

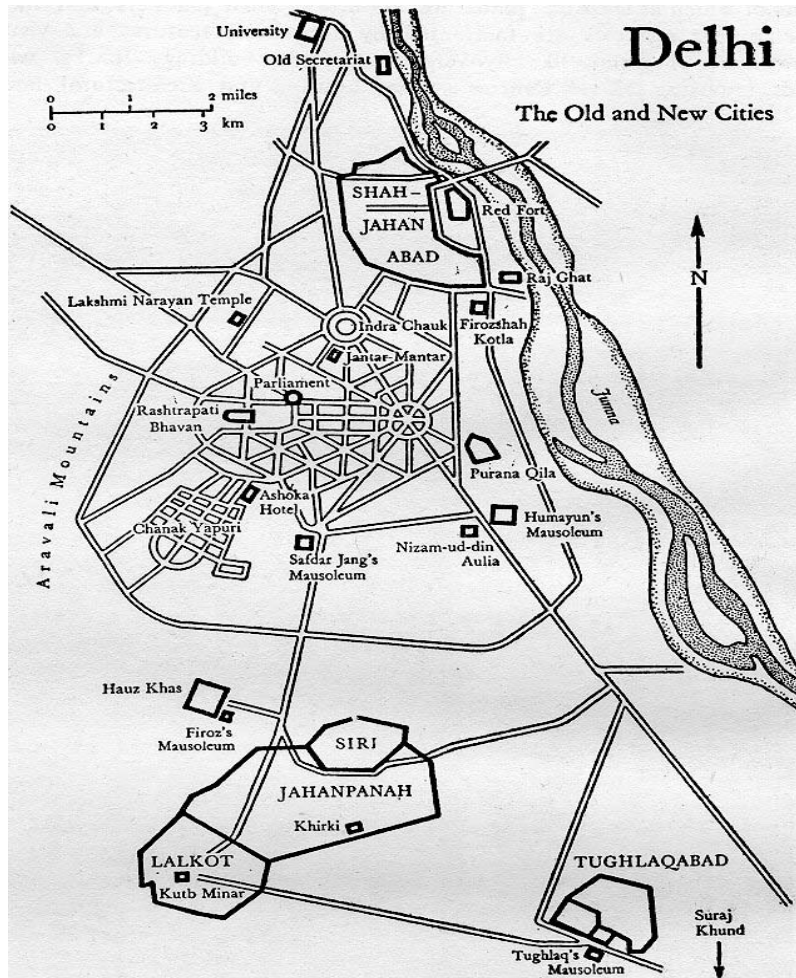
**Systems Analysis of Personal Transportation
Needs and Environmental Implications in New
Delhi, India -
A Map based narrative**

Sumeeta Srinivasan and Peter Rogers

Outline

- New Delhi – an overview of plans and infrastructure
- Creating a database to understand transportation, land use and air quality management in New Delhi
- Land use and transportation planning in New Delhi
- Air quality issues in New Delhi

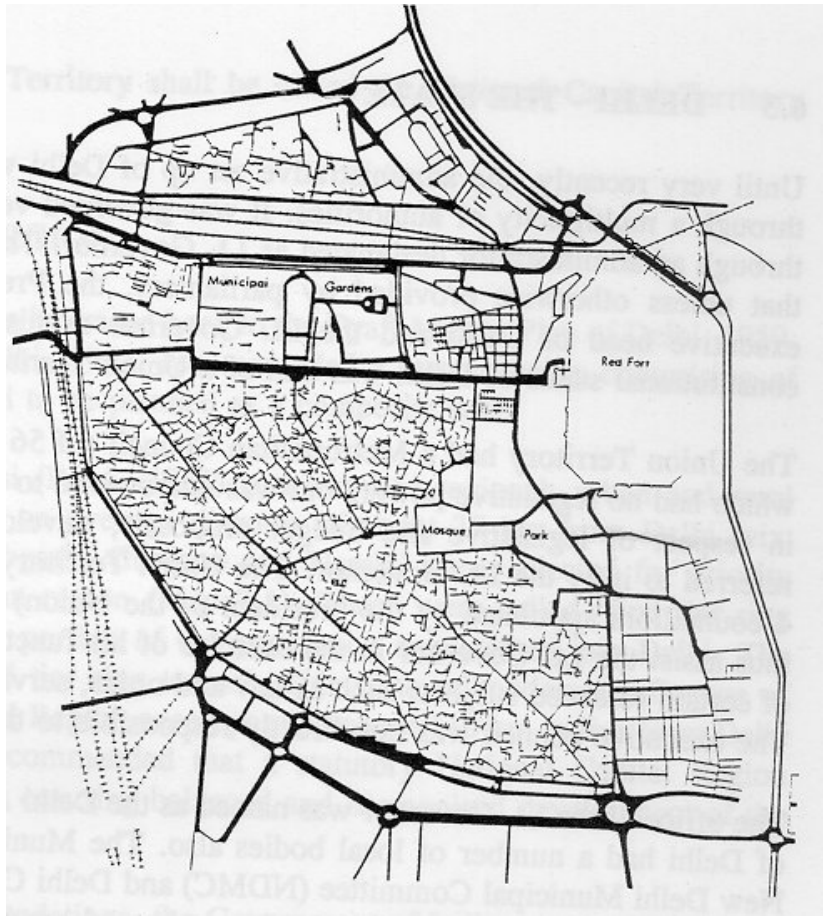
Historical images of Delhi - 1



Seven cities of Delhi:
Lalkot,
Siri,
Tughlakabad,
Jahanpanah,
Firuzabad,
Sher Shahi (Purana
Quila),
Shahjahanabad

Sources: A. K. Jain, *The making of a metropolis*

Historical images of Delhi - 2

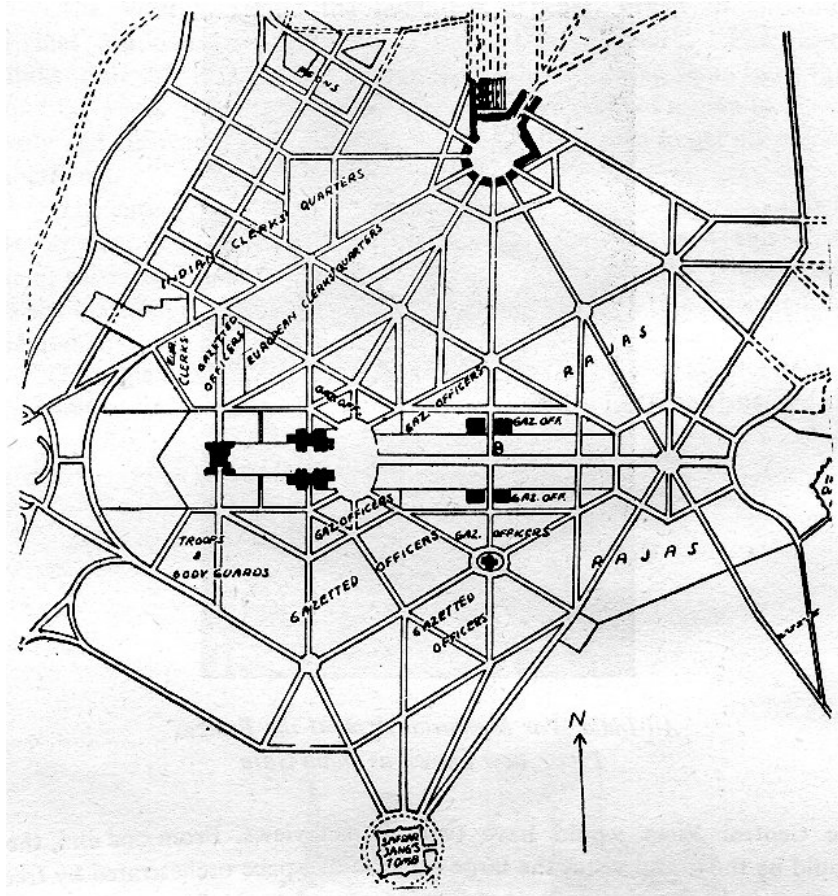


Historic walled city of Delhi

- Built in 1638 A.D. by Shahjahan
- Fortified with wall of 6 km circumference

Sources: Breese 1966

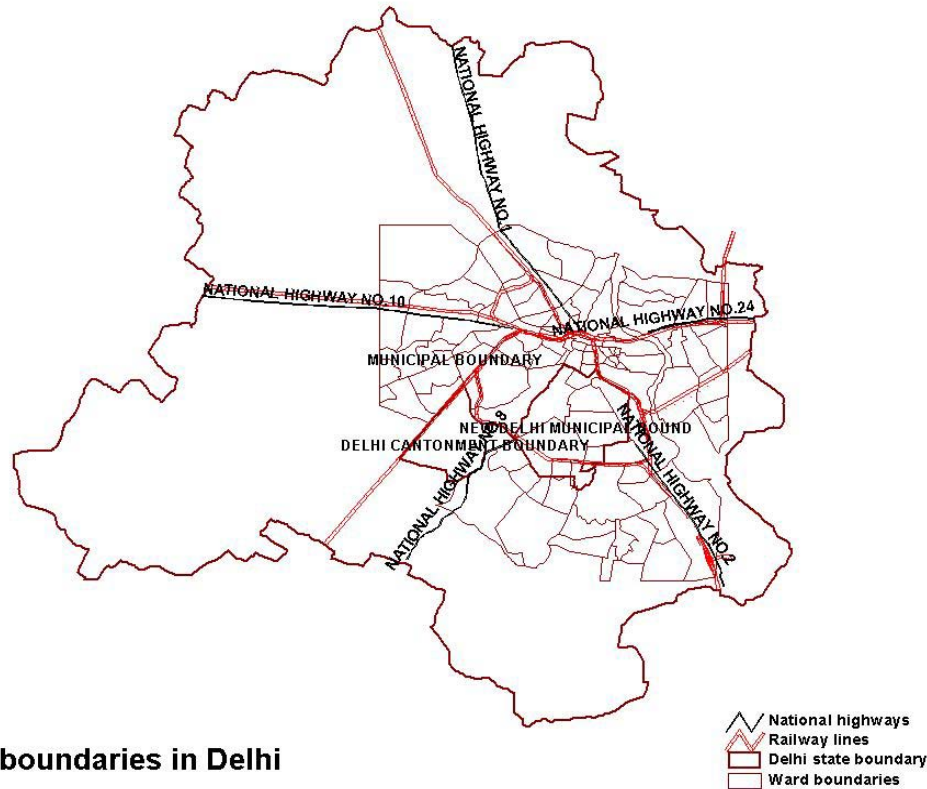
Historical images of Delhi - 3



- Came into existence in 1911 construction completed in 1931
- Planned on a hexagonal grid system
- Dominated by wide vistas, enormous buildings and large gardens

