Qualitative Influence Lines

- In 1886, Heinrich Müller-Breslau develop a method for rapidly constructing the shape of an influence line.
- Heinrich Franz Bernhard Müller was born in Wroclaw (Breslau) on 13 May 1851.
- In 1875 he opened a civil engineer's office in Berlin. Around this time he decided to add the name of his hometown to his surname, becoming known as Müller-Breslau.

Qualitative Influence Lines

- In 1886, Heinrich Müller-Breslau develop a method for rapidly constructing the shape of an influence line.
- In 1883 Müller-Breslau became a lecturer and in 1885 a professor in civil engineering at the Technische Hochschule in Hanover.

Qualitative Influence Lines

The Muller-Breslau principle states:

> The ***influence line*** for a function (reaction, shear, moment) is to the same scale as the deflected shape of the beam when the beam is acted on by the function.
>
> To draw the deflected shape properly, the ability of the beam to resist the applied function must be removed.

Qualitative Influence Lines

For example, consider the following simply supported beam.

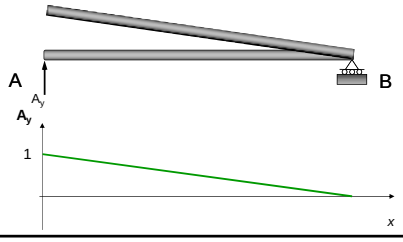
Let's try to find the shape of the influence line for the vertical reaction at A.

Qualitative Influence Lines

Remove the ability to resist movement in the vertical direction at A by using a guided roller

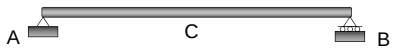
Qualitative Influence Lines

Remove the ability to resist movement in the vertical direction at A by using a guided roller



Qualitative Influence Lines

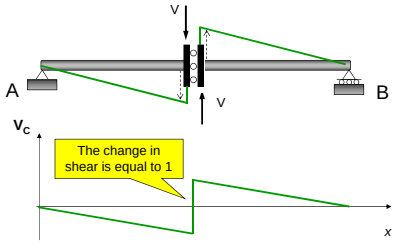
Consider the following simply supported beam.



Let's try to find the shape of the influence line for the shear at the mid-point (point C).

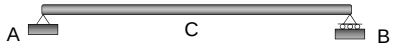
Qualitative Influence Lines

Remove the ability to resist shear at point C



Qualitative Influence Lines

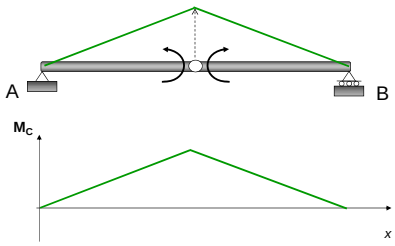
Consider the following simply supported beam.



Let's try to find the shape of the influence line for the moment at the mid-point (point C).

Qualitative Influence Lines

Remove the ability to resist moment at C by using a hinge

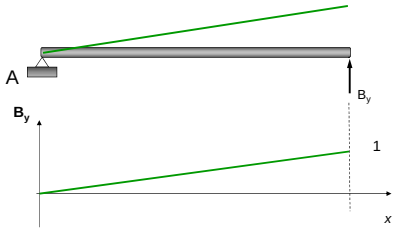


Qualitative Influence Lines

Sketch the shape of the influence line for the reaction at point B

Qualitative Influence Lines

Sketch the shape of the influence line for the reaction at point B

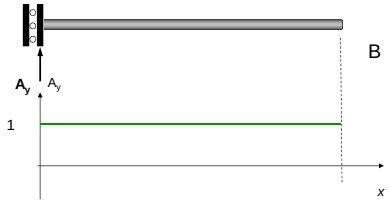


Qualitative Influence Lines

Sketch the shape of the influence line for the reaction at point A

Qualitative Influence Lines

Sketch the shape of the influence line for the reaction at point A



Qualitative Influence Lines

Sketch the shape of the influence line for the reaction at point B

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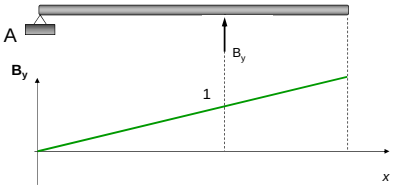
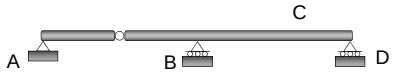
Sketch the shape of the influence line for the reaction at point B



