

Using Mobile Phone Data Records to Determine Criminal Activity Space

Presented by:

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IQPC International GIS Crime Mapping Conference

Brussels, Belgium

25 - 26 September 2007



Overview

- Activity space
- Proposed new method for examples 1 and 2
- Example 1: Call data records
- Example 2: Active tracking of a suspect
- Example 3: Forensic mapping using call data records

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Mental Maps

- **Paths** – routes of travel that tend to dominate most people's images of cities such as freeways and railways.
- **Edges** – boundaries of lines that help to organise cognitive maps such as rivers, freeways and railways.
- **Districts** – subareas with recognisable unifying characteristics consisting of well established cores with fuzzy boundaries for example business districts or skid rows.
- **Nodes** – intense foci of activities such as intersections, shopping mall, corner shop, etc.
- **Landmarks** – symbols used for orientation but which typically are not physically entered such as high buildings, trees, structures (i.e. water towers), etc.

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Journey-to-Crime

- Crimes in most cases occur close to the offender's anchor point.
- The number of crimes committed by an offender decreases with distance from his/her anchor point.
- Crime types dictate the distance from the anchor points: violent crime tends to be closer to anchor points than property crimes.
- High crime neighbourhoods influence the crime trip pattern.

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Data from cellular (mobile) telephones

•Call Data Records

- The recorded use by the service provider of the cellular telephone when it receives and makes calls, (including SMS and MMS).

•Actively tracking the suspect

- The cellular telephone is actively tracked at predetermined time intervals such as every five or ten minutes.

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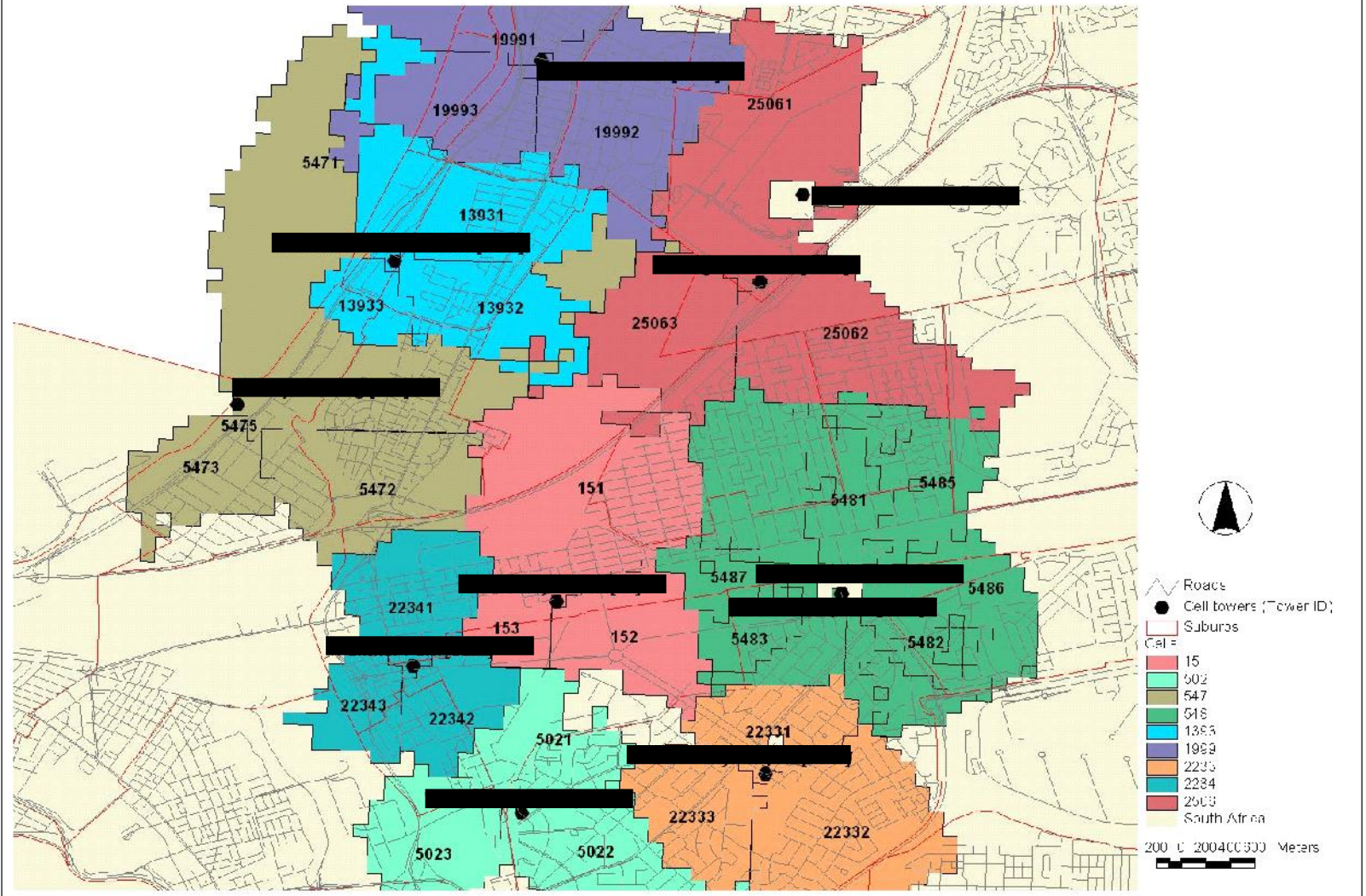
Call Data Records

Date	Time	No.Called	No.Calling	Call.Dir	Call Dur	CELL_ID	TOWER_ID	Site location	Site suburb
15/12/2002	000235	2773228250x	2783765762x	I	52	08393	839	ATS	Millpark
15/12/2002	000400	2783446106x	2773228250x	O	33	08393	839	ATS	Millpark
15/12/2002	000444	2783765762x	2773228250x	O	36	08393	839	ATS	Millpark
15/12/2002	000535	2783446106x	2773228250x	O	43	02772	277	Auckland Park Telkom Ex	AUCKLAND PARK
15/12/2002	001032	2773228250x	2783765762x	I	8	08392	839	ATS	Millpark
15/12/2002	001100	2783446106x	2773228250x	O	21	08393	839	ATS	Millpark
15/12/2002	001931	2783347574x	2773228250x	O	0	08393	839	ATS	Millpark
15/12/2002	001948	2773288063x	2773228250x	O	17	08393	839	ATS	Millpark
15/12/2002	002949	2772392694x	2773228250x	O	26	08393	839	ATS	Millpark

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Cell Network

Example of cell towers and cells as planned by a service provider



Determining the centroid of a cell

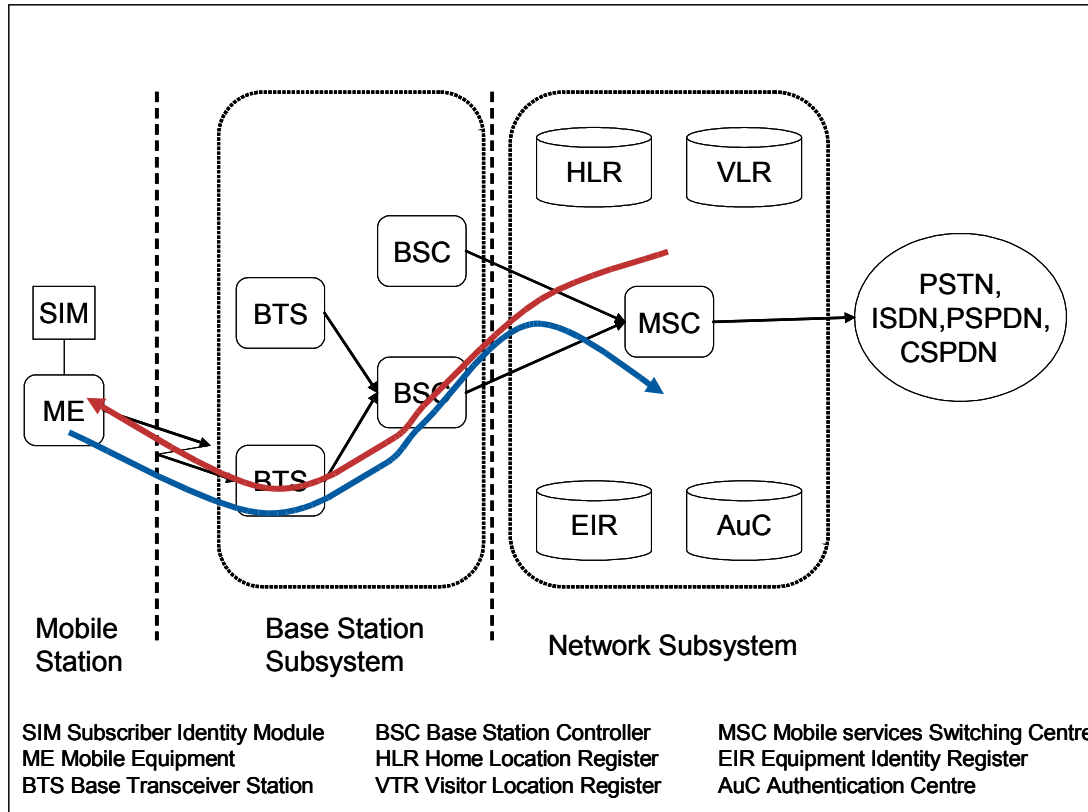
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Determining the x,y position of a cell used to locate a ping in an active track



