Transport Sector Policies for Managing Air Pollution in Delhi

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Project Objectives

• To assess climate change and environmental impacts in urban areas in India related to the transport sector

• Develop mitigation and adaptation strategies under risk, uncertainty and irreversibility (RUI)
Case City of Delhi
Profile of Delhi

- Population: 16.8 million (2011)
- Total road length: 31,969 km (2011)
- Registered vehicle population: 8.3 million (2013-14)

Source: Transport Department, GNCT of Delhi.

### Growth of Commercial Vehicles in Delhi ('000)

<table>
<thead>
<tr>
<th>Year</th>
<th>Auto Rickshaw</th>
<th>Taxis</th>
<th>Buses</th>
<th>Good Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-81</td>
<td>20</td>
<td>6</td>
<td>8</td>
<td>36</td>
</tr>
<tr>
<td>1990-91</td>
<td>10</td>
<td>19</td>
<td>19</td>
<td>36</td>
</tr>
<tr>
<td>2000-01</td>
<td>18</td>
<td>41</td>
<td>22</td>
<td>70</td>
</tr>
<tr>
<td>2011-12</td>
<td>88</td>
<td>70</td>
<td>64</td>
<td>229</td>
</tr>
</tbody>
</table>

Source: Transport Department, GNCT of Delhi.

### Age Profile of Diesel Vehicles Over 10 Years Old

<table>
<thead>
<tr>
<th>Category</th>
<th>0-5 Years</th>
<th>6-10 Years</th>
<th>11-15 Years</th>
<th>15+ Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trucks (Diesel)</td>
<td>49</td>
<td>35</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Tempo (Diesel)</td>
<td>54</td>
<td>31</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Light Goods Veh</td>
<td>84</td>
<td>13</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Auto Rickshaws (CNG)</td>
<td>39</td>
<td>56</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Passenger Buses (CNG)</td>
<td>22</td>
<td>70</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Two Wheelers</td>
<td>73</td>
<td>23</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Cars</td>
<td>67</td>
<td>26</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Source: Centre for Atmospheric Sciences, Indian Institute of Technology Delhi.

### Growth of Personal Vehicles in Delhi (in Lakhs)

<table>
<thead>
<tr>
<th>Year</th>
<th>Cars</th>
<th>Two Wheelers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-81</td>
<td>1.17</td>
<td>3.34</td>
</tr>
<tr>
<td>1990-91</td>
<td>3.84</td>
<td>11.91</td>
</tr>
<tr>
<td>2000-01</td>
<td>9.21</td>
<td>22.31</td>
</tr>
<tr>
<td>2011-12</td>
<td>23.43</td>
<td>46.44</td>
</tr>
</tbody>
</table>

Source: Transport Department, GNCT of Delhi.
Air Pollution Trends in Delhi (2010-14) (During Winters)

PM10 (Safe limit is 100µg/m³)

PM2.5 (Safe limit is 60µg/m³)

NO2 (Safe limit is 40µg/m³)

(Source: Delhi Pollution Control Committee)
Issues and Challenges for Delhi

- Increasing vehicle ownerships (increase by 97% in 2002-12) leading to excessive motorisation
- Increasing dieselization of cars
- Weak PUC tax regime and enforcement system
- Inability to check pollution status on BS I, BS II and BS III vehicles entering into Delhi
- Inadequate Public Transport fleet coupled with operational losses

34.7% diesel in Delhi consumed by private cars and utility vehicles
## Potential Strategy Response

Avoid- Shift- Improve (A-S-I) approach

### Planning Instruments
- Land Use Planning
- Promoting Public Transport
- Infrastructure for Non Motorised Modes

### Regulatory Instruments
- Low Emission Zones
- Speed Restrictions
- Regulation of parking Supply
- Traffic Management
- Emission norms

### Economic Instruments
- Road Pricing
- Fuel Taxes
- Vehicle Taxation
- Parking Pricing

### Technological Instruments
- Fuel improvement
- Cleaner Technology
- End- of- pipe control devices

(Source: Transport and Climate Change, GTZ - 2010)
Policy Actions for Controlling Air Pollution - Beijing

- Ban on registration of diesel car in 2003
- 20,000 buses introduced by 2008 (including CNG buses)
- Increased subsidy for old vehicles scrap
- Cap on number of cars that can be sold in a year
- Increased parking fee in Feb 2011
- Promoting CNG, electric vehicles and hybrids etc.

