٢٫٢٥

مراجعه STeel
رابعه انشاءات
م/ ورزى

Final Term Revision

Part (1-C)

النظرى

Example

2013-2014

النظرى

Explain Briefly Using neat Sketches the following

1)How can the Braking Force trasmite to the bearing

2)Removal Of Braking Force bracing

3)Explain How Can the Wind Load transmite to the bearing in case of plate Girder Bridge (DECK & PONY)

4)Removal Of Stringer Bracing

5)state Factors affecting stress range (Fatigue)

6)state the recomendation of min. thikness of plates of bridges

7)the types and function of stiffeners used for plate girder

8)the differences between buckling of plates and buckling of Column.

9)State types of Fatigue Loads affecting members

10)the additional loads affecting cross girder in Pony bridge

11)State the different method of Welded Splice

12)What is the height of construction for the bridge?

13)locations of curtailment used in plate girder's flange

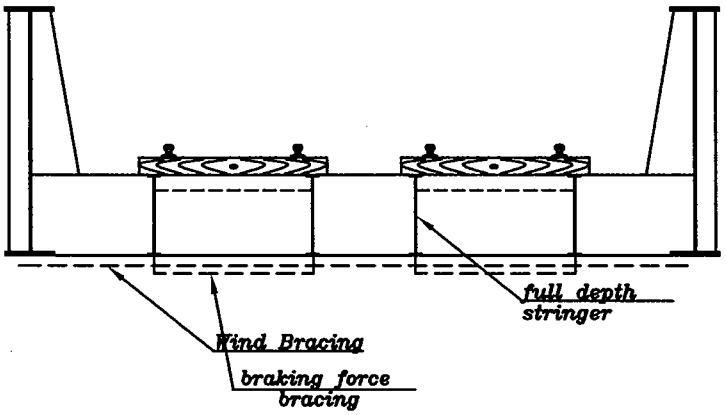
14)State Different method to achieve changes in the flanges

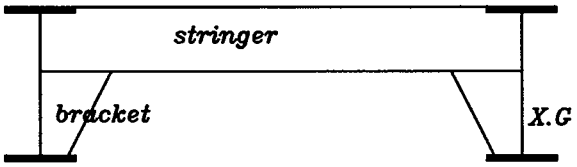
15)Explain How Can the Wind Load transmite to the bearing in case of TRUSS Bridge (THROUGH)

16)How Can the bracking force & lateral shock transmitted to bearing level

Question 1

to trasmitte the braking force , by using braking force bracing is at the lower level of the flange of cross girder
and to transmitte this force we use either full depth stringer at the first and last pannels
or using inverted u–frames at the place of braking force bracing to transmite the bracking force to the bracing level and then to the bearing level



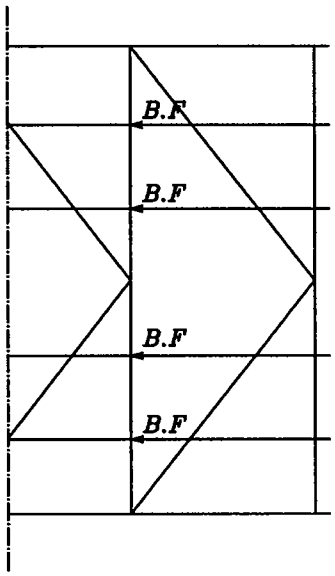


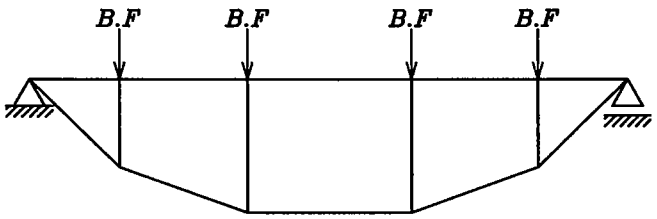
Question 2

if there is no braking force bracing the braking force would not transmitte to the bearing

and it will effect cross girder as shown below

Braking Force(B.F)



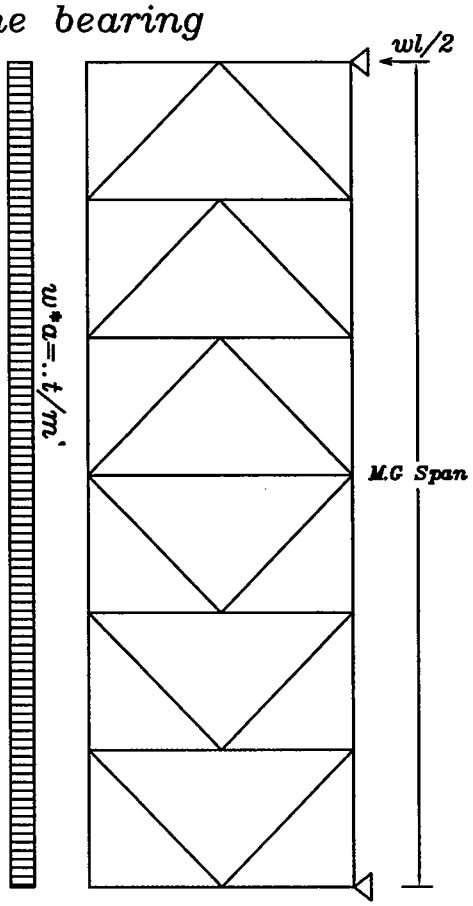


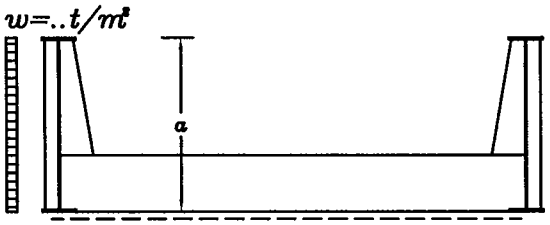
the braking force cause M_Y on cross girder

Question 3

a)Pony Bridge

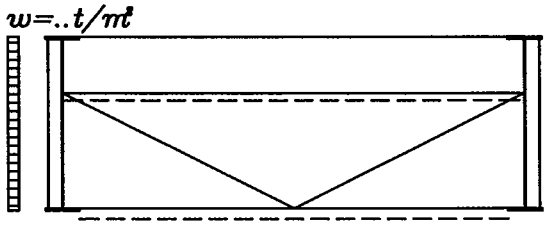
Wind transmite directly to the lower wind bracing and then to the bearing

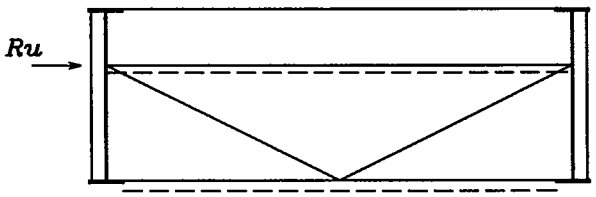




b)Deck Bridge with vertical bracing

Wind transmite to the upper wind bracing and then to the vertical bracing and then to the lower bracing and then to the bearing