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Actively tracking a cellular telephone



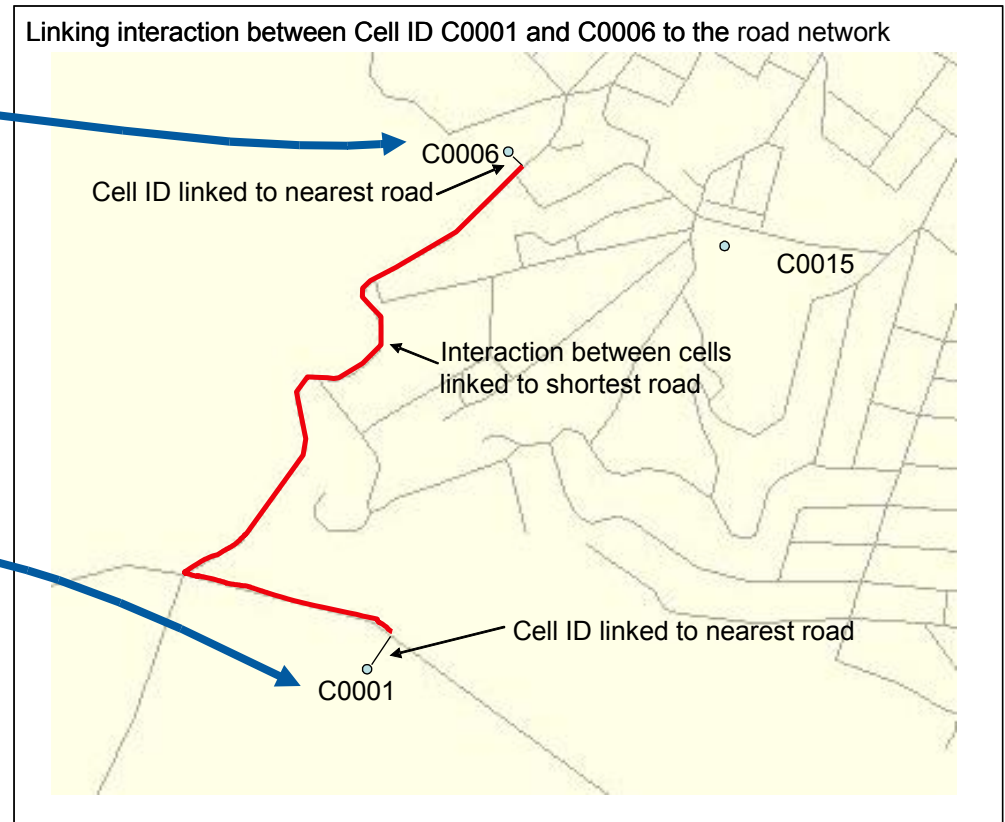
Send a blind SMS to the cellular telephone
Cellular telephone responds by giving the cell in which it is located

The cell is then linked to the centroid, which gives the geographic location

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Linking centroids to road network to determine activity space

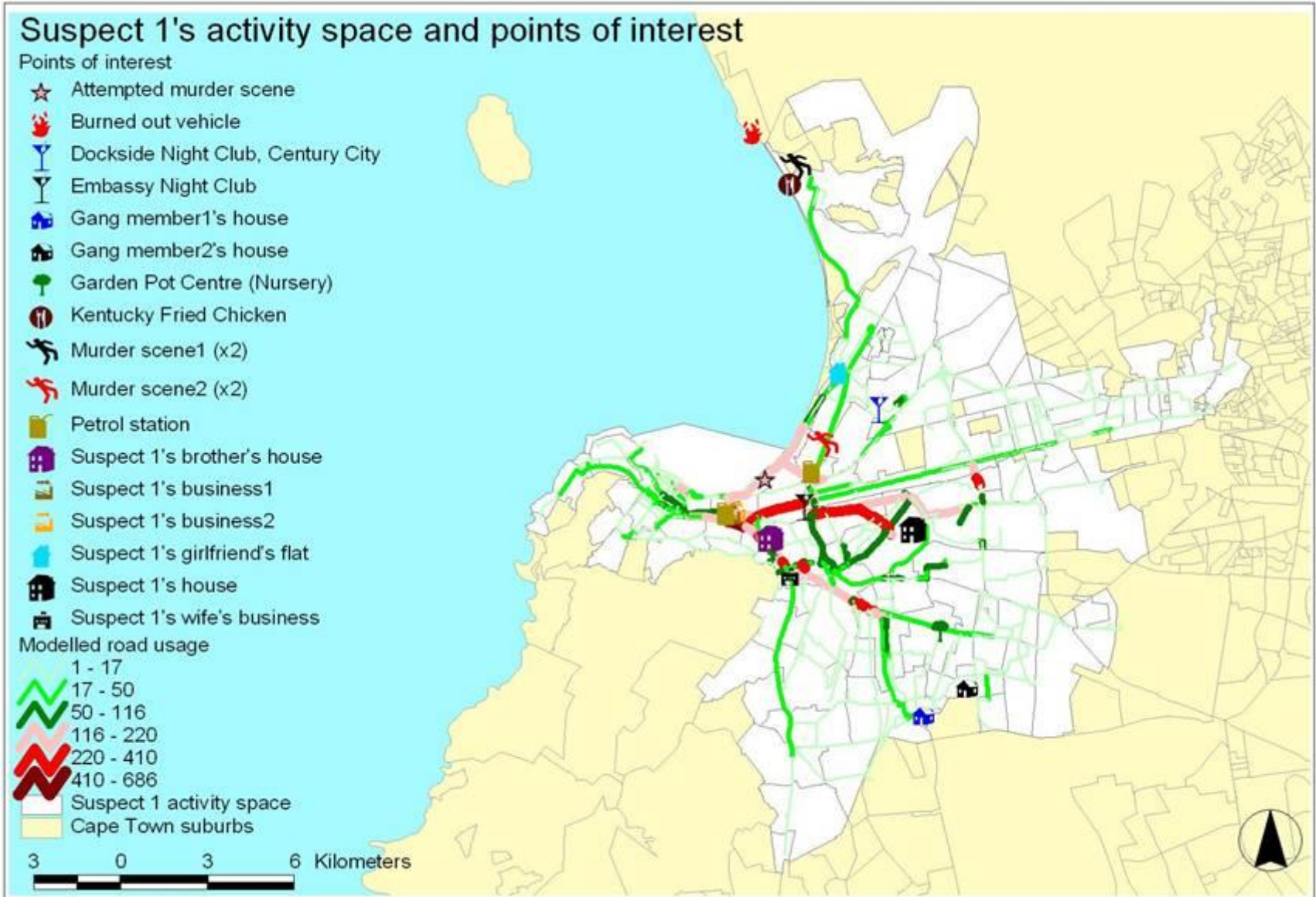
	A	B	C	D	E
1	From_Ping	To-Ping	Interaction		
2	C001	C001	1		
3	C001	C006	1		
4	C002	C002	1		
5	C002	C004	1		
6	C003	C003	2		
7	C003	C004	1		



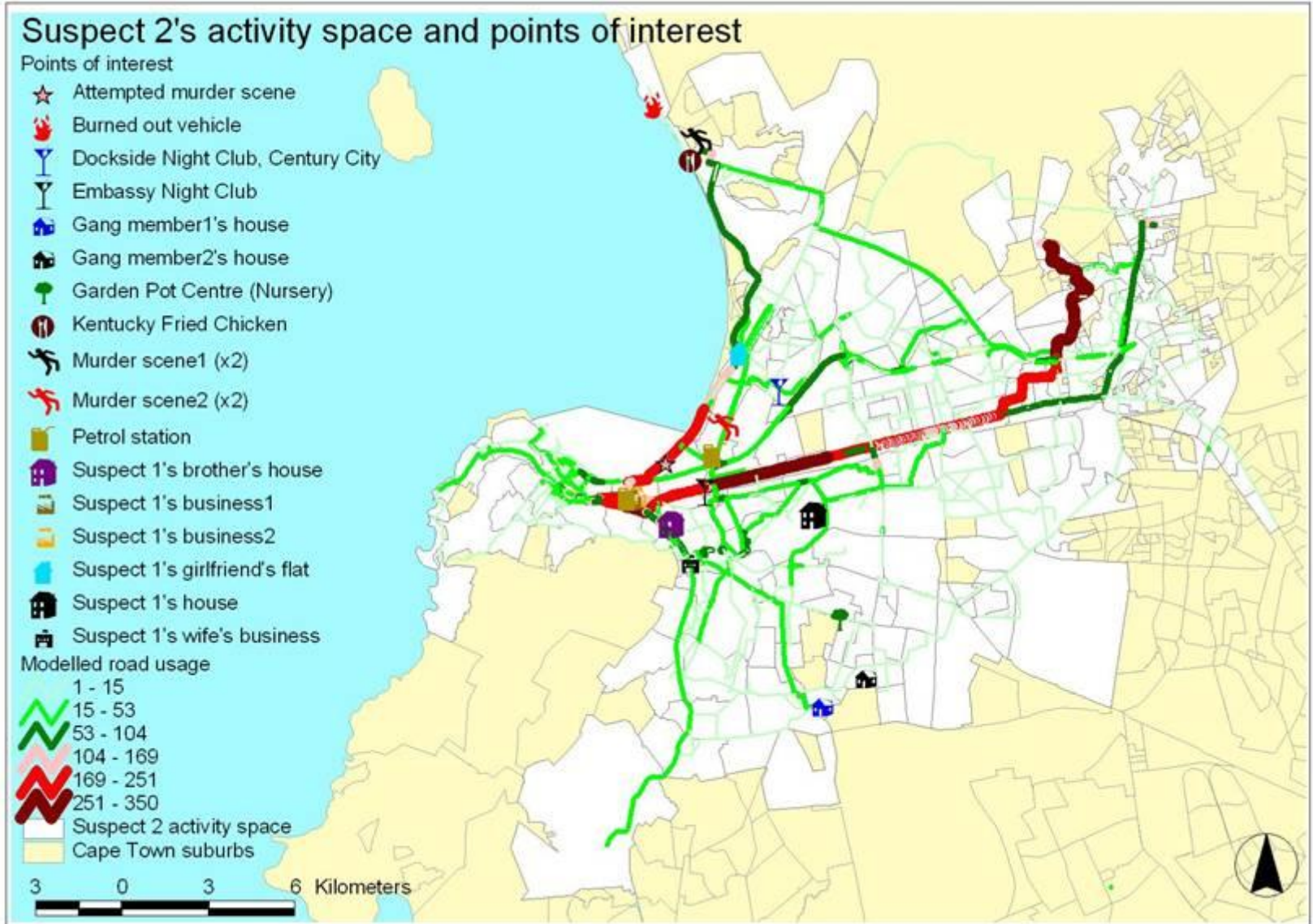
Use Flowmap to link the interaction to the road network.

