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Dynamic Analysis of Cable Stayed Bridge under Moving Loads with the Effect of Corrosion of Cables

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***Abstract:-* The effect of failure of cables under different levels of corrosion on the structural behavior of cable stayed bridge will be a prominent aspect for the analysis of a cable stayed bridge. With respect to that view, the static response of the cable stayed bridge moving loads subjected to corrosion in different levels has been studied in the present work. The cable stayed bridges are subjected to loads and corrosion in fluctuating manner which will generate the differential displacement of pylon and deck. H shape pylon and single shape pylon are analyzed by time history analysis for 0%, 10% 25%, 50% and failure stages of corrosion. And the load received by the moving load on pylons in different locations and parameters like displacement, acceleration, period and frequencies are also studied. The above studies give the output that the pylon in the middle location is under least displacement compared to the end locations and the H shaped pylon expresses suitability within permissible limits. The time history studies on Bhuj and Elecentro earthquakes are also extracted, analyzed and checked for the suitability of H shape and Single pylon.**

Key Words: Cable Stayed Bridge, Corrosion, Pylon, Bhuj and Elcentro etc…

1. INTRODUCTION

The History of Cable Stayed Bridge dates back to the year 1595, found in a book by the Venetian inventor (Bernard et al., 1988). Many cable-stayed and suspension bridges have been designed and developed since the year 1595 such as the Albert Bridge and the Brooklyn Bridge (Wilson and Gravelle, 1991). Cable stayed bridges have then been later constructed all around the world. The Swedish Stromsund bridge designed in 1955 is known as the first modern cable-stayed bridge. The main span length of the bridge is 182 m and the total length of the bridge is 332 m and it was opened in 1956. It was the largest cable-stayed bridge at that time. The bridge was constructed by a German named Franz Dischinger who was a pioneer in construction of cable-stayed bridge. The designers then realized that cable-stayed style requires fewer materials for cables and deck and can be erected in a much easier way than Suspension bridges. This is mainly due the advances in design, construction method and the availability in high strength steel cables. The Theodor Heuss bridge was the second largest cable-stayed bridge and it was erected in 1957 across the Rhine river at Dusseldrof. It had side spans of 108 m and a main span of 260 m which was larger than the Stromsund. It had a harp cable arrangement with parallel stays and a pylon composed of two free-standing posts fixed to deck. The reason for choosing harp style was for its aesthetic appearance. The Severins Bridge in Koln which was designed in 1961 was the first fan arrangement cable stayed bridge, which had an A-shape pylon. In this bridge, the cross section of the deck was similar to the deck used in Theodor Bridge. The first bridge to use the semi fan arrangement was the Flehe Bridge erected in 1979 in Germany. Now a days the semi fan arrangement is the most commonly used type of cable arrangement for cable-stayed bridges.

1.1 Methodology

In the present study effect of various cable-stayed bridge configurations on the response (behavior) of already constructed cable-stayed bridge will be studied with the help of static, moving load and earthquake analysis and at the end out of this cable forces, displacement and acceleration of the components of the cable stayed bridge will be obtained. Effect of dead load and moving loads will be considered according to the code IRC 20 and IRC: 6-1966. Three types of pylons are considered for the 2 span 3 pylon cable-stayed bridge i.e. H-shape pylon and single pylon. The bridge is tested for four different levels of cable corrosion namely 10%, 25%, 50% and for failure of cables. The software used for the analysis will be SAP-2000 and the codes used will be IS-1893-2002, IRC 20 and IRC 6-1966.

2. DIMENSIONAL DESCREPTION

In this study a typical 2 span 3 pylon cable-stayed bridge is chosen. The span, cable arrangement and the dimension of the deck remains the same for all the models. The total length of the bridge is 610m with two main spans which are both 210 m in length. As one can see in the figure the deck superstructure is supported by stay cables with a semi-fan arrangement. The whole bridge is composed of 120 stay cables. The precast concrete deck has thickness of 0.3 m and a width of 22 m. The diameter of the stay cables is 0.313 m. The height of the pylon in all the models is 15 m below the deck and reaches to a height of 60 m above the deck level. The stay cables are arranged from a height of 5 m below the top of the pylon and spaced equally at a distance of 2 m from the top most pylon. A total number of 10 anchorage points are present on one side of pylon. The cable is made of steel strands of diameter 7mm and one cable consists of 100 such strands. The cross sectional area of each cable is 7696 mm^2.

Table -1: Typical Model series

TYPE	No Corrosion	10% Corrosion	25% Corrosion	50% Corrosion	Failure
H-Shape Pylon	HP	HP10	HP25	HP50	HPF
Single Pylon	SP	SP10	SP25	SP50	SPF

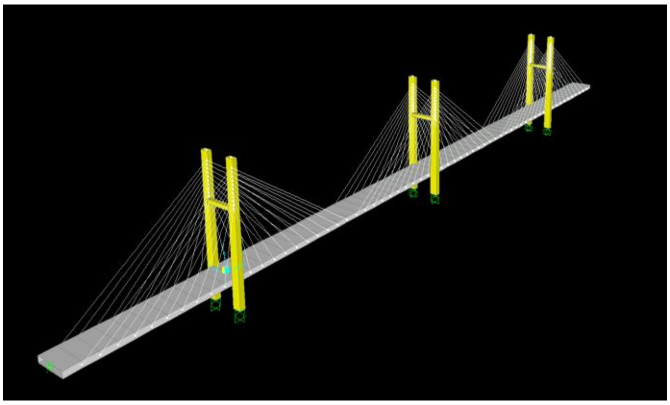

Fig -1: H-Shape Pylon Cable Stayed Bridge

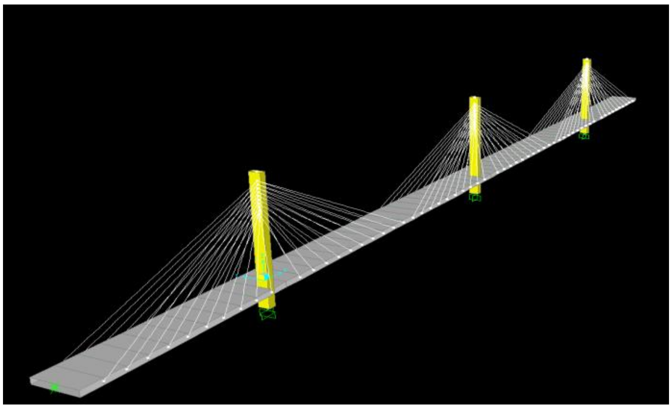

Fig -2: Single Pylon Cable Stayed Bridge

2.1 Basic Data for Modelling

- Number of grid lines in X direction =3, Y= 5, Z =3.
- Moving load = IRC Class AA Truck Load
- Height of pylon = 75 m.
- Grade of concrete f_{ck} = M_{45}
- Depth of deck slab = 0.3 m
- Grade of Cable = ASTM A416 Grade 270
- Grade of Steel = Fe 550
- Earth Quake Input for Time History Analysis = Bhuj 2001 and Elcentro 1940

