Salahaddin University-Erbil College of Engineering Civil Department 3rd Year Students



Elective Course

(Computer Application-CAD Software)

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ETABS Software

ЕТАВ

1-Introduction

ETABS is a powerful program that can greatly enhance an engineer's analysis and design capabilities for structures. Consists array of options and features and simple to use. The basic approach for using the program is very straightforward. The user establishes grid lines, places structural objects relative to the grid lines using joints, frames, links, tendons, and shells, and assigns loads and structural properties to those structural objects (for example, a frame object can be assigned section properties; a joint object can be assigned spring properties; a shell object can be assigned slab or deck properties).

Analysis, design, and detailing are then performed based on the structural objects and their assignments. Results are generated in graphical or tabular form that can be printed to a printer or to a file for use in other programs.

Behavior of load path gravity and lateral loads

- For Gravity Loads,

Analysis of Gravity Load Resisting System for:

Dead Load, Live Load, Pattern Loads, temperature, shrinkage Important Elements: Floor slabs, beams, openings, Joists, etc.

- For Lateral Loads

Analysis of Lateral Load Resisting System for:

Wind Loads, Seismic Loads, Structural Un-symmetry

Important elements: Columns, shear walls, bracing, beams



The Need for Modeling

Real Structure cannot be Analyzed:

It can only be "Load Tested" to determine response

We can only analyze a "Model" of the Structure

We therefore need tools to Model the Structure and to Analyze the Model

Finite Element Method: The Analysis Tool

• Finite Element Analysis (FEA)

"A discretized solution to a continuum problem using FEM"

• Finite Element Method (FEM)

"A numerical procedure for solving (partial) differential equations associated with field problems, with an accuracy acceptable to engineers"



- 2-3 Nodes. A, I etc.
- 2 D Elements (Plate type)
- Can be used in 2D and 3D Model
- 3-9 nodes. Thickness
- 3 D Elements (Brick type)
- Can be used in 3D Model
- 6-20 Nodes.

1



Elastic Material

Follows the same path during loading and unloading and returns to initial state of deformation, stress, strain after removal of load.

Inelastic Material

Does not follow the same path during loading and unloading and may not returns to initial state of deformation, stress, strain after removal of load.

Most materials exhibit both, elastic and inelastic behavior depending upon level of loading.

Linearity

The response is directly proportional to load (Deflection doubles if load is doubled)

Non-Linearity

The response is not directly proportional to load (deflection may become 4 times if load is doubled

Structure, Member, Element

Structure can consider as an assemblage of Members Slabs, Beams, Columns, Footings Members can be modeled by using one or more Elements 1D elements, 2D element, 3D elements Frame element, plate element, shell element, solid element, etc. Modeling in terms Graphical Objects to represent Physical Components

Vertical Load Resisting Systems

Transfer Gravity Loads Applied at the Floor Levels down to the Foundation Level Gravity loads: Self weight, Super imposed load, live load **Direct Path Systems**

- Slab Supported on Load Bearing Walls
- Slab Supported on Columns

Ex. Flat Slab and Flat Plate, Waffle Slab

Indirect Multi Path Systems



- Slab Supported on Beams
- Beams Supported on Other Beams
- Beams Supported on Walls or Columns

Ex. (Beam, Slab), (Girder, Beam, Slab

Lateral Load Resisting Systems

Transfer Lateral Loads Applied at any location in the structure down to the Foundation Level

Lateral Loads

- Wind Load
- Seismic Load

- Horizontal component of Gravity Loads in Inclined Systems and in Un-symmetrical structures

- lateral soil pressure, liquid and material retention

Single System

- Moment Resisting Frames
- Braced Frames
- Shear Walls
- Tubular Systems

Dual System

- Shear Wall Frames
- Tube + Frame + Shear Wall

Moment Resisting Frame

- The Load is transferred by shear in columns, that produces moment in columns and in beams
- The Beam-Column connection is crucial for the system to work
- The moments and shear from later loads must be added to those from gravity loads



