2nd ARCH-RC

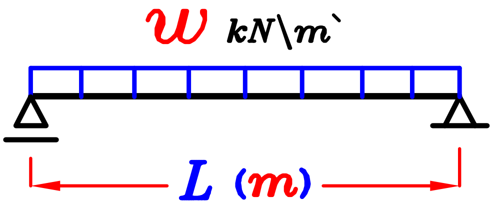
RC COURSE OUTLINES

1. **STRUTURE REVISION.**
2. **DESIGN OF BEAMS FOR FLEXURE.**
3. **DESIGN OF BEAMS FOR SHEAR.**
4. **REINFORCEMENT DETAILS.**
5. **DESIGN OF SHORT COLUMNS.**

Revision on Drawing Bending Moment Diagram B.M.D.

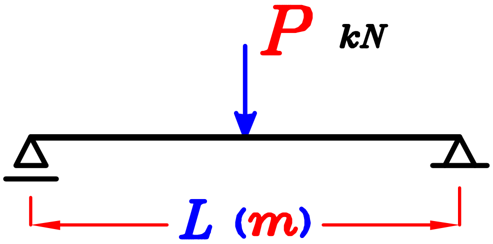
Determinate الـ للكمرات B.M.D. سنحتاج فى البدايه أن نتذكر رسم الـ

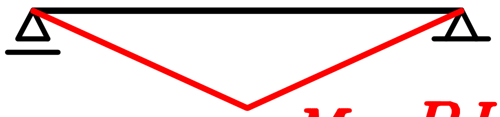
① Simple Beam subjected to distributed Load.



$$M = \frac{wL^2}{8}$$

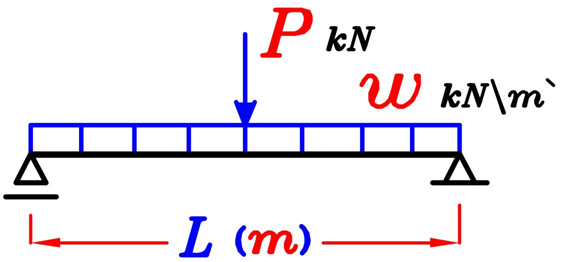
② Simple Beam subjected to concentrated Load at the mid. span.

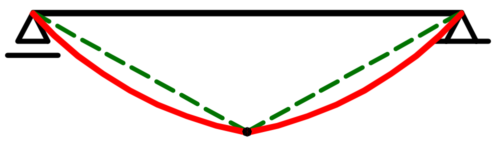




$$M = \frac{PL}{4}$$

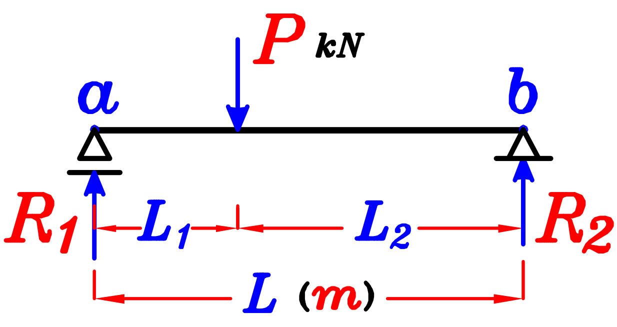
③ Simple Beam subjected to distributed Load + concentrated Load at the mid. span.

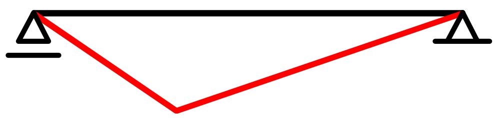




$$M = \frac{wL^2}{8} + \frac{PL}{4}$$

④ Simple Beam subjected to concentrated Load not at the mid. span.

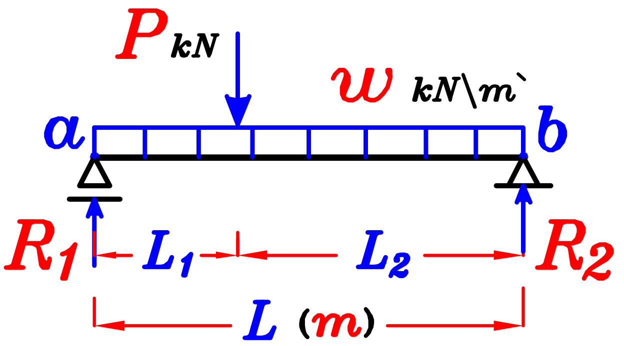


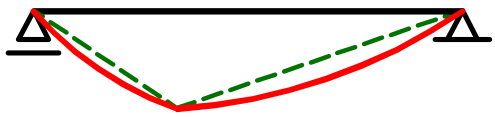


$$M = R_1 * L_1 = R_2 * L_2$$

$$\sum M_b = Zero \xrightarrow{Get} R_1 \qquad \sum Y_a = Zero \xrightarrow{Get} R_2$$

⑤ Simple Beam subjected to distributed Load + concentrated Load not at the mid. span.



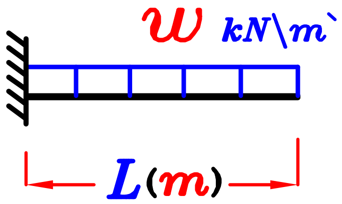


$$M = R_1 * L_1 - \frac{w * L_1^2}{2}$$

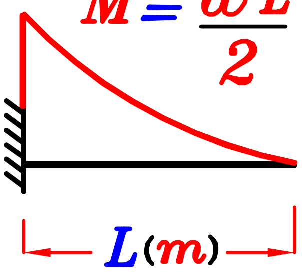
$$M = R_2 * L_2 - \frac{w * L_2^2}{2}$$

$$\sum M_b = Zero \xrightarrow{Get} R_1 \qquad \sum Y_a = Zero \xrightarrow{Get} R_2$$

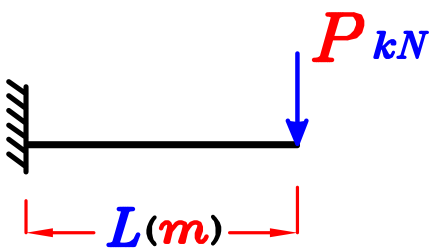
⑥ Cantilever subjected to distributed Load.



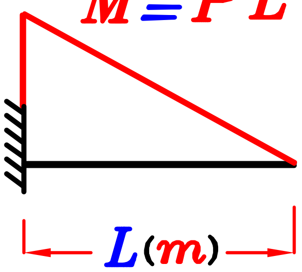
$$M = \frac{w L^2}{2}$$



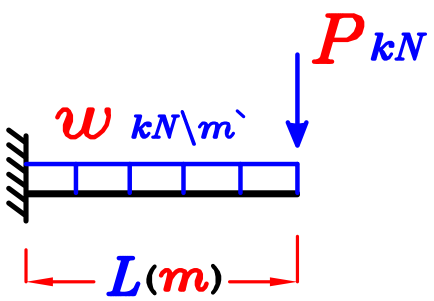
⑦ Cantilever subjected to concentrated Load at the End of the cantilever.



