Application of GIS tools and techniques for better urban planning

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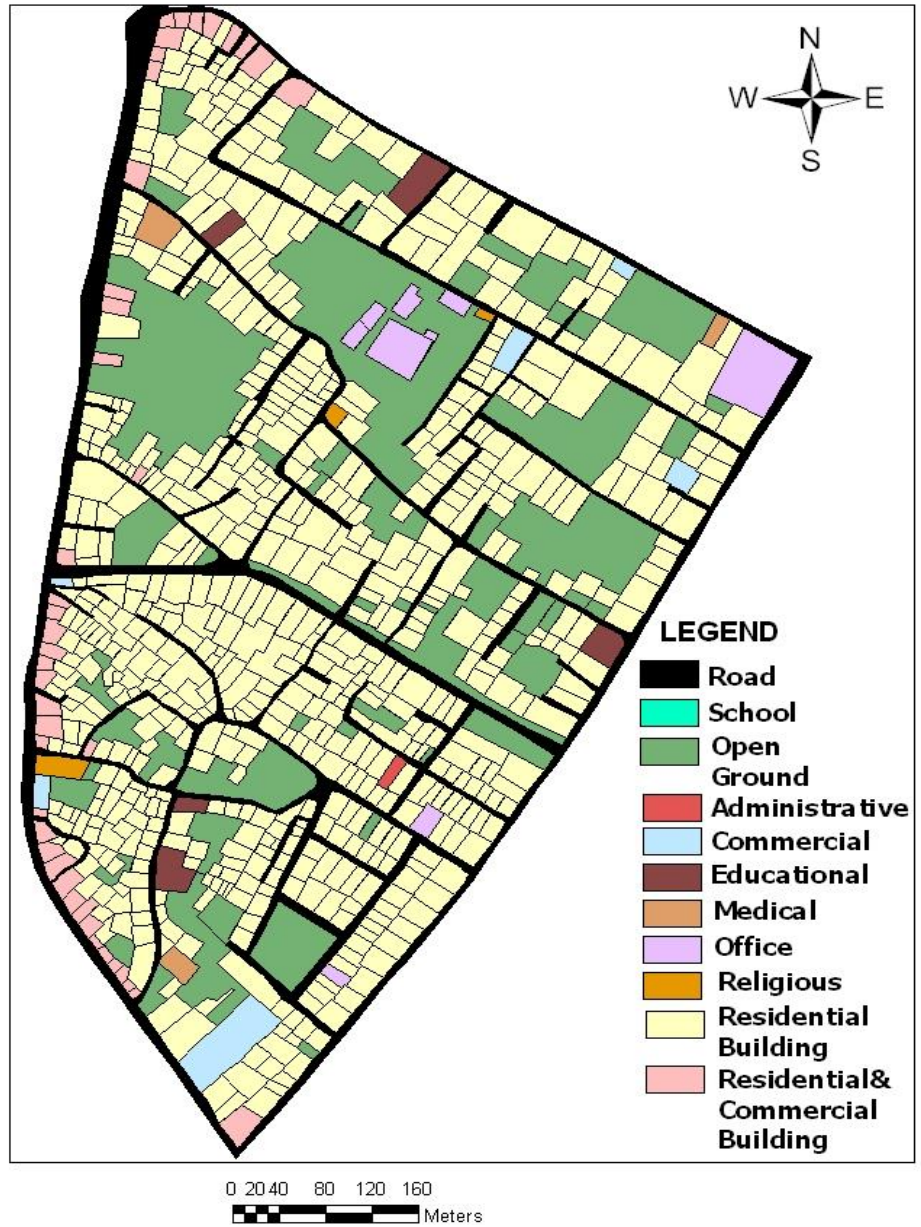
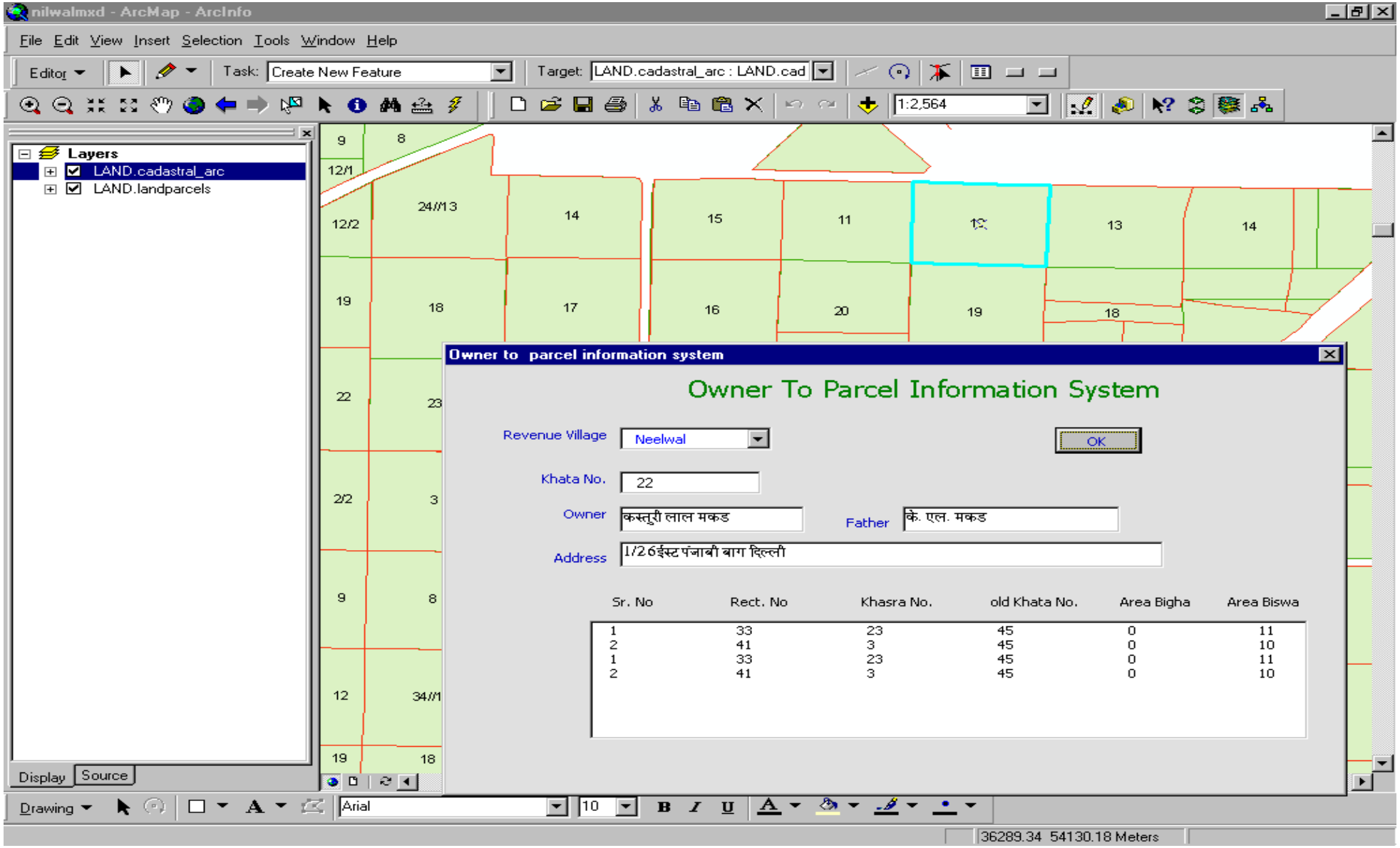
Urban planning is a spatial activity (we need accurate maps)

LANDUSE


N
W
E
S
LEGEND
Road
School
Open Ground
Administrative
Commercial
Educational
Medical
Office
Religious
Residential Building
Residential& Commercial Building
0 20 40 80 120 160
Meters


nilwalmxd - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
Editor
Task: Create New Feature
Target: LAND.cadastral_arc : LAND.cad
1:2,564
Layers
LAND.cadastral_arc
LAND.landparcels
Display
Source
Owner to parcel information system
Owner To Parcel Information System
Revenue Village
Neelwal
OK
Khata No.
22
Owner
कस्तूरी लाल मकड
Father
के. एल. मकड
Address
1/26ईस्ट पंजाबी बाग दिल्ली
Sr. No
Rect. No
Khasra No.
old Khata No.
Area Bigha
Area Biswa
1 33 23 45 0 11
2 41 3 45 0 10
1 33 23 45 0 11
2 41 3 45 0 10
Drawing
Arial
10
36289.34 54130.18 Meters

Conventional Method of Record Keeping

Role of Remote Sensing and GIS

?

