How can urban planning influence traffic safety?

Interaction at three levels:

- Landuse planning (travel mode choice & trip distances)
- Urban design (built environment - blocks, density - travel mode choice)
- Transport infrastructure (roads, PT, mode choice, risk to captive users)
Low density single use development

Sprawl

<table>
<thead>
<tr>
<th>Authors</th>
<th>Main Findings</th>
</tr>
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<tbody>
<tr>
<td>(Lovegrove and Sayed 2007)</td>
<td>Related number of crashes to amount of travel within geographic unit</td>
</tr>
<tr>
<td>(Galster et al. 2001)</td>
<td>Accounted for multifaceted nature of design and density and their relationship to sprawl.</td>
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<tr>
<td>(Ewing et al. 2003)</td>
<td>Created a sprawl index and examined the relationship between this index and traffic crashes. The main findings include sprawling areas that are associated with more traffic and pedestrian fatalities.</td>
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<tr>
<td>(Trowbridge et al. 2009; Trowbridge and McDonald 2008)</td>
<td>Constructed sprawl indices to show that sprawl is associated with more teen driving and longer ambulance arrival times. In both papers the authors conclude that sprawl can lead to more traffic fatalities.</td>
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<tr>
<td>(Lambert and Meyer 2006; Lucy 2003)</td>
<td>Used another index of sprawl and found that sprawl is associated with more crashes.</td>
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</tbody>
</table>
Landuse policy can influence the following dimensions to influence urban traffic safety

- **Density**: policy that increases or maintains the population density
- **Structure**: policies that favour the concentration of employment and retail activity
- **Diversity**: traditional separation of landuses
- **Local Design**: Cities can encourage short car trips by good design of local facilities for nonmotorized transport

Where people live

- Mature cities: high rise density
- Growing cities: low rise densities
How people travel

Car share remains high in HIC: Newyork, London
Despite extensive PT network

LA cities PT dominates, NMV negligible

Asian cities (growing cities): NMV and walking dominates

Urban Density and traffic risk

• Dense urban areas are safer than lower density suburban environments. This is because per capita lower vehicle kilometers are travelled in denser areas at lower speed as compared to low density sub urban environments.

• Development with lower vehicle mile travelled is likely to have lower crash rate. This is related to density, diversity, design, and destination.

• Density in urban areas and design treatments like narrower streets, street trees, and traffic calming measures appear to enhance a roadway safety.
What is Transport Planning?

• Spatial and temporal spread of activities; where we live, work, how long we travel
• Travel demand estimation and design of facilities to meet the present and future demand; how do we travel
• Long range plans for multi-modal transportation systems; roads, metro, bus system, bicycle and pedestrian facilities

Travel demand model
Existing Landuse (2001)/future landuse

DESIRE LINES FOR
BASE YEAR: TWO
WHEELER TRIPS
(PCU)
Infrastructure Improvement

8 Bridges Across River Sabarmati (3 Proposed)
8 Underpass/flyovers (11 proposed)

Problem Analysis

- Analysis in terms of PCU (NMV, pedestrians ignored)
- Focus on inter zonal trips, short intra zonal trips ignored
- Focus on travel time(speed)
- Conventional method designed to promote personal motorised trips
Planning for safe Urban transport: a multi-sector task

- Transportation System
  - Infrastructure
  - Technology
- City systems
  - Landuse plans

Conflict between safety and mobility

- Higher level of service implies higher speeds - i.e. higher probability of fatality
Share of bicyclist in fatal crashes is less than the share of trips by bicycles, pedestrians and MTW are higher (Selected cities, IATSS report, 2015)
Transport Market & Latent Demand

- Changing demand

Investment in car infrastructure leads to higher speeds (short term), increased accidents, more cars, congestion!!!
Traffic Congestion Is Slowly Strangling Our Cities; Solutions Must Be Found (2017)

Traffic jam soon to become history; travelling on ropeway to start in Kolkata

Court asks for a vehicle free day in Mumbai

Delhi Traffic at night

Major recommendations

- Increase density, diversity, destinations and design in urban environments. It is expected that this promotes narrower, shorter, more enclosed and interconnected streets leading to safer travels.

- Density is measured by number of people, households or jobs per unit area (acre or km$^2$),

- Diversity refers to mixing of commercial, residential and industrial areas.

- Involves street typology of a community which can vary from straight interconnected streets to loops of curvilinear streets. Design also involves sidewalks, pedestrian crossings road side trees.
Co existence of formal and informal settlements: Necessity of access to employment!