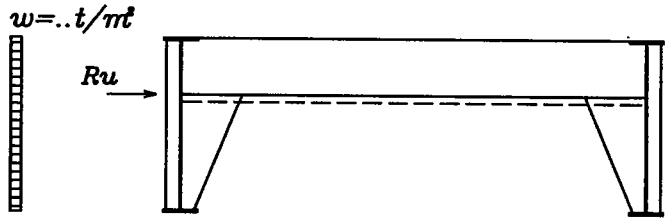


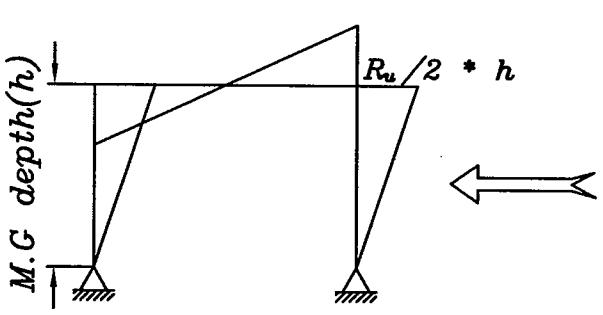


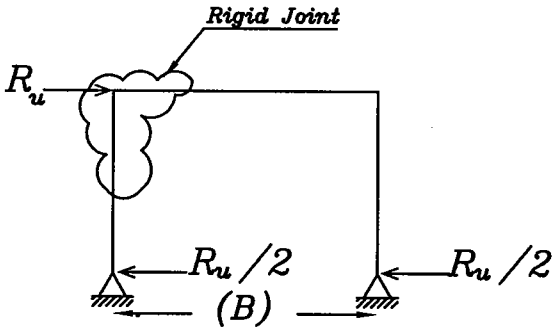
Question 3

Deck Bridge with bracket

Wind transmite directly to the upper wind bracing and by inverted u frame action at each X.G the wind load be transmitted to the bearing

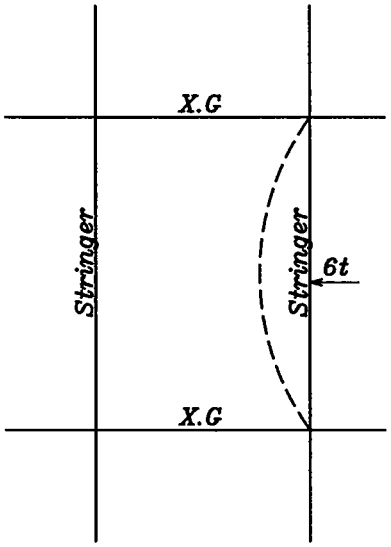






Question 4

Removal Of Stringer Bracing System in rail way bridge lateral Chock of the train (6t) will affect the stringer by My



Question 5

Factors affecting Fatigue

1–type of Bridge (Road Way Or Rail Way)

2–No. Of Cycles N

3–Section Details (A , B , B' , C , ...)

Question 6

6mm for road way bridges

8mm for rail way bridges

Question 7

the types and function of stiffeners used for plate girder

1–Use transverse (Vertical) end bearing Stiffner at the bearing of the M.G to resist the high reaction of the M.G

2–Use transverse (Vertical) intermediate bearing Stiffners at Points Of Concentrated Load (X.G)

3–Use transverse (Vertical) intermediate Stiffners every distance 1.50m ⟶ 1.80m between X.G to Support the web plate against buckling

4–Use Longitudinal (Horizontal) Stiffners For Plate girders with big Web Depth

Question 8

the differences between buckling of plates and column

i–Two Dimension(Plates)

$$\delta_{cr} = \frac{\pi^2 * \varepsilon}{12(1-\upsilon^2)} * \left(\frac{t}{b}\right)^2 * K$$

$$\delta_{cr} = 1898\left(\frac{t}{b}\right)^2 * K$$

تعتمد المعادله على

(ε , υ) نوع الماده المستخدمه

t تخانة الـ $Plate$

b ارتفاع الـ $Plate$

ii–One Dimension(Columns)

$$\delta_{cr} = \frac{\pi^2 * \varepsilon}{\lambda^2} \qquad \lambda = \frac{K*L}{r}$$

تعتمد المعادله على

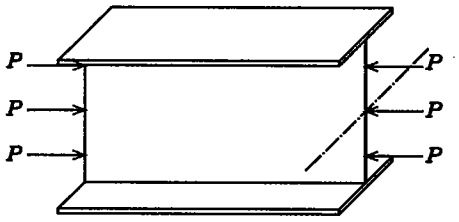
ε نوع الماده المستخدمه

KL طول العمود

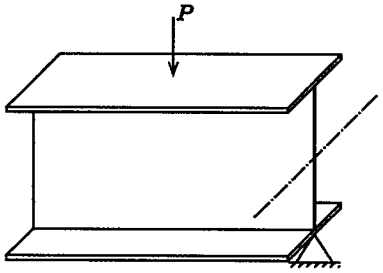
r القطاع المستخدم $\quad r = \sqrt{\frac{I}{A}}$

