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## The spatial pattern of commuting of property offenders in Chennai city

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### ABSTRACT

A study has been conducted in the City of Chennai and the data collected from eighty one police stations revealed interesting findings on spatial pattern of commuting of Property offenders in Chennai City. The study shows that the spatial interaction is highly significant between relatively deprived divisions and more flourishing divisions. It is also noted, that the interacting divisions are essentially the adjacent areas in the inner part of the Chennai City. The long distance journey is more a function of environmental opportunity and accessibility of the destination.

**Keywords:** GIS application, Remote Sensing, property offenders.

### 1. Introduction

Journey to crime (JTC) a term first coined by Philips (1980) is the study of the travel behaviour between an offender residence to and from the crime scene. The journey to crime approach is a precursor to geographic profiling techniques and has been used for years to locate the likely origin of a serial offender based on the properties associated with the distribution of crime incidents (Tania Pal, 2007). Since the place of residence of criminal is usually different from the place of occurrence of crime, the analysis of mobility of offenders is useful in understanding the criminal activities in relation to environment. The journey of offenders is often the result of differential environmental opportunity. The mobility pattern of offenders living in different areas of the city reflects the differential pattern of mobility in the general population. The journey to crime is also a reflection of type of offense, operational convenience and individual decisions.

It is becoming more and more evident that the problem of crime can be neither theoretically conceived nor practically controlled as a local phenomenon. Beginning with the introduction of the automobile at the turn of the century, our whole social life has been evolving a new territorial character. Two basic changes have occurred: human mobility has increased in amount and altered in kind and population has become distributed in a new settlement structure fundamentally different from that of the pre-automobile era (Stuart Lottier, 1938).

The spatial interaction of offenders is the pattern of movement of offenders from origin to destination (Table 1.1). In order to determine the interaction the police division from which the property offenders originate and the police division in which they and their journey to commit crime, the movement of significant number of offenders only was taken (Table 1.1).

### 2. Review of Literature

A number of studies have been undertaken in the Western countries to analyse the relationship between the residences of offenders and place of occurrence of offenses. Lind

(1930) has identified two separate patterns of group crime in Honolulu: (1) Neighborhood triangle of delinquency (two or more offenders live in the same neighborhood in which the delinquent act is committed) and (2) mobility triangle of delinquency (two or more offenders live in the same neighborhood yet commit their offenses outside the neighbourhood). The former pattern occurred mostly in slum areas and involved mischief acts while latter was more common in more stable neighbourhood, the author explained in terms of neighbourhood social control.

Baldwin and Bottom (1976), have found that while the spatial studies can hardly be expected to account for the totality of individual behaviour, some knowledge about collective behaviour with regard to urban crime can be discovered.

White (1932) found that crimes against persons were committed to very near the offender's place of residence while crimes against property were committed at a considerable distance from the place of residence. Apparently, crimes against persons are frequently committed against neighbours produced by close and frequent contact. In addition, white contended that crimes against persons are committed away from the offender's residence because of the obvious desire to remain anonymous.

It is found that the travel distances are short especially the young offenders and for expensive crimes. The spatial configuration of social areas is such that middle and high income areas are in close proximity to low income areas where most offenders live. A study conducted during 1975 shows that only 28.3% of property offenses were committed locally (Sivamurthy, 1979). Commuting is the journey that starts from the criminal residence and end in the place of operation. This commuting from one place do another denotes that the criminals own area is less attractive in many ways (Sivamurthy, 1979).

As far as India is concerned, a pioneering effort was made by Sivamurthy (1980) to analyse the spatial pattern of commuting of property offenders in Chennai city by taking census divisions as areal units. The study by Daniel Beavon (2003), explored the relationships among property crime, the accessibility of street networks and centrality of potential target. The concentration of potential targets was highly related to accessibility and traffic flow. The study suggests that the traffic barriers and road closures can be used as effective crime prevention techniques.

### **3. Objectives**

The objective of the study is to analyse the mobility or travel pattern and the spatial interaction of property offenders in the newly urbanized as well as old inner parts of Chennai during the period of 2005-2007.

The objective of the study is therefore to develop a better understanding of spatial aspects of collective crime related behaviour within the city of Chennai for better crime prevention planning. It is therefore expected that every part of the city inhibits a certain motivation for changing the pattern of crime. A change in the physical set up of the area brings about a corresponding change in the incidence of crime.

Since the environmental opportunity varies from one part of the city to another, the pattern of journey of offenders involved in theft and house burglary especially their commuting pattern is expected to have significant spatial variations. The objectives of the study are:

1. To analyse the flow (journey to crime) of offenders to property crimes in Chennai city cartographically by applying GIS techniques.
2. To prepare automated mapping methods by using GIS and to produce choropleth and flow maps.
3. To prepare a transaction matrix to analyse the spatial interaction of offenders between origin and destination.
4. To analyse the distance traveled by property offenders in their journey to crime.
5. To devise and apply aggregated commuting index to understand the pattern of mobility of offenders in Chennai city.

### **3.1 Hypotheses**

1. There is significant spatial variation in the distribution of residence of property offenders in Chennai city.
2. Pattern of mobility of offenders is more a function type of offense.
3. The distance traveled by property offenders depends on environmental opportunity.
4. The convergence by interaction matrix is more prominent in peripheral areas than the interior areas.
5. The commuting of property offenders is greater in the interior areas when compared to peripheral areas.

### **3.2 Coverage of the study**

The present study is undertaken to analyse the journey to crime (mobility) of property offenders in a large metropolitan city in India, namely, Chennai city. Among the one Lakh cities, in Tamil Nadu, Chennai city, the capital of the State is the biggest in size. Chennai has a good manufacturing base in light and heavy engineering industries. It is also home for India's biggest film industries. Chennai's port facilities, literate and efficient workforce and efficient services have made it a favoured destination for automobile industries. Chennai can be described as a city with unique and harmonious blend of tradition and modernity. Chennai city that ranks first in population also ranks first in the occurrence of most type of crimes. Law enforcement is taken care of in Chennai city by 81 police stations

### **3.3 Data and Methodology**

Data relating to offenders charged with property offenses (Theft, pocket picking, house-burglary etc.) have been collected from the FIR Index (First Information Report Index) of each of the 81 police stations in Chennai city for the years 2005 and 2007 being the latest period for which complete data were available.

For the analysis of spatial interaction of offenders, a partially processed data for 2003 were used. The analysis has been restricted to the occurrence of theft and house-burglary only due to their high frequency. Choropleth and dot maps have been prepared using GIS software to describe the spatial distribution. Geographical Information System (GIS) is a computerized

mapping system that permits information layering to produce description of conditions and analyses of relationships among variables.

