GRIDLOCKED NEIGHBOURHOODS

SIGN OF FLAWED CIRCULATION AND POOR CONNECTIVITY

THE CASE OF SOUTH DELHI

GRIDLOCKED NEIGHBOURHOODS

SIGN OF FLAWED CIRCULATION AND POOR CONNECTIVITY

THE CASE OF SOUTH DELHI

Writers: Anumita Roychowdhury and Usman Nasim
Research inputs: Gaurav Dubey and Anu K Soman
Cover photo: Vikas Chaudhary
Cover design: Ritika Bohra
Photographs: Usman Nasim
Editor: Arif Ayaz Parrey
Design: Ajit Bajaj
Production: Rakesh Shrivastava and Gundhar Das

Traffic survey: Ark Foundation, New Delhi

We are grateful to the Citizens' Alliance (Delhi), local residents and volunteers for their valuable inputs.

Citation: Anumita Roychowdhury and Usman Nasim 2017, *Gridlocked neighbourhoods: Sign of flawed circulation and poor connectivity—The case of South Delhi*, Centre for Science and Environment, New Delhi

Maps in this report are indicative and not to scale.

Published by
Centre for Science and Environment
41, Tughlakabad Institutional Area
New Delhi 110 062
Phones: 91-11-40616000
Fax: 91-11-29955879
E-mail: cse@cseindia.org
Website: www.cseindia.org

Contents

List of graphs

List of maps

List of tables

Abbreviations

CNCRI	Chittaranjan National Cancer Research Institute
CPCB	Central Pollution Control Board
CR Park	Chittaranjan Park
DDA	Delhi Development Authority
GK-II	Greater Kailash-II
IIT	Indian Institute of Technology
IRC	Indian Road Congress
LOS	Level of Service
PCUs	Passenger Car Units
RITES	Rail India Technical and Economic Service
V/C ratio	Volume to capacity ratio

Introduction

Choked roads, polluted air and road injuries are but a few symptoms of the severe and crippling mobility crisis in Delhi. The city is in a health emergency with the lungs of every third child impaired, as established by a joint study of Central Pollution Control Board and Chittaranjan National Cancer Research Institute. Vehicular pollution is worsening this toxic risk as more than 55 per cent of Delhi's population live within 500 meters from any road where exposure to highly toxic vehicular fumes is maximum. The city also records the highest fatal road accidents among all Indian cities—an average of five road accident deaths per day. Clearly, Delhi is paying a very high price for explosive motorization.

While several steps are now underway to solve the problem and a comprehensive action plan has taken shape under the direction of the Supreme Court for time-bound action on all sources of pollution, transportation and traffic-related strategies have remained one of the most poorly understood challenges. Even though there is focus on public transport strategies including bus, metro and para-transit, and last-mile connectivity, interlinked solutions are yet to be found. The weakest link in the mobility strategies is the role of efficient local area circulation plans to improve last-mile connectivity and enable efficient traffic dispersal to reduce congestion and pollution. The city is now full of local choke points that hold up traffic.

Yet transportation planners ignore local area networks and circulation and remain obsessed with long-distance through traffic via arterial roads. Neighbourhoods in the city are becoming conduits of only large volume of through traffic from large catchments to arterial roads. But local areas remain severely deficient in efficient network grids that are needed for wider dispersal of traffic as well as for better last-mile connectivity. While this discourages walking and proper deployment of para-transit and non-motorized trips in neighbourhoods needed for integration of public transport strategies, this also creates severe traffic choke points in neighbourhoods rendering them immobile. There are very limited openings from neighbourhoods to arterial roads, most inner streets remain gated, further impeding traffic dispersal, and the very small number of junctions that are inlets and outlets to a zone become completely choked.

Choking congestion has led to serious tension and protests across neighbourhoods today. Local congestion has become so severe that any proposal of new commercial or mixed-use development in neighbourhoods draws angry protest for fear of those becoming traffic magnets in already over-saturated areas. These are all symptomatic of public policy failure in addressing integrated street design and management as well as vehicle restraint measures to cater to the needs of all road users and special requirements of local areas.

This is particularly important in view of the fact that autonomous growth of the city in itself is leading to more densification and commercial development across neighbourhoods, a natural and inevitable corollary of urban growth and also a means of plugging the huge housing deficit in the city. But if this happens without proper traffic impact assessment and mitigation strategy, it can lead to unintended consequences. In fact, globally, new development now requires special traffic mitigation strategies.

To highlight this problem, Centre for Science and Environment (CSE) has initiated a series on micro-mapping of some of the critical zones and neighbourhoods of Delhi. The first in the series is the vast expanse of the contiguous neighbourhoods of South Delhi, including plotted colonies in Greater Kailash-II (GK-II) and Chittaranjan Park (CR Park); DDA colonies in the Alaknanda area; and the Tughlakabad Institutional Area. This zone is cut off from the rest of the city on four sides by four big arterial roads including the Outer Ring Road towards Nehru Place, Ravidas Marg towards Govindpuri, Mehrauli Badarpur Road towards Tughlakabad Institutional Area, and the BRT corridor towards Greater Kailash-II. Jahapanah district forest is a natural boundary between Khanpur and this zone.

