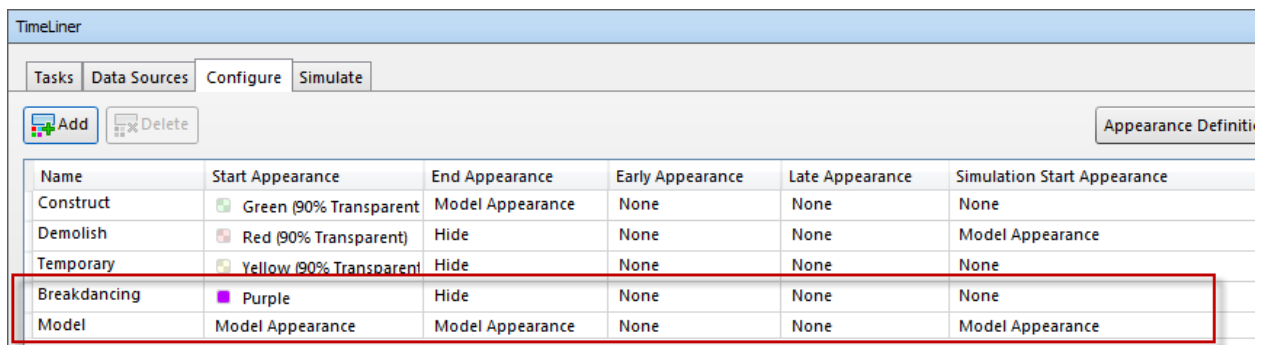23. Add task type, name this 'Breakdancing' and set Planned Start appearance to Purple, End Appearance to Hide and leave others as None

Name	Start Appearance	End Appearance	Early Appearance	Late Appearance	Simulation Start Appearance
Construct	Green (90% Transparent)	Model Appearance	None	None	None
Demolish	Red (90% Transparent)	Hide	None	None	Model Appearance
Temporary	Yellow (90% Transparent)	Hide	None	None	None
Breakdancing	Purple	Hide	None	None	None
Model	Model Appearance	Model Appearance	None	None	Model Appearance

Create Tasks and attach selections

24. Open Tasks tab
25. Change Columns to Extended
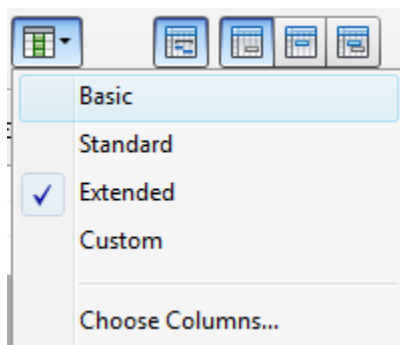
26. Create a task named 'Model', set planned start and end dates to 1/1/2013 and 1/21/2013 respectively, set Task Type to Model, attach the 'Death Star' selection set using drag and drop
27. Create a task named 'Stormtrooper Breakdancing', set planned start and end dates to 1/8/2013 and 1/14/2013 respectively, set Task Type to Breakdance, attach the EVIL BREAKDANCE AREA search set using drag and drop
28. Create a task named 'Tie Fighter', set planned start and end dates to 1/1/2013 and 1/16/2013 respectively, set Task Type to Model, attach Tiefighter selection set using drag and drop, Add the Animation 'Tiefighter' to the task, ensure Animation Behaviour is set to Scale to ensure this lasts the duration of the task
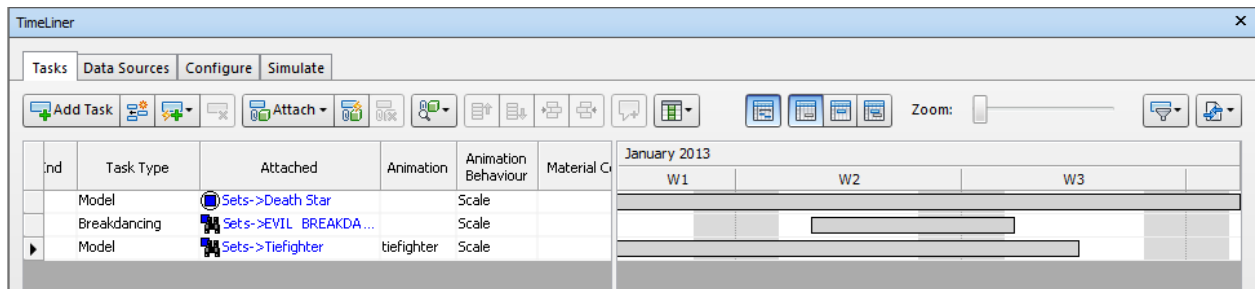
29. Run this in the Simulate tab to ensure this works
30. Open Clash Detective (Ctrl + F2)

