



POLYTECH[®]
TOURS

Département Aménagement

Ecole d'ingénieurs
polytechnique
de l'université de Tours

CITERES
UMR 6173
*Cités, Territoires,
Environnement et Sociétés*

Equipe IPA-PE
Ingénierie du Projet
d'Aménagement, Paysage,
Environnement

Projet de Fin d'Etudes

URBAN RISK MANAGEMENT: ACCESSIBILITY PLANNING DURING MAJOR FLOOD EVENT



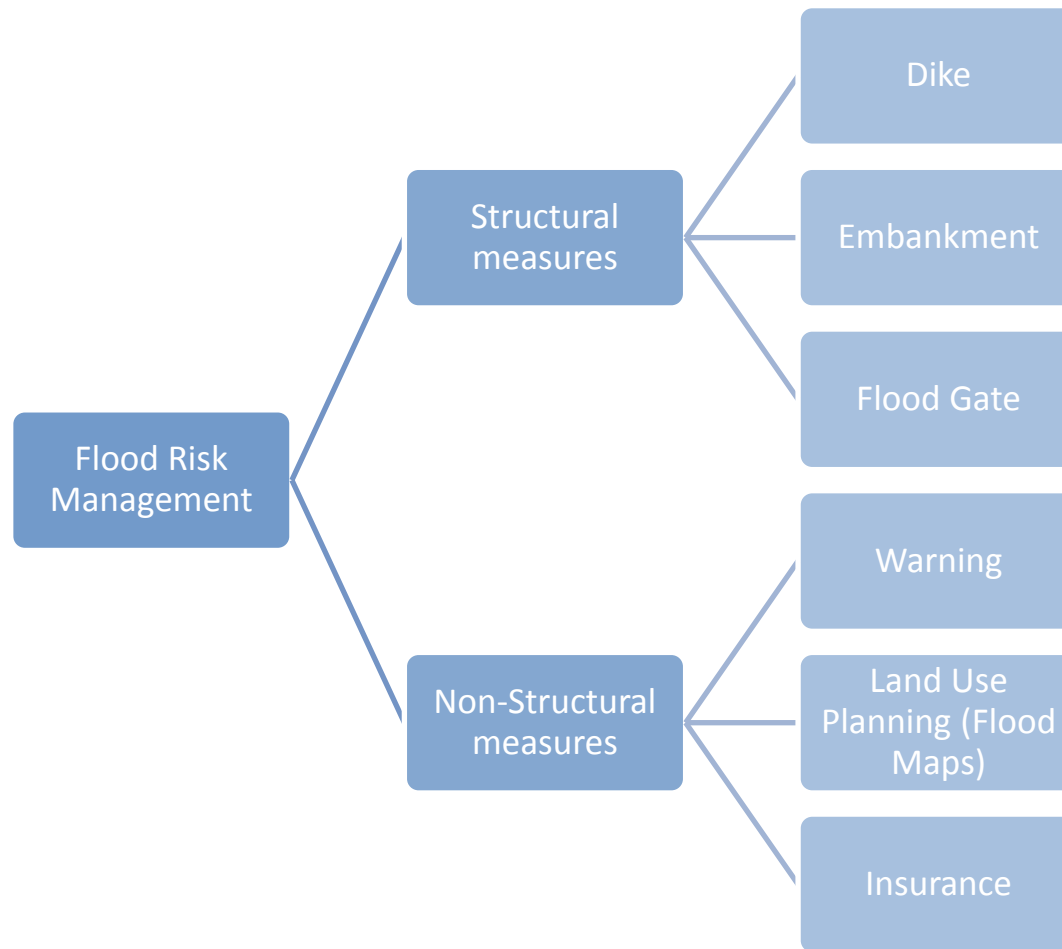
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RESEARCH DIRECTOR

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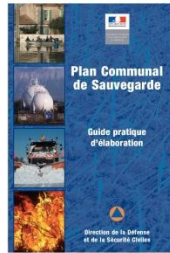
HARISH EMBERUMANAR LAKSHMINARAYANAN

Introduction to FRM (Flood Risk Management)



Need for this research?

- ✓ The present community safety plan PCS (Plan Communal de Sauvegard) of Tours, France is not optimized.



- ✓ Homogeneous DICRIM for an Heterogeneous zoned communities.

Conclusions that are coming from the scientific state of the art in terms of accessibility planning for evacuation of urban flood risk area will justify the need for this research.