Question 9

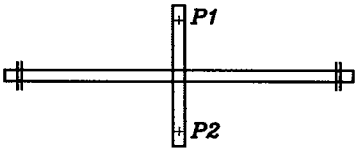
1–axial fatigue



2–Bending Fatigue

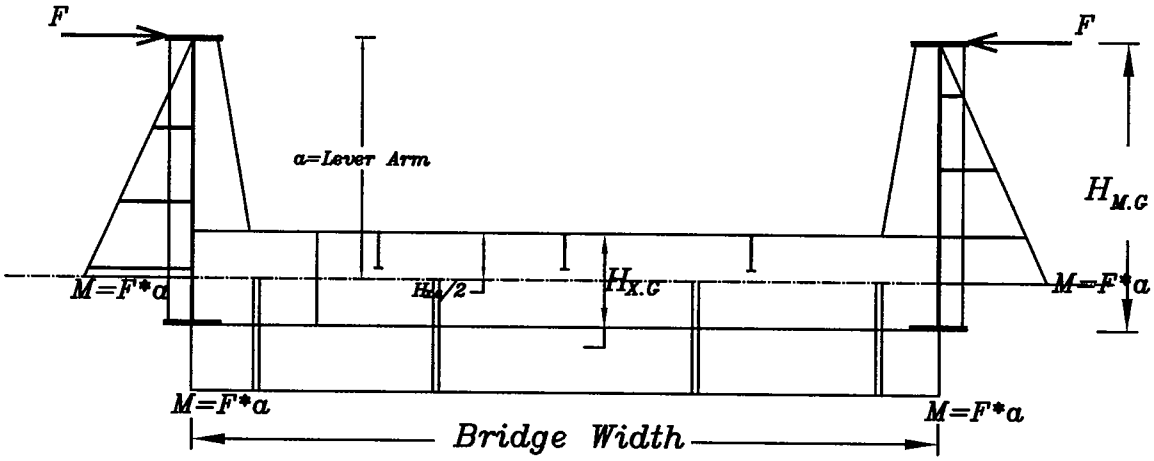


3–Torssion fatigue



10-Additional Loads On Pony Bridge

1-Effect Of Elastic Force



$$F = \frac{1}{100} C_{max.} \qquad C_{max.} = \frac{M_{max.}}{y_{ct}}$$

Where $M_{max.}$ is the Max. moment due to D+L+I on the Main Girder

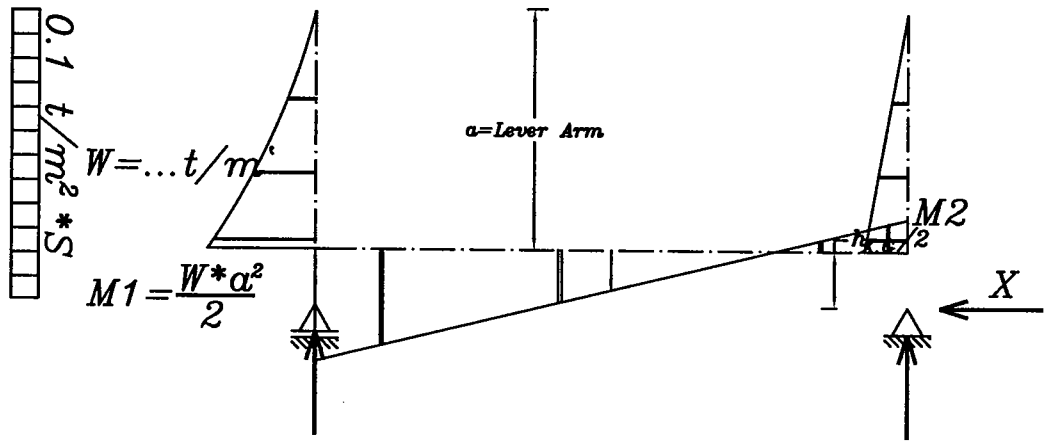
$y_{ct} = 0.97 h_{mg}$

$a = h_{mg} - 1/2 h_{xg}$

∴ The Additional Moment Due to Elastic Force is

$$\boxed{M_X = F * a}$$

2-Effect Of Wind Pressure



$a = h_{mg} - 1/2h$

$X = W * a$

$M1 = \frac{W*a^2}{2}$

$M2 = X * h_{X.G} / 2$

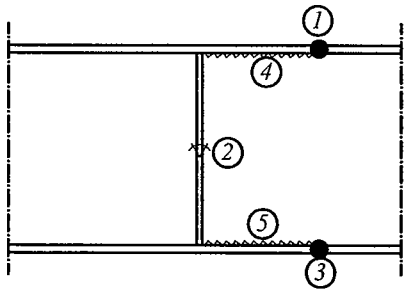
∴ The Additional Moment Due to Wind Load is

$$\boxed{M_X = \frac{M1 - M2}{2}}$$

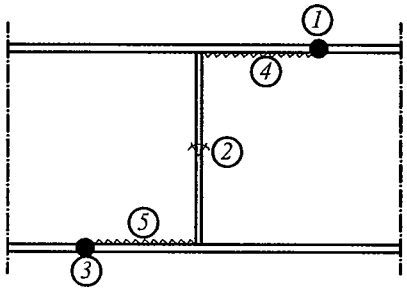
Welded Splice *Question 11*

هناك طرق مختلفه للحام الكمره داخل المصنع وقبل نقلها الموقع

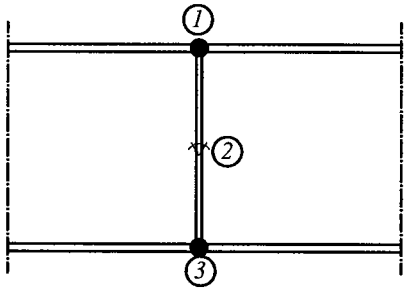
طريقة التركيب الاولى



طريقة التركيب الثانيه



طريقة التركيب الثالثه



يتم تركيب القطاعين مع بعضهما ثم ترتيب اللحامات على حسب الترقيم بحيث

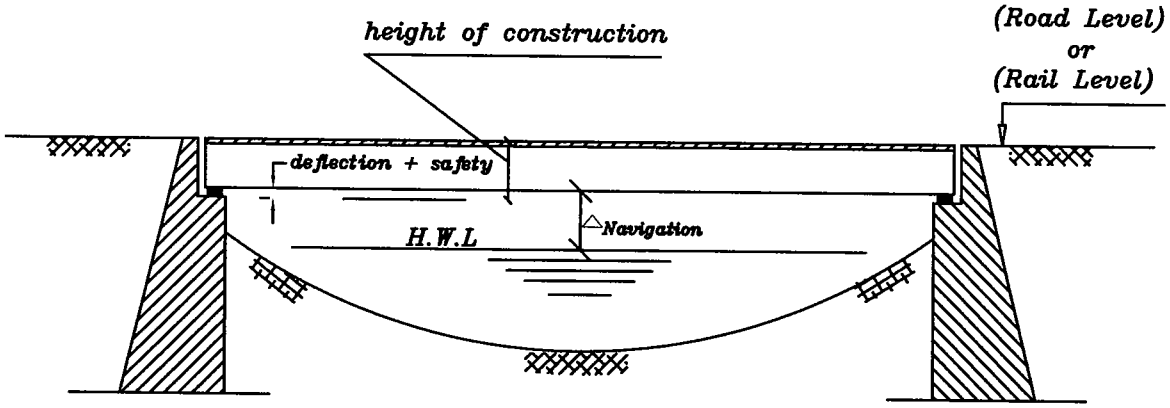
①, ②, ③ *Butt Weld*, ④, ⑤ *Fillet Weld*

–staggared splicing is recommended to minimize residual stresses and distortions at the splice position

Butt Weld is usually checked by x–ray or ultrasonic to ensure the quality of Weld

Question 12

a-What is the height of construction for the bridge?



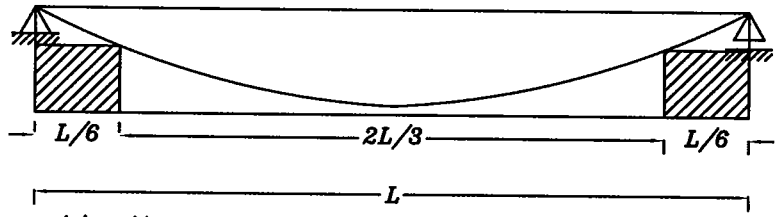
The height of construction : usually governs the choice of the type of cross section of the bridge (deck, semi-deck, through or pony)

H_c = M.G depth + asphalt + Concrete + Deflection + safety

13-locations of curtailment used in plate girder's flange

If L < 15.00m NO NEED TO USE CURTAILMENT

If L < 30.00m



فى حالة ان طول الكمره اقل من ٣٠ م فانه يتم تغيير القطاع مره واحده عند (L/6)اى ان قطاع الكمره يظل ثابت فى(2L/3)ويتغير عند (L/6) From Support

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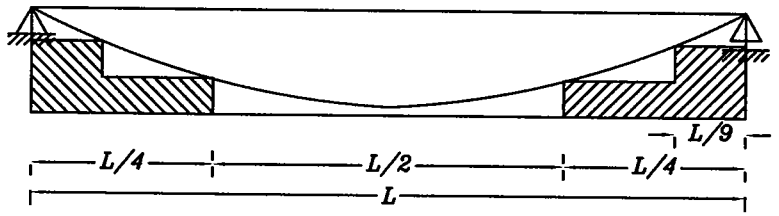
If L > 30.00m

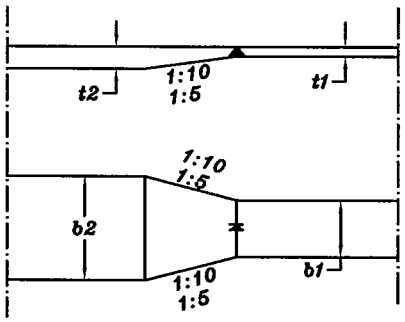


فى حالة ان طول الكمره اكبر من ٣٠ م فانه يتم تغيير القطاع مرتان عند (L/4,L/9) ويتم تثبيت القطاع فى L/2

