L-3/T-2/BURP   **Date : 18/02/2018**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2   B. Sc. Engineering Examinations 2016-2017

Sub : **ARCH 355** (Urban Design)

Full Marks: 210   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What are the design factors that contribute to the visual aesthetic character of urban environment? Discuss the design criteria for designing building facade in an urban space.   **(10+10=20)**

    (b) Elaborate the principles for analysis of visual and aesthetic character of the square in urban design.   **(15)**

2. (a) Discuss the basic human needs that people seek to satisfy in an urban space.   **(15)**

    (b) What are the urban design factors that may affect micro-climate of a city? Elaborate the factors that should be considered to minimize the wind effect in urban design.   **(10+10=20)**

3. (a) Discuss different stages of urban design process.   **(15)**

    (b) Elaborate the process of historic survey analysis in the urban design process.   **(10)**

    (c) Discuss the five elements of urban design that help to make a city legible.   **(10)**

4. (a) Discuss the importance of unity, proportion and scale in urban design.   **(15)**

    (b) Write short note (any two)   **(10+10=20)**
       (i) Transparency
       (ii) Imeagibility
       (iii) Coherence.

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE** questions.

5. (a) Discuss the problem of modern Urban Design from the point of user's perspective.   **(20)**

    (b) "Urban design is both a process and a project"- Explain.   **(15)**

ARCH 355

6. (a) Define the objectives of Urban Design. **(20)**

   (b) Discuss how a place can retain its own identity through urban design. **(15)**

7. (a) What are the Urban design Principles of the ancient Greek cities. **(15)**

   (b) Elaborate the City Planning and Design Principles of a Medieval Town with an example. **(20)**

8. Write short notes on urban design movements (any three): **(11 $\frac{2}{3}$ ×3)**

   (a) City Beautiful Movement

   (b) Garden City and New Town Movement

   (c) New Urbanism

   (d) Sustainable Urban Design.

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2   B. Sc. Engineering Examinations 2016-2017

Sub : **PLAN 331** (Rural Development Planning I)

Full Marks: 210   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) Compare between "Participatory Rural Appraisal (PRA)" and "Rapid Rural Appraisal (RRA)" with example.   **(10)**

    (b) Which was the first attempt to carry out a comprehensive program of village development? Describe the program with limitations.   **(2+8=10)**

    (c) Define Sustainable Livelihood. Explain the parameters which can be used to evaluate the sustainability of different livelihood outcomes.   **(5+10=15)**

2. (a) Describe the scope of "Integrated Rural Development (IRD)" in fisheries and forestry sectors of Bangladesh.   **(15)**

    (b) The haor basin in north-eastern Bangladesh is one of the flood prone regions of the country with hindered economic growth, limited access to livelihood opportunities and lack of proper communication systems and social services. Therefore, the farmers living in this area are vulnerable to flood. An Integrated Rural Development (IRD) program will be adopted for the farmers in this region with an intension to ensure access to basic services and sustainable livelihood opportunities. – Explain the best suitable IRD model that can be adopted for such purpose. What type of activities can be adopted for such purpose using that IRD model?   **(5+8=13)**

    (c) Describe the objectives of public participation in the context of Rural Development planning in Bangladesh.   **(7)**

3. (a) "The general idea of compact township is simply a combination of integrated rural development with idea of a growth pole" – explain the statement with example.   **(10)**

    (b) Give a list of major PRA (Participatory Rural Appraisal) Techniques. Compare between social Mapping and Resource Mapping.   **(5+5=10)**

    (c) What do you understand by rural development? Why is rural development planning necessary in Bangladesh?   **(4+6=10)**

    (d) Compare between agricultural development and peasantization of development as the dimensions of rural development with example.   **(5)**

4. (a) What are the types of land reform? Describe with example.   **(2+8=10)**

PLAN 331

Contd... Q. No. (4)

(b) The following pair-wise ranking (Table 1) represents the problem prioritization of Monipuripara community, Dhaka. Briefly explain the key findings of this table. **(8)**

Table 1: Pair-Wise Ranking: Problem Prioritization of Monipuripara community								
Problems	1	2	3	4	5	6	Priority Frequency	Rank
	Traffic Congestion	Water Logging	Roadside Hawker	Inadequate Community Service	Increased Number of Hostel	Sewerage and Drainage		
1 Traffic Congestion	X	1	1	1	1	1	5	1
2 Water Logging		X	3	4	5	2	1	
3 Roadside Hawker			X	3	3	3	4	2
4 Inadequate Community Service				X	4	4	3	3
5 Increased Number of Hostel					X	5	2	
6 Sewerage and Drainage						X	0	

(c) What do you understand by "Triangulation" and "Optimal Ignorance?" Explain the need of "Triangulation" and "Optimal Ignorance" for conducting RRA (Rapid Rural Appraisal) in rural areas of Bangladesh with examples. **(4+8=12)**

(d) "At village level, participation depends on traditional decision making patterns"- Do you agree with the statement? Justify with examples. **(5)**

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE** questions.