2.2 Results

2.2.1 Static

The following parametric results are extracted from the software SAP 2000 and graphs are plotted for the respective parameters using EXCEL spread sheets for all the fifteen models as given in the table below

- Static analysis with moving load
  Peak deflection of pylon for the load combination (DL+ Moving load) and cable forces- Extracted from different models of SAP 2000
- Time history analysis
  Acceleration and peak displacement –Extracted from different models of SAP 2000 Mode, frequency and period – Extracted from different models of SAP 2000

Table -2: Deflection of H-shaped Pylon for Dead + Moving load

Model Name	Corrosion (%)	Joint	Output Case	Deflection
				mm
	0	5	DL+ Moving	25.6241
HP		157	DL+ Moving	0.05189
		244	DL+ Moving	23.001
	10	5	DL+ Moving	25.6004
HP10		157	DL+ Moving	0.2243
		244	DL+ Moving	24.5275
	25	6	DL+ Moving	26.5107
HP25		157	DL+ Moving	0.65984
		244	DL+ Moving	25.1115
	50	6	DL+ Moving	27.501
HP50		157	DL+ Moving	1.45501
		244	DL+ Moving	25.43
	Failure	6	DL+ Moving	29.1958
HPF		157	DL+ Moving	2.70745
		244	DL+ Moving	25.6413

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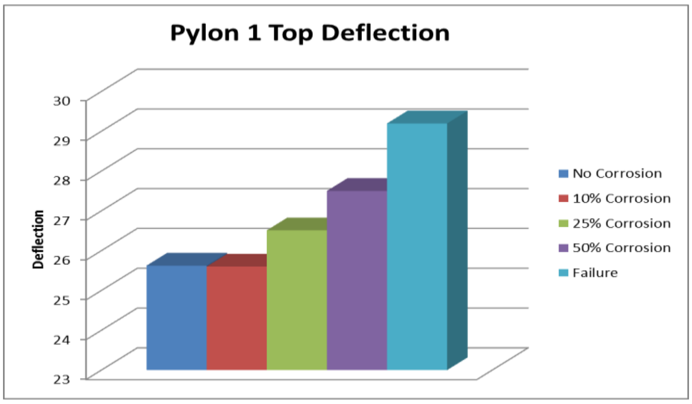

Fig -3: Deflection of Pylon 1 of H-shape Pylon Bridge

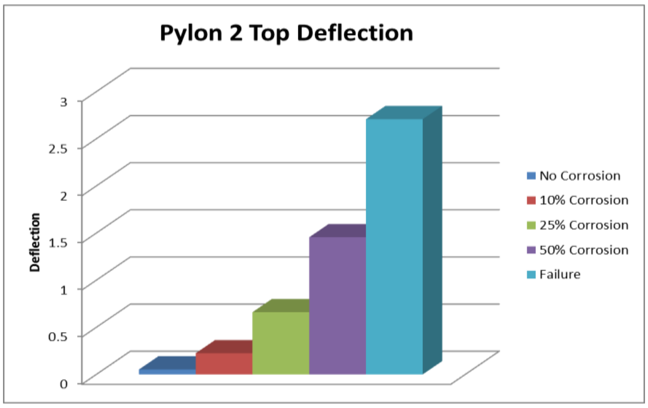

Fig -4: Deflection of Pylon 2 of H-shape Pylon Bridge

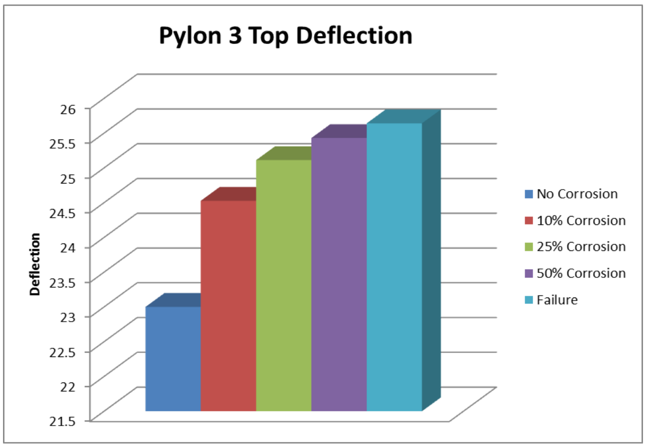

Fig -5: Deflection of Pylon 3 of H-shape Pylon Bridge

Observations: By the bar charts plotted for H shaped pylon cable stayed bridge, after failure of tendons due to corrosion, pylon 1 and 3 are showing maximum deflection of 29.19mm and 25.64mm respectively. But pylon 2 exhibits least deflection of 2.71mm

Table -3: Deflection of Single Pylon Bridge for Dead + Moving load

Model Name	**Corrosion (%)**	**Joint**	**Output Case**	**Deflection Mm**
	0	4	DL+ Moving	47.041173
SP		15	DL+ Moving	0.08795
		152	DL+ Moving	43.0176
	10	4	DL+ Moving	47.320885
SP10		15	DL+ Moving	0.269403
		152	DL+ Moving	44.8859
	25	4	DL+ Moving	47.737584
SP25		15	DL+ Moving	0.689
		152	DL+ Moving	46.00736
	50	4	DL+ Moving	48.414467
SP50		15	DL+ Moving	1.433734
		152	DL+ Moving	46.00736
	Failure	4	DL+ Moving	50.59957
SPF		15	DL+ Moving	1.670353
		152	DL+ Moving	47.04117

