Vishvadeep Sharma, 2021, 9:2
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

Structural Investigation and Optimization of Long Span with Short Span of Hypothetical Bridge

(Observation Report)

M. Tech. Scholar Vishvadeep Sharma,Prof. Sourabh Dashore
[1, 2] Department of Civil Engineering,
Sanghvi Institute of Management & Science,
Indore, (M.P.) India

Abstract- Bridges have an important role in impacting the civilization, growth and economy of cities from ancient time until these days due to their function in reducing transportation cost and time. Along these lines, improvement of extensions has been an information area in structural designing investigations regarding their sorts and development materials to affirm a dependable, sheltered, financial plan and development. Brace scaffold of the solid deck and I- bar support has been utilized generally for short and medium-range spans due to straightforwardness and ease of manufacture. Nonetheless, numerous hypothetical and pragmatic examinations are as yet attempted concerning the kind of bar brace; i.e steel composite or prestressed concrete. This paper assesses the impact of extension range and the kind of support on the capital expense and life cycle expenses of scaffolds. Three kinds of braces were explored in this examination: steel composite, pre-tensioned pre-focused on cement and post-tensioned pre-focused on concrete. The basic plan was investigated for 6.2 m range lengths to 9.3 m. At that point, the capital development cost was represented extensions as per each length and development materials. Besides, the upkeep needed for a very long time of extension life was assessed and developed as entire life costs for each scaffold. Because of this examination, the impact of both range length and sort of brace on starting development cost and upkeep entire life costs were evaluated to help the chiefs and creators in the choice cycle for the ideal arrangement of support spans.

Keywords:- Bridge, Structural Designing, Span length.

I. INTRODUCTION

Establishment For interstate scaffolds, composite extension deck utilizing a strengthened solid section more than at least three steel supports is more mainstream than steel scaffold and solid scaffold. The composite scaffold additionally diminishes commotion and vibration levels in contrast with steel connect, and are, consequently, earth cordial. Composite extensions are lighter, ensure better quality and have simpler and quicker erection than solid scaffolds. In late pattern pre-focused on solid scaffolds have been growing the pertinent range length and are turning into a hard contender against steel extensions and solid scaffolds. Steel spans, along these lines, need novel plans to recapture intensity. Steel plates have high elasticity yet are moderately helpless against clasping brought about by compressive powers and should be solidified and reinforced. Obstruction against clasping of the composite structure increments when steel supports are joined with strengthened solid deck chunk. The utilization of outside post-tensioning for the fortifying of existing extensions has been accounted for to give a productive and monetary answer for a wide scope of scaffolds.

We are attempting to make a pressure between to the same length connect with various range length the method is filling in ubiquity in view of the speed of development and hence forth outside post-tensioning for prestressed solid scaffolds is utilized in numerous nations in the development of new extensions. While new extensions are built utilizing outer post-tensioning, throughout the most recent twenty years outside post-tensioning has additionally been considered as one of the most impressive strategies for basic reinforcing and restoration.

The presence of early age cross over breaking in solid scaffold decks is regularly what prompts the inevitable basic lack of extensions over the long haul, in light of the fact that these breaks grant the entrance of unsafe substances into solid extension decks. With the presence of breaks in solid scaffold decks, water, sulfates, chlorides, and other possibly destructive specialists ready to penetrate to the inside of the extension deck and create additional decay as considerably bigger breaks, potholes and in the long run, lost cross-part of the scaffold deck or fortifying steel, which at last prompts a hazardous extension. The fix of solid scaffold decks is frequently troublesome and costly on the grounds that backup courses of action are in some cases troublesome or difficult to get.

To keep disintegration from beginning in any case, concrete must not be permitted to break, particularly at an early age. For a solid structure, to be workable, breaking must be controlled and avoidances must not be exorbitant. It should likewise not vibrate exorbitantly. Solid shrinkage assumes a significant part in every one of these parts of the administration load conduct of solid structures [4,5]. Workableness disappointments of solid Deck-type spans visit those during which the street deck is carried on the top projection or on high of the supporting braces.