This vast zone virtually has two major openings as inlet and exit points for traffic—one near Savitri Cinema on outer Ring Road and the second near Tara Apartments on Ravidas Marg. Within this zone there are basically two to three key roads that are available for circulation of the entire local area as well as through traffic from a very large catchment going upto Faridabad. These roads are the crescent road through GK-II connecting Tara Apartments and Savitri Cinema; and Bipin Chandra Pal Road through CR Park and the road that divides Kalkaji and CR Park.

Besides the two major openings, there are only minor openings which prove inadequate to enter and exit the area. This limits and constrains the circulation so much that traffic chokes colonies as well as the surrounding arterial roads. The neighbourhood-level connector roads that have 18–24 m wide right-of-way are smaller than arterial roads. But they are increasingly being forced to function as arterial or sub-arterial roads carrying large volume of through traffic. There is also no local system to organize parking encroachment on these roads that further reduces efficiency of the carriageway and crossings. Moreover, due to impossibly large block sizes of residential colonies without deeper penetration of para-transit, average distances to the nearest public transport nodes and services have increased, discouraging people from walking and making them captive users of cars.

CSE's in-depth micro-mapping and traffic assessment of the area has assessed circulation and alignment patterns, and traffic flow and peak congestion build-up within the zone. This has been done based on CSE's analysis of Google traffic speed data in this zone as well as analysis of traffic survey data that has been made available by the Ark Foundation for this zone. For the traffic survey, critical entry exit and mid-blocks were selected on the main conduit roads (see *Map: Stretches selected for the traffic count survey*). CSE has closely engaged with Citizen's Alliance, a network of prominent resident welfare associations and local residents in this zone to understand the local traffic challenges.

The traffic survey of Ark Foundation has generated data on traffic flow in terms of vehicles per hour and vehicles per day. As the traffic is composed of different types of vehicles, it was practical to convert the flow into equivalent passenger car units (PCUs), by using certain equivalency factors. This helps to assess the current situation on the road—whether the usage of the road is above or below its vehicle carrying capacity. Based on this traffic count survey, CSE has calculated the 'peak hour factor' to indicate congestion pressure. This indicates trip generation patterns that are typically calculated from traffic counts and considers the peak hour volume. The traffic volume count survey was carried out at seven locations from 8 a.m. to 10 p.m. and covered all modes of transport, motorized and mon-motorized (see *Table 1: Road stretches assessed for traffic survey*).

Similarly, CSE has used daily real-time information of Google Maps for the same selected seven stretches from 31 August–4 September 2017. This has been used to estimate the traffic speed in the area to get a sense of the impact of congestion.

Map 1: Stretches selected for the traffic count survey

Note: Blue dots indicate traffic survey points
Source: Google Maps

Table 1: Road stretches assessed for traffic survey

Name of road	From	To
Lal Bahadur Shastri Marg	Chirag Delhi intersection	Ambedkar Nagar Terminal
Mehrauli Badarpur Road	Ambedkar Nagar terminal	Guru Ravidas Marg
Guru Ravidas Marg	Guru Ravidas Marg (Near Hakim Abdul Hameed hospital)	Hanuman Mandir, Govind Puri
CR Park Road–Outer Ring Road	Hanuman Mandir, Govind Puri	Chirag Delhi Intersection
Alaknanda Road	Tara Apartments	Block E, GK-II
Bipin Chandra Pal Marg	Outer Ring Road	DDA Flats, Kalkaji
Bipin Chandra Pal Marg–Alaknanda Road	Kalka school	Tara Apartments

Source: CSE

Overstretched local roads: A reality check

Roads are normally designed keeping in view a certain traffic volume capacity, which is defined in India by the guidelines of the Indian Road Congress (IRC). According to IRC 106-1990 guidelines for capacity of urban roads in plain areas, every category of roads have a designed service volume (see *Table 2: Designed service volume of different road categories*), which is considered as the maximum carrying capacity of those roads.

In addition the level of service (LOS) of the road, which is defined as the qualitative measure for describing operational conditions within a traffic stream and their perception by drivers or passengers, is a clear indicator of the level of utilization of roads and the consequent pressure. LOS is dependent on various parameters including speed, travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience etc. This is expressed as volume by capacity of the road (V/C ratio). If V/C exceeds one, it is considered to have exceeded the design capacity and is the threshold for congestion build up.

LOS is graded from A to F, with 'A' representing the best operational condition and service level or is considered free flow (see *Table 3: Grading of level of service of roads based on volume to capacity ratio*). However, for urban roads, given the heterogeneity of traffic, pedestrian flow, roadside fringe conditions, parking, frontage access of buildings etc. are all taken into account to define the level of service and normally, LOS C is adopted for the design of urban roads in Indian conditions.