Create a time based clash

31. Add a test, name it 'Loading vs Breakdancing'
32. Select dockingbay.nwc on left, select tieload.iam on right
33. In Clash Settings ensure these are
    a. Hard
    b. Tolerance = 0.01m
    c. Link = Timeliner
    d. Step (sec) = '3600' (1 hour)
34. Run Test

This will tell you when a clash will happen so you can reschedule.

Try finishing the breakdancing one day early, or start the Tie Fighter a day later and re run the task

Linking Animations to Timeliner for powerful presentations

Use *animator_detentionblock.zip*

Create Viewpoints for Animations
1. Open detentionblock.nwf in Navisworks
2. Open Saved Viewpoints (Ctrl + F11) > Overview
3. Go to Simulate tab and press the Play button
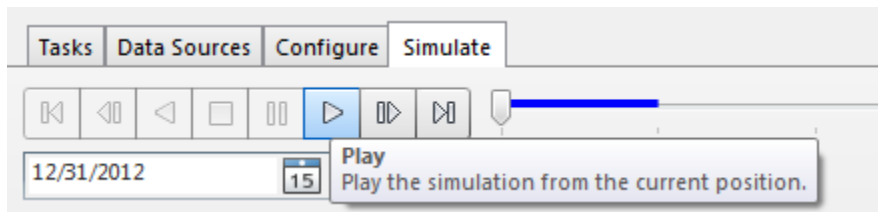
4. Create the first animation
    a. Go to the Tasks tab
    b. Use the Walk tool (Ctrl + 2) to move to the center of reception and turn toward the lift.
    c. On the Viewpoints tab click Save Viewpoint, rename to 'Lift Doors'

    d. Use the Look Around tool (Ctrl + 3) to look towards the central corridor
    e. On the Viewpoints tab click Save Viewpoint, rename 'Towards Corridor'
    f. In Saved Viewpoints right click in space and Add Animation, rename to 'Turn in Reception'
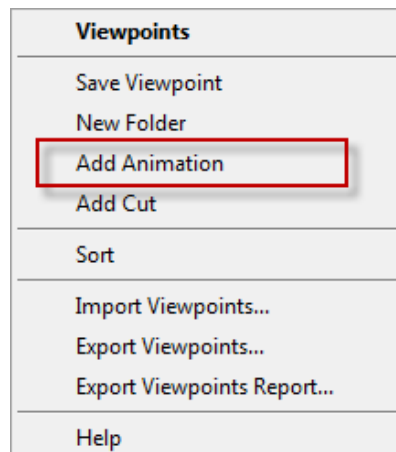
g. Drag 'Lift Doors' into the new animation, then drag 'Towards Corridor' into the animation

h. Play the Animation in the Viewpoints tab (Ctrl + Right Arrow) to ensure the view turns round towards corridor
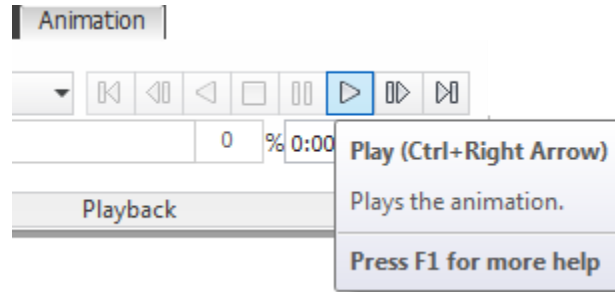
5. Create the second animation
    a. Select the new 'Lift Doors' Viewpoint
   b. Use the Walk tool (Ctrl + 2) to move backwards until you are slightly in the corridor (2 or 3 blocks in)
    c. On the Viewpoints tab click Save Viewpoint, rename to 'In corridor'
    d. Use the Walk tool to move backwards until you are about halfway down
    e. On the Viewpoints tab click Save Viewpoint, rename 'Halfway down corridor'
    f. In Saved Viewpoints right click in space and Add Animation, rename to 'Walk back through corridor'
    g. Drag 'In corridor' into the new animation, then drag 'Halfway down Corridor' into the animation
    h. Play the Animation in the Viewpoints tab (Ctrl + Right Arrow) to ensure the view turns round towards corridor