Contiguous development of low-density, high income and high-density, low-income colonies (enclosed within red boundary) in southern part of Delhi.
Characteristics of Informal settlements

- Self organized, organic growth, outside the formal process
- Lack of formal services (water, sewage, electricity)
- Poor quality housing

Density, Diversity, human scale

Location (access to employment)

Landuse – transport integration for ‘unplanned’ sector implies:

- **Density**: High rise buildings vs small houses (12-18sqm)
- **Structure**: Monocentric/polycentric vs street vendors
- **Diversity**: mixed landuse vs informal markets
- **Local Design**: short car trips vs walking/bicycling trips
Large number of people relocated for metro and other development projects

Converting walking trips to motorised trips - buses, RTVs, LCVs

Long cycling trips

Time poverty of women increases
Opportunity for “self employed” business reduces
Planned landuse has lead to ~40,000 households relocation in 4 years

<table>
<thead>
<tr>
<th>Site Number</th>
<th>No. of Households</th>
<th>Distance from original site</th>
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<tbody>
<tr>
<td>1</td>
<td>8000</td>
<td>8 km</td>
</tr>
<tr>
<td>2</td>
<td>4000</td>
<td>7 km</td>
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<tr>
<td>3</td>
<td>5000</td>
<td>18 km</td>
</tr>
<tr>
<td>4</td>
<td>3000</td>
<td>10 km</td>
</tr>
<tr>
<td>5</td>
<td>2300</td>
<td>12 km</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>5 km</td>
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<tr>
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<td>13</td>
<td>65</td>
<td>35 km</td>
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<tr>
<td>14</td>
<td>20</td>
<td>40 km</td>
</tr>
<tr>
<td>15</td>
<td>1200</td>
<td>25 km</td>
</tr>
</tbody>
</table>

- Rehabilitation of slums results in converting pmy trips to my trips
- avg. distance to main road before relocation < .5 km.
- avg. distance to main road after relocation > 2 km
- Avg. distance to bus stop 200 m before relocation
- Avg. distance to bus stop 1 km after relocation
- Minimum distance to bus stop before 10 m, after 1 km
Captive and potential NMV users

Low income households (slums/ JJ colonies, LIG Colonies, urban villages)

- 10% - 50% households in Indian cities with Household income 100-180 USD/month
- Motorized public transport (bus) - not an affordable option

**CAPTIVE RIDER GROUP**

School and College students

High density (planned and unplanned) And mixed land use – Short Trip Maker

- High ownership of bicycle, low car ownership

**POTENTIAL RIDER GROUP**
Impact on safety

- The probability of a specific threat-victim crash = total “at-risk” kms travelled by road users in the victim’s travel mode \( (U_{\text{victim}} \times d_{\text{victim}}) \) X total distance travelled by the vehicles that pose the threat \( (M_{\text{threat}} \times d_{\text{threat}}) \).

- The mobility indicators for travel to work – distance, time and cost – have increased for 83%, 82% and 61% of the households respectively.

- The relocated households are travelling longer distances than before on arterial or national highways coming to the city. These roads do not have dedicated facilities for pedestrian, bicycles or buses.

- Aggregate data of fatal crash from 2001-2009 shows the increase in fatal crashes involving pedestrians and bicyclists.

Planning for safe Urban transport: a multi sector task

![Diagram showing the relationship between transportation systems, outcome, flows, congestion, pollution, and accidents in an urban transport context.](image-url)
Contrasting Approaches to Transport Planning

The Conventional Approach: Transport Planning and Engineering

Physical dimensions
Mobility
Traffic focus, particularly on the car
Large in scale
Street as a road
Motorised transport
Forecasting traffic
Modelling approaches
Economic evaluation
Travel as a derived demand
Demand based
Speeding up traffic
Travel time minimisation

An Alternative Approach

Sustainable Mobility
• Social dimensions
• Accessibility
• People focus, either in (or on) a vehicle or on foot
• Local in scale
• Street as a space
• All modes of transport often in a hierarchy with pedestrian and cyclist at the top and car users at the bottom
• Visioning on cities
• Scenario development and modelling
• Multicriteria analysis to take account of environmental and social concerns
• Travel as a valued activity as well as a derived demand
• Management based
• Slowing movement down
• Reasonable travel times and travel time reliability
• Integration of people and traffic
Seoul

Restoration of Cheonggyecheon

Decrease of car-traffic volume: 125,000 veh/day

Sustainable Development Goals (SDGs)

• Universal, integrated and transformative 2030 Agenda for Sustainable Development 17 Sustainable Development Goals and 169 associated targets.
• Sustainable transport has been included in 7 of the 17 goals and is covered directly by 5 targets and indirectly by 7 targets.
Transport related issues in specific targets

- **Target 3.6.** By 2030, halve the number of global deaths and injuries from road traffic accidents.

- **Target 7.3.** By 2030, double the global rate of improvement in energy efficiency.

- **Target 9.1.** Develop quality, reliable, sustainable, and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.
Landuse-Transport integration for **safe**-sustainable cities

- Integrating diverse socio economic households in master plan
- Street designs and transport system to ensure current and potential walking and bicycling trips
- Lessons- indicators and methods from self organising cities.