Table 2: Designed service volume of different road categories

Type of carriageway	Total design service volumes for different categories of urban roads (PCU per hour)		
	Arterial	Sub-arterial	Collector
Two-lane (one-way)	2,400	1,900	1,400
Two-lane (two-way)	1,500	1,200	900
Three-lane (one-way)	3,600	2,900	2,200
Four-lane undivided (two-way)	3,000	2,400	1,800
Four-lane divided (two-way)	3,600	2,900	-
Six-lane undivided (two-way)	4,800	3,800	-
Six-lane divided (two-way)	5,400	4,300	-
Eight-lane divided (two-way)	7,200	-	-

Source: IRC 106-1990 guidelines for capacity of urban roads in plain areas

Table 3: Grading of level of service of roads based on volume to capacity ratio

LOS	V/C	Performance
A	0–0.2	Excellent
B	0.2–0.4	Above average
C	0.4–0.6	Average
D	0.6–0.8	Below Average
E	0.8–1	Poor
F	> 1	Very poor

Source: IRC 106-1990 guidelines for capacity of urban roads in plain areas

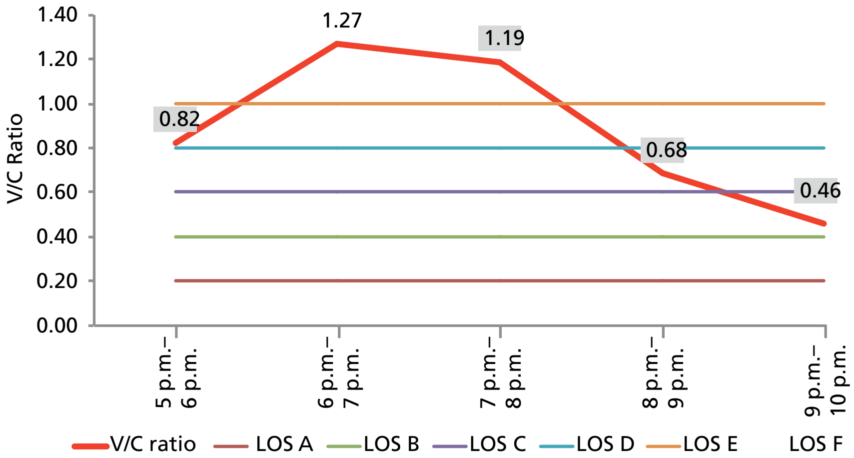
The traffic volume count in this zone shows that the current traffic volume far exceeds the designed capacity and the desired level of service. The level of service is considered ideal when V/C ratio is 0.2. But the actual traffic volume inside the zone can be more than six times and on the surrounding arterial roads—especially close to the junctions—more than ten times. The level of service is three–four times worse than the C level of 0.4–0.6. These streets and roads cannot hold any more traffic if other mitigation strategies are not adopted in terms of improving circulation, public transport access and car restraint measures.

Alaknanda (Tara Apartment F-Block)

This area includes a group of housing blocks developed by Delhi Development Authority. The survey point on the road along Tara Apartments (F Block) is a 20 metres wide with 4-lane undivided carriageway which is also the main entry point of traffic from outside the area. Being inside a residential area, the road segment has extensive on-street parking and heavy cross-traffic. Buildings along both sides have free frontage access that effectively reduces overall capacity of the road. The Alaknanda stretch, which comes under the category of collector roads, has a design capacity of 1,800 PCUs per hour. Traffic survey conducted at this spot shows evening peak hours between 6–7 p.m., when the PCU reaches 2,282, 27 per cent higher than the design capacity. The LOS of the stretch has a V/C ratio of 1.27, about two-three higher than the average. The peak subsides after 9 p.m. (see *Graph 1: Hourly traffic along the Alaknanda road*).

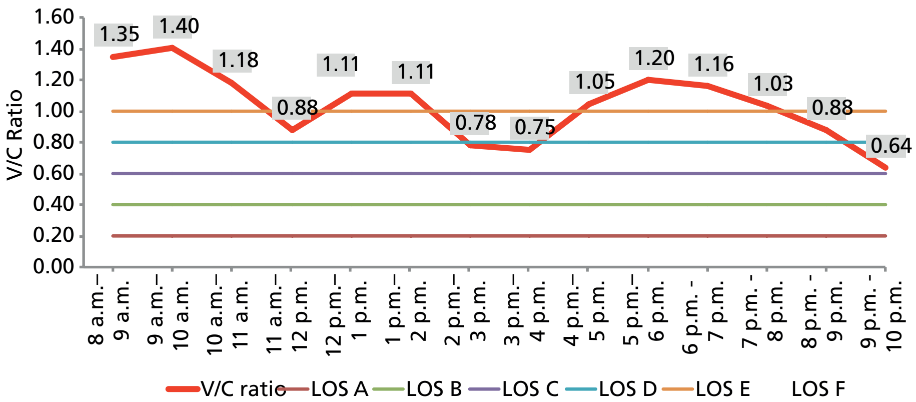
During the morning peak, traffic builds up between 9 and 10 a.m., when V/C ratio reaches up to 1.4. The road stretch remains congested all day with an average V/C ratio of 1.04 (see *Graph 2: Hourly traffic along Pocket F, Alaknanda*).