5. (a) Compare and explain impacts of first five "Five year Plans" on poverty condition in Bangladesh with proper justification. **(20)**

(b) Describe how NGOs can intervene in broad areas for improvement of households and communities in rural areas of Bangladesh. **(15)**

PLAN 331

6. (a) "Growth centers in Bangladesh have positively impacted on its surrounding areas." – Do you agree with this statement? Justify your answer through evaluation of the impacts of growth centers. **(22)**

    (b) Identify the poverty concept in which at-risk-poverty line is utilized. Describe the method for determining at-risk-poverty line. **(13)**

7. (a) "RIIP-1project was successful in improving communication network in the project area." – Do you agree with this statement? Justify your answer through description of different measures taken under the project and evaluation of their impact on the project area. **(25)**

    (b) Identify and describe the method in which geographical location is considered to identify and select growth center. **(10)**

8. (a) Compare the scopes of sixth and seventh " Five Year Plan"s for rural development in Bangladesh. **(15)**

    (b) The following table (Table 2) summarizes poverty measurements of four regions. Compare their poverty condition with proper explanation and justification. **(20)**

Table 2: Region wise poverty measurements			
Region	HCI	PGI	SPGI
R1	0.62	0.19	0.07
R2	0.42	0.16	0.12
R3	0.21	0.30	0.22
R4	0.53	0.19	0.11

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2   BURP Examinations 2016-2017

Sub : **PLAN 333** (Regional Development Planning)

Full Marks: 210   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) "Both Weber and Losch's theories of industrial location lag behind while determining profit maximizing location for industry" – Do you agree with the statement? Justify your answer with necessary illustrations.   **(10)**

    (b) Discuss the characteristics of leading industry and propulsive firms.   **(10)**

    (c) Discuss the evolution of industrial policies of Bangladesh with respect to different political principles.   **(15)**

2. (a) Discuss the basic concepts associated with 'Central Place Theory' with example.   **(9)**

    (b) "Propulsive firms within a leading industry can capitalize the advantage of agglomeration economics." Describe the types of agglomeration economics.   **(9)**

    (c) How the "Central Place Theory" can play important role in regional planning? Criticize "Central Place Theory" with examples.   **(8.5+8.5=17)**

3. (a) Between "Growth Pole Policy" and "Growth Center Policy" which one do you think is more appropriate in the context of Bangladesh? Justify your answer with example.   **(10)**

    (b) What is "K-value"? How do you think "K-value" in central place theory helps to understand the alternative forms of hierarchy? Discuss briefly.   **(15)**

    (c) Differentiate between "spread effect" and "backwash effect".   **(5)**

    (d) Explain regional growth pole according to Perrouse and Boundeville.   **(5)**

4. (a) How do you think micro-policy options can help to develop a stressed region of country? Discuss briefly.   **(18)**

    (b) "Development of a balanced settlement pattern integrating both urban and rural areas would require formulation of land management policies" – Do you agree with the statement? Justify your answer in the context of Bangladesh.   **(10)**

    (c) Compare between "Theoretical approach" and "Empirical approach" in the context of identifying the location of an industry.   **(7)**

PLAN 333

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE** questions.

5. (a) "Regional planning deals with designing and placing infrastructures and other elements across a large area, which may include several towns, cities or even parts of different states or regions". Explain the statement. **(10)**

(b) Suppose you are working as a Regional Planner in the Local Government Engineering Department (LGED). You have to select suitable locations for certain socio-economic facilities like primary school, community clinic and rural market in the coastal areas of Bangladesh. Now before selecting the locations you need to know the catchment areas of the mentioned facilities that already exist. What method would you follow to determine the catchment areas for the mentioned facilities? Discuss the method. **(13)**

(c) The regionalization process depends on – (i) the purpose, (ii) criterion/criteria to be used, and (iii) data availability. Explain with examples. **(12)**

6. (a) "Administration of planning areas is very much important for the implementation of a regional plan". Explain the statement. **(10)**

(b) Briefly explain the key features of an Input – Output Model for regional economic analysis. **(25)**

7. (a) The economic base theory establishes a cause and effect relationship between basic and non-basic activities. Explain with examples. **(12)**

(b) One of the implications of Harris-Todaro Model is –
"Urban job creation is an insufficient solution for the urban unemployment problem". Explain the statement in the context of Bangladesh. **(15)**

(c) Distinguish between proportionality and differential shift components in the industrial structure analysis. **(8)**

8. Write short notes on the followings:

(a) Necessity of regional economic theories. **(10)**

(b) Limitation of "economic base theory". **(15)**

(c) Labor migration and regional development. **(10)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2   BURP Examinations 2016-2017

Sub : **PLAN 345** (Transportation Policy Planning)

Full Marks: 210   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1.   (a) Why is it necessary to lend the explanatory variables to relatively easy projection in a trip generation model? **(5)**

