International Journal of Research Publication and Reviews, Vol 4, no 11, pp 235-240 November 2023

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Effect of Crashes in Bridge Under Seismic Motion: Dynamic Analysis of Bridge

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DOI: https://doi.org/10.55248/gengpi.4.1123.112906

ABSTRACT:

This examination presents a unique investigation of substantial brace spans while representing the impacts of mishaps on the railing walls. Additionally, the application of seismic confinement elastic on railings and pier structures was examined. Substantial support spans with various space sizes were theoretically researched utilizing a 3D FEM model of MIDAS Civil. The projection was rearranged by embracing a railing wall that was planned as a three-layered, substantial design. To explore the seismic behavior of the bridge, seismic ground speed increases were applied to the balance of the pier development. It has been recommended that by confining the development of brace spans, the size of extension joints can be decreased, subsequently diminishing the expense of development and seismic support and considering a projection impact. The response weight of the railing wall on the small space was greatly reduced by the seismic disengagement elastic.

Keywords: Dynamic analysis, crashes, space, isolation rubber, concrete girder bridge.

1.0 Introduction:

Indian bridges developed before the tremor of 2008 were intended to have a 15 mm space. Regardless, there were some bridge harms, like mishaps among decks and among deck and projection. Accordingly, a crash is one of the main things to consider while assessing the seismic presentation of the bridge. The vital space between the closures of two neighbouring supports should be viewed as in the superstructure's plan when a bridge is dependent upon tremor ground movement to forestall any deficiency of the extension because of a crash between two contiguous superstructures, a superstructure and a projection, or a superstructure and the shortened piece of a pier head.

Notwithstanding, adding a wide space would increase the expense of development and seismic support since relatively huge extension joints should be utilized. Earlier investigations analysed the unique way of behaving of substantial bridges while representing the impact of beating. The projection's harm has been assessed using three-layered FEM. Beating has been mimicked by applying five elective situations of effect speeds and setting a starting speed on the superstructure. Besides, an outline examination has been conducted to have a superior comprehension of the extension's general powerful way of behaving during pounding. The review's discoveries demonstrate that an effect of 3.0 m/s truly harms the projection, the projection's base, and the entire railing. One more exploration took a gander at the amount of distinction there was in building costs. The end safeguard of the brace has been thought about while displaying the support and pier using shaft parts. It has been shown that the reaction stress at the closures of the extension braces and the response revolution point at the foot of the dock are both diminished by the expansion of elastic safeguards to the support closes. Moreover, the complete expense of the proposed seismic support would be 30% higher than that of the ongoing seismic support. Utilizing MIDAS Common's Substantial Harmed Versatility model, analysts have inspected the way cement behaves, including the model confirmation of RC shaft structures. This code has demonstrated to be a dependable technique for displaying the nonlinear way of behaving of RC structures when contrasted with the genuine outcomes. It was found through this examination that the primary breaks showed up at the intersection of the projection wall and railing wall. Past examinations demonstrate that further examination is expected to appreciate the powerful way of behaving of completely loaded spans of areas of strength for during. Then again, utilizing a wide space will bring about a more prominent development joint, driving up the cost of seismic rebar and development. It has been suggested that permitting the support impact at the projection can diminish the size of development joints and subsequently decrease the expense of development and seismic building up. This examination takes a gander at the unique investigation of substantial support spans while thinking about the effects on the projections. The use of base-secluded piers was additionally inspected. A two-range substantial brace span was falsely examined utilizing a 3D FEM model of MIDAS Civil.

2.0 Methodology:

2.1 Outline of Analytical Method

The non-direct limited component program MIDAS Civil was used to play out the extension's mathematical display. To re-enact the impact peculiarity, the balance of the dock had a fee wave input ground speed increase laid out. And the lower part of the railing wall was set to be pivoted. The parametric examination of bridge in this work incorporates the effect of the seismic detachment elastic at the pier.