Graph 1: Hourly traffic along the Alaknanda road



Source: CSE computation based on survey data of Ark Foundation

Graph 2: Hourly traffic along Pocket F, Alaknanda

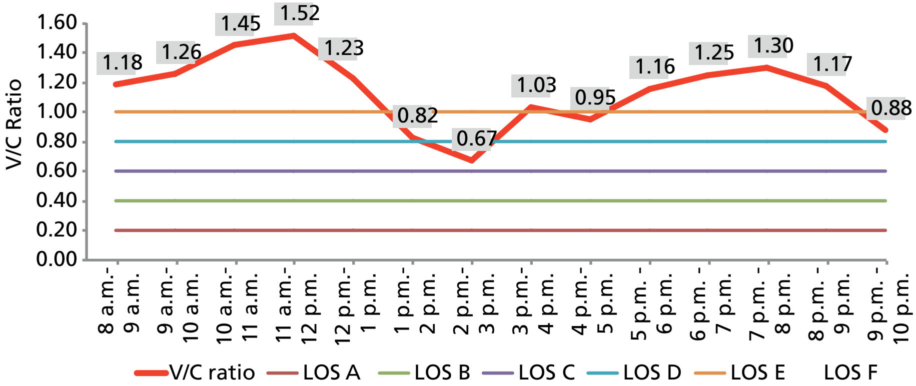


Source: CSE computation based on survey data of Ark Foundation

Chittaranjan Park

CR Park, the residential community area, has experienced high density housing development with equally busy commercial streets. The 18 metre wide two-lane undivided road of the area functions like a collector road with free frontage access to buildings on both sides as well as heavy cross-traffic. According to IRC, such roads should have maximum design service volume of 900 PCUs per hour. From the day long traffic survey conducted, it is evident that the road experiences peak traffic between 11 a.m. and 12 p.m., when the PCU reaches 1,365, 52 per cent higher than the design capacity, and with a maximum V/C ratio of 1.52; except between 1 and 3 p.m., the area experiences congested traffic with LOS-F almost all day long (see *Graph 3: Hourly traffic along Bipin Chandra Marg, CR Park*).

Graph 3: Hourly traffic along Bipin Chandra Marg, CR Park

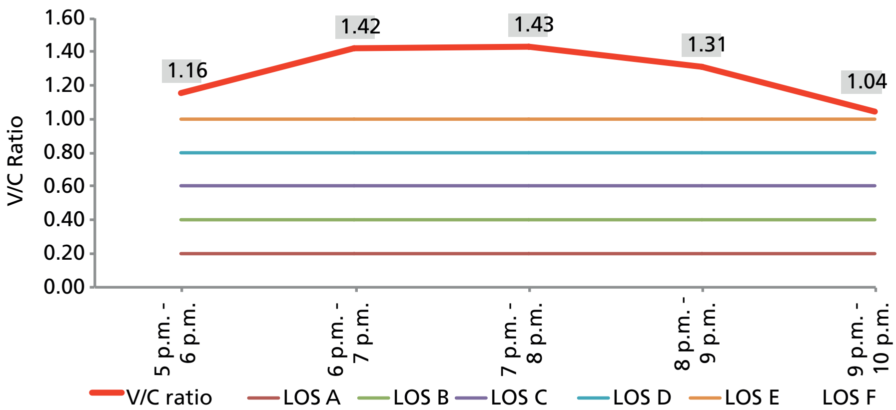


Source: CSE computation based on survey data of Ark Foundation

Greater Kailash-II (GK-II)

GK-II is a posh neighbourhood with multiple market places. Though the area has a 24 metre wide four-lane undivided road, the frequent crossings and frontage access to buildings and market places along both sides of road pushes it to the category of sub-arterial roads with a capacity of 2,900. From 5–10 p.m. (the period for which the survey was conducted), when the PCU reaches 4,144, 42 per cent higher than the design capacity, and the road is congested with a V/C greater than 1. Peak hour builds up from 7–8 p.m. (see *Graph 4: Hourly traffic along GK-II main road*).