Research Question and Aims

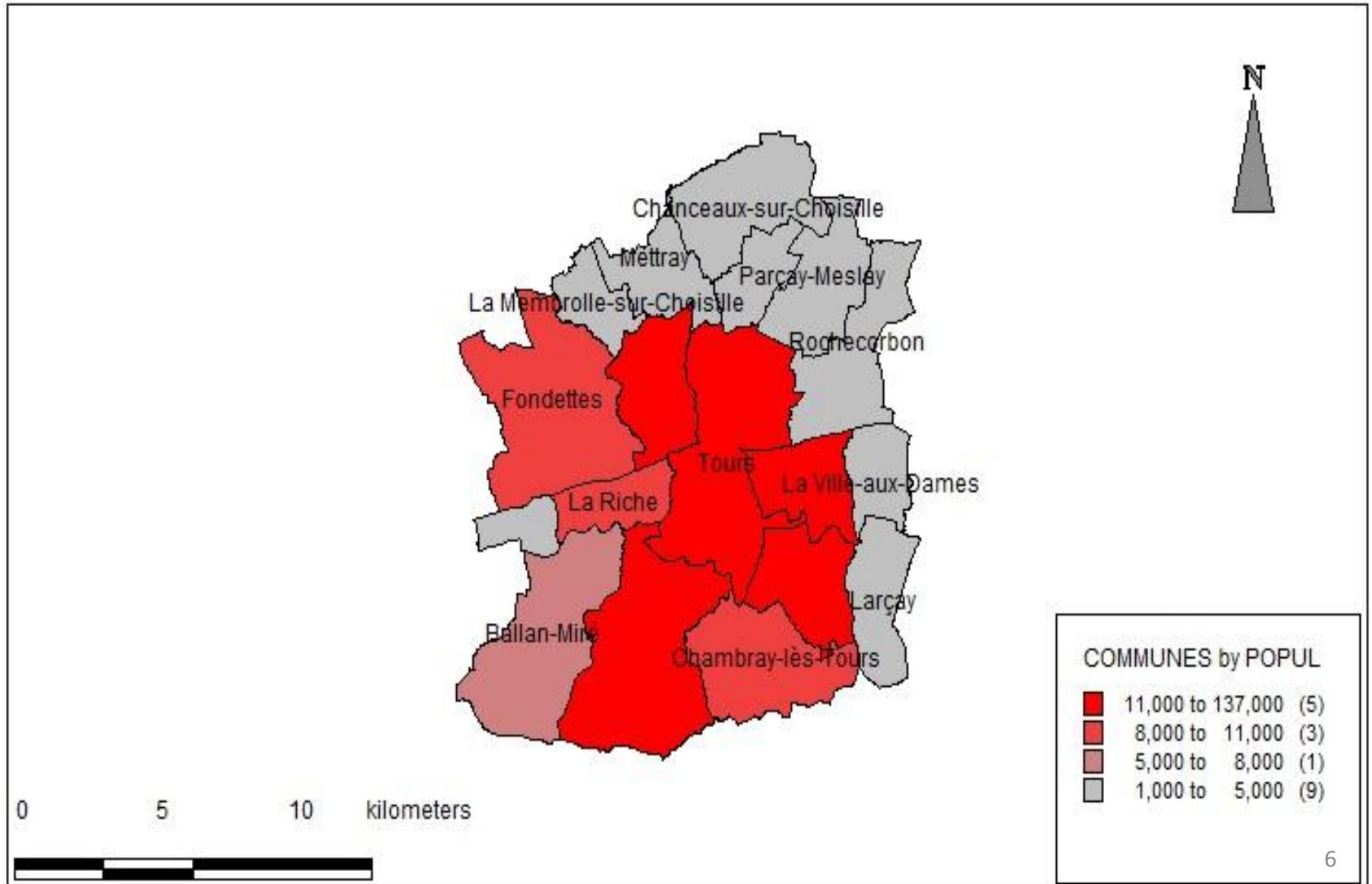
How effective is the accessibility planning (modélisation method & tools) in Urban evacuation during major flood event ?

- ➔ This master's research outlines the issues involved in designing an effective method while building an evacuation plan.
- ➔ This helps in improving the efficiency of PCS and DICRIM and also in the warning system by providing precise information related to the evacuation (ex. total time required to evacuate).


Objectives

- ➔ Accessibility model
 - ➔ Literature Review
 - ➔ Predetermined Urban stakes
 - ➔ Existing specific database etc.,
- ➔ Evacuation Plan for specific area at risk.
- ➔ To make the actors understand about the importance and necessity of evacuation plan