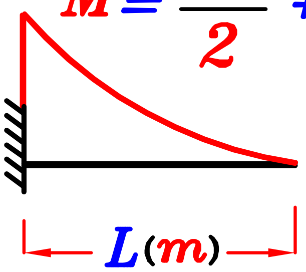
$$M = P L$$



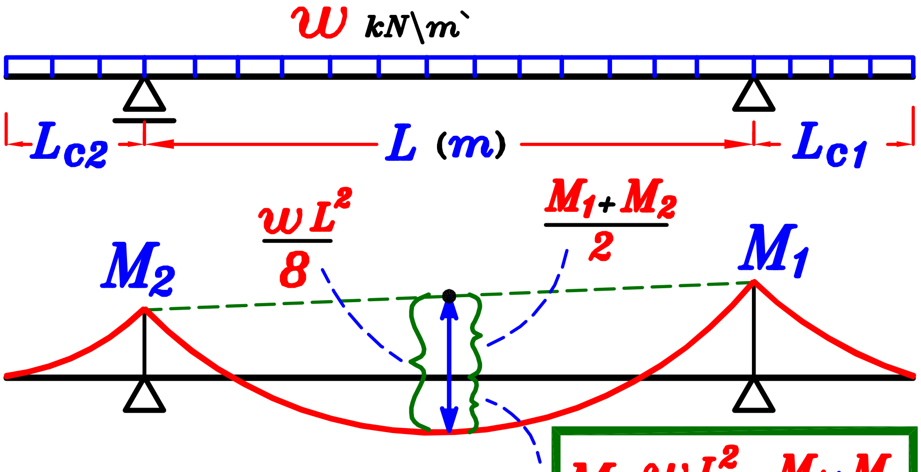
⑧ Cantilever subjected to distributed load + concentrated Load at the End of the cantilever.



$$M = \frac{w L^2}{2} + P L$$

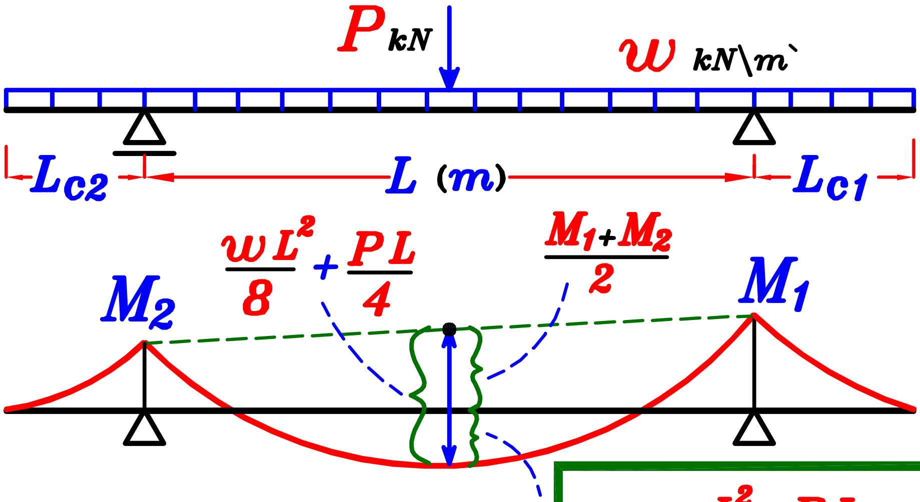


⑨ Beam with two cantilever subjected to distributed Load.



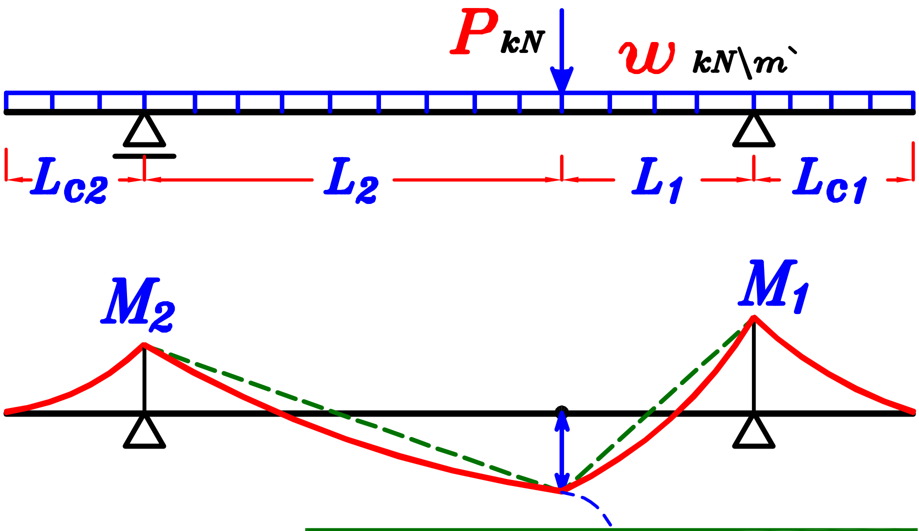
$$M = \frac{wL^2}{8} - \frac{M_1+M_2}{2}$$

⑩ Beam with two cantilever subjected to distributed Load + concentrated load at the mid. span.



$$M = \frac{wL^2}{8} + \frac{PL}{4} - \frac{M_1+M_2}{2}$$

⑪ Beam with two cantilever subjected to distributed Load + concentrated load not at the mid. span.



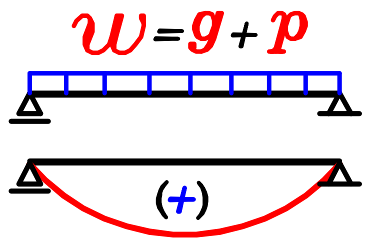
نأخذ العزم حول النقطه من جهه اليمين أو اليسار
مثل طرق الـ structure العادية

Absolute (Max–Max) B.M.D. For Beams.

توجد لكل كمره عده حالات من التحميل لتحديد أكبر عزوم على الكمره .

① Simple Beam.

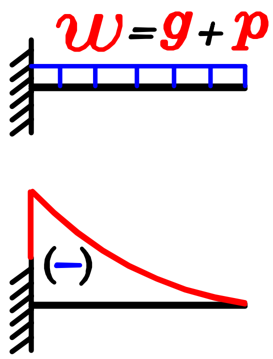
Max. (+ve) B.M.



NO (–ve) B.M.

② Cantilever Beam.

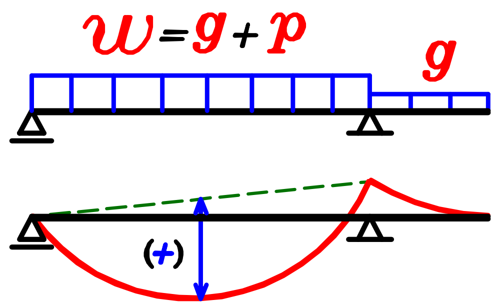
Max. (–ve) B.M.



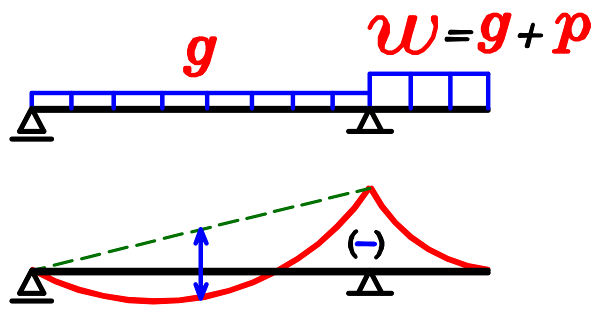
NO (+ve) B.M.

③ Beam with Cantilever.

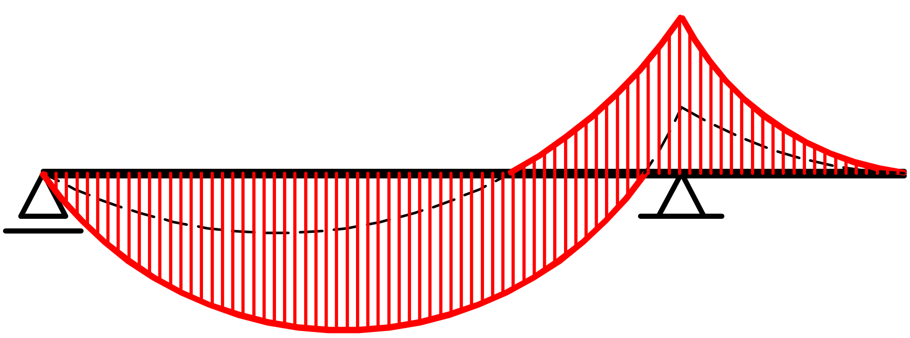
ⓐ Max. (+ve) B.M.