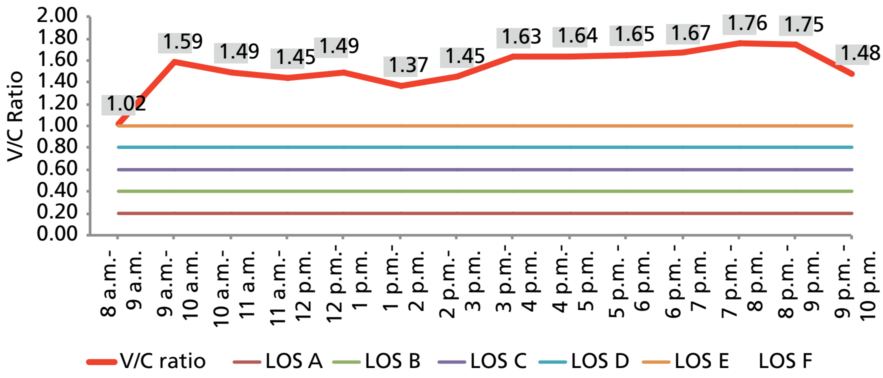
Graph 4: Hourly traffic along GK-II main road



Source: CSE computation based on survey data of Ark Foundation

The full day-long survey also shows the road stretch passing through the busy GK–II neighbourhood is congested all day with an LOS F. Even the period of minimum traffic (between 8 and 9 a.m.) has volumes crossing the maximum capacity of the road. V/C ratio of the road during peak hours (between 7 and 8 p.m.) is found to be 1.76, and PCU reached 5,093, 76 per cent higher than the design capacity, while the minimum V/C ration during a 24-hour cycle is still a high 1.02 (see *Graph 5: Hourly traffic along GK-II main road*).

Graph 5: Hourly traffic along GK-II main road

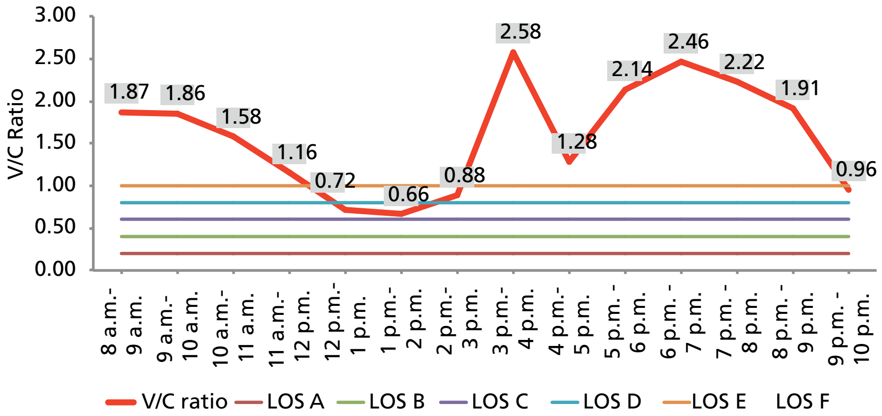


Source: CSE computation based on survey data of Ark Foundation

Tughlakabad Extension

Tughlakabad Extension, which connects Mehrauli–Badarpur road with the Alaknanda area, is among the busy roads of Delhi. The traffic pressure here is enormous as it is the only conduit of traffic for a large catchment upto Faridabad, drawing heavy numbers into the study zone. The 30 metre wide road with a four-lane divided carriageway is an arterial road by function, with limited frontage access, no standing vehicles and least number of crossings. The road has a maximum capacity of 3,600 PCUs per hour. According to the day-long survey conducted, traffic on this road peaks between 3 and 4 p.m, when the PCU reaches 9,298, 1.6 times the design capacity. During the hour, the V/C ratio of the road reaches 2.58, which is thrice the maximum capacity of the road. The road is heavily congested in the evenings, with an hourly V/C ratio consistently above two. The lean period occurs between 1 and 2 p.m. (see *Graph 6: Hourly traffic along Guru Ravidas Marg, Tughlakabad Extension*).

Graph 6: Hourly traffic along Guru Ravidas Marg, Tughlakabad Extension



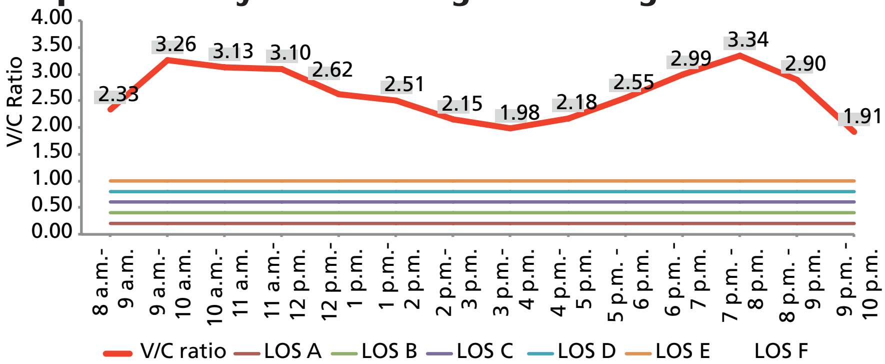
Source: CSE computation based on survey data of Ark Foundation

Outer Ring Road near Savitri Cinema

The Outer Ring road is one of the busiest arterial roads of Delhi, bearing a heavy traffic burden. The 45 metre wide six-lane divided carriageway has a maximum carrying capacity of 5,400 PCUs per hour. Our survey was conducted at the segment near Savitri flyover, where the road intersects with the main Greater Kailash-II road. The day-long survey shows heavy traffic along the road stretch with a traffic volume that is more than twice or thrice the maximum capacity of the road stretch. The V/C ratio of road reaches 3.34 during 7–8 p.m., which is the peak hour, when the PCU reaches 18,047, 2.34 times the design capacity. It is interesting to note that the minimum traffic on the road itself is about twice the maximum capacity of the road. Minimum hourly V/C ratio of the road is 1.91 around the time 9–10 p.m. (see *Graph 7: Hourly traffic along Outer ring road*).