Sources: A. K. Jain, *The making of a metropolis*

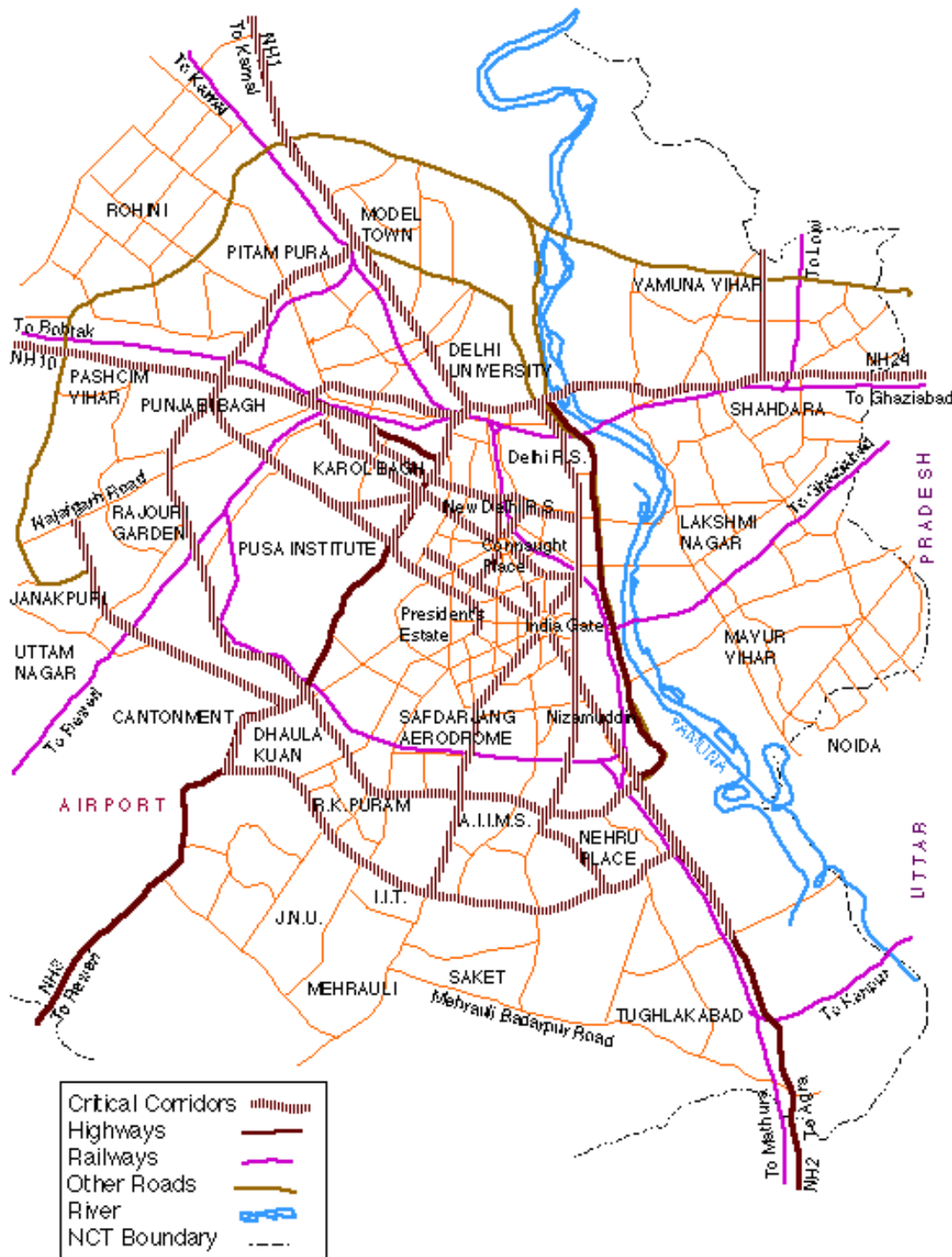
Modern Delhi



Ward boundaries in Delhi

- Became state in 1992
- Key bodies for all municipal services:
 - MCD (Municipal Corporation of Delhi)
 - NDMC (New Delhi Municipal Committee)
 - Delhi Cantonment Board
- Has 70-member legislative assembly and a 7-member council of ministers

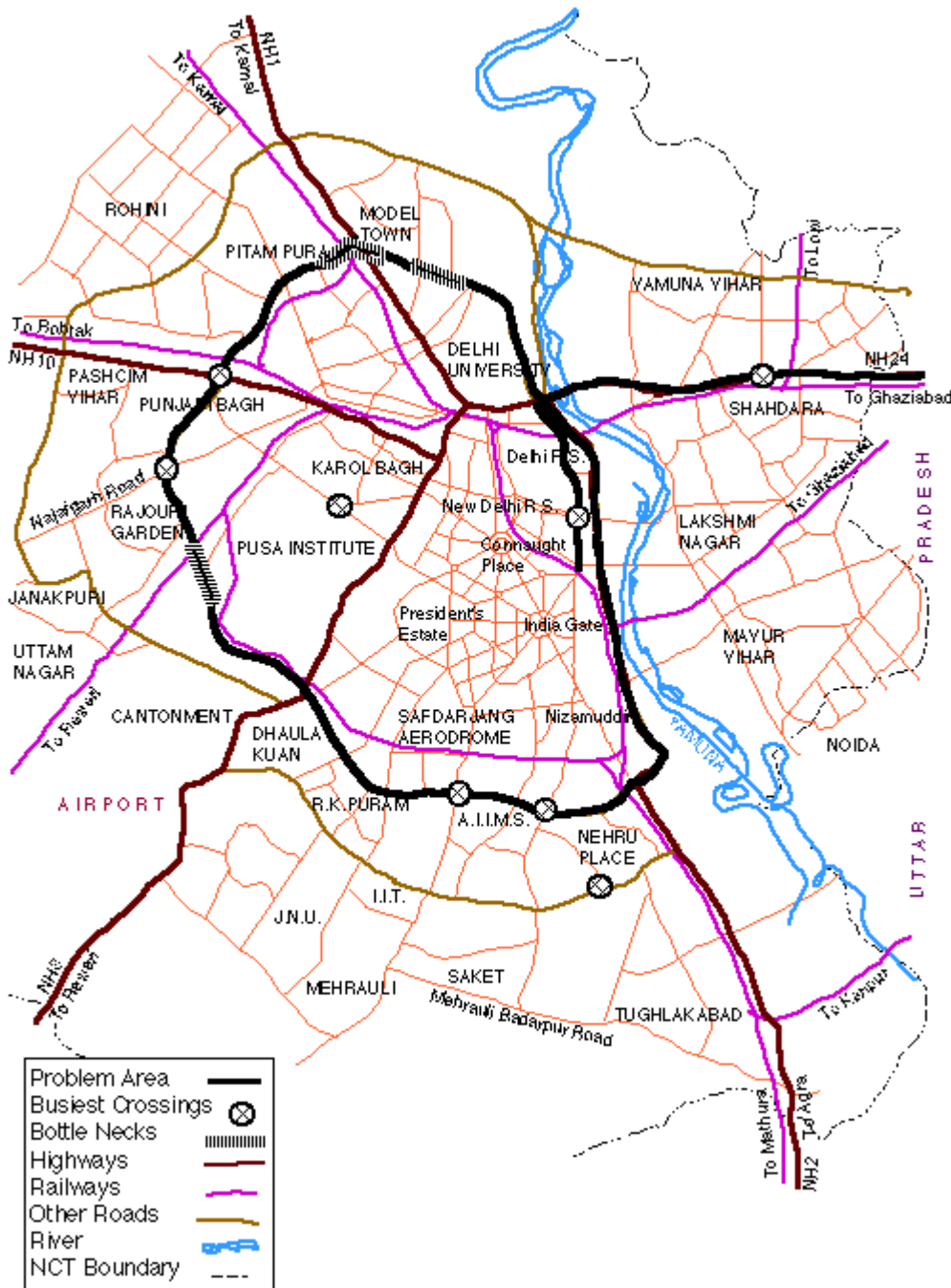
Infrastructure issues - Traffic corridors



Source: www.isl.uni-karlsruhe.de/vrl/resp/delhi/respdwww/c

[overpage.html](#)