ⓑ Max. (–ve) B.M.

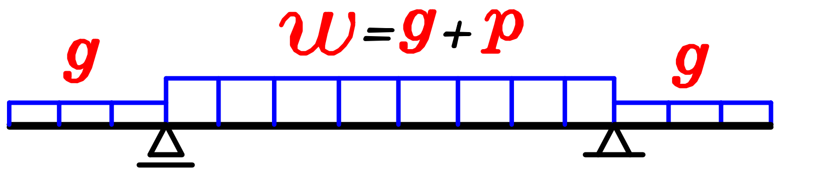


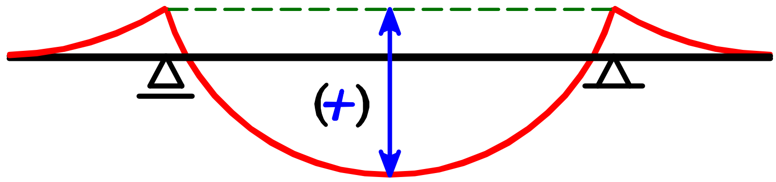
Max–Max B.M.D.



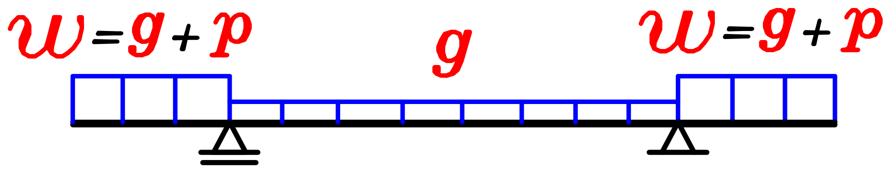
④ Beam with 2 Cantilevers.

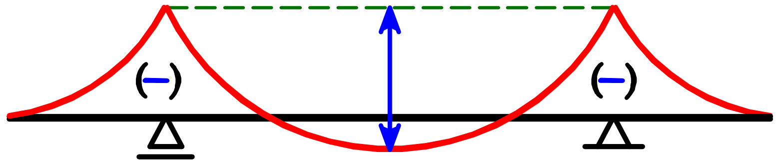
ⓐ Max. (+ve) B.M.



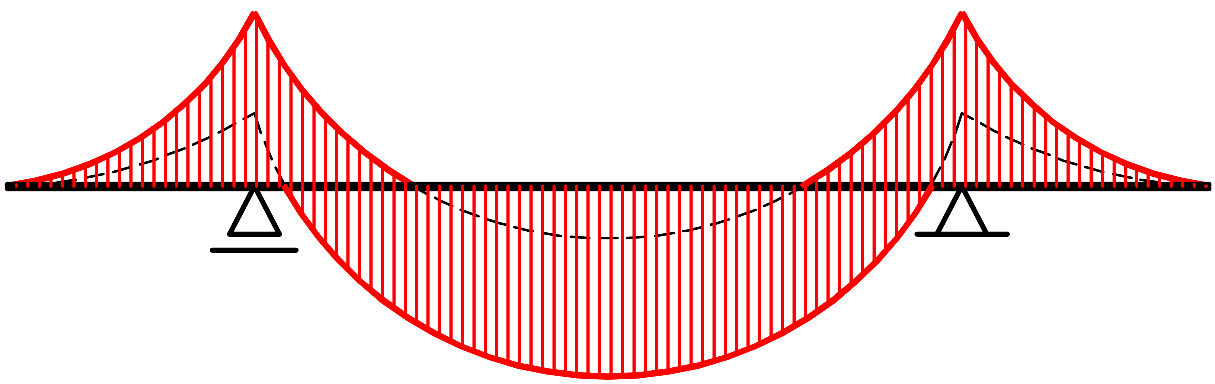


ⓑ Max. (−ve) B.M.





Max−Max B.M.D.



Example.

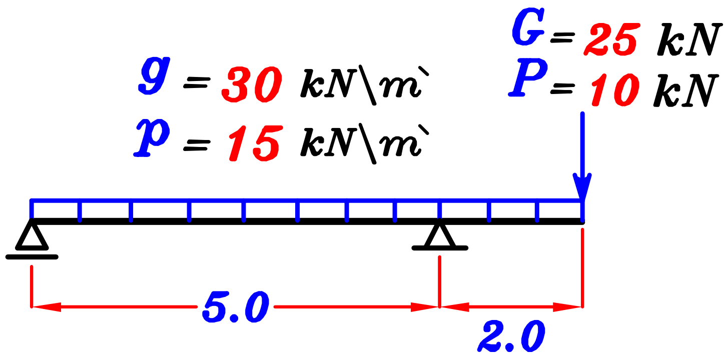
Draw Max–Max B.M.D.

g = D.L. (Distributed Load)

G = D.L. (Concentrated Load)

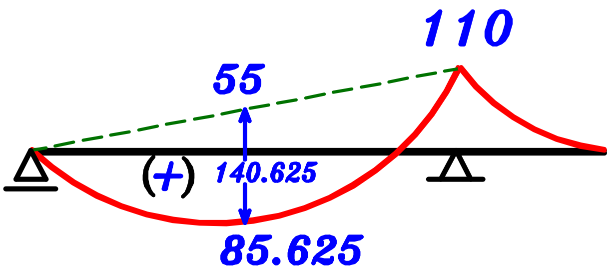
p = L.L. (Distributed Load)

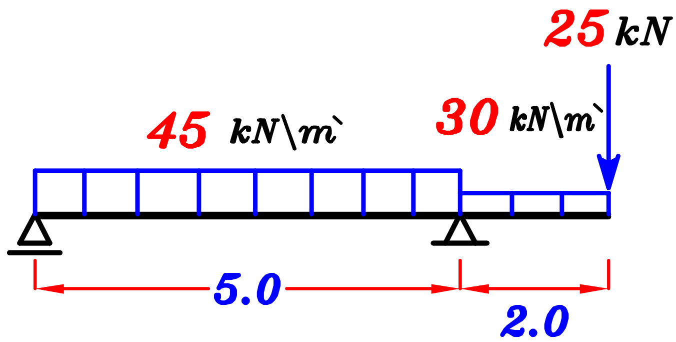
P = L.L. (Concentrated Load)



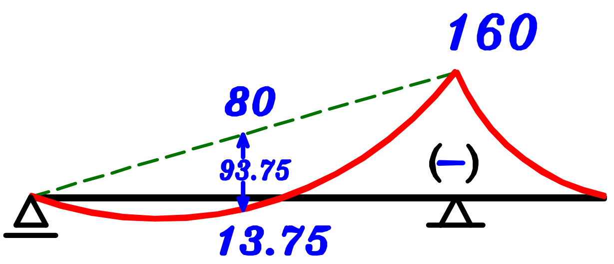
Solution.

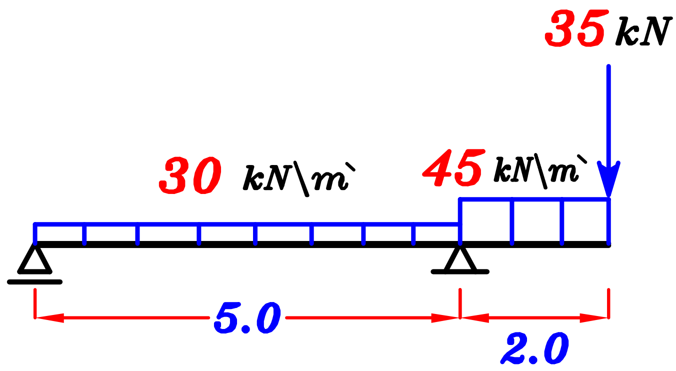
@ Max. (+ve) B.M.



