# CHAPTER 9

# LOAD CLASSIFICATION OF BRIDGE

## SECTION 13

## MILITARY CLASSIFICATION OF CIVIL BRIDGE

1301. **Introduction**. Most of the time it is found that existing civil bridges do not bear any load classification. As a result, they need to be assessed, classified and given a military load classification. This is a usual routine whenever a civil bridge is intended to be used by military vehicle both for troops and wheel vehicles. When the classification of a bridge is done in a non-military situation, it involves an considerable amount of time and detail measurement and calculation of each components of bridge structure. The accurate assessment is carried out basing on engineer knowledge of making a careful study of a bridge. In wartime, however, time will seldom be sufficient to do so. Bridges will usually have to be classified within 30 to 45 minutes by an experienced engineer officer. To perform this task an engineer officer has to resort to approximate methods. These methods are rapid and based on some general rules. They are not entirely accurate; but will provide a satisfactory result if applicable with inelegance. This section aims to teach how to attain such skill and obviously, it is a very critical one. Because, an error in classification may turn all the efforts in vain.

1302. **Method and Calculation**.

a. **Keys Used**. Following keys are used to denote various measurements and dimensions:

(1) E: Eff road-way width in ft.
(2) T: Road-way thickness in inches.
(3) N: No of girders.
(4) S: Distance between girder centers in ft.
(5) P: Safe UDL capacity of one girder in tons.
(6) Q: Dead load carr by one girder (including its own wt) in tons.
(7) X: Uniformly distributed live load capacity of all girders in tons.
(8) B: Width of girder in inches.
(9) H: Height of girders in inches.
(10) W: Thickness of wearing su/coat in inches.
(11) L: Length of span in ft.

b. **Steps of Calculation**. The steps are as following:

(1) **Calculate E**. You have to calculate the eff road-way width E in feet, under which the girders are regarded as sustaining the live load.

(2) **Calculate N**. You have to calculate the no of girders acting to take the load.

(3) **Calculate P**. Calculate the safe uniformly distributed load capacity 'P' (in tons) that one girder can carry. This is done in consultation with 'Table 10, section 14, ERPB-64'. In that table, the various relations are given according to the dimension of the girders. From those relations, the section modulus 'Z', a particular type of girder is ascertained. Then, basing on 'Z', span length 'L' and dead load 'WD' that is being carr 'P' is determined.

(4) **Calculate Q**. Calculate the dead load 'Q' (in tons) carr by one girder, including its own wt.

(5) **Calculate X**. Calculate the total uniformly distributed live load capacity of the girders in tons. It is: X = N (P-Q).

(6) **Find Corresponding Cl**. This is done by comparing the total uniformly distribution live load capacity 'X' with Appreciating EUDDL tables to obtain the corresponding cl.

(7) **For Two-way Cl**. The above mentioned cl is done for one-way cl of a br. In case of two-way cl, the steps will be:

(a) Calculate 'N' for two-way tfc.

(b) Repeat step 5 using new value of 'N' to obtain value of 'X' for two-way tfc.

(c) Repeat step 6 using the new value of 'X'.

1303. **Solution of Problem**.

a. **Solution of Problem**. Span of a bridge is 60 ft long having 12 numbers of 18" x 6" British standard steel beams spaced at 2ft intervals with 4 inch thick timber decking. Calculate one-way and two -way cl of the br. (Assume weight of timber 55 lbs/cft). (Consulting ERPB-1964).

(1) **One Way Class**.

(a) **Step -1**

E = (t+4) feet
= (4+4) feet
= 8 feet.

Where
E = Effective road-way width in feet.
t = Road-way thickness in inches
= 4 inch

(Ref : Section 14, para 9 - ERPB - 1964).

(b) **Step-2**

i. N = E/S+1
= 8/2+1
= 4 + 1 = 5
Where
N = Number of girders so acting.
S = Distance between girder centers in feet.
= 2 feet.

ii. Max value of N

N = 3/4 x Total number of girders in the bridge
= 3/4 x 12
= 9

Therefore, lesser value from above (1) and (2) is taken as N = 5

(c) **Step -3**

P = 8Z/L
= 8 x 152/40
= 1216/40

Where,

P = Safe UDL that one girder can carry in tons.
Z = Section modulus of steel beam in inch.
= 30.4 tons

L = Length of span in ft (Ref : Section 14, Para 9 ERPB-1964).

(Value of Z taken from table 24 ESPB No. 3 Br).

(d) **Step-4.**

Q = Weight of timber decking + weight of steel beam.

Where,

Q= Dead load Carried by one girder including its own weight in tons.

I. Decking.

(4" x 2" x 40') x 50 lbs
= 4/12 x 240) x 50 lbs.
= 1333 lbs.

II. Steel beam (girder).

40' x 75 lbs
= 3000 lbs
so, Q = 1333 + 3000
= 4333 lbs
= 4333/2240 tons
= 1.94 tons.
(Weight of steel beam taken from section 14, para-11, ERPB-1964).

(e) **Step-5**.

X = N (P-Q) tons
= 5(30.4 - 1.94)
= 5 x 28.46
= 142.3 tons
Where,

X = Total UDLL capacity of the girders so acting in tons

(f) **Step-6**. Comparing the value of X fol one-way cl is found out: (Ref: Section 14, Para 14 - ERPB - 1964).

i. For troop vehicle : Class 80
ii. For wheel vehicle : Class 100

Road way width of the bridge is (12 -1) x 2' = 22 feet, which is more than required min width. (Ref: Sec 14, Para 16 ERPB 1964)

Hence, final one-way cl of the br is 80 T and 100 w.

(2) **Two Way Cl**.

(a) **Step-7 (New value of N).**

(1) N = 3/8 x Total number of girders
= 3/8 x 12
=4.5
(Ref: Sec 14 Para 9 - ERPB 1964).

(2) Value of N for one-way cl is 5.
Comparing (1) and (2) above lesser values taken; hence N= 4.5

(b) **Step-8.**

= N (P - Q)
= 4.5 (30.4 - 1.94)
= 4.5 X 28.46
= 128.07 tons

(Ref: Section 14, Para 9 - ERPB - 1964).

(c) **Step-9.** Comparing the value of X follow two-way cl is found out: (Ref: Sec 14, Para 12 - ERPB - 1964).

(1) For troop vehicles : Class 70
(2) For wheel vehicles : Class 100

From road-way width consideration the br cannot be cl over cl 30 since its road-way width is 22 ft.

(Ref: Section 14, Para ld - ERPB - 1964).

Hence, final two-way cl of the bridge is cl 30 (common for troop and wheel vehicle).

Note: Impact factor has not been catered for, since the UDLs given in table of section 14, Para 9 – ERPB - 1964, including an allowance for impact.

1304-1400 Reserve.