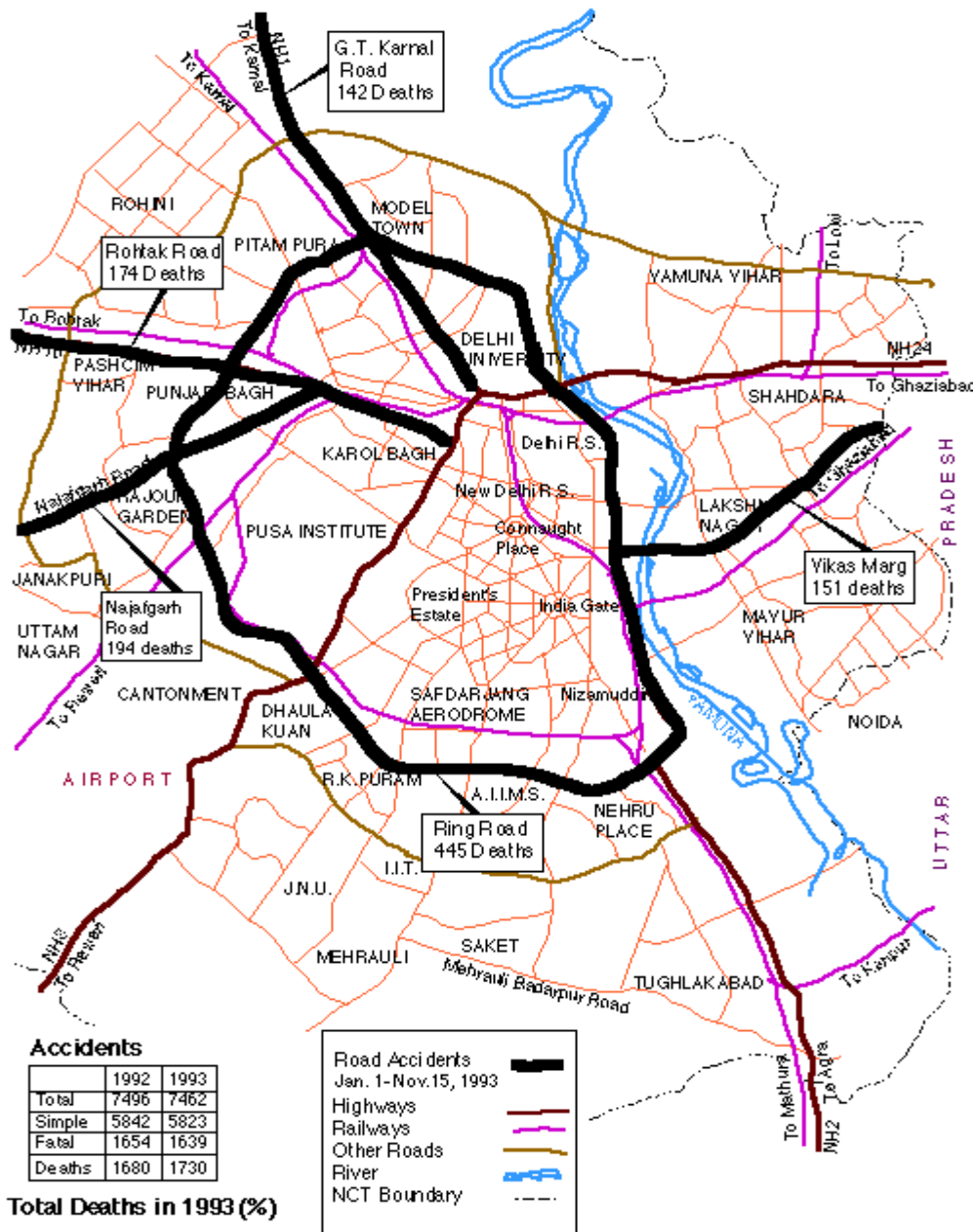
Traffic problem areas



Source: www.isl.uni-karlsruhe.de/vrl/resp/delhi/respdww

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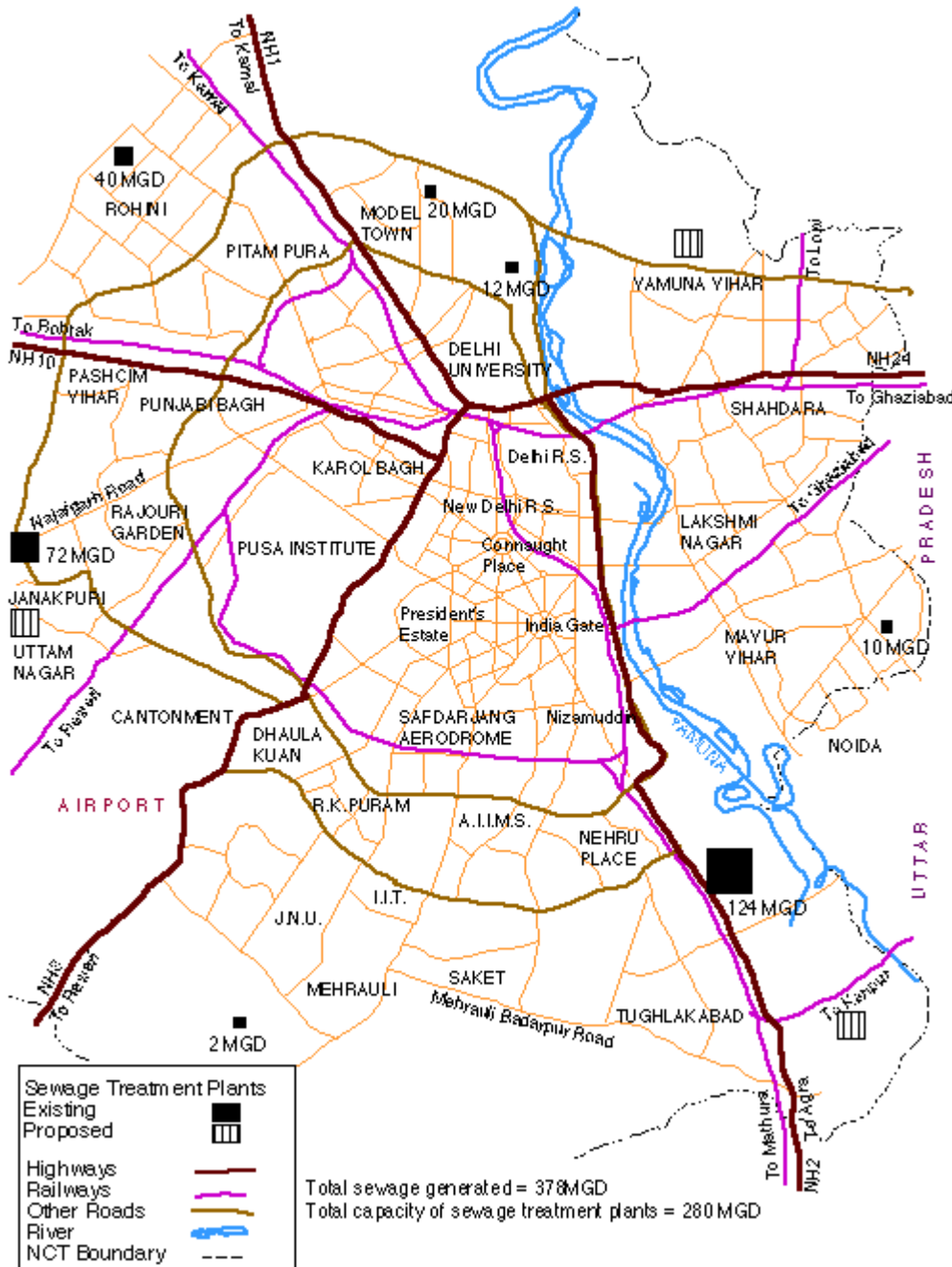
Traffic accidents



Source: www.isl.uni-karlsruhe.de/vrl/resp/delhi/respdww

w/coverpage.html

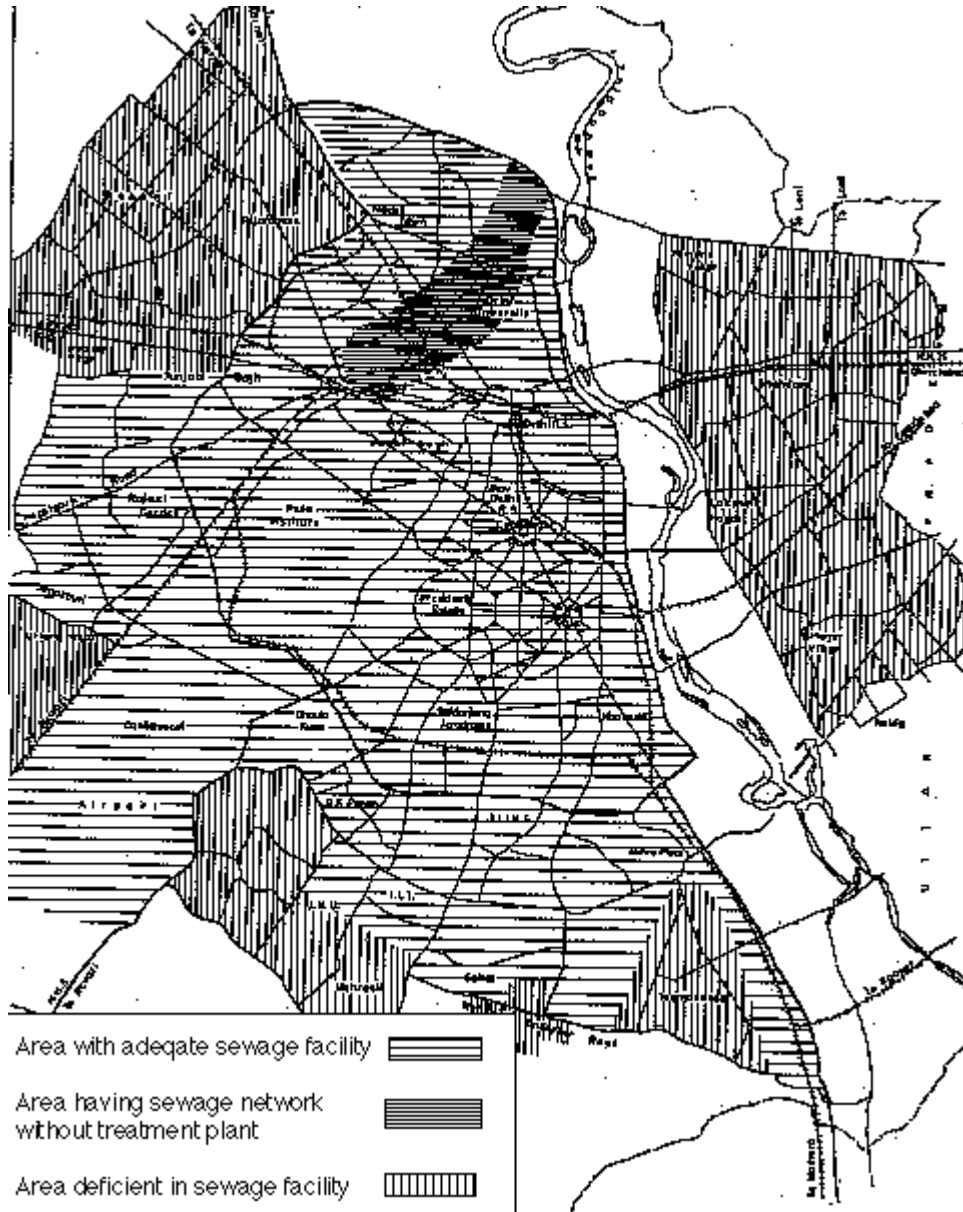
Infrastructure issues – Sewage treatment plants