14–Different method to achieve changes in the flanges

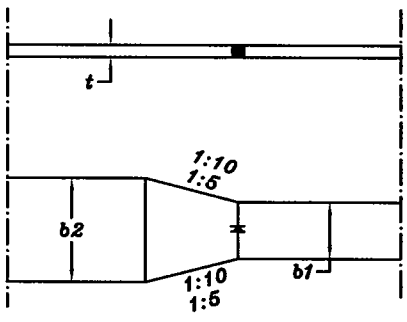
هناك ثلاث طرق لتغيير ال Flange

Case1



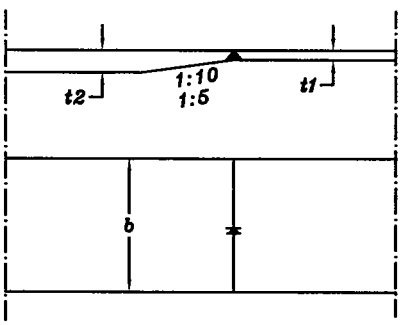
تم تقليل عرض وتخانة ال Flange

Case2



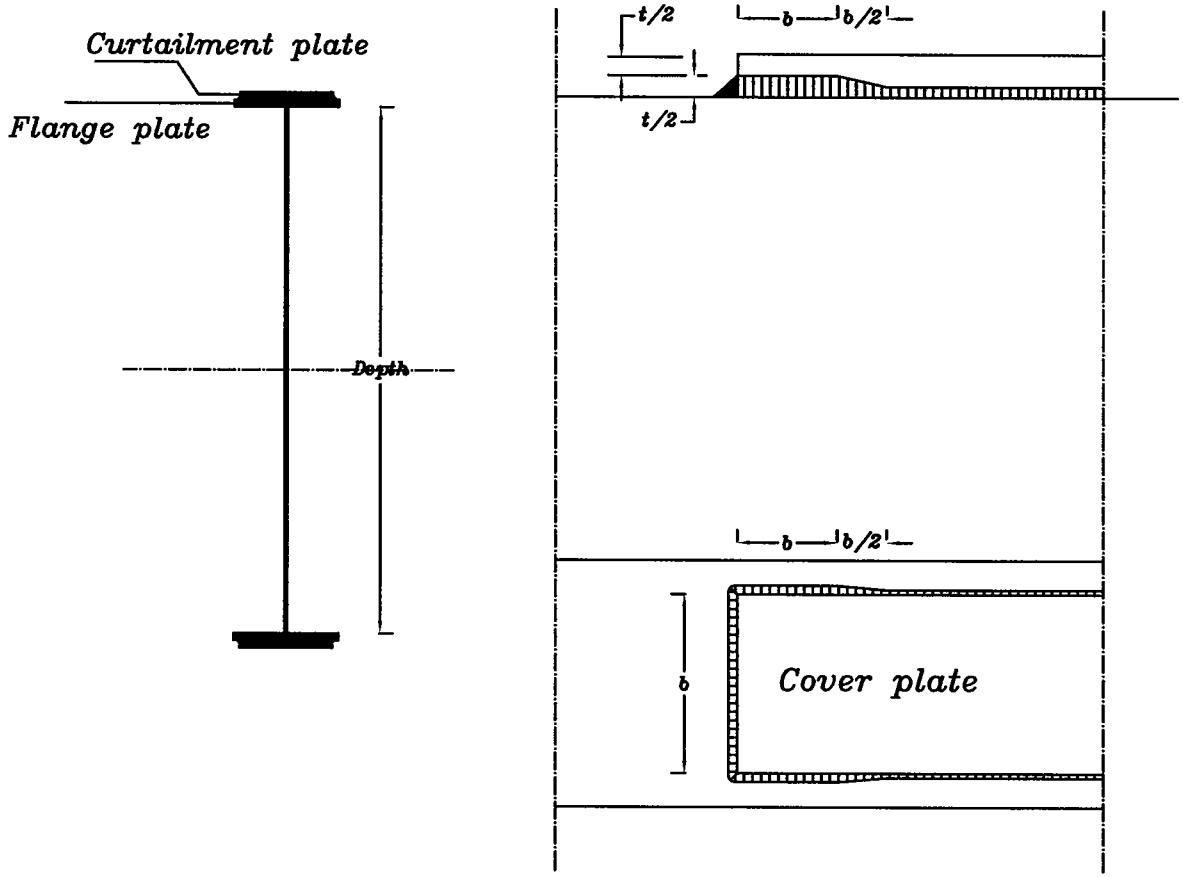
تم تقليل عرض ال Flange فقط

Case3



تم تقليل تخانة ال Flange فقط

Case4



Question 15

in case of using through bridge , closed portal frame or inclined open portal frame at both ends of the bridge must be provided to transfer load from upper level of upper bracing to bearings

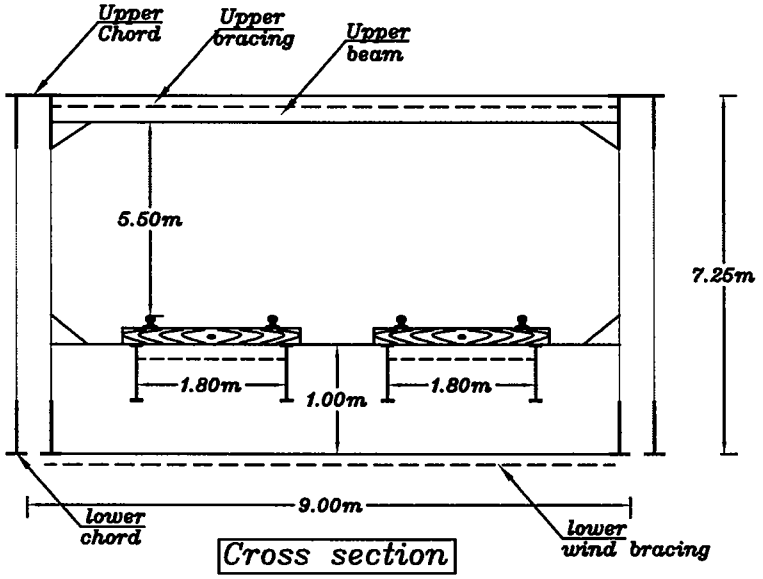
the wind load is acting at two level

1–upper wind bracing level

2–lower wind bracing level

the wind load in lower wind bracing transmitte directly to the bearing level

the wind load in upper wind bracing is transmitted by either closed or open portal frame to the bearing level