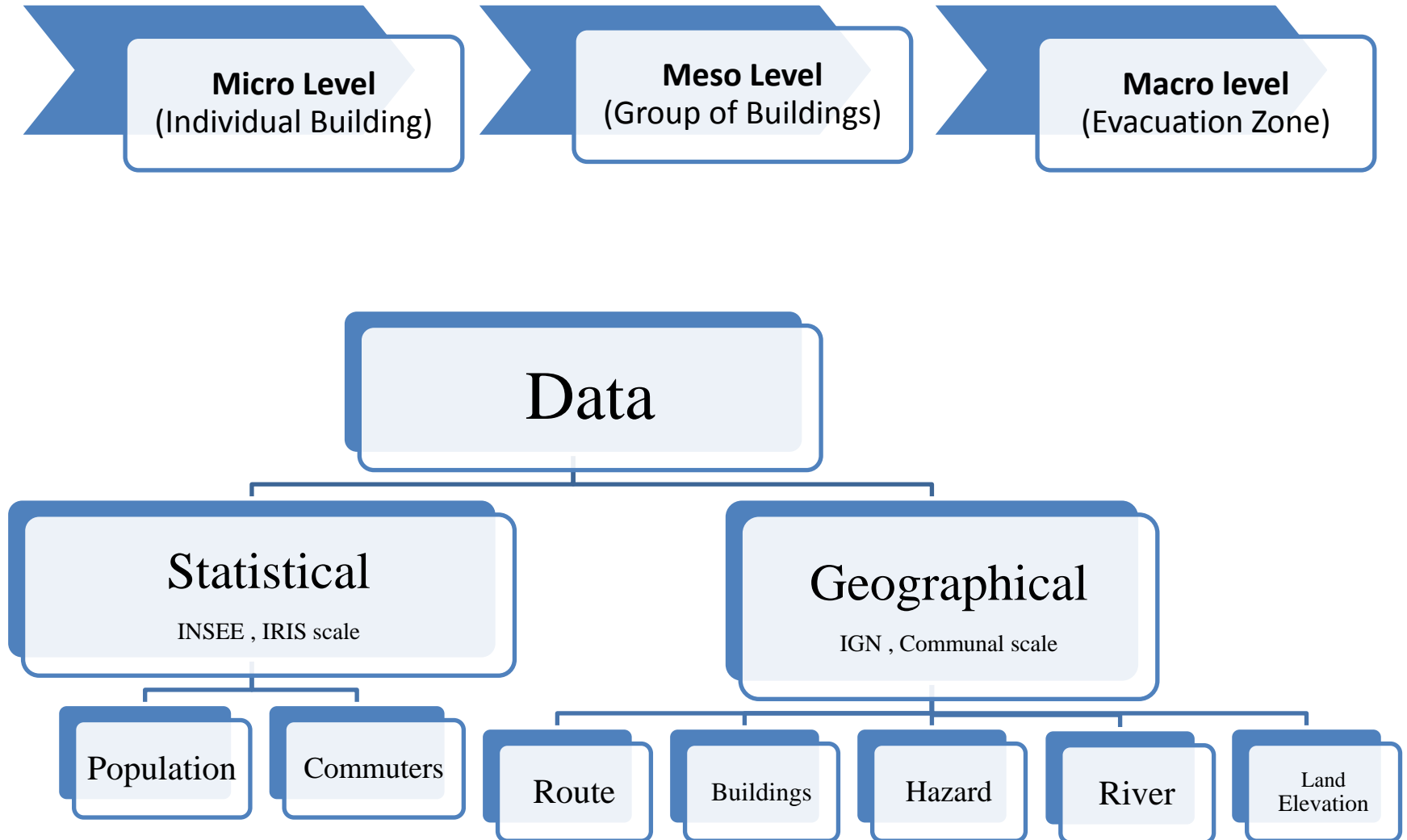
Le Val de Tours



Social & Geographical Description - La Riche

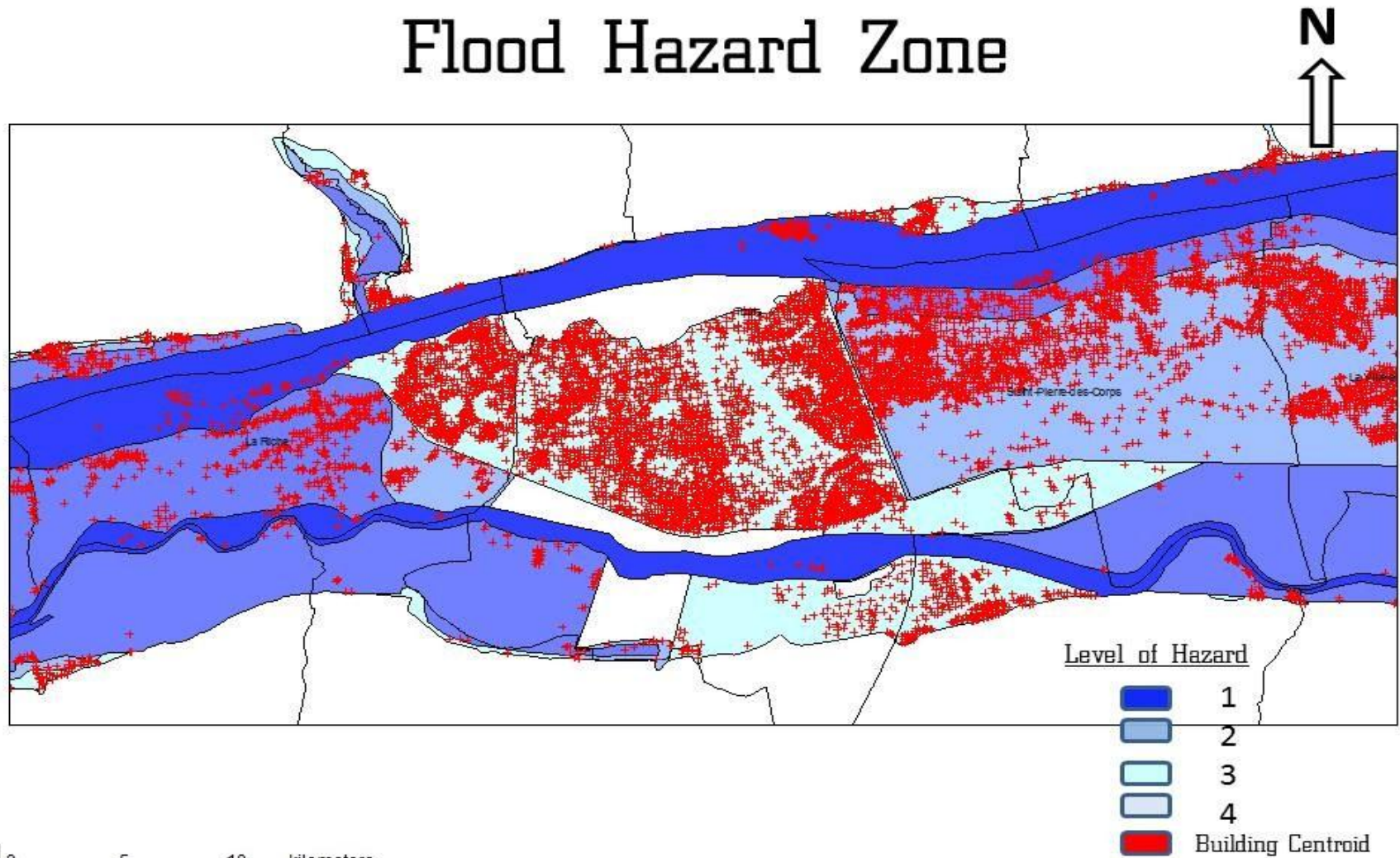
Location	<div>- Eastern limit: St. Francis Street / Rue Lieutenant Roze</div> <div>- Western limit: Railway</div>	
		
