

lecture
 thirteen

shear and bending
 moment diagrams



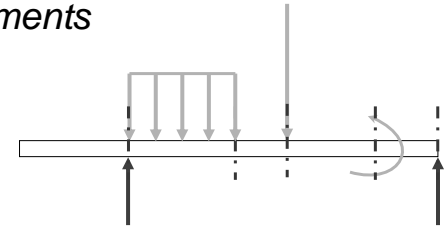
Method 2: Semigraphical

- by knowing
 - area under loading curve = change in V
 - area under shear curve = change in M
 - concentrated forces cause “jump” in V
 - concentrated moments cause “jump” in M

$$V_D - V_C = - \int_{x_C}^{x_D} w dx \quad M_D - M_C = \int_{x_C}^{x_D} V dx$$

Method 1: Equilibrium

- important places
 - supports
 - concentrated loads
 - start and end of distributed loads
 - concentrated moments
- free ends
 - zero forces



Method 2

- relationships

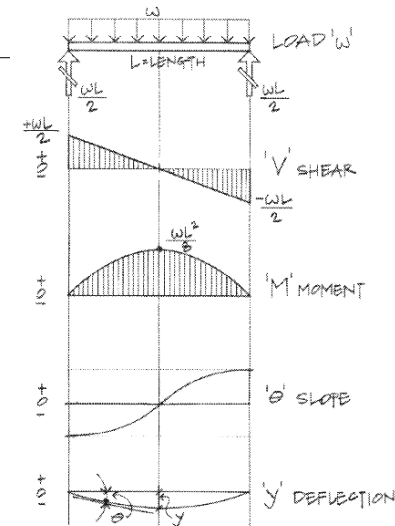
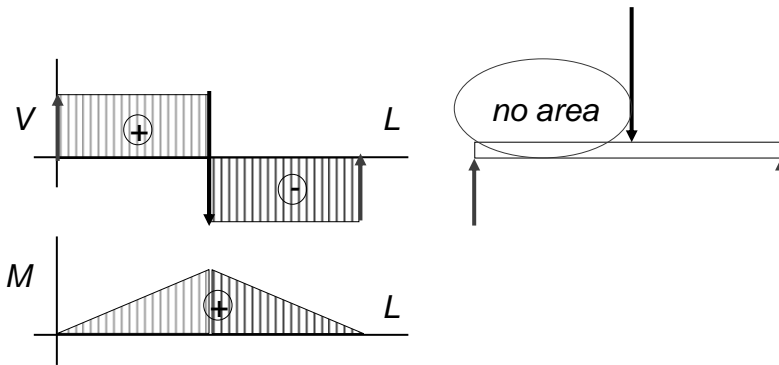


Figure 7.11 Relationship of load, shear, moment, slope, and deflection diagrams.

Method 2: Semigraphical

- M_{max} occurs where $V = 0$ (calculus)



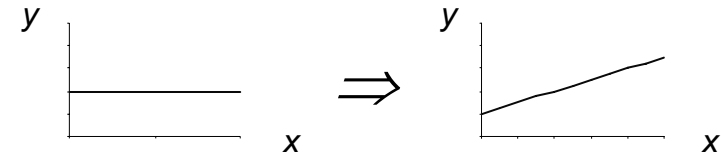
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Curve Relationships

- integration of functions
- line with 0 slope, integrates to sloped



- ex: load to shear, shear to moment

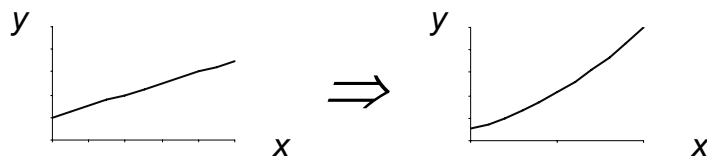
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Curve Relationships

- line with slope, integrates to parabola



- ex: load to shear, shear to moment

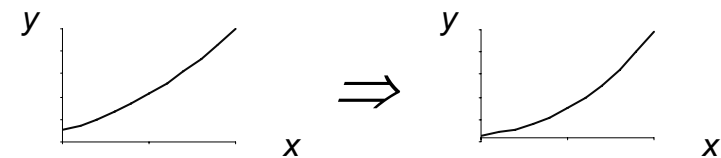
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Curve Relationships

- parabola, integrates to 3rd order curve



- ex: load to shear, shear to moment

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Basic Procedure

1. Find reaction forces & moments
Plot axes, underneath beam load diagram

V:

2. Starting at left
3. Shear is 0 at free ends
4. Shear jumps with concentrated load
5. Shear changes with area under load

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Basic Procedure

M:

6. Starting at left
7. Moment is 0 at free ends
8. Moment jumps with moment
9. Moment changes with area under V

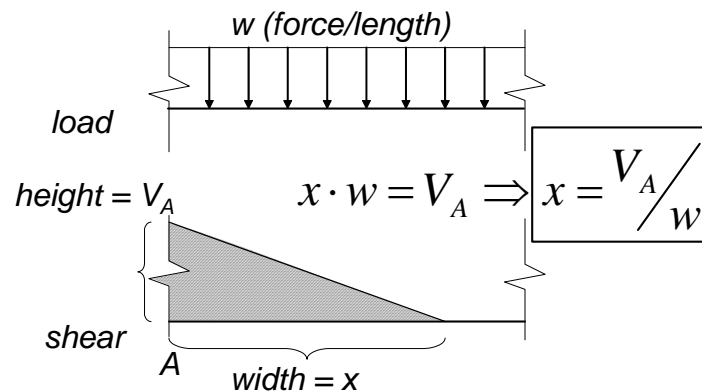
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Triangle Geometry

- slope of V is w ($-w:1$)



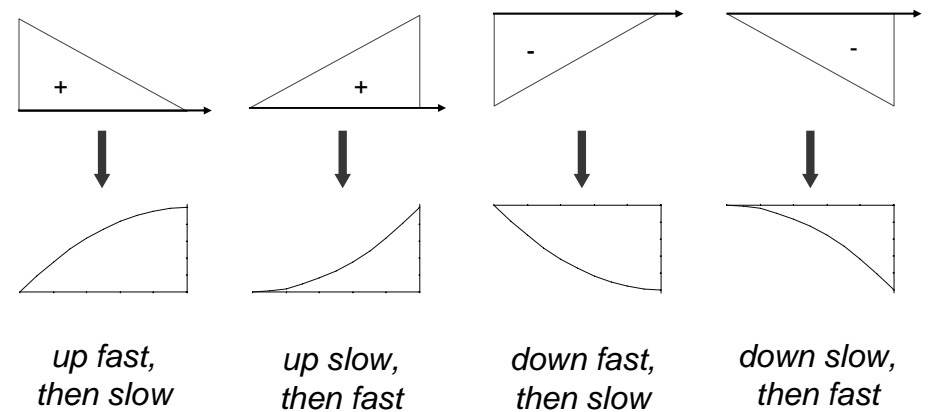
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Parabolic Shapes

- cases



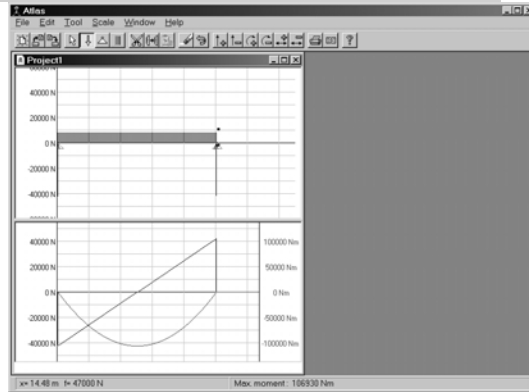
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Tools

- software & spreadsheets help
- <http://www.rekenwonder.com/atlas.htm>



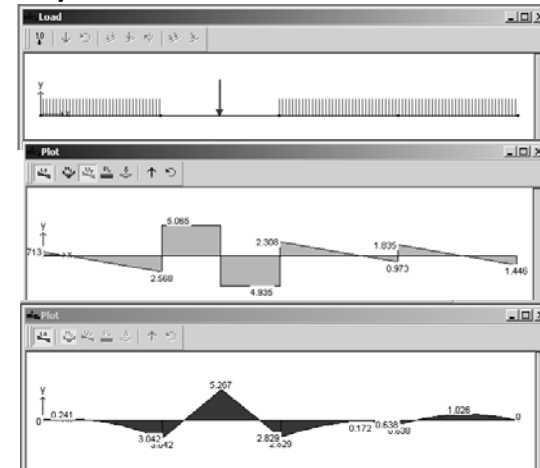
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Tools – Multiframe 2D

- in computer lab



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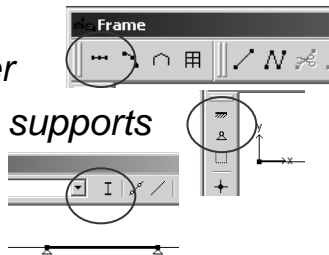
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Tools – Multiframe 2D

- frame window

- define beam member
- select points, assign supports
- select members, assign section



- load window

- select point or member, add point or distributed loads



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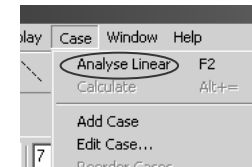
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Tools – Multiframe 2D

- to run analysis choose

- case menu
 - Analyse Linear



- plot

- choose options



- results

- choose options

Joint	Label	Rx' kip	Ry' kip	Mz' kip-ft
1		0.000	-0.000	0.000
2		0.000	9.250	0.000
3		0.000	6.102	0.000
4		0.000	3.093	0.000
5		0.000	1.398	-0.000
6	Total (Global)	Rx=0.000	Ry=19.843	

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