Remote Sensing & GIS: tools in urban planning

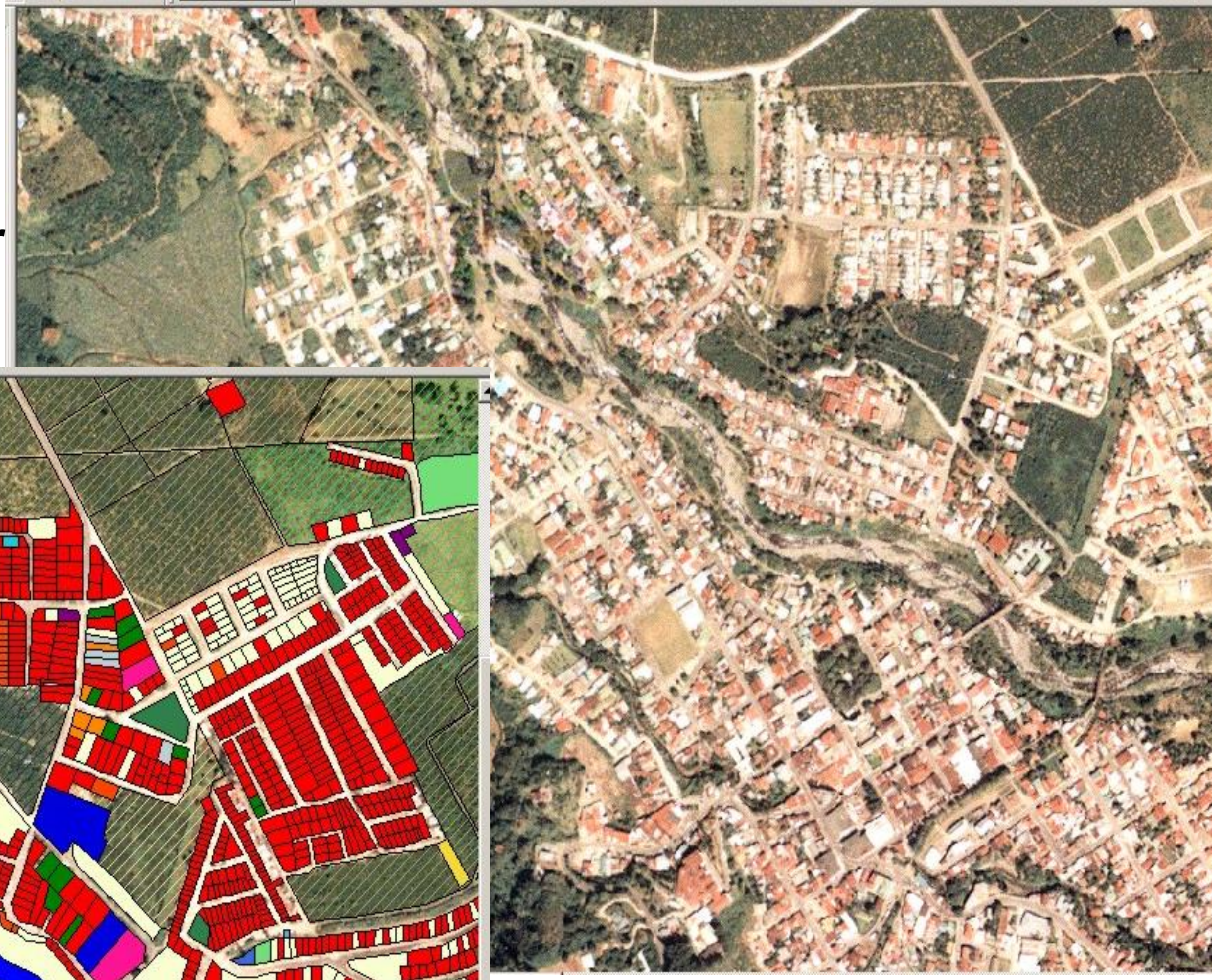
✓Remote Sensing → Spatial data provider

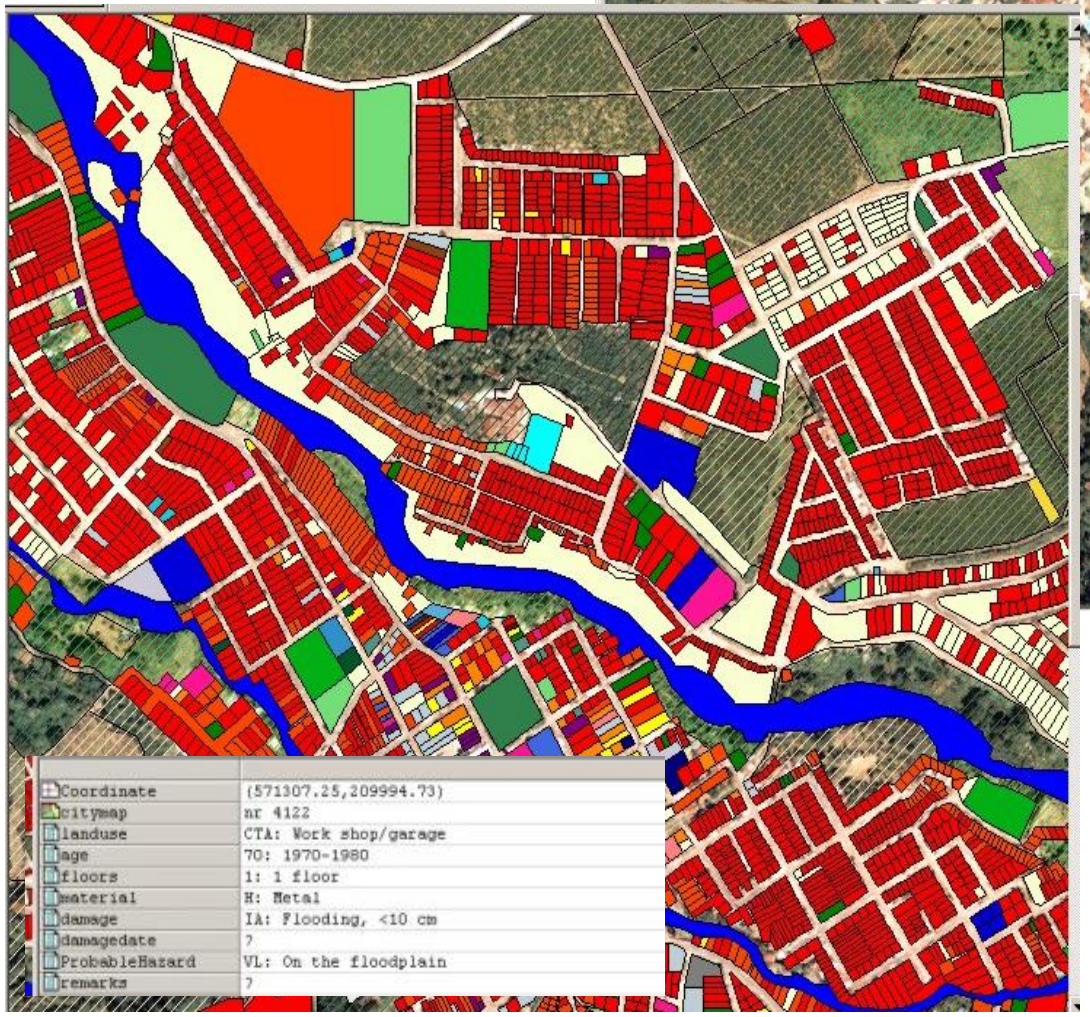
✓GIS (Geographical Information system)

→ Spatial data handler

Remote sensing:

Spatial data provider





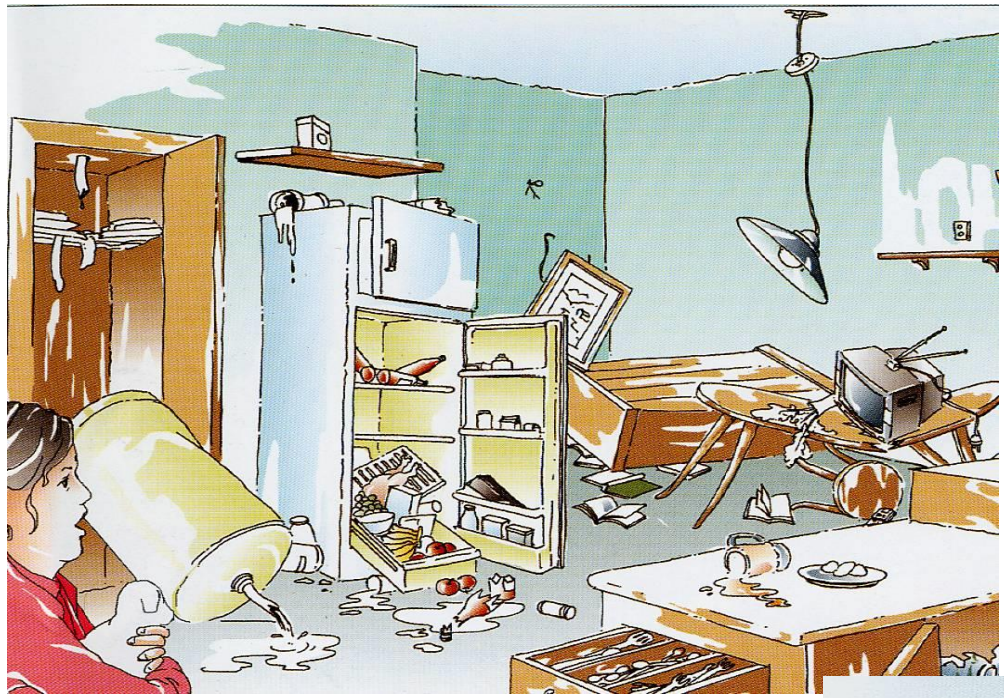
GIS:

Spatial data handler

Some of the applications

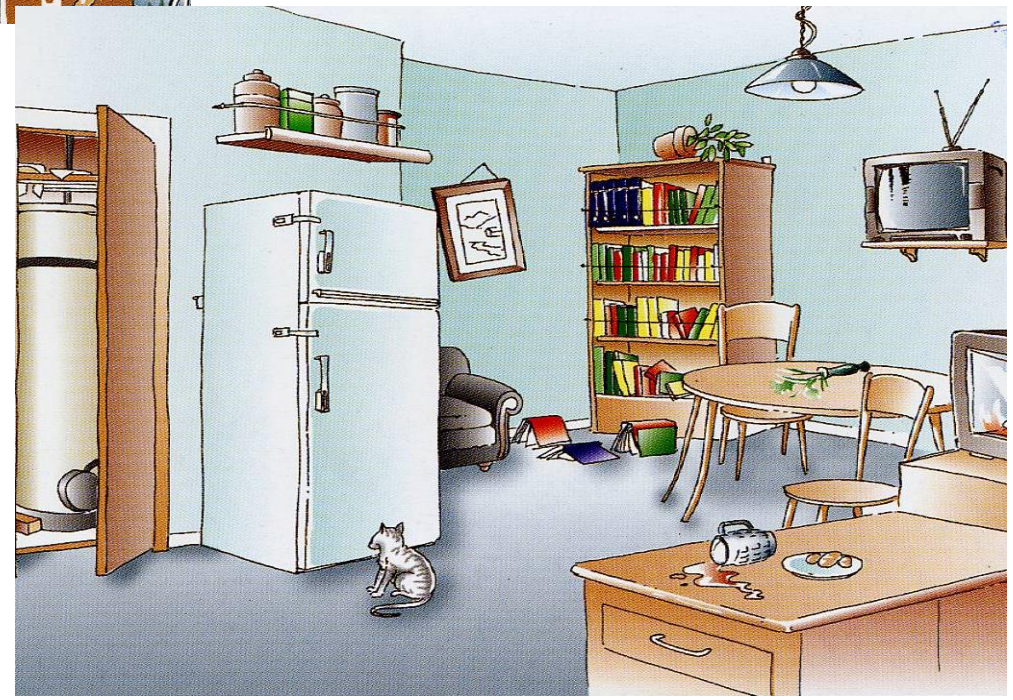
- Urban Seismic Risk Assessment.
- Network Analysis.
- Land cover/ Land use change modelling.