(b) Distinguish between 'shifted traffic' and 'development traffic' with example. **(10)**

(c) Given the following data (Table 1), use cross-classification method to estimate the number of trips that will occur in the future if the estimated number of future household is as shown in Table 2. **(20)**

Table 1: Current trip making characteristics

Household Income	Household Size					
	1		2		3+	
	HH	Trips	HH	Trips	HH	Trips
Low	350	1,190	5,640	23,125	4,240	19,458
Medium	675	2,498	6,955	31,275	9,641	47,241
High	540	2,108	2,420	11,616	3,202	17,291

Table 2: Future zonal households

Household Income	Household Size		
	1	2	3+
Low	110	275	430
Medium	220	1222	2,415
High	90	120	250

2.   (a) The total trips produced in and attracted to the three zones A, B and C of a survey area in the design year are tabulated in table 3. **(20)**

Table 3: Design year trip production and attraction

Zone	Trips produced	Trips attracted
A	2000	3000
B	3000	4000
C	4000	2000

It is known that the trips between two zones are inversely proportional to the second power of the travel time between zones, which is 20 minutes. If the trip interchange between zones B and C is known to be 600, calculate the trip interchange between zones A and B, A and C, B and A, C and B.

(b) Differentiate between mode specific and attribute specific model. Briefly discuss the advantages of these models over one another with example. **(8+7=15)**

PLAN 345

3. (a) A city has the following utility function for use to estimate the modal share.

$$U = -0.075A - 0.05W - 0.04R - 0.02C$$

where A is the access time in minutes, W is the waiting time in minutes, R is the riding time in minutes, and C is the out-of-pocket cost in paisa.

(i) What modal distribution would you expect, using the following values for A, W, R and C for the four modes used in the city? (See Table 4). **(10)**

Table 4

Mode	A	W	R	C
Auto	6	1	25	300
Rail	7	10	15	75
Bus	10	15	35	60
Bike	1	0	45	10

(ii) Suppose, the city is seriously thinking of subsidizing rail and bus by 50%, encouraged biking by constructing bike paths and thus reducing biking time by 20%, and increasing auto costs (through higher parking changes) by 10%. What is likely to be the new modal distribution with these changes? Discuss the results. Note: Construction of bike path doesn't necessary mean improvement of accessibility. **(10+5=15)**

(b) Briefly explain the advantages of gravity model over uniform factor method used in trip distribution stage of transportation modeling. **(10)**

4. (a) Briefly discuss five travel demand management techniques, highlighting their potential benefits, suited to the context of Dhaka city. **(15)**

(b) Find the shortest route between node 1 and 7 (Figure 1) using minimum tree algorithm.

Figure 1
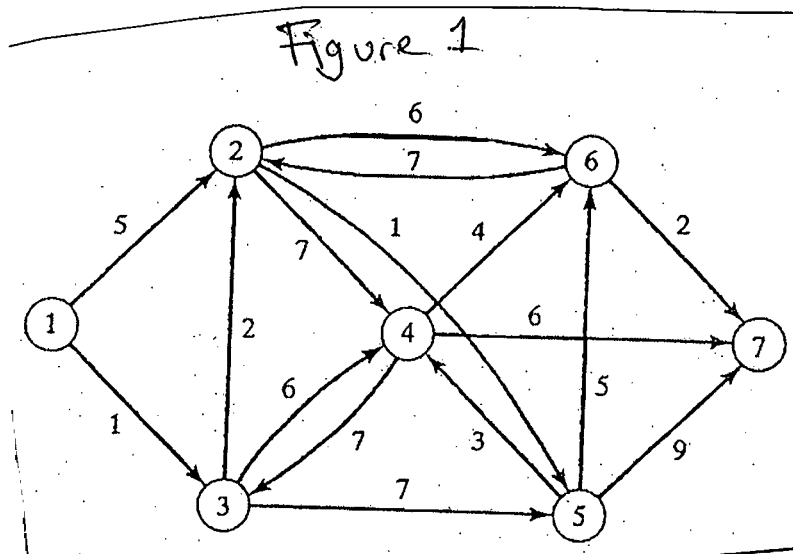
Estimate link traffic loading for trips emanating from node 1 to node 7 using. 'All or nothing' trip assignment method. Traffic interchanges between nodes are given in the following Table 5. Briefly discuss the problems associated with the application of 'All or nothing' method for this network diagram. **(10+5+5=20)**

PLAN 345
Contd... Q. No. 4(b)

Table 5

	1	2	3	4	5	6	7
1	100	50	350	150	75	450	350
2	80	100	450	35	120	870	1,000
3	70	425	100	450	500	650	335
4	50	25	600	100	375	125	225
5	350	250	75	185	100	475	525
6	225	550	840	110	85	100	330
7	335	350	220	320	150	420	100

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Many people state that 25% area of a city should be designated for road. Do you agree with the statement? Justify your answer. **(10)**

