Analysis of A Arch Type Bridge Using Analysis Tool: A Review

Vivek Mandage[1], Praveen Ghidode [2]
[1] Dept of Civil Engineering
[2] Assistant Professor, Dept of Civil Engineering
[1, 2] Sam Global University, Raisen-464551, Madhya Pradesh, India

Abstract- Bridges connect the geographical areas surrounded with barriers for effective movement of roadways, train and locomotives. Such barriers are valley, water stream and long span flyovers to speed up traffic in metro cities. Such bridges are classified in type of shapes namely arch, slab and box shaped bridges or material used namely masonry (brick, stone etc.) or reinforced cement concrete. Since bridge go through the earthen bank, these are exposed to same traffic loads as the street conveys and in this manner, needed to be intended for such loads. The pad relies upon rail profile at the bridge area.

This paper presenting review of literature considering analysis.

Keywords- Analysis, bridge, staad.pro, IRC, structure, forces, displacement, stone masonry.

I. INTRODUCTION

Bridge are great structures which glide the pathway above the obstacles in different scenario as bridge can be tough when gliding over a river, or an elevated bridge in form of flyover or even may be in form of elevated metro bridges. Such bridges can provide passage for roadways, railways, pedestrians and valley. Bridges are generally classified on basis of their shape and material and generally the specification of bridge depends on case to case or geography as different customization options are available proving to be economical in carrying loads and primary study is related to its resistance towards lateral loads.

Bridge is most useful structure for highway Structures and River & Canal structures in without any obstruction of water, traffic is flow out on structures. In Bridge structures many sort of vehicles like little vehicles, light vehicles and substantial vehicles are streaming in inevitably, so primary idea of bridge is the manner by which to end up a safe under different kinds of loading state of vehicles in a single bearing. By and large the vehicles are stream in structure, the heap of vehicles are Both side scatter in 45 degree from edge of feel burnt out on vehicle in both

longitudinal and parallel bearings implies ranges heading and length of Structure headings. So this scattering of load is specifically influenced to best of bridge (Deck section) and after that longitudinal support and in addition cross brace. After that the long individual from bridge superstructure like brace is transported the load towards the substructure of Bridge and afterward establishment to soil. The plan of superstructure is by and large utilized with RCC, however now a days in length range individual from Bridge utilizing with PSC, forget significantly more preferred standpoint and security of Structure.

II. LITERATURE REVIEW

Yutao Pang and Li Wu (2024) the examination paper explored the impact of post-quake tremors on seismic reactions of multispan built up concrete (RC) spans utilizing the delicacy based mathematical methodology. For that reason, a ceaseless support RC bridge class containing 8 extensions was chosen dependent on the factual investigation of the current RC spans in China. 75 recorded mainshock-delayed repercussion seismic arrangements from 10 notable tremors were chosen for the examination. To represent the vulnerability of displaying boundaries, uniform plan technique was applied as the testing strategy for producing the examples for delicacy investigation. Delicacy bends were then evolved utilizing nonlinear time-history examination as far as the pinnacle shape of wharf segment and dislodging of course. At last, the framework delicacy bends were determined by carrying out Monte Carlo reenactment on multi-ordinary dissemination of two parts.

Results expressed that for the RC continuous bridges, the impact of post-quake tremors can be damaging to both bridge parts and framework, which increments both the segment delicacy of the dislodging of direction and seismic load and flow of dock areas and framework delicacy. Furthermore, it is smarter to assess the weakness of extension framework, instead of just survey the impact of consequential convulsion dependent on a solitary segment.

Luca Pelà et.al (2023) the exploration paper introduced reasonable philosophy to assess the seismic security level of existing workmanship curve spans. Two specific cases were viewed as specifically a stone workmanship connect with block made vaults and a stone work bridge with concrete-made vaults. The primary investigation was done by utilizing an improved on inelastic method: the underlying limit, gotten by a nonlinear static (weakling) examination, was straightforwardly contrasted and the interest of the tremor ground movement portrayed by an inelastic reaction range, to assess the seismic presentation of the extensions.