Population	Population in 2007	8639 habitants
	% Of people over 65 years	13.54%
	% Of children under 10 years	12.1%
	Number of households	4469
	% Of single parent households	8.32%
Estimated number of cars	3546	
Number of persons not motorized estimated	1451 people	
Bridge (s) attached to neighborhood	<div>- In the West, the bridge of Saint-Cosme.</div> <div>- In the East, the Napoleon bridge</div>	
Boundary zones of influence of the bridges	Street and Simon Street Vauquier Sablons	
Starting points for buses in the neighborhood	<div>- Place de l'Europe</div> <div>- Super U Parking</div> <div>- Parking Botany</div>	
Tramway		
Train		

Methodology of Evacuation

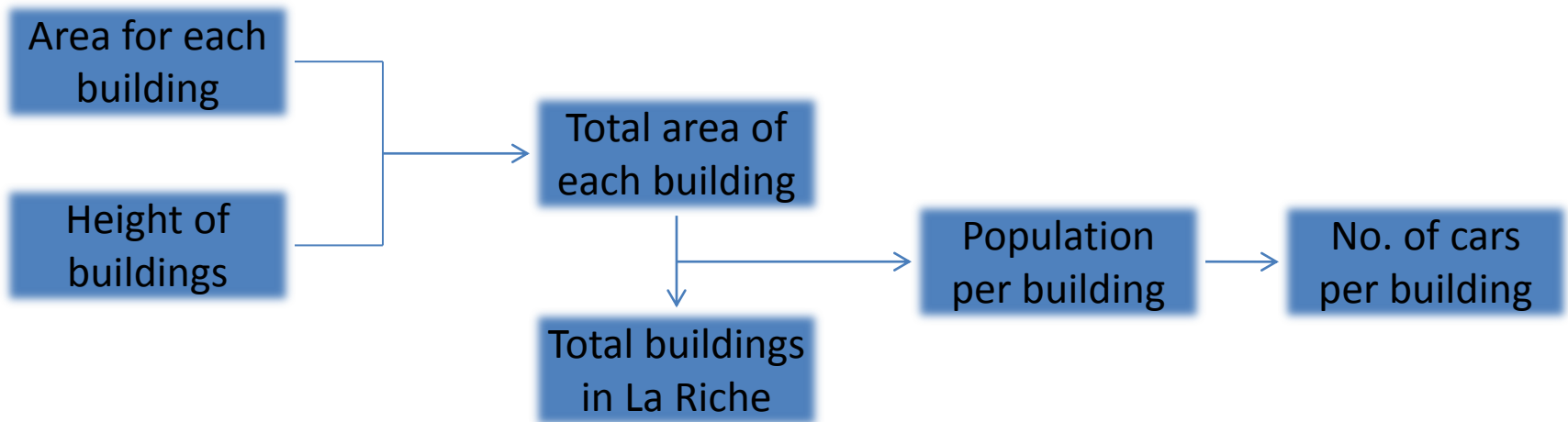


Identification of buildings in Hazard zone

Flood Hazard Zone



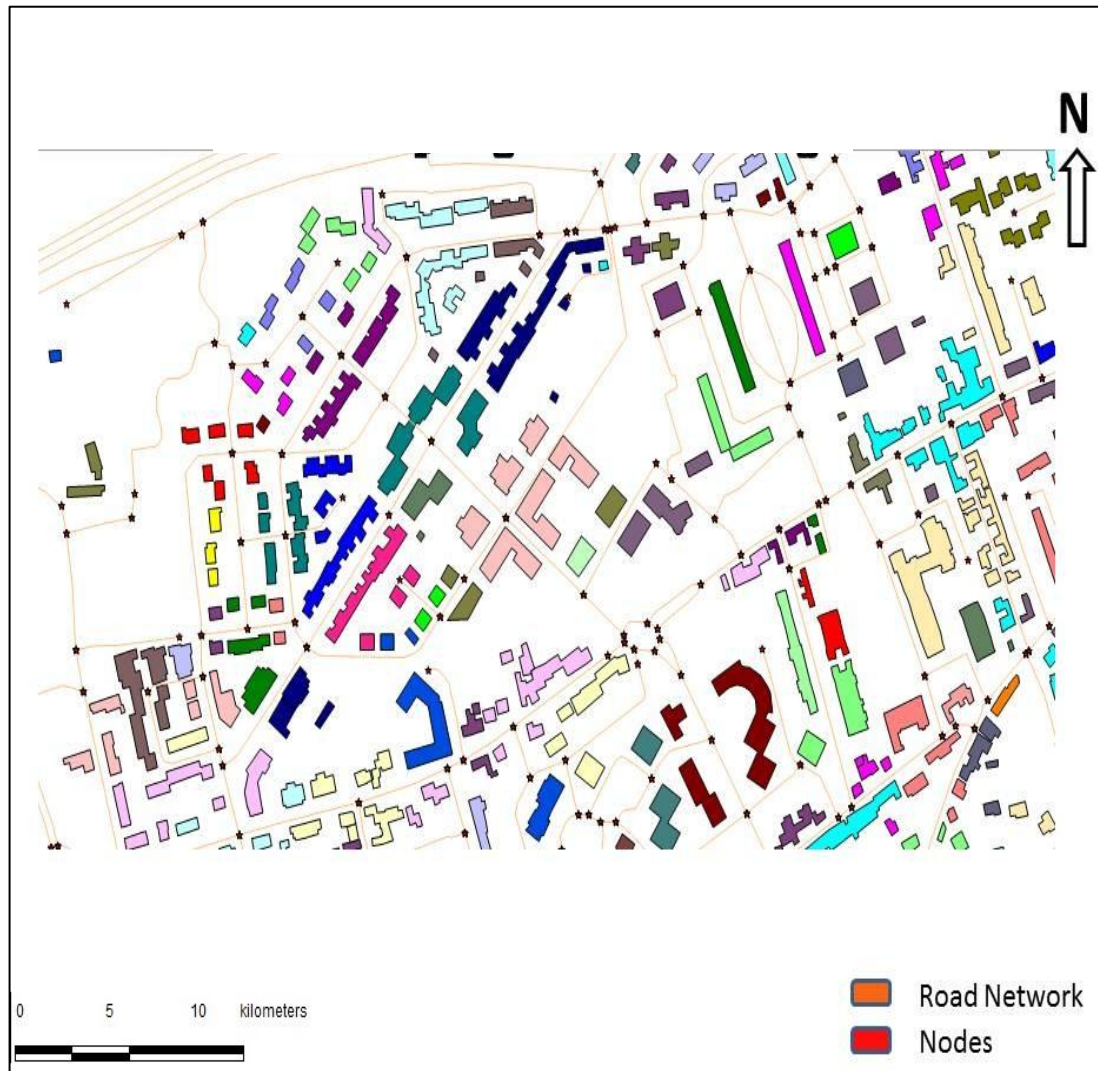
Micro Level



Micro Level: Data Disaggregation

Si.no	Building ID	Height of Buildings (m)	Floor area per Floor (Sq.m)	No. of floors (@2.5m / floor)	Total Floor Area (Sq.m)
1	BATIMENT0000000031246790	4	68.52	1.60	109.62
2	BATIMENT0000000031246791	4	158.39	1.60	253.43
3	BATIMENT0000000031245739	5	120.24	2.00	240.47