The deck square or sleeper may cantilever undaunted some degree on the far side the intense longitudinal support. As indicated by the between length relations as simple, constant or cantilever spans.

Essentially upheld For the most part expansiveness of extension is part into the scope of individual ranges. For each length, the heap conveying part is simply upheld at each closure. The plate pillar and bracket supports square measure utilized as such a scaffold. They are fitting at places any place lopsided settlements of establishment's square measure apparently to happen.

II. LITERATURE REVIEW

Caroland et al. 1992, Number et al. 2003, PCI 2004). Lin et al. (1968) Splicing is certainly not another idea. A few instances of joined support extensions can be discovered going back to the 1950s. Since the presentation of prestressed concrete, just about 33% of the scaffolds worked in the United States are made of prestressed concrete. The standard I-brace and bulb tee support have gotten extremely regular for straightforward range spans for range lengths up to 150 ft. As the upside of utilizing prestressed concrete for spans turned out to be clearer, there emerged a requirement for discovering elective techniques for expanding range lengths of prestressed solid extensions. Higher quality concrete, bigger width prestressing strands and different techniques were distinguished for expanding the range lengths. Grafting joined with these techniques was found to have the greatest favourable position. Joining was at first utilized for straightforward ranges and afterwards stretched out to consistent ranges, along these lines further expanding length lengths.

In the mid 21st century grafted brace spans have accomplished range lengths in the scope of 320 ft. Normal issues looked According to Dekker (2000), the most concerning issue engineers (60%) face while making an answer for a scaffold is the absence of time for finding the most ideal arrangement.

Frequently a too brief timeframe period is accessible for a reasonable plan and normally designs will in general glance back at past activities or utilize their involvement with a request to rapidly give solid and savvy arrangements. Just 50% of the talked with engineers addressed that they utilize an organized methodology for a reasonable plan, Dekker (2000).

Subsequently, during the meetings completed by the Authors, it turned out to be certain that the architects tend not to recall the entirety of the choices they had as a main priority and figure just the last applied proposition. Another found issue was the troubles when assessing and thinking the expense of another structure both for development and upkeep.

Castrodale, R.W. also, White, C.D. (2004). "Expanding Span Ranges of Precast Prestressed Concrete Girders." Transportation Research Board, National Cooperative Highway Research Program, Report No. 517, 603 uneven stacking to eliminate impermanent shoring and forestall traffic obstacle. A further bit of leeway can be acquired by inflexibly interfacing the cap pillar and the wharf head. Utilizing slanted docks was suggested for expanding the range lengths as it kills the shoring towers and gives soundness during development. introduced different choices for expanding span range lengths as a feature of NCHRP venture 517. Along side high-quality concrete, numerous different methods have been distinguished. These incorporate material related alternatives, plan improvements, post-tensioning and grafted support development Ronald, H.D. (2001).

"Plan and Construction Considerations for Continuous Post tensioned Bulb Tee Girder Bridges." PCI Journal, 46(3), 44-66. Ronald (2001) summed up huge numbers of the significant issues in the development of grafted brace spans. The article zeroed in on an incompletely shored arrangement of development and gave plan guides to three-length and five- range units. The Wonder wood Connector has a three-range primary unit that comprises of a joined support connect with range lengths of 195-250-195 ft. The support portions were 78 in. profound Florida bulb tees. The drop-in support portions and end-sections are 140 ft long and the rump brace

III. RESEARCH METHODOLOGY

Principle targets of the proposition are to perform Dynamic investigation and to get various exhibitions of various state of structures situated in India and to assess shear powers, upsetting second, Lateral dislodging and execution.

The venture's driving point is to play out a correlation between two cases, where the present norm and elective specifying arrangements were considered for each case, for various types of limited capacity to focus Long-traverse spans.

The examination ought to be completed by utilizing investigations along with encounters of common boundary related with chosen sorts of existing scaffolds.

- To study the performance of different span bridge with geometric irregularities.
- To study the effect of shear on the bridge having geometric irregularity with and without shear load.
- To study this effect on the parameters lateral displacement and performance. To compare the bridge for above parameters for long span and Short span.
- To study the performance of bridge with geometric irregularities and also study about the Rectangular shape with & without shear load.
- To also calculation maximum bending moment, maximum shear force, maximum axial force in beam and column.

