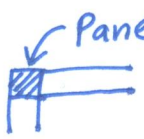
ETABS: End Offsets and Rigid zone factor

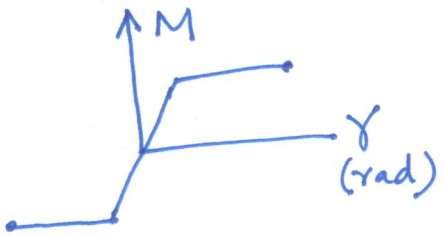
Define → Section Properties → Panel Zone



↓

Can be assigned to a point object at beam/column intersection.

Properties of Panel zone:

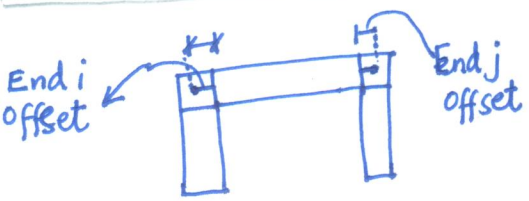


- → Automatically from column elastic properties
- → Specified Spring properties
- → " Link "
- → Auto inelastic properties → ASCE 41-13
- → " " " → User
  - Back bone degradation
  - Acceptance Criteria

→ Select a frame → Assign → Frame → End Length Offsets

The overlapping length
- → Automatic
- → Define lengths — or
- → Rigid zone factor

The flexible length of frame = Total Length − Rigid zone factor (End i offset + End-j offset)



default
- 0 ⇒ NO rigid offset
- 1 ⇒ Fully rigid offset (i.e full offset length is rigid)

For concrete frames → 0.5 is recommended

Panel zone and Rigid offset

Model 1: Rigid zone factor = 0, No panel zone
Deflections : Largest (most conservative)
Moments : Smallest (least ")

Model 2: Rigid zone factor = 1, No panel zone
Deflections : Smallest
Moments : Largest

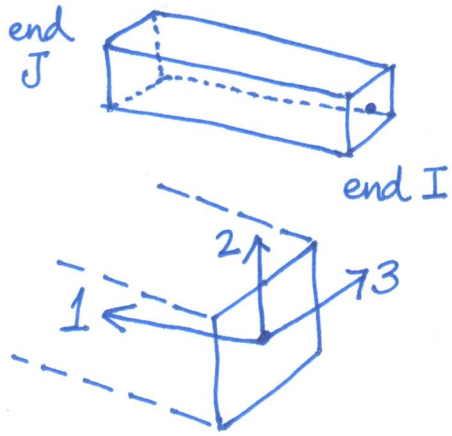
Model 3: Rigid zone Factor = 0, Panel zone (Properties from Column)
Flexibility duplicated at joint locations.
Deflections : Unrealistically large
Moments : Unconservative

Model 4: Rigid zone factor = 1, Panel zone from column

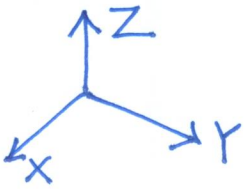
→ Rigid offsets only affect M3 and not axial and torsional properties.

ETABS: End Releases/Partial Fixity

Release: Removing the capacity of a frame to resist any of P, V2, V3, M2, M3 and T.



Global coordinates



1 → Always from I to J

2 and 3 → decide based on relationship between 1 and Z.

Default:

a) Plane 1-2 is vertical (parallel to Z)

b) 2 is in +Z direction unless the element is vertical (e.g column) → 2 will be in +X direction

c) 3 is horizontal (lies in X-Y plane)

So

U1 → P

U2 → V2

U3 → V3

R1 → T

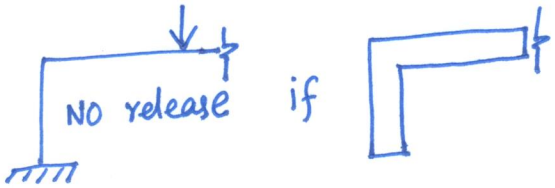
R2 → M2

R3 → M3

DoF → Action

Any or all of the six actions can be released.

→ M3 release in a beam will act like an internal hinge. It will not transfer moments to connecting element.



Apart from geometry,

→ In RC beams, reinforcement also determines whether the end condition should be released, partially released.