(Source: Department of Environment, GNCTD)

Air pollution trend in Delhi

(Source: Beijing Environmental Protection Bureau)
Enforced Euro II emissions standards in 2000, five years ahead of schedule.

Euro III in 2005 - unleaded petrol.

Mandated pre-mix petrol to two- and three-wheelers.

Implemented largest ever CNG programme: Largest ever public transport bus and three-wheeler fleet on natural gas.

Relocated polluting industry.

Strengthened vehicle inspection programme (PUC).

Phased out 15 year old commercial vehicles.

Capped the number of three-wheelers.

(Source: Centre for Science and Environment New Delhi, February 5, 2014)
Policy Efforts to Check Air Pollution (2008-2014)

- Metro system expanded
- Close to 6000 new buses
- Euro IV standards in 2010; upgraded PUC* tests
- Air Ambience Fund in 2009

- SC upholds ban on 10-year-old diesel vehicles
- 1,18,773 Private Vehicles
- 34,659 commercial vehicles
- 5 lakh vehicles enter Delhi every day
- 50,000-75,000 Trucks
- 2,500 Transport buses

- Marginal increase in parking prices in NDMC area
- 40 km of cycle tracks with new footpaths in 2010

* Pollution Under Control
Odd-Even Policy Features

• On even dates, only cars with license plates ending with an even number will be allowed on city roads, and on odd dates, cars with license plates ending with an odd number will be allowed.
• The first pilot of this rule i.e. 1st January 2016 and would last for 15 days, effective between Monday-Saturday between 8 AM to 8 PM.
• A fine of Rs. 2,000 charged if anyone will not comply with the odd-even rule.

Exemptions from the rule:
• All CNG-driven vehicles
• Electric vehicles
• Hybrid vehicles
• Two-wheelers
• Vehicles driven by women, with only women passengers
• Vehicles driven by women, with children below the age of 12
• Those on way to hospital for medical emergency (should carry proof)
• Vehicles of physically challenged
• Emergency vehicles - Ambulance, fire, hospital, prison, hearse, enforcement vehicles, etc
• President
• Vice President
• Prime Minister
• Chief Justice of India
• Speaker of the Lok Sabha
• Deputy chairman of the Rajya Sabha
• Deputy speaker of the Lok Sabha
• Governors of the states
• Lt Governors

Even’s of the policy:
1. For starters, it will help reduce the congestion from the choc-o-block traffic we face everyday
2. It will bring down the pollution level in the capital during peak hours
3. People will search for alternative methods for travelling like car pooling
4. The government will improve the public transport, which will be a boon in the long run
5. We can see the blue sky in the day and the stars in the night, a sight for rare eyes
6. Fuel usage will be reduced, and hence we will help in conserving the fossils
7. The noise pollution will also come down
8. Last but not the least, it’s for 15 days and not lifetime.
Transport Logistics for Odd-Even Rule

- Delhi Metro to run 198 trains to make an additional 365 trips every day during the 15-day trial period of the rule and upgraded 2 min 30 sec frequency in peak hours.
- 3000 more buses on the street for ensuring a seamless, hassle-free experience
- Car Pooling services by the private operated taxi services (Ola and Uber),
- Regular and CNG taxies are exempted from Odd-Even Rule
- Pooch-O app to book an Auto. (75000 autos available through Pooch-O App.)
- 5700 teams of Civil defence persons, 200 Traffic Police, 66 Persons from transport Department and 40 teams from Municipal Corporation appointed
Experience in Beijing

• In Beijing 2008, Odd-Even Registration plate policy implemented.
• At that time Beijing had population of 17 million and cars 3.3 million
• The immediate policy implementation results are
  – Emission levels down to 40%
  – 95% supported the restrictions
  – Traffic reduced by 22.5%
  – Average travel speed improved from 23.5 kmph to 30.2 kmph
  – Accidents reduced by 53.1%,
  – PM level dropped by 73.2%
• After appearance of some positive results from the policy application people started buying multiple cars, covering the number plate with borrowed licence plates etc.
• In 2009, 26% rise in vehicle population and congestion index which was 5.93 (2008) jumped to 7.80 in 2010.
Impact of the Odd-Even Rule