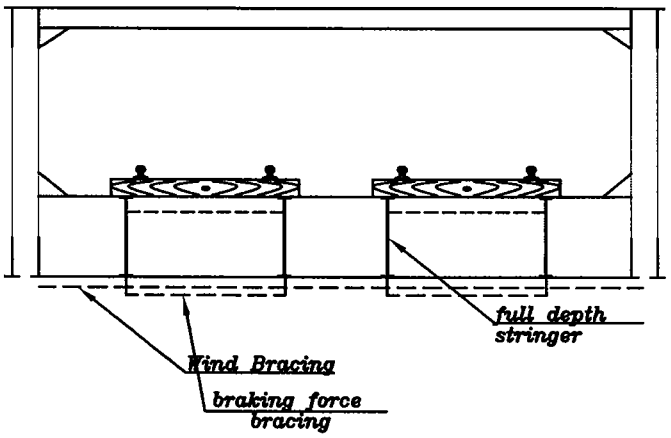


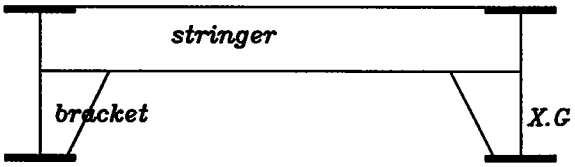
Cross section

Question 16

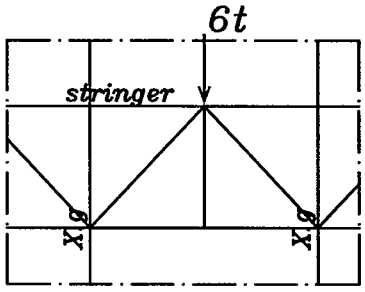
2-Braking Force

to trasmitte the braking force , by using braking force bracing is at the lower level of the flange of cross girder
and to transmitte this force we use either full depth stringer at the first and last pannels
or using inverted u-frames at the place of braking force bracing to transmite the bracking force to the bracing level and then to the bearing level



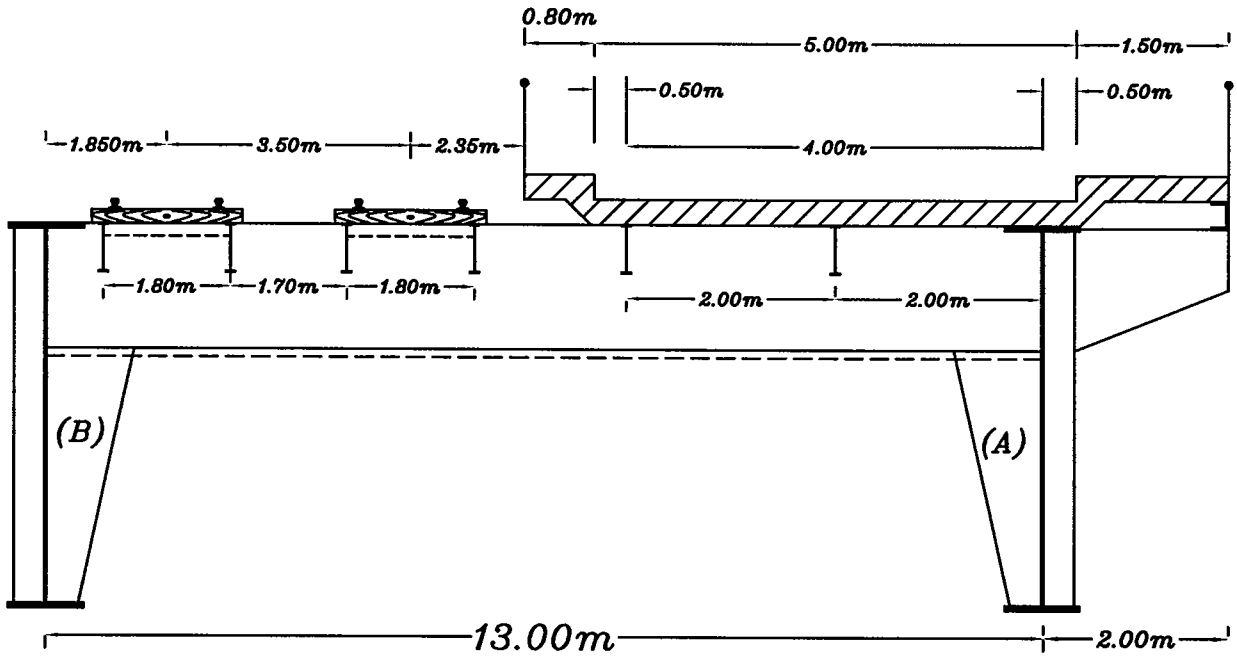


3-Lateral shock (6t)



first lateral shock 6t transmitted directly to the stringer bracing level and then to the wind bracing level and finaly to the bearing level.

Example



A rail–roadway Plate girder deck bridge of the shown cross section has a span of 40.00ms and is divided into 8 equal pannel 5.00ms each. The main girders are spaced 13.00ms apart.

it is Required to

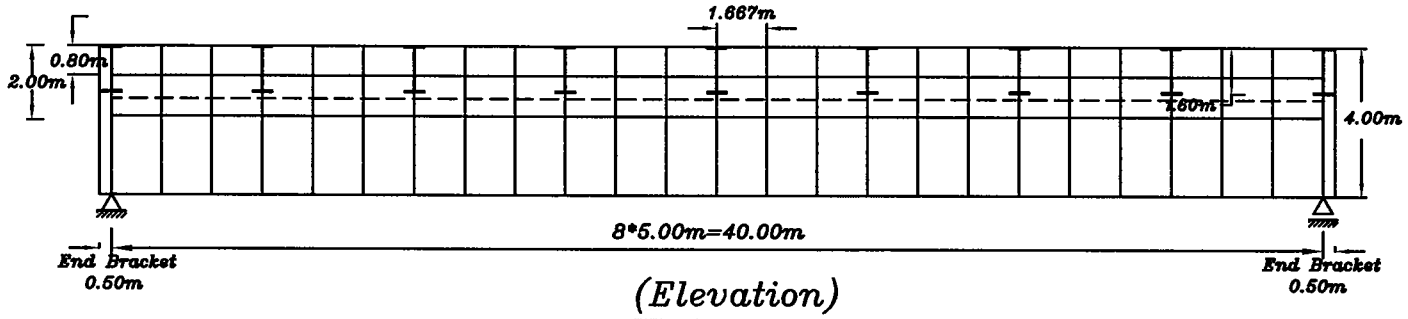
1–Complete general layout for the shown cross section

2–Find the maximum bending moment and the maximum Shearing force for an intermediate cross girder due to live loads Plus impact only

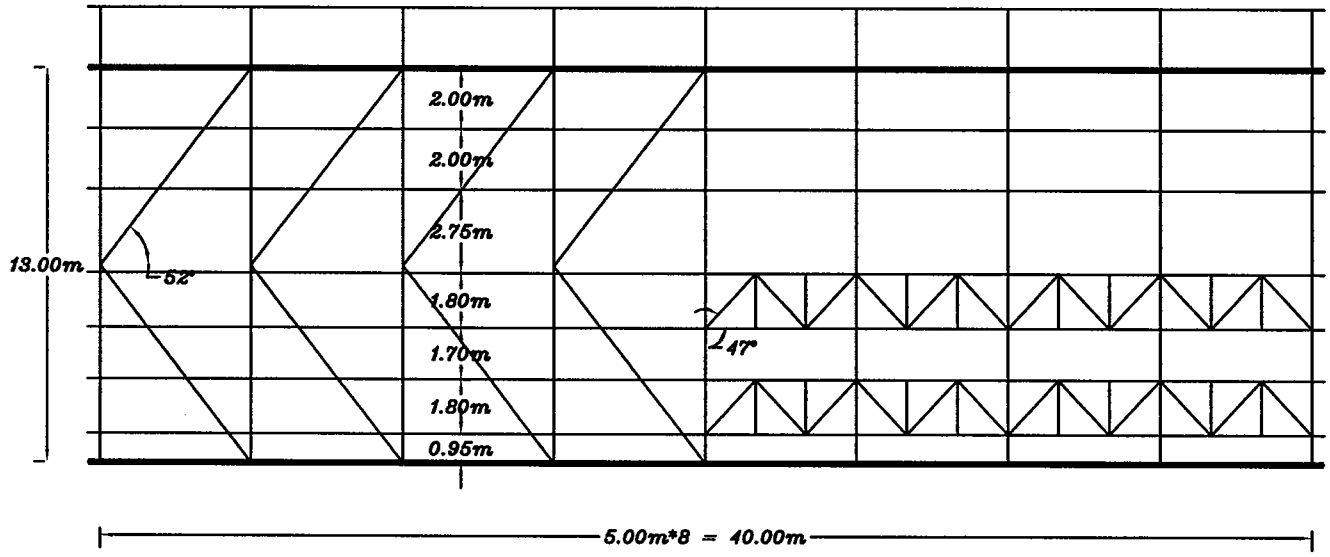
3–Find the maximum bending moment and max. shearing Force For M.G A