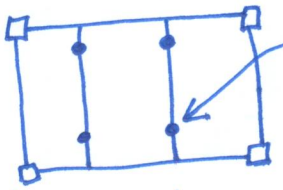
Cases where we can use M3 release:

a) Intentionally not transferring the end moment.
e.g to reduce reinforcement → model like no resistance to moment.

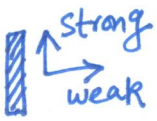
b) Not enough development length available to rebars to behave like a rigid connection.

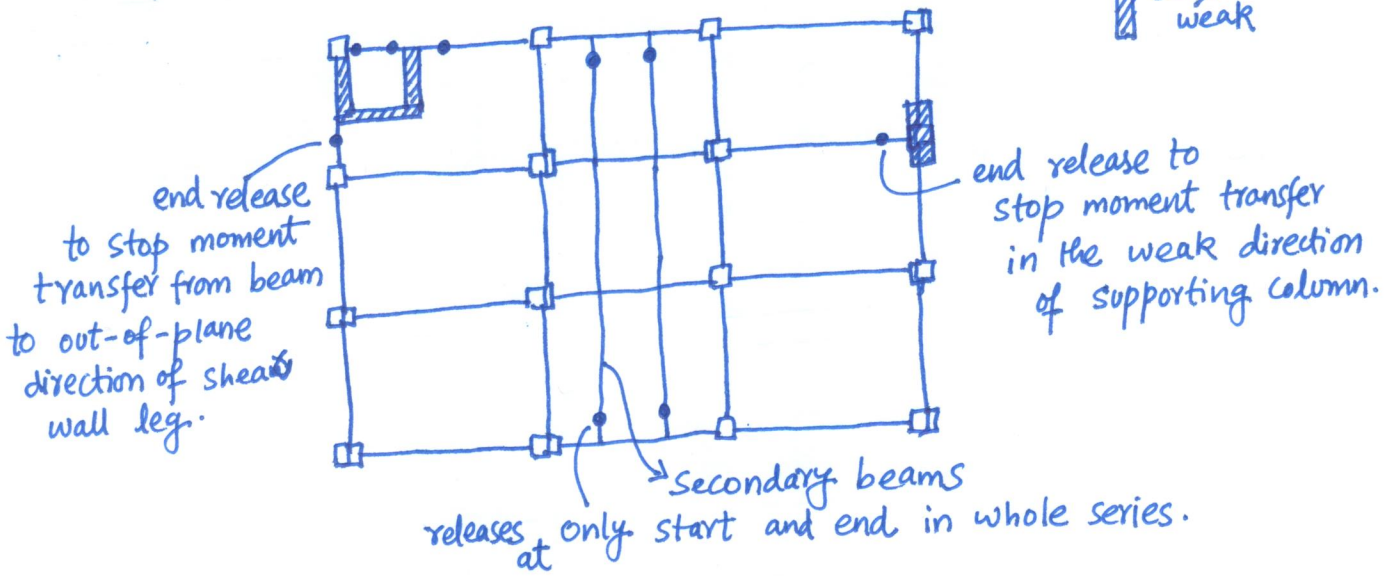
c) Column is so thin and unable to carry moments coming from beam.

d) On secondary beams supported on main beams (girders). This will avoid the introduction of torsion → Just simply supported.



But if series of secondary beams, then one release at start and one at end is enough.

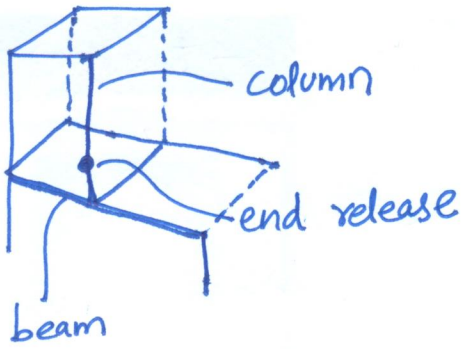




(nodes of)

e) On beams connecting to walls and columns on their weak axis. (i.e perpendicular to longer dimension of leg or cross-section)

f) Columns supported on beams (to avoid torsion in supporting beams)



⇨ Select Frame → Assign → Frame → Releases/Partial Fixity

Releases: completly remove the capacity of a node to resist a particular action.

Partial Fixity: Provide your own stiffness coefficient corresponding to any dof.

⇒ Wrongly applied releases → Structural Stability