4	BATIMENT00000000221924479	8	105.90	3.20	338.86
5	BATIMENT0000000031244289	5	130.54	2.00	261.09
6	BATIMENT0000000031244304	6	497.24	2.40	1193.39
7	BATIMENT0000000031244308	5	214.03	2.00	428.07
8	BATIMENT0000000031244331	5	142.99	2.00	285.99
9	BATIMENT0000000031244339	17	592.33	6.80	4027.82
10	BATIMENT0000000031244361	5	158.15	2.00	316.30
Si.no	Building ID	Height of Buildings (m)	Floor area per Floor (Sq.m)	No. of floors (@2.5m / floor)	Total Floor Area (Sq.m)
1352	BATIMENT0000000031245350	5	154.93	2.00	309.86
1353	BATIMENT0000000031245365	6	53.54	2.40	128.50
1354	BATIMENT0000000031245416	9	73.10	3.60	263.17
1355	BATIMENT0000000031245460	8	83.81	3.20	268.20
1356	BATIMENT0000000031245459	4	24.90	1.60	39.84
1357	BATIMENT0000000031245518	7	75.77	2.80	212.17
1358	BATIMENT0000000031246669	5	106.75	2.00	213.51
1359	BATIMENT0000000031254270	7	121.23	2.80	339.45
1360	BATIMENT0000000031245551	3	127.95	1.20	153.54
1361	BATIMENT0000000031245465	12	923.02	4.80	4430.52
1362	BATIMENT0000000031254711	0	22.48	22.48	505.19
			Total Floor area		930036.23
		Population (2007)			8639100
	Persons per sq.m in Building				0.009289