4–Explian how can the wind load transmite to the bearing level

Question One



(Elevation)



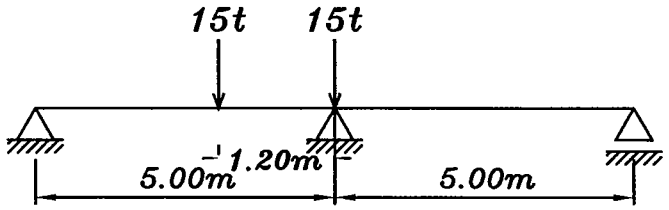
(Plan Of Upper Bracing)

Question Tow

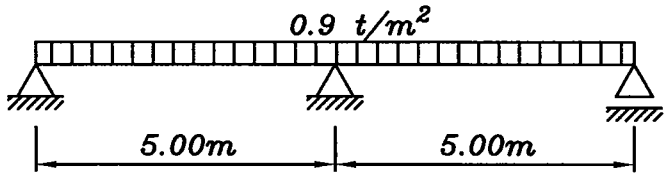
For Road Way Part

Live Loads + Impact

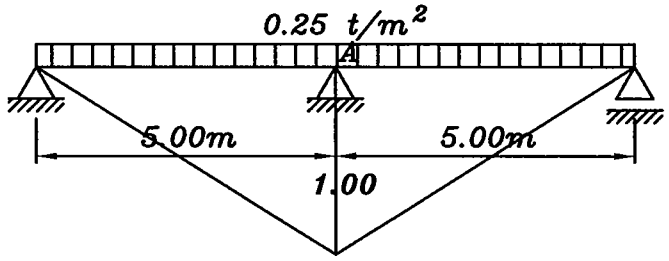
Strip1
Get R_1



Strip2
Get W_1



Strip4
Get W_2

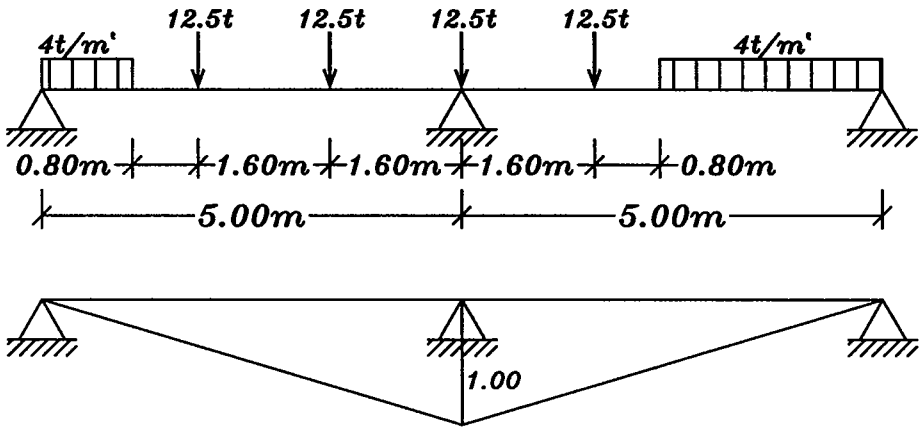


$R_1 = 15*(1+0.76) = 26.40t$

$W_1 = 0.90*5.00 = 4.50t/m'$

$W_2 = 0.25*5.00 = 1.25t/m'$

For Rail Way Part



$R_{LL} = 3*12.5*0.625+12.5*0.625+4*2.6*0.26+4*1.0*0.10$

$R_{LL} = \boxed{34.35t}$

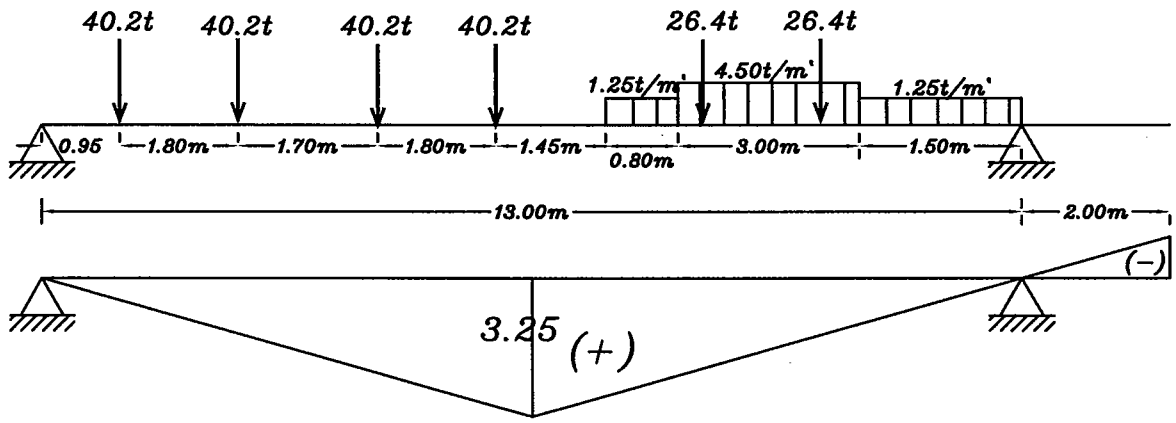
$$(1+I) = 0.73 + \frac{2.16}{\sqrt{L_1} - 0.2}$$