The study area is, therefore, tightly placed between over-saturated arterial roads.

Graph 7: Hourly traffic along Outer Ring Road



Source: CSE computation based on survey data of Ark Foundation

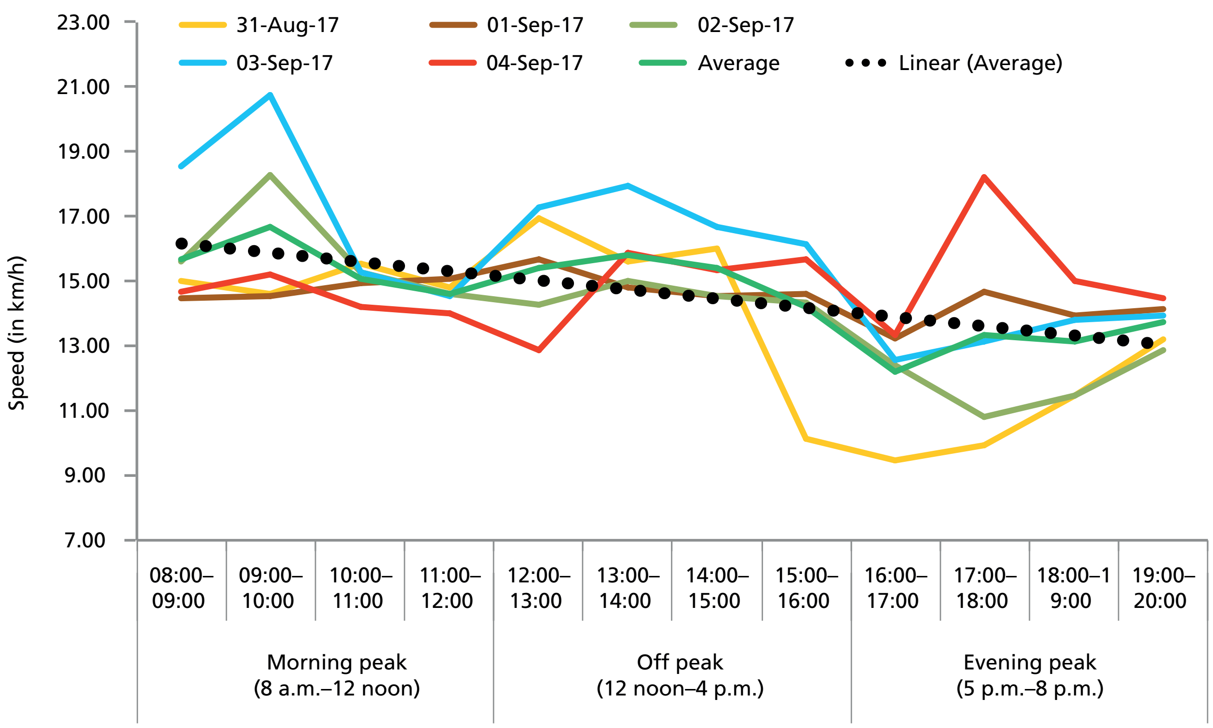
Massive slow down: Assessment of Google traffic data

CSE also assessed real-time traffic information of Google Maps—a popular tool to gauge traffic time by residents of Delhi while travelling in the city—for different stretches to calculate average traffic speed on the roads during different hours of the day. This assessment has used daily real-time information of Google Maps for the selected seven stretches from 31 August–4 September 2017. The data has been noted for every hour from 8 a.m. to 8 p.m. The speeds were then calculated for every hour for all the roads daily. This simple exercise for key stretches of the seven roads shows low traffic speeds, high weekend congestions and low traffic speeds during peak hours.

Average speed in this zone significantly lower than the average speed on Delhi's roads