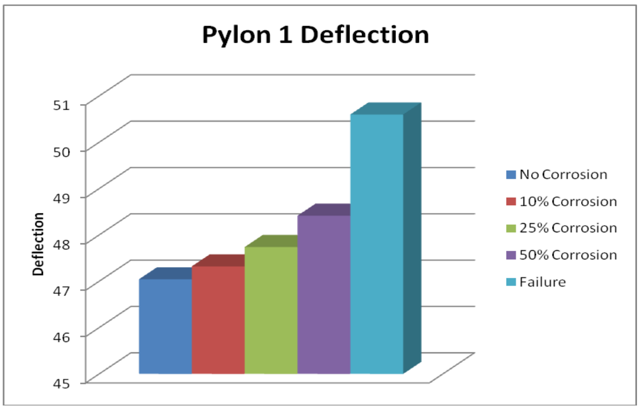

Fig -6: Deflection of Pylon 1 of Single Pylon Bridge

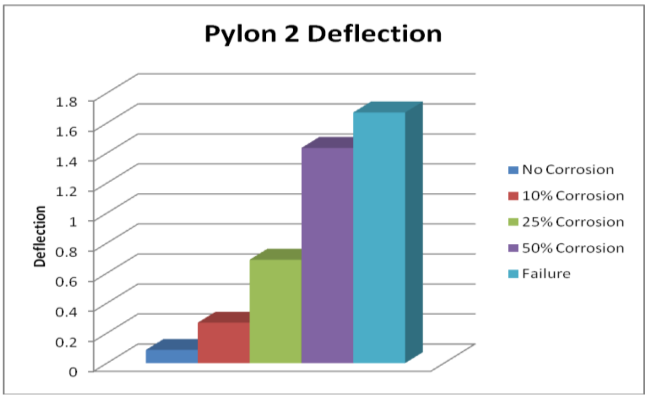

Fig -7: Deflection of Pylon 2 of Single Pylon Bridge

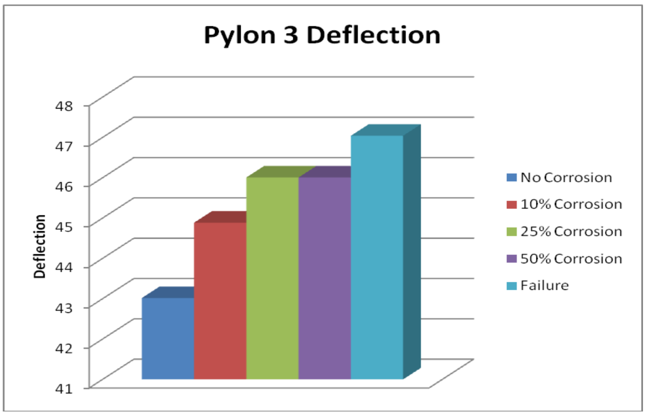

Fig -8: Deflection of Pylon 3 of Single Pylon Bridge

Table -4: Cable Forces of H shaped Pylon

Cable Forces kN			
No Corrosion	10%	25%	50%
11.882	10.482	8.381	4.879
105.224	94.615	78.619	51.728
274.25	247.892	207.8	139.435
288.83	260.419	217.476	145.009
28.92	25.847	21.219	13.449
11.882	10.482	8.381	4.879
28.92	25.847	21.219	13.449
105.224	94.626	78.642	51.759
11.882	10.52	8.461	4.987
288.867	259.896	216.332	143.428

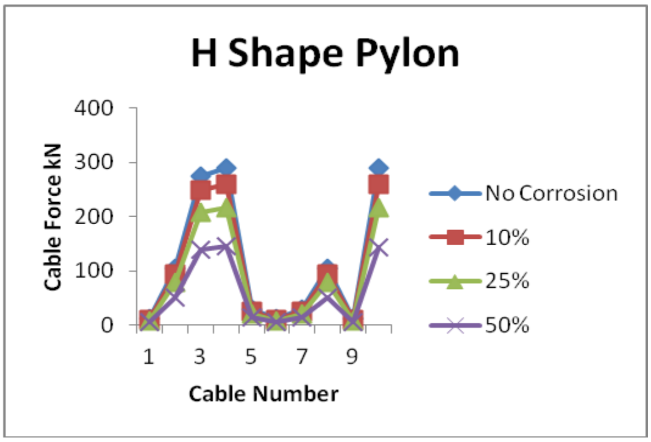

Fig -9: Cable Forces for H Shaped Pylon

Observations: In H shaped pylon cables which are close to the pylon will exhibits maximum cables forces. The above graph plotted for corrosion and cable force shows that cable subjected to corrosion retains their cable force up to 25% corrosion. After that at 50% corrosion cable strength will reduce drastically nearly half of the prior that is from 216.332KN at 25% to 143.428KN at 50% corrosion.

Table -5: Cable Forces Single Pylon Bridge

Cable Forces kN			
No Corrosion	10%	25%	50%
11.753	10.37	8.294	4.832
105.85	95.232	79.207	52.217
294.925	264.07	218.69	143.883
349.695	312.647	257.762	168.193
28.99	25.929	21.312	13.54
11.753	10.37	8.294	4.832
28.99	25.903	21.257	13.464
106.637	95.952	79.82	52.641
11.753	10.403	8.364	4.927
349.695	314.136	260.884	172.397

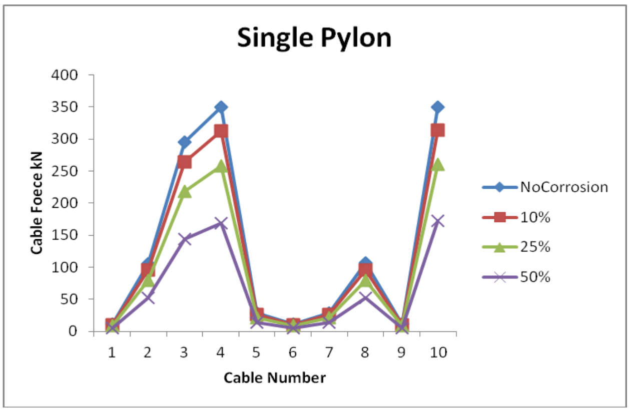

Fig -10: Cable Forces for Single Pylon Bridge

Observations: In single pylon bridge cables which are close to the pylon will exhibits maximum cables forces. The above graph plotted for corrosion and cable force shows that cable subjected to corrosion retains their cable force up to 25% corrosion. After that at 50% corrosion cable strength will reduce drastically nearly half of the prior that is from 260.884KN at 25% to 172.397KN @50% corrosion.

