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# A STUDY ON HEALTH MONITORING OFPRESTRESSED CONCRETE SLAB BRIDGE

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**ABSTRACT**

*This undertaking depicts a Civil Structural Health Monitoring (CSHM) technique for evaluation of common structures by utilizing a blend of cutting edge observing gear with probabilistic based appraisal. The quantities of common structures, for example, spans, burrows, holding dividers, dams, and so forth have expanded significantly the most recent a long time since an expansion in development were available in the sixties. In the most recent decade's new procedures in upkeep, review and evaluation of out foundations have been created to make it conceivable to keep on utilizing the structures longer than the planned administration life. Additionally the requests of the structures are diverse currently contrasted with when they were raised, for instance the heaps are higher, less unsettling influences in rush hour gridlock are acknowledged and higher traffic streams are available. Thusly new innovations for review, evaluation, upkeep, reinforcing are required. In this undertaking we are thinking about psc piece connects by and large oppressed gravity stacks just and managing the wellbeing checking by utilizing probabilistic put together evaluation with respect to psc chunk spans.*

***Index terms- Civil Structural Health Monitoring, Probabilistic Based Assessment, Maintenance, Inspection, PSC Slab Bridges.***

## INTRODUCTION

Concrete, like stone, is particularly concrete in weight and capacities outstandingly when used as a vertical fragment or supporting post, for example. Exactly when used on a dimension plane as a segment or shaft, concrete can conventionally cross simply short divisions before it begins to split and miss the mark with the exception of in the event that it is made thicker. The significance and weight of a plain strong column a little while later become too much immense and unfeasible for longer level crosses required in structures and augmentations.

**EXPERIMENTAL PROGRAM**

The trial consider is directed in two stages. In the principal stage, straightforward rectangular prestressed pillars are examined. In the second stage, a scale model of a run of the mill support piece connect normally embraced by the Indian Railways is contemplated. In the two stages, center was around examining the impact of breaking and prestress constrain on the characteristic recurrence. The post-tensioning technique for prestressing is utilized utilizing a mono-wire prestressing jack. The wedges and barrels are made of high quality steel. The most extreme power through the prestressing jack is constrained by the water powered hand siphon and the related weight measure showing the liquid weight. No bond is permitted to create between prestressing wires and encompassing cement. This is guaranteed by oiling the wires and afterward turning them intermittently until cement is solidified. Four rectangular light emissions meter length each are utilized in this examination. The geometry of these pillars is appeared in Fig. 1(a) and support subtleties are appeared in Fig. 1(b). The four shafts vary just in the measure of prestressing power. The areas of the 7mm breadth HTS prestressing wires inside the cross-segment of the pillars are appeared in Fig. 1(c). Steel molds are utilized to cast the 4-meter length bars. The support enclosure of HYSD bars is arranged and set in position. The prestressing wires of the required length (example length of 4 meters in addition to grasp length of 1.5 meters for prestressing jacks) are cut and set in the ideal position.

**MATERIALS PROPERTIES**

High pressure steel (HTS) wires of 7mm distance across are utilized. The material passes the prerequisites for HTS wires noted in IS: 1785-1983. A definitive elasticity of the 7mm wires are gotten as 1338 N/mm2 . The greatest burden in each wire is taken as 40 kN compares to a worry of about somewhat less than 80% of a definitive rigidity. Standard 150mm solid shapes cast with the pillar and scale show example are tried according to IS:516-1959 at 28 days just as upon the arrival of testing the example. The objective evaluation of cement is M35. The modulus of versatility of cement is determined utilizing the accompanying articulation [IS: 456-1978] E c f ck = 5700

**EXPLORATORY STUDY**

The key characteristic recurrence of the bar is gotten by a vibration study office. A stream diagram of the test system demonstrating the test set-in the mood for acquiring the common recurrence of the prestressed shaft is appeared in Fig. 3. One power balance accelerometer (FBA) is set at the mid-range of the bar and another accelerometer at the quarter length (so as to check whether there is a noteworthy difference in mode shape). The example is tapped vertically with a sledge and the resulting free vibration reaction of

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the pillar is found out. The FFT (Fast Fourier Transform) of this speeding up reaction is utilized to acquire normal recurrence of the example. This activity is accomplished for various benefits of prestressing power (by presenting or discharging the prestressing power in a portion of the wires), and with various dimensions of splitting presented in the example. Breaking in the example is presented via cautiously stacking the example by an actuator in a dislodging control mode and after that discharging the heap.