Use Animator to animate objects
6. Select Overview viewpoint in Saved Viewpoints
7. Open Animator (Ctrl + F5)
8. Add a Scene and name it 'Corridors'

9. In the Sets window expand Corridor Steps and Select Step01
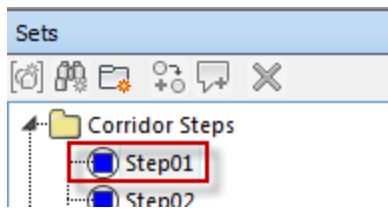
10. Select Corridors and right click in the Animator window > Add Animation Set > Use Current Search/Selection Set > Rename to 'Step01'
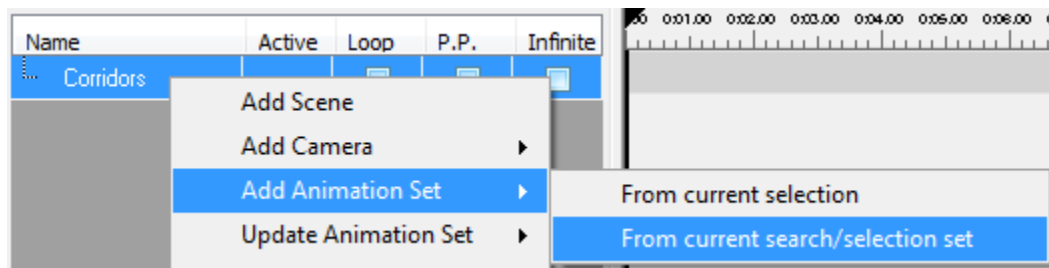
11. Drag the top diamond to 10 seconds in

12. Capture keyframe using camera button, and a diamond should appear

13. Drag the top diamond to the start
14. Select the Translate Animation Set button

Translate animation set
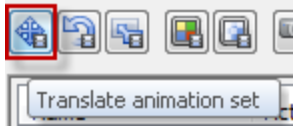
15. Move the Step01 set vertically up using blue axis until it is off the screen
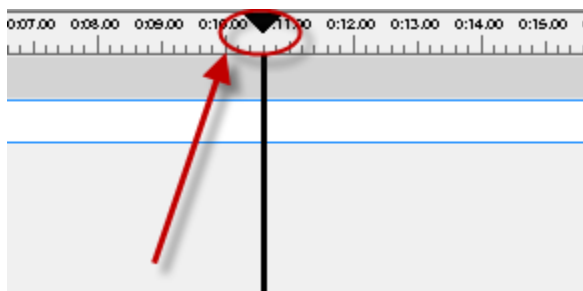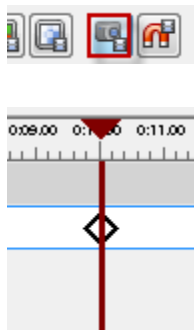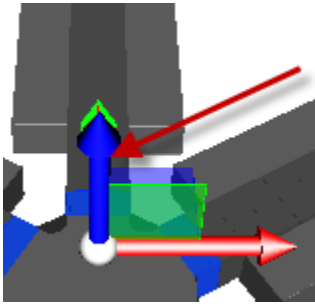

16. Capture a new keyframe, a diamond should appear at the new location
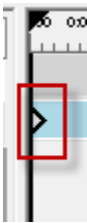
17. Rewind animation and run to be sure this is working

Repeat for all steps
18. Repeat for all steps, to add steps 02 to 40
    a. Right click and Copy 'Step01'
    b. Right click the 'Corridors' Scene and Paste, 39 times
    c. Rename to Step02, Step03 etc
    d. Select Animation Set > Select relevant Selection Set
    e. Right Click over Animation Set > Update Animation Set > From Current
        Search/Selection Set for each set
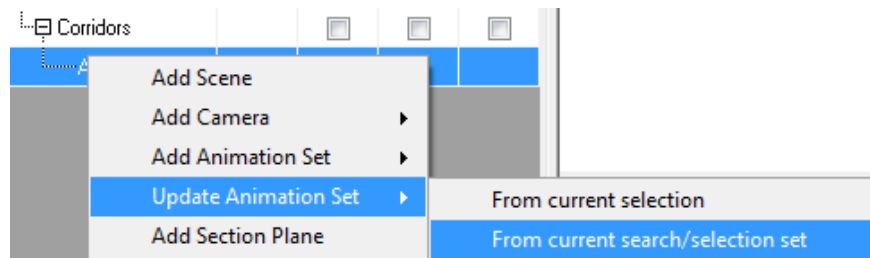
19. Add three more Animation Sets
20. Name them Cell Walls, Cell Ceilings and Reception Ceiling and attach the relevant sets.
21. Open Simulate tab > Settings