The journey to crime by offenders was developed by drawing lines on maps which connect offenders addresses with crime locations. Flow maps were first analyses cartographically. This was accomplished through the use of automated mapping methods to produce flow maps. This was done with the help of GIS software. The zone wise flow maps show the direction of movement of offenders and their numbers. Movements are synthesized visually and statistically zone by wise flow map.

In order to analyse the spatial interaction of offenders, a Police station wise “transaction matrix” of 81 X 81 was prepared to show the origin (Residence) of offenders and destination (Place of occurrence) which would show the spatial interaction of offenders. The distance traveled by significant number of offenders would show the nature of interaction. The transaction matrix is the frequency of offenders for each origin (Residence) and destination (Place of occurrence) which would show the spatial interaction of offenders. The distance traveled by significant number of offenders would show the nature of interaction.

The commuting index is derived by calculating the proportion of number of offenders who live and commit crimes in the area to the number of offenders living in the area. The relative commuting index is the proportion of commuting index for the area to the total number of crimes known to the police in the area. The attractiveness of the area for the mobility of offenders is measured from the commuting index. The lower value will show that the area depends very little on outward commuting. Since the area itself is rich in environmental opportunity, conversely, the higher value will show lack of opportunity in the area.

### **3.4 The Spatial Interaction of Offenders**

It has been found that the spatial pattern of mobility or interaction is highly significant between relatively deprived divisions and more flourishing division, it is also noted that the interacting divisions are essentially the adjacent areas. Thus, the divisions of operation of offenders tend to be situated close to the areas of high opportunity. It is found that the characteristics of origin and destination together influence the pattern of interaction.

The spatial interaction is more significant in the inner commercial and high income residential areas. The peripheral zones do not show this amount of interaction since the majority of crimes are committed locally. The study shows that about 28% offenders involved in property crimes have come from local areas. The modern high income residential areas attract offenders locally.

The Table (1.1) shows that the criminal interaction takes place in a significant way between P3 Vysarpadi and P2 Otteri; F5 Choolaimedu and R3 Ashok Nagar; H1 Washermanpet and C3 Seven Wells; J3 Guindy and R1 Mambalam; P1 Pulianthope and P2 Kodungaiyur and G5 Secretariat Colony; P6 Kodungaiyur and K3 Aminjikai; R5 Virugambakkam and K3 Aminjikai. It is found that the interacting divisions are essentially the adjacent areas.

### **3.5 Journey to Crime and Distance Traveled by Property Offenders**

The long distance journey is more a function of environmental opportunity and general accessibility of the destination. It is found that the commercial and industrial areas with

maximum degree of accessibility and environmental opportunity are able to attract offenders from far off places.

Table (1.1) shows the journeys made by property offenders from origin to destination with significant number of offenders. The longest distance of 16.15 km is traveled by the offenders from H8 Thiruvottiyur to J2 Adyar. About 8 offenders have traveled in this category.

**Table 1:** Journey to Crime: Spatial Interaction and Distance Travelled

S.No.	From Origin Police Division	To Destination Police Division	Distance in Km	No. of Offenders
1	H8 Thiruvotiyur	J2 Adyar	16.15	8
2	J3 Guindy	K5 Peravur	11.17	5
3	J2 Adyar	K3 Aminjikarai	10.03	7
4	J7 Velachery	E4 Abiramapuram	7.75	7
5	P6 Kodungaiyur	K3 Aminjikarai	7.15	16
6	J7 Velachery	J4 Kotturpuram	6.11	5
7	J3 Guindy	E4 Abiramapuram	5.52	8
8	J2 Adyar	R1 Mambalam	4.93	8
9	P6 Kodungaiyur	K2 Ayanavaram	4.93	9
10	V1 Villivakkam	K8 Arumbakkam	4.63	5
11	J7 Velachery	J2 Adyar	4.56	8
12	P3 Vyasarpadi	P6 Kodungaiyur	4.43	6
13	P3 Vyasarpadi	K2 Ayanavaram	4.22	10
14	P1 Pulinthope	D1 Triplicane	4.08	10
15	F5 Choolaimedu	R3 Ashok Nagar	3.80	15
16	H8 Thiruvotiyur	H1 Washermenpet	3.58	6
17	P6 Kodungaiyur	K1 Sembium	3.40	9
18	V1 Villivakkam	K9 Thiru. Vi. Ka Nagar	3.36	7
19	J3 Guindy	R1 Mambalam	3.33	14
20	P3 Vyasarpadi	K1 Sembium	3.10	7
21	H5 New Washermenpet	N3 Muthialpet	3.05	6
22	P1 Pulinthope	K2 Ayanavaram	3.04	7
23	R5 Virugambakkam	F4 Thousand Lights	2.92	5
24	E4 Abiramapuram	D2 Annai Salai	2.90	5
25	F1 Chintadiripet	E2 Royapettah	2.88	8
26	V5 Thirumangalam	K4 Anna Nagar	2.86	5
27	R1 Mambalam	E3 Teynampet	2.84	5
28	P1 Pulinthope	C1 Flower Bazar	2.63	5
29	E5 Pattinapakkam	E4 Abiramapuram	2.62	6
30	R5 Virugambakkam	K3 Aminjikarai	2.41	14
31	V5 Thirumangalam	K3 Aminjikarai	2.29	7
32	F1 Chintadiripet	D2 Annai Salai	2.25	6
33	R5 Virugambakkam	G1 Vepery	2.23	8
34	F1 Chintadiripet	P2 Otteri	2.21	39
35	P2 Otteri	E4 Abiramapuram	2.01	7
36	P3 Vyasarpadi	K9 Thiru. Vi. Ka Nagar	1.97	8
37	C3 Seven Wells	J5 Sastri Nagar	1.94	5

38	K1 Sembium	G5 Secretariat Colony	1.84	14
39	J6 Thiruvanmiyur	K3 Aminjikarai	1.82	7
40	P1 Pulinthope	R5 Virugambakkam	1.82	6
41	P3 Vyasarpadi	P5 MKB Nagar	1.81	7
42	V1 Villivakkam	V5 Thirumangalam	1.73	8
43	F1 Chintadiripet	F2 Egmore	1.57	7
44	P3 Vyasarpadi	C2 Elephant Gate	1.51	5
45	H4 Korukkupet	H3 Tondiarpet	1.43	5
46	H4 Korukkupet	H1 Washermentpet	1.32	6
47	R1 Mambalam	R4 Pondy Bazar	1.18	6
48	P3 Vyasarpadi	H1 Washermentpet	1.09	7
49	H1 Washermentpet	C3 Seven Wells	1.04	15
50	P1 Pulinthope	P2 Otteri	0.95	18
51	C3 Seven Wells	C5 Kothawal Chavadi	0.79	9
52	H4 Korukkupet	H6 RK Nagar	0.53	5
53	H3 Tondiarpet	H5 New Washermentpet	0.36	5

The next longest distance traveled is 11.17 km from J3 Guindy to E4 Abiramapuram followed by J2 Adyar to K3 Aminjikarai (10.03 km); J7 Velachery to E4 Abiramapuram (7.75km).

