

**Training/workshop on  
“Earthquake Vulnerability and Multi-Hazard Risk Assessment:  
Geospatial Tools for Rehabilitation and Reconstruction Effort”**

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# Population at Risk

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# Earthquake damage zone

IKONOS image of 12 Oct 2005, Balakot city, 30 km north east of Earthquake epicenter



**Legend**  
 Damaged areas  
 Catastrophic  
 Extensive  
 Moderate

Map ID: 1068  
 Production Date: 19 October 2005  
 Scale 1:4,000 for A1 printing  
 0 125 250 500 Meters



**Description**  
 On October 8, 2005 a series of severe earthquakes struck northern Pakistan and India. The main epicenter was located near Muzaffargarh city, in the Sindh region, about 100 km south east of Islamabad, the Capital of Pakistan. This IKONOS satellite image, acquired on 12 October 2005 depicts the village of Balakot, situated 30 km north east of the epicenter. Damage is detected through the satellite image and is classified as:  
 Catastrophic: more than 70% of buildings collapsed;  
 Extensive: between 30 and 70% of buildings collapsed; and  
 Moderate: less than 30% of the buildings collapsed.

Reference coordinate system  
 Projection: UTM Zone 43 N  
 Spheroid: WGS 84  
 Datum: WGS 84

Processing analysis  
 Image processing by JRC  
 (Panfile creation, 4 and 8bit spectral fusion bands)  
 Source image date: 12 October 2005  
 Source image spatial resolution: 1 meter

Data source  
 Source: SPOT/IKONOS/IKONOS  
 UNOSAT  
 www.unosat.com

Disclaimer: This map does not reflect the official opinion of the European Commission or other European Community institutions. Neither the European Commission nor any person or institution acting on the behalf of the European Commission is responsible for the use that may be made of the information contained in this map.



# Catastrophic damage

**More than 70% of buildings collapsed**



pre-disaster image



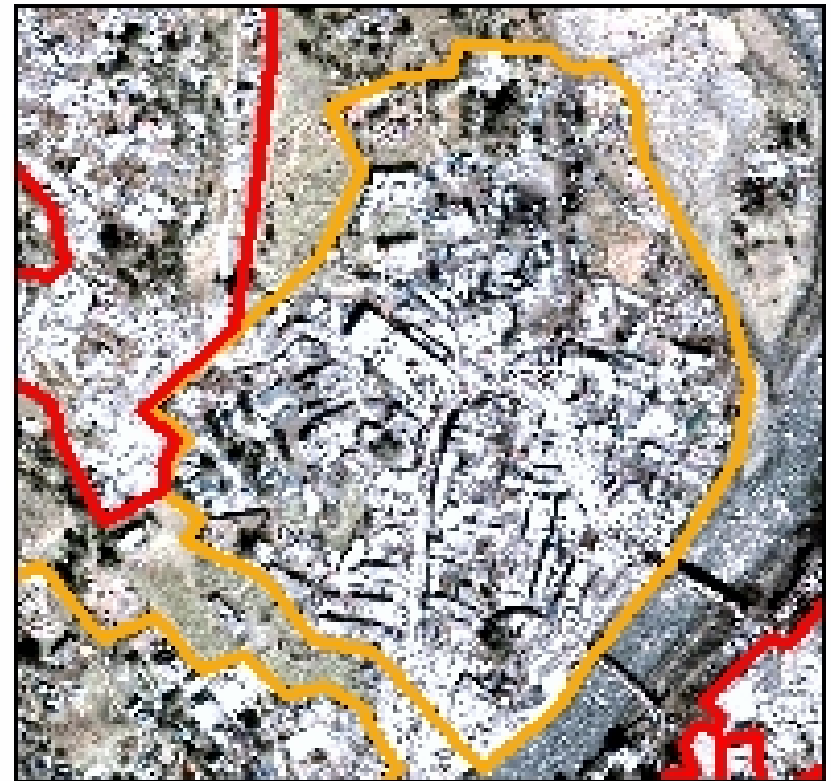
Catastrophic damages  
post-disaster image

# Extensive damage

Between 30 and 70% of buildings collapsed



pre-disaster image



Extensive damages  
post-disaster image

# Moderate damage

less than 30% of the buildings collapsed



pre-disaster image



Moderate damages  
post-disaster image

# Building footprints

- *spatial distribution* – Basic location information
- *localize population* on activities of people:  
residential + others
- for emergency response + mitigation management

TO KNOW WHERE TO LOOK

# Ward data (Lalitpur SMC)

Ward	Sub-blocks	Area (ha)	Pop	Pop/h <sub>a</sub>
1	16	42.4	7090	167
2	38	129.9	10459	81
3	42	151.0	10637	70
4	62	180.9	10971	61
5	33	70.3	6573	93
6	12	25.5	6352	249
7	8	23.8	6408	269
8	18	44.4	7355	166
9*	22	75.0	8135	108
10	36	81.1	5430	67
11	7	10.3	4238	411

