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Seismic Response of Structural Components in Near Fault and Far Fault Region

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***Abstract:*-- The current study deals with the performance of a structure in a G+11 multistorey building is investigated under different ground motions such as Fault normal and Fault parallel component of the ground motion by dynamic time history analysis method and the analysis is done in the ETAB software. The Acceleration, Velocity and displacement curves have been drawn for both Fault Normal and Fault Parallel component of Far Fault and Near Fault ground motion. The values of acceleration, velocity, displacement have been found in every 0.010 seconds, also the values of Peak Ground Acceleration, Peak Ground Velocity and Peak Ground Displacement has been determined for both components. The values of PGA, PGV, PGD obtained for fault normal component are higher than the values obtained for the fault parallel component of the ground motion, also the frequencies of fault normal component of ground motion are more than that of the fault parallel component of ground motion.The values of Peak Ground Acceleration, Peak Ground Velocity and Peak Ground Displacement of Fault Normal and Fault parallel components don't differ much for Far Fault earthquake ground motions, but they differ much for Near Fault Earthquake ground motions. The response spectrum curves are different for each kind of earthquake ground motions, hence it means that the structure have different responses to each kind of earthquake ground motions**

key words: Fault normal, Fault Parallel, Time History Analysis, ETABS etc.

I. INTRODUCTION

An earthquake is the result of an unexpected release of energy in the Earth's crust that creates seismic waves. The seismicity or seismic action of an area refers to the frequency, type and size of earthquakes practiced over a period of time. Near-fault ground motions are different from ordinary ground motions in that they often contain strong coherent dynamic long period pulses and permanent ground displacements. The probabilistic approach to seismic hazard analysis has an important advantage over the deterministic approach in that it takes into account the degree of activity of the faults that contribute to the hazard, providing explicit estimates of the likelihood of occurrence (or return period) of the hazard level that is specified in the design ground motions.

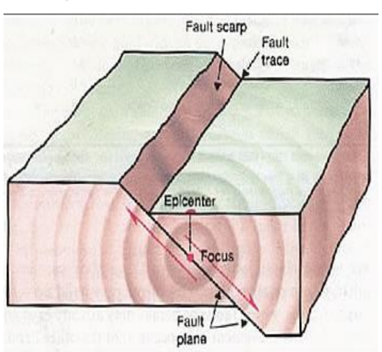

FIG 1: FAULT PLANE SLIP AND FOCUS

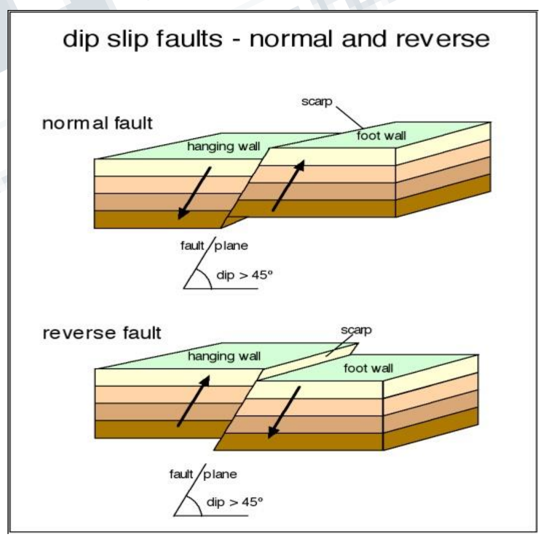

FIG: NORMAL AND REVERSE FAULT

2. BUILDING DISCRIPTION:

2.1 Material properties:

S no.	Material	Grade
1	CONCRETE(SLAB)	M35
2	REBAR	HYSD-500
3	STEEL	Fe345

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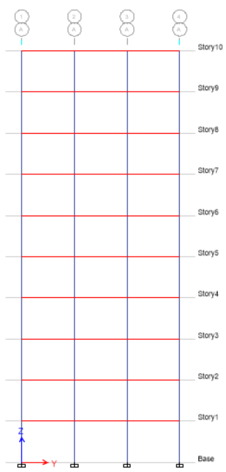
2.2 Seismic data:

S no.	Parameter	Factor
1	SEISMIC ZONE FACTOR	IV
2	TYPE OF SOIL	MEDIUM
3	IMPORTANCE FACTOR	1
4	RESPONSE REDUCTION FACTOR	5
5	TIME PERIOD	PROGRAM CALCULATED