Table -6: Mode and Period of H Shape Pylon

Mode	**Period(Sec)**				
	No Corrosion	**10%**	**25%**	**50%**	**Failure**
1	3.827565	4.03498	4.42046	5.41227	3.82759
2	3.827556	4.0345	4.42002	5.4119	3.82753
3	3.827357	3.82757	3.82757	3.82758	3.82738
4	3.827348	3.82746	3.82747	3.82749	3.82721
5	3.827266	3.82736	3.82736	3.82737	3.82696
6	3.827078	3.82719	3.82719	3.8272	3.82673
7	3.826727	3.82693	3.82694	3.82694	2.76366
8	3.826726	3.82673	3.82673	3.82673	2.76364
9	2.763626	2.76363	2.76363	2.76364	2.76358
10	2.763615	2.76362	2.76362	2.76363	2.76344
11	2.763496	2.7635	2.76351	2.76353	2.76342
12	2.763398	2.7634	2.7634	2.76341	2.76323

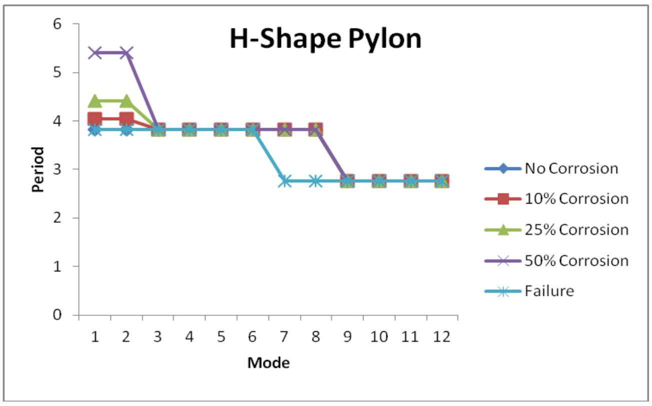

Fig -11: Graph for Mode vs. Period

Table -7: Mode and Frequency of H Shape Pylon

Mode	Frequency(Cyc/sec)				
	No Corrosion	10%	25%	50%	Failure
1	0.26126	0.24783	0.22622	0.18477	0.26126
2	0.26126	0.24786	0.22624	0.18478	0.26127
3	0.26128	0.26126	0.26126	0.26126	0.26128
4	0.26128	0.26127	0.26127	0.26127	0.26129
5	0.26128	0.26128	0.26128	0.26128	0.2613
6	0.2613	0.26129	0.26129	0.26129	0.26132
7	0.26132	0.26131	0.26131	0.26131	0.36184
8	0.26132	0.26132	0.26132	0.26132	0.36184
9	0.36184	0.36184	0.36184	0.36184	0.36185
10	0.36184	0.36184	0.36184	0.36184	0.36187
11	0.36186	0.36186	0.36186	0.36186	0.36187
12	0.36187	0.36187	0.36187	0.36187	0.36189

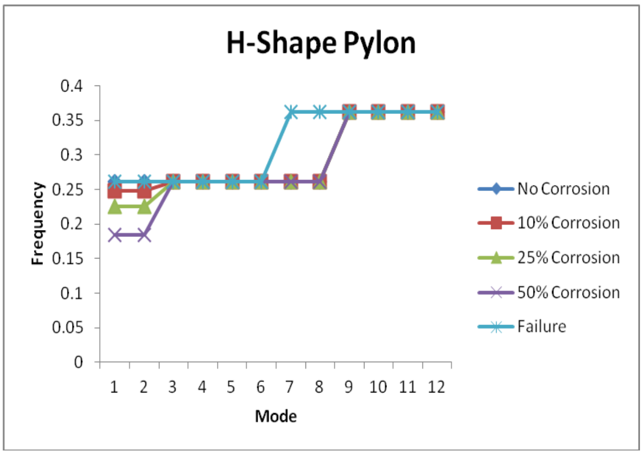

Fig -12: Graph for Mode vs. Frequency

Table -8: Mode and Period of Single Pylon Bridge

Mode	Period(Sec)				
	No Corrosion	10%	25%	50%	Failure
1	3.6131	3.805	4.168	5.1022	3.6125
2	3.6131	3.8021	4.1653	5.1001	3.6093
3	3.6069	3.6131	3.6131	3.6132	3.6069
4	3.6067	3.6095	3.6096	3.6097	3.6065
5	3.6061	3.6068	3.6068	3.6068	3.6061
6	3.60616	3.6064	3.6065	3.6065	3.6061
7	3.60613	3.6061	3.6061	3.6061	2.8002
8	3.60613	3.6061	3.6061	3.6061	2.8001
9	2.8009	2.8009	2.8012	3.3382	2.7944
10	2.80083	2.8008	2.8011	3.3382	2.794
11	2.79437	2.7944	2.7944	3.3344	2.7934
12	2.79398	2.7939	2.794	3.33415	2.79344