URBAN SEISMIC RISK ASSESSMENT

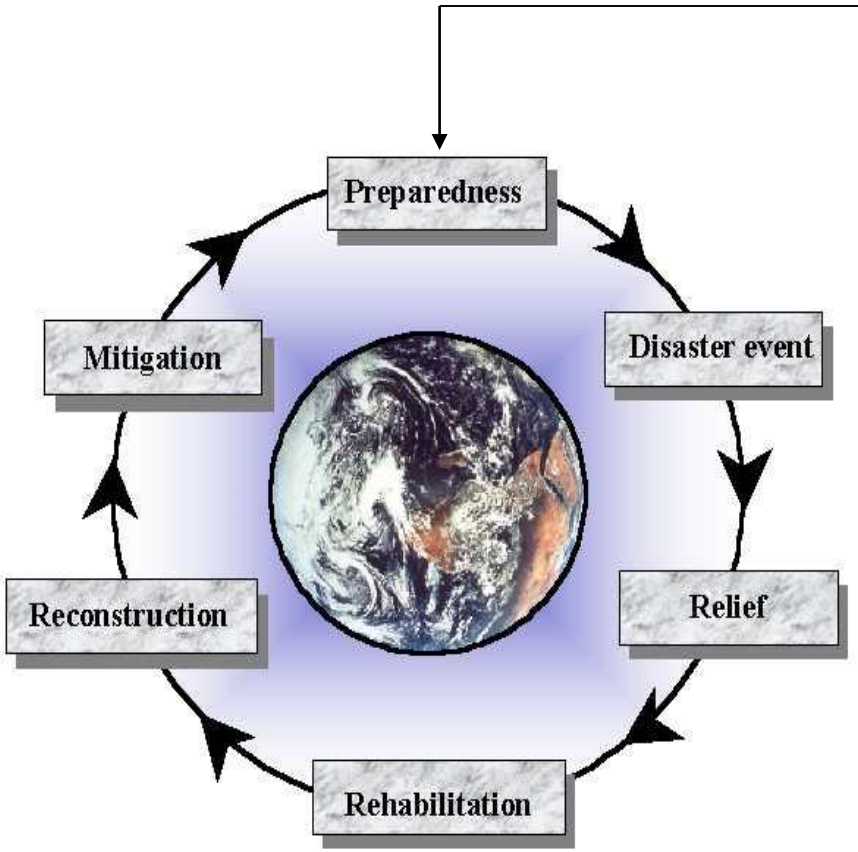


Preparedness

Reduce losses



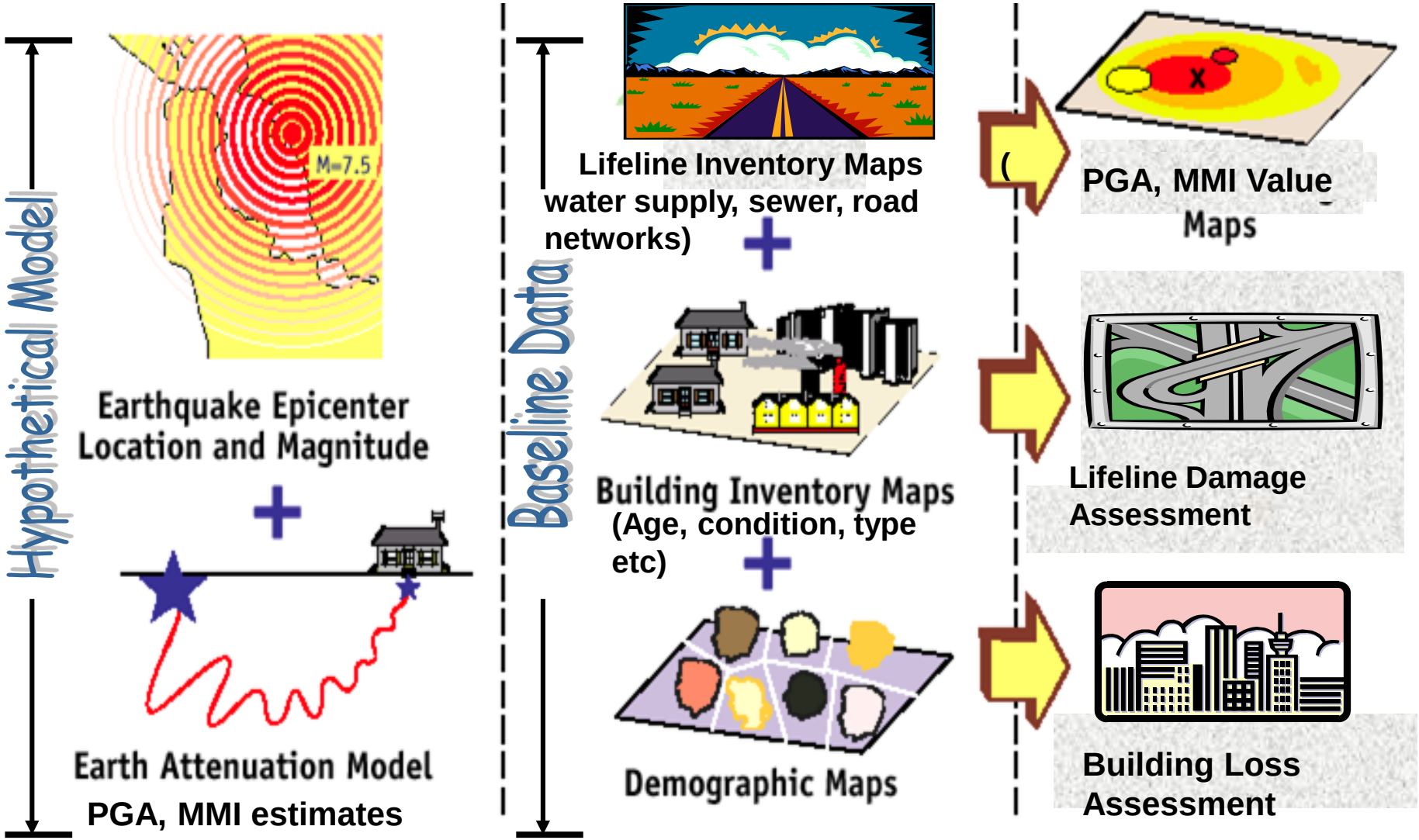
Need of urban risk assessment?

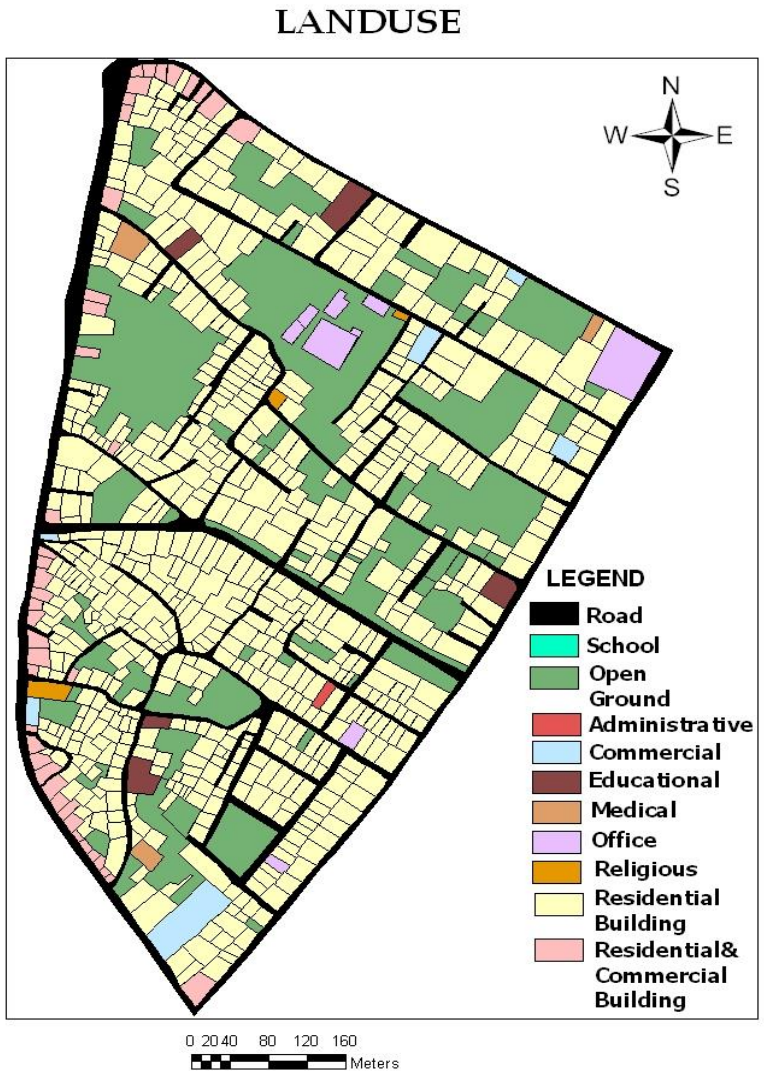


Risk assessment

THE AIM IS TO QUANTIFY THE LOSS
DUE TO DISASTERS OF VARYING MAGNITUDE

APPROACH / METHODOLOGY:

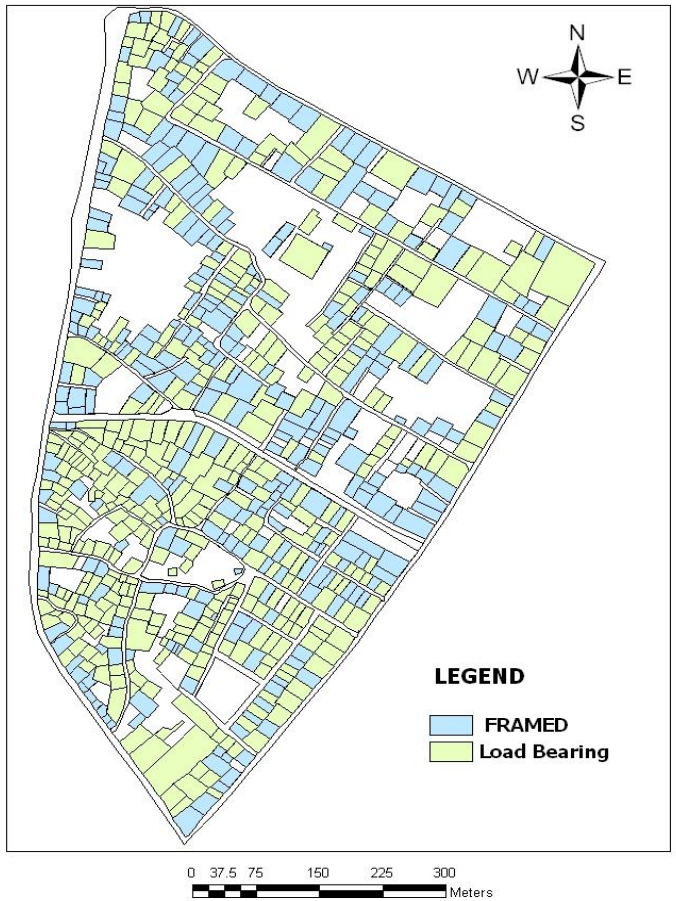




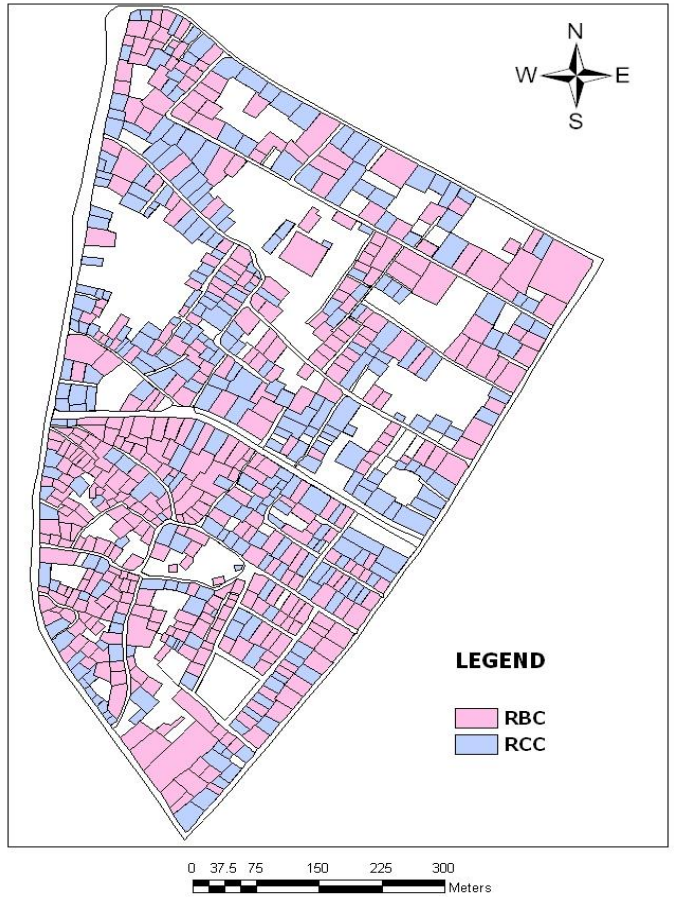
LANDUSE OF THE AREA

The residential area - 229422 sq mts.
Commercial areas - 11642 sq mts.
Open space - 102276 sq mts.
Roads in the area - 50454 sq mts.
Utility buildings - 21803 sq mts.
Total area - 415600 sq mts.

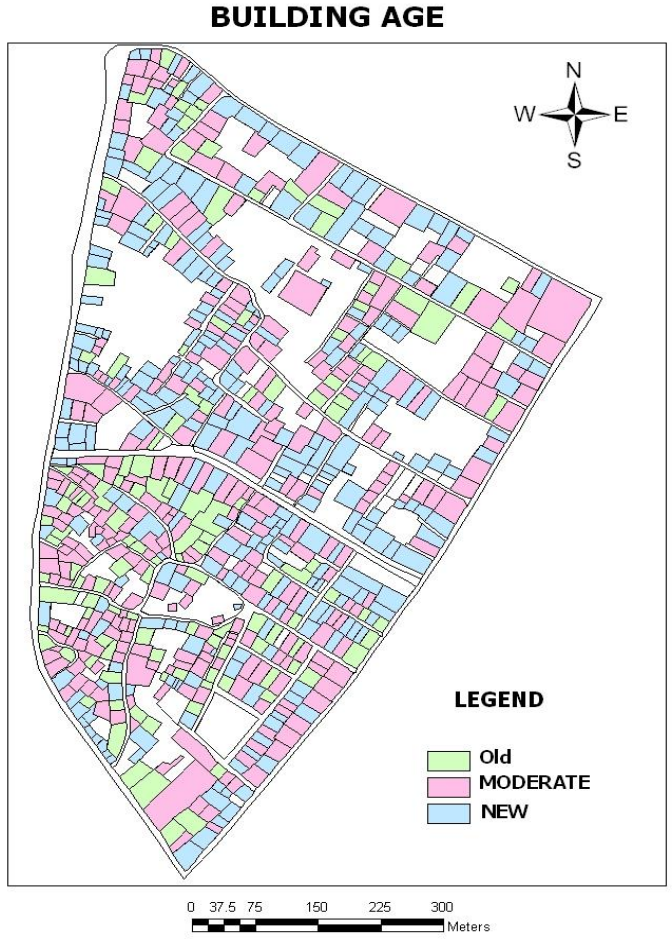
BUILDING TYPE

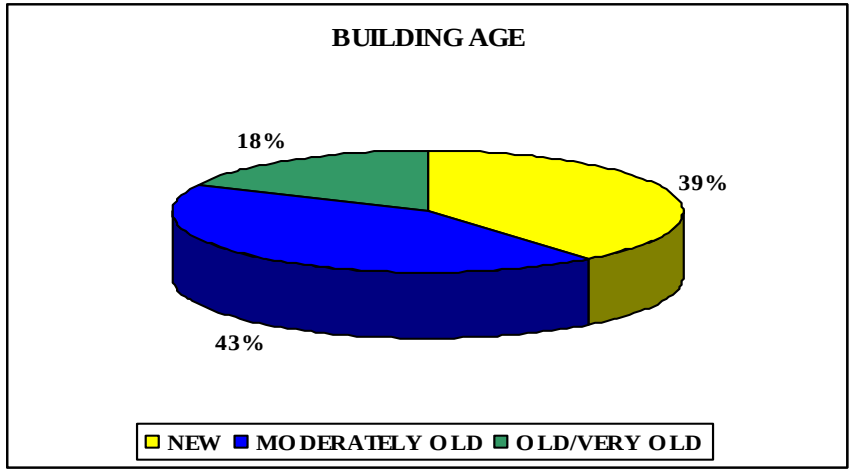


ROOF MATERIAL



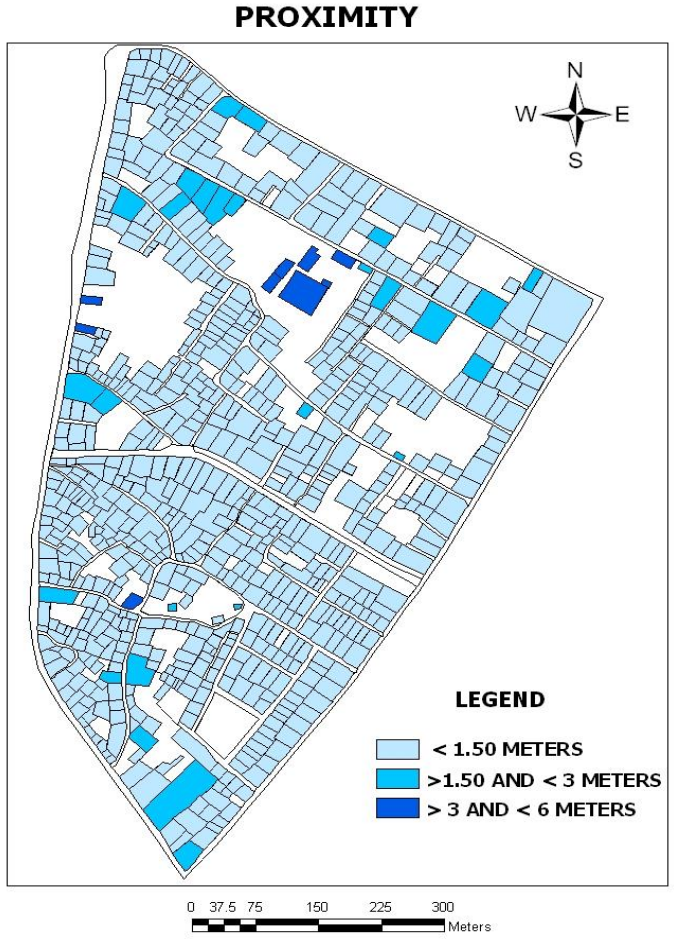
BUILDING AGE

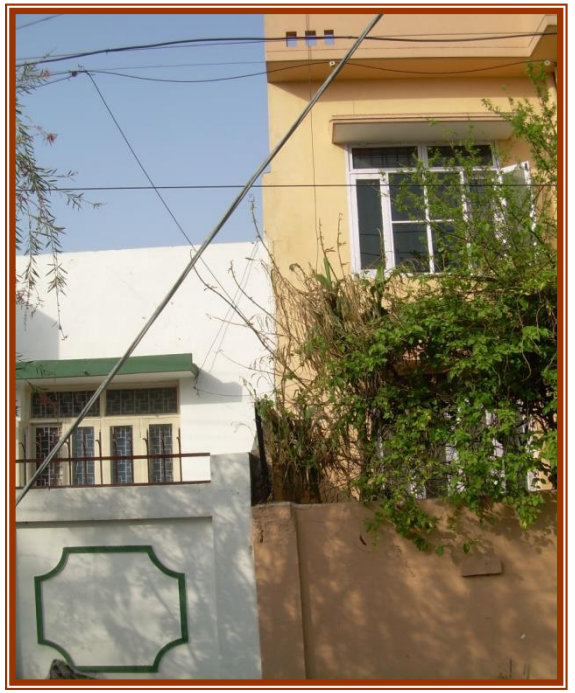




- Newly Built houses – 289
- Moderately old houses – 317
- Very old houses - 132

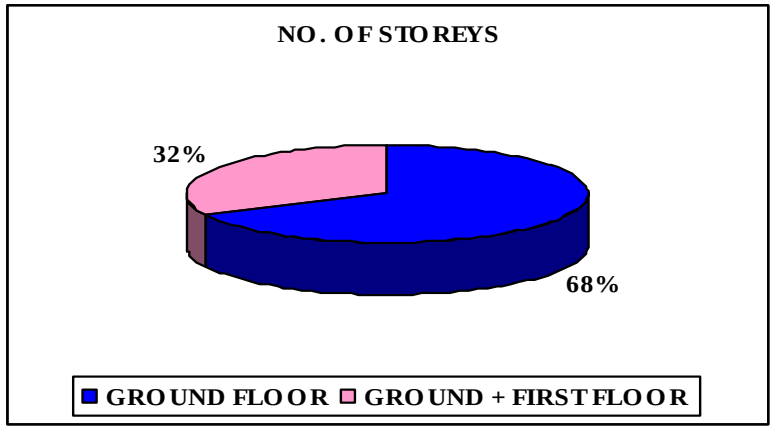
PROXIMITY BETWEEN BUILDINGS





- Within 2 feet – 285
- Within 3 feet – 232
- Within 4 feet – 152
- Within 5 feet – 32
- Within 6 to 22 feet - 36

NO. OF STOREYS



- Ground floor (G) – 502
- G + First floor – 236

RATIONALE FOR DAMAGE ASSESSMENT

❖Damage probability matrix (DPM)