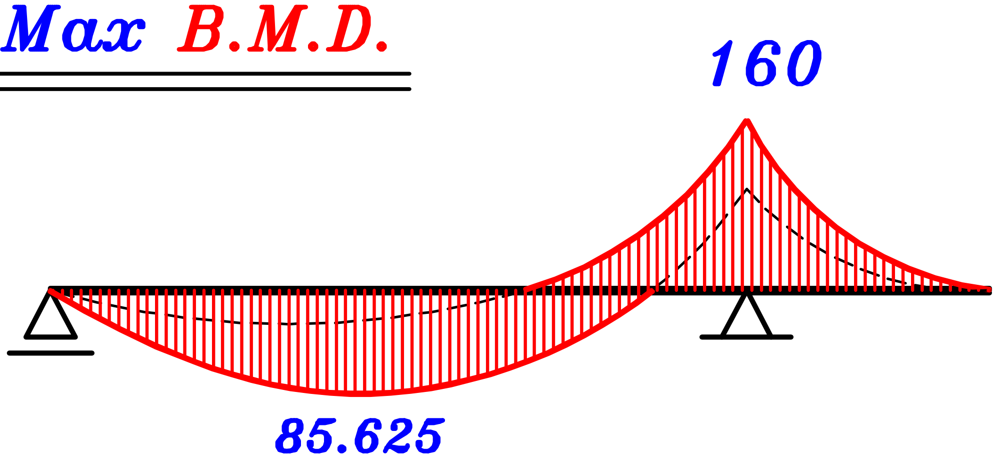


ⓑ Max. (–ve) B.M.

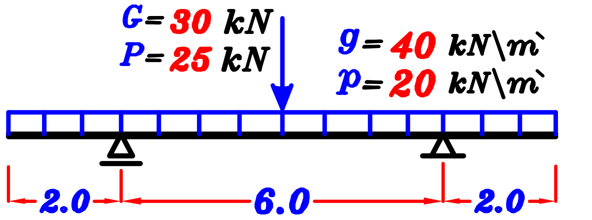




Max–Max B.M.D.

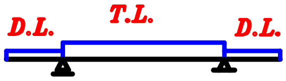


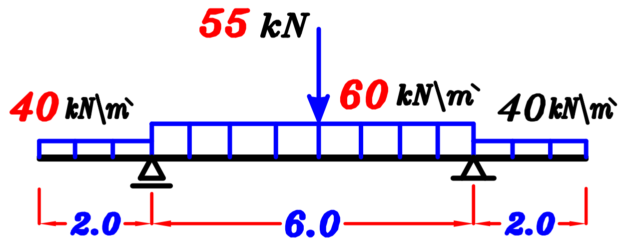
Example.



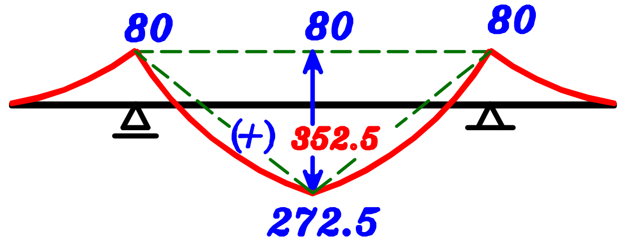
Draw Max–Max B.M.D.

ⓐ Max. (+ve) B.M.

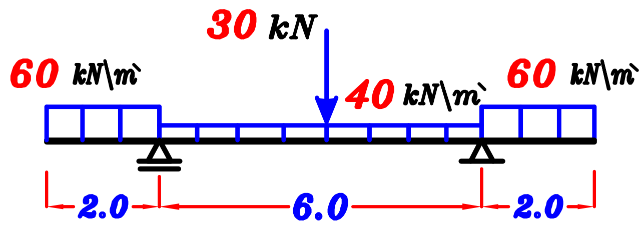




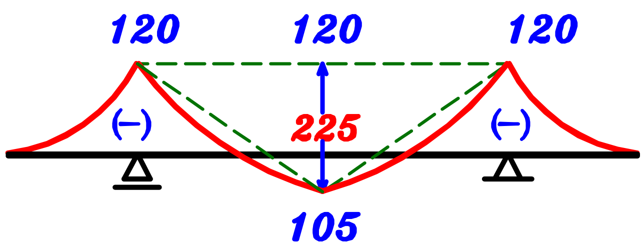
$$\frac{wL^2}{8} + \frac{P\,L}{4} = \frac{60(6)^2}{8} + \frac{55\ (6)}{4} = 270 + 82.5 = 352.5$$



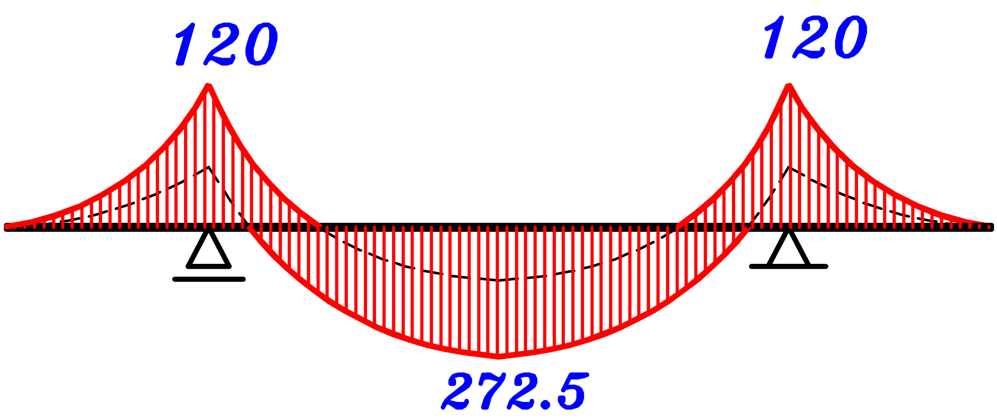
ⓑ Max. (–ve) B.M.



$$\frac{wL^2}{8} + \frac{P\,L}{4} = \frac{40\ (6)^2}{8} + \frac{30\,(6)}{4} = 180 + 45 = 225$$

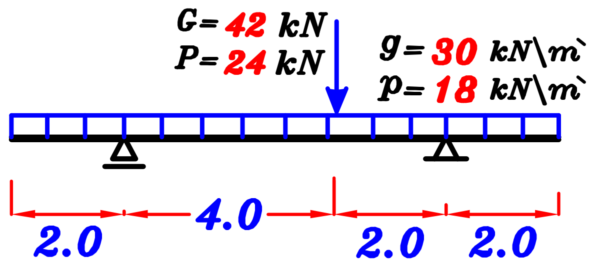


Max–Max B.M.D.

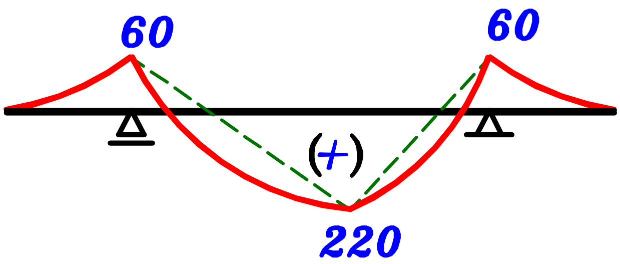


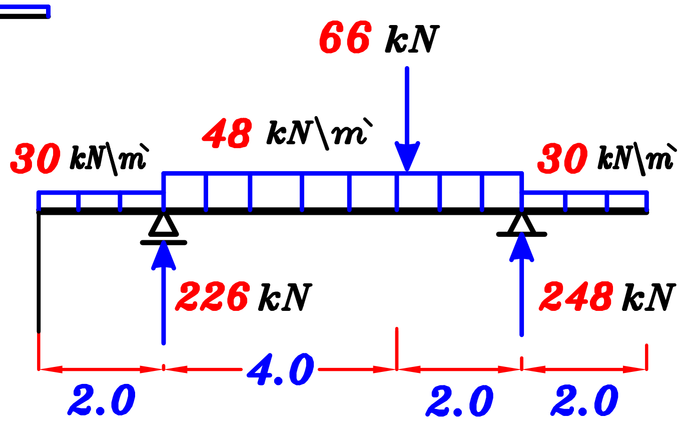
Example.