a. Animation > set to 'Saved Viewpoints Animation'
b. Check Override Start and End Dates
c. Set Dates to Start 1/2/2013 and End 1/11/2013
d. Set Playback Duration to 20 seconds
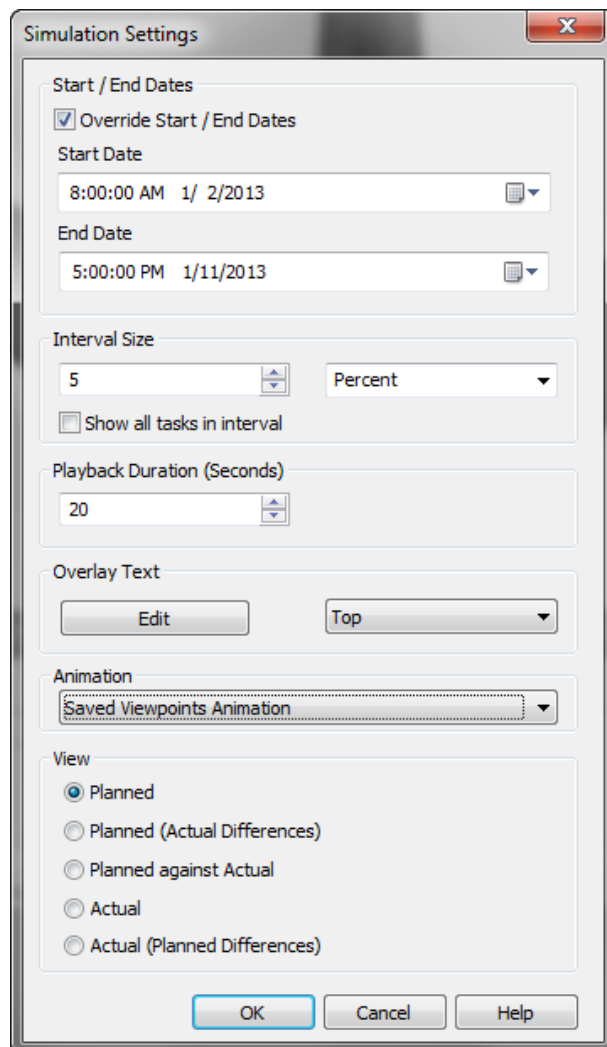
22. Select Overlay Text > Edit
    a. Delete current text and paste
       DETENTION BLOCK SCHEDULE
       %A %X %x Day=$DAY Week=$WEEK
       $TASKS
    b. Select a suitable Font
    c. If you want to change the color, put the cursor before the text, then select a color
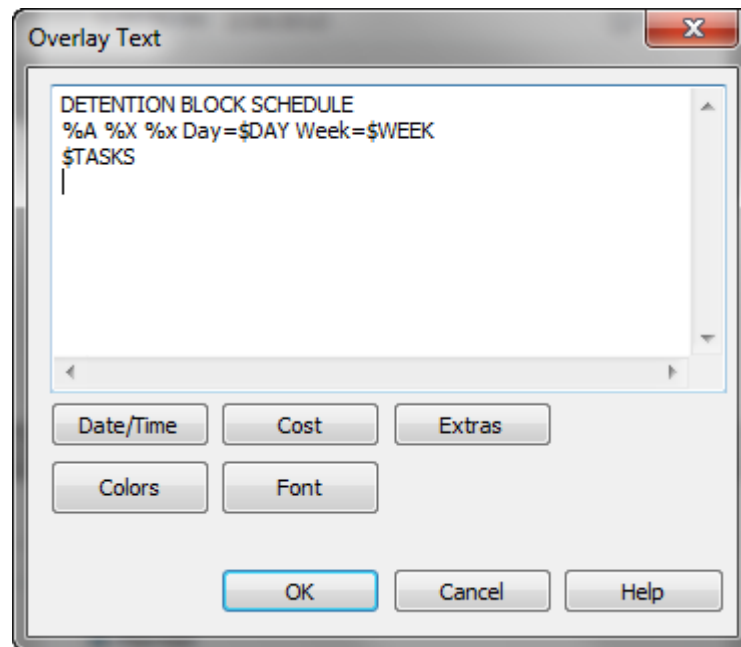
    d. Press OK
23. Press OK again
24. Select 'Turn In Reception' Animation in Saved Viewpoints