(b) In Bangladesh, particularly in big cities like Dhaka and Chittagong, there is a tendency among a large section of people including decision makers to deny the role of rickshaws in keeping the cities moving. What are their common allegations against rickshaws and what are the actual facts? **(8+7)**

(c) What are the differences between supply based solutions and management based solutions to urban transport problems? **(10)**

6. (a) Since the independence of Bangladesh, there has been a bias towards road based transport system development. Do you agree with this statement? Illustrate your answer with facts. Also discuss the causes of such bias in our development policies. **(10+6)**

(b) Discuss the advantages and disadvantages of bus based rapid transit (BRT) and rail based rapid transit (MRT). **(8)**

(c) Briefly discuss the sociological concept of mobility as opposed to engineering concept of mobility. **(11)**

7. (a) Among other reasons, route orientation, fragmented network and inconsistency in gauges are identified as barriers to development in railway sector of Bangladesh. Explain these three reasons. **(12)**

PLAN 345

Contd... Q. No. 7

(b) Car and motor bike based urban mobility is strongly discouraged in countries with higher quality of life and environment. Explain why? **(10)**

(c) Discuss the approaches of parking policies and regulations of different Asian countries. **(13)**

8. (a) Name the organizations involved in transport related decision making and implementation in Dhaka. Describe their role. **(5+8)**

(b) Critically discuss the policy recommendation in strategic Transport Plan (STP) and Revised STP (RSTP) of Dhaka keeping in mind 'pedestrian first and private vehicle last' context. **(12)**

(c) Discuss the role of technology in developing sustainable, equity based and eco-friendly mobility system. **(10)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2   BURP Examinations 2016-2017

Sub : CE 363 (Elements of Civil Engineering Structures)

Full Marks: 210   Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) Determine the number of bolts needed in a bearing-type connection as shown in Fig.1. Use three bolts per row and draw a neat sketch of final design. Follow AISC/LRFD method and use ASTIM A 36 steel. Use chart 1 if necessary. **(20)**

   (b) What will be the lengths (L_1 and L_2) of filler weld (using E60XX electrode) at two sides of channel (see fig.2). Use Table 1 and Table 2 attached herewith. **(15)**

2. (a) Determine the buckling load (Pcr) of the built-up cloumn $\left(4L\,4'' \times 3\frac{1}{2}'' \times \frac{1}{2}'' \right)$ section as shown in Fig.3. Follow AISC/LRFD method and use ASTIM A36 steel. Properties of single angle $\left(4'' \times 3\frac{1}{2}'' \times \frac{1}{2}'' \right)$ section are attached in Table 3. **(20)**

   (b) A W 14 × 62 column section (length = 15′, one end fixed and other end pinned) is selected to carry an axial DL = 80 kip and LL = 220 kip. Check it's adequacy. Use A36 steel. Given properties of W14 × 62 section, $A_g = 24.1$ in², $r_x = 6.05$ in, $r_y = 2.48$ inch. **(10)**

   $$\sigma_{cr} = 0.658^{\lambda_c^2} \sigma_y; when\ 0 \le \lambda_c \le 1.5$$

   $$\sigma_{cr} = \frac{0.877}{\lambda_c^2} \sigma_y; when, \lambda_c \ge 1.5$$

   $$\lambda_c = \frac{KL}{\pi r} \sqrt{\frac{\sigma_y}{E}}$$

   (c) What do you mean by compact and non-compact steel section? **(5)**

3. (a) Design a W 12 beam section on a simple span of 30′ to support a dead load of 250 lb/ft (excluding beam self-wt) and live load of 300 lb/ft. Deflection under service load is limited to $\frac{1}{300}$ of span length. Follow AISC/LRFD method and use ASTM A36 steel. Properties of W 12 sections are attached at the end. See Table 4 for necessary calculation. **(20)**

   (b) A simply supported I beam has a symmetrical cross-section with following properties. **(15)**

           Moment of Inertia, I = 15,000 in⁴

           Cross-sectional Area, A = 190 in²

           and depth, h = 24 inch.

CE 363/URP

<u>Contd... Q. No. 3(b)</u>

The span of the beam is 20 feet. The prestressing force, immediately after transfer is 170 kips, with an eccentricity of 6 inch. The beam will support a service load of 500 lb/ft. Find concrete flexural stresses at mid span section at service load stage. Take loss of prestress as 8% of initial force.

4. (a) Design the shear-reinforcement of the beam as shown in Fig. 4. by USD method. **(20)**

    Given. $f'_c = 4$ ksi, $f_y = 60$ ksi

    (b) Determine the ultimate moment capacity of the beam section as shown in Fig. 4.

    Given. $f'_c = 4$ ksi, $f_y = 60$ ksi. **(5)**

    (c) Two plates are lap connected as shown in Fig. 5. Use E 60XX electrode. Design additional transverse weld "a" at the side of groove. Use A36 steel. **(10)**

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE** questions.