IV. DESIGN METHODOLOGY

Various combinations of cross-section were generated to optimize the resulting bridge profiles keeping the maximum flexural stresses and maximum deflection at the mid span within the permissible limits. Resulting bridges were studied to investigate the influence of prestressing force and girder spacing.

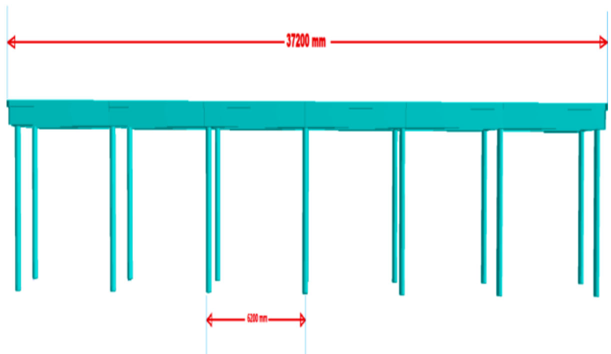

Fig 1. Short Span.

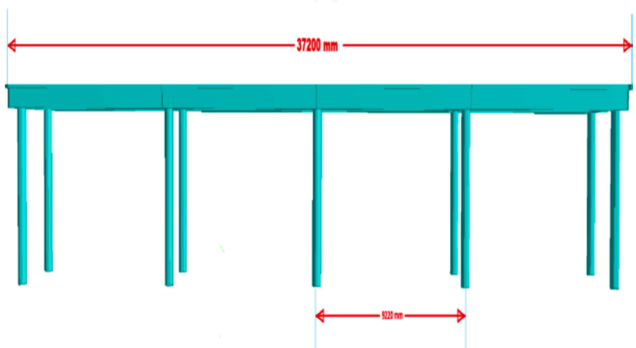

Fig 2. Long Span.

1. Cost analysis of different simple-span bridges:

This study carried out and compared two types of cost analysis for each bridge span: (a) comparison analysis for only the initial capital costs; and (b) cost analysis including the initial costs and 50-year life cycle costs encompassing the maintenance costs.

The life cycle costs are derived using Eqs.

$$F_V = P_V(1+i)^n$$
$$P_V = F_V[1/(1+r)]^n$$

Where,

- FV is Future Value of n number of years.
- PV is Present Value.
- i is the inflation rate.
- r is the interest rate.

Table 1. The relationship between span and depth of the girder for 6.2 M span length.

Depth of girder	Pre- Tension	Post - Tension	Composite
0	0	0	0
0.3	0.75	0.75	0.75
0.5	0.91	0.91	0.86
0.7	1.2	1.2	1.12

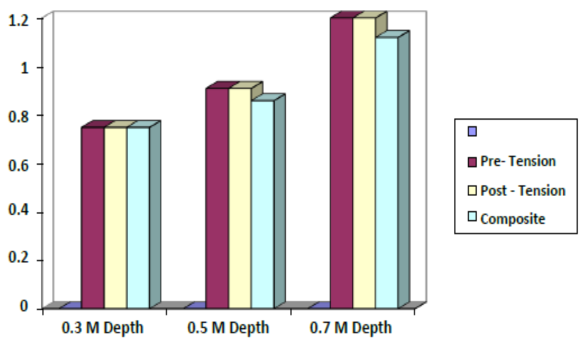

Fig 3. The relationship between span and depth of the girder for 6.2 M span length.

Table 2. The relationship between span and depth of the girder for 9.2 M span length.