Draw Max-Max B.M.D.

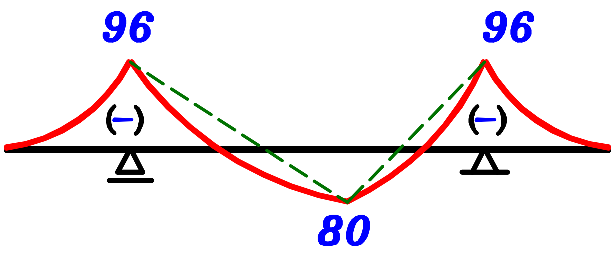


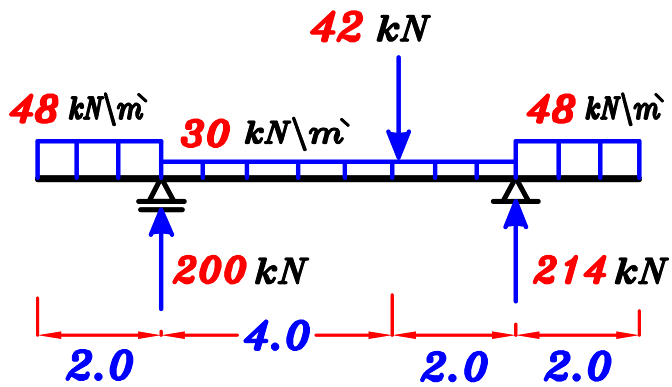
ⓐ Max. (+ve) B.M.



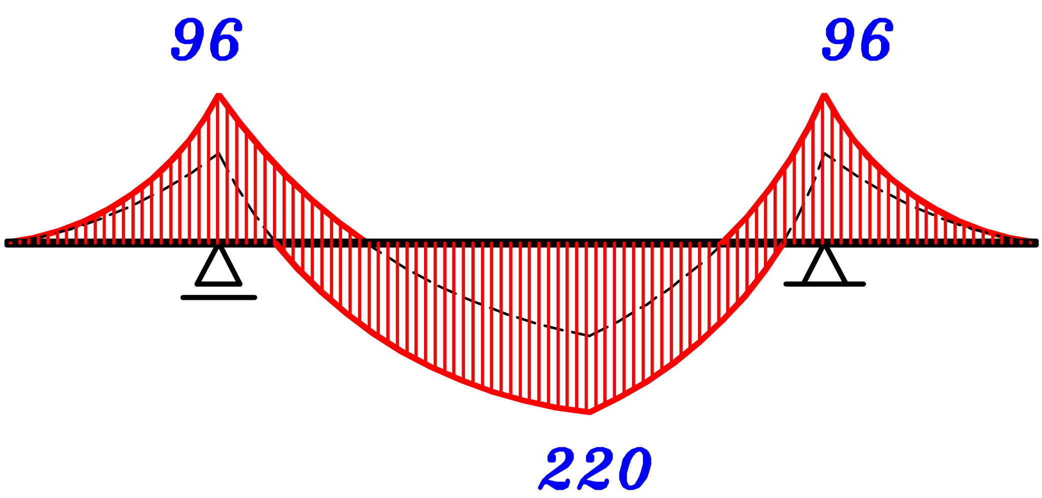


ⓑ Max. (–ve) B.M.





Max-Max B.M.D.



Max-Max S.F.D.

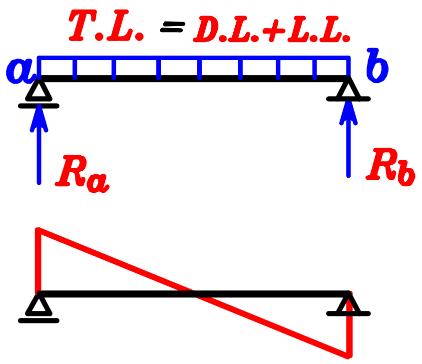
ترتبط الـ *Shear Force* بالـ *Reactions* .

لذلك عند رسم *Max Shear Force* نعمل على أن تكون الـ *Reactions* أكبر قيمه لها .

① Simple Beam.

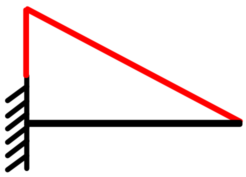
Max. R_a

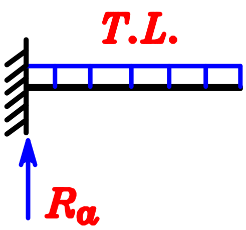
, Max. R_b



② Cantilever Beam.

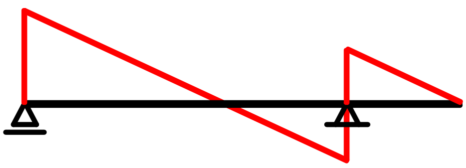
Max. R_a

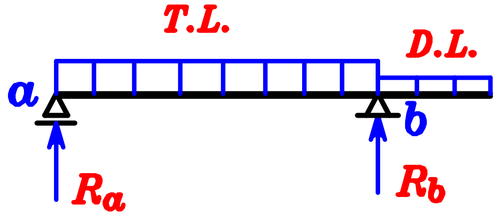




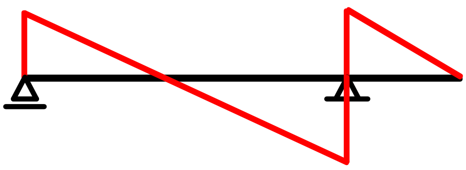
③ Beam with Cantilever.

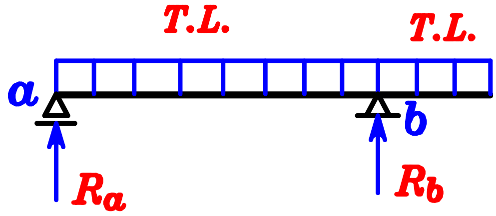
① Max. R_a



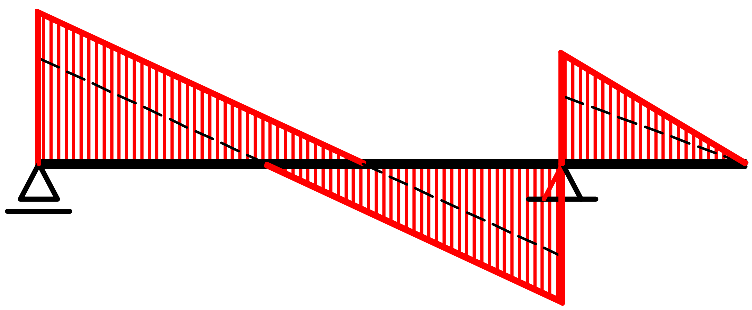


② Max. R_b



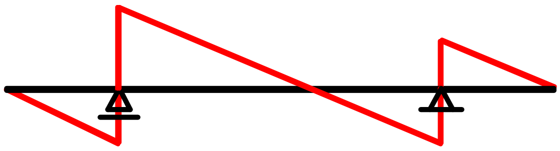


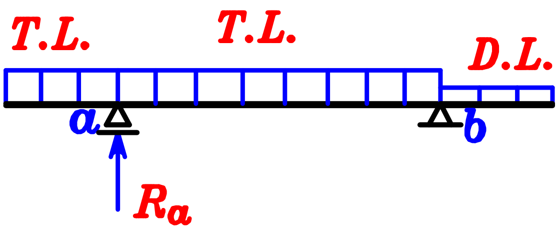
Max–Max S.F.D.