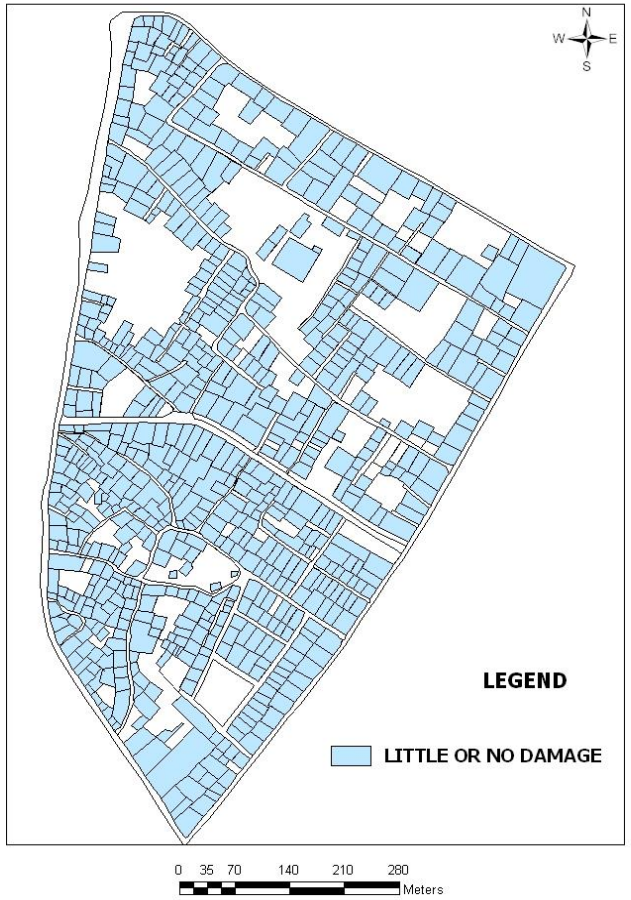
Class	Type	Roof	Symmetry	Maintenance	Age	Remarks
A	Load Bearing	GI/Other	Any	Low	Any	~Slum
A1	Any	Any	Any	NA	NA	Under Con
B	Load Bearing	GI	Any	Any	Any	
B1	Load Bearing	GI-RCC	Symmetrical	Moderate	Old	Abandoned
C1	Load Bearing	RBC/RBC-GI	Asymmetric	Any	Old/Mod	
C2	Load Bearing	RBC/RBC-RCC	Symmetric	Any	Old/Mod	
C3	Load Bearing	RCC/RCC	Any	Any	Mod/Old	
D1	Framed	RCC	Symmetric	Low	Old	
D2	Framed	RCC/GI	Asymmetric	Moderate	Old	
D3	Framed	RCC	Any	Any	Mod/New	
D4	Framed	RCC	Any	High	New	
E	Steel/GI	Steel	Symmetric	High	Any	All Steel

MMI/Type	A	A1	B	B1	C1	C2	C3	D1	D2	D3	D4	E
V	0.04	0.04	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VI	0.10	0.10	0.04	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VII	0.45	0.45	0.20	0.20	0.10	0.10	0.05	0.03	0.02	0.00	0.00	0.00
VIII	0.60	0.60	0.45	0.45	0.25	0.30	0.18	0.12	0.06	0.03	0.01	0.01
IX	0.80	0.80	0.60	0.60	0.45	0.60	0.40	0.30	0.17	0.12	0.06	0.06
X	1.00	1.00	0.80	0.80	0.65	1.00	0.72	0.55	0.35	0.25	0.17	0.17
XI	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.85	0.60	0.50	0.35	0.35

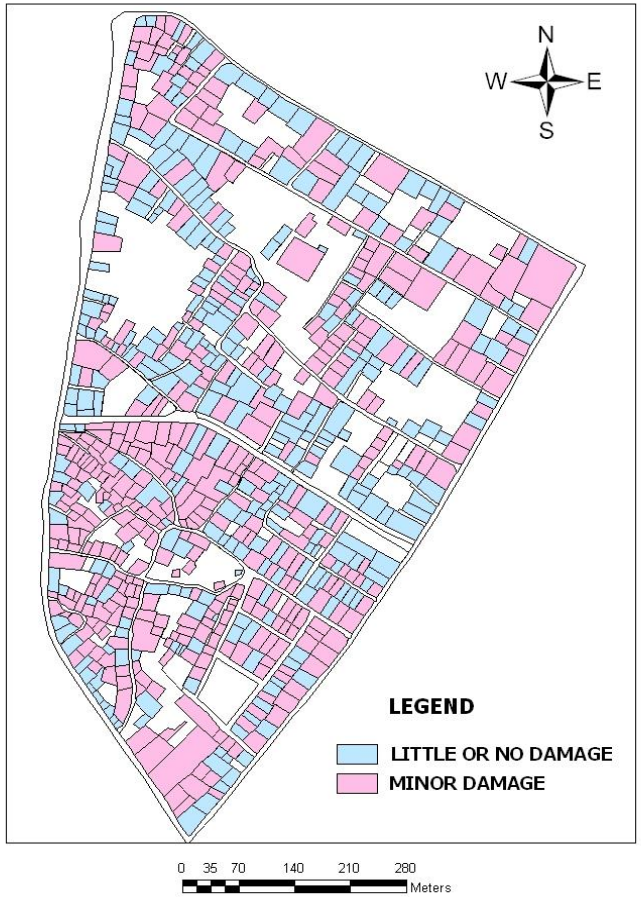
- **❖Probability > 75% is taken as Total Collapse**
- **❖Probability 50 – 75% is taken as major structural failure**
- **❖Probability 30 – 50% is taken as major damage failure**
- **❖Probability 5 – 30% is taken as minor damage**
- **❖Probability < 5% is taken as little or no damage**