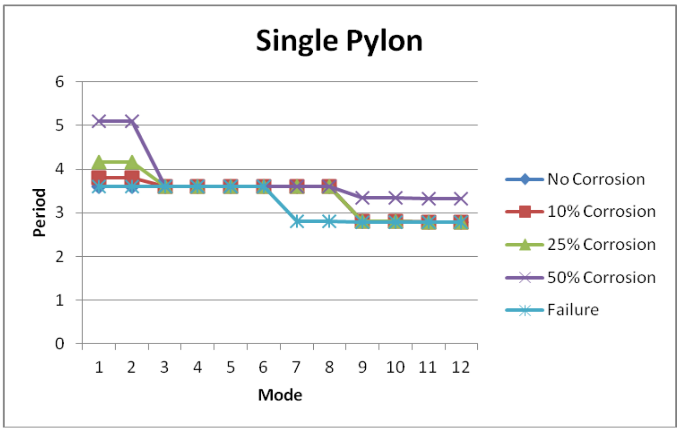

Fig -13: Graph for Mode vs. Period

Table -9: Mode and Frequency of Single Pylon Bridge

Mode	Frequency(Cyc/sec)				
	No Corrosion	10%	25%	50%	Failure
1	0.27677	0.26281	0.23992	0.19599	0.27681
2	0.27677	0.26301	0.24007	0.19607	0.27706
3	0.27724	0.27677	0.27677	0.27676	0.27725
4	0.27726	0.27704	0.27704	0.27703	0.27727
5	0.2773	0.27725	0.27725	0.27725	0.2773
6	0.2773	0.27728	0.27728	0.27728	0.27731
7	0.27731	0.2773	0.2773	0.2773	0.35712
8	0.27731	0.27731	0.27731	0.27731	0.35713
9	0.35703	0.35702	0.35699	0.29955	0.35785
10	0.35704	0.35703	0.357	0.29956	0.35791
11	0.35786	0.35786	0.35786	0.29991	0.35798
12	0.35791	0.35791	0.35791	0.29993	0.35798

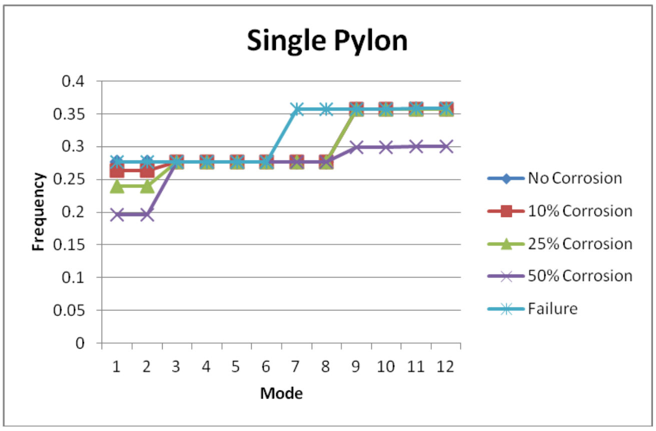

Fig -14: Graph for Mode vs. Frequency

Observations and discussions: From the graph plotted for frequency v/s mode number and period v/s mode number for the two types of pylons such as single and H shaped pylon, we can notice that mode 1 is with least frequency and higher period. For mode 1, all types of pylons with 50% corrosion depicts that we have least frequency and higher period value compared to other corrosion percents and it indicates that H shaped pylon exhibits frequency of 0.184cycs/sec which is the least and period of 5.41sec which is the maximum value obtained by time history analysis. The observed results which are tabulated indicate that H shaped pylon is with first preference and then single pylon.

2.2.2 Time History Results

2.2.2.1 Bhuj Earthquake

Table -10: Time History Results of H Shaped Pylon for Bhuj Earthquake

	Pylon		Deck	
Stage	Deflection (mm)	Acceleration (mm/s^2)	Deflection (mm)	Acceleration (mm/s^2)
No Corrosion	10.95	3.032	1.909	0.5412
10%	10.86	3.016	1.86	0.5307
25%	11.08	2.992	1.85	0.5133
50%	11.53	2.975	1.839	0.4866
Failure	11.62	2.982	1.643	0.4374

Table -11: Time History Results of Single Pylon Bridge for Bhuj Earthquake

	Pylon		Deck	
Stage	Deflection (mm)	Acceleration (mm/s^2)	Deflection (mm)	Acceleration (mm/s^2)
No Corrosion	19.98	4.694	0.9645	0.2362
10%	19.55	4.685	0.9267	0.2334
25%	19.73	4.699	0.9129	0.2297
50%	10.96	2.623	0.5969	0.1448
Failure	21.04	4.7	0.8665	0.2029

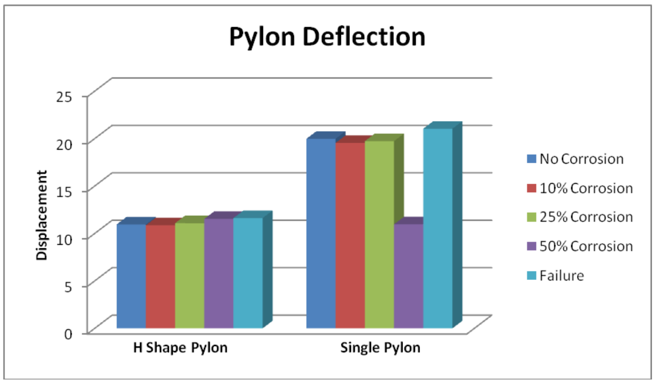

Fig -15: Pylon Deflection for Bhuj Earthquake

From the plotted bar chart for displacement it is observed that H shaped pylon exhibits least deflection of 10.95mm at No corrosion and maximum deflection of 11.62mm at failure stage. Whereas single pylon exhibits least deflection of 10.96mm at 50% corrosion and maximum deflection of 21.04mm when subjected to corrosion at failure.

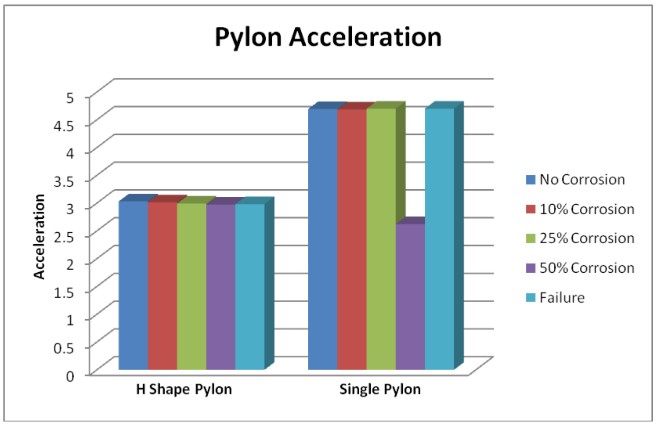

Fig -16: Pylon Acceleration for Bhuj Earthquake

From the plotted bar chart for acceleration it is observed that H shaped pylon exhibits least acceleration of 2.982mm/sec^2 at failure and maximum acceleration of 6.723 mm/sec^2 at no corrosion stage. The bar chart indicates that the pylon acceleration decreases till 50% Corrosion and later increases at failure stage. Whereas single pylon exhibits least acceleration of 2.623mm/sec^2 at 50% corrosion and maximum acceleration of 4.7mm/sec^2 mm when subjected to corrosion at failure.