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Call data records

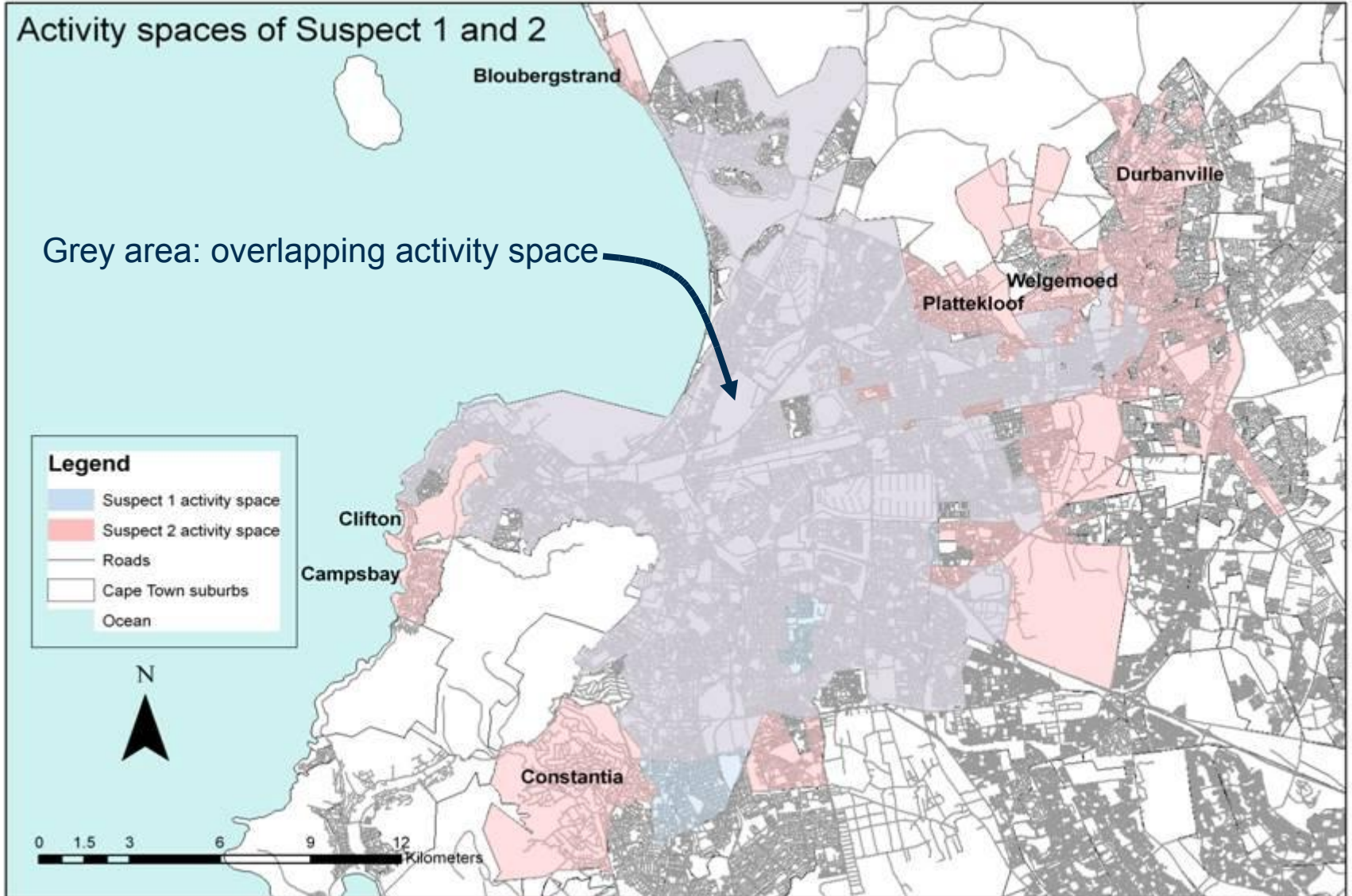


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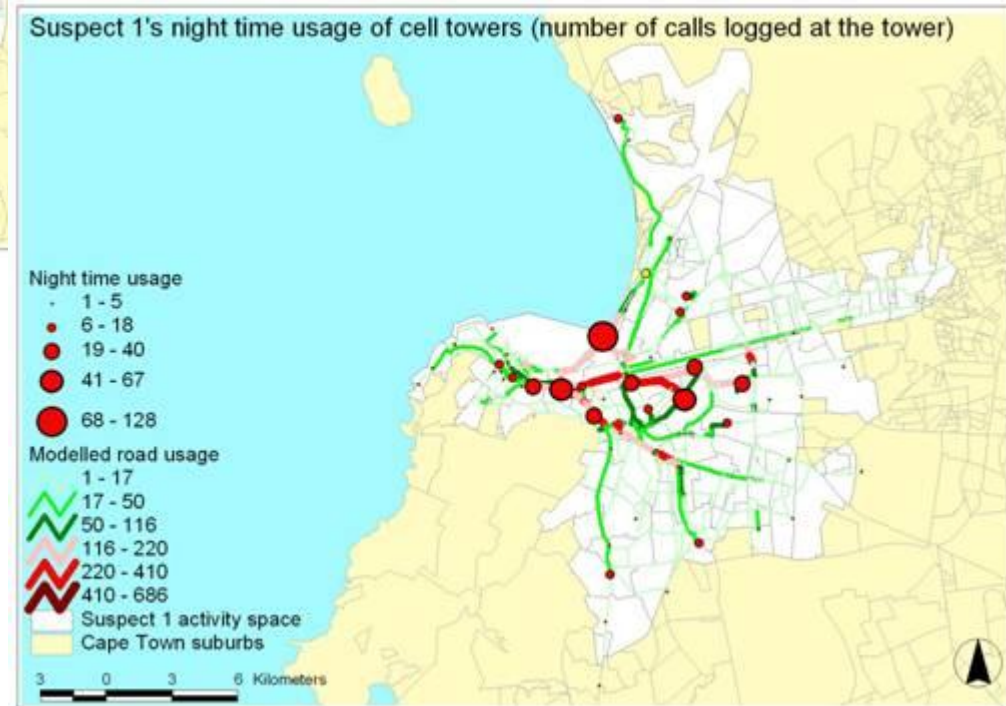
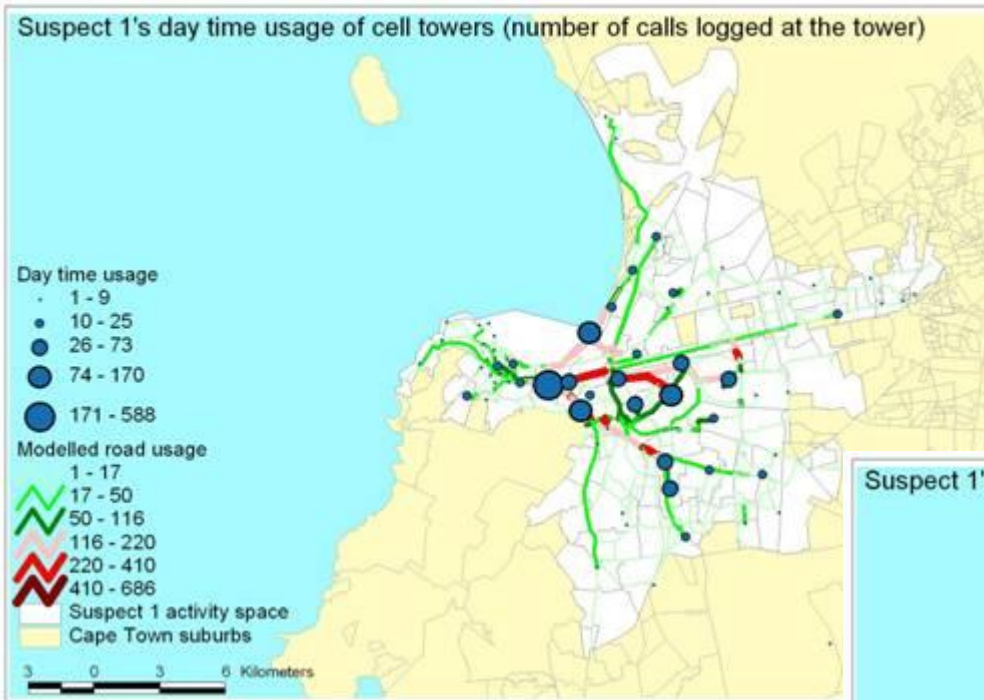
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Activity spaces