Elevation detail



MODEL

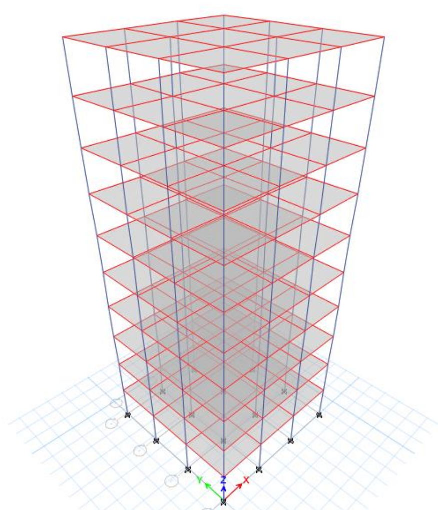


FIG.3: MODEL DESIGNED ON SPFTWARE

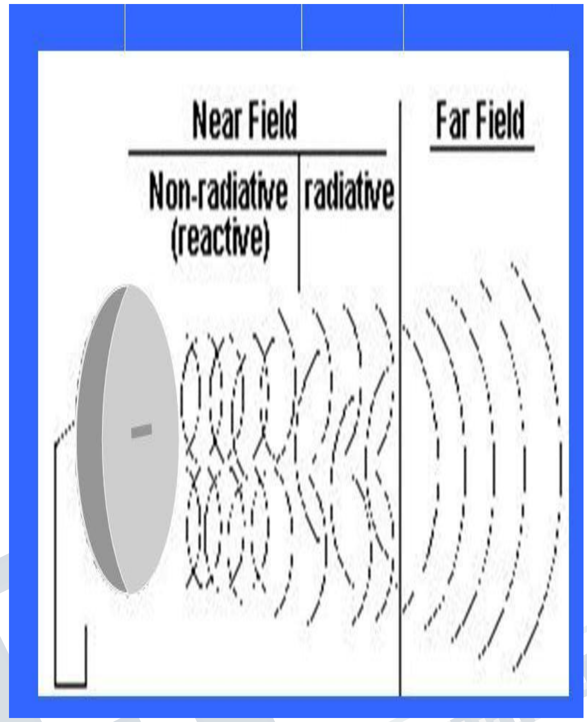


FIG4: RADIATIVE PULSE IN NEAR FIELD AND FARFIELD

3. OBJECTIVE AND SCOPE

1. To study the differences in structural responses against different earthquake ground motions conditions.
2. To perform dynamic time history analysis on a structure in model structure by the associated data of time history.
3. To compare the associated peak ground acceleration (PGA) for near field earthquake and far field earthquake.

4. EARTHQUAKE AND STATION DETAILS

Uttarkashi 1991-10-19 21:23:15 UTC Magnitude:(Ms=7.0)	STATION: BHATWARI HYPOCENTRAL DISTANCE:21.7 Km (near field)
Uttarkashi 1991-10-19 21:23:15 UTC Magnitude:(Ms=7.0)	STATTION: KOSANI HYPOCENTRAL DISTANCE:148.2 Km (far field)

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5. DATA COLLECTION AND INPUT FOR ANALYSIS

Input data for near fault region

• Station: Bhatwari, India Station Owner: Dept of Earthquake Eng., Indian Inst. of Technology, Roorkee, India
Station Latitude & Longitude: 30.8000, 78.2200
• HP = High Pass and LP = Low Pass Filters
• Spectra are available for 0.5 - 20% damping.

5.1 Data collection

5.1.1NEAR FAULT LINE

PGA(CM/S/S)	PGV(CM/S)	SPECTRA
-242.00	-29.80	0.5% 1% 2% 3% 5% 7%
289.00	-13.40	0.5% 1% 2% 3% 5% 7%

5.1.2 FAR FAULT LINE

PGA(CM/S/S)	PGV(CM/S)	SPECTRA
-28.30	-1.88	0.5% 1% 2% 3% 5% 7%
-11.00	0.92	0.5% 1% 2% 3% 5% 7%

6. RESULT:

The velocity-sensitive spectral region for the fault-normal component of near-fault records is much thinner, and their acceleration-sensitive and displacement-sensitive regions are much broader, compared to far-fault motions.