**Tests on Prestressed Beam**

The accompanying advance shrewd technique is utilized to think about the prestressed shaft 1: 1. The principal normal recurrence is estimated on the virgin pillar with no prestressing power.

2. The example is currently exposed to prestress compel. Of the three wires in the shaft, one wire is worried at once (each wire being prestressed upto 40 kN) and normal recurrence estimated with each new wire being prestressed.

3. With every one of the wires conveying the prestress constrain, a transverse heap of 4kN is connected on the example at the mid-length utilizing a dislodging controlled water powered actuator. In the wake of applying the most extreme heap of 4kN, the heap is discharged. At the point when the heap is totally evacuated and the contact between the actuator and the example is discharged, the common recurrence is estimated once more.

4. Presently 8kN transverse burden is connected in additions of 4kN each. In the wake of stacking, emptying, and discharging the contact between the actuator and the example, the characteristic recurrence is estimated once more.

5. Stage 4 is rehashed for transverse heap of 12 kN and 16 kN.

6. The prestress compel in the three wires is slowly expelled in the turn around arrangement in which they were stacked.

7. The prestress wires are again stacked one by one, and common recurrence estimated at each dimension. Table 2 gives the outcomes. Bolt in the table speaks to arrangement of testing.

**Tests on Prestressed Beam**

An alternate method was utilized in shaft 2.

1. The crucial normal recurrence is estimated on the virgin pillar with no prestressing power.

2. A transverse heap of 4kN is connected and evacuated, with none of the four wires focused. That is, the bar is split even before any wire is conveying a prestress drive. Common recurrence of the broke shaft is estimated.

3. A higher heap of 6kN is presently connected and evacuated and the characteristic recurrence of this split bar is estimated.
4. Presently, the prestress is connected in one wire at any given moment. At each dimension of prestress, the characteristic recurrence of the pillar is estimated.
5. After every one of the wires are prestressed, the prestress constrain in the four wires is discharged one by one in the switch succession in which they were stacked. At each dimension of prestress, the characteristic recurrence is determined.

This strategy is uniquely intended to break down the impact of shutting of splits by prestressing power on the normal recurrence. Table 3 gives the outcomes. Bolt in the table speaks to succession of testing. Tests on Prestressed Beams 3 and 4 The method of test embraced in bars 3 and 4 is indistinguishable to that utilized for bar 1, then again, actually the quantity of wires is seven in pillar 3 and nine in bar 4 (each wire being prestressed upto 40 kN), as against three in bar 1. Thusly, shafts 3 and 4 are stacked transversely up to about 27kN. Tables 4 and 5 give the outcomes. Scale Model of a Girder-Slab Bridge The technique of testing the scale show example is as that embraced for bars 1, 3, and 4.

One noteworthy distinction is that after each utilization of transverse burden, the prestressing links were discharged and afterward stacked once more (with normal recurrence being estimated at each stage) before another cycle of transverse burden was connected.

1. The extension demonstrate is basically bolstered.
2. The crucial characteristic recurrence of the virgin extension demonstrate is estimated.
3. The example is exposed to prestress constrain. Out of the six wires in the model (three in each web), the symmetric pair of wires (one wire in every brace) are prestressed at once. The grouping of prestressing utilized with reference to the wire numbering is same as given in Fig. 2(c).
4. At each dimension of prestress, the normal recurrence of the scale show is gotten.
5. At the point when the extension show is exposed to the greatest prestress drive, a transverse heap of 20kN is connected on it at the mid-length utilizing an uprooting controlled water driven actuator in 9 augmentations of 5kN each. Subsequent to applying the most extreme heap of 20kN, the heap is discharged. At the point when the heap is totally evacuated and the contact between the actuator and the example is discharged, the normal recurrence is estimated once more.
6. The prestress compel in the six wires is steadily expelled in sets of two wires in the invert grouping in which they were stacked.
7. Stages 3 and 4 are rehashed.