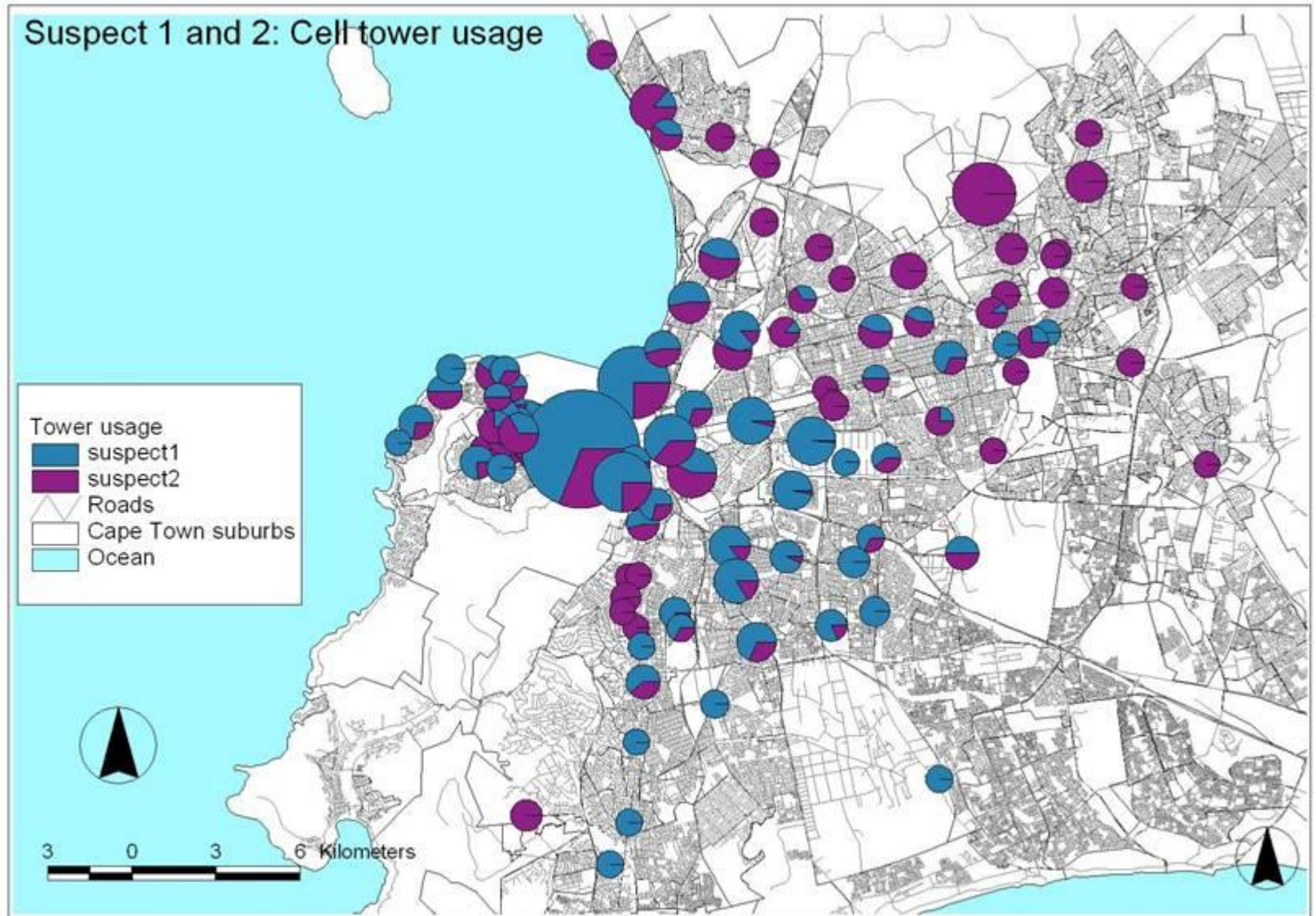


Diurnal patterns

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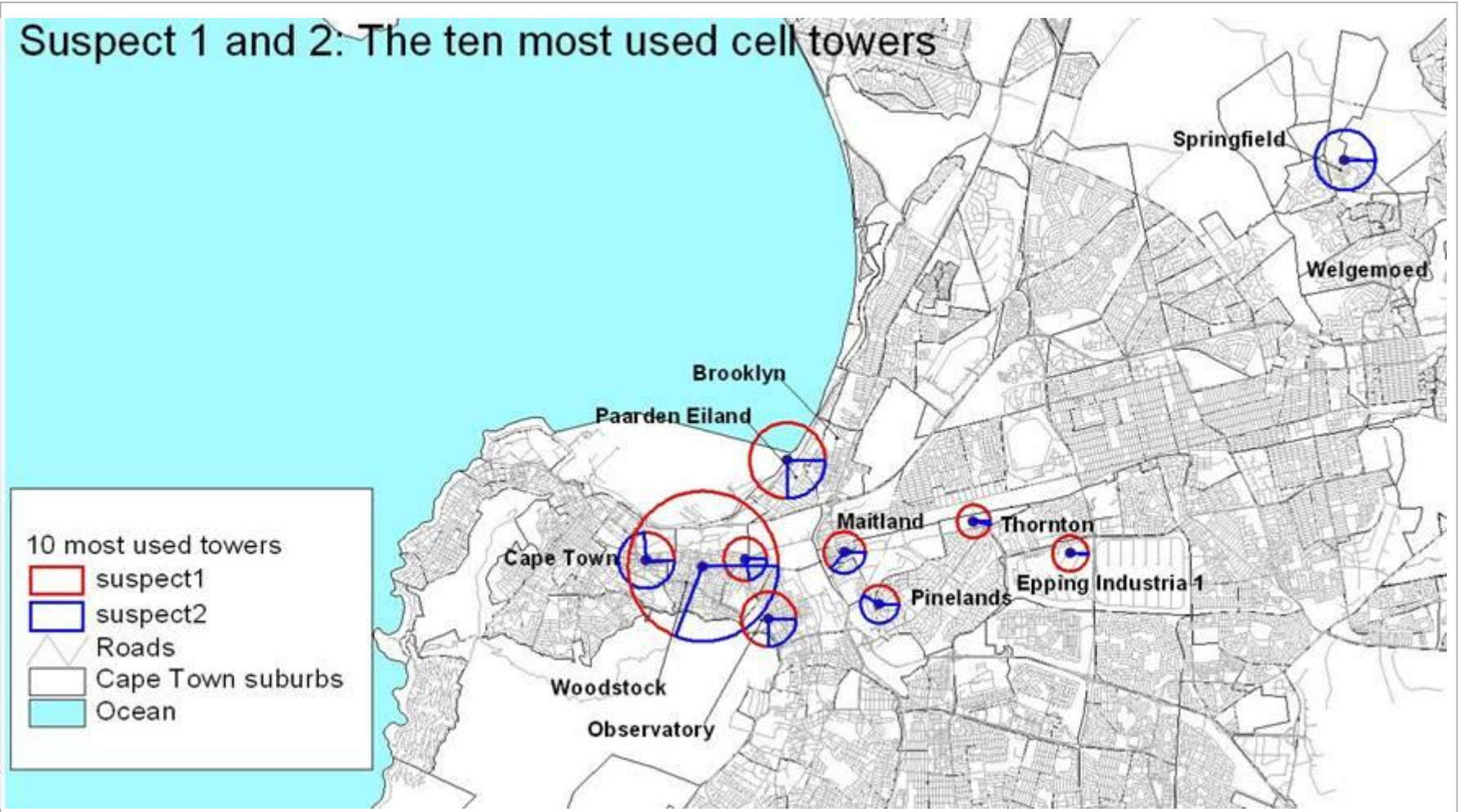