The strategy characterized in the current work is by all accounts reasonable for a cautious seismic evaluation of existing bridge without falling back on specific bundles. Specifically, the seismic wellbeing of the S. Marcello Pistoiese Bridge and the Cutigliano Bridge was shown by discovering that their dislodging limits are higher than the seismic requests of the locales where they are situated, for the entire scope of the stone work material properties that bound the genuine ones.

Rahul Gangwar et.al (2020) This paper gives the similar investigation of R.C.C.(Reinforced Cement Concrete) Girder and P.S.C.(Prestressed Concrete) Girder, which incorporate the plan and gauges of R.C.C. also, P.S.C. Brace of different ranges. The point of this work is to contemplate R.C.C .brace just as P.S.C. support and afterward analyze the outcomes. The thought is to prevail in an unrivaled end in regards to the commonness of the 2 procedures over one another. R.C.C individuals are usually utilized for private just as business structures and are by and large limited capacity to focus. In R.C.C. profundity of support increments with the increment in range because of redirection limit. To deduce, R.C.C brace will be appropriate for little to medium range anyway the predominance of prestressed substantial support is evident for broadened ranges.

The conclusion from the outcomes expressed that Reinforced cement footers are for the most part hefty. They generally need shear fortifications other than the longitudinal support for flexure. Prestressed cement footers are lighter. By giving the bended ligaments and the pre-pressure, an impressive piece of the shear is stood up to. In built up cement footers, high strength concrete isn't required. Be that as it may, in prestressed cement footers, high strength concrete and high strength steel are important. Built up cement footers being enormous and hefty are more appropriate in circumstances where the weight is more wanted than strength. Prestressed cement footers are truly appropriate for hefty burdens and longer ranges. They are thin and imaginative medicines can be effectively given. Breaks don't happen under working burdens.

Regardless of whether brief break happens when over-burden, such break gets shut when the over-burden is taken out. The redirections of the prestressed cement footers are little. Prestressed substantial areas are more slender and lighter than RCC segments, since high strength cement and steel are utilized prestressed concrete.

Melika Naderi and Mehdi Zekavati (2018) the aim of examination was to research the seismic conduct of the extension. Nonlinear unique investigation was utilized for recreation of seismic conduct of the extension. Concerning intricacy in mechanical highlights and math of the extension, exact assessment of seismic conduct is a troublesome undertaking. Thusly, exploratory examination was utilized to expand the displaying accuracy.

Bridge mathematical displaying was utilized by mix of FEM and DEM. This combinational technique is a useful asset for break and disappointment recreation. Grinding was likewise used to expand the exactness of examination for precise recreation of Osmanli Bridge seismic conduct, blend of FEM and DEM was utilized. After 5.7 s from the quake the formation of breaks began in both parallel dividers. Toward the finish of the tremor, breaks were made in the curve which is around 1 cm. Because of the applied speed increase the squares would be discarded. Discrete reenactment was utilized for reproduction of Senyuva Bridge. A piece of right parallel divider was obliterated during the seismic tremor. The left horizontal divider likewise harmed however was not annihilated. The squares of the right divider were tossed along z course. The development of curve breaks expanded during the tremor and the most extreme break had the side of 4.5 cm. As per the aftereffects of mathematical examinations, mix of FEM and DEM is a productive strategy. Seismic limit of the two not really set in stone dependent on the consequences of mathematical investigations. It is prescribed to support the two bridges against the seismic tremors.

Wei-Xin Ren et.al (2010) the examination paper introduced a pillar curve fragment gathering system for the powerful displaying and investigation of curve spans. It is shown that the proposed pillar curve portion get together strategy is effective with the upsides of less component numbers and enough exactness. It is normal that this philosophy can be a viable methodology for the further powerful reaction examination of curve spans under a wide range of dynamic loads like seismic tremors, winds and vehicles.