BUILDING VULNERABILITY ASSESSMENT

MMI - VI

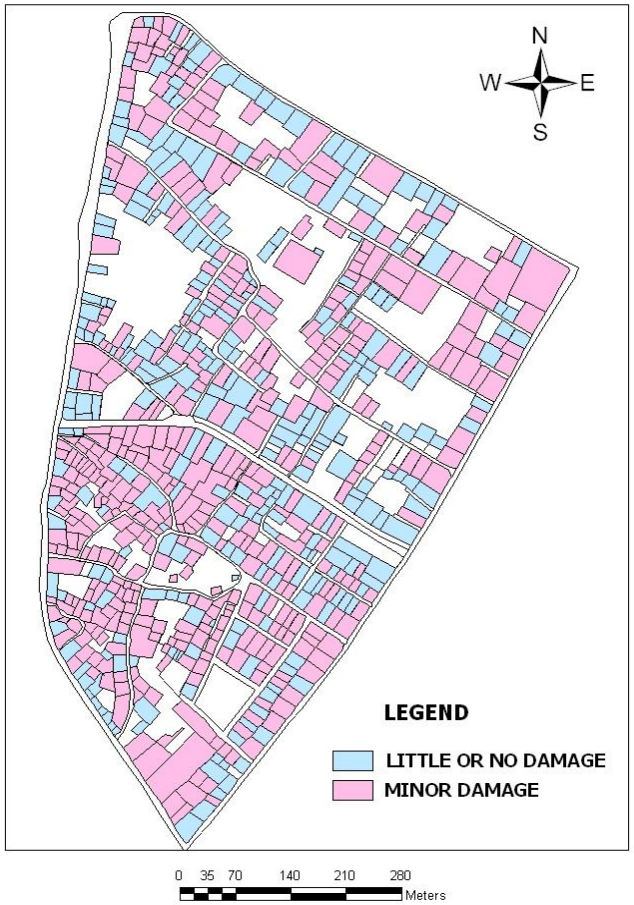


MMI - VII

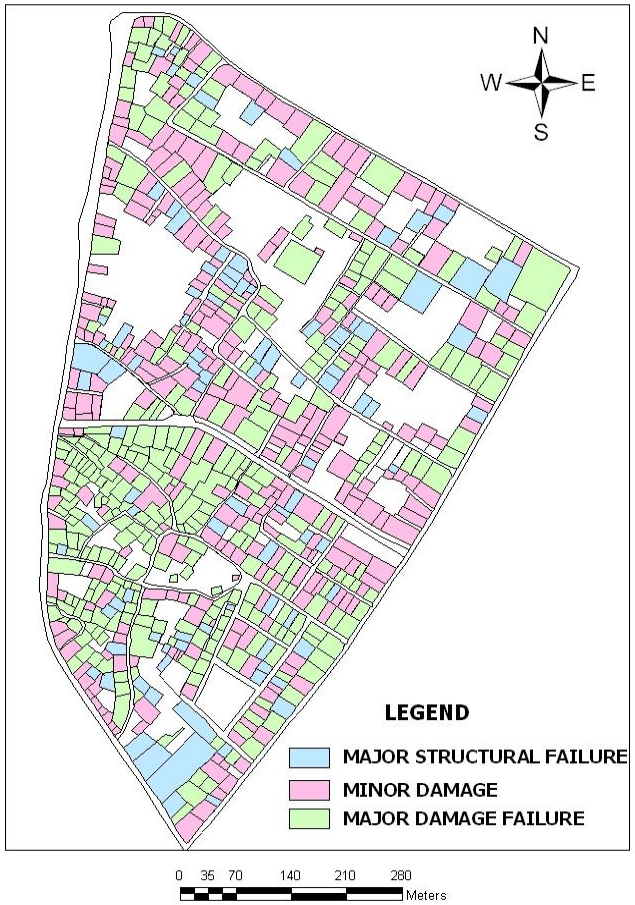


BUILDING VULNERABILITY ASSESSMENT

MMI - VIII

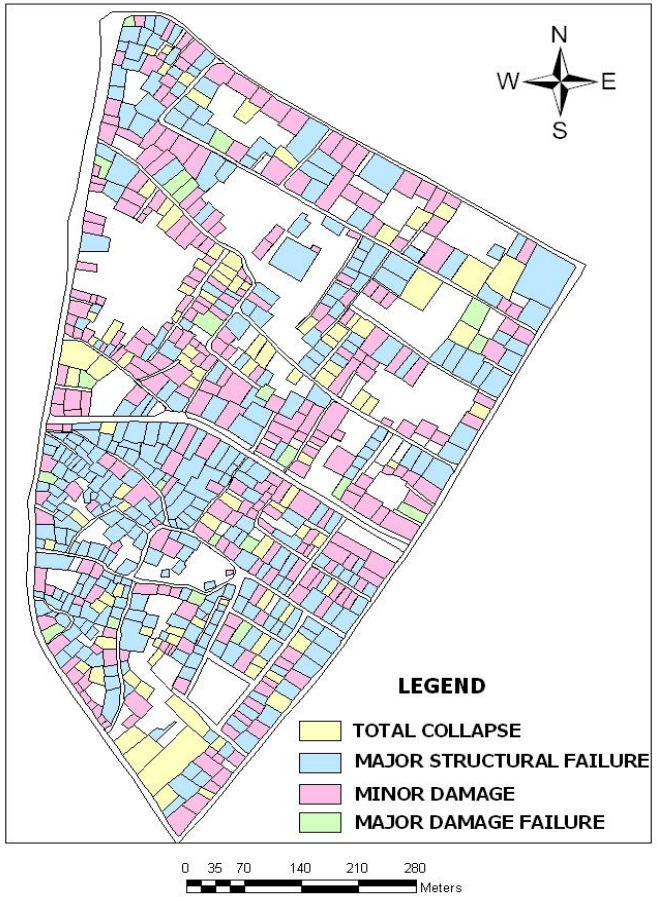


MMI - IX

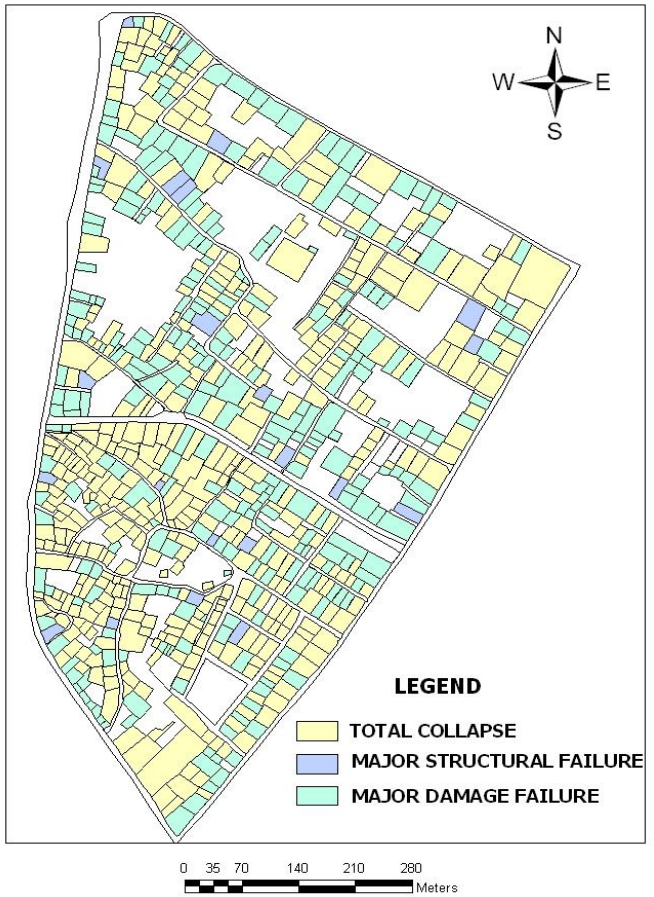


BUILDING VULNERABILITY ASSESSMENT

MMI - X



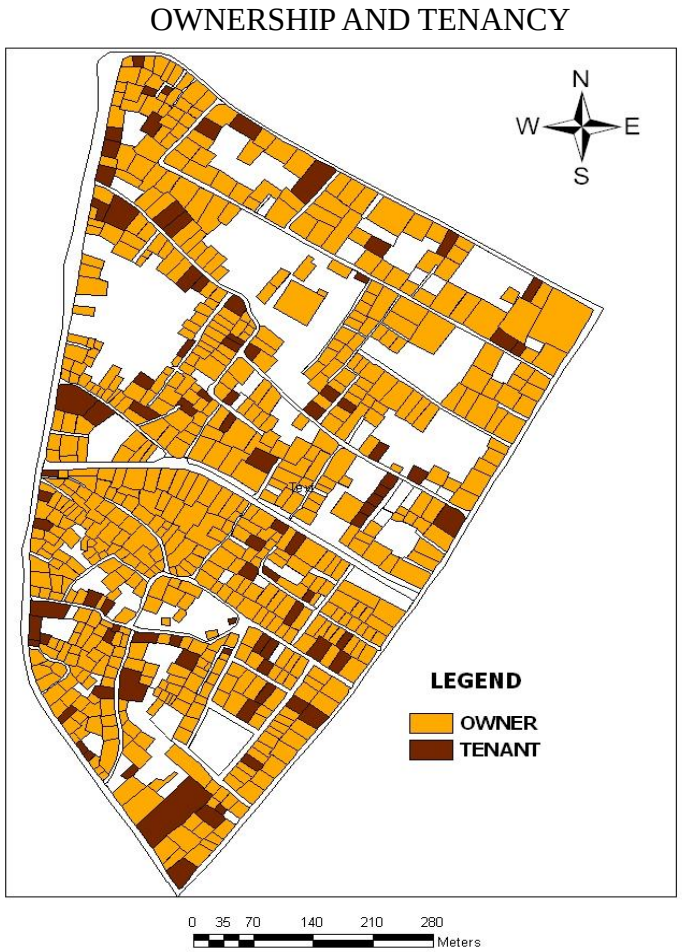
MMI - XI

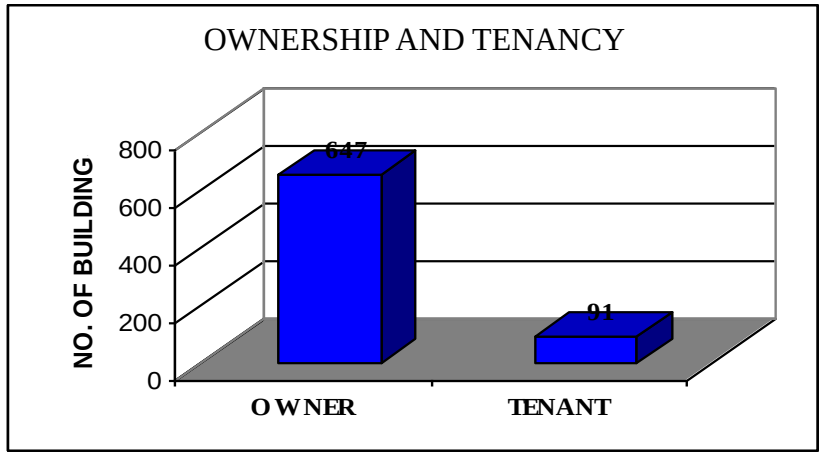


PROBABILITY OF DAMAGE FOR BUILDINGS

MMI	PROBABILITY OF DAMAGE	NO. OF BUILDINGS	(%)
VI	LITTLE/NO DAMAGE	738	100
VII	LITTLE/NO DAMAGE	312	42.276423
	MINOR DAMAGE	426	57.723577
VIII	LITTLE/NO DAMAGE	291	39.430894
	MINOR DAMAGE	447	60.569106
IX	MAJOR DAMAGE FAILURE	329	44.579946
	MAJOR STRUCTURAL FAILURE	97	13.143631
	MINOR DAMAGE	312	42.276423
X	MAJOR DAMAGE FAILURE	21	2.8455285
	MAJOR STRUCTURAL FAILURE	329	44.579946
	MINOR DAMAGE	291	39.430894
	TOTAL COLLAPSE	97	13.143631
XI	MAJOR DAMAGE FAILURE	291	39.430894
	MAJOR STRUCTURAL FAILURE	21	2.8455285
	TOTAL COLLAPSE	426	57.723577

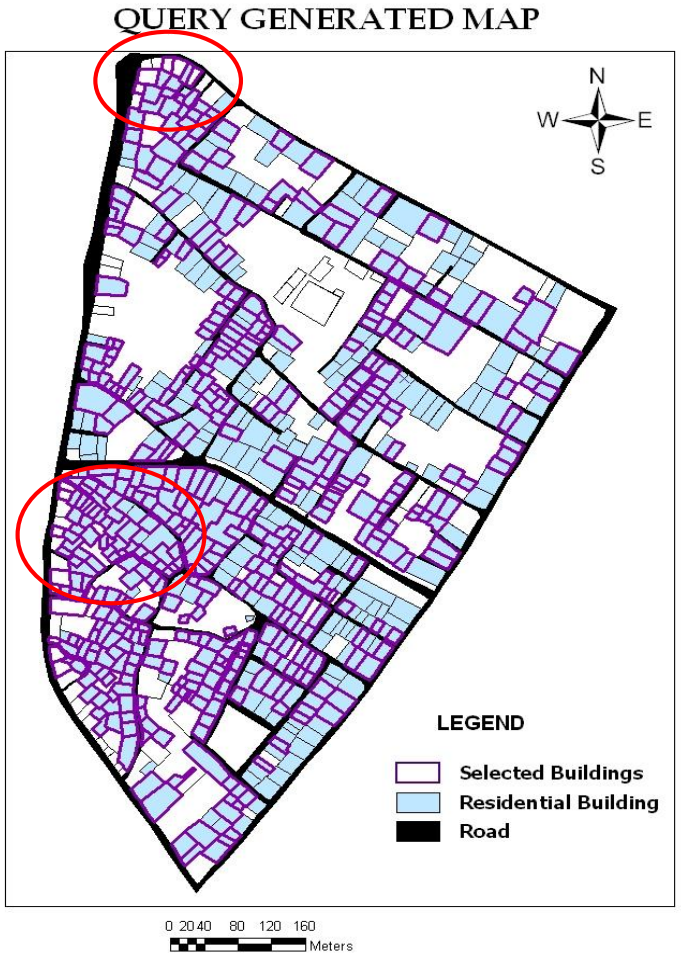
OWNERSHIP AND TENANCY





- Owners residing in the same building – 647
- Only tenants residing - 91

QUERY 1



RESIDENTIAL

+

CLOSE PROXIMITY

+

ASYMMETRICAL SHAPE

+

POOR MAINTENANCE

+

MODERATELY/OLDER

+

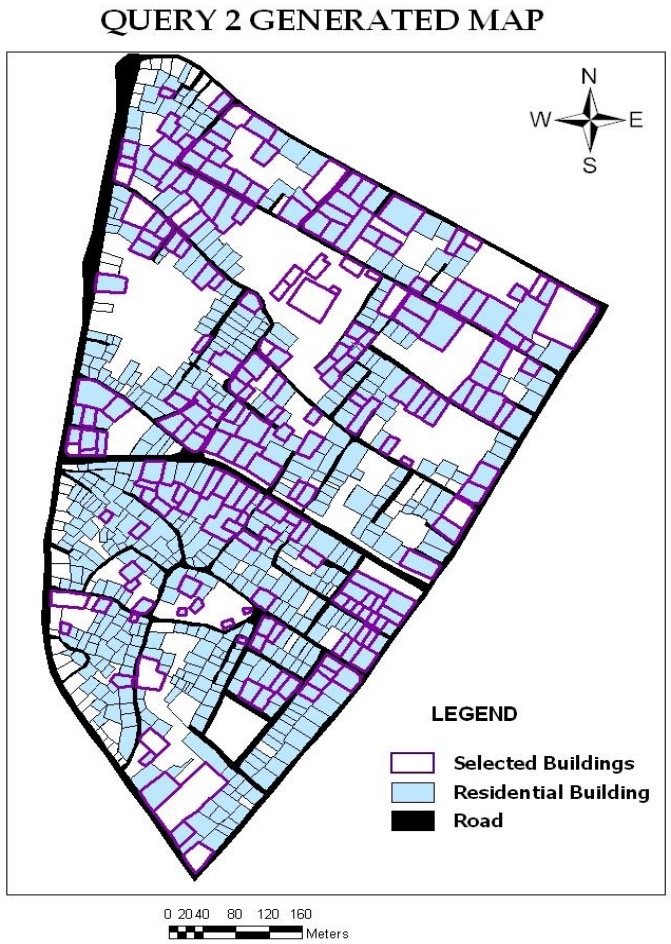
LOAD BEARING

+

RBC ROOF

= 463 HOUSES!