8. Once more, when all the six wires are focused on, the water driven actuator is utilized to apply a transverse burden, yet this time with a bigger plentifulness of heap of 40kN in augmentations of 5kN each. Subsequent to stacking, emptying and discharging the contact between the actuator and the example, the normal recurrence is estimated once more.
9. This method is rehashed until the abundancy of the transverse burden is gradually expanded to close to a definitive heap of the example. The stacking history demonstrating the most extreme plentifulness of the heap in each cycle is appeared Table.
10. The test common recurrence of the scale show connect example acquired by the above strategy is given in Table.

**DISCUSSION OF RESULTS**

The accompanying perceptions are produced using the test outcomes acquired amid the tests:

1. Hypothetical gauge of the characteristic recurrence of the shafts was 22.5 Hz. This matches great with the watched regular recurrence, and ends up being an upper bound an incentive on the watched qualities. This is valid as hypothetical gauge of the flexural unbending nature is constantly higher than genuine because of splitting of the solid.
2. The scale model of support piece connect demonstrates a huge variety in the essential normal recurrence as gotten by investigation (= 55.6 Hz) with the exploratory qualities (in the range 30 to 37 Hz). Comparable variety in expository and measures recurrence has additionally been accounted for in different investigations (Kato and Shimada, 1986; Saidi et al, 1994). This unmistakably shows it 10 is somewhat hard to expect exact estimation of regular recurrence of solid structures because of challenges in effectively displaying the modulus of versatility and the snapshot of inactivity. Also, dynamic qualities are delicate to changes in help conditions that may have minimal auxiliary outcome (Salawu, 1995).
3. Prestressing power when all is said in done tends to build the characteristic recurrence of the solid pillar. It does as such by shutting the smaller scale splits in the solid, in this manner making the shaft all the more hardened. Results in the initial four sections of Table 2 demonstrate a distinction of about 13% on this record.
4. Basic splits in a solid shaft cause a decrease in the characteristic recurrence. Table 3 demonstrates a distinction of about 16% because of breaking without prestressing power.
5. Prestressing power can close the basic splits in the shaft and reestablish the normal recurrence esteem. For example, Table 2 demonstrates the normal recurrence within the sight of prestressing power as about 20.4 Hz when the example was stacked and emptied with the transverse burden.

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Notwithstanding, once the prestressed drive is discharged the regular recurrence drops down to about 14.0 Hz.

6. Loss of prestress together with the auxiliary splits in the pillar can cause huge drop in the regular recurrence of the bar. For example, according to Table 2, the normal recurrence of flawless pillar with prestressing power is 21.7 Hz which drops down to about 14.0 Hz with all out loss of prestressing power and with basic breaks: a drop of about 35%.
7. Aftereffects of Specimen 3 and 4 are especially like those acquired in the example 1. This builds up that the outcomes acquired are very broad and mirror the normal conduct of the PSC supports. 8. Characteristic recurrence estimations of the scale show for the most part concur with the patterns noted above for the shaft example. For example, the prestressing expands the regular recurrence of the model by around 10%.