Meso Level: Building Aggregation

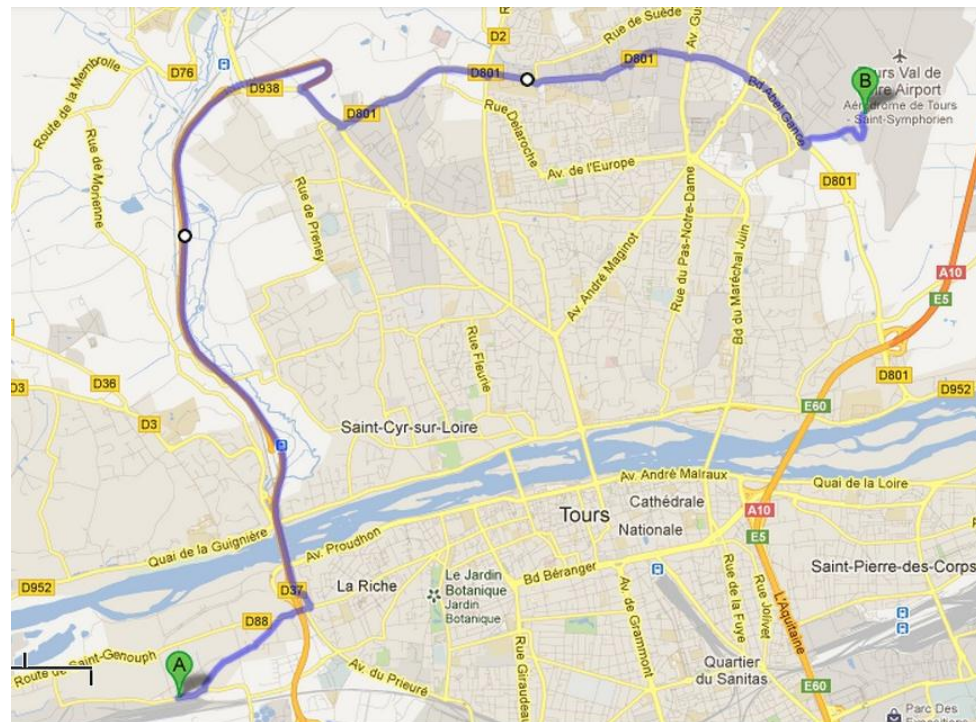
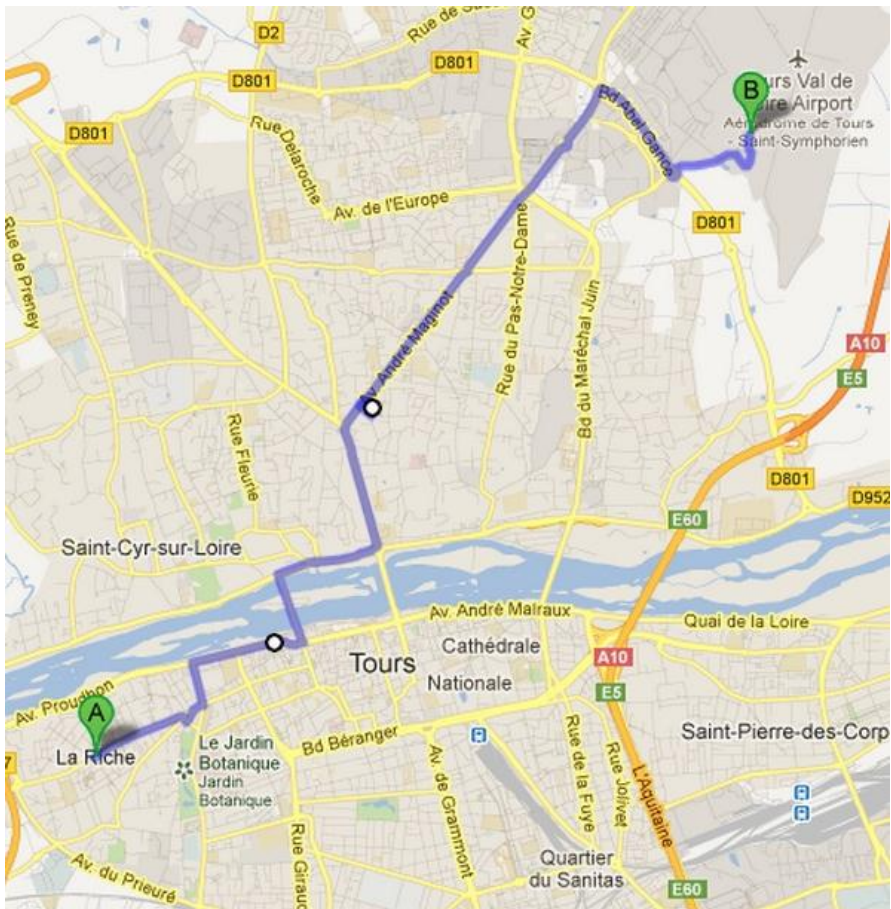