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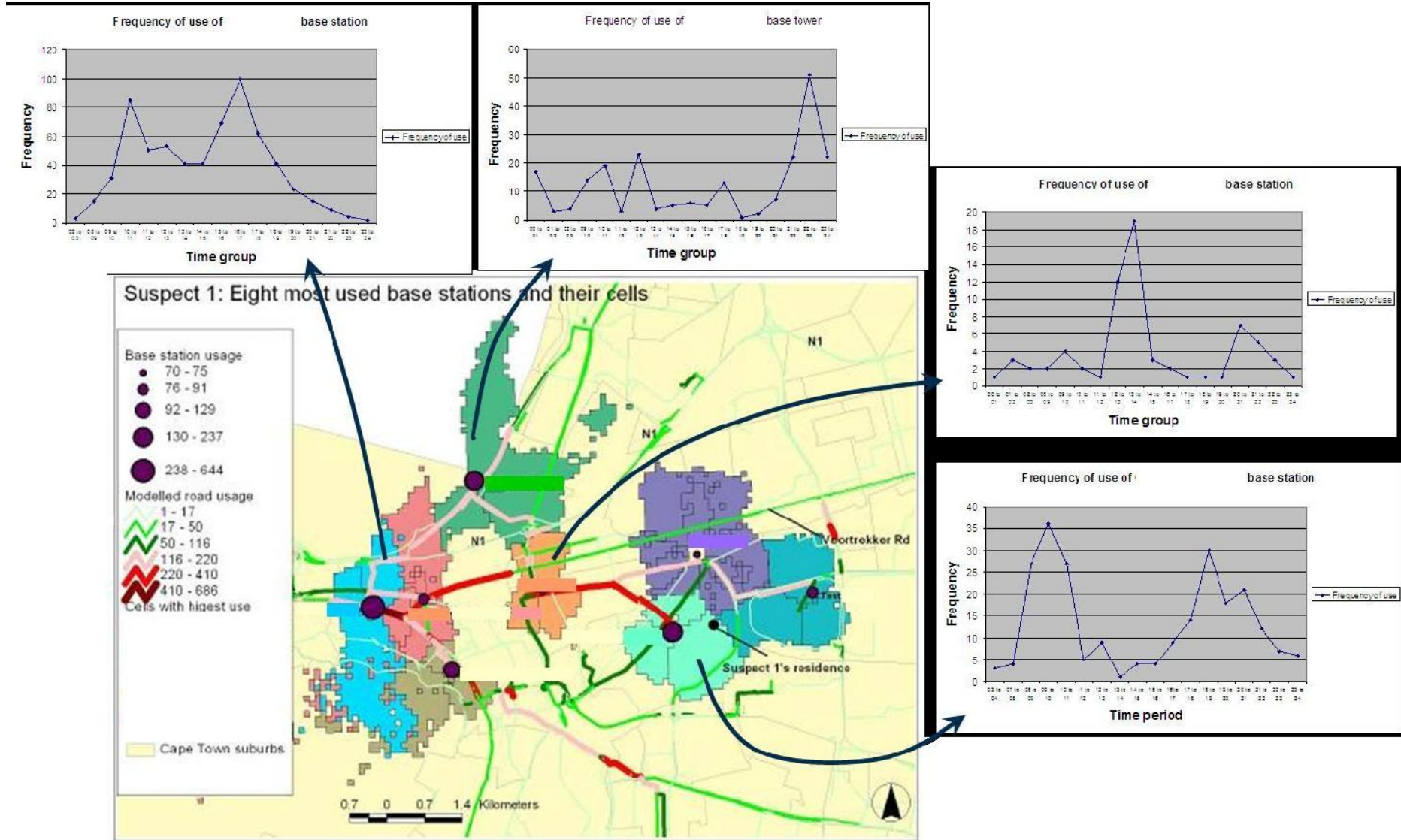
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Suspect 1 and 2: The ten most used cell towers



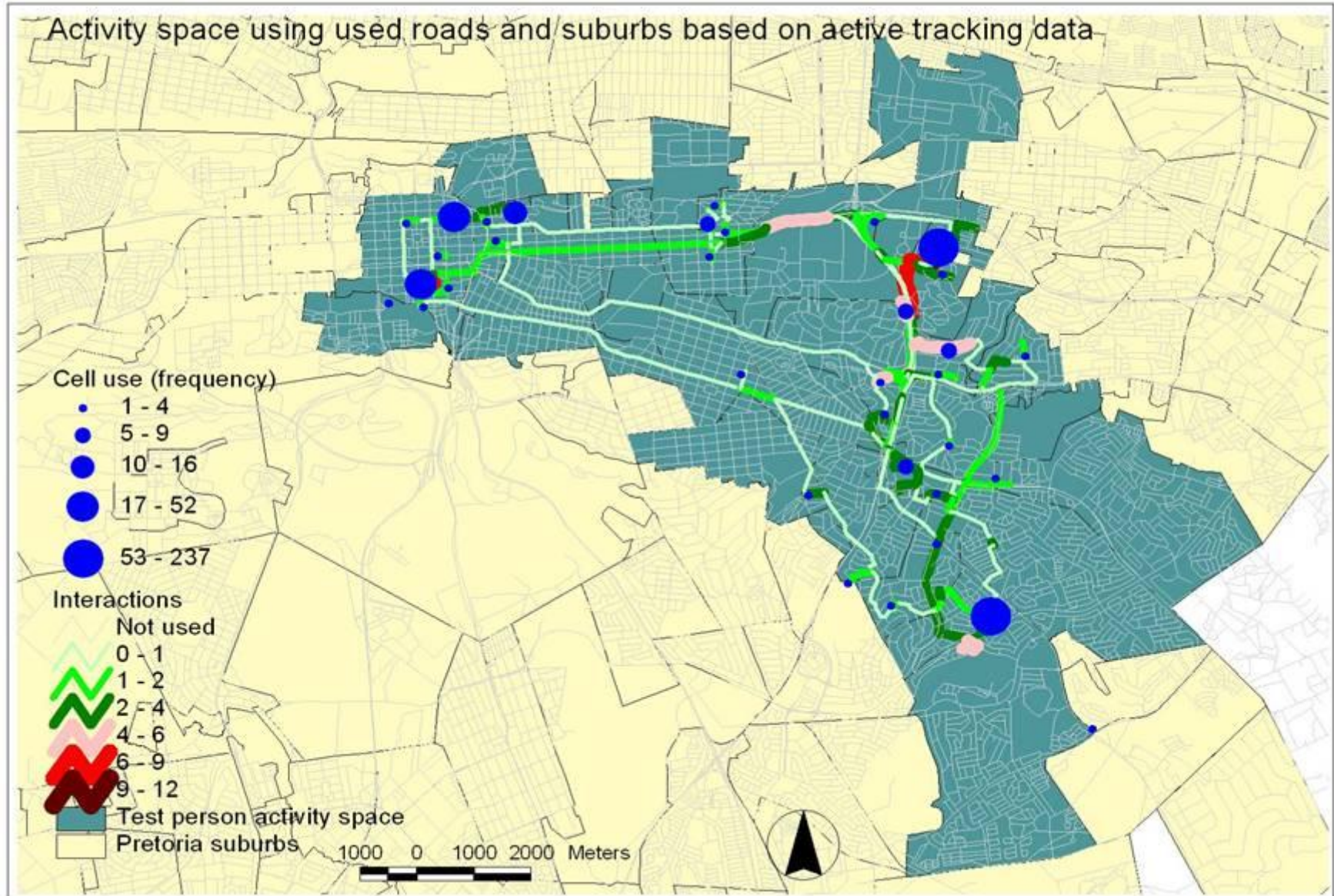
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Frequency of use



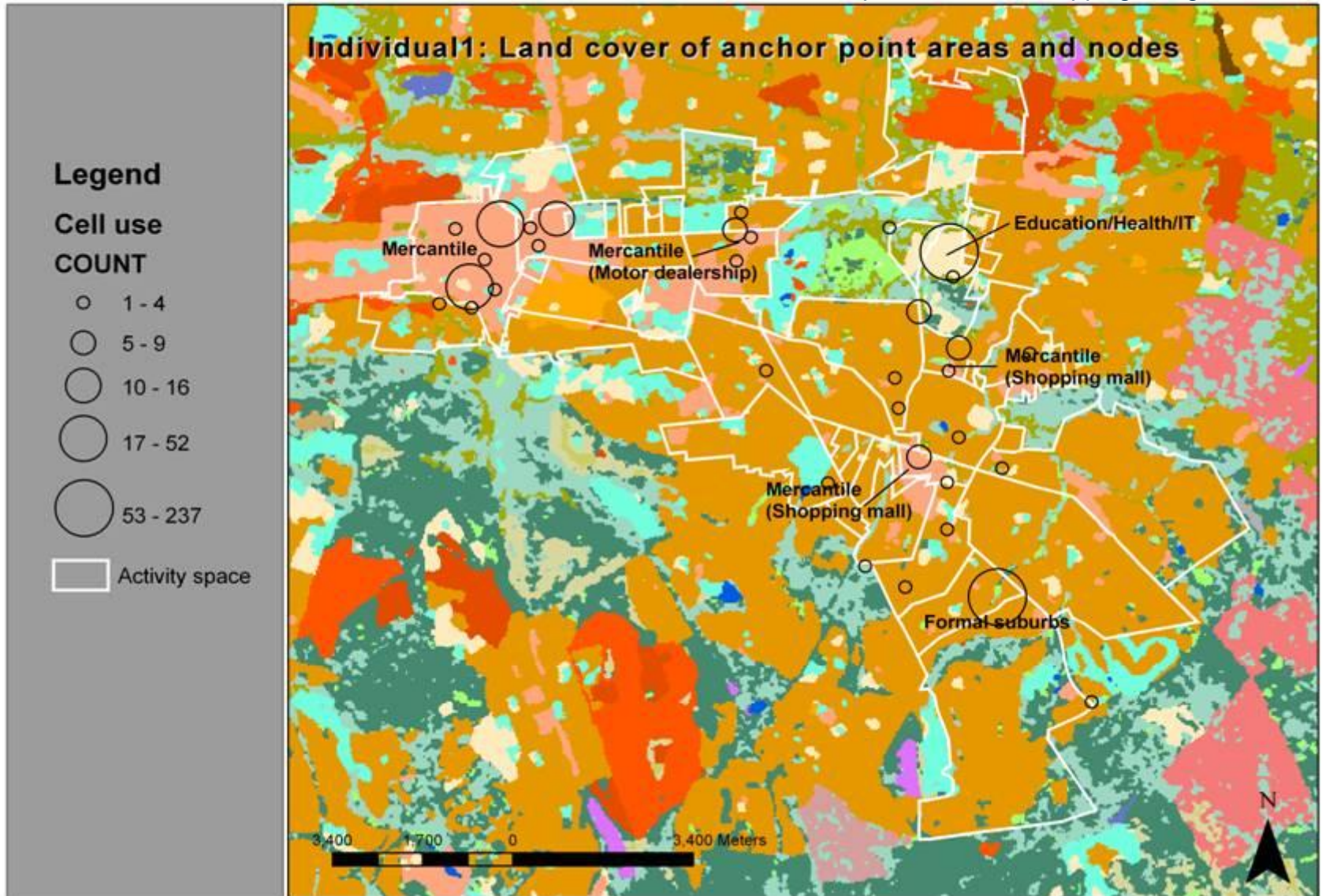
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Active tracking