Depth of girder	Pre- Tension	Post - Tension	Composite
0	0	0	0
0.3	0.86	0.86	0.87
0.5	0.98	0.98	0.93
0.7	1.32	1.32	1.24

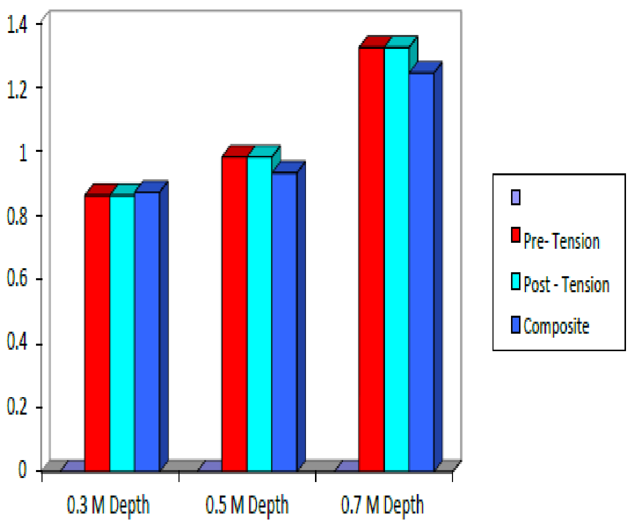

Fig 4. The relationship between span and depth of the girder for 9.2 M span length.

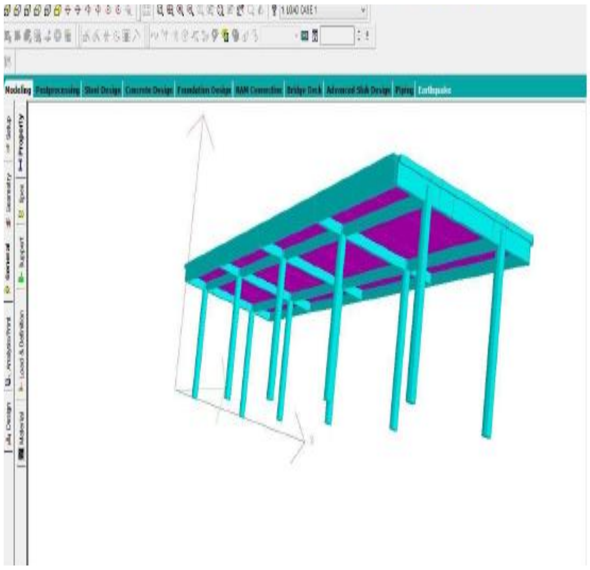

Fig 5. 3 D View of the Long Span Bridge.

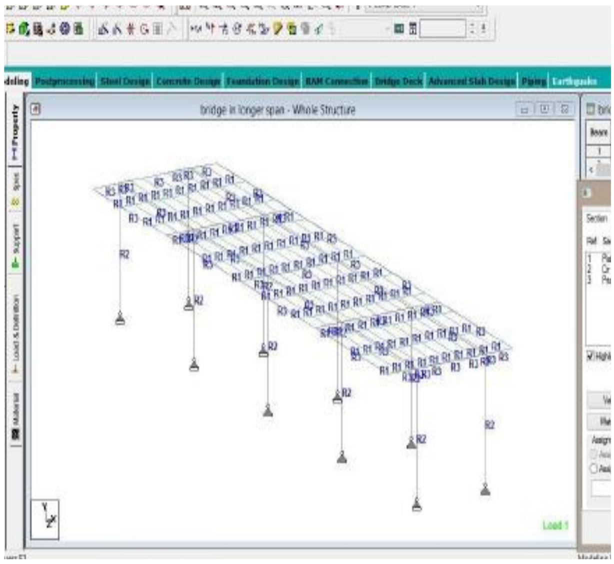

Fig 6. Node Concentration

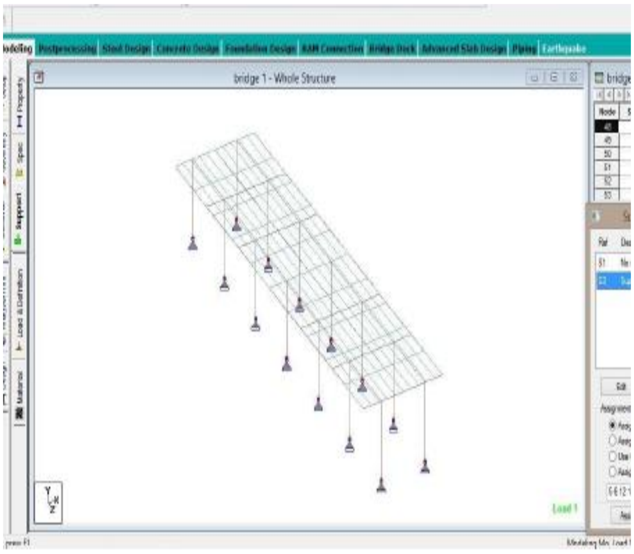

Fig 7. Short Span.