From Meso to Macro Level

Si.no.	Node ID	Name of Junction		Dist. in (km)		Dist. in (min)		Shortest Dist. (Km)	Shortest Dist. (min)	Route near to (W.R.T Distance)	Route near to (W.R.T Time)
				To North	To South	To North	To South				
1	31448318	Rue de la Petite Entente	Rue Francois Mitterrand	8.90	7.80	18.00	19.00	7.80	18.00	South	North
2	31448430	Rue de la Petite Entente	Dead end	8.80	7.90	17.00	20.00	7.90	17.00	South	North
3	31448419	Rue Joachim du Bellay	Rue Charles de Gaulle	9.10	8.70	18.00	17.00	8.70	17.00	South	South
4	31448437	Rue Charles de Gaulle	Rue Robert Desnos	9.00	8.50	20.00	16.00	8.50	16.00	South	South
5	31448304	Rue Charles de Gaulle	Rue Francois Mitterrand	9.20	8.50	19.00	19.00	8.50	19.00	South	South
6	53372905	Rue Robert Desnos	Rue Francois Mitterrand	8.40	8.20	18.00	18.00	8.20	18.00	South	South
7	31448352	Rue Charles de Gaulle	Rue Georges Melies	8.40	8.00	18.00	15.00	8.00	15.00	South	South
8	31448286	Rue Charles de Gaulle	Rue camille Claudel	8.70	8.00	17.00	15.00	8.00	15.00	South	South
9	31448319	Rue Robert Desnos	Rue Rene Cassin	9.10	7.60	18.00	14.00	7.60	14.00	South	South
10	31448426	Rue Joachim du Bellay	Rue Charles de Gaulle	8.00	7.60	21.00	14.00	7.60	14.00	South	South

Si.no.	Node ID	Name of Junction		Dist. in (km)		Dist. in (min)		Shortest Dist. (Km)	Shortest Dist. (min)	Route near to (W.R.T Distance)	Route near to (W.R.T Time)
				To North	To South	To North	To South				
80	31449061	Rue de Grand Carroi	Rue de vivions	9.70	7.70	20.00	13.00	7.70	13.00	South	South
81	39838709	Rue de vivions	Rue de Hautes Marches	9.90	7.50	21.00	13.00	7.50	13.00	South	South
82	31448471	D37	Rue de Hautes Marches	9.70	7.70	22.00	11.00	7.70	11.00	South	South
83	31448500	Rue de Saint-Genouph	74	10.00	7.90	20.00	13.00	7.90	13.00	South	South
84	31449096	Rue de Grand Carroi	44	10.10	7.90	20.00	13.00	7.90	13.00	South	South
85	31448507	Rue de Hautes Marches	122	10.10	7.60	22.00	13.00	7.60	13.00	South	South
86	31449060	Rue de Grand Carroi	Rue de la Fuye	10.10	7.80	22.00	14.00	7.80	14.00	South	South
87	31449058	Rue du Pigeonnier	Rue des Pavillions	10.20	8.00	22.00	14.00	8.00	14.00	South	South
88	31453224	Rue des Pavillions	44	10.60	8.30	23.00	15.00	8.30	15.00	South	South
89	31448504	Rue de Saint-Genouph	Rue de la Fuye	10.00	8.10	20.00	13.00	8.10	13.00	South	South
90	31453106	Rue de Saint-Genouph	130	10.50	8.50	21.00	14.00	8.50	14.00	South	South
91	31453107	Rue de Saint-Genouph	142	10.60	8.60	22.00	14.00	8.60	14.00	South	South