Assume reasonable values for missing data.

5. (a) What are the special advantages of reinforced concrete as a building material? **(8)**

    (b) A propped cantilever beam with a span of 15 feet is shown in Fig. 6. The beam has to carry a dead load of 1.5 kip/foot and a live load of 1.1 kip/foot. Bending moment diagram of the beam for a uniformly distributed load is shown in the figure. Calculate required beam depth and flexural steel requirements. Assume, beam width is 10 inches.

    Given $f'_c = 3$ ksi, $f_y = 40$ ksi. Follow USD method for the design. **(15+12)**

    Say, the roller support of the beam is removed after one year of construction. Check if the beam is safe to carry the above loads in this condition.

6. (a) Write down the ACI code requirements for lateral reinforcement of tied and spirally reinforced columns. **(8)**

    (b) Find the design moment capacity of the isolated RC T-beam shown in Fig. 7. Given $f'_c = 3$ ksi, $f_y = 40$ ksi. **(14)**

    (c) Design a short tied square column with 1.5% reinforcement for a service dead load of 400 kips and a live load of 350 kips. **(13)**

7. (a) Briefly discuss the types of structural slabs. **(5)**

    (b) Describe the behavior of RC beams under flexure at (i) low load, (ii) moderate load, and (iii) ultimate load. **(10)**

CE 363/URP

Contd... Q. No. 7

(c) A footbridge is to be built, consisting of a one-way solid slab spanning 15 feet between masonry abutments, as shown in Fig. 8. The slab is to carry its self-weight, a service live load of 100 psf. 2-inches thick asphalt wearing surface will be used on the slab weighing 20 psf. Assume, the slab is simply supported on the abutment. Given f'_c = 3 ksi, f_y = 40 ksi. Determine the thickness of the slab, and show the reinforcement details with neat sketches. **(20)**

8. (a) A RC rectangular beam has a width of 12″, a total depth of 25″ and effective depth of 23″. The tensile steel consists of 4#8 bars. Find the stresses caused by a bending moment M = 90 ft-kip. Given f'_c = 3 ksi, f_y = 40 ksi, n = 8, and f_r = 475 psi. **(15)**

(b) An 18″X18″ column carries a service dead load of 250 kips and a live load of 200 kips, and the column is supported on a square footing with base 5 feet below the grade. Design the footing, and show reinforcement details. Given f'_c = 3 ksi, f_y = 40 ksi. The allowable bearing pressure of soil is 5 kips/foot^2. Unit weight of the soil is 100 pcf, and that of concrete is 150 pcf. Assume, average unit weight of soil and concrete is 125 pcf. **(20)**
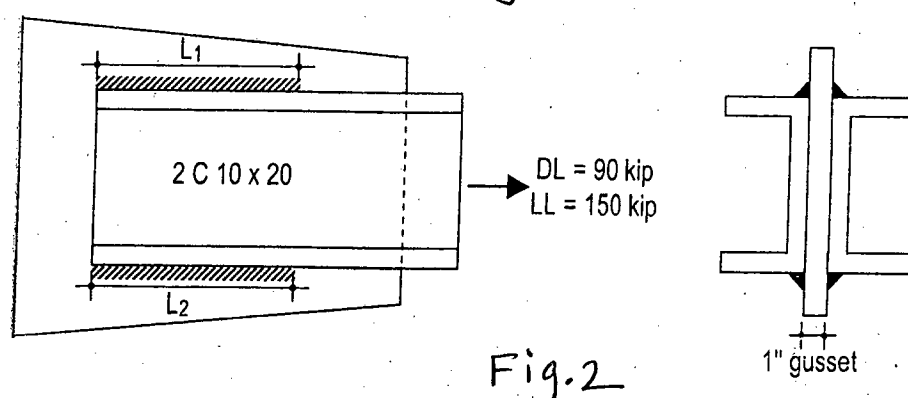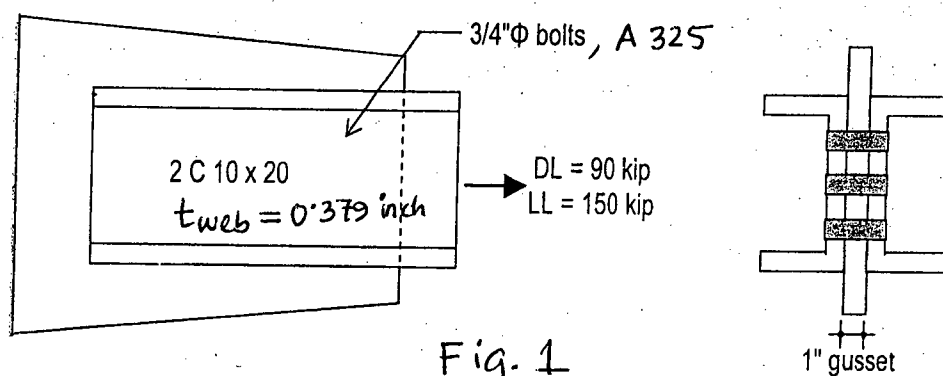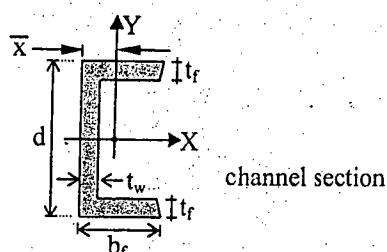