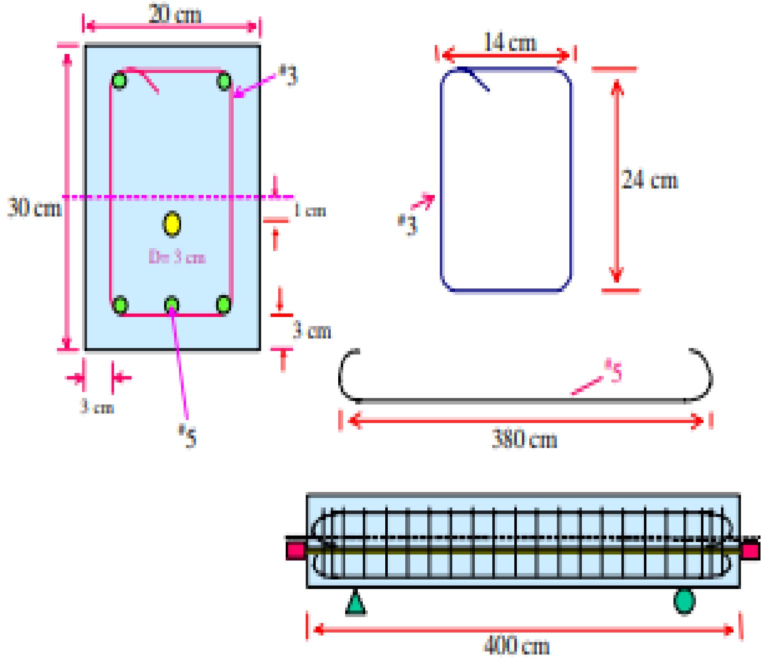


**Figure: A schematic outline of the PC pillar.**

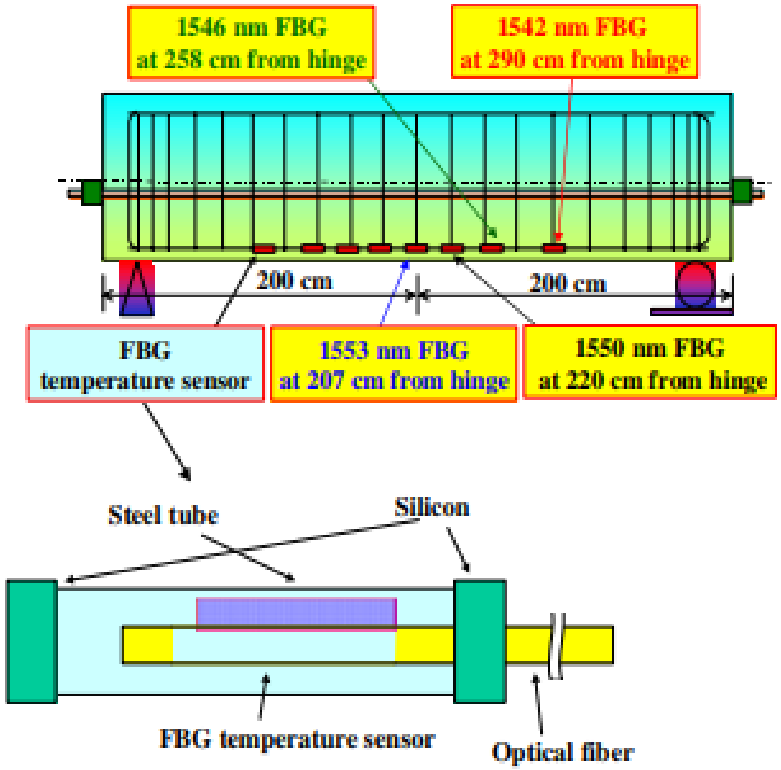


**Figure: The areas of the FBG sensors in the PC shaft**

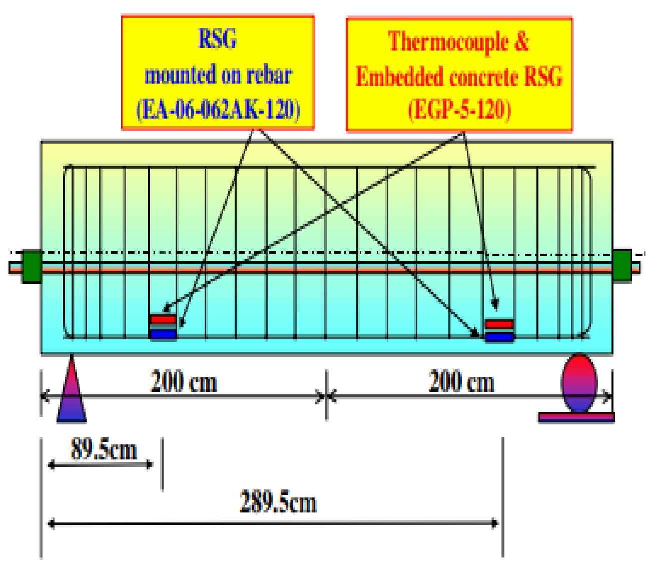


**Figure: The areas of the thermocouples and the RSG sensors in the PC pillar**

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Nonetheless, the wavelength move, the temperature and the strain can't be estimated all the while with a solitary grinding, since there is just a single detecting parameter in this application. So as to isolate the strain reaction from the temperature flag, the FBG temperature sensor, appeared in figure 2, was placed in a 1 mm width steel tube, fixed with silicone at the