The Table (1.1) also shows the number of offenders travelled from P3 Vyasarpadi (39) to P2 Otteri with a distance of 2.21 km; P1 Pulianthope to P2 Otteri (18) with a distance of 0.95 km; P6 Kodungaiyur to K1 Sembium (16) with a distance of 7.15 km; P5 Choolaimedu to F2 Egmore (15) with a distance to 3.80 km; H1 Washermentpet to C3 Seven wells (15) with a distance of 1.04 km; J3 Guindy to R1 Mambalam (14) with a distance of 3.33 km ; and P1 Pulianthope to G5 Secretariat colony (14) with a distance of 1.84 km.

The Table (1.1) shows that a large number of offenders have traveled less than 2 km from their origin (residence) to the place of commission of crime. Many studies have shown that the journey to crime is typically very short and offenders generally commit crimes with one or two km of their homes. Familiarity with the area may be one of the reasons for choosing neighboring areas.

The Table (1.1) shows that a large number of offenders are originating from P3 Vysarpadi and P1 Pulianthope. These areas located in North Chennai are characterized by a large number of slums surrounded by economically weaker working population.

### **3.6 Zone Wise Flow (Movement) of Property Offenders**

#### **3.6.1 Origin Zone B**

The flow of offenders from B zone to other areas is very insignificant. The B zone is located in the east near the harbor (Fig 1.1). It covers C1 Flower Bazar, C2 Elephant Gate, C3 seven wells and C5 Kothawalchavadi.

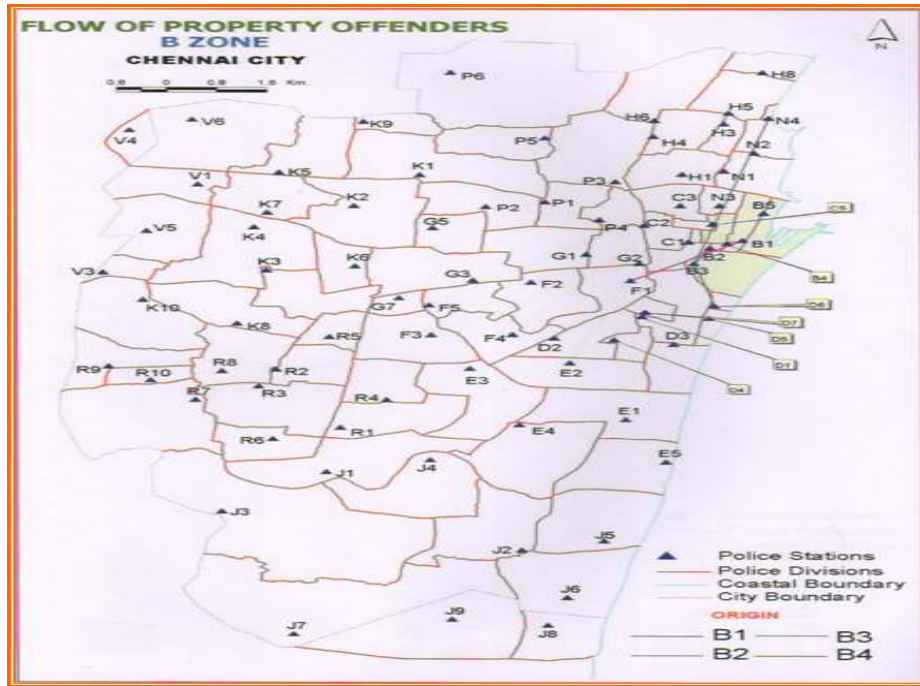


Figure 1: Flow of property offenders – Zone B

### 3.6.2 Zone C

The flow of offenders from C zone is towards north east. The offenders travel to a fairly long distance to commit offense elsewhere (Fig. 1.2).

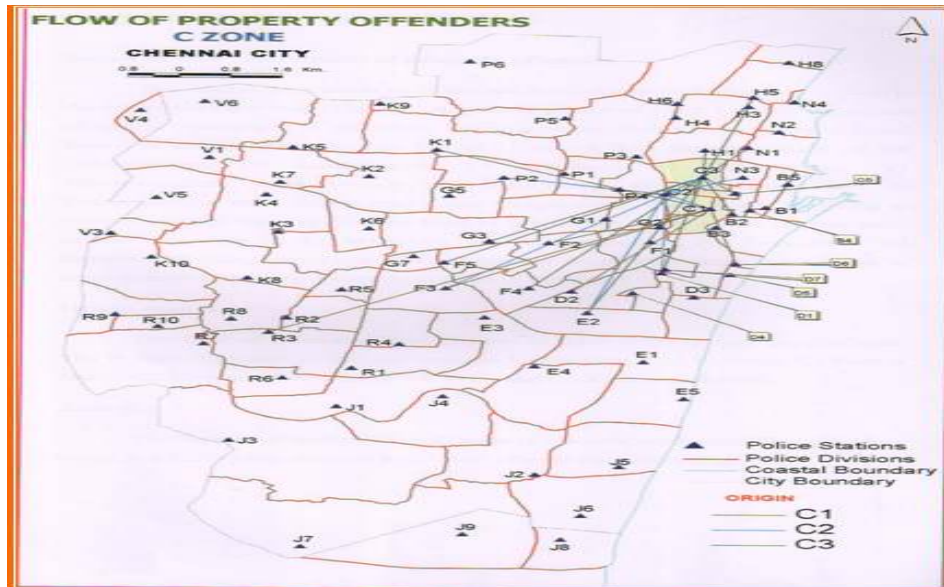
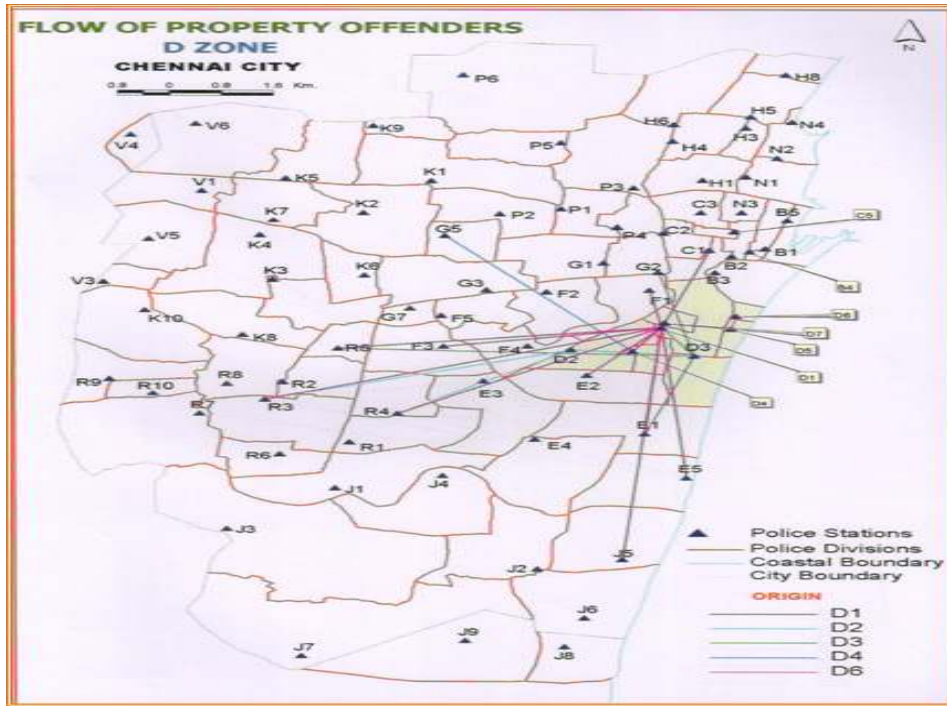