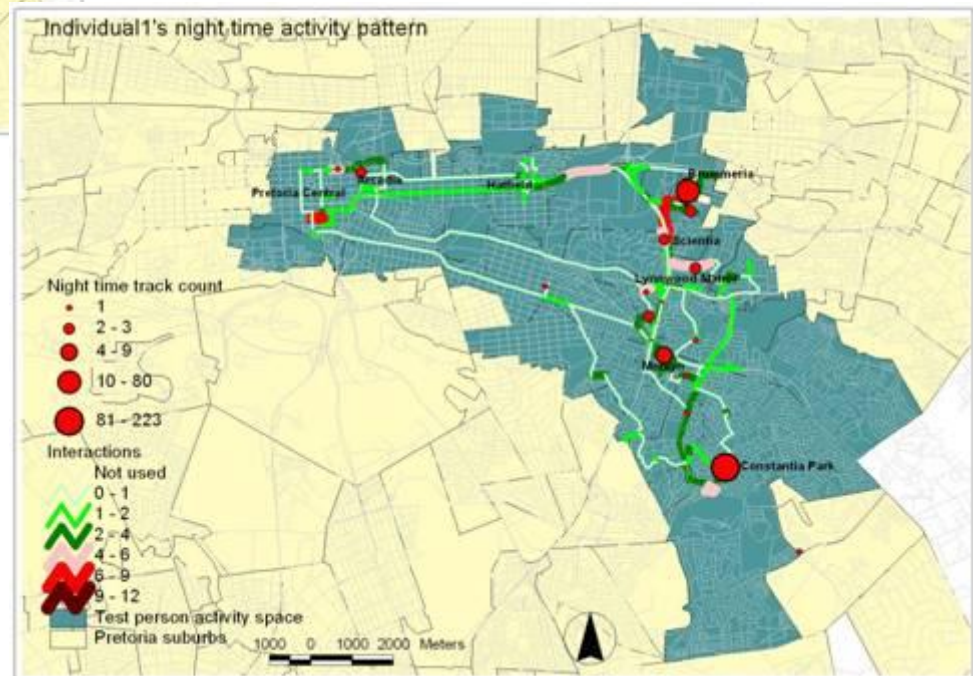
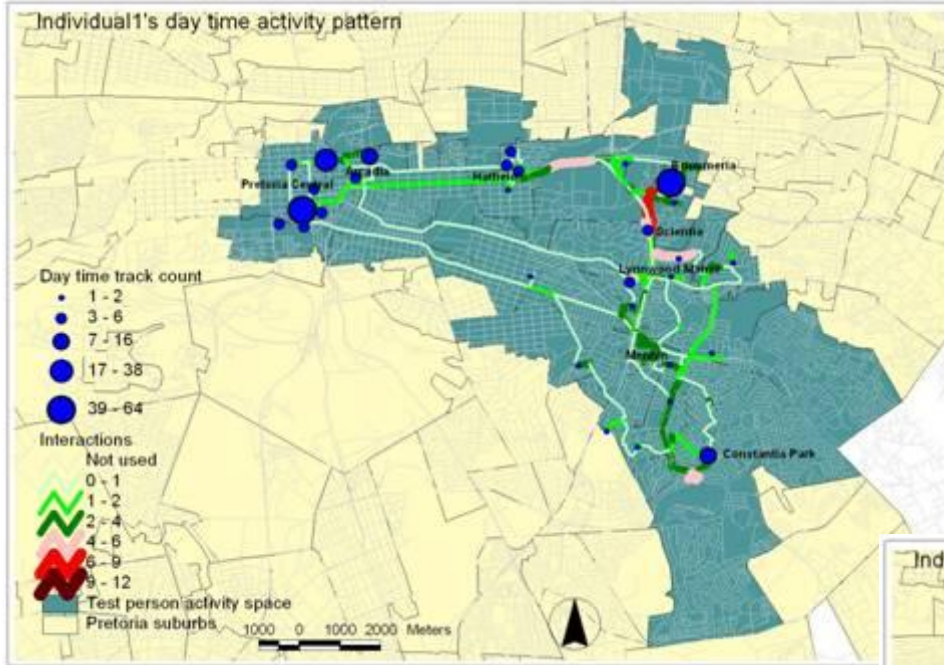
Land use/cover

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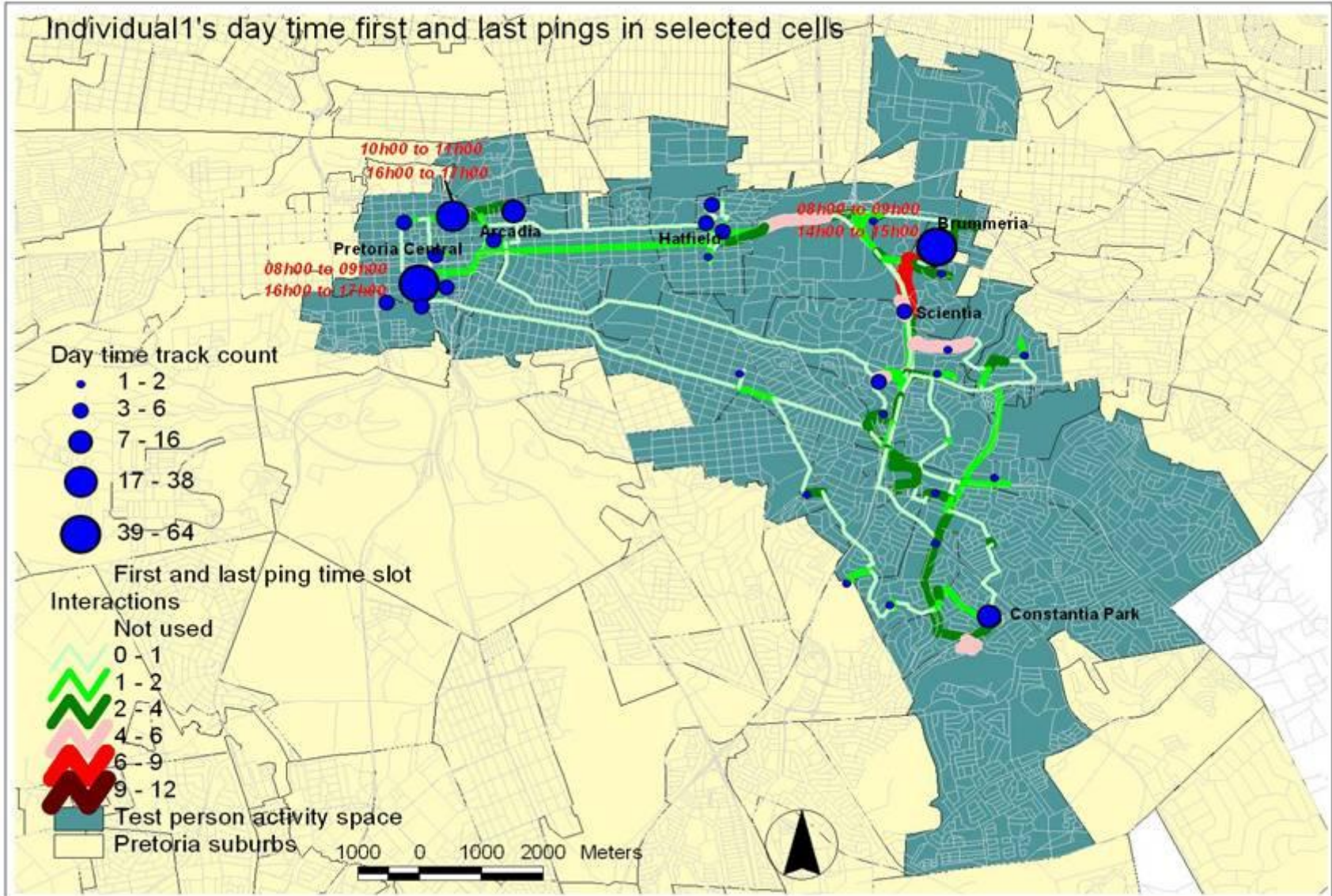
Diurnal pattern