25. Run in Simulate to ensure that the simulation displays at the same time as the animation turning round in the corridor runs
26. Click Animation Export (Ctrl + Shift + A) and use the following settings
    a. Source – Timeliner Simulation
    b. Renderer – Viewport (Presenter takes a lot long and has no progress update)
    c. Format – JPG (in Options set to uncompressed)
    d. Size – Explicit 1600 x 900 for widescreen 16:9 movie, 1200 x 900 for 4:3
    e. FPS – 25
    f. Anti-aliasing – 64x
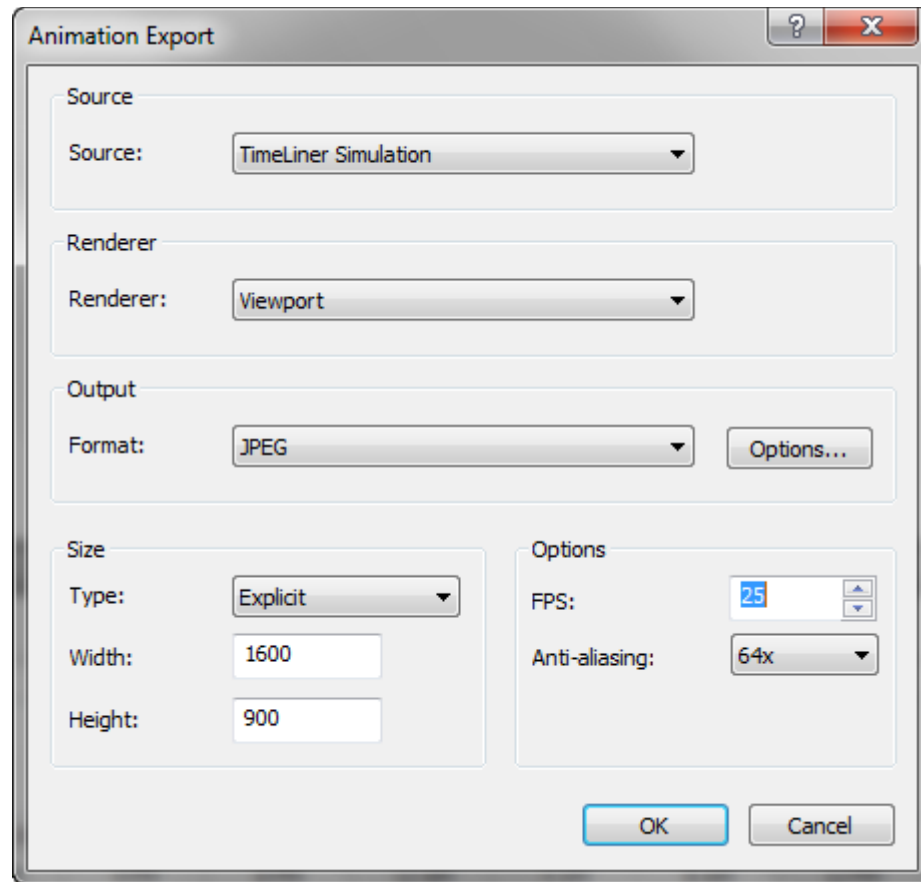
27. Save to a new folder named 'Detention Block 1'
28. This exported animation will be the first part of your animation