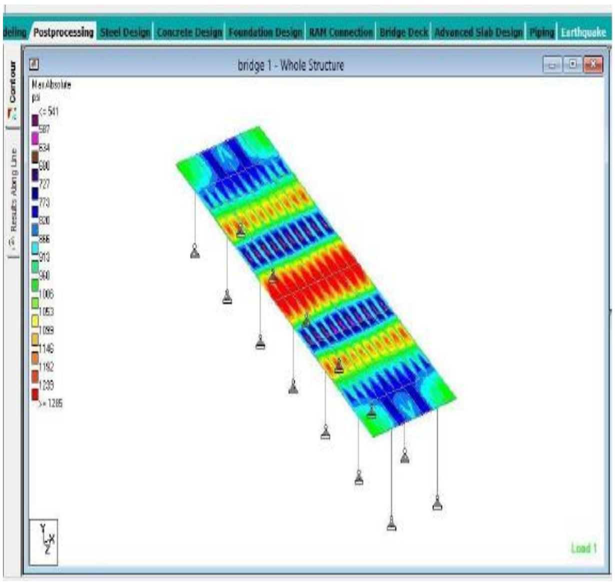

Fig 8. Load Analysis.

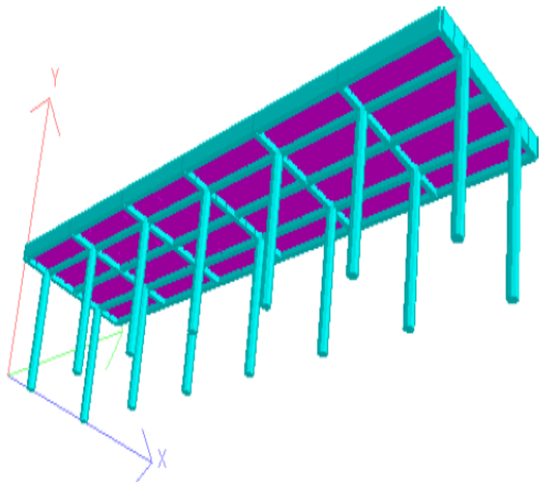

Fig 9. 3 D View of the Long Span Bridge.

Table 3. Short Span Bridge.

TOTAL VOLUME OF CONCRETE = 45.3 CU.METER

BAR DIA (in mm)	WEIGHT (in New)
8	7424
10	2681
12	9453
16	1728
20	3487
25	703
*** TOTAL=	25476

Table 4. Long Span Bridge.

TOTAL VOLUME OF CONCRETE = 40.2 CU.METER

BAR DIA (in mm)	WEIGHT (in New)
8	6827
10	2082
12	9014
16	1489
20	3121
25	682
*** TOTAL=	23215

Table 5. Overall analysis.

S. No.	Factors	Long Span Bridge	Short Span Bridge
1.	Volume of Concrete(in m^3)	40.2	45.3
2.	Cost of Concrete (in rupees)	216235.80	243668.70
3.	Weight of Steel (in KG)	23215	25476
4.	Cost of steel (in rupees)	1160750.00	1273800.00
5.	Total Cost of material	1376985.8	1517468.7
6.	% Difference in cost of material		10.20%

V. CONCLUSIONS

As we can observe that there is some difference between long and short span bridge on the material quantity for same length bridge. We have made a formal conclusion for very small length.

REFERENCES

[1] Carlos Sousa1, Helder Sousa, Afonso Serra Neves and Joaquim Figueiras, (2012) Numerical Evaluation of the Long-Term Behavior of Precast

Continuous Bridge Decks, Journal of Bridge Engineering, Vol. 17, No. 1, 89-96.

