

CE4002 Assignment 1 (15%)
Modeling and Estimating from a 3D Model (Due: 27/12/16 9:30)
"This is a group assignment!"

PART 1: Model Based Estimating via Allplan (30 pts)

In the first part of this assignment, you will be responsible for estimating (using Allplan) the quantity of downstand beams, columns, walls, and windows for Quickstart building model (Figure 1).

You are given a base template (BeamQT.rdlc) to use as a starting document for preparation of your quantity take-off templates in Allplan Report Designer.

- Open Allplan, following the steps in the guideline document modify the report BeamQT.rdlc for taking estimates of beams, columns, walls, and windows. Save each report separately with the name of the elements that will be quantified.
- For downstand beams calculate, Length (m), Thickness (m), Height (m), Area (m²), Volume (m³), Formwork (m²). Select architecture objects>downstand beam to filter the model for the objects that this report will look in the model to calculate associated quantities.
 For columns, calculate Length (m), Thickness (m), Height (m), Area (m²), Formwork (m²), Volume (m³). Select architecture objects>column to filter the model for the objects that this report will look in the model to calculate associated quantities.
 As a bonus (5 pts), re-calculate column parameters according to conditional statement for thickness and length parameters:

$$\begin{array}{ll} \text{Thickness} = \text{Thickness}, \text{Length} = \text{Length} & \text{Thickness} \leq \text{Length} \\ \text{Thickness} = \text{Length}, \text{Length} = \text{Thickness} & \text{Thickness} > \text{Length} \end{array}$$
- For walls, calculate Thickness (m), Length (m), Height (m), Net Area (m²) and Net Volume (m³). Select architecture objects>wall to filter the model for the objects that this report will look in the model to calculate associated quantities.
- For windows, report Window Name and calculate Pieces, Length (m), Height (m), Area (m²) for single window, and Total Area (m²) for all pieces. Select architecture objects>window, smart symbol + SmartPart to filter the model for the objects that this report will look in the model to calculate associated quantities.

Warning: Use three decimal for reporting

Beams:

1. Calculate formula with the formula given in guidelines as Alternative II.

Material	Length [m]	Thickness[m]	Height [m]	Area [m2]	Volume [m3]
[Story]					
[Material]					
Database image: [Graphics].	[Length]	[Thickness]	[Height]	[Area]	[Volume]
	[Length]	[Thickness]	[Height]	[Area]	[Volume]
"Total" & [Material]					
"Total " & [Story]					
Grand Total					

Column:

1. Calculate formwork in formula format as given in the list of Allplan data fields (Alternative I).
2. Calculate total area, total formwork area and total volume for each material type, story and grand total.

BONUS: Re-design column report table considering the conditional statement “Thickness being less than length”.

Hint: IIF(condition, result if condition is true, result if condition is false)

Material	Thickness [m]	Length [m]	Height [m]	Area [m²]	Formwork [m²]	Volume [m³]
[Story]						
[Material]						
Database image:[Graphics].						
"Total" & [Material]						
"Total " & [Story]						
Grand Total						

Wall:

1. Net area is calculated as mean area in Formula (Step 6.2).
2. Calculate total net area and total net volume for each material type, story and grand total.

Material	Thickness [m]	Length [m]	Height [m]	Net Area [m²]	Net Volume [m³]
[Story]					
[Material]					
Database image:[Graphics].					
"Total" & [Material]					
"Total " & [Story]					
Grand Total					

Window:

1. Window Name formula (Step 6.2): General architecture/Code text
2. Total area for each window name should be selected from formula.
3. Calculate total number of pieces and total window area for each story and grand total.

Story	Window Name	Pieces	Length [m]	Height [m]	Area [m²]	Total Area [m²]
[Story]						
Database image:[Graphics].						
"Total " & [Story]						
Grand Total						

PART 2: Model Based Estimating via Navisworks (30 pts)

In the second part of this assignment, you will be responsible for estimating (using Autodesk Navisworks Quantification) the quantity and cost of constructing of structural columns, structural framing, curtain panels and curtain wall mullions, structural foundations, exterior walls, interior walls, floors, windows, doors, and roofs for a three-storey building with retail and office spaces (Figure 2).