Figure 2: Flow of property offenders – Zone C

### 3.6.3 Zone D

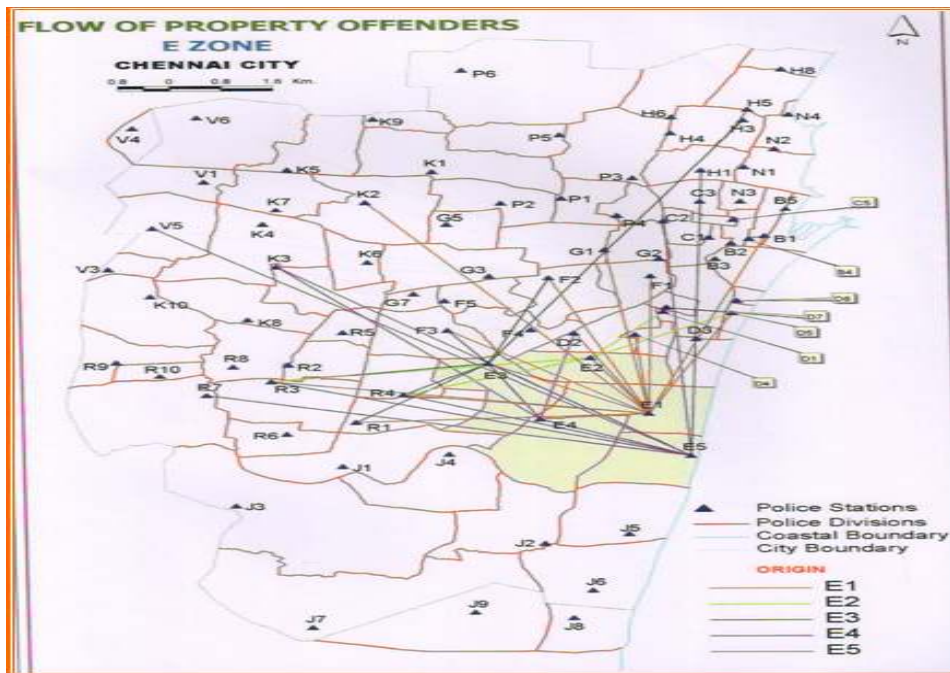
The offenders travel towards all directions but with limited distance. The offender's emerge from D zone which covers D1 Triplicane, D2 Anna Salai, D3 Ice House, D4 Zam Bazar, D5 Marina, D6 Anna square and D7 Govt. Estate (Fig 1.3).



**Figure 3:** Flow of property offenders – Zone D

### 3.6.4 Zone E

The E zone is an important origin for property offenders. It covers E1 Mylapore, E2 Royapettah, E3 Teynampet, E4 Abiramapuram and E5 Pattinapakkam. This zone generates offenders to travel to north and North West part of the city (Fig 1.4).



**Figure 4:** Flow of property offenders – Zone E

### 3.6.5 Zone F

The F zone covers F1 Chitadiripet, F2 Egmore, F3 Nungambakkam., F4 Thousand Lights and F5 Choolaimedu. The Fig (1.5) shows the flow of offenders to all directions.

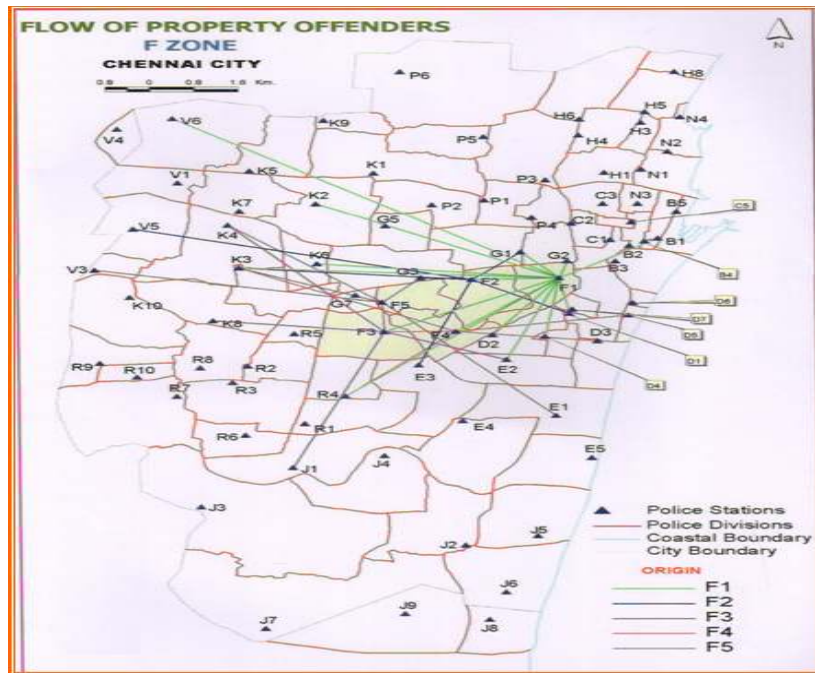


Figure 5: Flow of property offenders – Zone F

### 3.6.6 Zone G

The offenders from G zone travel in all directions to commit crimes. But the distance travelled is relatively shorter. The G zone includes G1 Vepery G2 Periamet, G3 Kilpauk, G5 Secretariat Colony and G7 Chetput (Fig.1.6).