two finishes, to permit peaceful removal of the temperature twisting of the FBG. This sensor was used to gauge the temperature inside the PC shaft. For correlation, solid strain measures and thermocouples (figure 3) were implanted in the PC pillar. The safe sort strain measures (RSG) were additionally set on the fortification, in nearness to the FBG sensors. Furthermore, a reference thermocouple was utilized to screen the surrounding temperature. Figure 4 demonstrates an average hydrated response temperature amid the solidifying procedure.

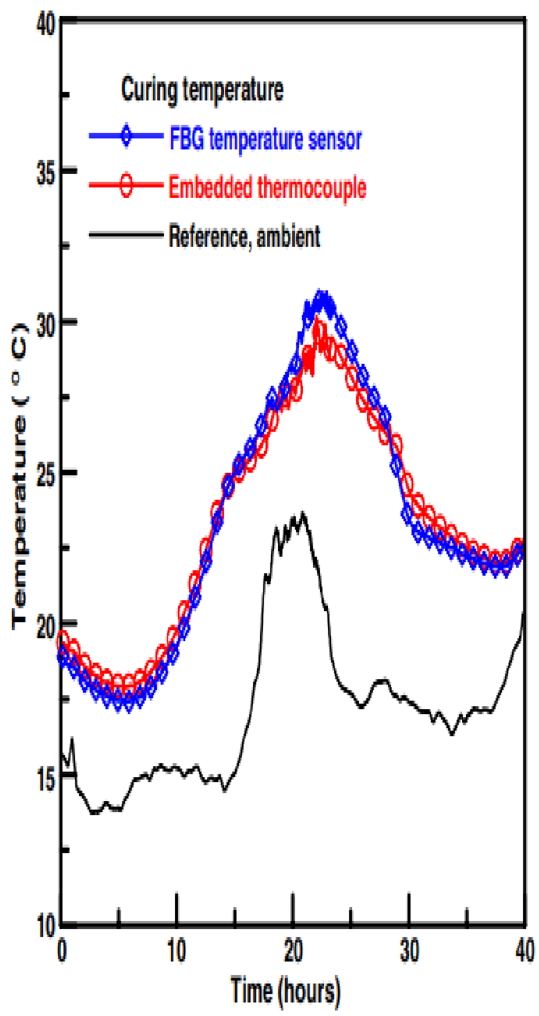


**Figure.A schematic outline of the hydrated responses.**

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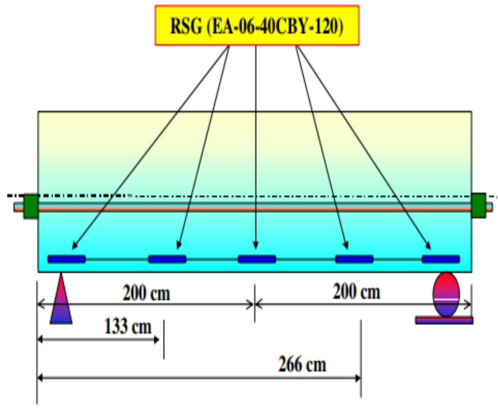