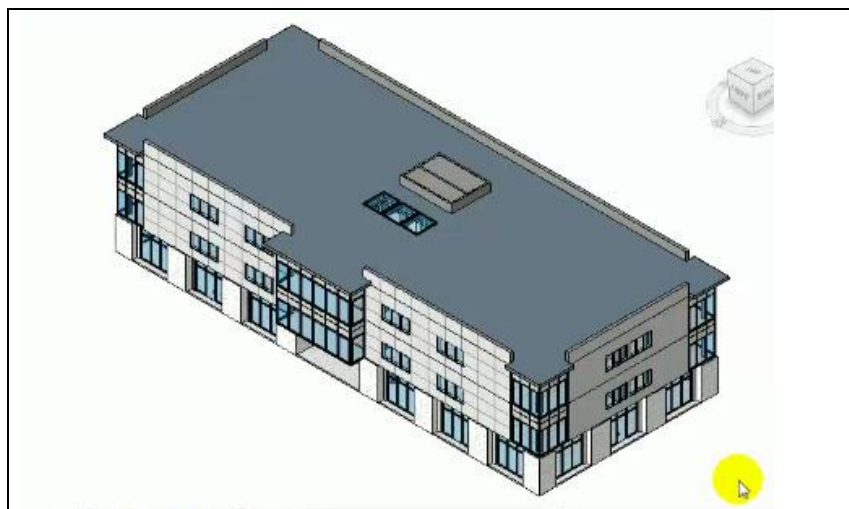


Figure 2. Three storey building model for cost estimating

You will be given a Navisworks model (HW3_part2_model.nwc). In order to generate your estimate:

- Open the given .NWC file in Navisworks Manage.
- Click Quantification button under home tab.
- Start with Project Setup in Quantification Workbook to begin Quantification.
- Select Unifomat as a catalog.
- Use Metric Unit System.

- Use units given in the figure below (Figure 3).

Takeoff Property	Units
<input checked="" type="checkbox"/> General Properties	
<input checked="" type="checkbox"/> ModelLength	Meters
<input checked="" type="checkbox"/> ModelWidth	Meters
<input checked="" type="checkbox"/> ModelThickness	Meters
<input checked="" type="checkbox"/> ModelHeight	Meters
<input checked="" type="checkbox"/> ModelPerimeter	Meters
<input checked="" type="checkbox"/> ModelArea	Square Meters
<input checked="" type="checkbox"/> ModelVolume	Cubic Meters
<input checked="" type="checkbox"/> ModelWeight	Kilogram

Figure 3. Units

- Click Selection Tree under home tab to open Selection Tree window.
- Click Sets>Manage Sets under home tab to open Sets window.
- Create selection sets for the group of items you need to estimate or select those items from the Selection Tree without creating the sets.
- Without sets: Once you select a group of elements (eg. windows) from Selection Tree, you should also select the corresponding Unifomat category from the Quantification Workbook that these items quantification will go under. Then by clicking “Take off to Selected” option under “Model Takeoff” button in Quantification Workbook, quantification will be done for the selected elements.
- If you use sets: Complete the takeoff by creating new item in Item Catalog under associated Unifomat category and taking-off the quantities of the corresponding set group to this new item.
- All units of quantification available for the elements are calculated by the quantification process. One of the units should be selected as the valid unit for each element during cost calculation.
- Valid units for the elements are listed below.
 - o columns: structural columns – W-wide flange → volume
 - o beams: structural framing – W-wide framing → volume
 - o structural foundation: foundation slab → volume
 - o walls: exterior walls → volume, interior walls → area
 - o basic roof : generic 12” → volume, steel truss → area
 - o floors: LW concrete on metal deck → area
 - o windows → count
 - o curtain wall: curtain wall panels → area, curtain wall mullions → length
 - o doors → count
- Save your Navisworks project by naming it as HW3_groupX. Submit both .NWC and .NWF files.
- Export quantities to excel by selecting “Export Quantities to Excel” from Import/Export button in Quantification Workbook.
- In your excel report identify unit prices for each element (by guessing or searching the cost information). Find material, labor, and equipment unit prices as necessary.

- Add unit cost and total cost columns to your excel file for each element and calculate your total project cost.
- Save your estimate excel report as HW3_takeoff_groupX.

While completing the estimate, familiarize yourself with the features of the software system so that you have sufficient background to answer the following questions.

DISCUSSIONS (40 pts):

In addition to your estimate report, submit a one to two-page write-up addressing the followings:

1. Describe the benefits and limitations of doing a model-based cost estimate
2. How Allplan tool improve the estimating task? What features of the system need improvement?
3. How Autodesk Navisworks Quantification tool improve the estimating task? What features of the system need improvement?
4. Do you think you are exporting all the information in the building model when you save it as a .NWC file for the cost estimate?
5. Can you be sure that the model based quantity take-off is correct? What considerations you should make while using Autodesk Navisworks Quantification to estimate? Do you think this method covers all the cost items you should include in a construction cost estimate?
6. How did you estimate the unit prices? From a web-based source? A unit price book? By an educated guess, etc.?
7. Are there any advantages of doing manual instead of automated quantity take-off?
8. At what point in the design process would this tool be most useful? (i.e. is this tool more useful for 90% complete design versus 30%) Why?

On 27/12/16, submit your estimate and write-up by 9:30. Create zip file labeled HW3.groupX.zip which includes: *i*) Allplan quantity take-off templates (rdlc), *ii*) Allplan quantity take-off reports (beams, columns, walls, windows) in excel format, *iii*) Navisworks model file, *iv*) excel estimate report and *v*) word write-up. Submit your assignment zip file as a group to odtuclass.metu.edu.tr.

The selected groups (Group 7-8-9) will be asked to make a 15-20 minutes presentation on this assignment on 27/12/2016 by discussing specific topics assigned to them (the guidelines for the presentation will be provided separately).