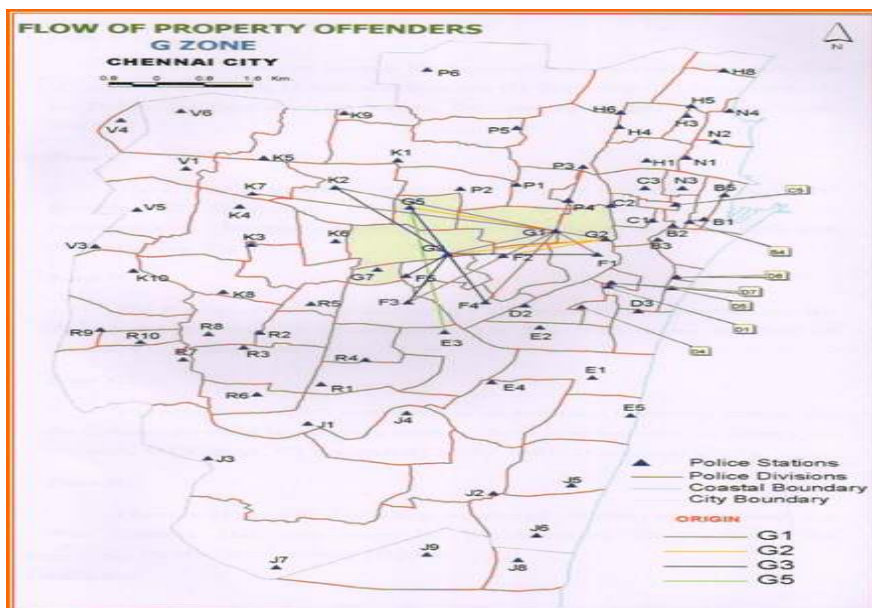
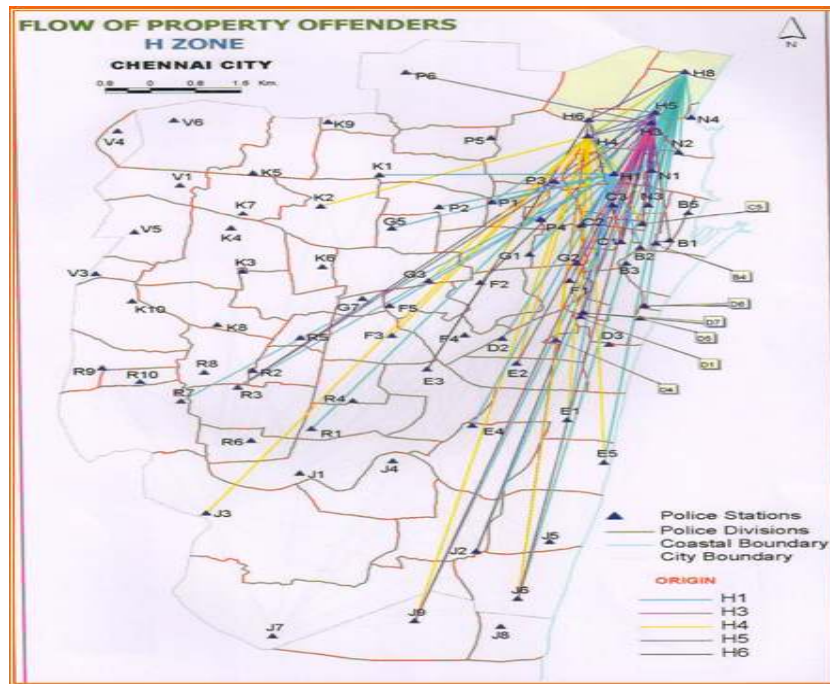


Figure 6: Flow of property offenders – Zone G

### 3.6.7 Zone H

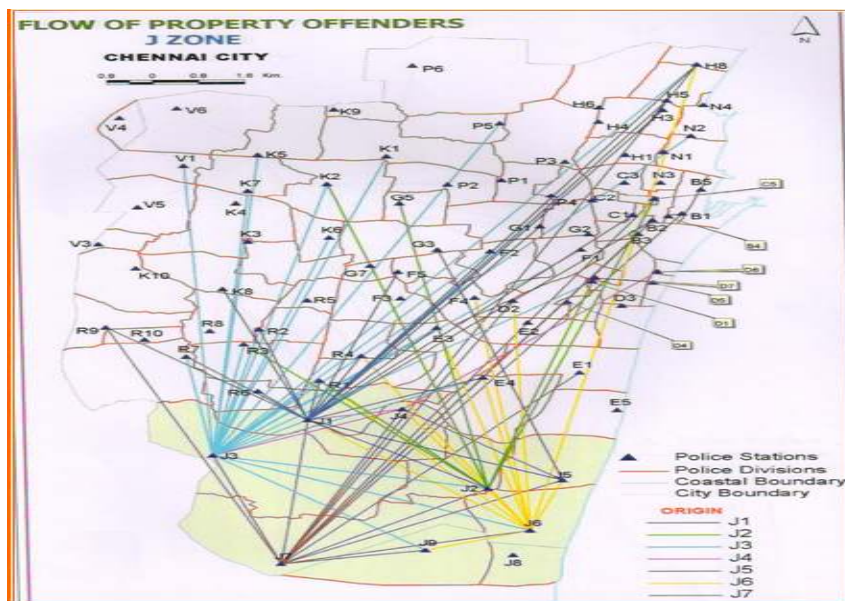
The zone H has a flow of a large number of offenders towards south and West Chennai. This zone covers H1 Washermanpet, H3 Tondiarpet, H4 Korukkupet, H8 Thiruvottriyur (Fig.1.7).



