INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY
HYDERABAD

R&D SHOWCASE 2021
Technology, Social Impact

STRUCTURAL HEALTH MONITORING OF BUILDING USING ITK SENSOR DUE TO SEISMIC DISTURBANCES IN CHANDIGARH, INDIA

Objective and Scope of Study :

- The objective of this study is to monitor the health of buildings due to microtremors, using high precision building vibration sensors.
- Scope of the study is to understand the change in lateral stiffness and natural period of the buildings due to micro and minor earthquakes over a large period. Variation in building response is estimated for similar future earthquakes

Introduction:

- Main reason for casualties is due to collapse of buildings. On the other hand, large and rapidly growing urban seismic risk in India is a problem that needs to be quickly solved.
- To assess seismic performance of buildings due to seismic disturbance, 7 buildings were selected, based on Purpose, height and type of building. In total seven buildings and among one is in Hyderabad and rest are in Chandigarh city.

Sensors:

- There are two types of IT Kyoshin Vibration sensors i.e., Portable and permanent. Portable one is used to find the proper location to install permanent sensors In all seven buildings, permanent sensor set were installed at appropriate location.
- These sensors are installed with permanent network setup and are connected to a mac-mini. The data acquired from both these sensors have a sampling rate of 100 and a frequency range of 0–50 Hz. The data from both these sensors are recorded in three directions.

Observation and Discussion:

- Ambient vibration study was carried out for all seven buildings using six minutes ambient wave form (Fig.1). Natural period is estimated along NS and EW direction of each buildings.
- Ambient and earthquake event response (Punjab University) are compared. It is found that the natural frequency during event is higher than the ambient. Also it is clearly seen that after every event there is small change in structural stiffness.
- In Punjab University, two events were recorded. EQ1: East of Khash, Iran Observed PGA=2.1gal and EQ2: North-East of Bhadarwah, India .Obs. PGA=4.2gal.
- From this record EQ2 the maximum ground motion acceleration was about 4.2 gal (cm/sec2) for N-S and E-W direction at the ground floor of the building and the maximum ground motion acceleration at the ground floor of the building at EQ1 was 2.1 gal (cm/sec2) which is about half of the earthquake on May 1 (EQ2) described above.
- Therefore, it is necessary to investigate further about the difference in the NS direction. About the difference in the case of EQ2 and EQ1, because the external force to be input to the building in an earthquake are different for each earthquake, it is considered that some errors due to it might be occur. In order to reduce this error, observation data of many earthquakes are required.

Case Study:

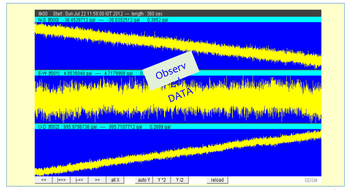


Fig 1. Example data of Microtremor Observation

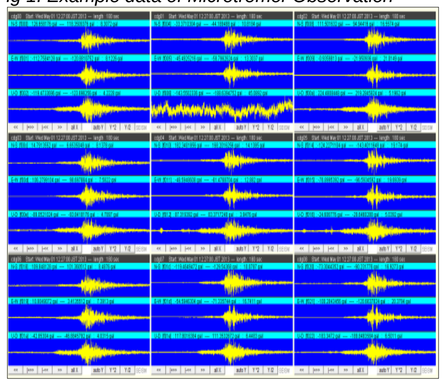
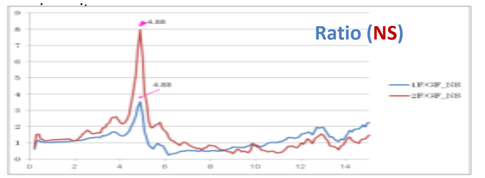
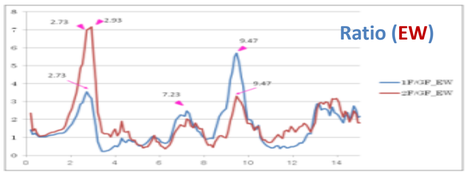


Fig 2. EQ1: 2013-05-01 12:27 IST M5.4 North-East of Bhadarwah, India, Observed PGA=4.2gal, at Punjab

Indian Time (ut+5:30)		Max p-p (gal/base floor)			USGS Info.	
DATE	TIME	CDG00	CDG05	Base Int	M	Location
2012/8/14	2:04:00	1.39	-	-	5.4	Pakistan
2013/2/11	16:19:42	3.63	2.84	0.3	4.7	21km NNE of Barkot, India
2013/4/4	12:03:00	1.08	1.06	-	5.3	46km SW of Ashkasham, Afghanistan
2013/4/16	16:17:44	4.38	3.28	1	**7.7**	83km E of Khash, Iran
2013/5/1	12:28:17	**8.49**	**11.59**	**1.5**	5.7	17km NE of Bhadarwah, India
2013/5/1	14:50:00	0.58	0.69	-	4.6	11km NNE of Bhadarwah, India
2013/5/24	11:23:00	1.19	0.67	-	?	
2013/6/6	3:35:00	1.32	2.05	-	4	40km NNE of Chamba, India
2013/7/9	19:20:00	-	1.1	-	5.1	112km ENE of Kyelang, India
2013/7/13	23:19:00	0.7	1.53	-	4.4	36km NE of Dharmsala, India

	North - South		East -West	
	EQ1	EQ2	EQ1	EQ2
Block 1	5.03	4.88	3.13	2.83
Block 2	4.20	4.20	3.03	2.93
	4.20	4.00	2.93	2.64
All values are in Hz				





(a) *(b)*

Fig 3. Transfer function of Punjab University building due to EQ1 along (a) NS component and (b) EW

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