Buckling test of slender column

THEORY

- A long slender bar subjected to axial compression is called a column.
- The term column is frequently used to describe a vertical member
- The vertical members of a building frame or any structural system which carry mainly compressive loads are called as columns.
- A compression member is generally considered to be column when its unsupported length is more than 10 times its least lateral dimension.

Euler formula

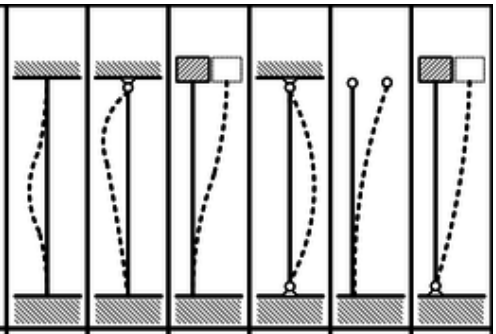
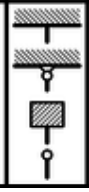
- This formula was derived in 1757, by the Swiss mathematician Leonhard Euler.
- The critical load/Euler Load is the maximum load which a column can bear while staying straight.
- The "critical load" is the greatest load that will not cause lateral deflection (buckling). For loads greater than the critical load, the column will deflect laterally.

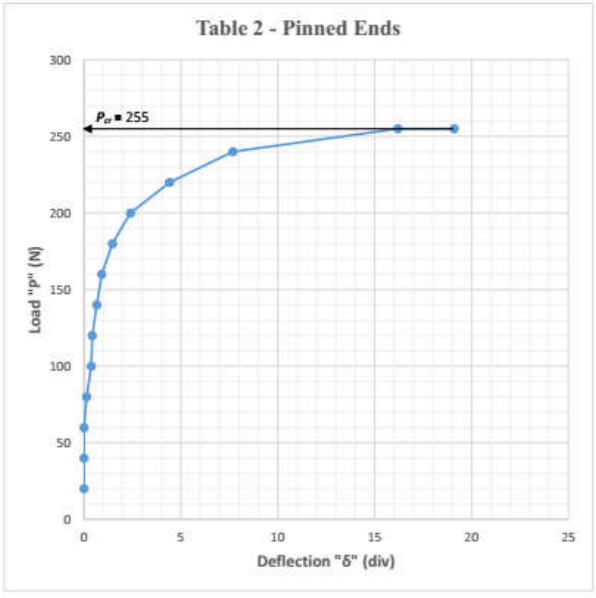
$$P_{cr} = \frac{\pi^2 EI}{(KL)^2}$$

where

P_{cr} = Euler's critical load (longitudinal compression load on column),
E = modulus of elasticity of column material,
I = minimum area moment of inertia of the cross section of the column,
L = unsupported length of column,
K = column effective length factor

K Value

Buckled shape of column shown by dashed line						
Theoretical K value	0.5	0.7	1.0	1.0	2.0	2.0
Recommended design value K	0.65	0.80	1.2	1.0	2.10	2.0
End condition key		Rotation fixed and translation fixed Rotation free and translation fixed Rotation fixed and translation free Rotation free and translation free				



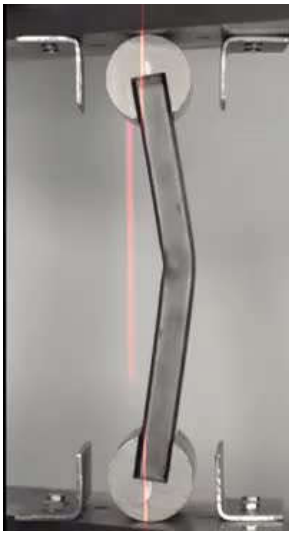
Objective

- To determine Euler load /critical load/buckling load of slender columns experimentally .
- To determine Euler load /critical load/buckling load of slender columns theoretically from Euler formula for slender columns.
- To compare the experimental critical loads and theoretical critical loads.

Procedure

- Measure Dia, length etc.
- Look for support condition and Apply load
- Read max. load (N)
- Calculate theoritical load and compare with experimental value.

Examples



Assignment (individual)

1. Assumptions of Euler formula
2. Derive the equation of Euler Critical load for pin ended column.
3. Derive the equation of Euler Critical load for fixed ended column.