Both normal frequencies and mode states of the Jian bridge determined from the proposed pillar curve fragment gathering system concur well with those got from the business

limited component investigation bundle ANASYS and field dynamic testing under functional vibration conditions. It is shown that the proposed pillar curve fragment get together methodology is appropriate and solid for the powerful examination of curve spans with the upsides of less component numbers and enough precision. It is normal that this strategy can be a successful methodology for the further powerful reaction investigation of curve spans under a wide range of dynamic loads like seismic tremors, winds and vehicles.

Hayder Ala'a Hasan et.al (2012) the essential goal of the exploration was to research the harm in the normal built up substantial bridge pier under seismic heaps of force same as that occurred nearby around Iraq and see if it will support such a tremor. The entire extension base and the encompassing soil were demonstrated utilizing ANSYS. The case under investigation was displayed utilizing the SOLID65 substantial component, which is utilized for demonstrating three dimensional strong models with or without rebars. The soil model is 18m long, 9m width and 17m profundity. The distances between focus to focal point of heaps are equivalent to 4.5m. Since the breadth of heaps is 1.5m, accordingly separates between the focuses of heaps and the edges of soil volume is 4.5m which is equivalent to multiple times the distance across of heaps.

The outcomes expressed that the diversions are little and inside permissible cutoff points, however the anxieties in the substantial were higher than the restrictions of the primary substantial plan cutoff points of the overall codes of work on, remembering the seismic tremor load applied was not extreme contrasted with quake occurred close to Iraq region. It is energetically prescribed to compel connect originators in Iraq to utilize and rely upon the unique arrangements for tremors in codes to cover such insufficiencies in pier plan.

L. Di Sarno et.al (2012) the exploration project targets examining the seismic conduct of existing R.C. bridge along with the examination of the viability of disengagement frameworks. The exploration program centers around the appraisal of an old R.C. viaduct with outline docks through PsD test. The trial program will be performed at the European Laboratory for the Assessment of Structures of Joint Research Center at Ispra (Italy). Specifically, two of the twelve docks will be underlying scale 1:2.5 though the excess piece of the viaduct will be mathematically reproduced.

A refined mathematical model has been utilized for fundamental reproduction of the seismic reaction of the whole viaduct; the model has been adjusted utilizing writing results and exploratory information coming from a test crusade did at the University Roma Tre on R.C. outline docks. This permitted to two or three wharfs to be truly tried during the experimentation. Every one of the vital parts of the issue have been here tended to: the most reasonable test rig design, the mix plan to be received during the PsD test, the determination of information, the mathematical model for both separated and non-segregated case.

Lina Ding et.al (2012) in the exploration paper, the nonlinear limited component examination, fusing the model refreshing method was utilized to foresee the conduct of a 30-year-old piece brace bridge. The first limited component model dependent on the plan drawings is refreshed by altering the solidness boundaries of the braces, piece, shear connectors and course so the vibration properties of the model match the field vibration estimation information. The refreshed model addresses the current state of the bridge better compared to the first model that depends on the plan outlines. The heap conveying limit of the bridge was determined utilizing the first and refreshed limited component models, separately, with thought of nonlinear material properties. The impact of the shear connectors on the heap conveying limit is extraordinarily researched.

The examination completed on the first model shows that the heap conveying limit of the extension is 1.67 occasions a definitive burden determined in the plan code and 20% higher than the limit determined by the experimental recipe. This shows that the observational equation thinks little of the heap conveying limit of extensions. The limited component model is then refreshed dependent on the field vibration tests. The nonlinear examination on the refreshed model demonstrates that the extension extreme burden conveying limit is about 1.49 occasions the ostensible burden, suggesting the scaffold is as yet protected under the current traffic condition, though 12% not exactly that assessed from the plan model. This activity exhibits that the refreshed model can address the real state of the bridge better and the heap conveying limit dependent on the refreshed model can give a more reasonable state of the extension.