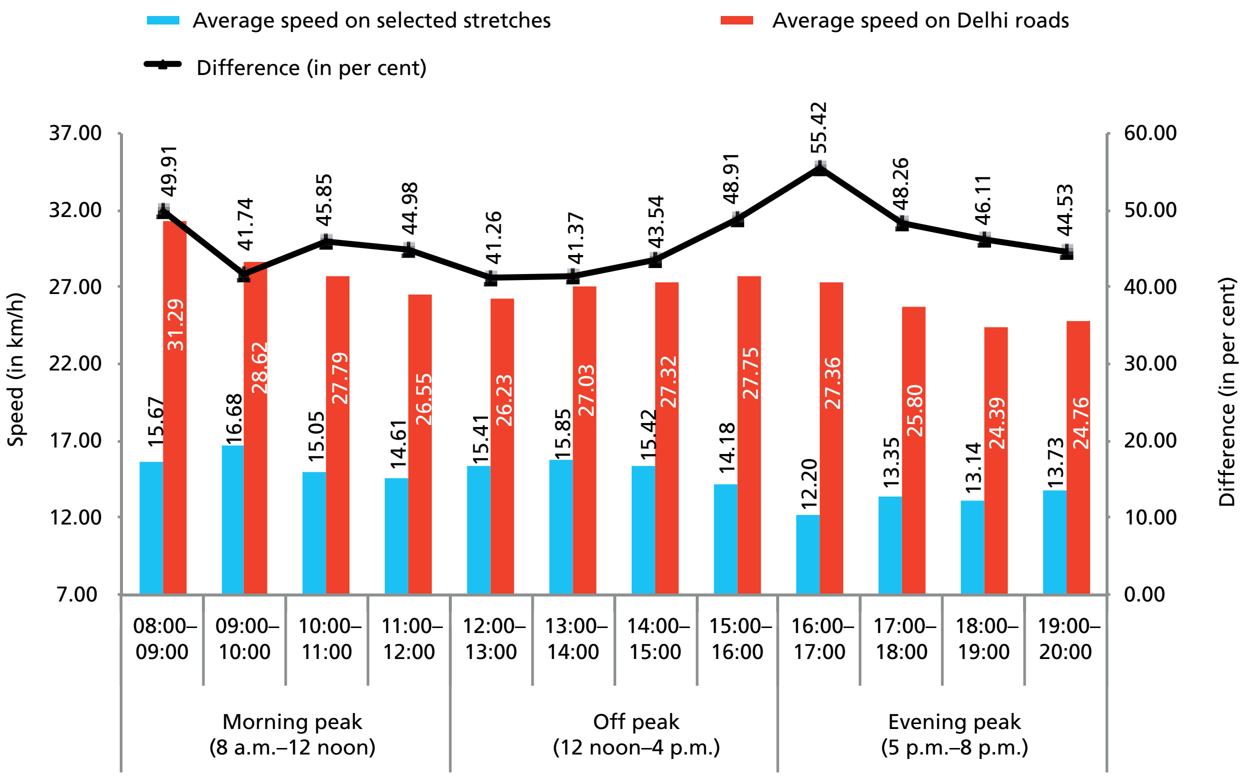
The main takeaway is that the average traffic speed in this area is much lower than the current average traffic speed in Delhi, which in turn is much lower than the legal speed limit. The average traffic speed on the seven selected stretches of roads in the zone is 14.6 km/h, which is 46 per cent lower than average speeds on Delhi's roads. The average speed on Delhi's roads is 27 km/h according to CSE's recent analysis, whereas the average legal speed is 40 km/h.

Graph 8: Hourly average speeds on selected the seven stretches in the study area



Source: CSE computation based Google real time traffic data

Graph 9: Hourly comparison of average speeds on the selected seven stretches with Delhi's average speed



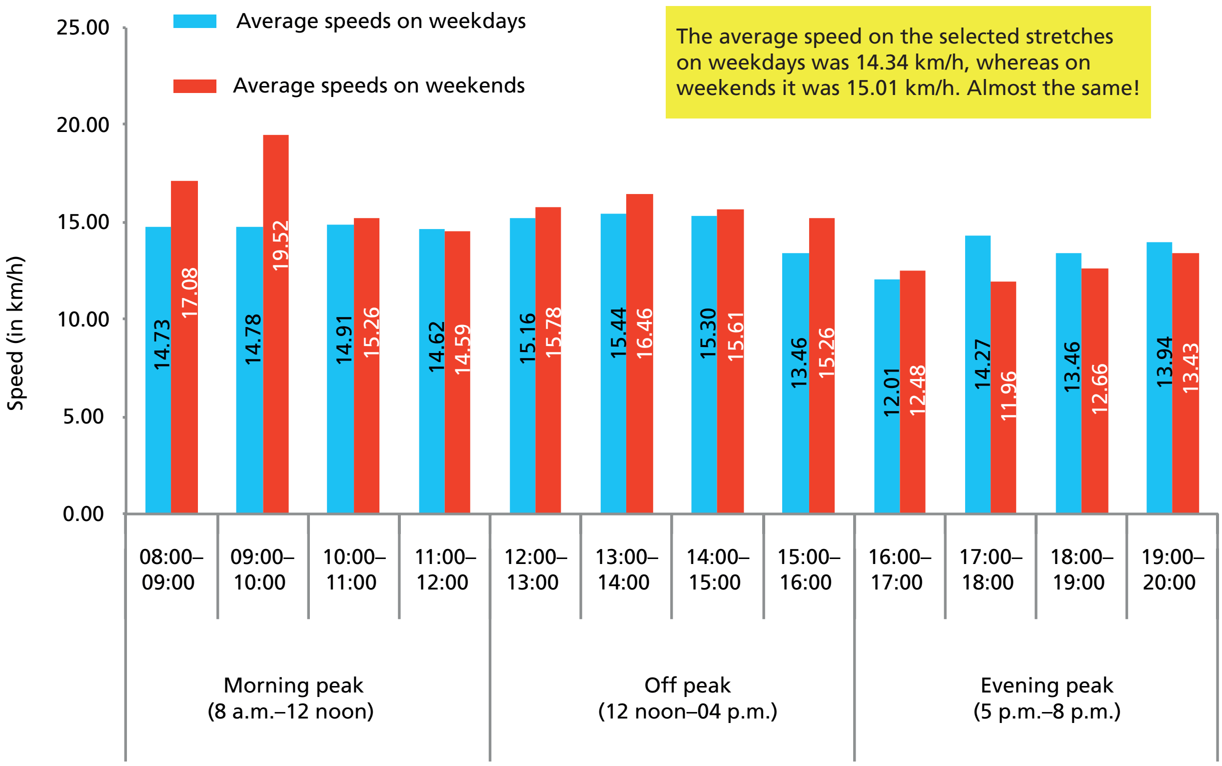
Source: CSE computation based on Google real time traffic data