Source: www.isl.uni-karlsruhe.de/vrl/resp/delhi/resp/www/cove

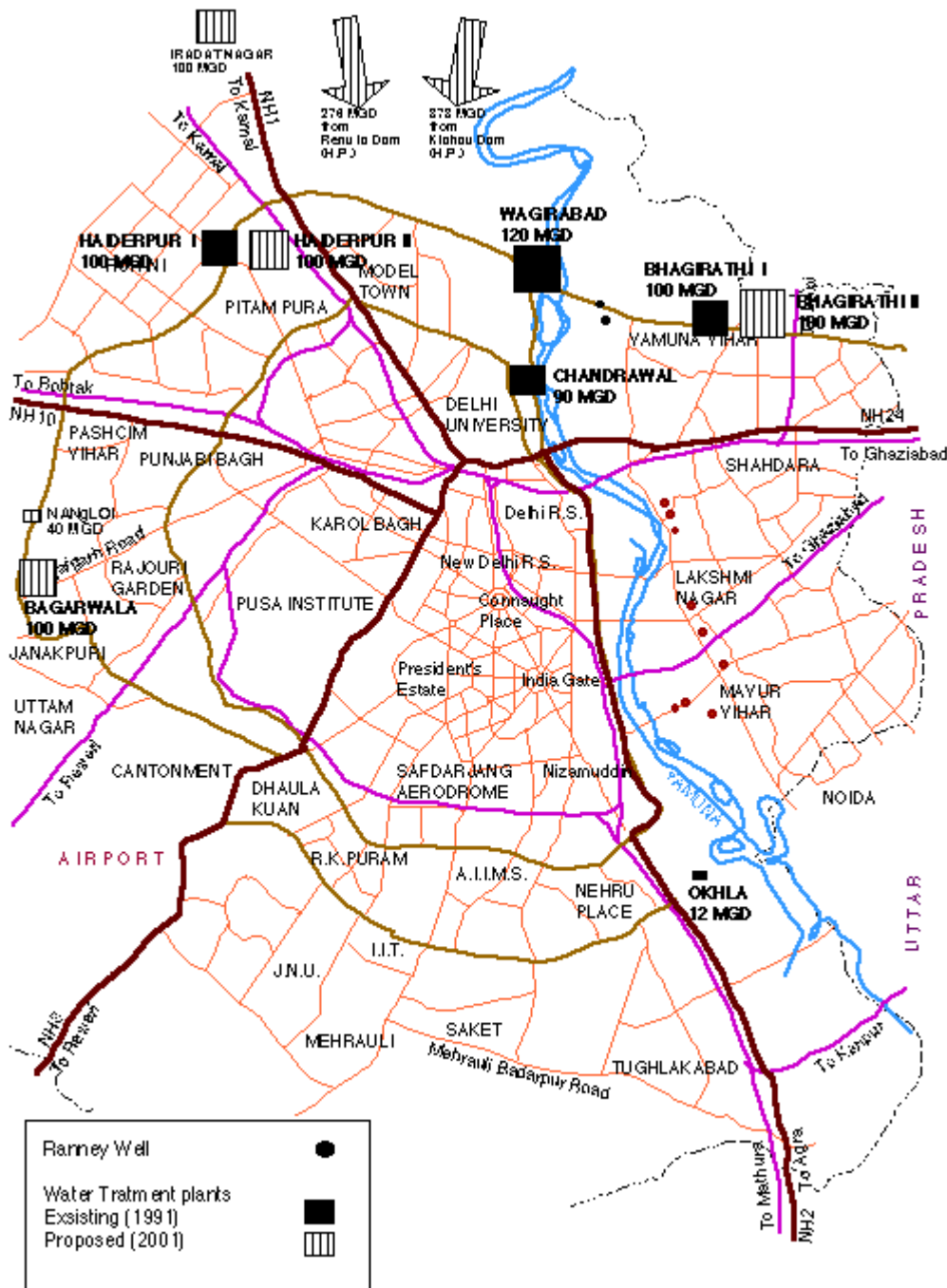
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Infrastructure issues – Sewage problem areas



*Source: Urban Environmental Maps,
National Institute of Urban affairs, New
Delhi 1994*

Infrastructure issues – Water treatment plants



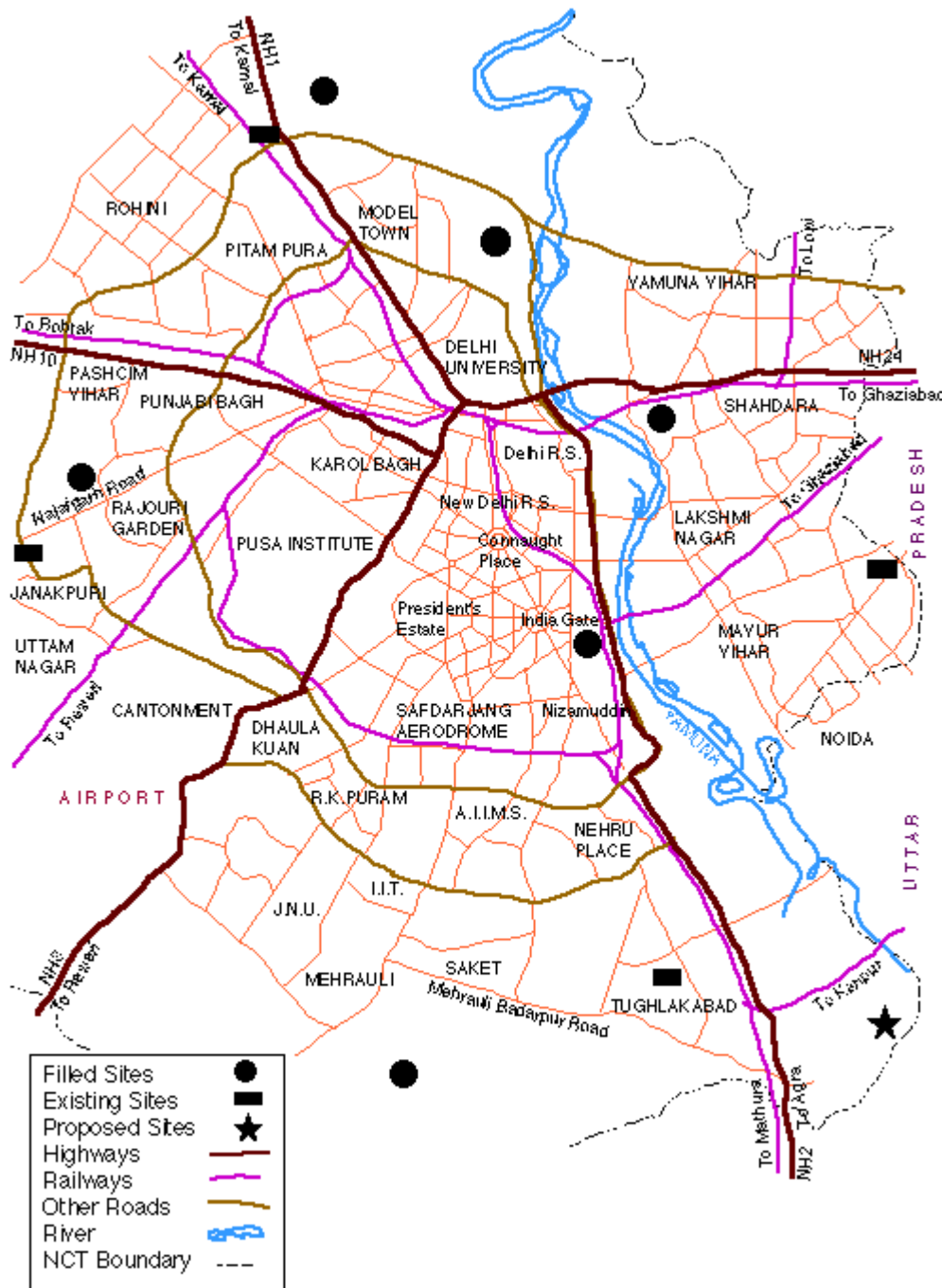
Source: www.isl.uni-karlsruhe.de/vrl/resp/delhi/resp/www/covepage.html

Infrastructure issues – Water problem areas



*Source: Urban Environmental Maps,
National Institute of Urban affairs, New
Delhi 1994*

Infrastructure issues – Landfill sites



Source: [www.isl.uni-](http://www.isl.uni-karlsruhe.de/vrl/resp/delhi/respdwww/c)

karlsruhe.de/vrl/resp/delhi/respdwww/c
overpage.html

New Delhi - Data



- Land use data derived from IRS for 1962 and 1990
- Major roads, railway lines
- Census 1991 data for wards in New Delhi
- Air quality data from CPCB 7 monitoring stations

Source: IKONOS Satellite picture of Central Delhi 1999

Database development

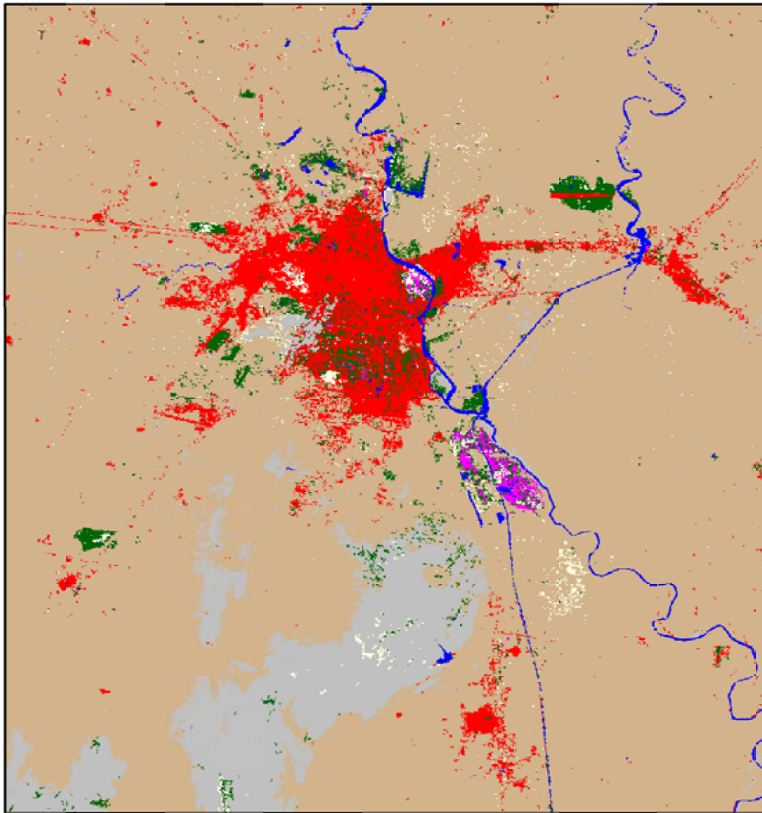
- Sharing of publicly available data from the local level agencies such as
 - DDA
 - NDMC
- State level agencies such as
 - Government Ministries
 - Town and Country Planning Organization
- Central Government Agencies such as the Central Road Research Institute,
- And other concerned data users and providers (Academic institutions, NGO, TERI)

Land use planning for New Delhi

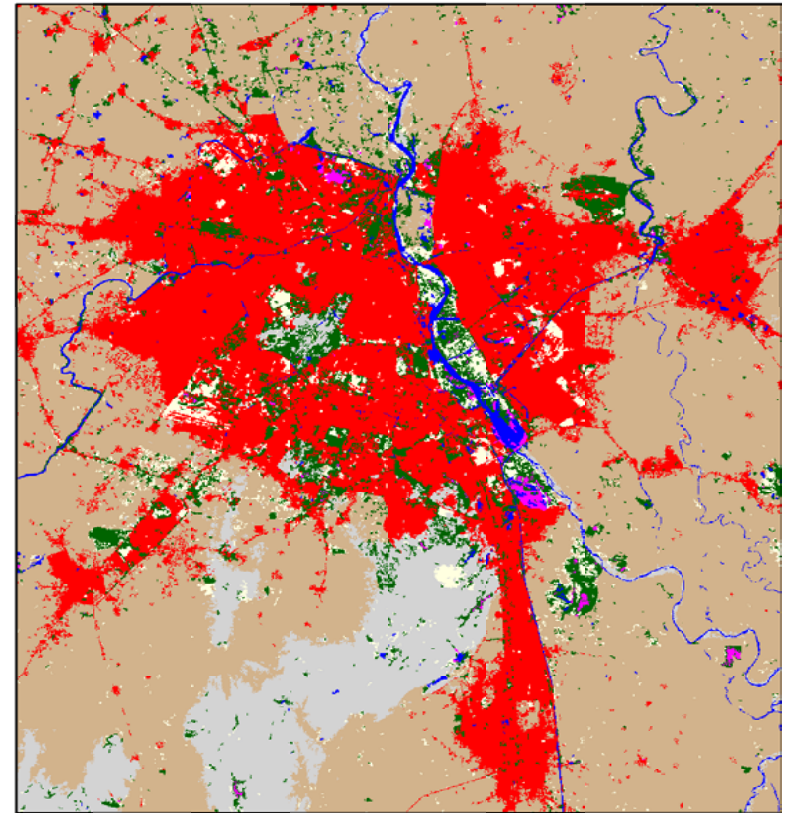
- Who plans for
 - the City of Delhi?
 - the NCT?
 - the NCR?
- Integrated Land use and transportation planning is vital in cities with the growth rate that we can see in Delhi. Successful cases of such integration include:
 - Curitiba, Brazil
 - Portland, Oregon, USA
- Note that the variety of land uses is high in New Delhi