29. Open Simulate tab > Settings > Animation > set to 'Saved Viewpoints Animation'
30. Check Override Start and End Dates
31. Set Dates to Start 1/11/2013 and End 2/1/2013
32. Set Playback Duration to 40 seconds
33. Select 'Walk back through corridor' Animation in Saved Viewpoints
34. Run in Simulate to ensure it works
35. Click Animation Export (Ctrl + Shift + A) and use the following settings
    a. Source – Timeliner Simulation
    b. Renderer – Viewport (Presenter takes a lot long and has no progress update)
    c. Format – JPG (in Options set to uncompressed)
    d. Size – Explicit 1600 x 900 for widescreen 16:9 movie, 1200 x 900 for 4:3
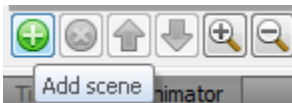   e. FPS – 25
    f. Anti-aliasing – 64x
36. Save to a new folder named 'Detention Block 2'

Create a smooth camera view through Animator

37. Use the Navigation Tools to create 4 viewpoints that would create a sweep over the Detention Block
38. Drag into to a new Animation in Saved Viewpoints as before
39. Play the Animation
40. In Animator add a Scene and rename this to Sweep

41. Add a Camera using the button, Using the Current Viewpoint Animation
42. Drag the diamonds to make the animation run more smoothly

43. Add intermediate frames
   a. Move the playhead (the red triangle at the top) to between two keyframes

    b. Using the Navigation tools move to smooth the animation, you may want to walk backwards or look around to make the transition between frames less jerky
    c. Capture a new keyframe

    d. Play the animation to look where you need more intermediate frames, drag them on the timeline appropriately

44. Change the Columns in View to Extended if it isn't already
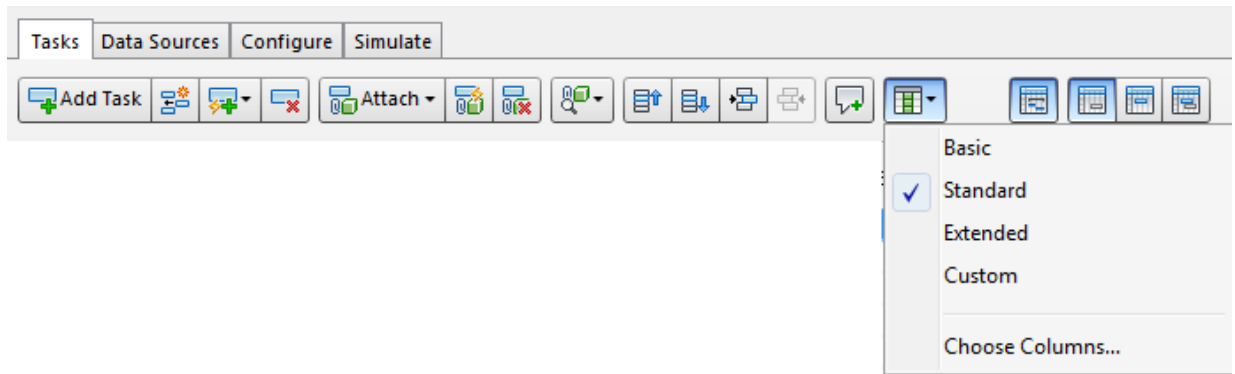
45. Add a Timeliner Task, rename to Sweep
    a. Set Planned Start to 2/1/2013 and Planned End to 2/21/2013
    b. Set Animation to 'Sweep > Camera' and ensure behavior is set to Scale

Active	Name	Status	Planned Start	Planned End	Actual Start	Actual End	Task Type	Attached	Animation	Materia
☑	Sweep	▬	2/1/2013	2/21/2013	N/A	N/A	Construct	Explicit Selection	Sweep\Camera	

46. Open Simulate tab > Settings
    a. Change Animation to 'Sweep > Camera'
    b. Check Override Start and End Dates and Set Dates to Start 2/1/2013 and End 2/21/2013
    c. Set Playback Duration to 40 seconds
47. Run in Simulate tab to ensure the Animation you created highlights the key areas, adjust the Camera Scene in Animator if not.
48. Click Animation Export (Ctrl + Shift + A) and use the following settings
    a. Source – Timeliner Simulation
    b. Renderer – Viewport (Presenter takes a lot long and has no progress update)
    c. Format – JPG (in Options set to uncompressed)
    d. Size – Explicit 1600 x 900 for widescreen 16:9 movie, 1200 x 900 for 4:3
    e. FPS – 25
    f. Anti-aliasing – 64x
49. Save to a new folder named 'Detention Block 3'

Create a video from the images
50. Use something like Quicktime Pro to splice the frames for all three animations together. Where possible keep uncompressed up until the final video is ready
51. Extra tips
    a. Add an opening slide with branding
    b. Use cuts between videos
    c. Use the last frame as a closing slide so the animation doesn't end prematurely

    d. Use sounds and music
    e. Use Appearance Profiler to add more color
    f. Add materials and lights in Presenter
       Switch to Full Render and Full Lights in Viewpoints tab if exporting as 'Viewport'
    g. Export as a Presenter render (no progress is provided this way), will take much longer, export as many small animations on multiple machines to save time

Find more tips on [Beyond Design Blog](#)