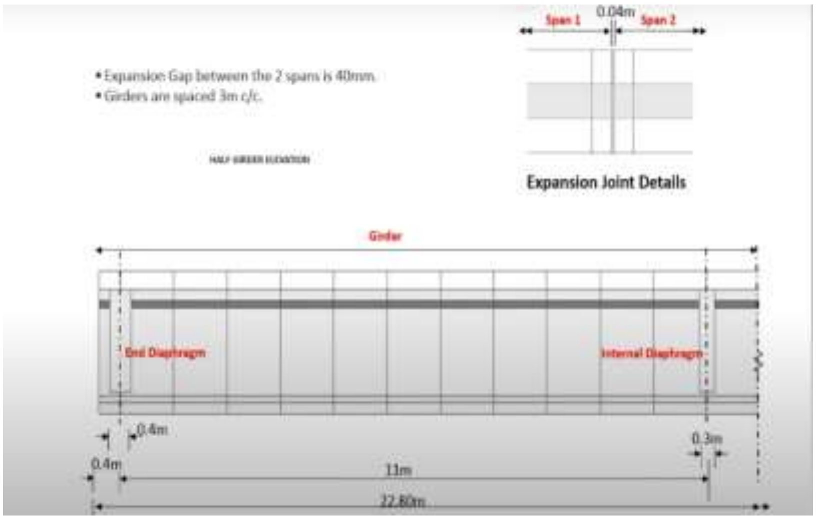


Fig. 1 Layout of Bridge Girder

The space, which shifted between 10, 20, 30, 40, and 50 mm and lined up with the contribution of seismic ground speed increases, was the principal variable in this examination. The two sorts of burdens applied to the extension were self-weight, or a gravity power of 9.8 m/s2, and the outside load, or a seismic tremor ground speed increase forced at the pier balance. Eight-hub strong (block) parts with diminished coordination were utilized in this displaying method to glorify the crate brace superstructure, the railing wall, and the supporting bars. Probabilistic weather conditions figures show the opportunity of specific climate occasions, such as a couple-day storm, occurring in a specific area over a given period of time. Then again, forecasters are baffled by environmental change welcomed by a wealth of ozone-harming substances in the air since it becomes more earnest to decide if varieties in the environment are driven by outside factors or via occasional examples.

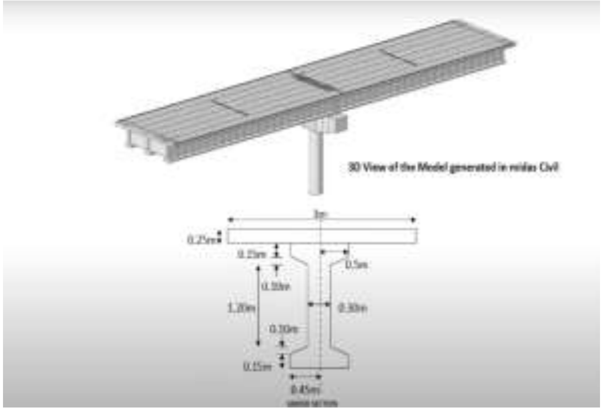
Table 1: Tendon Coordinates

TENDON COORDINATES OF PSC GIRDER														
G1T1				G1T2				G1T3-L				G1T3-R		
X	Y	Z		X	Y	Z		X	Y	Z		X	Y	Z
0	0	-1.27		0	0	-1.5		0	0.31	-1.8		0	-0.3	-1.8
1	0	-1.3		1	0	-1.5		1	0.31	-1.8		1	-0.3	-1.8
2	0	-1.35		2	0	-1.53		2	0.31	-1.8		2	-0.3	-1.8
3	0	-1.37		3	0	-1.55		3	0.31	-1.8		3	-0.3	-1.8
4	0	-1.4		4	0	-1.58		4	0.31	-1.8		4	-0.3	-1.8
5	0	-1.43		5	0	-1.6		5	0.31	-1.85		5	-0.31	-1.85
5.4	0	-1.45		5.4	0	-1.63		5.4	0.31	-1.85		5.4	-0.31	-1.85
6.4	0	-1.48		6.4	0	-1.65		6.4	0.31	-1.85		6.4	-0.31	-1.85
7.4	0	-1.5		7.4	0	-1.68		7.4	0.31	-1.85		7.4	-0.31	-1.85
8.4	0	-1.53		8.4	0	-1.7		8.4	0.31	-1.85		8.4	-0.31	-1.85
8.9	0	-1.55		8.9	0	-1.73		8.9	0.31	-1.85		8.9	-0.31	-1.85
9.4	0	-1.58		9.4	0	-1.75		9.4	0.31	-1.85		9.4	-0.31	-1.85
10.4	0	-1.58		10.4	0	-1.78		10.4	0.31	-1.85		10.4	-0.31	-1.85