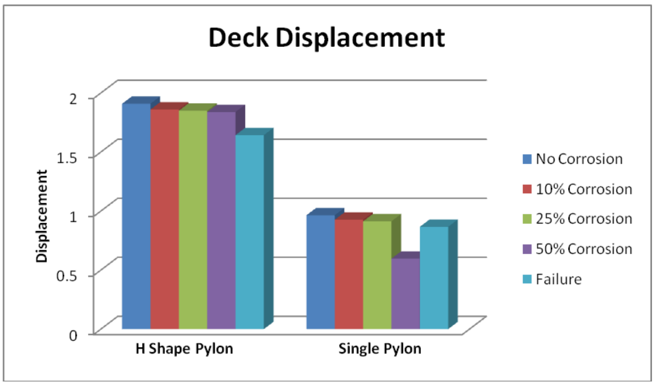

Fig -17: Deck Displacement for Bhuj Earthquake

From the plotted bar chart for deck displacement it is observed that H shaped pylons exhibits least deflection of 1.643mm at failure and a maximum deflection of 1.909mm at no corrosion stage. The bar chart indicates that deck displacement decreases with increase in corrosion and we can also observe that there is a gradual drop from no corrosion to 50% stage and decreases drastically at failure stage. Whereas single pylon exhibits least deflection of 0.5969mm at 50% corrosion and maximum deflection of 0.8665 mm when subjected to 0% corrosion

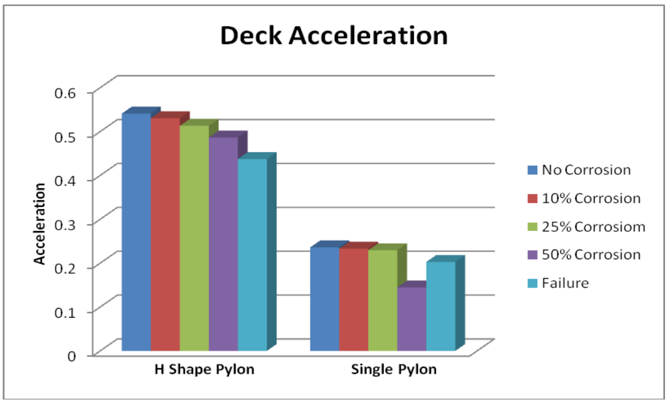

Fig -18: Deck Acceleration for Bhuj Earthquake

From the plotted bar chart for deck acceleration it is observed that H shaped pylons exhibits least acceleration of 0.437mm/sec^2 at 50% corrosion and a maxim.um acceleration of 0.5412 mm/sec^2 at no corrosion stage. The bar chart indicates that the deck acceleration decreases with increase in corrosion percentage and is least at failure stage. Whereas single pylon exhibits least acceleration of 0.1448mm/sec^2 at 50% corrosion and maximum acceleration of 0.2362mm/sec^2 when subjected to corrosion at failure.

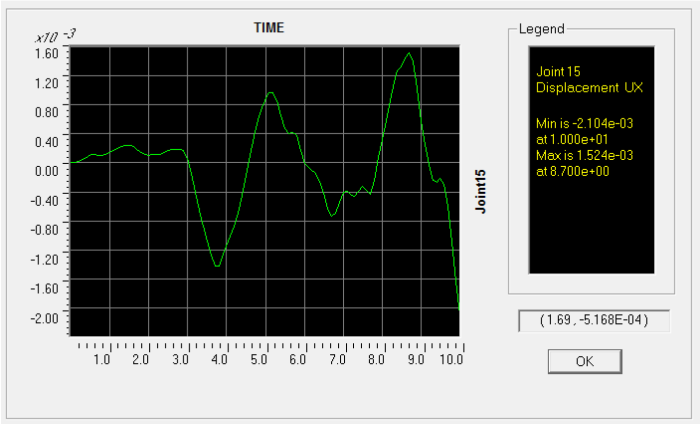

Fig -19: Time History Graph showing Peak Displacement for Bhuj Earthquake

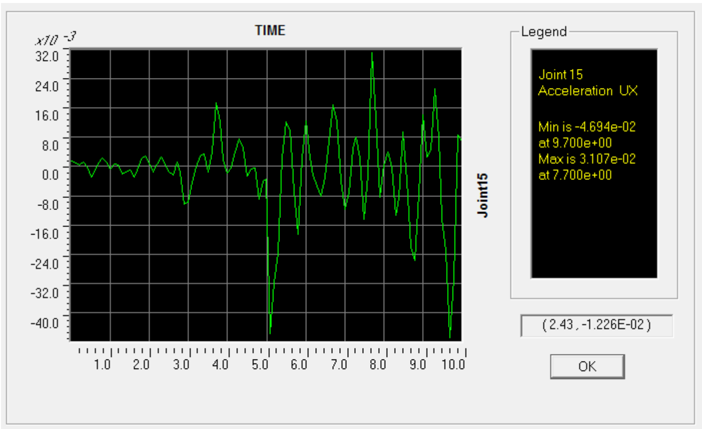

Fig -20: Time History Graph showing Peak Acceleration for Bhuj Earthquake

2.2.2.2 Elcentro Earthquake

Table -12: Time History Results of H Shape Pylon for Elcentro Earthquake

	Pylon		Deck	
Stage	Deflection (mm)	Acceleration (mm/s^2)	Deflection (mm)	Acceleration (mm/s^2)
No Corrosion	36.44	12.55	0.6362	0.2229
10%	36.58	12.38	0.6269	0.2157
25%	37.32	12.33	0.6194	0.2078
50%	37.09	12.32	0.5751	0.1952
Failure	38.25	12.43	0.5098	0.1706