S.Basilahamedand A.R.R.Kalaiyarrasi (2018) the exploration paper examined a solitary range two path t-shaft bridge by fluctuating the range of 25m, 30m, 35m and 40m where the width was kept consistent. The bridge models are exposed to the IRC class AA and IRC class 70R followed loading framework to acquire most extreme bowing second and shear power. The issue in continuum mechanics was approximated by FEM (limited component strategy) in STAAD Pro, which is general technique for primary examination.

From the examination it is seen that with the increment in the range, Courbon's strategy and limited component technique have no huge variety. Courbon's technique gives the normal outcome with deference BM esteems in the longitudinal support when contrasted with Guyon Massonet strategy. The outcomes were broke down and it was tracked down that the outcomes got from the limited component model are lesser than the outcomes acquired from one dimensional investigation, which implies that the outcomes got from I.R.C. loadings are traditionalist and FEM gives prudent plan.

Xiaoke Li et.al (2012) the exploration paper presented fundamental measurements and drawings and further examined the static insightful consequences of the bridge. The mathematical model was worked by the incorporated arrangement framework for bridge and structural designing MIDAS/Civil. The heaps, heap covers, pier, twisted covers, deck sections and associations between two adjacent supported substantial empty chunks were totally reenacted. The powers and removals of curve under the given loads and burden blends can be determined near the genuine qualities.
The appropriations of bending moment, hub forces, shear power and vertical dislodging along the curve hub demonstrate that sedimentation removal of curve toe and curve temperature are the key factors and should be thought about genuinely during configuration measure.

Ravikant and Jagdish Chand (2019) in the examination of bridge brace plan, three same models were ready in the STAAD genius and afterward there loadings are changed by IRC codes, Euro codes and AASHTO details separately. The range of the extension is taken as 25m in which braces are built. The size of longitudinal supports is taken as2000x500 mm and cross braces is 1500x250 mm. There are three longitudinal supports are considered having separating 2600 mm c/c and cross braces are considered as 5000mm c/c. The plan of supports is done utilizing the product STAAD Pro. The similar boundaries of the examination were the shear power, bending moment and space of steel in the plan of scaffold supports for example longitudinal supports and cross braces because of the use of various loading as per IRC codes, Euro codes and AASHTO particular.

The end got from the outcomes expressed that In examination of every one of the three codes, Euro code plans are over built up as contrast with the other two for example IRC codes and AASHTO particulars. In plan of extension supports with Euro codes shear powers, twisting second and diversion are practically twofold as contrast with the other two for example IRC codes and AASHTO particulars. Plan of extension braces (up to 25m) utilizing IRC codes are generally practical and more secure as contrast with the other two for example AASHTO determinations and Euro codes. IRC codes have the best blend of stacking and plan techniques as contrast with the other two for example AASHTO details and Euro codes. Since the plan of scaffold support utilizing IRC codes obtain least worth of diversion and bowing second so consequently IRC Class A loading is the most conservative and ideal stacking for the plan of extension brace in INDIA.

Alessandro Rasulo et.al (2020) the exploration paper introduced a limited component model for surveying the nonlinear conduct of RC connect wharfs under joined pivotal, shear, and bending moment. The model unequivocally considers the reaction brought about by the shear limit crumbling because of the association with flexural deformity.
This significant impact has been presented through the consolidation of a zero-length shear spring in series with a flexural section component and a rotational slip spring. A phenomenological bend for the shear reaction has been proposed and adjusted, practically catching the monotonic and cyclic reaction of segments, including the squeezing, the firmness relaxing, and the strength weakening because of distortions and cyclic burden inversions. A decent arrangement between the mathematical expectation and exploratory information was noticed.

