

Summary Notes for Exam #2

DEFINITION: “An influence line is a graph of a response function of a structure as a function of the position of a downward unit load moving across the structure.”

RECALL: Influence lines are piecewise linear for all statically determinate structures.

TWO METHODS FOR CONSTRUCTING INFLUENCE LINE FUNCTIONS:

- **Equilibrium** - Requires use of appropriate free body diagrams to establish the response function equation(s) as the unit load traverses the structure. This technique produces a quantitative influence line diagram.
- **Müller-Breslau Principle** - Introduce displacement release (internal hinge for moment, roller support for shear, and support removal for reaction) at the desired response function and then sketch the displaced shape of the structure by introducing a unit displacement at the release. This will produce a qualitative influence line diagram. Typically, limit the application of the Muller-Breslau Principle to beam and frame structures.

TRUSS ANALYSIS

Typically, use the equilibrium method for determining the influence line functions of truss members. When making a section cut through the truss, remember to skip over the cut panel. Since the ILD is piecewise linear, this portion of the member force response can be constructed by linearly connecting the calculated linear influence line functions for the truss member.

STRUCTURE LOADS

Concentrated Load (P): Response Function = $P * y$; y = ordinate of ILD
Maximum Response = $P * y_{max}$

Uniform Load (w_l): Response Function = $w_l * \text{Loaded Area of ILD}$
Maximum Positive Response = $w_l * \text{Positive Area of ILD}$
Maximum Negative Response = $w_l * \text{Negative Area of ILD}$

RECALL: Uniform dead load is applied to the entire span of the structure.

Wheel Load Series: Response Function = $\sum P_i * y_i$

Maximum Response: Place series of loads such that largest loads are over the peak ILD ordinates. You must consider more than one load position to justify maximum response position. Typically, if the response function decreases in absolute magnitude, then the previous position of the wheel load series is a good candidate for the Maximum Position.

Remember: Wheel loads can move in both directions along the structure.

Problems on Exam 2 will be similar to the homework problems. There will be three problems: truss, beam or frame, and load calculation problem. Each problem will ask multiple questions.