\* Ward 9: oblique photo showing non-uniform distribution of buildings and population

Ward	Sub-blocks	Area (ha)	Pop	Pop/h <sub>a</sub>
12	11	13.1	5677	433
13	24	95.3	6553	69
14	26	184.6	11530	62
15	42	243.3	11352	47
16	15	9.1	5294	582
17	9	56.7	6693	118
18	17	12.7	6915	544
19	12	17.7	6048	342
20	20	19.9	6519	328
21	5	6.2	4249	685
22	23	46.9	8513	182
Total	498	1540.1	162991	106

# Mapping units

Blocks      minimum      0.2 ha      250 population

maximum 2 ha < 1000 population

(rural areas maximum 7 ha)



# Population distribution in time

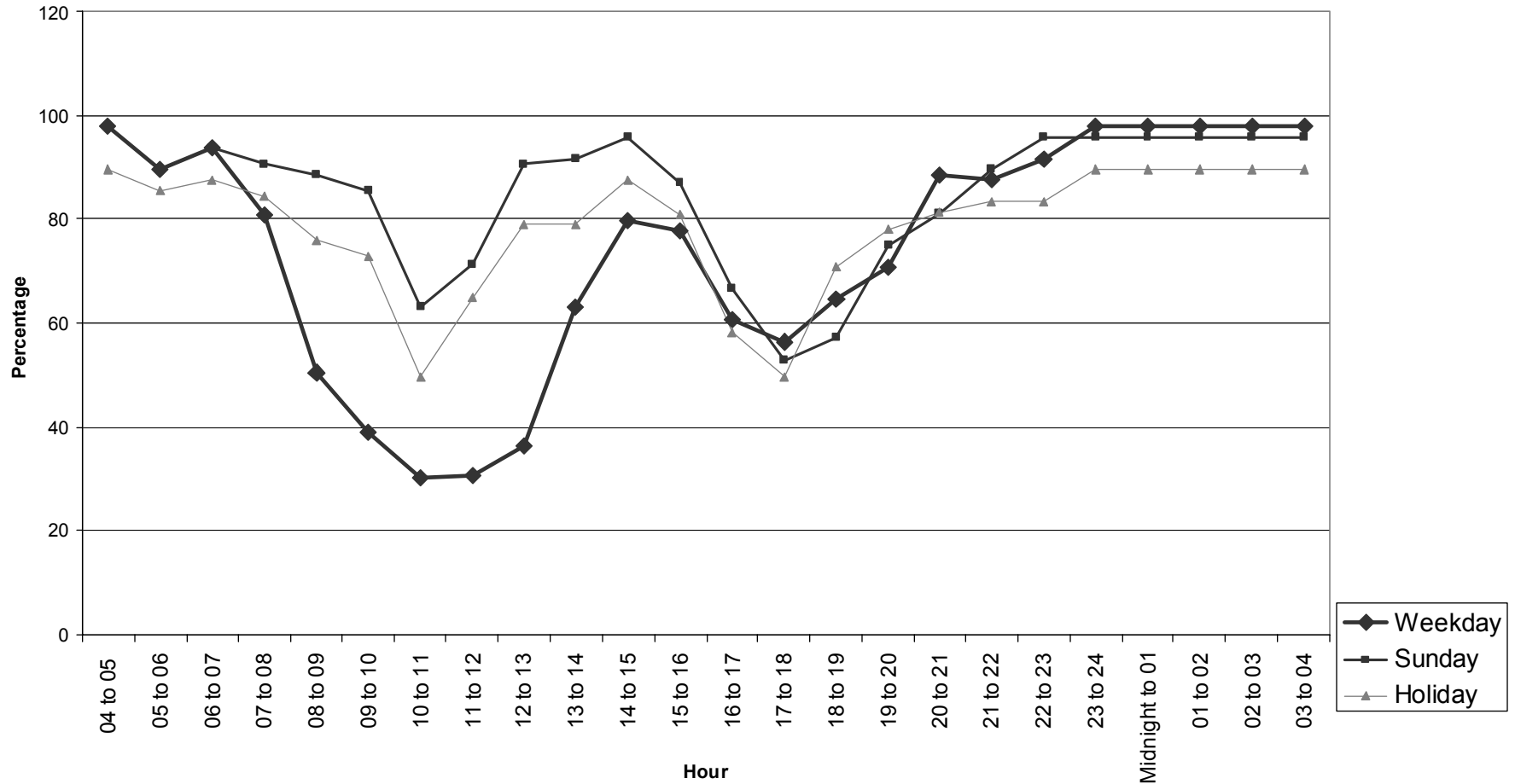
## Small mapping units / Time / location information

- residential activities of people (at home)
- other activities (school, office, industry, moving, ....)
- special case: commuters, non-registered population (students, visitors, etc)

### Example from Dehradun

TO KNOW WHEN + WHERE PEOPLE ARE

# Dehra Dun: % of household at home



# Population Indoors: House