**Figure: Diagram of the RSG sensors on the PC shaft—surface mounted.**

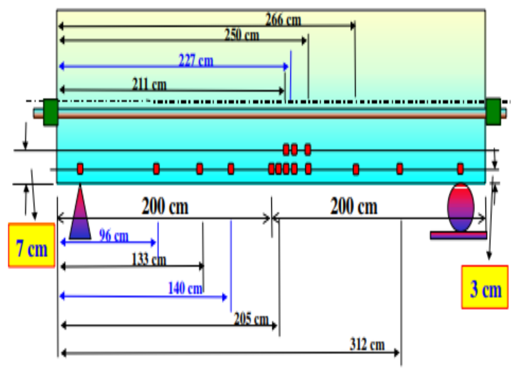


**Figure. A schematic diagram of the FBG sensors on the PC beam—surface mounted.**

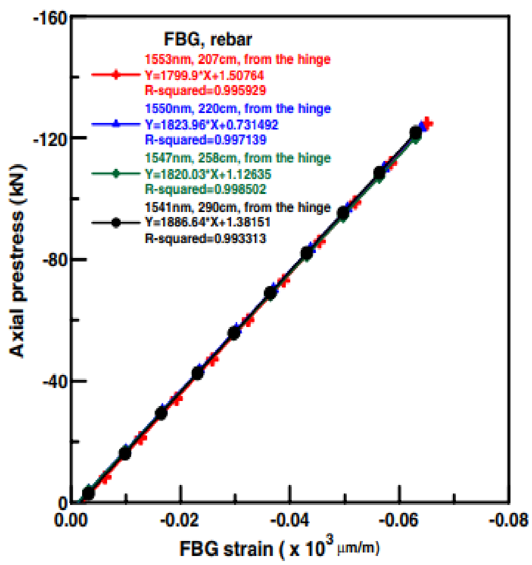


**Figure.The strain response of the FBG sensors under axial prestress on the rebar.**

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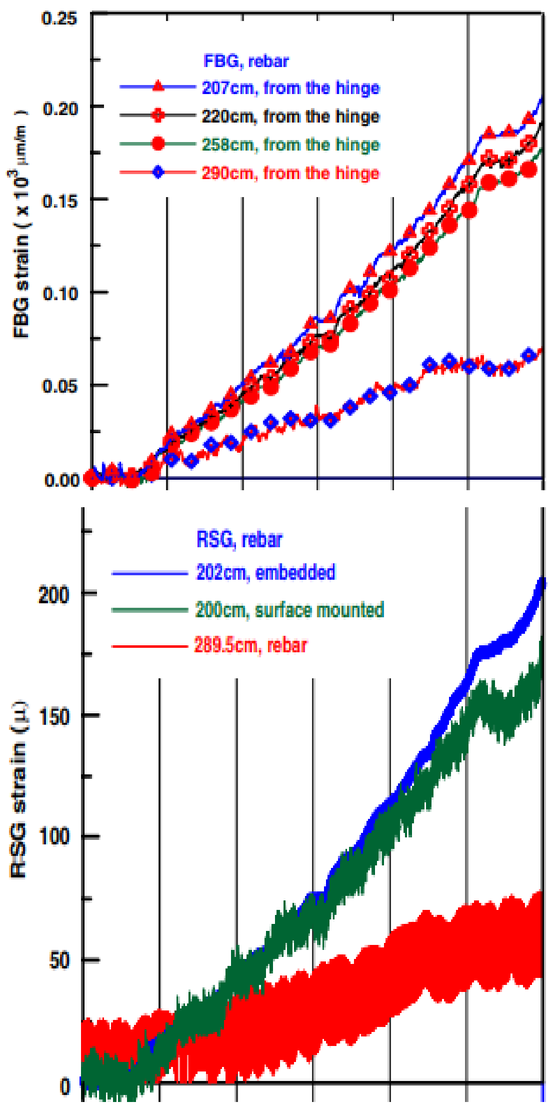
**Crack monitoring**

It was assessed that the PC shaft at first broke at a vertical stacking of around 21.8 kN, under 100 kN hub prestressed stacking; the solid compressive quality was 10 000 psi for this PC bar that had relieved for 90 days. The harm to the PC pillar, under outer stacking, is appeared in figure. As can be seen, as the breaks spread, they cut over the sensors. At the point when the connected stacking surpassed as far as possible, the started breaks harmed or split the RSG and FBG sensors. Then, the area of the harm or splits could be surveyed from the reaction of the RSG or FBG sensors, since these measures did not work appropriately because of the breaks.