3/4"Φ bolts, A 325

2 C 10 x 20
$t_{web} = 0.379$ inch

DL = 90 kip
LL = 150 kip

1" gusset

Fig. 1

L₁

2 C 10 x 20

DL = 90 kip
LL = 150 kip

L₂

1" gusset

Fig. 2

chart : 1

$\bar{x}$

d

t_f

t_w

b_f

channel section

Properties of Channel section

Designation	Area (A)	Depth (d)	$\bar{x}$	Web Thickness (t_w)	Flange Width (b_f)	Flange Average thickness (t_f)	Nominal weight per foot	Axis X-X I	Axis X-X r	Axis Y-Y I	Axis Y-Y r
	inch²	inch	inch	inch	inch	inch	lb.	inch⁴	inch	inch⁴	inch
C 12×30	8.82	12	0.674	0.510	3.170	0.501	30	162	4.29	5.14	0.763
C 12×25	7.35	12	0.674	0.387	3.047	0.501	25	144	4.43	4.47	0.780
C 10×30	8.82	10	0.649	0.673	3.033	0.436	30	103	3.42	3.94	0.669
C 10×25	7.35	10	0.617	0.526	2.886	0.436	25	91.2	3.52	3.36	0.676
C 10×20	5.88	10	0.606	0.379	2.739	0.436	20	78.9	3.66	2.81	0.692

Table 1: Minimize size of fillet weld

Minimum fillet weld size (inch)	Maximum thickness of part(inch)
2/16	To $\frac{1}{4}$ inclusive
3/16	Over $\frac{1}{4}$ to $\frac{1}{2}$
4/16	Over $\frac{1}{2}$ to $\frac{3}{4}$
5/16	Over $\frac{3}{4}$ to $1\frac{1}{2}$
6/16	Over $1\frac{1}{2}$ to $2\frac{1}{4}$

Table 2: Minimum size of fillet weld

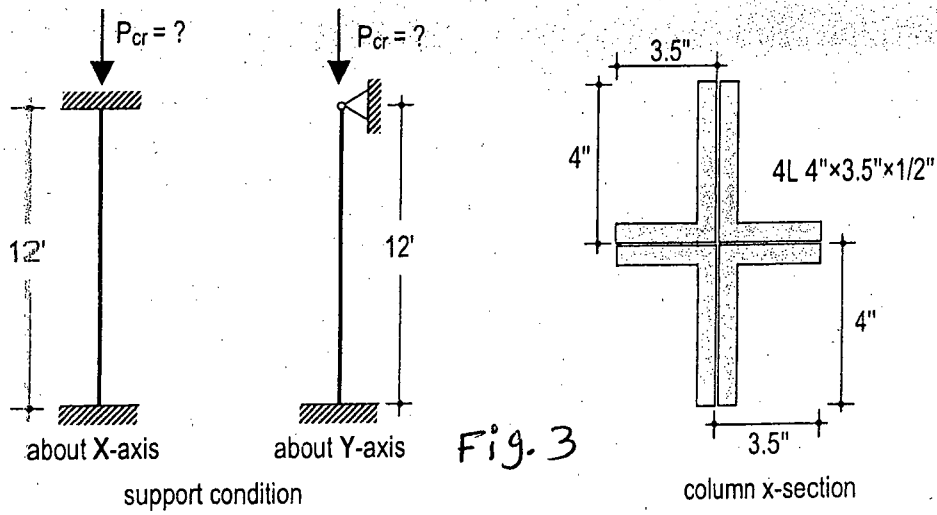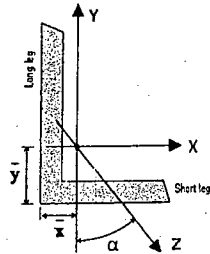| Maximum fillet weld size (inch)	Minimum thickness of part(inch)
Thickness of material	Less than $\frac{1}{4}$ inch
(Thickness of material – 1/16 inch)	$\frac{1}{4}$ inch & over $\frac{1}{4}$ inch

$P_{cr} = ?$ $P_{cr} = ?$

3.5"

4"   4L 4"×3.5"×1/2"

12'   12'   4"

about X-axis   about Y-axis   **Fig. 3**   3.5"

support condition   column x-section

Table 3: Properties of angle section (long leg vertical)