Table -13: Time History Results of Single Pylon for Elcentro Earthquake

	Pylon		Deck	
Stage	Deflection (mm)	Acceleration (mm/s^2)	Deflection (mm)	Acceleration (mm/s^2)
No Corrosion	54.41	19.44	2.675	0.9666
10%	54.78	19.4	2.627	0.9532
25%	56.72	19.52	2.602	0.9403
50%	29.11	9.77	1.592	0.5382
Failure	58.93	19.79	2.363	0.8415

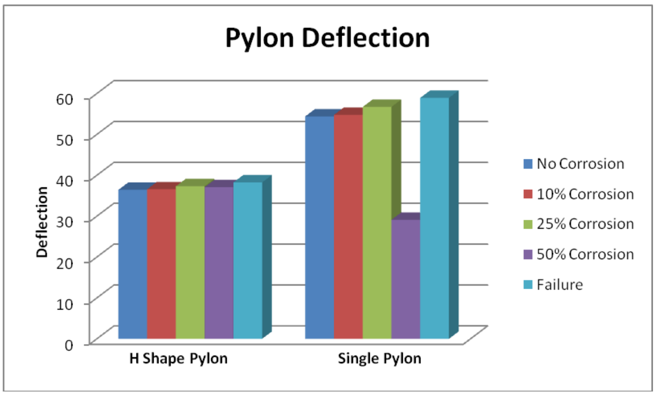

Fig -21: Pylon Deflection for Elcentro Earthquake

From the plotted bar chart for displacement it is observed that H shaped pylon exhibits least deflection of 36.44mm at No corrosion stage and a maximum of 38.25mm at failure stage which indicates that we can see that deflection increases with increase in corrosion but there is a gradual drop at 50% corrosion stage and later increases at failure stage which is the maximum deflection. Whereas single pylon exhibits least deflection of 21.11mm at 50% corrosion and maximum deflection of 58.93mm when subjected to corrosion at failure.

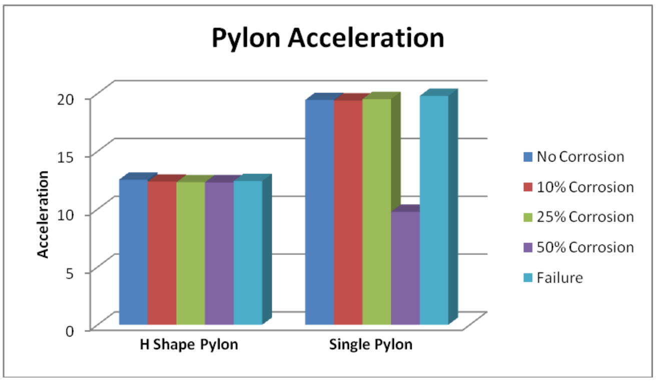

Fig -22: Pylon Acceleration for Elcentro Earthquake

From the plotted bar chart for acceleration it is observed that A shaped pylons exhibits least acceleration of 12.32mm/sec^2 at 50% corrosion stage and a maximum of 12.55mm/sec^2 at no corrosion stage which indicates acceleration is maximum at no corrosion stage and gradually decreases till 50% corrosion stage and increases at failure stage. Whereas single pylon exhibits least acceleration of 19.4mm/sec^2 at 50% corrosion and maximum acceleration of 19.79mm/sec^2 mm when subjected to corrosion at failure.

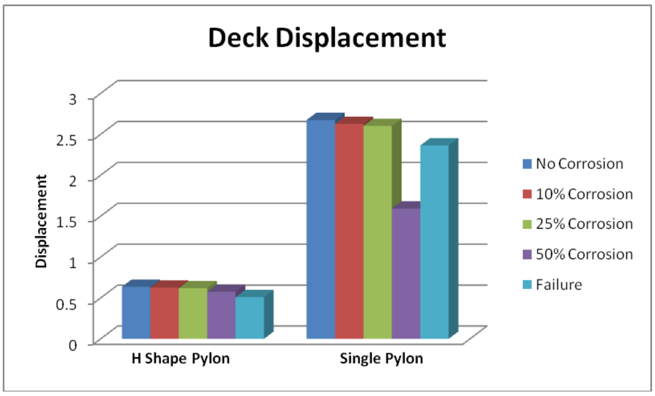

Fig -23: Deck Displacement for Elcentro Earthquake

From the plotted bar chart for deck displacement it is observed that H shaped pylon exhibits least deflection of 0.5098mm at 50% corrosion stage and maximum deflection of 0.636 mm when subjected to 0% corrosion which indicates that deck displacement decreases with increase in corrosion. Single pylon exhibits a maximum deflection of 58.93mm at failure stage and a least deflection of 29.11mm at 50% corrosion stage.

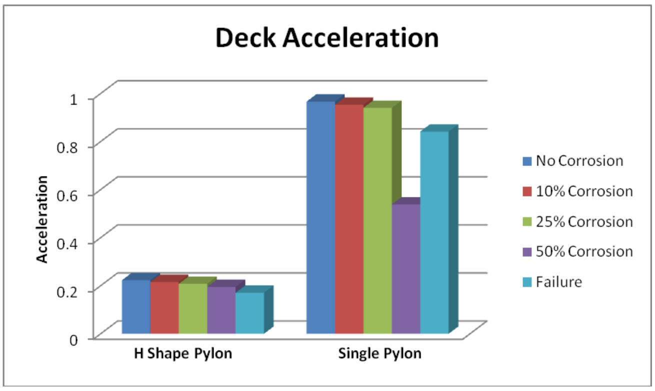

Fig -24: Deck Acceleration for Elcentro Earthquake

From the plotted bar chart for deck acceleration it is observed that H shaped pylons exhibits least acceleration of 0.1708mm/sec^2 at 50% corrosion stage and 0.2229 mm/sec^2 acceleration at failure stage which indicates that acceleration decreases with the increase in corrosion. Single pylon exhibits a maximum acceleration of 0.9666 mm/sec^2 at no corrosion stage and a minimum acceleration of 0.5382 at 50% corrosion stage