No difference between weekdays and weekends traffic

There is virtually no difference between peak hour speed of weekdays and weekends. The average speed on the selected stretches on weekdays is 14.34 km/h, whereas on weekends it is 15.01 km/h, nearly the same. Overall, weekend traffic in Delhi has increased quite substantially in recent times. Combined with local commercial areas, this is drawing heavy traffic into the area.

According to the 2010 RITES report, the average peak speed in Delhi was 27.7 km/h and off-peak was 30.8 km/h, today, it is 26 km/h and 28 km/h, respectively. According to an IIT Madras study on Delhi's congestion cost, traffic congestion in Delhi cost the city close to Rs 54,000 crore a year in 2013. This is expected to get worse, especially as Delhi has now crossed the 10-million mark of total vehicle registrations. Estimates suggest the losses due to traffic congestion will increase to Rs 90,000 crore a year by 2030.

Graph 10: Hourly traffic comparison of weekdays and weekends of the seven selected stretches



Source: CSE computation based Google real-time traffic data

Impeded access to public transport

Even though this zone is well within the catchment of three metro stations—Nehru Place, Govindpuri, and upcoming one at Savitri Cinema, there is no clear plan for feeders, para-transit deployment, and local connectivity for convenient and easy transfers from all neighbourhoods. If a proper street grid with adequate openings and pedestrian access are engineered in this zone, it can open up more choices for commuters and reduce local vehicular pressure. Moreover, as the entire traffic flow is confined to two or three roads with inlets and outlets from two main junctions, this seriously impedes bus movement in the area and at least six bus routes have become defunct in the area.

The way forward

This local area assessment has clearly shown that lack of attention to local area networks for efficient circulation and absence of mitigation efforts in terms of improved public transport and last-mile connectivity has led to serious mobility crisis in the area. This is not only worsening congestion but is also adding to high exposure to toxic air pollution. An earlier exposure monitoring of particulate pollution carried out by CSE in the Alaknanda area during the winter of 2014 had shown hourly levels hitting more than 600 µg per cum. Such toxic exposure can have serious public health consequences. The demand for residential, commercial and retail spaces in the neighbourhood can only be expected to increase. More and more mixed use buildings are coming up to cater to this demand. But there is no planning strategy in place to mitigate traffic impact of this growth as new and large developments are not being planned based on potential traffic impact and the requisite mitigation strategies. Thus, all new proposed commercial developments in the area, including the Savirti cinema complex, the proposed mall in Alaknanda etc., have kindled fierce agitation and local anger.

Lessons from this local area are relevant for city-wide interventions. Similar mapping of local area networks and circulation, traffic flow patterns including parking impacts, public transport availability, and status of pedestrian access and of last-mile connectivity is essential to design mitigation strategies, including road engineering interventions. Globally, especially in Chinese cities like Beijing, all new residential and commercial buildings have to mandatorily provide clear strategies to ensure that these developments do not induce more traffic in the area and reduce traffic pressure by providing direct connectivity with the nearest public transport nodes and by freezing and restricting parking requirements in the area.

We recommend:

- Architects, urban planners and members of RWAs should be part of the consultative process when carrying out transport and traffic planning for the local area.
- Review and assess the local street grid and density and porosity to improve circulation and traffic dispersal, minimizing pressure on only a few key junctions that ultimately lead to massive choking points.
- Implement traffic impact assessment of all new developments and mandate mitigation strategies to prevent inducement of traffic into the area.
- Implement a time-bound action plan to improve connectivity of the neighbourhood through feeder services and para-transit efficiently for all the metro stations in the vicinity while upgrading the bus strategy.
- Implement a city-wide parking area management strategy to organize legal, shared and priced parking in public spaces. Adopt a vehicle restraint policy on a city-wide scale.

Centre for Science and Environment
41, Tughlakabad Institutional Area, New Delhi 110 062
Phones: 91-11-40616000
Fax: 91-11-29955879 E-mail: usman@cseindia.org
Website: www.cseindia.org