Designation	Area (A)	Axis X - X				Axis Y - Y			
		I	S	r	$\bar{y}$	I	S	r	$\bar{x}$
inch	inch²	inch⁴	inch³	inch	inch	inch⁴	inch³	inch	inch
L $4 \times 3\frac{1}{2} \times \frac{1}{2}$	3.50	5.32	1.94	1.23	1.25	3.79	1.52	1.04	1.00

12"

18"

○ ○ ○

20ᴷ   Total working load = 5 ᴷ/ft

10'

20'

Fig. 4

12"   Filet weld = 5/16"

6"

6"   a = ?   187 kip

4"

Thickness = 0.5"
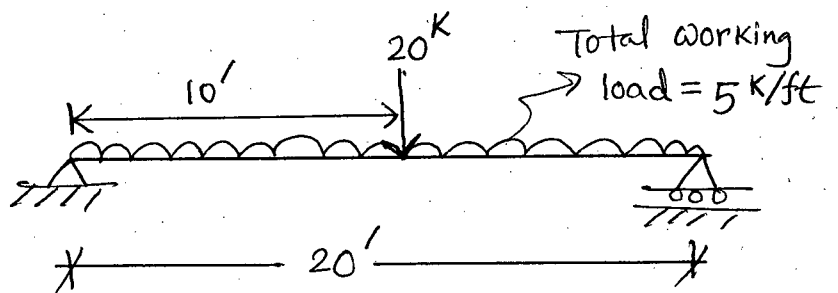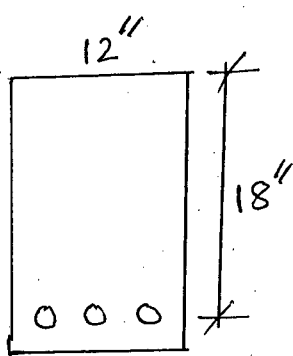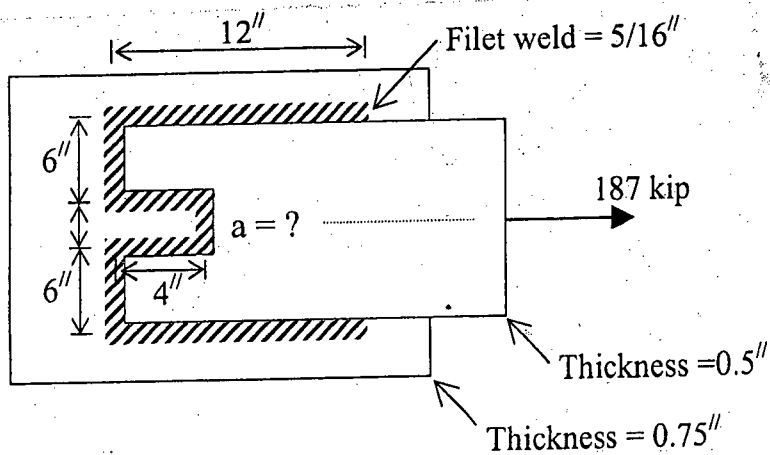
Thickness = 0.75"

Fig. 5

Table: 4

beam's component	width-thickness ratio (λ)	λ_p	λ_r
Flange of Channel section	$\dfrac{b_f}{t_f}$	$0.38\sqrt{\dfrac{E}{F_y}}$	$0.83\sqrt{\dfrac{E}{(F_y-10)}}$
Web of Channel section	$\dfrac{h_w}{t_w}$	$3.76\sqrt{\dfrac{E}{F_y}}$	$5.70\sqrt{\dfrac{E}{F_y}}$

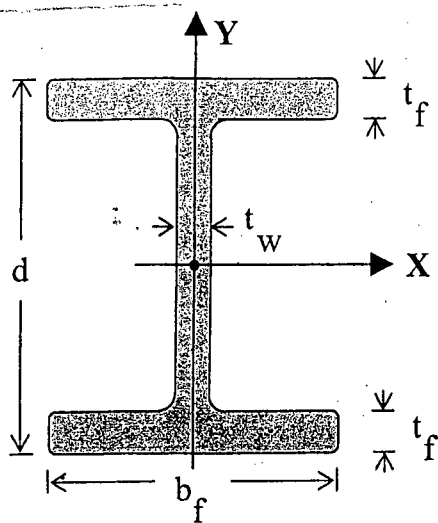| beam's component	width-thickness ratio (λ)	λ_p	λ_r
Flange of Box section	$\dfrac{(b-3t)}{t}$	$1.12\sqrt{\dfrac{E}{F_y}}$	$1.40\sqrt{\dfrac{E}{(F_y-10)}}$
Web of Box section	$\dfrac{(h-3t)}{t}$	$3.76\sqrt{\dfrac{E}{F_y}}$	$5.70\sqrt{\dfrac{E}{F_y}}$