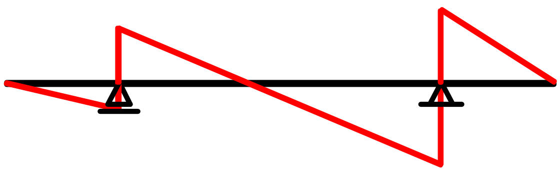
④ Beam with 2 Cantilevers.

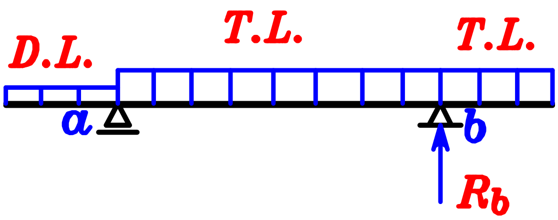
① *Max.* R_a



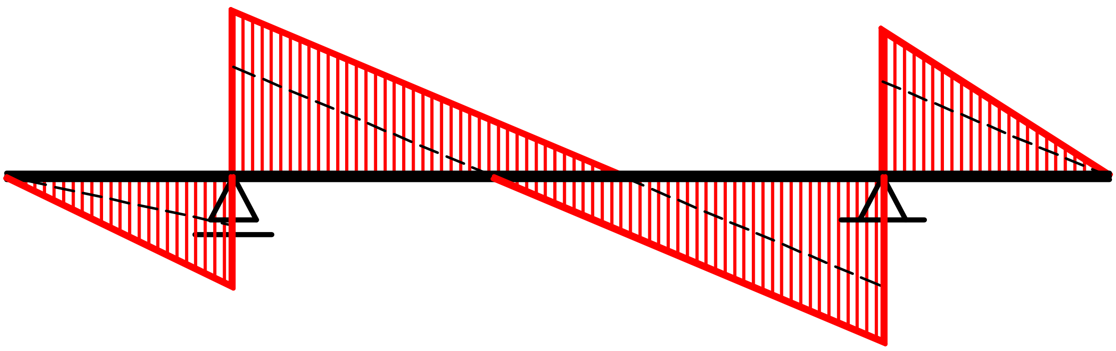


② *Max.* R_b





Max–Max S.F.D.



ملحوظه هامه

ممكن للتسهيل أخذ جميع حالات تحميل الا *Shear*
حاله واحده فقط و هى *T.L.* على كل الكمره .
وستكون النتائج قريبه من الا *max–max Shear*
و بالطبع هذه طريقه تقريبيه .

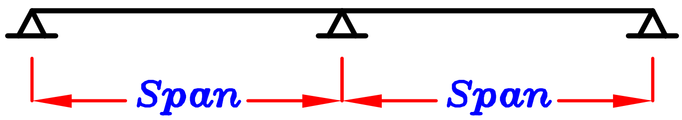
Continuos Beams.

الكمرات المستمره .

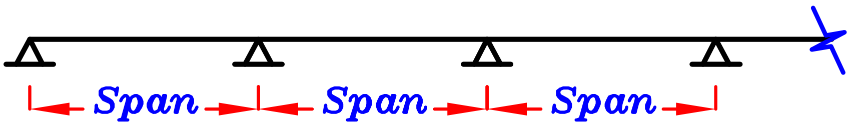
الكمرات المستمره هى كمرات لها أكثر من بحـر *Span*

و لها أكثر من ركيزتين *2 Supports*

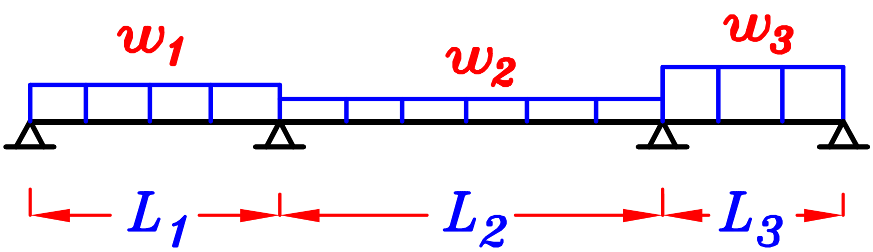
① 2 Spans.



② More than 2 Spans.



و هناك قيم لـ *max–max B.M.D.* و قيم لـ *max–max S.F.D.*



ممكن إستخدامها مباشره بشرطين :

١ ـ أن تكون بحور الكمرات متساويه .

أو أن يكون الفارق بين أكبر بحر و أقل بحر لا يزيد عن ٢٠ %

$$\frac{L_{max} - L_{min}}{L_{min}} \ngtr 20\,\%$$

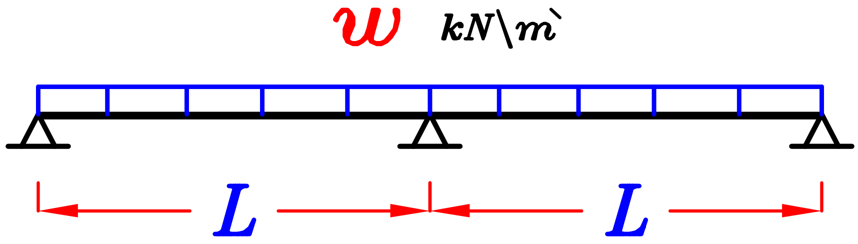
٢ ـ أن تكون الاحمال على البحور متساويه .

أو أن يكون الفارق بين أكبر حمل و أقل حمل لا يزيد عن ٢٠ %

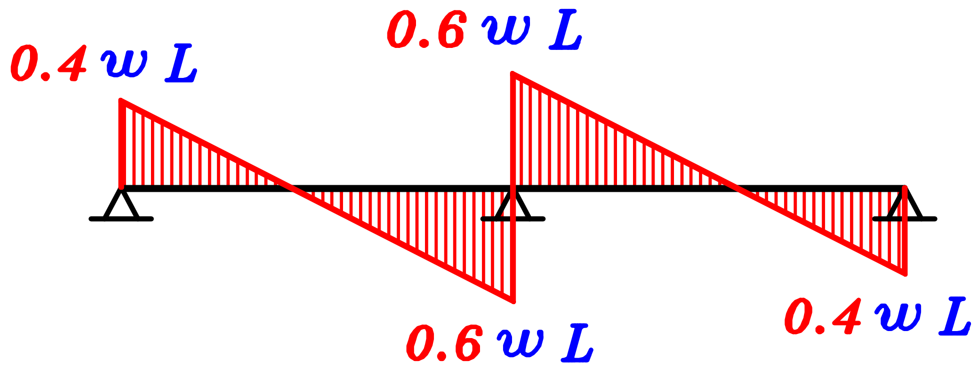
$$\frac{w_{max} - w_{min}}{w_{min}} \ngtr 20\,\%$$

① Continuos Beam with 2 spans.