11.15	0	-1.6		11.15	0	-1.8		11.15	0.31	-1.85		11.15	-0.31	-1.85
11.4	0	-1.6		11.4	0	-1.8		11.4	0.31	-1.85		11.4	-0.31	-1.85

2.2 Analytical model of bridge

Inspected is a substantial support span that has been used in past explorations. The two range superstructures were focused at the pier (P1). The bearing backings were versatile (M) and fixed (F) at pier 1 and the two projections individually. Each demonstration exercise was led under the assumption of non-liquefaction. Base-disengaged piers were likewise evolved, utilizing seismic confinement elastic at the lower part of the dock design to diminish the projection's seismic response. Similarly, the three-layered FE span models are shown..



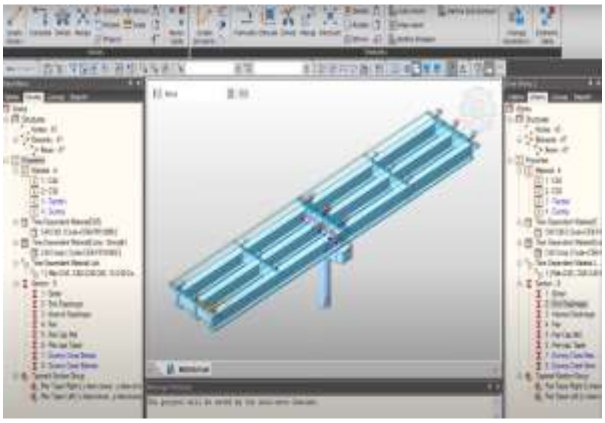


Fig. 2 Model of Two Span Bridge Generated in Midas Civil

Fig. 3 Midas Model of Two Span Bridge

2.3 Material Properties Of Model

Table- 2 Material Properties

Material Properties	Pier & Girder	
	Concrete	Rebar
Young's Modulus (GPa)	31.62	206.00
Poisson's ratio	0.2	0.3
Density (kg/m^3)	2500	7850
Compressive Strength (MPa)	40	294.00 (Yield Stress)
Tensile Strength (MPa)	4.427	

2.4 Interaction Properties And Rayleigh Damping

The communication surfaces between the essence of the railing wall and the end surface of the superstructure were assigned as broad contact surfaces since they had an erosion coefficient of 0.45 and a strong contact for pressure-over shutting. An installed imperative was utilized, as far as possible, to convert the rebar component into a strong component. The mathematical examination utilizes a Rayleigh-type damping model with a steady damping of 0.02.

2.5 Acting Loads on Bridge

On the bridge has applied many different load as per Indian Road Congrace (IRC).

Dead Load – In dead load considered self weight, wearing coarse weight, crash barrier weight, wet concrete weight, prestress weight as per.

Impose Load – Bridge is design for Class A type moving load as per IRC 6.

Impact Load – Braking load

Wind Load, Water content load, Temp. rise and temp. fall considered..

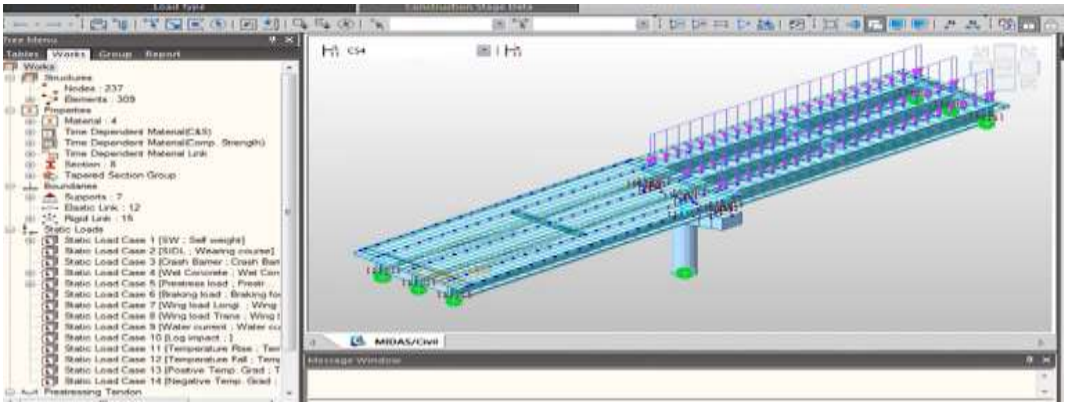


Fig. 4 Applied Load on Bridge (Midas Model of Two Span Bridge)