Table: 5

Wide Flange Section (W Shapes) Dimensions & Properties

Designation	self-weight (lb./linear ft)	A (inch²)	d (inch)	I_{xx} (inch⁴)	I_{yy} (inch⁴)	r_x (inch)	r_y (inch)
W 12×336	336	98.8	16.82	4060	1190	6.41	3.47
W 12×305	305	89.6	16.32	3550	1050	6.29	3.42
W 12×279	279	81.9	15.85	3110	937	6.16	3.38
W 12×252	252	74.1	15.41	2720	828	6.06	3.34
W 12×230	230	67.7	15.05	2420	742	5.97	3.31
W 12×210	210	61.8	14.71	2140	664	5.89	3.28
W 12×190	190	55.8	14.38	1890	589	5.82	3.25
W 12×170	170	50.0	14.03	1650	517	5.74	3.22
W 12×152	152	44.7	13.71	1430	454	5.66	3.19
W 12×136	136	39.9	13.41	1240	398	5.58	3.16
W 12×120	120	35.3	13.12	1070	345	5.51	3.13
W 12×106	106	31.2	12.89	933	301	5.47	3.11
W 12×96	96	28.2	12.71	833	270	5.44	3.09
W 12×87	87	25.6	12.53	740	241	5.38	3.07
W 12×79	79	23.2	12.38	662	216	5.34	3.05
W 12×72	72	21.1	12.25	597	195	5.31	3.04
W 12×65	65	19.1	12.12	533	174	5.28	3.02
W 12×58	58	17.0	12.19	475	107	5.28	2.51
W 12×53	53	15.6	12.06	425	95.8	5.23	2.48
W 12×50	50	14.7	12.19	394	56.3	5.18	1.96
W 12×45	45	13.2	12.06	350	50.0	5.15	1.94
W 12×40	40	11.8	11.94	310	44.1	5.13	1.93
W 12×35	35	10.3	12.50	285	24.5	5.25	1.54
W 12×30	30	8.79	12.34	238	20.3	5.21	1.52
W 12×26	26	7.65	12.22	204	17.3	5.17	1.51
W 12×22	22	6.48	12.31	156	4.66	4.91	0.847
W 12×19	19	5.57	12.16	130	3.76	4.82	0.822
W 12×16	16	4.71	11.99	103	2.82	4.67	0.773
W 12×14	14	4.16	11.91	88.6	2.36	4.62	0.753

w_u

L = 15 feet

$\frac{9}{128} w_u L^2$

Bending
moment diagram

$\frac{3L}{8}$

$\frac{1}{8} w_u L^2$
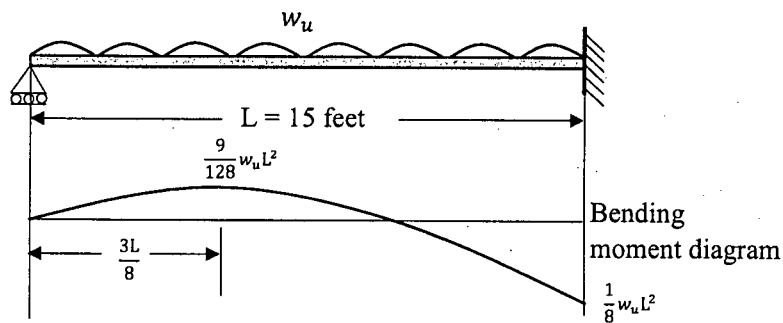
Fig.1: Bending moment diagram of a propped-cantilever beam.

25"

5"

#3@5"c/c

6#9
main bars

21" 25"

10"

25

Fig.2: An Isolated T-Beam.

L = 15 feet

(a)

6 feet

L = 15 feet
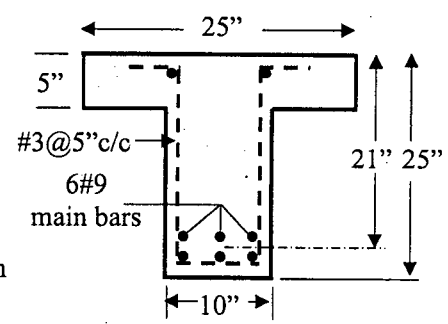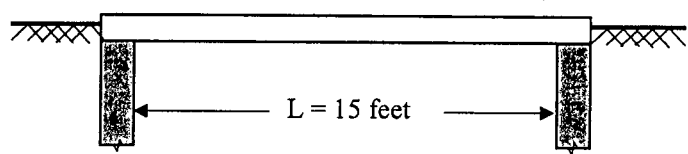
(b)
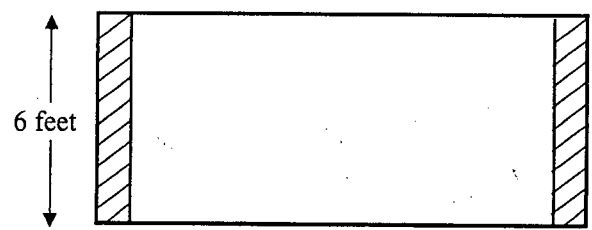
Fig.8: (a) Front elevation and (b) plan of a footbridge.