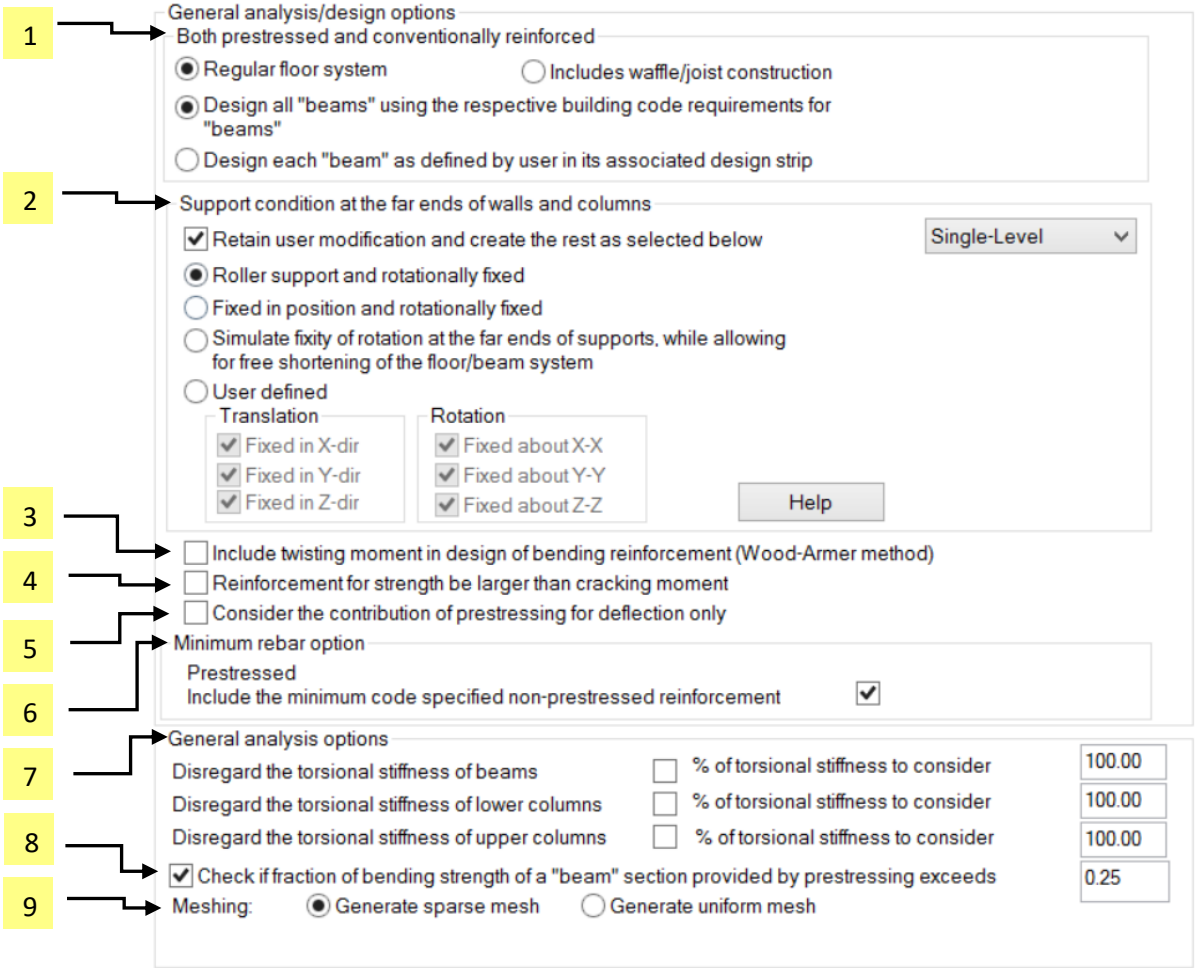
ADAPT-BUILDER®: General Analysis/Design Options

Quick Reference Guide

Updated October 2020



General analysis/design options:

1. **Both prestressed and conventionally reinforced –** Applies to how design sections consider slabs and beam components comprising section cuts for prestressed and conventional reinforced slab concrete slab and beam systems.
   a. **Regular floor system –** This option is the default option and is typically used for:
      - flat two-way slabs with/without drop panels or drop caps