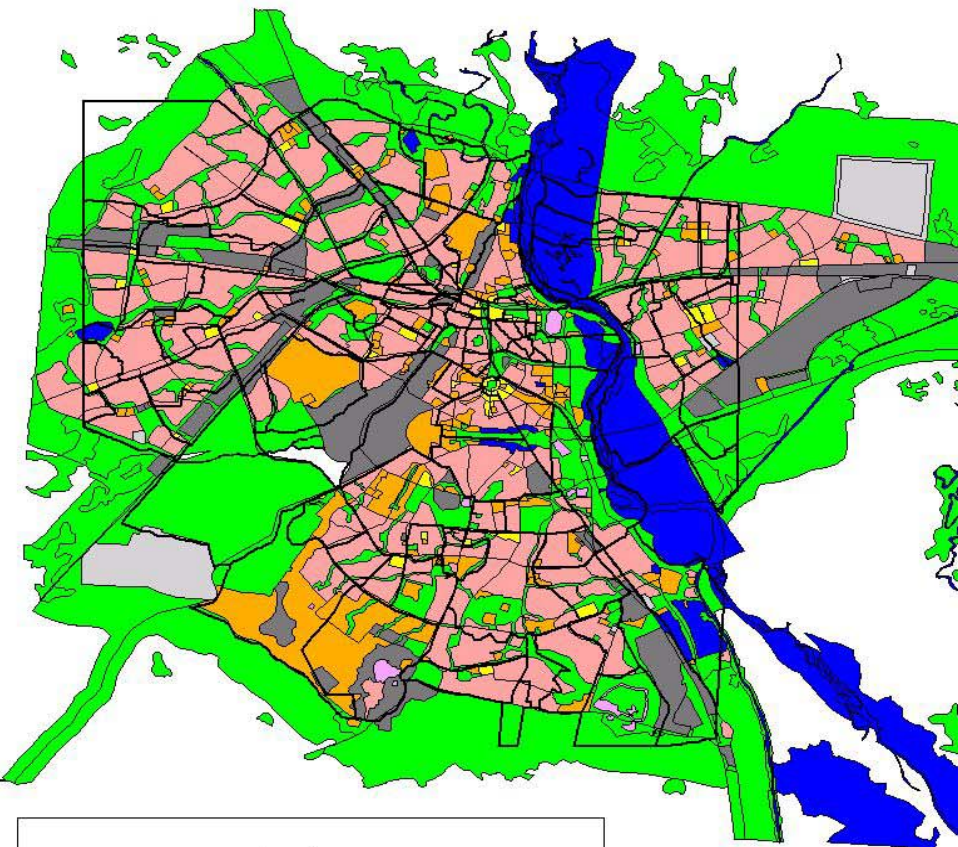
Land use change in New Delhi

Delhi 1974 Land cover derived from Landsat MSS
acquired May 8, 1974

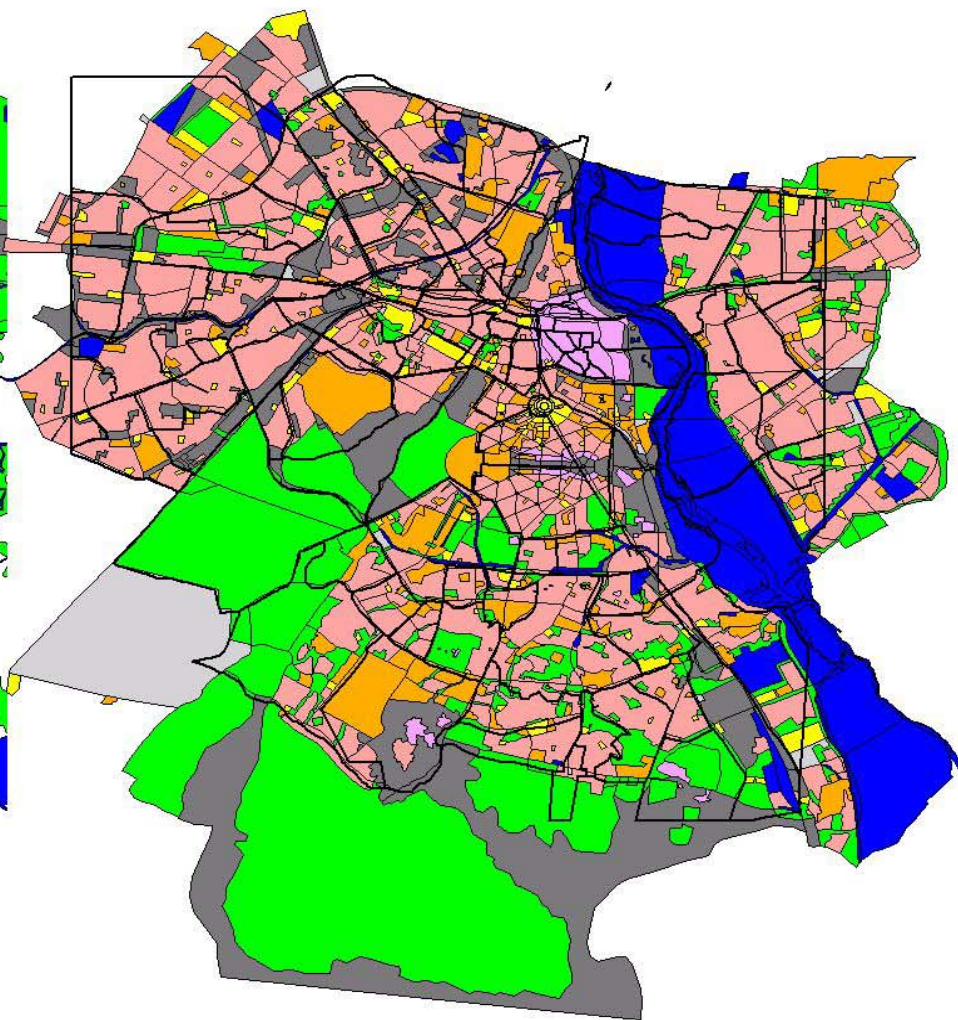


Delhi 1999 Land cover derived from Landsat TM
acquired April 21, 1999

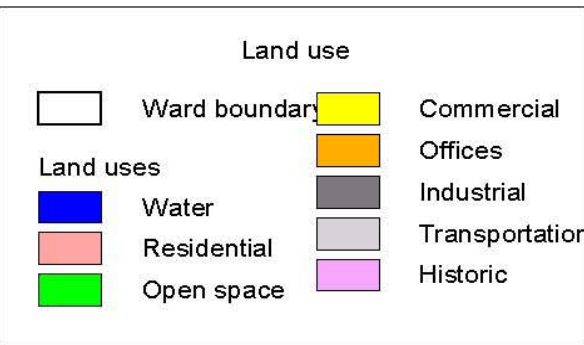
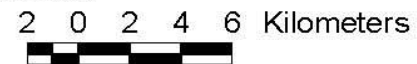