$L_1 = 2*13.0 = 26.00m$

$$(1+I) = 0.73 + \frac{2.16}{\sqrt{26.0} - 0.2} = 1.17$$ $> 1.1 \ , \ <2.00$

$R_{LL+I} = 34.35*1.17 =$ $40.189t$

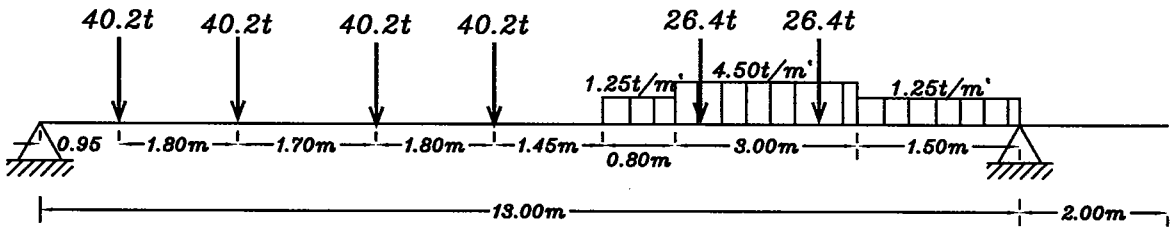
Case Of Max. Bending Moment

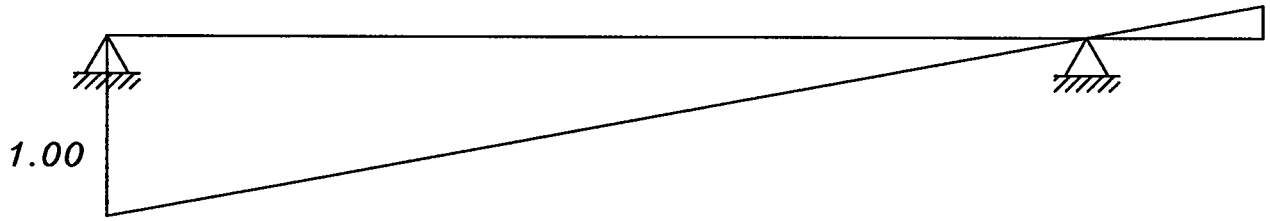


$M_{LL+I} = 2*26.4*1.50+1.25*(1.5*0.375+0.8*2.45)$
$+4.50*3*1.5+40.2*4*1.80$

$392.04m.t$

Case Of Max. Shear Force





خلى بالك

نفس حالة تحميل ال *B.M* هى نفسها حالة تحميل ال *Shear*

لاننا سوف نحسب من عند ال *Support* اللى ناحية ال *Rail Way*

وذلك للتسهيل فقط لكن من المفروض حساب ال *shear force*

من الجهتين *Road & Rail* واخذ القيمه الاكبر

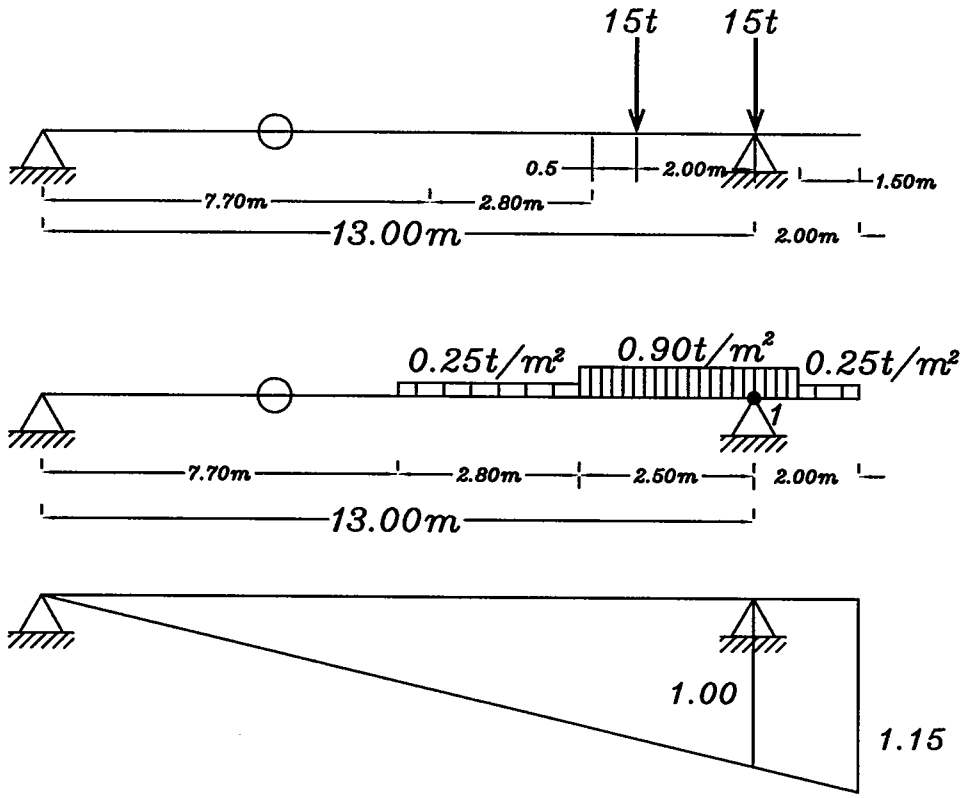
$$Q_{LL+I} = 40.2*4*0.723 + 1.25*(0.8*0.376+1.5*0.057) + 4.50*3*0.23 + 26.4(0.307+0.154)$$