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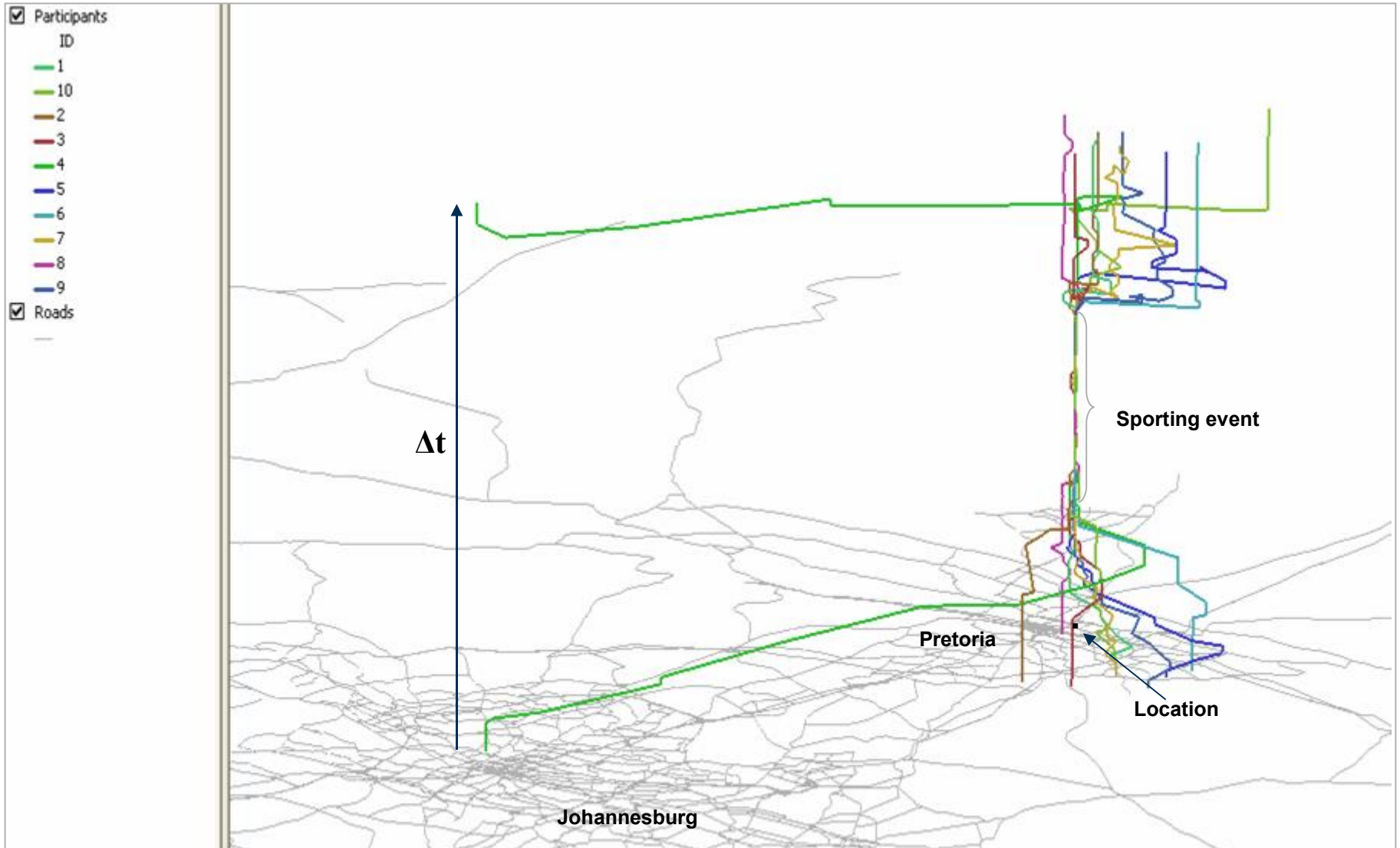
First and last pings

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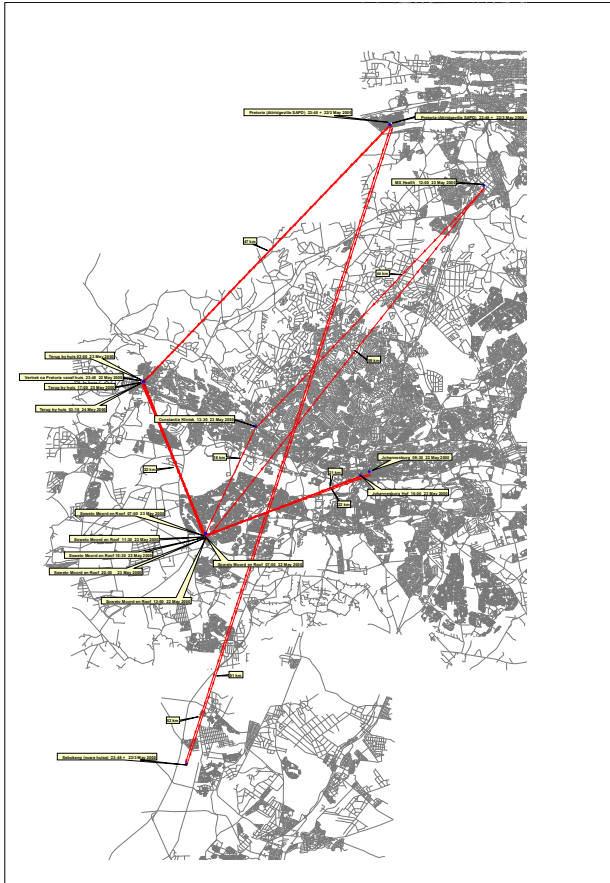


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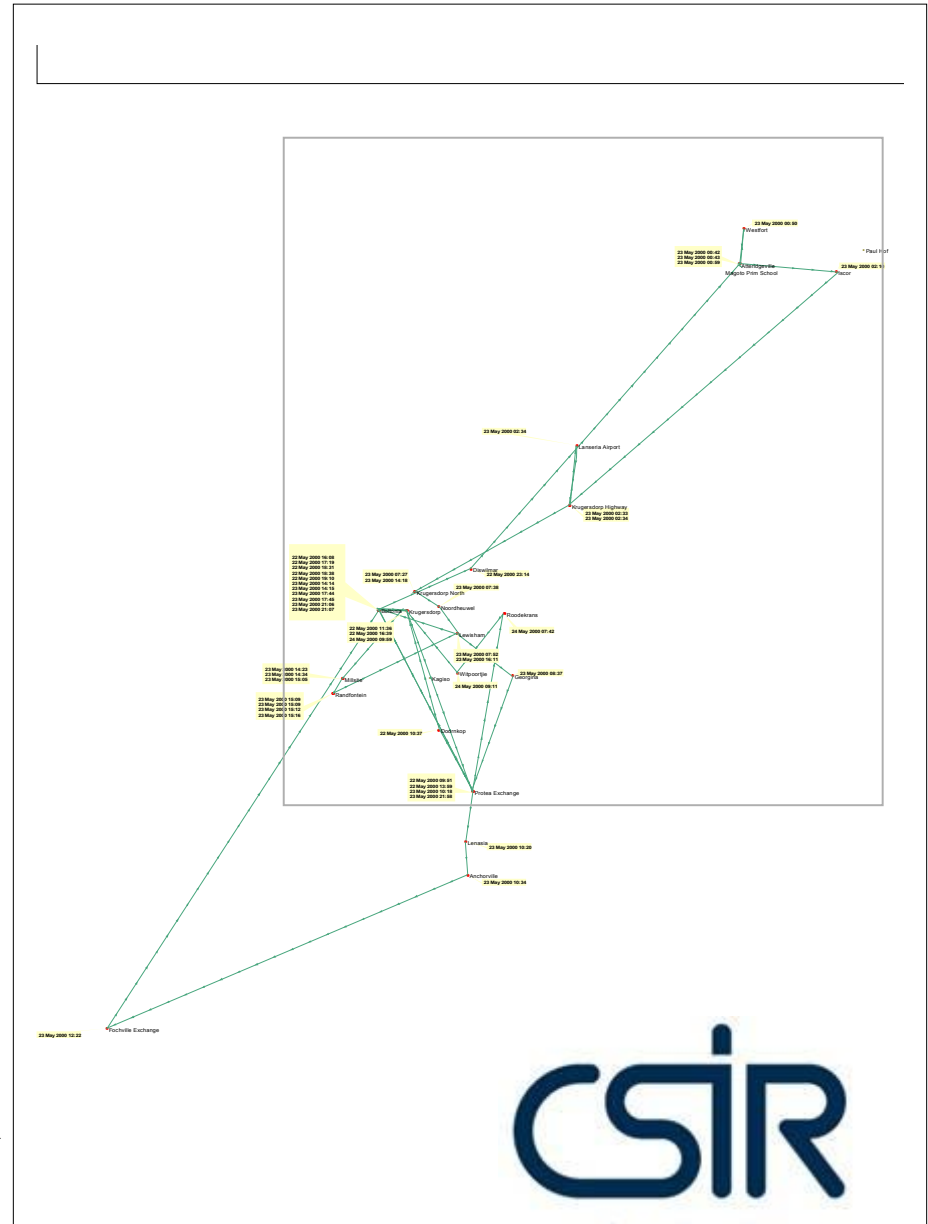
People traveling to and from an event