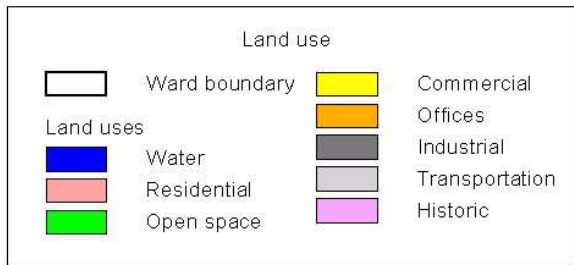
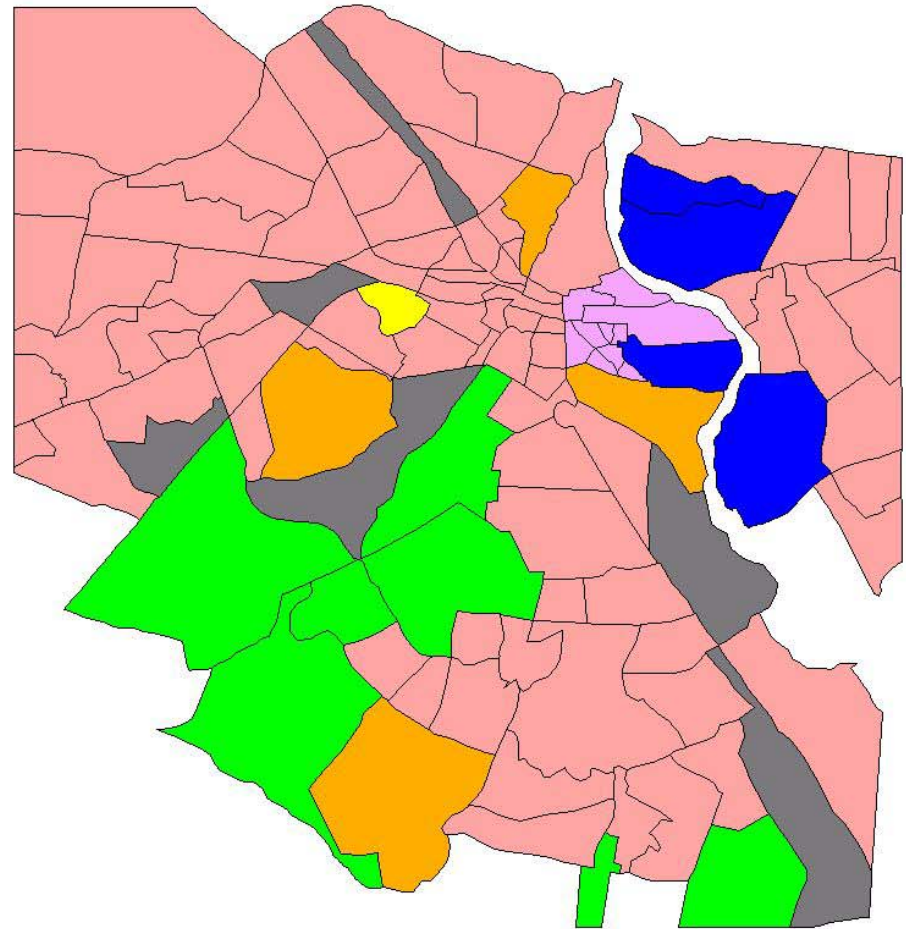
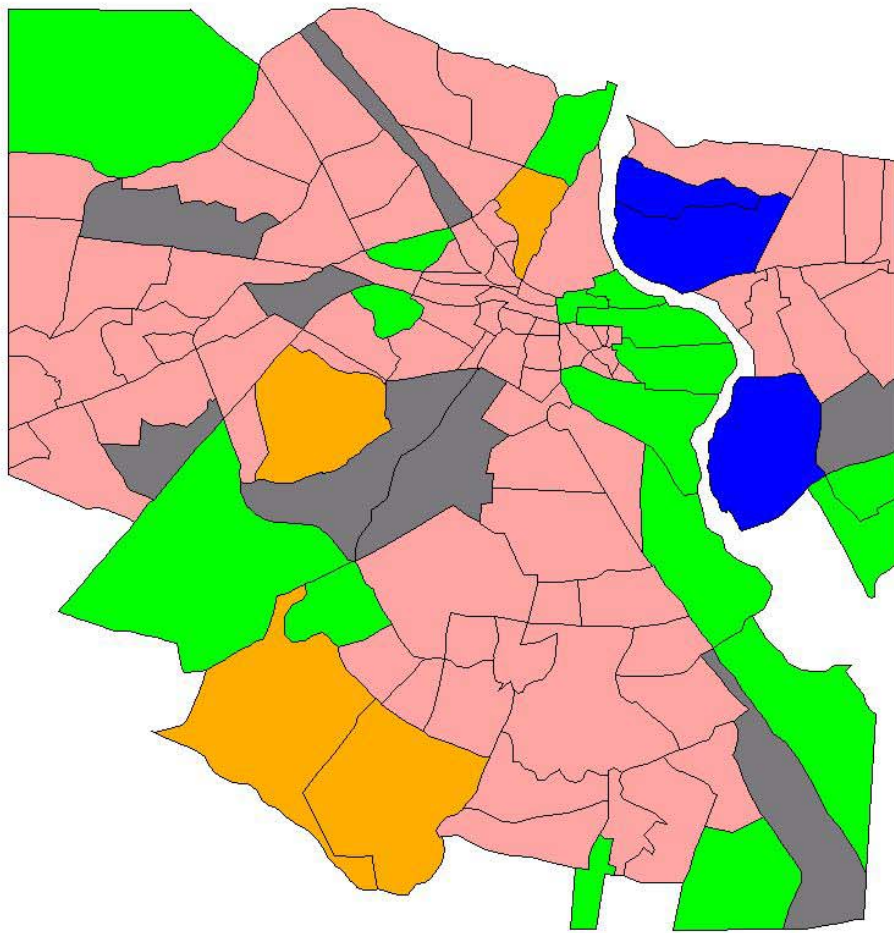


1962 land uses



1990 land uses

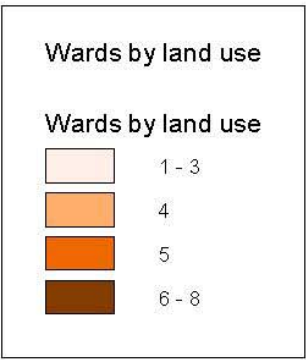
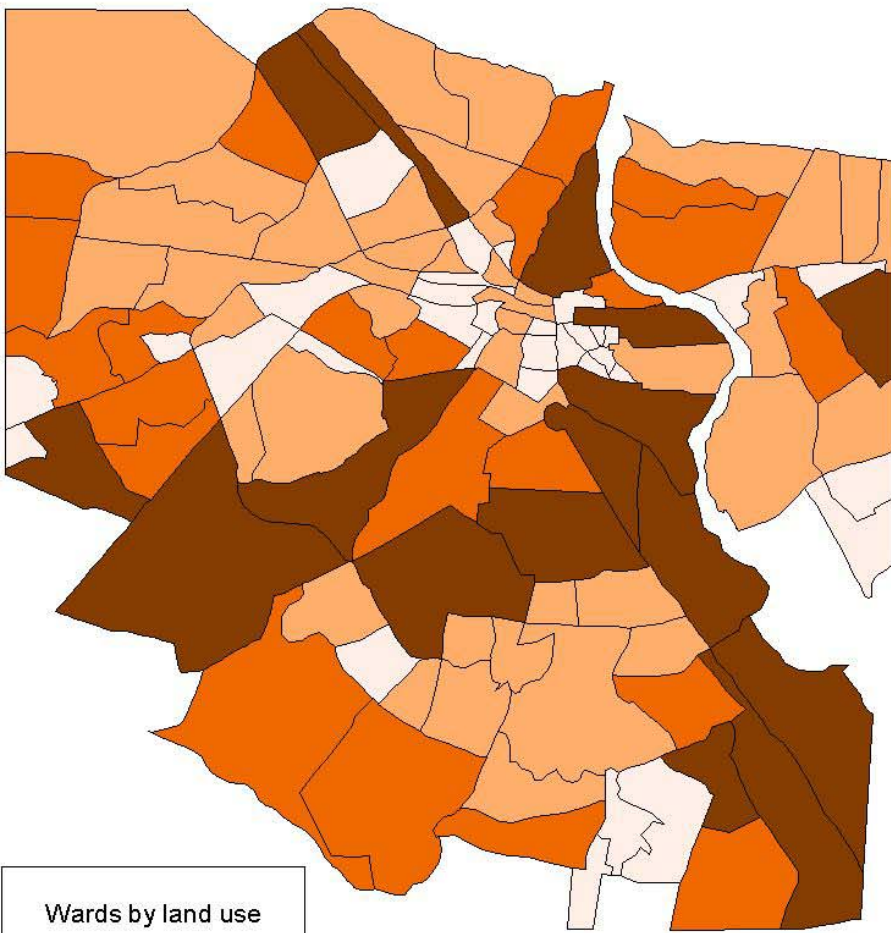




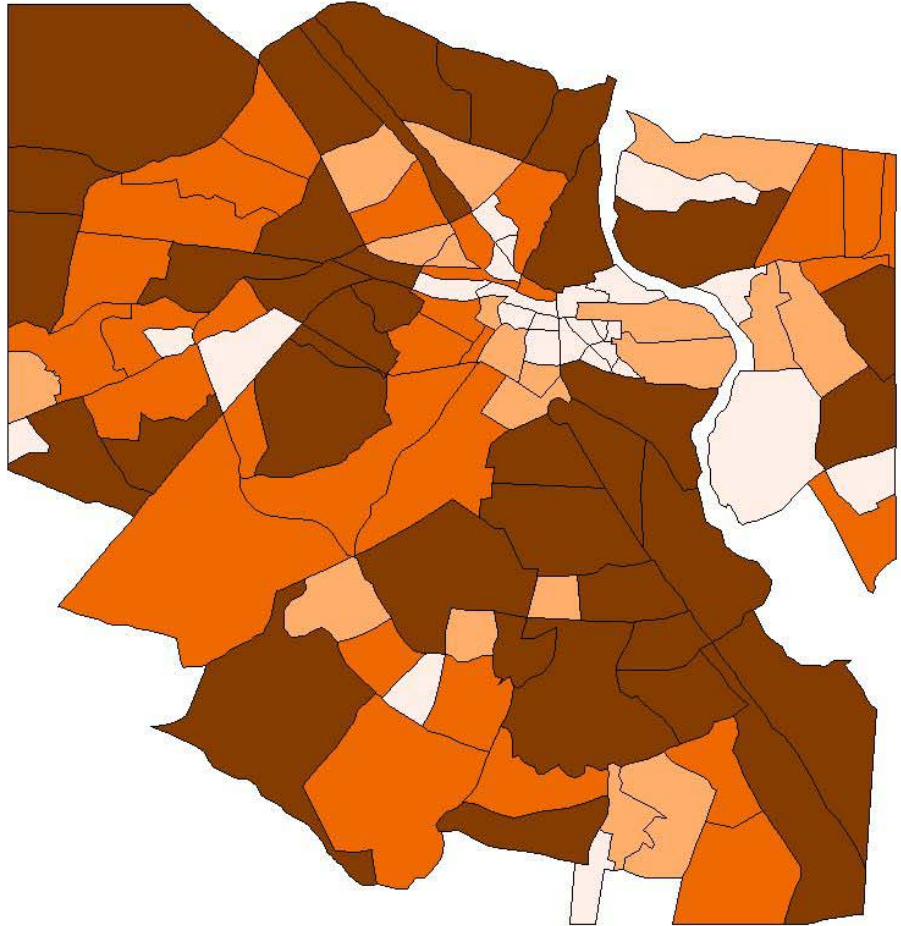
Major land use (1962)

Major land use (1990)

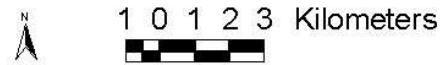




Variety of land uses (1962)



Variety of land uses (1990)