$$\boxed{132.01t}$$

For M.G A

Road Way Part

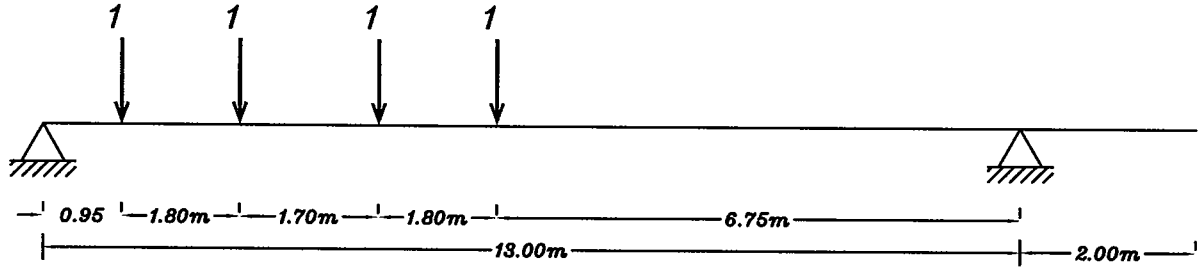
Question 2

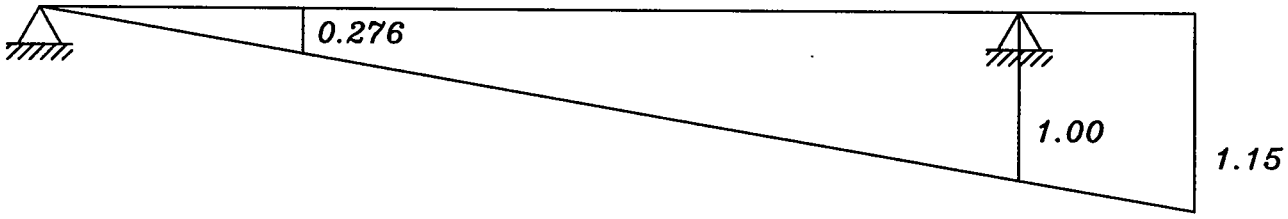


$R = 15.0*(1+0.846) = \boxed{27.69t}$

$W = 0.90*3.0*0.8+0.25*2.80*0.7+0.25*1.5*1.09 = \boxed{3.05t/m'}$

Rail Way





$R = 4*0.276 = \boxed{1.104}$

Reduction For Double track = 0.9

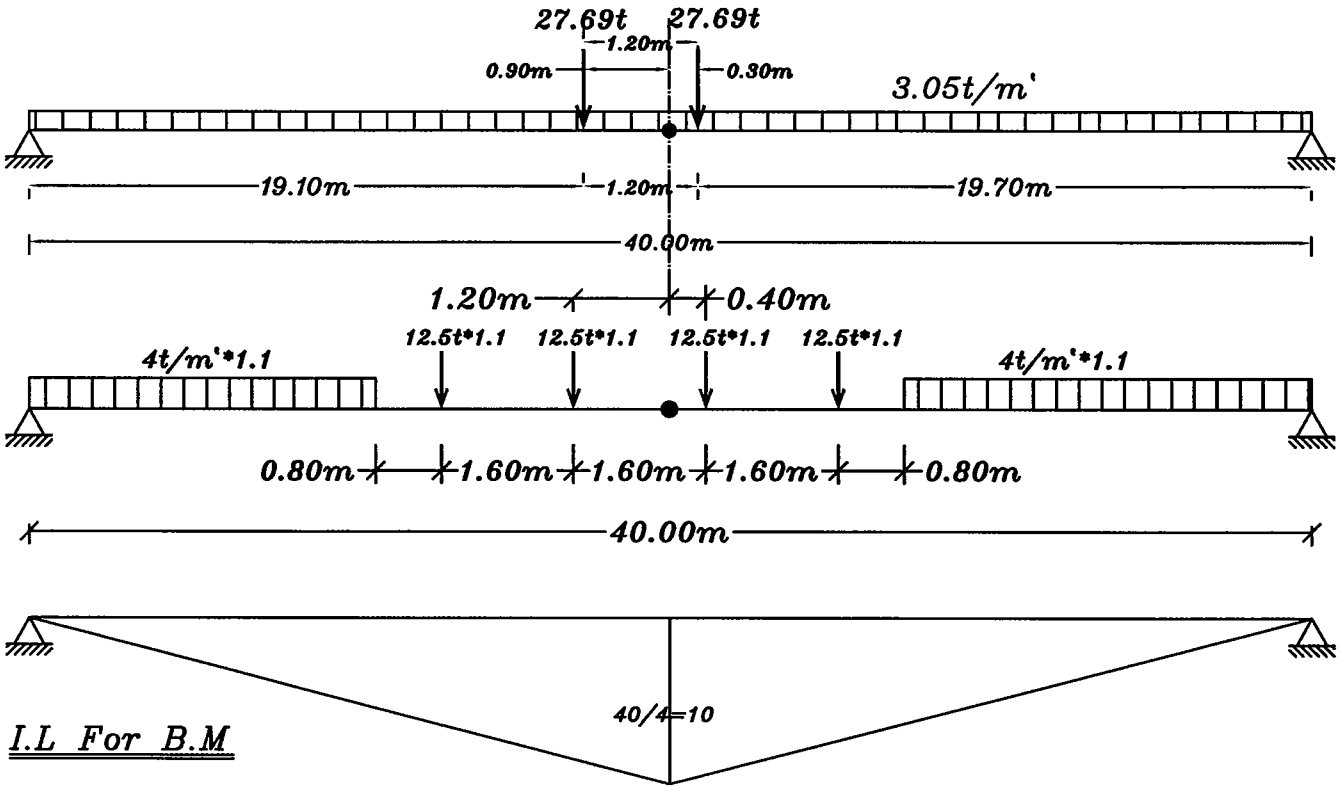
خلى بالك

لاحظ انه فى حالة ما كان الكوبرى ال *Rail Way* متماثل كان كل *M.G* يحمل نصف الكوبرى اما فى هذه الحاله فاالكوبرى غير متماثل وعلى هذا يتم فرض *Factor* مقداره ١ مكان كل *Rail* ومعرفة قيمة قيمة ال *Reaction* عند ال *M.G* المطلوبه وبهذا يتم معرفة قيمة نسبة الحمل على كل *M.G* من ال *Rail Way*

وللحصول على ال *Max. B.M* سوف يتم حل ال *M.G* على اساس مبدا ال *Super Position*

اى سوف يتم حساب العزوم على الكمره نتيجة ال *Rail Way* ثم يتم جمع العزوم عليها نتيجة ال *Road Way*

Case Of Max. Bending Moment



Road Way

M_{LL+I} = 27.69(9.85+9.55) + 3.05*20*5*2 = **1147.186 m.t**

Rail Way

M_{LL} = 2*12.5*1.1(9.00+9.40) + 4*1.1*(17.2*4.3+16.4*4.1)

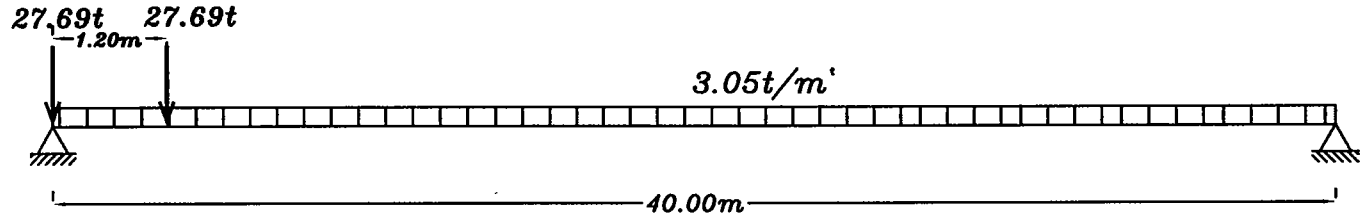
= 1127.28 m.t

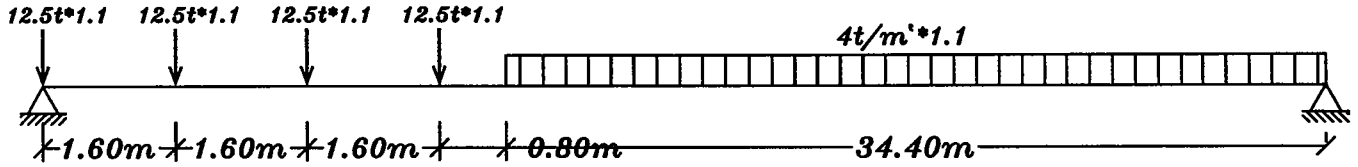
$(1+I) = 0.73 + \frac{2.16}{\sqrt{40.0}-0.2} = 1.08$ **< 1.1, ues 1.1**

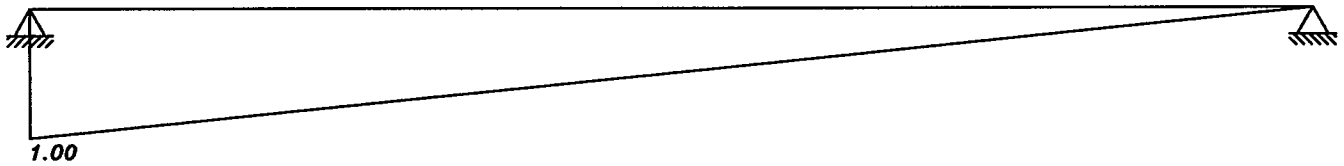
M_{LL+I} = 1127.28*1.1 = **1240m.t**

$M_{LL+I(Road+Rail)}$ = 1240+1147.186 = **2387.1m.t**

Case Of Max. Shearing Force @ mide Span







Road Way

Q_{LL+I}= 2*27.69*0.985+3.05*40*0.5 = **115.55t**

Rail Way

Impact factor I = **1.1** previously calculated

Q_{LL} = 4*12.5*1.1*0.94 + 4*1.1*34.40*0.43 = **116.78 t**

Q_{LL+I}= 116.78*1.1 = **128.46t**

$Q_{LL+I(Rail+Road)}$=115.55+116.78= **232.33t**

Question 4

Wind transmite directly to the upper wind bracing and by inverted u frame action at each X.G the wind load be transmitted to the bearing