Metro Ridership

- 21 lakh on regular days
- Metro ridership Increase to 23 lakhs from 21 lakhs daily commuters

Bus Ridership

- 35 lakh on regular days
- Bus ridership Increase to 40 lakh from 21 lakhs daily commuters

GURGAON ROUTE

Metro

- On Dec 30, 2015: 11,310
- On Jan 6, 2016: 12,271

Bus

- On Dec 30, 2015: 25,674
- On Jan 6, 2016: 27,157

Noida Route

Metro

- On Dec 30, 2015: 6,605
- On Jan 6, 2016: 7,362

Bus

- On Dec 30, 2015: 25,472
- On Jan 6, 2016: 31,757
Impact of the Odd-Even Rule

Road Traffic
Approximate Traffic Flow

<table>
<thead>
<tr>
<th>Regular Day</th>
<th>On 1 January</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 lakh</td>
<td>1 lakh</td>
</tr>
<tr>
<td>2.5 lakh</td>
<td>50,000</td>
</tr>
<tr>
<td>1.22 lakh</td>
<td>35,000</td>
</tr>
<tr>
<td>1.8 lakh</td>
<td>80,000</td>
</tr>
</tbody>
</table>

- 15% fall in vehicles on roads: from regular days 16-18 lakh to 13-15 lakh
- 30% rise in Taxies and Auto demand
- 29% fall in no. of accidents lakhs

A Q I During Odd-Even Rule

<table>
<thead>
<tr>
<th>Date</th>
<th>Average AQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-Dec-16</td>
<td>347</td>
</tr>
<tr>
<td>02-Dec-16</td>
<td>370</td>
</tr>
<tr>
<td>04-Dec-16</td>
<td>343</td>
</tr>
<tr>
<td>05-Dec-16</td>
<td>355</td>
</tr>
<tr>
<td>06-Dec-16</td>
<td>426</td>
</tr>
<tr>
<td>07-Dec-16</td>
<td>390</td>
</tr>
<tr>
<td>08-Dec-16</td>
<td>383</td>
</tr>
<tr>
<td>09-Dec-16</td>
<td>382</td>
</tr>
<tr>
<td>10-Dec-16</td>
<td>350</td>
</tr>
<tr>
<td>11-Dec-16</td>
<td>352</td>
</tr>
<tr>
<td>12-Dec-16</td>
<td>323</td>
</tr>
<tr>
<td>13-Dec-16</td>
<td>281</td>
</tr>
<tr>
<td>14-Dec-16</td>
<td>206</td>
</tr>
<tr>
<td>15-Dec-16</td>
<td>208</td>
</tr>
<tr>
<td>16-Dec-16</td>
<td>254</td>
</tr>
</tbody>
</table>

PM2.5 Level at 25 December 2015 to 12 January 2016

- Reduction in Peak hour pollution level up to 391 in January 2016 from 606 in November 2015
- Pollution level decline comparative to regular days but still at the higher side from the standards
Impact of Odd-Even Scheme on Travel Behaviour

**Modal Split:**

- **Before Odd-Even:**
  - CAR: 65%
  - 2W: 9%
  - BUS: 4%
  - METRO: 22%

- **On Odd days:**
  - CAR: 43%
  - 2W: 19%
  - BUS: 9%
  - METRO: 29%

- **On Even days:**
  - CAR: 41%
  - 2W: 14%
  - BUS: 9%
  - METRO: 32%

**Average travel cost per person**

- Before Odd-Even: 60 Rs.
- On Even days: 45 Rs.
- On Odd days: 45 Rs.

- Average travel cost reduced to 45 Rs. per person per day.

**Average Travel time**

- Before Odd-Even: 45 minutes
- On Even days: 35 minutes
- On Odd days: 40 minutes

- Average travel time reduced to 35 minutes from 45 minutes.