6.1 Fault normal acceleration

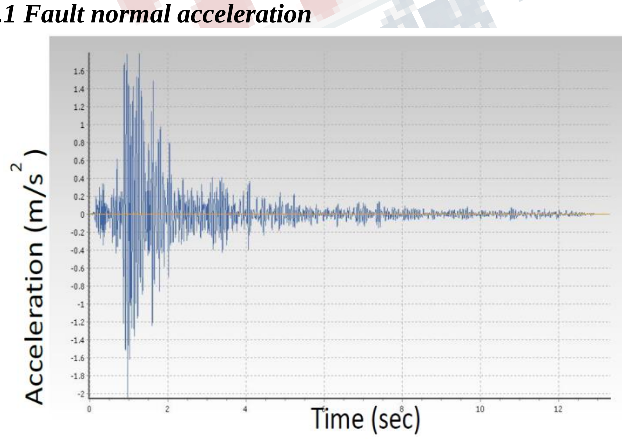

FIG 6: ACC VS TIME GRAPH FOR NORMAL

6.2 Fault parallel acceleration

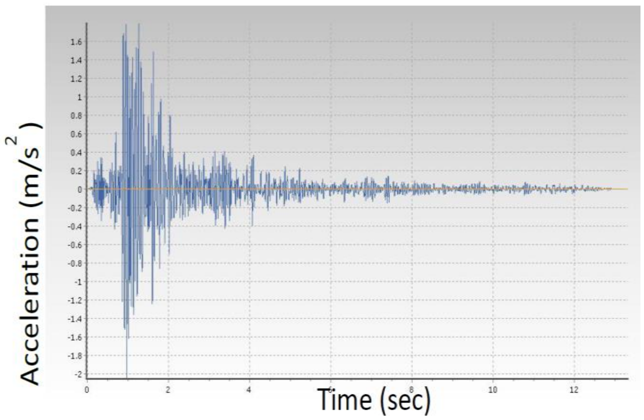

FIG 7: ACC VS TIME GRAPH FOR PARALLEL COMPONENT

6.3 Near fault components comparision

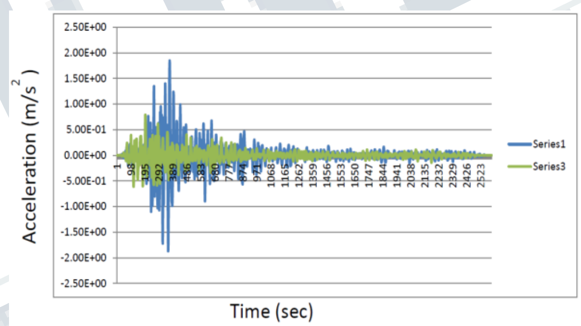

FIG 8: COMPARISON OF BOTH COMPONENTS(ACC VS TIME GRAPH)

6.4 Fault normal component

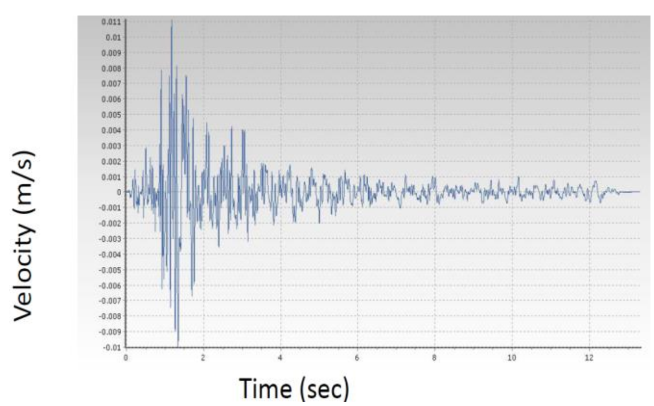

FIG 9: VELOCITY VS TIME GRAPH FOR NORMAL COMPONENT

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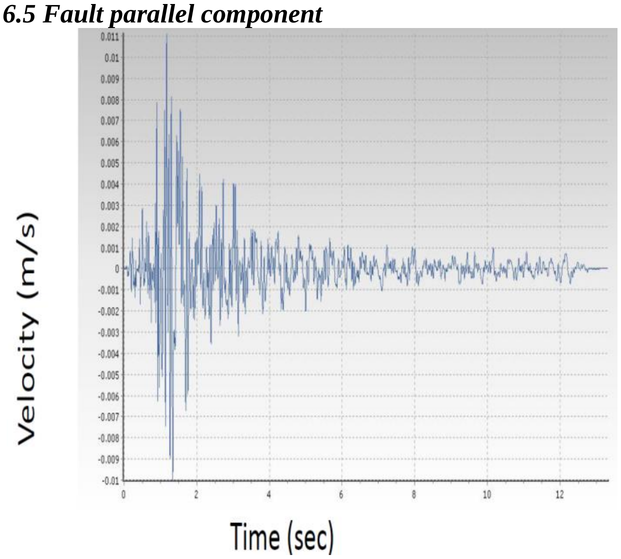
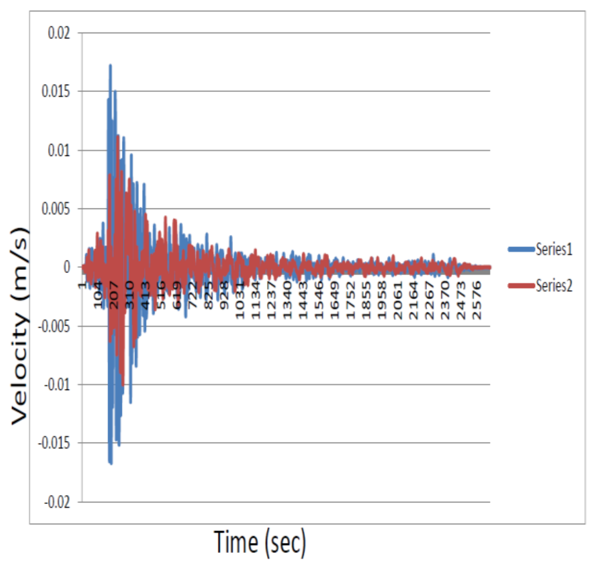
6.5 Fault parallel component



6.6 Combined velocity



7.CONCLUSION:

• The values of Peak Ground Acceleration, Peak Ground Velocity obtained for fault normal is higher than fault parallel component for every 0.010 sec time
• The obtained frequencies due to earthquake taken are higher for normal component than parallel component
• Combined graph for PGA and PGV shows the effect on normal and paraale component on fault plane occurring due to reverse slip producing radiative pulses in near field area.

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