Chapter Five

Resultsand discussion of results

5.1. General:

The analysis was carried out using SAP 2000 version 14.2.Grillage analysis method is used for analysis the modelof casestudied. After the completion modeling input data steps, analysis was run to gain the expectedresults; the finite element method is the tool that the programis used during analysis.

5.2. Results of case studied:

The analysis for studied structure has been carried out by applying HA alone (UDL+KEL) loading and (HA+HB) loading as shown in (case1).

Combinations for ultimate (ULS C1 & ULS C2) and serviceability (SLS C1&SLS C2) states are shown as follow:

- **Ultimate:**

1- ULS C1 = (1.15) Self-weight + (1.75) Surfacing + (1.2) Railing + (1.5) HA alone.

2- ULS C2 = (1.15) Self weight + (1.75) Surfacing + (1.2) Railing + (1.3) (HA+HB).

- **Serviceability:**

1- SLS C1 = (1) Self-weight + (1) Surfacing + (1) Railing + (1) HA alone.

2- SLS C2 = (1) Self weight + (1) Surfacing + (1) Railing + (1) (HA+HB).

The results obtained from the computer analysis for ULS C1, ULS C2 and SLS C1, SLS C2is shown in the table below.

(1) Sap Program obtained results forHA alone :

Table (5.1): Max obtained results of HA alone

Load combination	Beam	
	M max (KN.m)	S.F max (KN)
ULS C1	2921.5	745.71
SLS C1	2125.35	534.69

(2)Sap Program obtained results for (HA + HB) Loading :

Table (5.2): Max obtained resultsof (HA + HB) Loading

HB Position	Load combination	Beam	
		M(max) KN.m	S.F(max) KN
P(1)	ULS C2	3000.91	921.47
	SLS C2	2374.51	722.29
P(2)	ULS C2	2998.08	921.47
	SLS C2	2375.61	722.29
P(3)	ULS C2	2956.77	921.47
	SLS C2	2336.49	722.29

5.3.Comparison of obtained results with original design:

Table (5.3): Compression of obtained results and original design

		Obtained results	**Original design**
Girder	Depth	1200mm	1200mm
	Width	500mm	500mm
	Compression Rft (Asmin)	4 T 16	5 T 16
	Tension Rft	15 T 25	14 T 25
Slab	thickness	220mm	220mm
	Transverse Rft (top)	T 16 @ 250	T 16 @ 200
	Transverse Rft (bottom)	T 16 @ 250	T 16 @ 150
	Longitudinal Rft(top)	T 12 @ 300	T 12 @ 200
	Longitudinal Rft (bottom)	T 12 @ 300	T 12 @ 200

- Rft means reinforcement.
- For original design see appendix (B)

The girder maximum ultimate moment obtained from position (1) , where the Center of gravity of the HB vehicle divides the distance between center line of the bridge and near axle equally .

The ultimate &Serviceability shear forces are equal in all positions.

The girder maximum Serviceability moment obtained from position (2), wherethe Center of gravity of the HB vehicle located in center line of the bridge.

5.4.By comparing between two results among Table (5.2), observed the following:

- **Girders :**

The obtained results approximately are the same with the original results(percentage 94%).

- **Slab :**

Transverse reinforcement:

Steel Reinforcement in the bottom layerof deck slab is observed that the obtained results isLess simple difference from original design (percentage 67%), but in top layer the two results are convergent (percentage 80%).

Longitudinal reinforcement:

Quantity of steel reinforcement produced fromobtained results islesssimple difference than original results in both layers(percentage 70%).