2.6 Seismic Vibration Records for Dynamic Analysis

Seismic tremor-actuated ground vibrations were considered in the bridge's dynamic analysis.

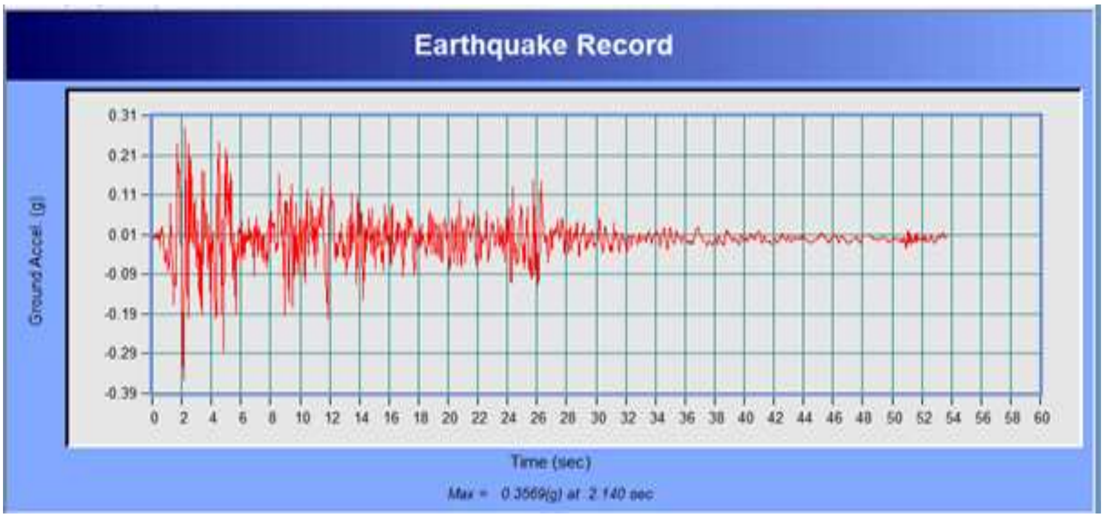


Fig. 5 Earthquake Vibration Record Graph

2.7 Eigen Value Analysis

The impact of seismic disconnection elastic on the normal patterns of the bridge was examined utilizing the eigenvalue examination. To comprehend the basic unique qualities of the design, the successful mass proportion and normal times of each overall mode were researched. The most powerful mass proportions in the X, Y, and Z tomahawks recommend the request for the overarching normal period.

Order of Periods	f (Hz)	T (sec)	Effective mass Ratio		
			X	Y	Z
1	0.29	3.0	95.82	0	0
2	2.62	0.38	0	0	0
3	3.10	0.34	0	89.52	0.9
4	3.45	0.30	0	2.51	40.32
5	5.10	0.23	0	0	49.2
6	5.52	0.19	0.2	0	0
7	6.86	0.17	0	0	0
8	8.00	0.13	0	0.19	0
9	9.00	0.14	0	0	0
10	10.00	0.1	0	0	0

Table 3 – Eigen Values

An outline of the powerful mass proportions, normal frequencies, and regular periods for every predominant method of the seismic seclusion elastic layered span model separately shows the prevailing Eigen modes that make the extension avoidable in the cross-over, vertical, and longitudinal directions. The primary mode in the longitudinal heading, the third mode in the in-plane bearing, and the fourth mode in the cross-over course are where the model might vibrate thoughtfully. As opposed to before renditions, the extension vibrates thoughtfully in the cross-over heading at the fifth mode when seismic confinement elastic is layered in two layers.

