1.1 INFLUENCE LINES FOR REACTIONS IN STATICALLY DETERMINATE BEAMS

Influence lines

An influence line is a graph showing, for any given frame or truss, the variation of any force or displacement quantity (such as shear force, bending moment, tension, deflection) for all positions of a moving unit load as it crosses the structure from one end to the other.

Uses of influence line diagrams

(i) Influence lines are very useful in the quick determination of reactions, shear force, bending moment or similar functions at a given section under any given system of moving loads and

(ii) Influence lines are useful in determining the load position to cause maximum value of a given function in a structure on which load positions can vary.

Influence line diagram

Influence line diagram represents variation of bending moment at one particular section at a unit load moves along the length of the member.

Influence line diagram are drawn for shear force, reaction and for bending moment..

If span longer than UDL for the maximum and negative shear force, the load should cover only either positive or negative portion of the influence line diagram.

Example:

A single rolling load of 100KN moves on a girder of span 20m. a) Construct the influence line for shear force and bending moment for a section 5m from the left support. b) construct the influence line for point at which absolute maximum shear and absolute maximum bending moment develop. Determine absolute maximum value.

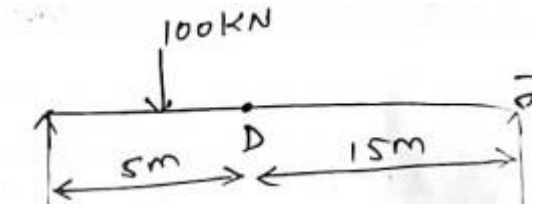

Fig. 1.1.1

Solution :

a) To find max shear force and bending moment at 5m from left support.

Influence line diagram for shear force

IL ordinate to the right of D

=l-x/l

=20-5/20

=0.75

IL ordinate to the left of D

=x/l

=5/20

=0.25

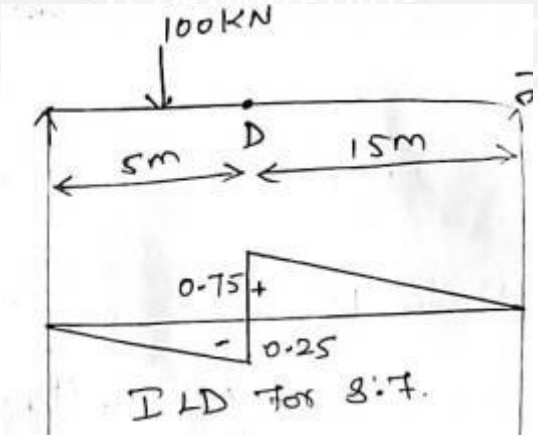

Fig. 1.1.2 Influence Line Diagram For Shear Force

lL for BM

IL ordinate at D

x(l-x)/l =5(20-5) / 20

= 3.75 m

Max positive shear force

= load × ordinate

=100×0.75

=75KN(+)

Max negative shear force

=load ×Ordinate

=100×0.25

=25KN(-)

Max bending moment

=load × ordinate

= 100×3.75

=375 KNm

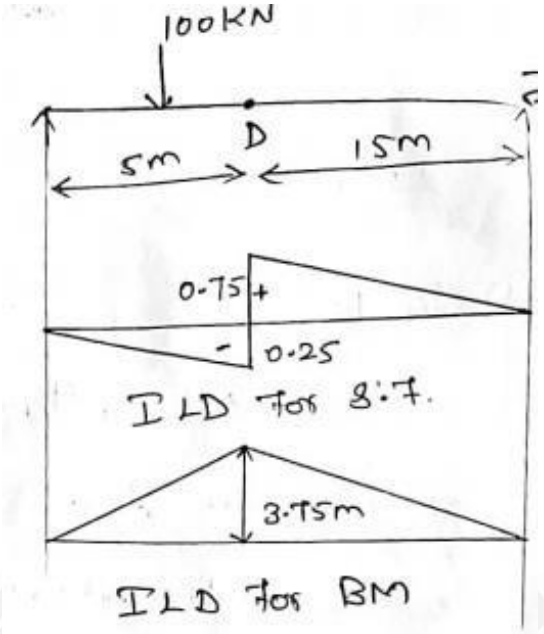

Fig. 1.1.3 Influence Line Diagram For Bending Moment

b) Absolute max shear force and bending moment

For shear force

IL ordinate at A

=20/20

=1

IL ordinate of B

=20/20

=1

IL ordinate at BM at mid span

=l/4

=20/4

=5

positive shear force = load × ordinate

=100×1

=100KN(+)

positive shear force = load × ordinate

=100×1

=100KN(-)

Absolute max bending moment

=load ×Ordinate

=100×5

=500 KNm

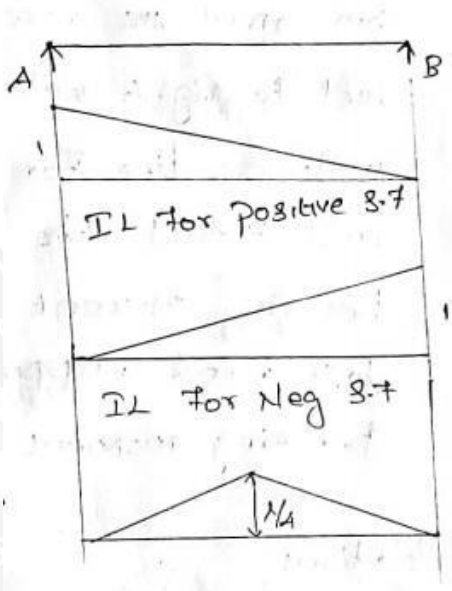

Fig. 1.1.4 Absolute Max Shear Force And Bending Moment