S.Basilahamedand A.R.R.Kalaiyarrasi (2018) the examination paper dissected a solitary range two path t-shaft bridge by changing the range of 25m, 30m, 35m and 40m where the width is kept steady. The bridge models are exposed to the IRC class AA and IRC class 70Rtracked stacking framework to acquire greatest bending moment and shear power. The investigation was done utilizing IRC codal arrangements. T-pillar connect decks are one of the significant kinds of cast in situ substantial decks which comprise of a substantial chunk fundamental with supports. The issue in continuum mechanics is approximated by FEM (limited component technique) in STAAD Pro, which is general strategy for primary examination.

The outcomes were investigated and it was tracked down that the outcomes acquired from the limited component model are lesser than the outcomes gotten from one dimensional examination, which implies that the outcomes got from I.R.C. loadings are traditionalist and FEM gives affordable plan.

B. Ozden Caglayan et.al (2012) the examination paper introduced evaluation of a great substantial curve bridge with a complete length of 210 meters having three significant ranges of 30 meters and a stature of 65 meters, which is situated in a tremor inclined area in southern piece of the

turkey. Three-dimensional limited component model of the bridge was created utilizing a financially accessible general limited component investigation programming and in light of the results of a progression of inside and out speed increase estimations that were directed nearby, the model was refined. By utilizing the underlying boundaries got from the dynamic and the static tests, aligned model of the bridge structure was gotten and this model was utilized for important computations with respect to primary appraisal and assessment.

The results of the heap rating system show that the bridge has the ability to withstand proposed train loads with significant security. Notwithstanding, because of recorded legacy status of this monstrous design, most extreme consideration should be taken in activity just as upkeep of this bridge.

J. Kiyono et.al (2012) dynamic practices of a few stone angled extensions are mimicked utilizing the 3-dimentional DEM in the examination. Initially, by contributing a drive wave to the models as an information ground movement, their first normal frequencies in quite a while are figured, and their vibration attributes was explored. Also, seismic practices are figured and the disappointment event instrument is examined. Impacts of the material properties of the inlay and the range length on seismic practices and disappointment designs are likewise explored lastly, viability of support by embeddings mortar between stones was checked.

All models aside from the single angled ring model abstained from falling, and it is tracked down that the dissected stone curved scaffolds with inlay have the seismic obstruction. Notwithstanding, as the quantity of ranges increments or on the other hand if the limit condition is free in the side, or then again in case soils are stuffed inside the extensions, there is plausible that a few stones tumble down in light of the fact that the out-of-plane disfigurement increments. Thusly, to survey the seismic presentation, suitable demonstrating of the limit conditions in the sides and the material properties in the inlay is discovered to be significant. Seismic practices of built up models by embeddings mortar between stones are likewise processed and the adequacy was affirmed.

S. De Santis and G.de Felice (2012) a modelling approach dependent on fiber shaft components was utilized to address workmanship curves under seismic burdens. Non-straight powerful reproductions under a bunch of regular accelerograms are performed on round curves and contrasted with push-over examinations uncovering that a decent arrangement is discovered given that a heap dispersion is utilized that incorporates both flat and vertical burdens corresponding to the result of masses and first mode relocations, to represent the presence of non-invalid

dislodging segments in both vertical and even ways in the modular shape. Consequently, this has all the earmarks of being a satisfactory portrayal of the inertial powers emerging in the real reaction of a stone work curve under quake movement to be utilized inside push-over based seismic evaluation techniques.

Push-over investigations on curves based on columns show that the seismic limit diminishes with the wharf slimness, aside from when the dock is firm to such an extent that the breakdown systems doesn't include it. The impact of both old style and inventive fortifying strategies, for example, steel tie-bars and remotely fortified composite material strips applied on the curve extrados, is assessed. The previous forestalls the general development of the curve springers, while the last doesn't permit the break opening on the curve extrados. Therefore, the most vulnerable disappointment modes are obliged and a huge limit improvement was accomplished.

III. CONCLUSION

The literature review has suggested that use of a finite element modeling of the Arch Bridges with various material. So it has been decided to use STAAD.Pro for the Finite Element Modeling. With the help of this software study of bridge structure has been done considering Vehicular loading. STAAD.Pro also helps in Finite Element Modeling in view of that different type of forces can apply to get the actual results. In this literature review it is revealed that live project work to implement the same at site and to develop a relation between software and practical work implementation.

