

Finite Element Investigations for The Purpose of Widening of an Old Arch Masonry Bridge Located Over National Highway No-17

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Abstract— This paper mainly deals with finite element investigations (to assess the widening of existing structure) for old masonry arch bridges. It has mainly two objectives first being to present salient features of the methodology of the plain strain finite element analysis of the bridge system. Second being is to demonstrate the application of the develop software a case history of an existing masonry arch bridge over national highway no-17 (Maharashtra State, India).

Keywords— arch bridge, bridge widening, FEM, masonry bridges

I. INTRODUCTION

Earlier, many of the highway bridges in our country were built in the form of Brick or CR masonry arches, supported over the abutment and piers also made from the same materials. In many cases those bridges, which were built several decades ago, were designed to cater to the traffic prevalent in that period. On inspection of these bridges, however, an inescapable conclusion could often be drawn that in spite of aging, the bridges could be strong enough to permit their widening to cater to the Present requirements of the traffic rather than abandoning such bridges.

II. OBJECTIVE

1. To present salient features of the methodology of the plain strain Finite Element Analysis of the bridge system.
2. The required analysis software is developed to cater to the general purpose applicability towards such bridge systems.
3. To demonstrate the application of the develop software a case history of on existing masonry arch bridge over NH-17 is taken above.

III. PREVIOUS WORK

Formidable amount of work have been done on the analysis of old masonry arch bridges in India as well as at work level. This would be systematically presented as important part of the dissertation.

IV. PROPOSED METHODOLOGY

The method of designing for the widening and the existing bridge has following features.

1. The existing bridge has carriage width of 5.3m to 6.3m which could tackle only one lane traffic the widening of this bridge will need to cater to a two lane traffic system which would be having a carriage width of more than 7.5m and also the width would have to accommodate the additional features such as, marking of the lanes through divide walls and also provision of footpaths on either sides.
2. For the above purpose the Finite Element Analysis is conducted in two stages.

STAGE-I:-

Considering central section of the existing bridge width 1m width and conducting a plain strain Finite Element Analysis, wherein all kinds of IRC wheel loadings are considered to arrive at details of critical loading systems.

STAGE-II:-

In the STAGE-II the actual 3-Dimensional structure of the existing bridge is considered along with integration of a concrete deck of required width and as mentioned above the additional features, now a 3-Dimensional Finite Element Analysis is performed.

3. The analysis results are utilized towards the design of the modified bridge systems.

V. EXPERIMENTAL WORK

The experimental work for this kind of work is highly expensive and time consuming and is has no validity for the proposed work. However some aspect of the prototype load tests conducted by Indian Railway is included as a demonstration as to what could be the nature of the experimental work.

VI. CONCLUSION

The work presented in the paper discusses the method of analysis and offers conclusions based on the after performed analysis.

REFERENCES

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