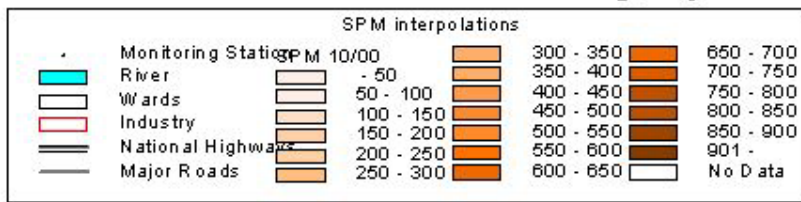
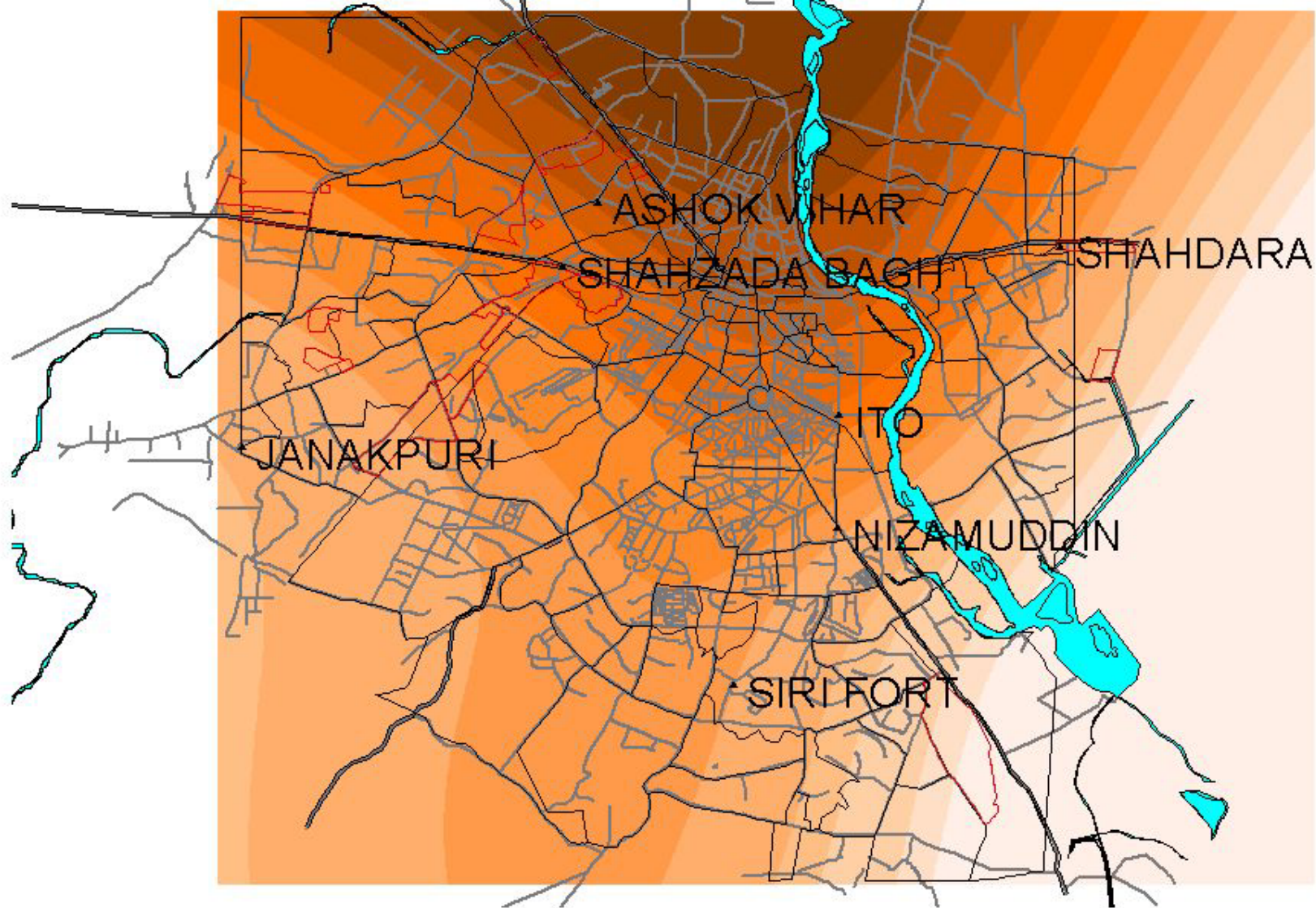


Transportation planning - New Delhi

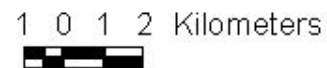
- Who is responsible for transportation planning?
 - DDA
 - Traffic Police
 - DTC
 - TCPO
- The need for data in the context of traffic management
 - Origin Destination survey
 - Bus route studies to study high density routes
 - Trip generation models to study location of work and non work trips
 - Viability of light or heavy rail in high density locations

Air quality in New Delhi

- A view of changes in SPM over 22 months
Jan 1999 - Oct 2000
- Note that SPM values tend to always exceed the NAAQS
- However, SO₂ and NO_x values tend to stay below NAAQS

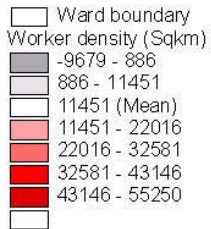
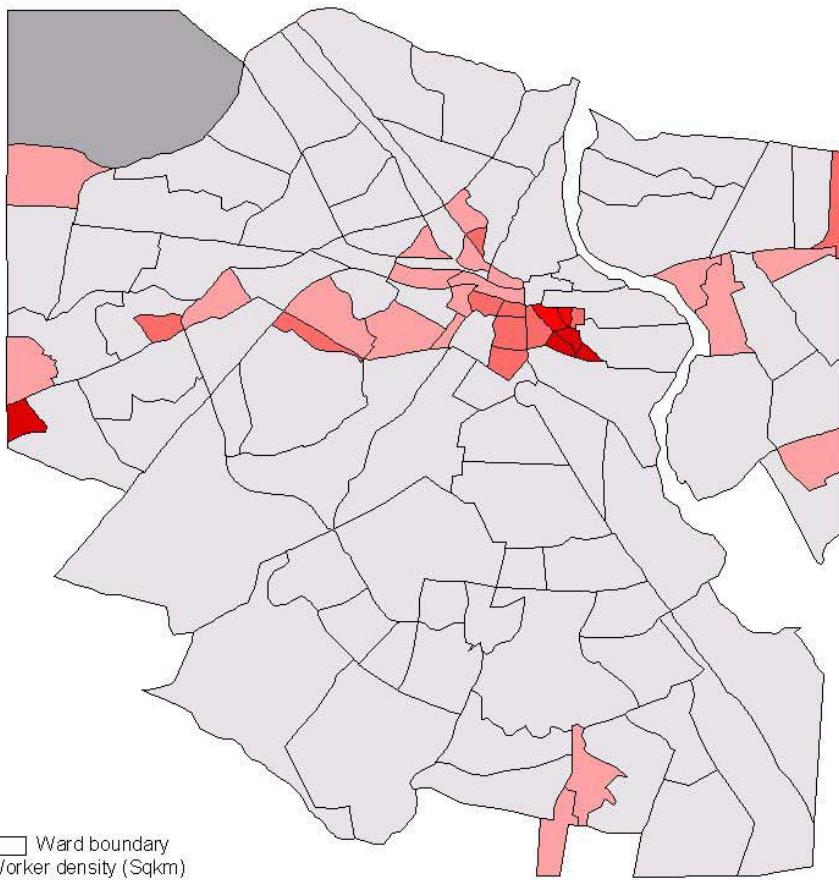


SPM Interpolation for October 2000



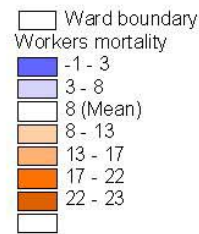
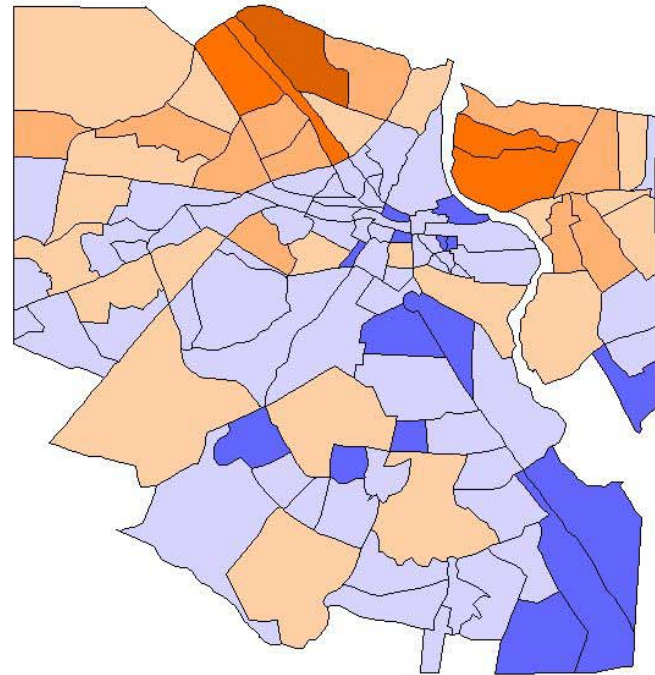
Health and Mortality risks

- High worker, population and children densities in the central wards and in West Delhi
- High mortality and health risks occur in the North (Modeltown, etc) and West Delhi (Gautampuri, etc) due to high concentration of SPM in these locations
- Low SPM related risks in South Delhi



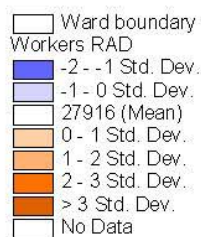
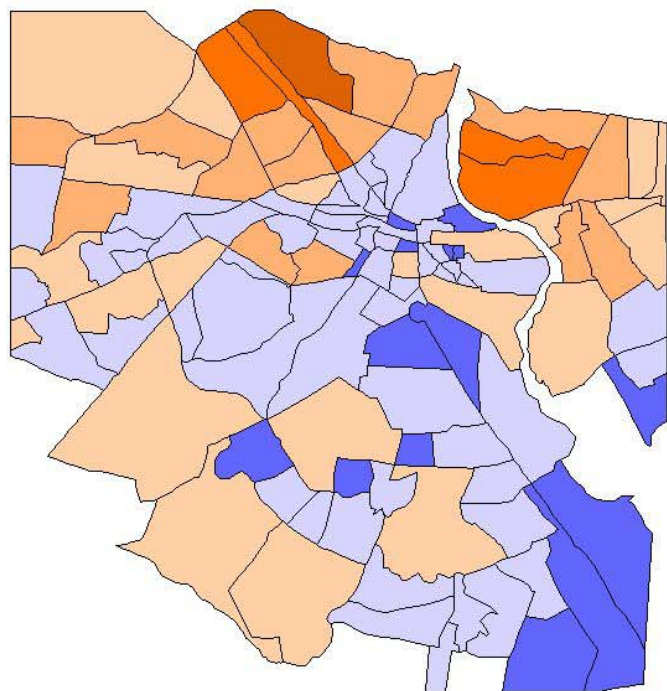
1 0 1 Kilometers

Worker density (Census 1991)

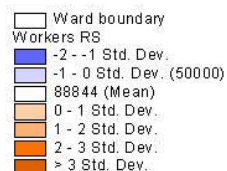
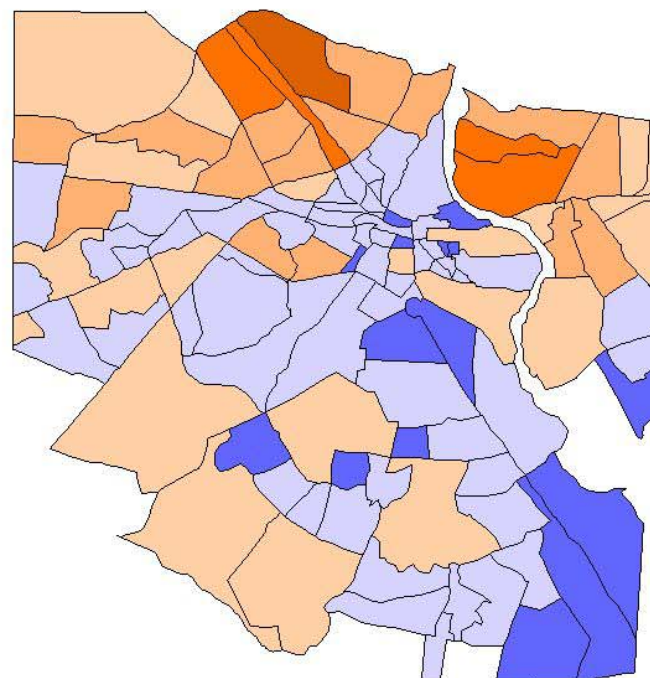