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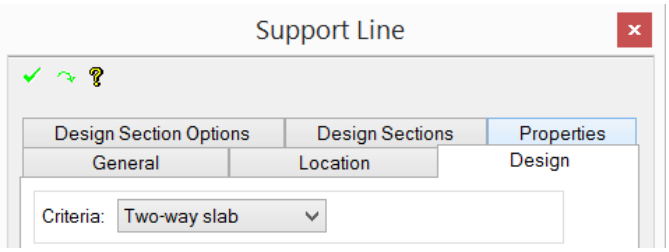
- one-way slabs and transverse beams
- slabs with complex geometry including folds, steps, transitions, etc.
- two-way slabs with beams (not waffle slabs)

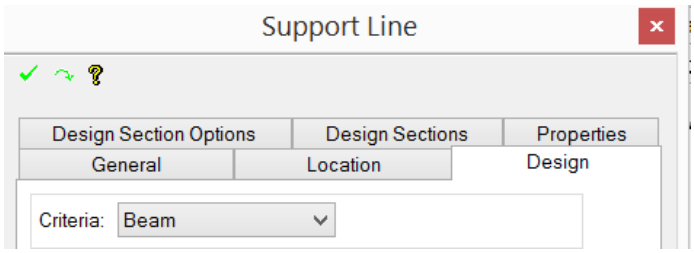
When a design section intersects a slab section, including a beam, the program will consider the beam as part of the design section geometry under the condition that at least 1 of the support lines nodes snaps on the beam component end-point. If the support line does not snap on the beam end-point, the beam is considered for analysis, but is not considered as part of the design section.

b. **Includes waffle/joist construction –** This option is commonly used for waffle slabs or beam and joist systems. Regardless of where the support line node is snapped, the design section intersecting a slab and beam or several beams, will consider the beam/s as part of the design section geometry. If multiple beams are intersected as part of one design section, the beam assumes the total sum of beam widths as the beam stem width. This option can also be applied to "regular" floor systems if the user requires more flexibility for support line node placement.

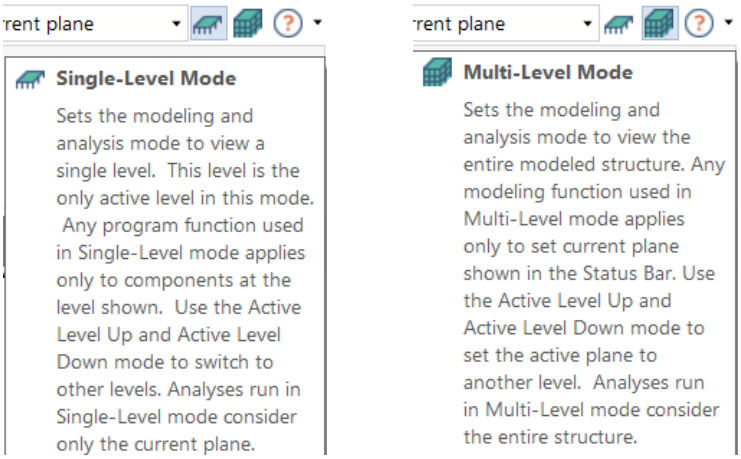
c. **Design all "beams" using the respective building code requirements for "beams" –** Each support line (used to generate design strips) is designated specific design criteria: Two-way slab, one-way slab or beam. If a beam is included as part of a continuous support line which also includes two- or one-way slabs, the program will automatically apply reinforcement design requirements (service and strength) for beams based on the design code selected. Note that the reinforcement size and graphical layout (FEM>Generate Rebar Drawing) are dependent on the criteria setting. For example, if a support line including a beam requires 3.0 in2 of reinforcement (10#5 bottom bars) at the section located at mid-span of the beam, the required area of steel is based on beam requirements. The #5 bars are selected due to the two-way slab setting of bottom bars using #5 US bar size.



d. **Design each "beam" as defined by user in its associated design strip -** The user can create an independent, non-continuous support line which extends only over the beam and set the design criteria to "Beam" to achieve the reinforcement quantity AND bar size related to Beam Criteria. If this option is selected, design section will be designed based on the setting in the support line "Design" settings for criteria.



2. **Support condition at the far ends of walls and columns** – These settings are used to set support conditions for Single-Level and Multi-Level modes of analysis. The pull down menu for Single- and Multi-Level conditions is used ONLY to set the support condition. It is not used to define which mode of analysis is being considered. The *Story Manager Toolbar* contains toggle buttons which change the mode from Single-Level to Full-Structure mode. This applies to the model graphically and also for the structure the model analyzes.