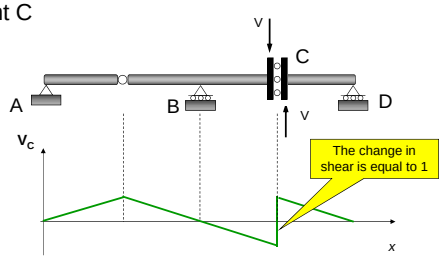
Qualitative Influence Lines

Sketch the shape of the influence line for the shear at point C



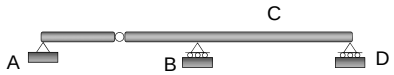
Qualitative Influence Lines

Sketch the shape of the influence line for the shear at point C



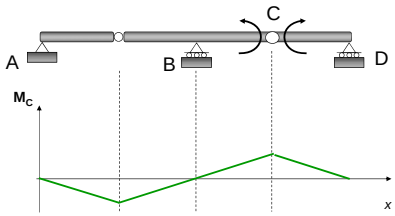
Qualitative Influence Lines

Sketch the shape of the influence line for the moment at point C



Qualitative Influence Lines

Sketch the shape of the influence line for the moment at point C



Qualitative Influence Lines

Sketch the shape of the influence line for the moment at point B

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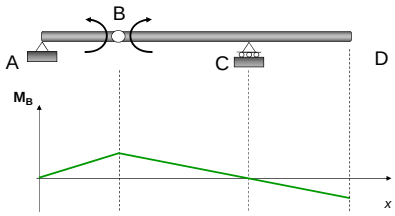
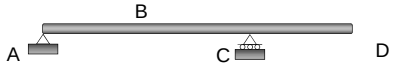
Sketch the shape of the influence line for the moment at point B



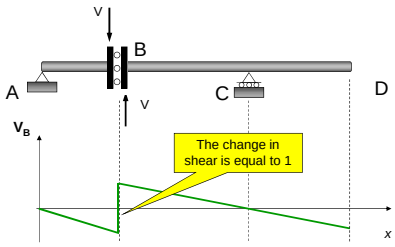
Qualitative Influence Lines

Sketch the shape of the influence line for the shear at point B



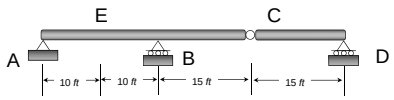
Qualitative Influence Lines

Sketch the shape of the influence line for the shear at point B



Qualitative Influence Lines

Draw the influence lines for the vertical reaction at D and the shear at E.



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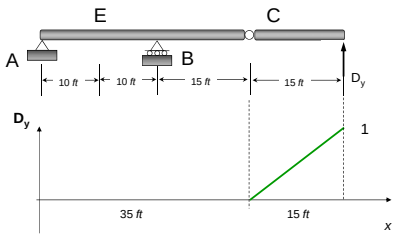

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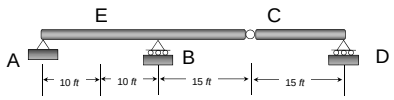
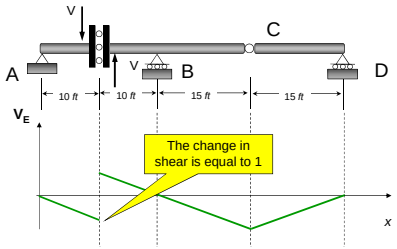


Qualitative Influence Lines

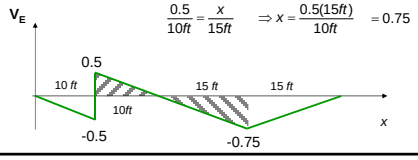
Draw the influence lines for the vertical reaction at D and the shear at E.



Qualitative Influence Lines

Draw the influence lines for the vertical reaction at D and the shear at E.

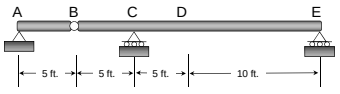
- The change in shear at point E is equal to 1
- The influence lines can be determined by similar triangles.



$$\frac{0.5}{10ft} = \frac{x}{15ft} \Rightarrow x = \frac{0.5(15ft)}{10ft} = 0.75$$

Qualitative Influence Lines

Determine the maximum positive moment that can be developed at point D in the beam shown below due to a concentrated live load of 4 *k*, a uniform live load of 300 lb/ft, and a dead load of 200 lb/ft.



End of Influence Lines – Part 2

Any questions?