1 0 1 2 Kilometers

**Worker mortality
(based on Oct 2000 air quality data)**



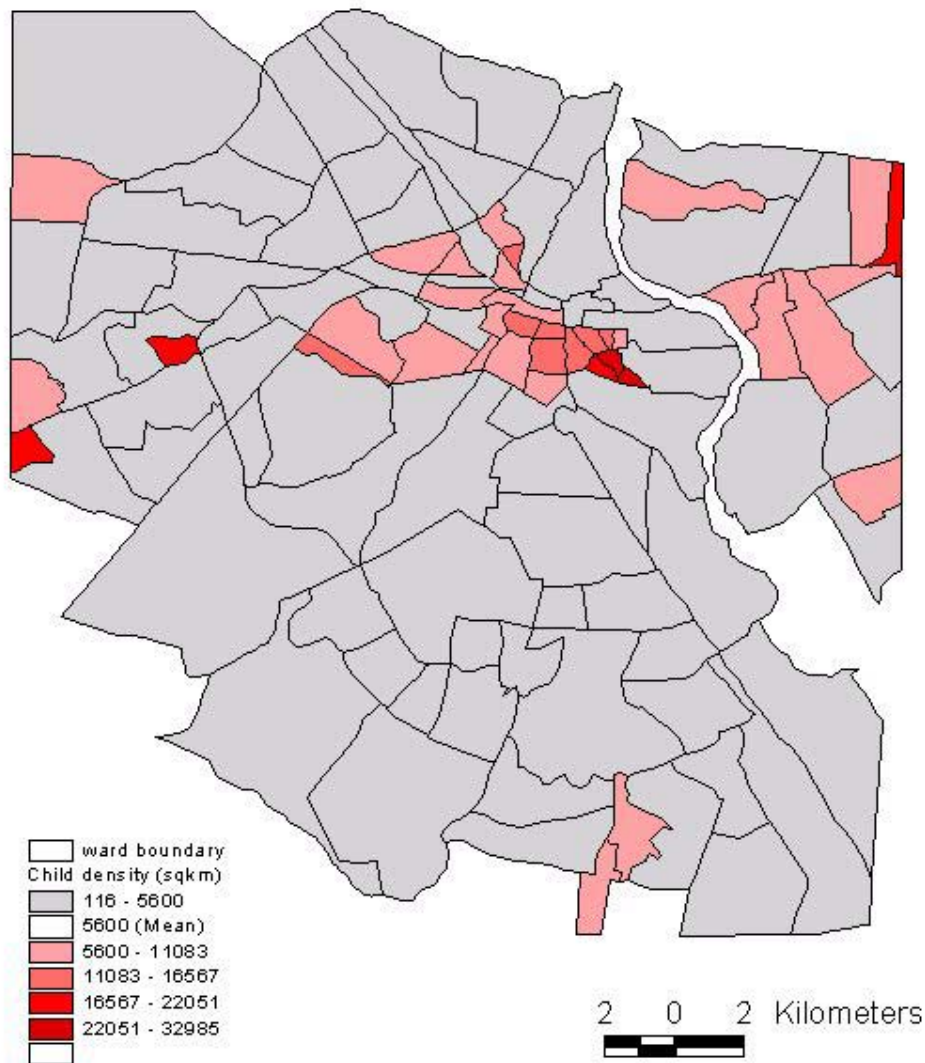
**Adult Restricted Activity days
October 2000**



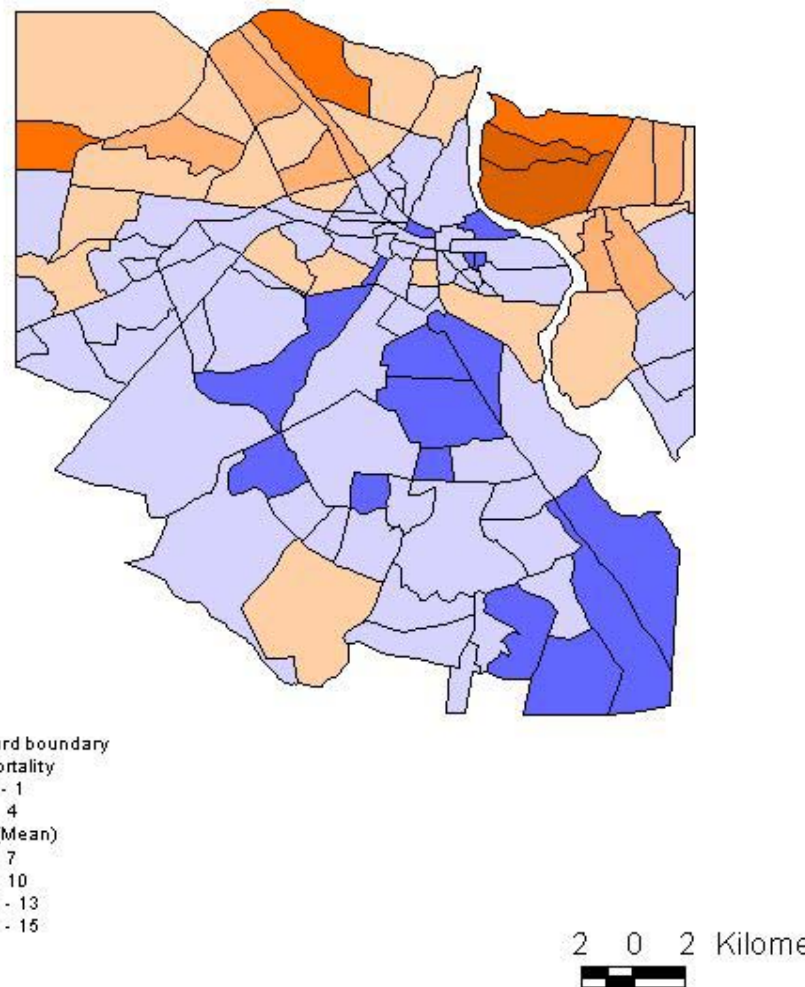
10.1 Kilometers

**Adults with respiratory symptoms
October 2000**

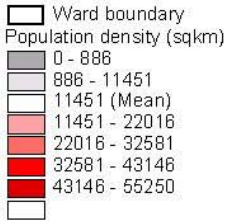
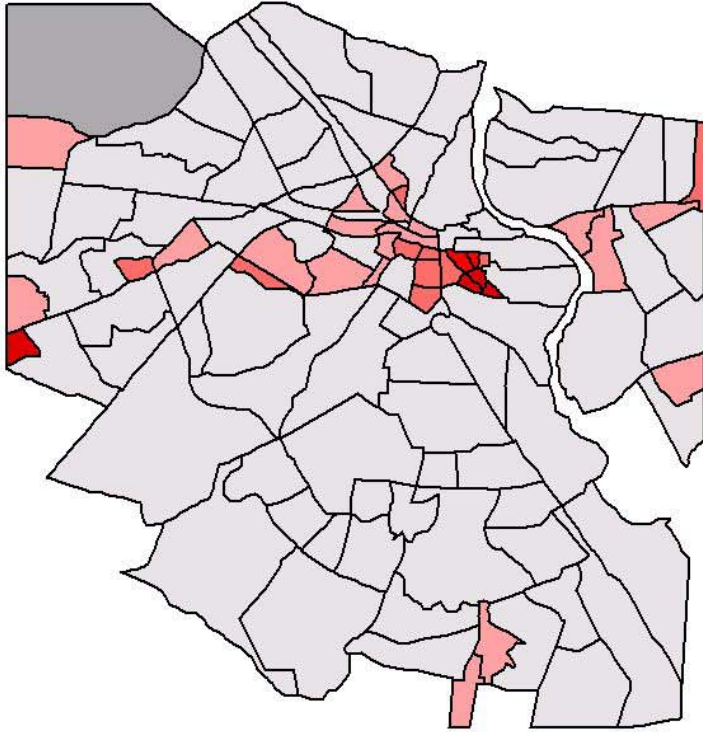




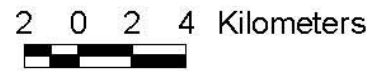
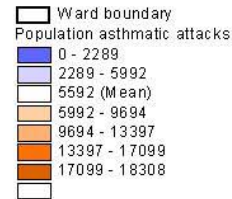
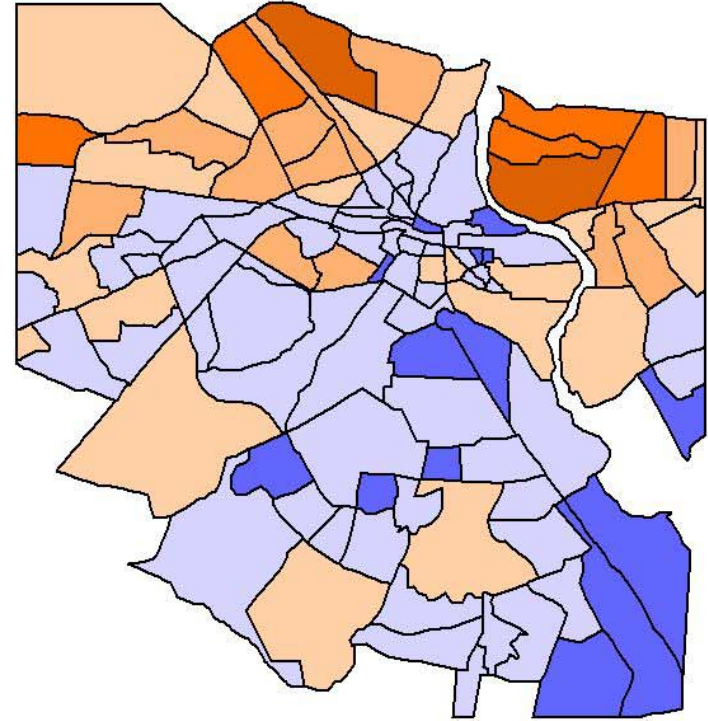
Density of children below age 6
Source: 1991 Census



Monthly mortality for children
October 2000



Density of population
Source: 1991 Census



Asthma attacks in population
October 2000