QUERY 2



RESIDENTIAL

+

PROXIMITY >4 FEET

+

SYMMETRICAL SHAPE

+

GOOD MAINTENANCE

+

NEWLY BUILT

+

FRAMED STRUCTURES

+

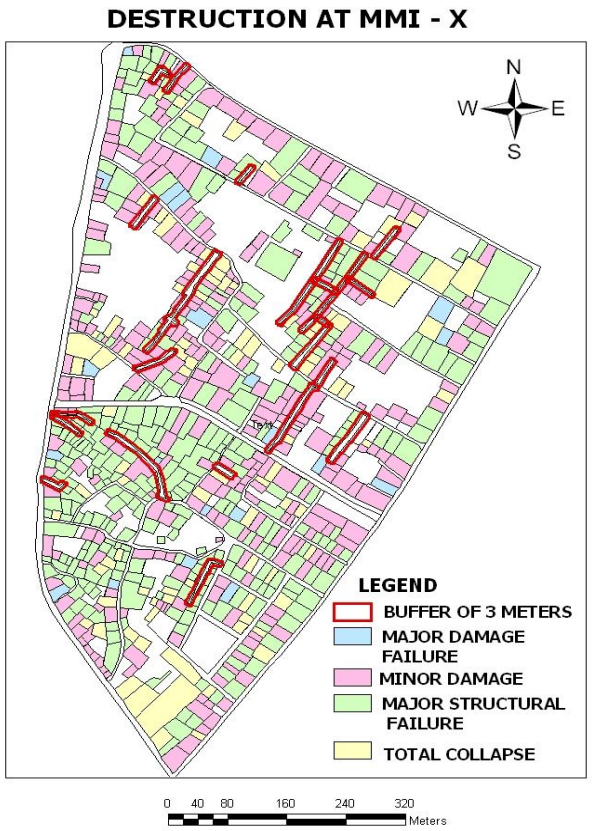
RCC ROOF

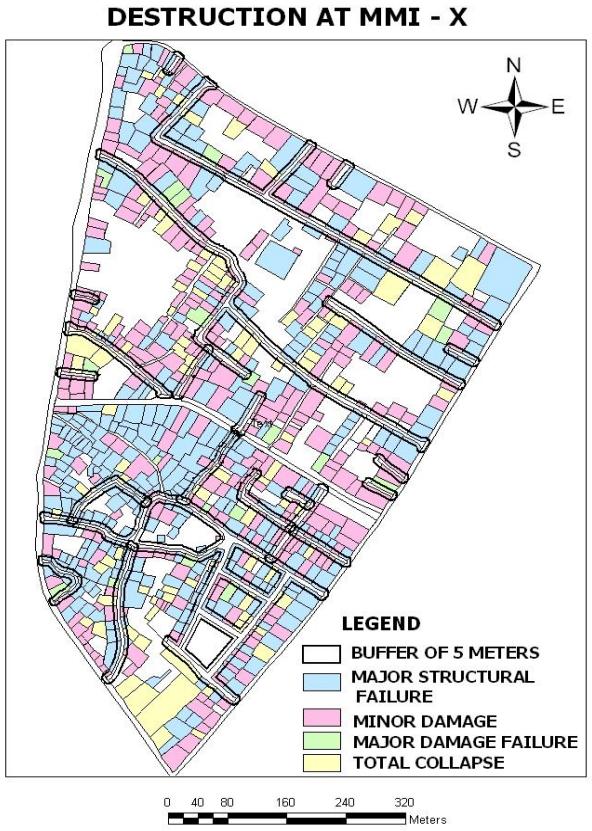
= 209 HOUSES!

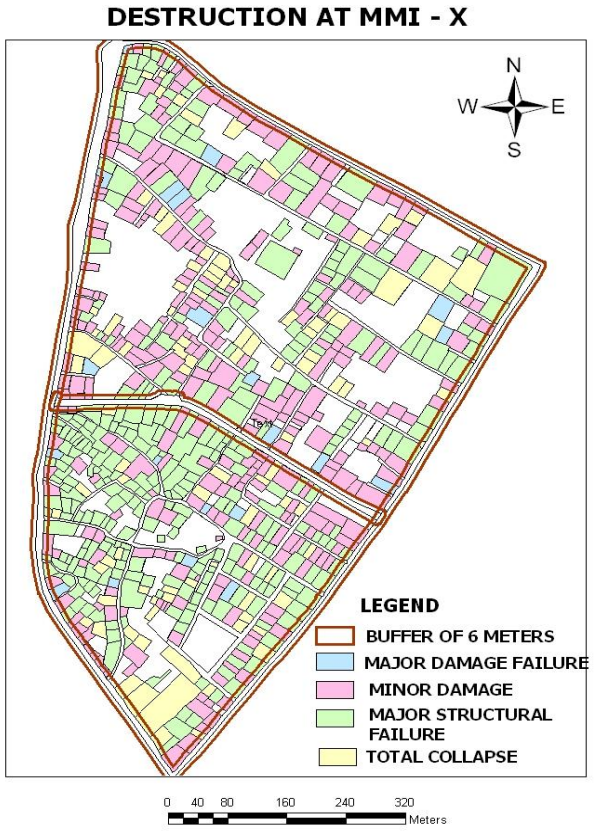
Blocked road

ATTRIBUTES OF ROAD

BUILDINGS AFFECTING ROADS AT DIFFERENT EARTHQUAKE INTENSITIES

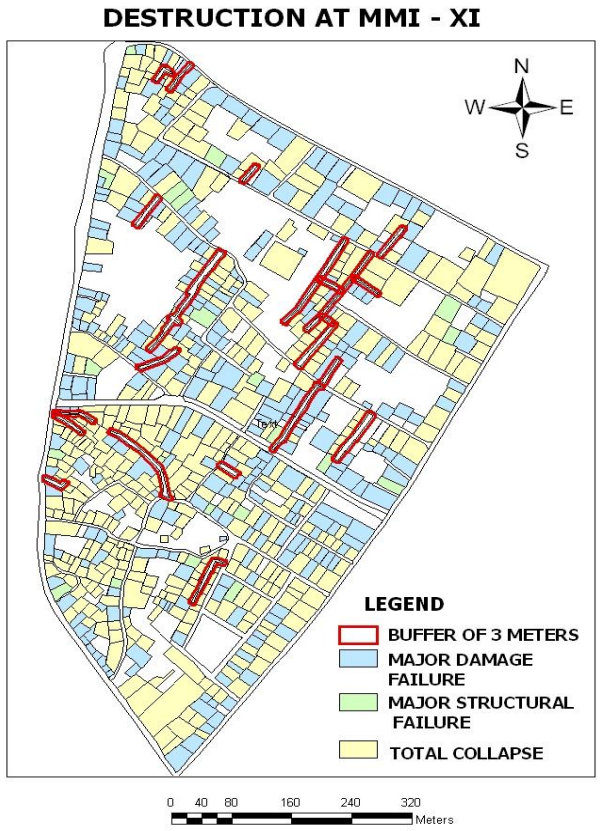


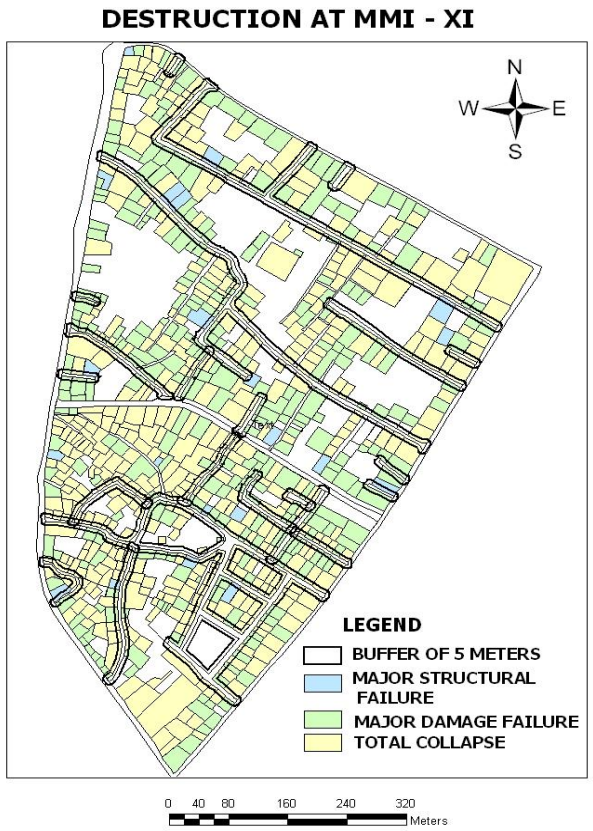


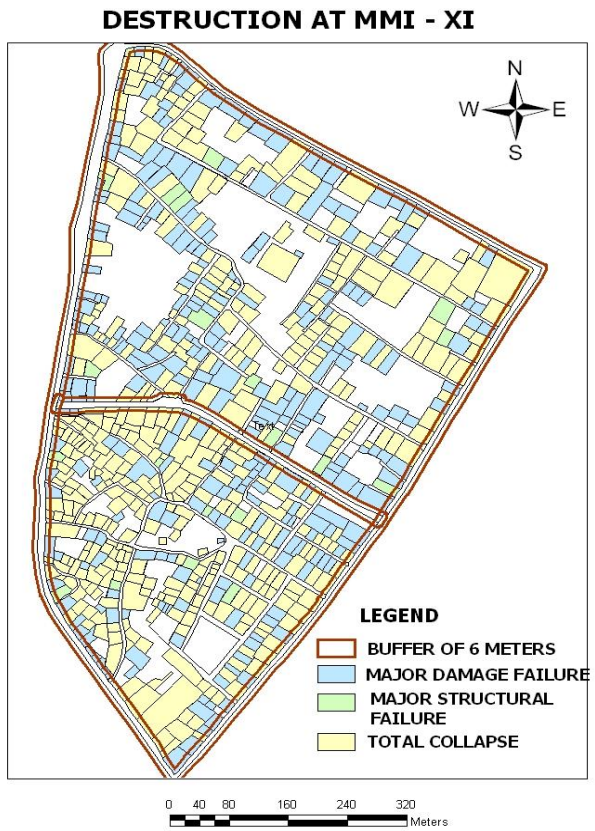


Urban Seismic Risk Assessment in Dehradun city
using GIS and Remote Sensing techniques.