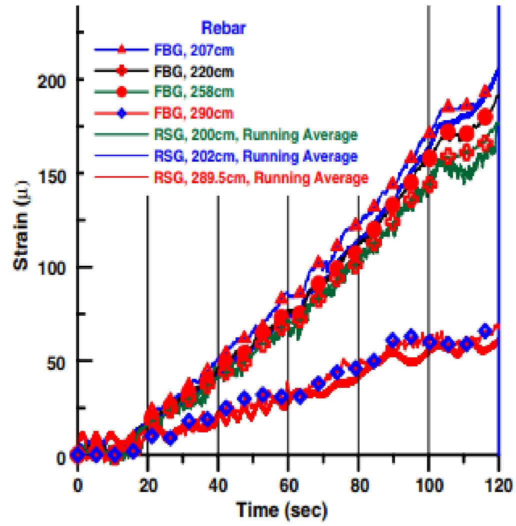
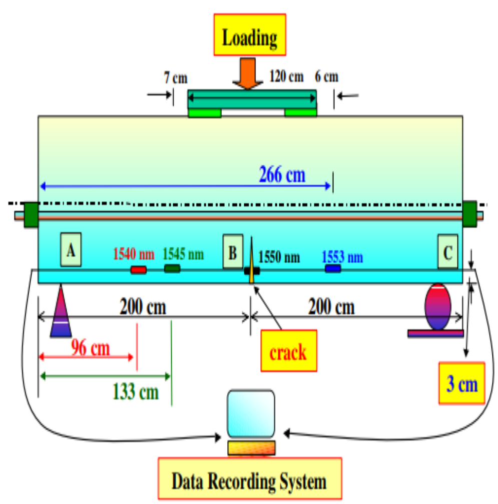



**Figure: The comparison of the strain response between the RSG and the FBG sensors under real-time measurement at different locations.**

Prestressed pillars are broadly utilized in structural designing structures. Somewhere in the range of 1945 and 1965, 1000 prestressed solid extensions were built, 550 were of the VIPP type (free range viaducts with prestressed bars). Therefore, the upkeep of such structures is a focal issue. To lessen support costs, the harmed shafts in the structure must be recognized early. To accomplish this reason, the shafts ought to be observed and non-dangerous control techniques ought to be utilized. Converse procedures utilizing dynamic reactions have been created in [2] to distinguish the prestress compel in a bar, considering a one-dimensional (1D) shaft modelisation.




**A schematic delineation of the transmission– reflection information recording strategy and the area of the split.**

**CONCLUSION**

The present examination gives an idea in regards to the assortment in ordinary repeat of the backings with loss of prestressing power and with fundamental parts. Basic completions of the examination are abbreviated here under:

1. The test and theoretical assessments of normal frequencies organize reasonably well for the rectangular bars yet don't facilitate well for the scaled platform appear. It clearly underlines the manner in which that one can't want to methodicallly get trademark repeat correctly for PSC props and after that would like to make reference to one-time exploratory target realities to assess the quality of the expansion.
2. There is no "weight progressing" as reported in some composition. Accordingly, the prestressing power does not lessen the normal repeat of the prestressed bolsters on this record.
3. Upto a particular regard, prestressing power all things considered forms the trademark repeat of the pole. This is done by closing the littler scale parts present in the strong, which grows the flexural rigidity. This drenching sway is a result of start of weight parts in concrete at raised measures of prestressing power.
4. As a result of essential part in non-prestressed bars, there is significant abatement in the typical repeat. In any case, prestressing force may suitably close these breaks and may in like manner restore the trademark repeat of the pole.
5. It is typical that if there ought to be an event of certified augmentations, if the fundamental parts are joined by loss of prestress oblige, discontinuous vibration estimations may force in perceiving the issue. In any case, if the prestress urge does not diminish with time, some debilitating in bond as parts may not consider much the normal repeat.
6. It was unreasonable to watch an essential change in the key mode condition of the columns with part or with loss of prestress. This is as per what was ordinary reliant on speculation of vibrations

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