- **Before the Odd-Even policy the work Place travel majorly dominated by Car users by 65% share.**
- **During the Policy Car trips decline to 43% and metro trips rise to 29% from 22% and Bus trips rise from 4% to 9%.**
- **During Even days also Car trips remain 41% and metro trips observed 32%**
Impact of Odd-Even Scheme on Travel Behaviour

- In 41% to 43% car user 75% travel individually though 25% uses carpooling.
- The Odd-Even Policy: 18% rate Good and 65% rate satisfactory
- For level of comfort: 72% find it Satisfactory

82% are continue to use Odd-even travel arrangement for rest of the trial period
95% agree with the odd-even formula for mitigating pollution in Delhi

Possible alternative for ‘ODD-EVEN scheme’ to mitigate air pollution in Delhi

<table>
<thead>
<tr>
<th>Policy</th>
<th>Ranking</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point-to-point taxi/auto rickshaw service</td>
<td>1</td>
<td>Very Good</td>
</tr>
<tr>
<td>Improved metro frequency &amp; carrying capacity</td>
<td>2</td>
<td>Very Good</td>
</tr>
<tr>
<td>Increased parking Charges</td>
<td>3</td>
<td>Good</td>
</tr>
<tr>
<td>Augment bus fleet on a fast track mode</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>Staggering of office timings/ activity areas/ industries (over the day or week)</td>
<td>5</td>
<td>Very Good</td>
</tr>
<tr>
<td>Mandatory carpooling in peak hours</td>
<td>6</td>
<td>Good</td>
</tr>
<tr>
<td>Increased taxation on purchase of subsequent vehicles</td>
<td>7</td>
<td>Good</td>
</tr>
<tr>
<td>Improved last mile connectivity around metro station/ bus stop</td>
<td>8</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Suggestions for the improvement:
- Enforcement of rule permanently
- Women’s should include
- Rather than reducing to 50% it should be 20% on selection of weekdays to ban cars
- Should be applicable to all
- Improve public transport
Recent Transport Policy Initiatives in Delhi

- The vehicular exhaust from diesel cars, SUVs and freight trucks has been identified as one of the major contributors to the alarming levels of particulate matter in Delhi’s atmosphere is well-established.
- As per the CSE report which had said that commercial vehicles entering Delhi spew close to 30% of the total particulate load and 22% of the total nitrogen oxide load from the transport sector.

- **Truck Entry Restrictions**
  - Restriction on the passage of commercial vehicles through Delhi if their destination is not the capital.
  - Such vehicles will not be allowed to enter Delhi through the entry points of NH-8 and NH-1.

- **Increased Pollution Surcharges**
  - Light commercial vehicles with two axles will have to pay Rs.1,400 for entering Delhi and commercial vehicles with three and four axles will have to pay Rs.2,600 for each trip for entering Delhi- Levy Environnement Compensation Cess (ECC) from 1st November for four months on a trial basis.

- **Ban on the registration of diesel-run private cars**
  - Registration of diesel SUVs and private cars of the capacity of 2000 CC and above using diesel as fuel shall stand banned in the NCR up to March 31, 2016.
Bharat stage emission standards are emission standards instituted by the Government of India to regulate the output of air pollutants from internal combustion engine equipment, including motor vehicles.

**Bharat-IV emission level for 2021**

- Since October 2010, Bharat stage III norms have been enforced across the country. In 13 major cities, Bharat stage IV emission norms have been in place since April 2010.
- Government *advances* roll out of **BS-V and BS-VI** norms for 4-wheelers. According to the roadmap earlier laid down by the Auto Fuel Policy, BS-V norms were to be implemented from April 1, 2022 and BS-VI from April 1, 2024.
- Now India will implement the Bharat Stage-V, or BS-V, emission norms for vehicles across the country from 2019 and BSVI emission norms for four-wheelers shall be implemented from 2023.
Summing Up

• The pollution levels in Delhi are increasing at an alarming rates in recent years.
• Muti pronged policy initiatives are being attempted in Delhi including introduction of odd even scheme for vehicle use, increasing parking charges, pollution surcharge in freight, restricting truck movements etc.
• The present transport policies attempted in Delhi to manage air pollution are devoid of scientific basis and its implications on mobility and air pollution levels.
• The city presently also does not have adequate resources to manage air pollution levels in Delhi on sustainable basis.
• There is a need to evolve informed policy packages for evolving climate risk mitigation and adaptation in transport sector in Delhi.