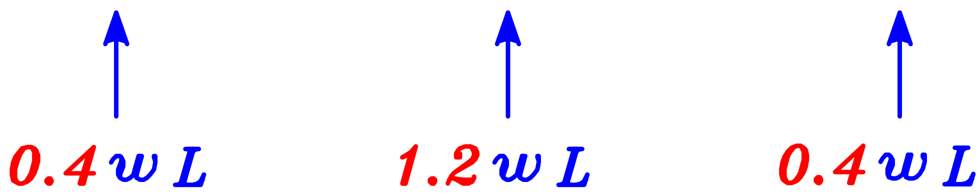
Load For Shear



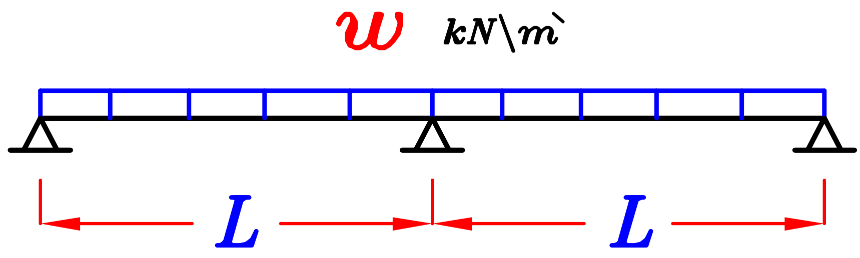
S.F.D.



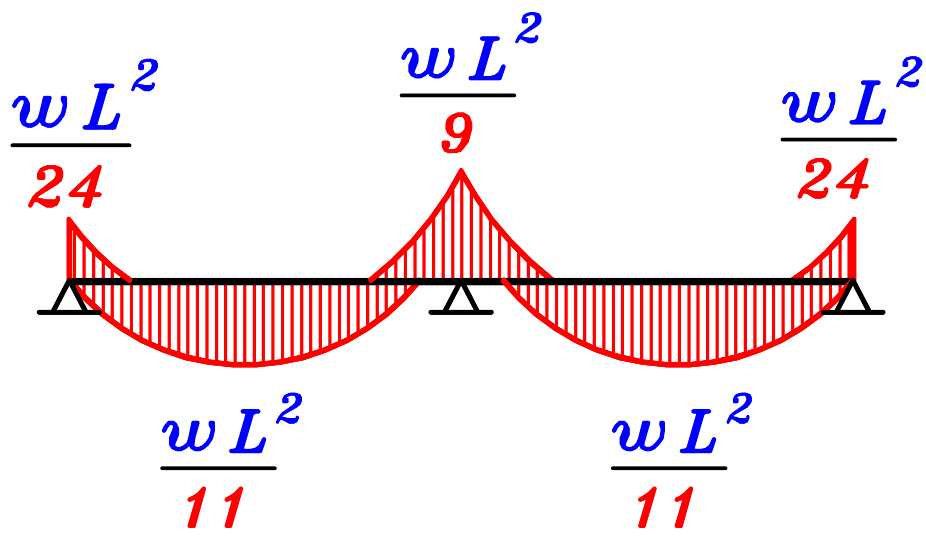
Reactions.



Load For Moment

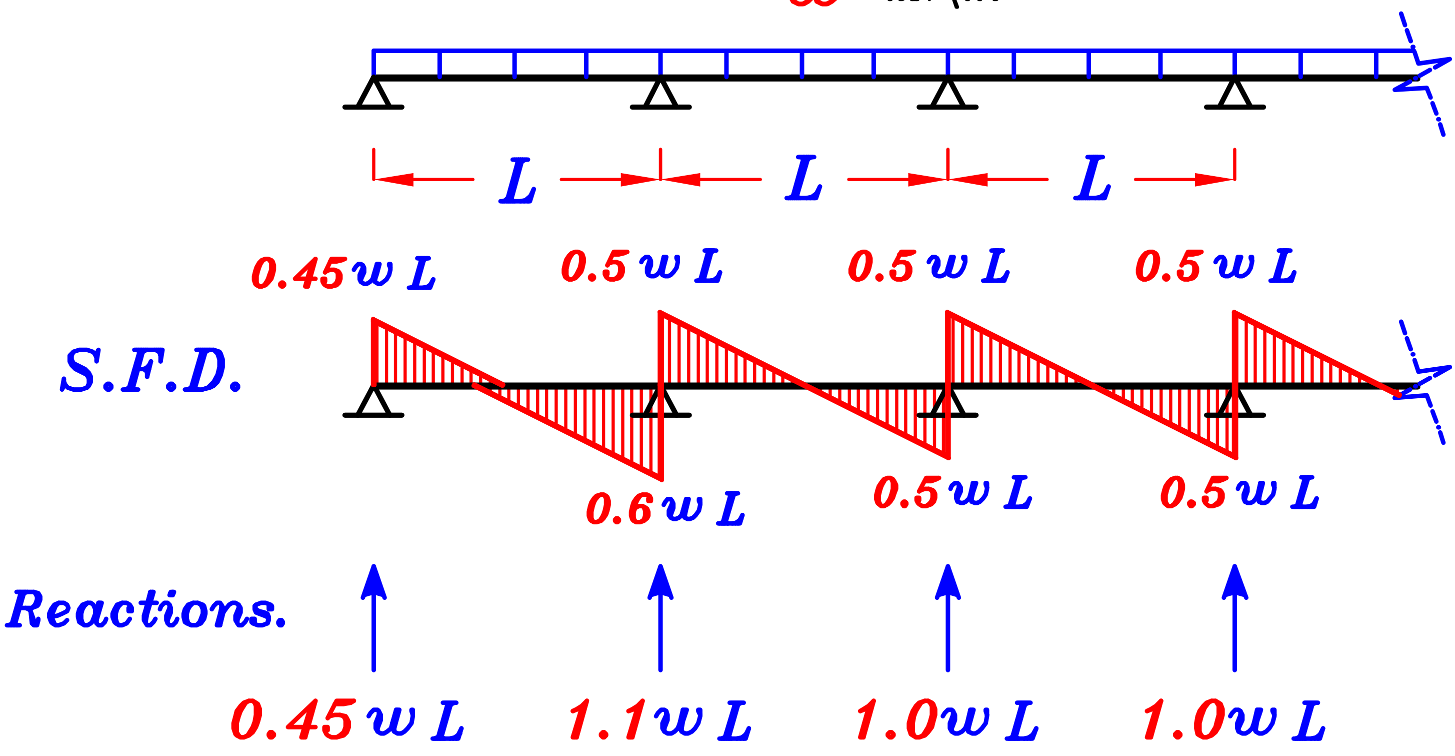


B.M.D.