   a. **Retain user modification and create the rest as selected below –** This option ensures that any boundary conditions that you manually modify to individual components are retained. If a component is not given specific boundary conditions they will be assigned according to the criteria listed below this setting at the onset of analysis. If this option is deselected, each time the user runs analysis of the structure, the support conditions are set to option selected below (b-e).
   b. **Roller support and rotationally fixed –** This is the program default condition for models analyzed in Single-Level mode. This condition restrains translation for the Z direction and releases the X and Y translation restraints. The X, Y and Z rotational restraints are fixed. Also known as a "fixed-roller" condition.
   c. **Fixed in position and rotationally fixed –** This condition fixes translation and rotational fixity in the X, Y and Z axes. Also known as a "fixed-fixed" condition.
   d. **Simulate fixity of rotation at the far ends of supports, while allowing for free shortening of the floor/beam system –** This condition is identical to the fixed roller condition (program default). The purpose of this option is to explicitly describe a condition for which a user could simulate free shortening of a post-tensioned slab.

e. **User-defined –** This option allows the user to set a customized boundary condition for translational and rotational degrees of freedom for the X, Y and Z axes.

3. **Include twisting moment in design of bending reinforcement (Wood-Armer method) –** This option allows the user to design for twisting moments as part of the Strength design using the Wood-Armer Method. See ADAPT Technical Notes 328 and 434.

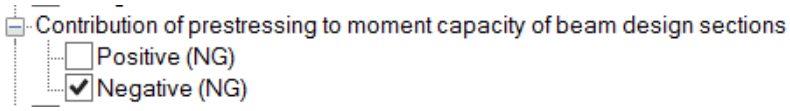
4. **Reinforcement for strength be larger than cracking moment –** This option is used to satisfy the code requirement found in ACI318 for bonded post-tensioned systems. When this option is selected, the program creates an additional load combination, stored internally, called "Cracking Moment." Reinforcement required to meet 1.2*Mcr is enveloped with other combinations.

5. **Consider the contribution of prestressing for deflection only –** This selection suppresses the tendons from being considered for section capacity and stress checks. The presence of tendons is only used for solving the model for FEM results for displacements. The design of sections ignores the presence of tendons for this selection. Stresses are not reported if this option is used. The purpose of the option is for designs which PT is used to control deflections but slab and/or beam design is performed based on conventional RC methodology. Note this option is unavailable in RC-only mode.

6. **Minimum rebar options**
    a. **Prestressed – Include the minimum code specified non-prestressed reinforcement –** This option suppresses the check for minimum reinforcement. For combinations that are set to an analysis/design option type of "Service (Total)" or "Service (Sustained)" the program will report no reinforcement if this option is de-selected. Note this option is unavailable in RC-only mode.

7. **General analysis options-** These settings allow the user to adjust the torsional stiffness of members without adjusting local stiffness modifiers. These settings should be used for models run in Single-level mode only.
    a. **Disregard the torsional stiffness of beams / % of torsional stiffness to consider –** Allows the user to ignore the torsional stiffness (rotation about local longitudinal axis of beam frame elements) or to reduce the stiffness by entering a % of stiffness to consider in the analysis.
    b. **Disregard the torsional stiffness of lower columns / % of torsional stiffness to consider –** Allows the user to ignore the torsional stiffness (rotation about local longitudinal axis, or Global Z axis, of lower column frame elements) or to reduce the stiffness by entering a % of stiffness to consider in the analysis.
    c. **Disregard the torsional stiffness of upper columns / % of torsional stiffness to consider –** Allows the user to ignore the torsional stiffness (rotation about local longitudinal axis, or Global Z axis, of upper column frame elements) or to reduce the stiffness by entering a % of stiffness to consider in the analysis.

8. **Check if the fraction of bending strength of a "beam" section provided by prestressing exceeds user-defined %-** This option allows the user to check if the portion of design section capacity from prestressing steel exceeds the user-specified value (entered in decimal format). The program will flag which sections exceed the threshold. From *Result Display Settings* the user can display the *Positive or Negative* capacities which violate the check.



If the user double-clicks on the design section to open the *Design Section* input window, and reviews the Design Section tab for the section information, the program reports the estimated amount of additional reinforcement required to maintain the user-defined threshold value.

Contribution of prestressing to moment capacity:	1.000	1.000	allowable (0.250)
Addition rebar: (estimated)	Astop = 8.6 in2 Asbot = 19.4 in2		

9. **Meshing –** Allows the user to define how the program will mesh the slab automatically.
    a. **Sparse Mesh –** Allows the meshing algorithm more flexibility in determining the slab mesh and has less restrictive internal requirements for shell size and edge length ratios. This is also known as an "organic" mesh. This is the default meshing setting.
    b. **Uniform Mesh –** Generates a mesh containing shells with are more uniform in size and more restrictive on the shell edge length ratios. This meshing selection will typically result in more shells and nodes.