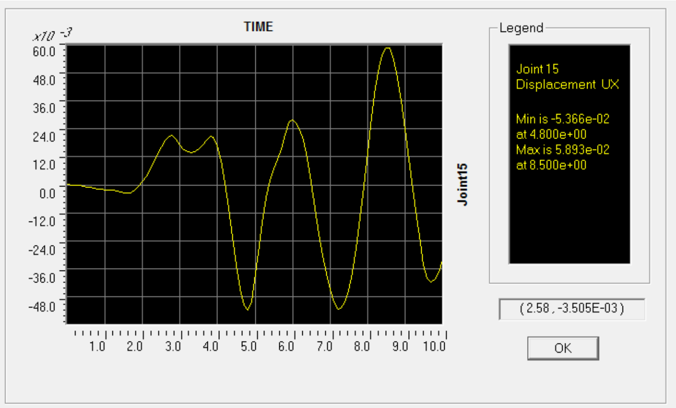

Fig -25: Time History Graph showing Peak Displacement for Elcentro Earthquake

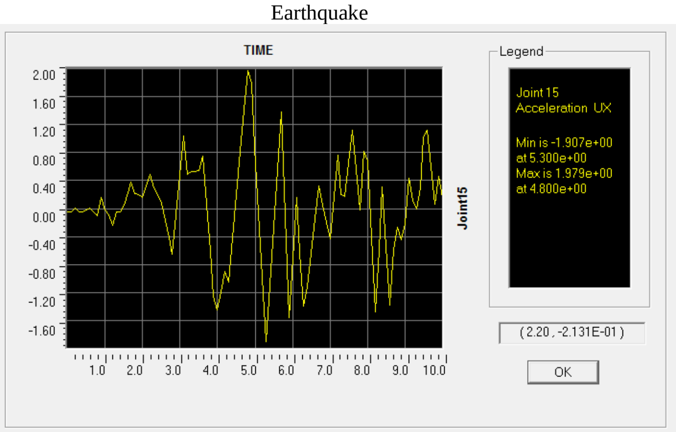

Fig -26: Time History Graph showing Peak Acceleration for Elcentro Earthquake

3. CONCLUSIONS

3.1 Conclusion on Static Analysis

- By the bar charts plotted for single pylon for deflection values, after failure of tendons due to corrosion, pylon 1 and 3 are showing maximum deflection of 50.599mm and 47.041mm respectively. But pylon 2 exhibits least deflection of 1.67mm.
- By the bar charts plotted for H shaped pylon, after failure of tendons due to corrosion, pylon 1 and 3 are showing maximum deflection of 29.19mm and 25.64mm respectively. But pylon 2 exhibits least deflection of 2.71mm.
- By the observations carried out on deflection of H and single pylons it is concluded that 'H' shaped pylon exhibits least deflection in comparison with other two shapes.
- In H shaped pylon cable force reduce from 216.332KN at 25% to 143.428KN at 50% corrosion. And in single pylon, cable subjected to corrosion retains their cable force up to 25% corrosion. After that at 50% corrosion cable strength will reduce drastically nearly half of the prior that is from 260.884KN at 25% to 172.397KN @50% corrosion.
- The above observations on cable forces indicate that single pylon will be subjected to maximum cable force and H shaped pylon cables with lesser cable force.
- From the observations made on period and frequency it can be concluded that for mode 1 for all models with 50% corrosion, least frequency and higher period values are observed compared to other corrosion percents and it indicates that H shaped pylon exhibits frequency of 0.184cycs/sec which is the least and period of 5.41sec which is the maximum value obtained by time history analysis. The observed results which are tabulated indicate that H shaped pylon is with first preference and single pylon.

3.2 Conclusion on Time History Analysis for Bhuj Earthquake

- It is observed that H shaped pylons exhibits least deflection of 10.86mm and least acceleration of 2.75mm/sec^2 at 50% corrosion and Whereas single pylon exhibits maximum deflection of 21.04mm and maximum acceleration of 4.7mm/sec^2 mm when subjected to corrosion at failure.
- For deck displacement it is observed that H shaped pylons exhibits least deflection of 1.643mm at failure and 0.4374mm deflection at failure. Whereas single pylon exhibits least deflection of 0.5969mm at 50% corrosion and maximum deflection of 0.8665 mm when subjected to 0% corrosion. Which indicates that H shaped pylon with failure criteria exhibits maximum deck displacement and single pylon shows least deck displacement.
- For deck acceleration it is observed that H shaped pylons exhibits maximum acceleration of 0.5412 mm/sec^2 acceleration at drastic failure. Whereas single pylon exhibits least acceleration of 0.1448mm/sec^2 at 50% corrosion

3.3 Conclusion of Time History Analysis for Elcentro Earthquake

- H shaped pylon exhibits least deflection of 36.44mm at No corrosion and 38.25mm deflection at failure stage. Whereas single pylon exhibits least deflection of 29.11mm at 50% corrosion and maximum deflection of 58.93mm when subjected to corrosion at failure.

- H shaped pylon exhibits least acceleration of 12.32mm/sec^2 at 50% corrosion and maximum of 12.55mm/sec^2 acceleration at no corrosion stage. Whereas single pylon exhibits least acceleration of 19.4m/sec^2 at 50% corrosion and maximum acceleration of 19.79mm/sec^2 mm when subjected to corrosion at failure.
- H shaped pylon exhibits least deck deflection of 0.509mm at 50% corrosion and maximum deflection of 0.636mm when subjected to 0% corrosion.
- H shaped pylons exhibit least deck acceleration of 0.1708m/sec^2 at 50% corrosion and 0.2229 mm/sec^2 acceleration at drastic failure. Whereas single pylon exhibits least acceleration of 0.5382mm/sec^2 at 50% corrosion and maximum acceleration of 0.9666mm/sec^2 when subjected to corrosion at failure.

From all the above observations on we can conclude that **H shaped pylons** show satisfactory performance by the parametric observations on displacement, period frequency and acceleration with respect to Single pylon bridge except the deviated deck displacement and acceleration parameters to be considered for analysis and design.

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