REFERENCES

[1] Yutao Pang and Li Wu, [Seismic Fragility Analysis of Multispan Reinforced Concrete Bridges Using Mainshock-Aftershock Sequences], Hindawi Mathematical Problems in Engineering, Volume 2018, Article ID 1537301, 12 pages.

[2] Luca Pelà, Alessandra Aprile and Andrea Benedetti, [Seismic assessment of masonry arch bridges], Engineering Structures 31 (2009) 1777_1788.

[3] RAHUL GANGWAR, ANKUR PRATAP SINGH and T.N.PANDEY, [Comparative Study of RCC and PSC Girder], International Research Journal of Engineering and Technology (IRJET), Volume: 07 Issue: 04 | Apr 2020.

[4] Melika Naderi and Mehdi Zekavati, [Assessment of seismic behavior stone bridge using a finite element method and discrete element method], Earthquakes and Structures, Vol. 14, No. 4 (2018) 297-303.

[5] Wei-Xin Ren, Cong-Cong Su and Wang-Ji Yan, [Dynamic Modeling and Analysis of Arch Bridges Using Beam-Arch Segment Assembly], CMES, vol.70, no.1, pp.67-92, 2010.

[6] Hayder Ala'a Hasan, Ammar A. Abdul Rahman and Hani Aziz Ameen, [Finite element analysis of reinforced concrete bridge pier subjected to seismic loading], AMERICAN JOURNAL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, 2012, 3(2): 94-98.

[7] L. Di Sarno, G. Della Corte, R. De Risi, M. Erdik , C. Yenidogan, A. Marioni, M. Sartori, F. Taucer, P. Pegon and R. Ceravolo, [Seismic analysis and retrofitting of an existing R.C.highway bridge: investigation through pseudo-dynamic], 15 WCEE Lisboa 2012.

[8] Lina Ding, Hong Hao, Yong Xia and Andrew J. Deeks, [Evaluation of Bridge Load Carrying Capacity Using Updated Finite Element Model and Nonlinear Analysis], Advances in Structural Engineering,Volume 15 No. 10 2012.

[9] Ravikant and Jagdish Chand, [Design and Analysis of Bridge Girders using Different Codes], International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 8 Issue 07, July-2019.

[10] Alessandro Rasulo, Angelo Pelle, Davide Lavorato, Gabriele Fiorentino, Camillo Nuti and Bruno Briseghella, [Finite Element Analysis of Reinforced Concrete Bridge Piers Including a Flexure-Shear Interaction Model], Appl. Sci. 2020, 10, 2209; doi:10.3390/app10072209.

[11] S.Basilahamedand   A.R.R.Kalaiyarrasi, [COMPARATIVE ANALYSIS AND DESIGN OF T-BEAM BRIDGE DECK BY RATIONAL METHOD AND FINITE ELEMENT METHOD, Proceedings of National Conference on Sustainable Construction Materials, March 27-28, 2018.

[12] B. Ozden Caglayan, Kadir Ozakgul and Ovunc Tezer, [Assessment of a concrete arch bridge using static and dynamic load tests], Structural Engineering and Mechanics, Vol. 41, No. 1 (2012) 83-94.

[13] J. Kiyono, A. Furukawa and K. Toki, [Seismic Assessment of Stone Arched Bridges], 15 WCEE LISBOA 2012.

[14] S. De Santis and G.de Felice, [Seismic Analysis of Masonry Arches], 15 WCEE LISBOA 2012.

[15] Xiaoke Li, Lixin Liu, Shiming Liu and Shunbo Zhao, [Static Analysis of Reinforced Concrete Arch-deck Bridge with Archaized Connective Corridors], Applied Mechanics and Materials Vol. 238 (2012) pp 738-742.