3.0 Results

3.1 Stress Responce

The most extreme reaction stresses at the foundation of the railing wall for a bridge with seismic detachment elastic development are looked at and displayed as a parametric response stress in the figures. There are two layers and one layer of seismic disengagement elastic, individually. That's what these figures show, except for an extension with a 10-mm space. The design vibrated evenly in light of the increase in ground speed, having a tendency to move in the right bearing and displaying the most elevated response. There is no crash when the reaction stress is zero.

Due to the increase in ground speed, the bridge vibrates constantly in an even direction. For instance, on a bridge with a 10 mm space, the response stress ascends from 6.4 MPa to 39.7 MPa. The vast majority of the outcomes show a propensity toward more noteworthy reaction stress at the most minimal partition of 10 mm, which may be credited to a higher crash recurrence. However, space rarely essentially affect lessening the reaction stress in span evaluations, except for expanding the separation from an extension without seismic disconnection elastic from 10 to 20 mm.

Utilizing one layer and two layers of seismic disconnection elastic, the response focuses on the fact that the impact between the brace and railing wall were diminished by up to 76% at the most reduced space of 10 mm. As the space increases from 10 to 50 mm, the railing wall's greatest reaction stress ordinarily rises. Nonetheless, when contrasted with the two layers, two layers of seismic segregation elastic don't impressively reduce the strength of a railing wall. In view of these outcomes, one of the most mind-blowing strategies to reduce the reaction weight on a bridge's railing wall is to introduce a seismic detachment elastic on a dock

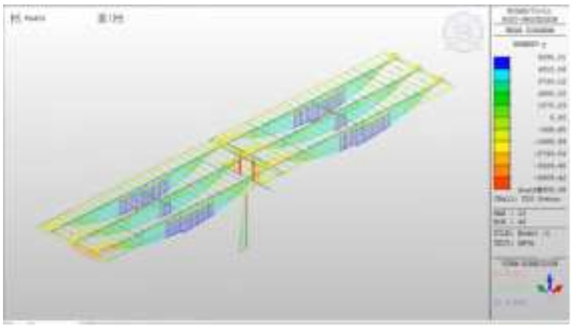


Fig. 6 Bending Moment Diagram of Beam in Bridge

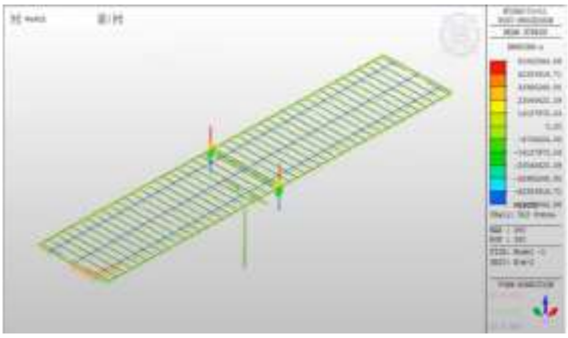


Fig. 7 Bending Stress Diagram of Beam in Bridge

3.2 Impact of Spacing on Crashes

The relationship between the number of accidents in an extension and the rising space between the railing wall and the finish of the brace The railing wall's response stress and the brace's end are looked at regarding results. These figures recommend that a more noteworthy distance will emerge from a lower crash rate. As displayed, in any case, utilizing seismic segregation elastic makes the opposite difference. Moreover, after the last effect, the seismic segregation elastic makes the extension influence in one direction, demonstrating a constant ascent in pressure..

4. Conclusion

The seismic way of behaving of substantial support spans presented to enormous ground developments was researched utilizing dynamic reaction examination, which was additionally viewed as the impacts of crashes and base-disengaged docks. Mathematical examinations were conducted on spans that displayed space and seismic disengagement elastic properties. The consequences of the review are summed up as follows:

1. The utilization of seismic detachment elastic on the pier development essentially impacted the extension's reaction conduct. At the smallest distance of 10 mm, the projection's reaction stress diminished by up to 76%. Expanding the space frequently raises the greatest reaction stress on the railing wall.
2. At the point when seismic confinement elastic was placed in one layer rather than two layers, the impact of reducing the response stress because of the crash was seen. In any case, when the expense of development was thought about, a critical reduction in the impact on the one-layer seismic seclusion elastic way of behaving was found.
3. It is as yet important to direct research on what soil pressure means for span conduct during tremors.

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