**Figure 7:** Flow of property offenders – Zone H

### 3.6.8 Zone J

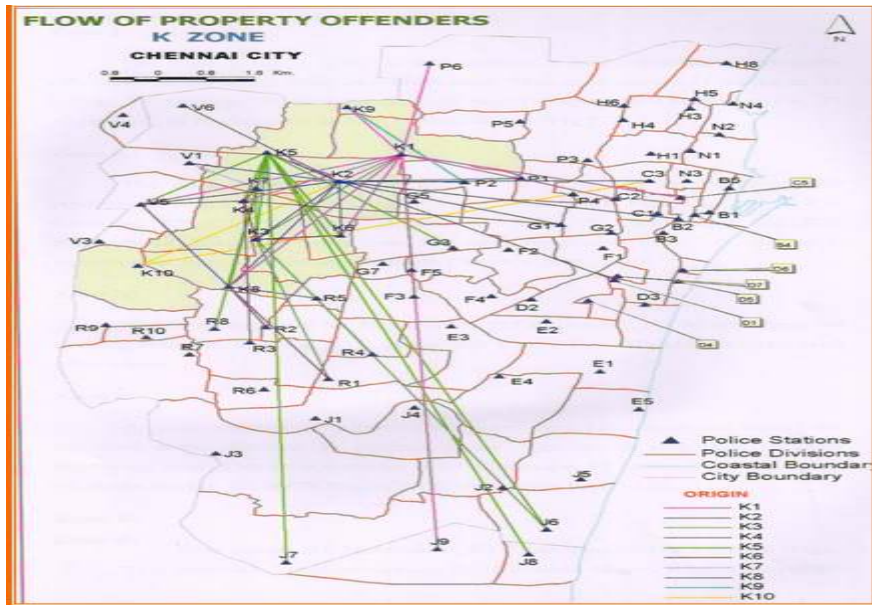
The zone J has a flow of a relatively a large number of property offenders travelling to north and north East. This zone covers J1 Saidapet, J2 Adyar, J3 Guindy, J4 Kotturpuram, J5 Sastri Nagar, J6 Thiruvanmiyur, J7 Velachery, J8 Neelangarai and J9 Thoraipakkam (Fig 1.8).



**Figure 8:** Flow of property offenders – Zone J

### 3.6.9 Zone K

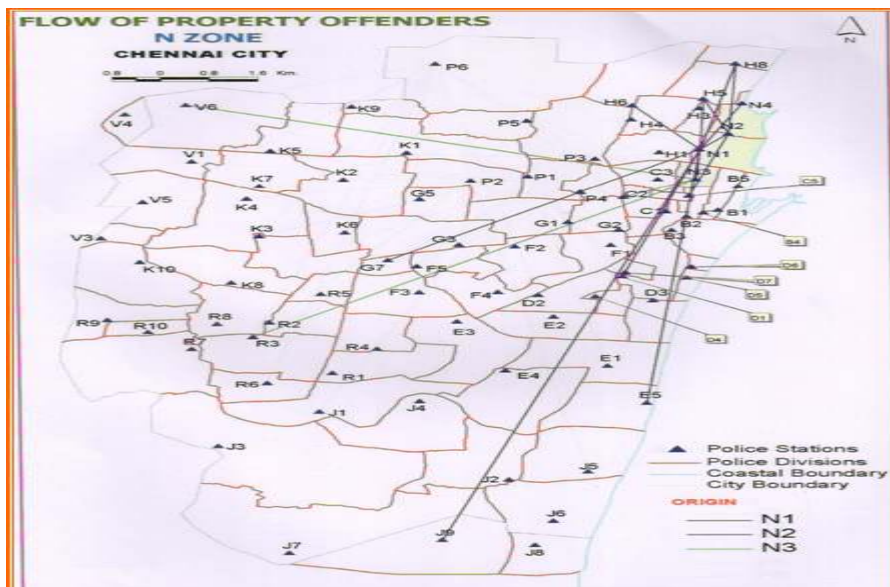
The zone K is located in North West. It covers K1 Sembium K2 Ayanavaram, K3 Aminjikarai, K4 Anna Nagar, K5 Peravalur, K 6 T.P. Chatram, K7 ICF, K8 Arumbakkam, K9 Thiru. Vi Ka Nagar and K10 Koyambedu. This zone has a flow of a large number of offenders moving to various directions particularly to south Chennai (Fig 1.9).



**Figure 9:** Flow of property offenders – Zone K

### 3.6.10 Zone N

The N zone covers N1 Royapuram, N2 Kasimedu, N3 Muthaialpet, N4 Fishing Harbour. The Fig 1.10 shows that a very few offenders interact with other areas.