BUILDINGS AFFECTING ROADS AT DIFFERENT EARTHQUAKE INTENSITIES







Urban Seismic Risk Assessment in Dehradun city
using GIS and Remote Sensing techniques.

BUILDINGS AFFECTING ROADS AT DIFFERENT EARTHQUAKE INTENSITIES

BUFFER AROUND ROADS (IN METERS)	MMI - VI
	LITTLE/NO DAMAGE
3	165
5	392
6	149

BUFFER AROUND ROADS (IN METERS)	MMI - VII	
	LITTLE/NO DAMAGE	MINOR DAMAGE
3	65	100
5	160	232
6	80	69

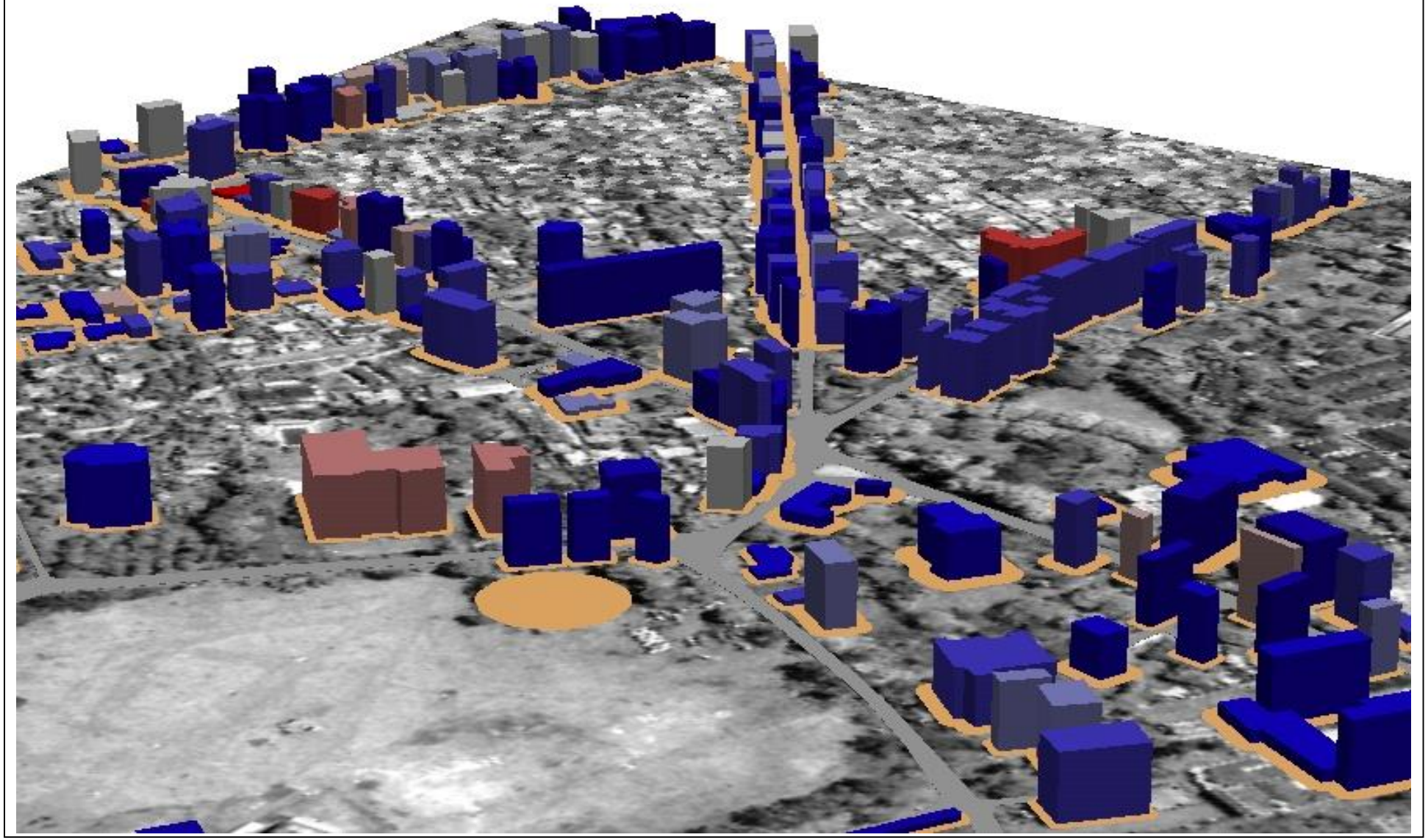
BUFFER AROUND ROADS (IN METERS)	MMI - VIII	
	LITTLE/NO DAMAGE	MINOR DAMAGE
3	63	102
5	147	245
6	75	74

BUFFER AROUND ROADS (IN METERS)	MMI - IX		
	MAJOR DAMAGE FAILURE	MAJOR STRUCTURAL FAILURE	MINOR DAMAGE
3	74	26	65
5	181	51	160
6	58	10	72

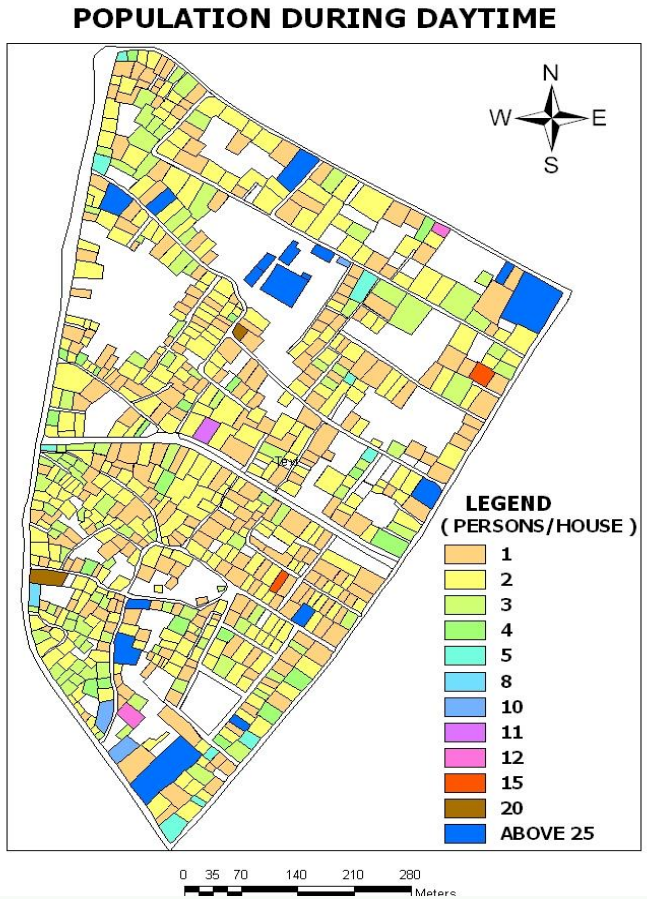
BUFFER AROUND ROADS (IN METERS)	MMI - X			
	MAJOR DAMAGE FAILURE	MAJOR STRUCTURAL FAILURE	MINOR DAMAGE	TOTAL COLLAPSE
3	3	74	62	26
5	13	181	147	51
6	5	59	75	10

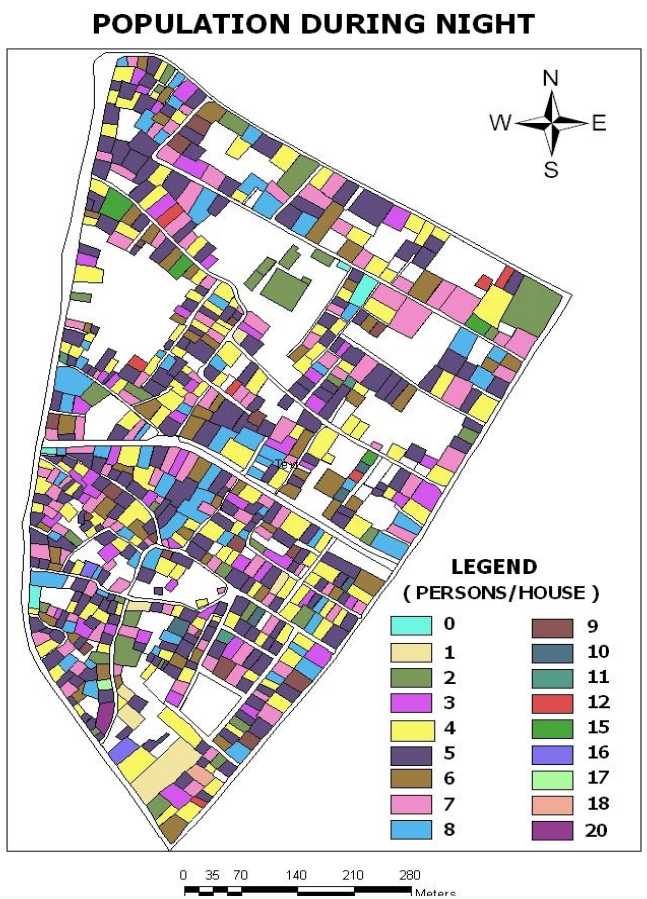
BUFFER AROUND ROADS (IN METERS)	MMI - XI		
	MAJOR DAMAGE FAILURE	MAJOR STRUCTURAL FAILURE	TOTAL COLLAPSE
3	62	3	100
5	147	13	232
6	75	5	69

KARANPUR ROAD BLOACKAGE



POPULATION AT RISK





TOTAL POPULATION (DAY TIME)	POPULATION AT RISK (DAY TIME)	TOTAL POPULATION (NIGHT TIME)	POPULATION AT RISK (NIGHT TIME)
2865	2131	4047	2865

techniques.