Activity space as provided by the suspect to the investigating officer



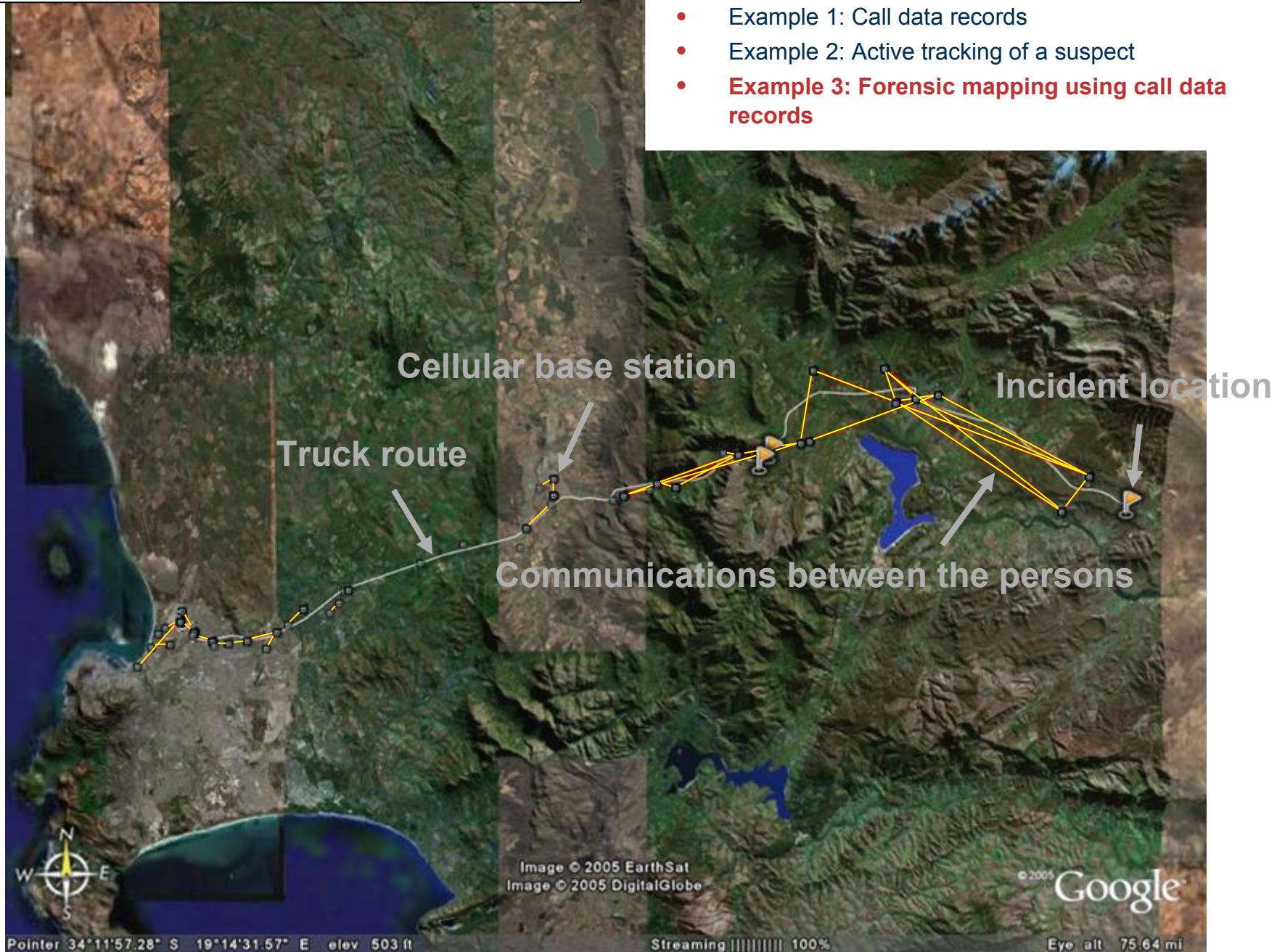
Activity space according to the suspect's call data records



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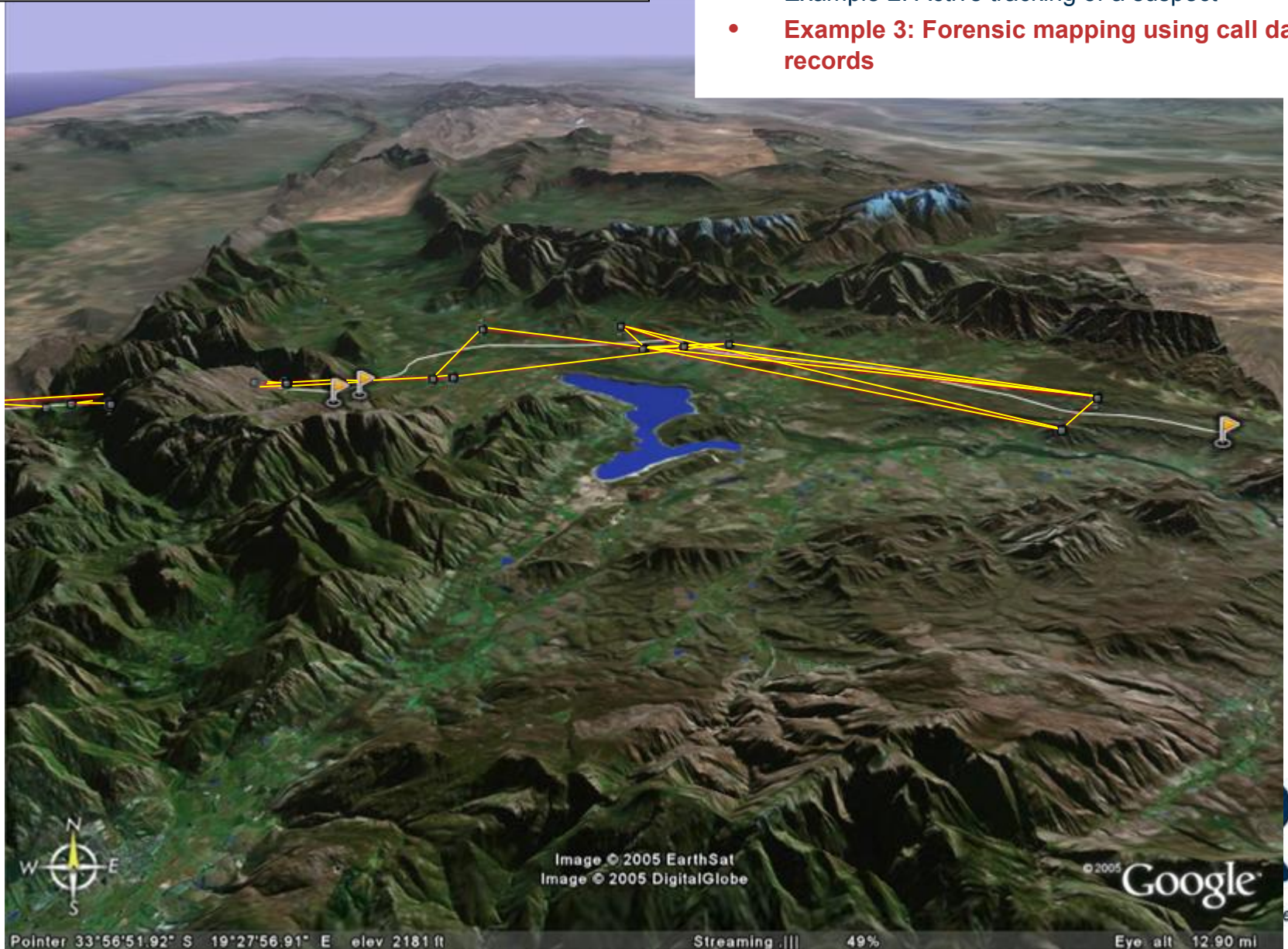
Bilateral movement and GPS data

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Bilateral movement and GPS: 3D view of communications

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Conclusions

- Using call data records (CDR) and/or active tracking data it is possible to determine the activity space of an individual using cellular telephone data.
- The data alone are not sufficient and need to be supported by local knowledge and gathered intelligence.
- SAPS indicates that it will drastically improve their targeted intelligence gathering based on the analysis done using CDR and/or results from the active tracking of the handset of a suspect.
- The analysis offers the investigating team an effective method to brief a new unacquainted investigating officer who joined the investigation with regards to the suspect's activity space, anchor points and the suspect's day/night activity.

Conclusions

- SAPS mentioned that the active tracking of a suspect can help the investigators to establish a finer detail on specific movements than what the CDR can provide.
- They will use the results of the CDR analysis to guide active tracking exercises.
- It is strongly recommended that the above should not be used for prosecution purposes, but only for assisting in solving a criminal case.
- Forensic mapping of call data records can be used for prosecution purposes

Acknowledgements

- CSIR for funding this research through its Strategic Research Panel, project number PPTH/2005/036, "GenDySI (Generation and Harnessing of Dynamic Spatial Intelligence)".
- CSIR employees for the permission to use the 5 minute interval tracking data for this project.
- Adv Riley and colleagues from the National Prosecuting Authority of South Africa to use the suspects' data.
- The cellular service providers MTN and Vodacom for providing the necessary data to do the study.
- Capt Dreyden and colleagues from the South African Police Services for input on the various suspects used in the examples.
- IPQC for the invitation and partial sponsorship



Thank you!



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