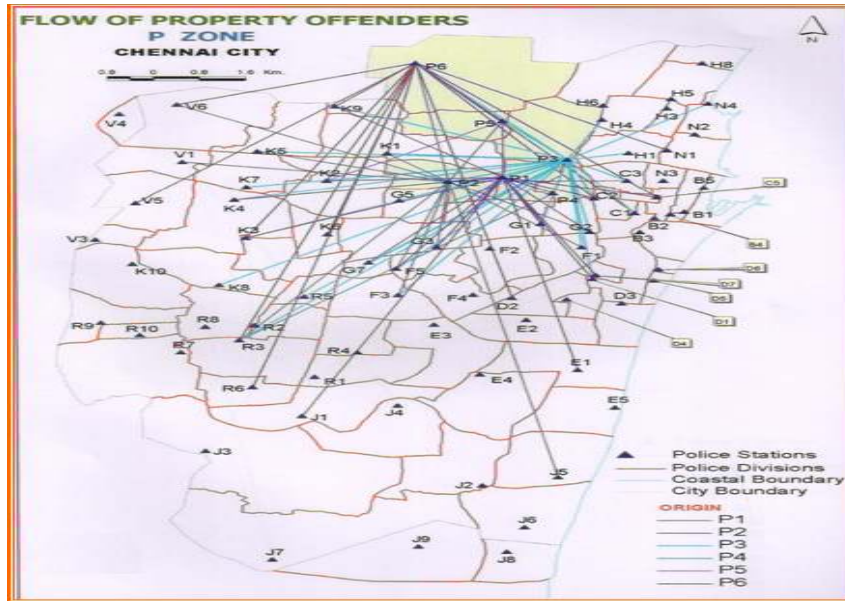


**Figure 10:** Flow of property offenders – Zone N

### 3.6.11 Zone P

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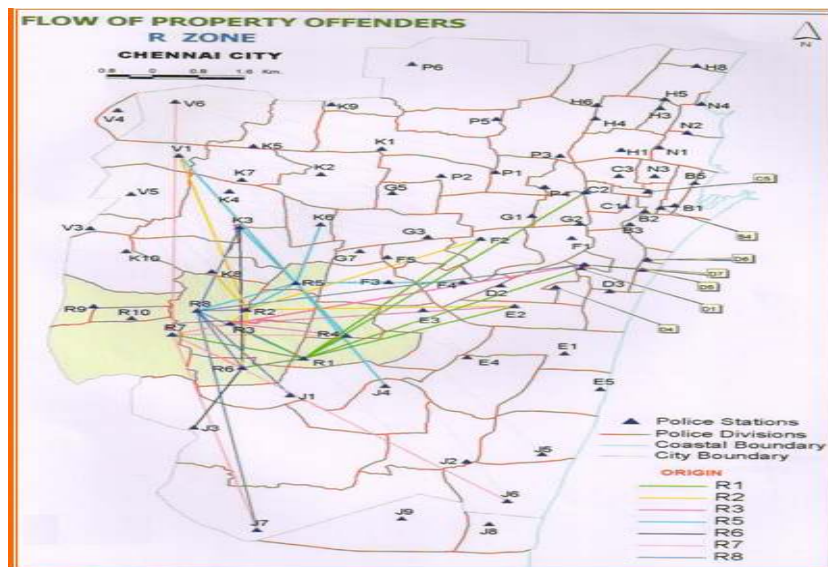
A large number of property offenders originate from this zone that traveled some distance to commit crime. This is an important offender producing area. This zone includes P1 Pulianthope, P2 Otteri, P3 Vyasarpadi, P4 Basin Bridge, P5 MKB Nagar, P6 Kodungaiyur (Fig.1.11).



**Figure 11:** Flow of property offenders – Zone P

**3.6.12 Zone R**

This zone covers R1 Mambalam, R2 Kodambakkam, R3 Ashok Nagar, R4 Pondy Bazar, R5 Virugambakkam, R6 Kumaran Nagar, R7 KK Nagar, R8 Vadapalani, R9 Valasarawakkam and R10 MGR Nagar. The interaction of offenders is more prominent in the inner city. (Fig.1.12).

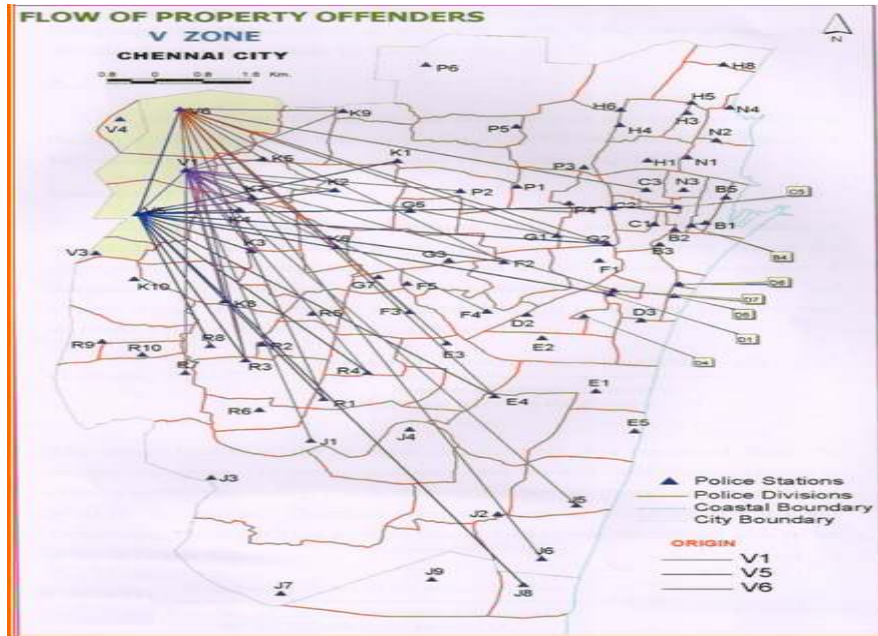


**Figure 12:** Flow of property offenders – Zone R

**3.6.13 Zone V**

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A large number of offenders who originate from this zone travel all over the city to commit crimes. This zone includes VI Villivakkam, V3 JJ Nagar, V4 Rajamangalam, V5 Thirumangalam and V6 Kolathur (Fig 1.13).



**Figure 13:** Flow of property offenders – Zone V

### 3.4 Commuting Index

The attractiveness of the division for the mobility of offenders is measured from the commuting index. The commuting index was derived for aggregating the movement data for 81 police station divisions. The number of criminals living in each division and the number of criminals who live and commit crimes in the divisions was computed. The commuting index for each division was computed as follows: (Table 1.2).

**Table 2:** The Spatial Pattern of Commuting of Property Offenders in Chennai City 2003

S.No.	Police Division	A	B	C	RCI
1	B1 North Beach	15	8	7	7.62
2	B2 Esplanade	20	9	7	6.43
3	B3 Fort	3	4	1	1.33
4	B4 High Court	1	0	0	0
5	B5 Harbour	1	0	0	0
6	C1 Flower Bazar	44	22	16	3.13
7	C2 Elephant Gate	31	23	15	4.95
8	C3 Seven Wells	44	35	7	11.36
9	C5 Kothaval Chavadi	24	1	1	4.17
10	D1 Triplicane	66	44	22	3.03
11	D2 Anna Salai	35	10	6	4.76
12	D3 Ice House	19	22	10	11.58
13	D4 Zam Bazar	11	6	2	27.27
14	D5 Marina	9	1	1	11.11
15	D6 Anna Square	8	1	1	12.50

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16	D7 Govt. Estate	5	1	1	20.00
17	E1 Mylapore	37	37	12	8.33
18	E2 Royapettah	45	19	15	2.81
19	E3 Teynampet	26	25	7	13.74
20	E4 Abiramapuram	52	18	12	2.88
21	E5 Pattinapakkam	4	39	1	975.00
22	F1 Chintadiripet	33	61	16	11.55
23	F2 Egmore	27	9	1	33.33
24	F3 Nungambakkam	41	8	1	19.51
25	F4 Thousand Lights	55	33	22	2.73
26	F5 Choolaimedu	11	14	1	127.27
27	G1 Vepery	39	20	9	5.70
28	G2 Periamet	24	8	1	33.33
29	G3 Kilpauk	36	17	7	6.75
30	G5 Secretariat Colony	27	5	1	18.52
31	G7 Chetput	1	0	0	0
32	H1 Washemanpet	9	55	11	55.56
33	H3 Tondiarpet	29	36	9	13.80
34	H4 Korukkupet	8	43	2	268.75
35	H5 New Washermanpet	22	24	10	10.91
36	H6 R.K. Nagar	13	7	1	53.05
37	H8 Tiruvottiyur	22	49	14	15.91
38	J1 Saidapet	27	40	15	9.88
39	J2 Adyar	43	29	11	6.13
40	J3 Guindy	22	82	14	26.62
41	J4 Kotturpuram	26	8	4	7.69
42	J5 Sastri Nagar	16	3	1	18.75
43	J6 Thiruvannmiyur	56	52	26	3.57
44	J7 Velachery	48	71	31	4.77
45	J8 Neelankarai	2	9	1	50.00
46	J9 Thuraiyakkam	2	1	1	50.00
47	K1 Sembium	47	33	12	5.85
48	K2 Ayanavaram	70	24	10	3.43
49	K3 Aminjikarai	132	47	36	0.99
50	K4 Anna Nagar	28	9	4	8.04
51	K5 Peravalur	15	19	2	63.33
52	K6 T.P. Chatram	24	12	9	5.56
53	K7 ICF	14	3	1	21.43
54	K8 Arumbakkam	33	23	6	11.62
55	K9 Thiru. Vi. Ka Nagar	22	1	1	4.55
56	K10 Koyambedu	69	9	1	13.04
57	N1 Royapuram	25	22	11	8.00
58	N2 Kasimedu	8	19	6	39.58
59	N3 Muthialpet	13	6	1	46.15
60	N4 Fishing Harbour	7	1	1	14.29
61	P1 Pullianthope	21	83	7	56.46
62	P2 Otteri	82	83	39	2.60
63	P3 Vyasarpadi	15	102	10	68.00
64	P4 Basin Bridge	5	1	1	20.00
65	P5 MKB Nagar	16	1	1	6.25
66	P6 Kodungaiyur	24	69	10	28.75