ETAB

Shear Wall and Frame

- The lateral loads is primarily resisted by the shear in the walls, in turn producing bending moment
- The openings in wall become areas of high stress concentration and need to be handled carefully
- Partial loads is resisted by the frames



Shear Wall and Frame

- The Walls are part of the frame and act together with the frame members
- The lateral loads is primarily resisted by the shear in the walls, in turn producing bending moment.
- Partial loads is resisted by the frame members in moment and shear



Braced Frame

- The lateral loads is primarily resisted by the Axial Force in the braces, columns and beams in the braced zone.
- The frame away from the braced zone does not have significant moments
- Bracing does not have to be provided in every bay, but should be provided in every story





Tubular System

- The system is formed by using close spaced columns and deep spandrel beams
- The lateral loads is primarily resisted by the entire building acting as a big cantilever with a tubular/ box crosssection
- There is a "shear lag" problem between opposite faces of the tube due to inefficiency of column beam connection



Braced Tube System

- Diagonal Braces are added to the basic tubular structure
- This modification of the Tubular System reduces shear lag between opposite faces





2-START WITH ETABS

Main window

- Latest News: new versions, products of CSI company
- Resources: Learn ETABS videos, Manuals, Knowledge Base, Website.



Open new model Select units and main code of design

Use Saved User Default Settings		0
O Use Settings from a Model File		0
O Use Built-in Settings With:		
Display Units	Metric SI	~
Steel Section Database	AISC14	~
Steel Design Code	AISC 360-16	Ŷ
Concrete Design Code	ACI 318-14	~



According to structure element select a template

Brid Dimensions (Plan)				Story Dimer	nsions		
Uniform Grid Spacing	3			Simple	le Story Data		
Number of Grid Lines	in X Direction		4	Nur	ber of Stories	4	
Number of Grid Lines	in Y Direction		4	Турі	ical Story Height	3	m
Spacing of Grids in >	Direction		8	m Bott	om Story Height	3	m
Spacing of Grids in 1	Direction		8	m			
Specify Grid Labeling	g Options		Grid Labels				
O Custom Grid Spacing	1			⊖ Cust	om Story Data		
Specify Data for Grid	l Lines		Edit Grid Data	Spe	cify Custom Story Data	Б	dit Story Data
dd Structural Objects	Grid Only	Т н Т т т т т Steel Deck	H H H	Flat Slab	Flat Slab with Perimeter Beams	Waffle Slab	Two Way or Ribbed Slab

Model Explorer: (model, Display, Tables, Reports)





Define material property

- Concrete and rebar

	Click to:
Steel	Add New Material
Rebar Tendon	Add Copy of Material
	Modify/Show Material
	Delete Material
	OK

Define section properties

- Column, Beam, Slab, Walls

iter Properties List		Click to:
Type All	\sim	Import New Properties
Filter	Clear	Add New Property
matias		Add Copy of Property
Find This Property		Modify/Show Property
ConcBm		
ConcBm		Delete Property
SteelBm SteelCol		Delete Multiple Properties
		Convert to SD Section
		Copy to SD Section
		Export to XML File
		OK Cancel

Define load pattern - DL, LL

ETAB

Loads		12 June 1		Click To:
Load	Туре	Self Weight Multiplier	Auto Lateral Load	Add New Load
Dead	Dead	v 1	×	Modify Load
Dead	Dead			
Live	Live	0		Modify Lateral Load
				Delete Load
				OK Cancel

Define load cases

Ludu Case Mallie			Add New Case
Dead	Linear Static		Add Copy of Case
Live	Linear Static		Modify/Show Case
		8	Delete Case
		*	Show Load Case Tree
			ОК

Define load combination

Add New Combo
Aud New Combo
Add Copy of Combo
Modify/Show Combo
Delete Combo
Add Default Design Combos
Convert Combos to Nonlinear Cases



Model Simple Building

Draw

- Draw column and quick draw column
- Draw wall
- Draw slab
- Opening
- Draw beams



- Assign loads
 - Slab loads
 - Own weight
 - Live
 - Beams loads



- Mesh
 - Shear wall and core (assign supports)
 - Slab