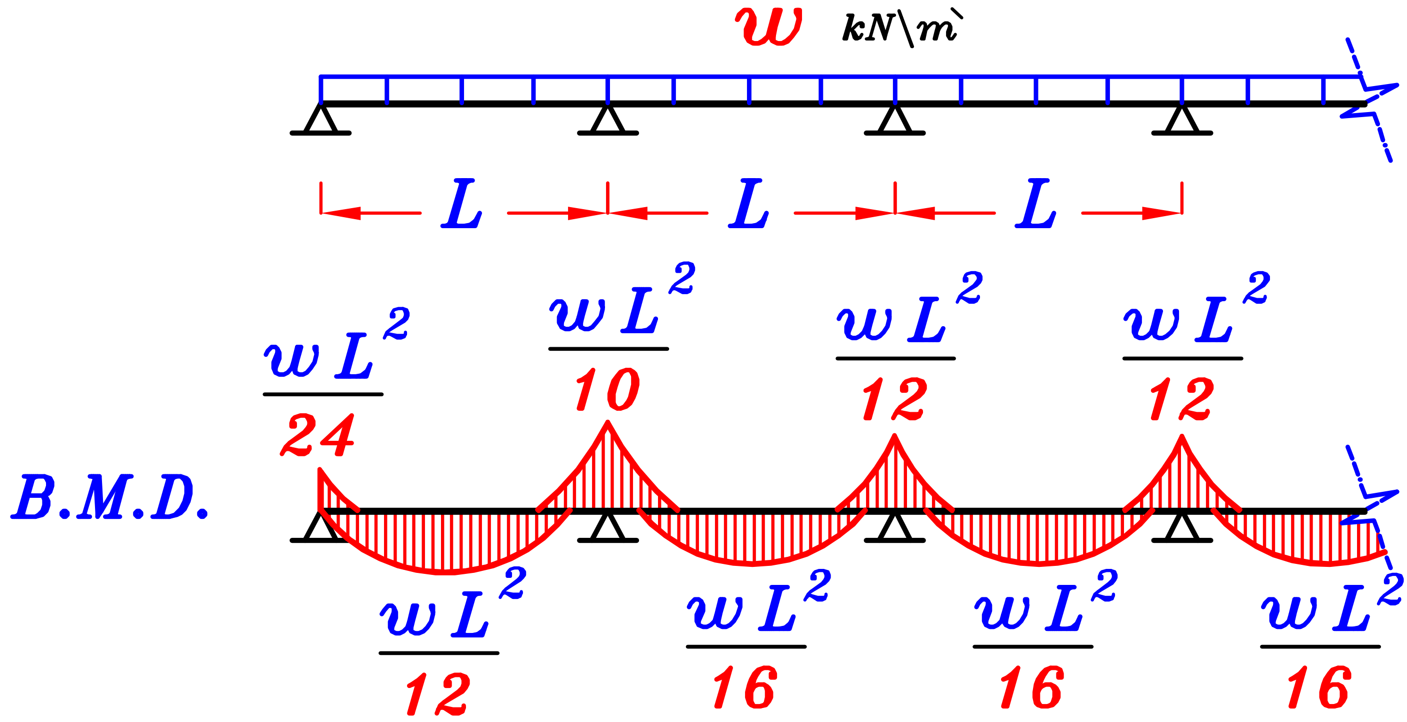


② Continuos Beam with more than 2 spans.

Load For Shear

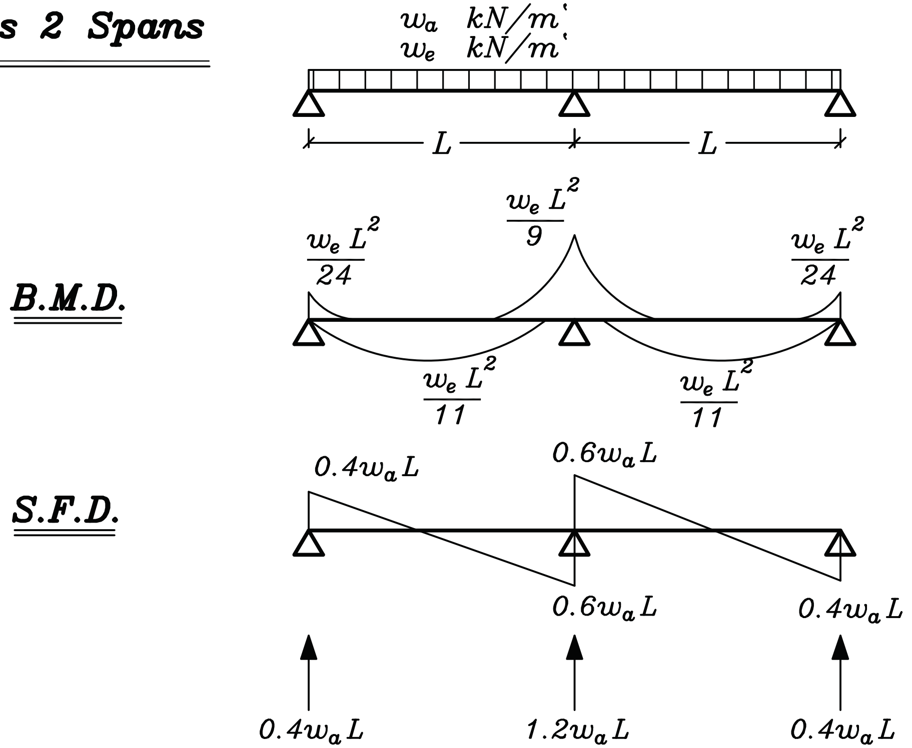


Load For Moment.

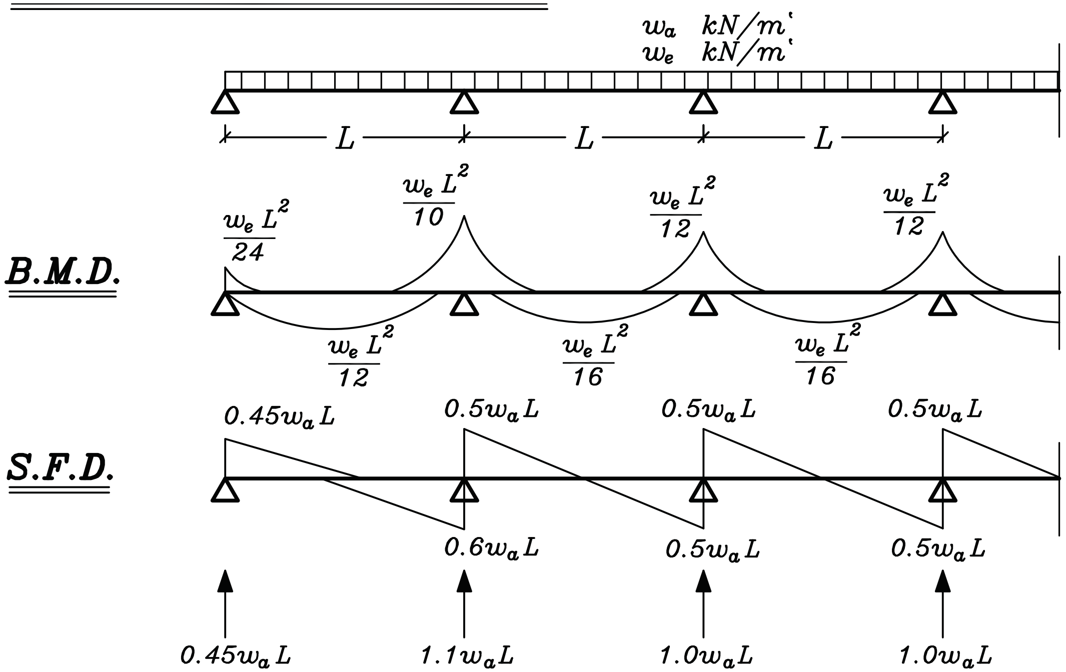


ملحوظه لا نعمل حالات تحميل للكمرات الـContinuos و لكن نضع عليها T.L.
لان قيم الـ max-max محفوظه على أساس أن قيمه w هى T.L.

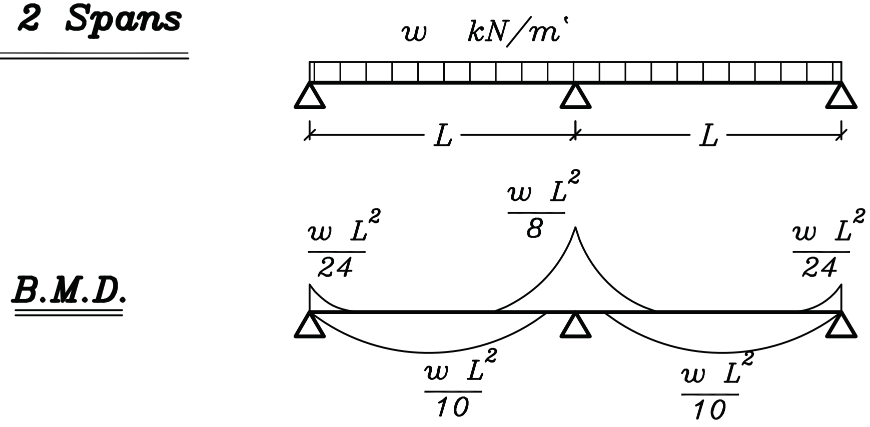
Beams 2 Spans



Beams more than 2 Spans



Slabs 2 Spans



Slabs more than 2 Spans