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67	R1 Mambalam	95	39	16	2.57
68	R2 Kodambakkam	18	15	3	27.78
69	R3 Ashok Nagar	60	9	1	15.00
70	R4 Pondy Bazar	49	3	1	6.12
71	R5 Virugambakkam	21	39	1	185.11
72	R6 Kumaran Nagar	16	6	3	12.50
73	R7 K.K. Nagar	11	8	1	72.73
74	R8 Vadapalani	20	16	1	50.00
75	R9 Valasaravakkam	2	1	1	50.00
76	R10 M.G.R. Nagar	1	0	0	0
77	V1 Villivakkam	46	75	24	6.79
78	V2 J.J. Nagar	82	1	1	1.22
79	V3 Rajamangalam	1	0	0	0
80	V4 Thirumangalam	75	69	35	2.63
81	V5 Kolathur	21	25	4	29.76

Note: Total number of offenders living in the police station division

CI - Total number of offenders who live and commit aims in the same division c

A - Total number of crimes committed in the divisions for which offenders are known

$$\text{Commuting Index (CI)} = \frac{\text{Number of offenders living in the division (B)}}{\text{Number of offenders who live and commit crimes in the division (C)}}$$

The attractiveness of the division of offenders was measured from the commuting index. However, this index may not represent the commuting in relation to the opportunity, unless the total number of crimes committed in area is taken into account. Therefore using the formula, we arrive at a Relative Commuting Index (RCI) as a proportion of total crimes committed with police division (Table 1.2).

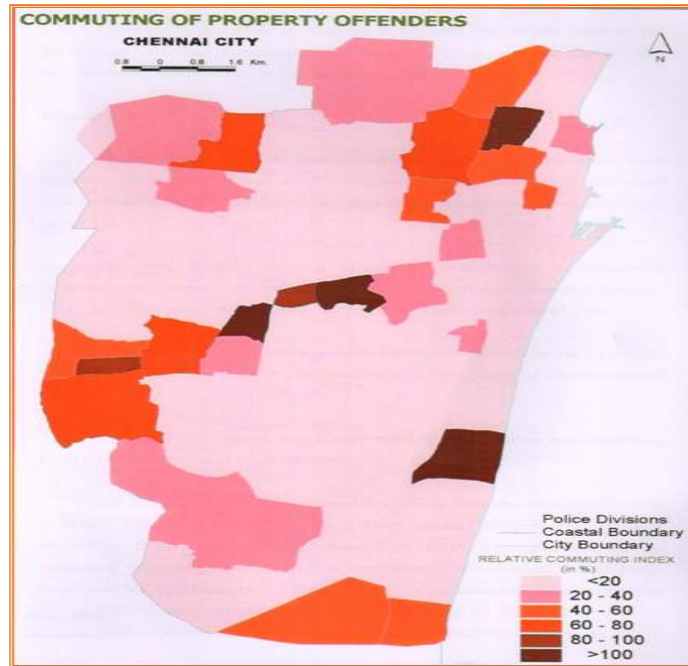
$$\text{RCI} = \frac{\text{Commuting Index of the police divisions}}{\text{Total No. of crimes in the police divisions for which offenders are known (A)}} \times 100$$

Choropleth map was prepared by using GIS to show the commuting index and spatial pattern of commuting (Fig.1.14) in order to understand the attractiveness of the area for mobility of offenders. The lower value of commuting index will show that the area depends very little on outward commuting since the area itself is rich in environmental opportunity. Conversely the higher value will show the lack of opportunity in the area. A cursory glance at the choropleth map (Fig.1.14) shows the spatial pattern of commuting of property offenders in Chennai city is highly concentrated in the inner parts.

*The spatial pattern of commuting of property offenders in Chennai city*  
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The Relative Commuting Index (RCI) is highest in E5 Pattinapakkam, R5 Virugambakkam, R10 Koyambedu and H4 Korukkupet. The other areas which show high percentage of Relative Commuting Index are: H1 Washermanpet, H6 RK Nagar, P3 Vysarpadi, P1 Pulianthope, K5 Peravalur and F5 Choolaimedu.

Most of these divisions are located in the inner parts of the city. These are characterized by lack of opportunity in the area.



**Figure 14:** Map showing commuting of property offenders

Conversely, the areas of high environmental opportunity such as R1, Mambalam, V5 Thirumangalam, El Mylapore, E2 Royapettah and B3 Fort have a very low proportion of offenders commuting out.

#### **4. Conclusion**

The study shows that the spatial interaction is highly significant between relatively deprived divisions and more flourishing divisions. It is also noted that the interacting divisions are essentially the adjacent areas in the inner parts of the city.

The long distance journey is more a function of environmental opportunity and general accessibility of the destination. The longest distance of 16.15 km is travelled by the offenders from H8 Thiruvattiyur to J2 Adyar. The study shows that a large number of offenders have travelled less than 2 km from their origin (residence) to the place of commission of crime. The study also shows that a large numbers of offenders are originating from P3 Vyasarpadi and P1 Pulianthope.

The Flow map shows the nature of spatial interaction of offenders. The zone wise flow of offenders shows a large number of property offenders originating from zone P1 Pulianthope, P2 Otteri, P3 Vysarpadi which is an important offender producing area. A large number of offenders who originate from zone V1 Villivakkam, V3 JJ Nagar and V4 Rajamangalam

travel all over the city of commit crimes. The zone R covering R1 Mambalam and R2 Kodambakkam shows that the interaction is more prominent in the inner city.

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