Itinerary to North Safe Area

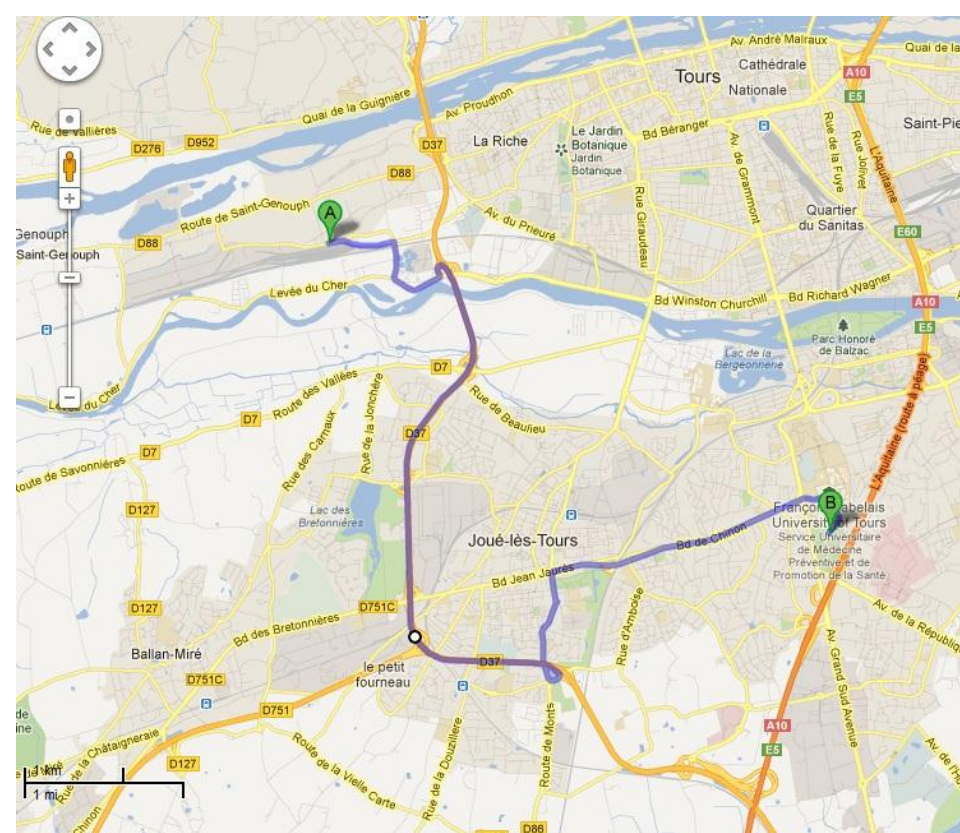


Time required From A to B = 21 minutes

Time required from A to B = 17 minutes

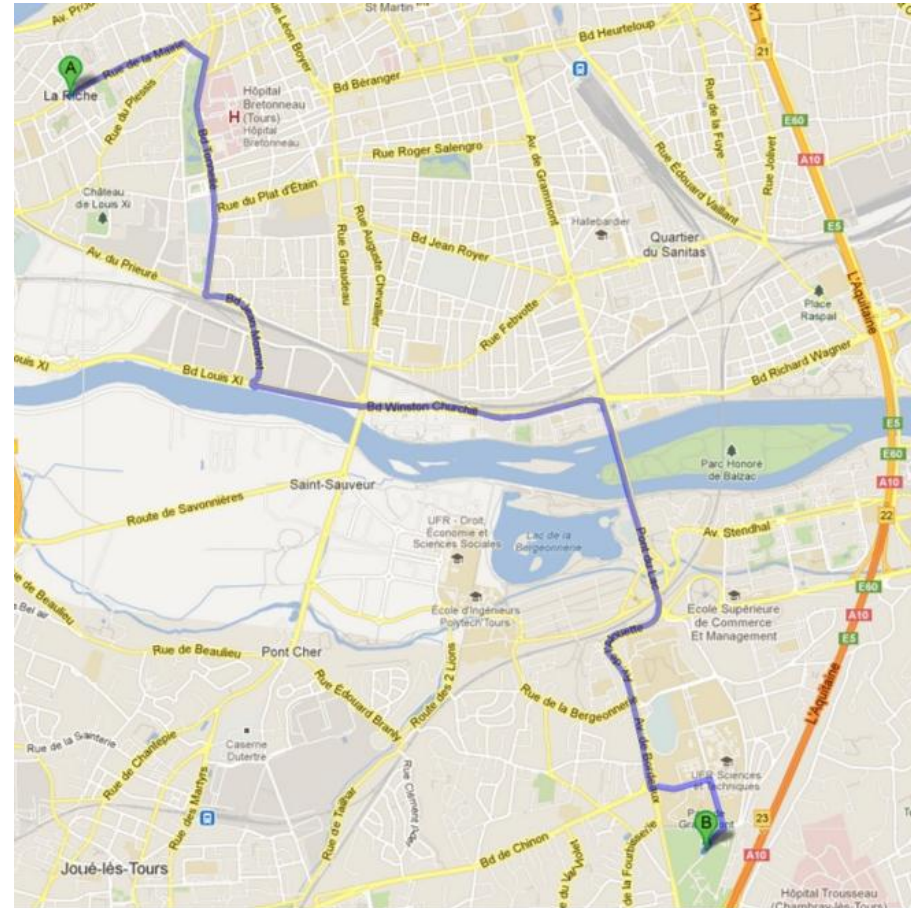
- A La Riche East
- B Air port near Tours
- Itinerary

Itinerary to South Safe Area



Time required from A to B = 14 minutes

- A La Riche West
- B Parc de Grandmont
- Itinerary



Time required from A to B = 13 minutes

Macro Level

Total number of cars = 3456 cars

As we have two directions = 1728 cars/direction

Average time taken for evacuation = 19 minutes/car

Therefore Total time taken to evacuate all 1728 cars (i.e- 864 cars/ itinerary) in two different itineraries at a rate of 1car /minute, hence

$$= 19 + (864 * 1)$$

$$= 883 \text{ minutes}$$

$$= 14.71 \text{ hours}$$

Conclusions and Limitations

General Conclusion:

- we developed a quantitative approach to an evacuation plan so that it helps in improving the evacuation plan of PCS and provides qualitative information of DICRIM.
- It is interesting to learn a methodology with scientific approach in Urban evacuation planning during major flood event.
- This scientific methodology will help in calculating time require to evacuate urban population.
- This methodology helps in improving the warning system by providing precise scientific information related to total time required to evacuate.
- This is a quantitative theoretical approach in evacuation as we does not know whether the evacuee will oblige to the evacuation plan and reach the urban safe area allotted to them.

Conclusions and Limitations

Limitation:

We are not considering:

- The traffic on road
- Non-residential buildings
- Financial requirement of the government to evacuate the population.
- People who can't evacuate with their own.
- Panic aspect.
- we assume the mode of commuting will be with cars only etc.
- The resilience after warning withdraw.

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- http://learning.environment-agency.gov.uk/courses/FCRM/FloodRiskManagement/section8_4_3.html
- Master plans like ORSEC, PCS, PPRI
- INSEE, IRIS, IGN
- Impacts of flooding and climate change on urban transportation: A system wide performance assessment of the Boston Metro Area - Pablo Suarez, William Anderson, Vijay Mahal, T.R. Lakshmanan (2005).
- FLOODPLAIN MANAGEMENT AND MITIGATION IN FRANCE - Vincent R. Parisi, International Committee Chair, Association of State Floodplain Managers And FEMA RegionV.

Thank You!