[2] Ronald, H.D., and Theobald, D. (2008). "Standardizing Existing Spliced Girder Systems." National Bridge Conference, Orland, Florida,

[3] Castrodale, R.W. and White, C.D. (2004). "Extending Span Ranges of Precast Prestressed Concrete Girders." Transportation Research Board, National Cooperative Highway Research Program, Report No. 517, 603.

[4] Nicholls, J. J., and Prussack, C. (1997). "Innovative Design and Erection Methods Solve Construction of Rock Cut Bridge." PCI Journal, 42(4), 42-55. (1997).

[5] Castrodale, R.W. and White, C.D. (2004). "Extending Span Ranges of Precast Prestressed Concrete Girders." Transportation Research Board, National Cooperative Highway Research Program, Report No. 517, 603.

[6] Ronald, H.D. (2001). "Design and Construction Considerations for Continuous Posttensioned Bulb Tee Girder Bridges." PCI Journal, 46(3), 44-66.

[7] Daly A. F. and Witarnawan W. (1997), ―Strengthening of bridges using external post tensioning, Transport Research Laboratory, Birkshire, U.K.

[8] DD ENV-1992-1-1 Eurocode 2, Design of Concrete Structures, British Standards Institute.

[9] Giussani F., Mola F. and Palermo A. ―Continuity effects in composite steel-concrete railway bridges Proc. 6th Int. Conf. Maintenance and Renewal of Permanent Way, Power and Signaling; Structures and Earthworks, Engineering Technics Press, Edinburgh, UK. , (2003).

[10] IRC: 22-1986, Code of Practice for Road Bridges, Section VI, Composite Construction. Indian Road Congress, New Delhi.

[11] Bentz D. P. and Jensen O. M., (2004) ―Mitigation strategies for autogenous shrinkage cracking, Cem. Concr. Compos., 26(6), 677–685.

[12] Rise Structures, International Journal of Innovative Research & Developement, Vol 1 Issue 8 October 2012.

[13] J. Memmott, Highway Bridges in the United States—an Overview, U.S. Department of Transportation, Bureau of transportation statics, special report (2006).

[14] Road and Transport Authority (RTA), RTA statistics 2012 (2012). B. Boatman, Prestressed vs. Steel Beams: Expected Service Life, Michigan Department of Transportation, State of Michigan (2010).

[15] Lin, T. Y., Kulka, Yang and Associate (1968). "Prestressed Concrete for Long- Span Bridges." Prestressed Concrete Institute, Chicago, IL.

[16] B. C. Bhagyashree C Jagtap and M. Shahezad , Comparative Study of Prestressed Concrete Girder and Steel Plate Girder for Roadway Over Bridge, International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), 2(1), pp.113- 117 (2016).

[17] Bureau of Indian Standards: IS-875, part 1 (1987), Dead Loads on Buildings and Structures, New Delhi, India.

[18] Giordano, A., M. Guadagnuolo and G. Faella, 2008. ―Pushover Analysis of Plan Irregular Masonry Buildings‖. Inthe 14th world conference on earthquake engineering. Beijing, China, 12-17.

[19] H.K.Baker and G.E. Powell, Understanding Financial Management, Blackwell Publishing Ltd., USA (2005).

[20] IRC: 6-2000, ―Standard specifications and Code of Practice for Road Bridges, Section II, Loads and Stresses, Indian Road Congress, New Delhi.

[21] IS 1343:1999, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi.

[22] IS 2062: 1999, ―Steel for General Purposes Bureau of Indian Standards, New Delhi.

[23] IS 800: 2007, General Construction in Steel - Code of Practice Bureau of Indian Standards, New Delhi.

[24] Kasim.S.Y and Chen.A. (2006), ―Conceptual design and analysis of steel concrete composite bridges" Technical article.

[25] Kim H. Y., Jeong Y. J., Kim J. H. and Park S. K. (2005), ―Steel concrete composite deck for PSC Girder bridges. Journal of Civil Engineering, ASCE, Vol-9, No.-5, September.pp.385-390.

[26] Miyamoto A., Tei K., Nakamura H., and Bull J. W. (2000). "Behavior of Prestressed Beam Strengthened with External Tendons." Journal of Structural Engineering, 126(9), 1033-1044.