मेट्रोची गरज - शाश्वत विकास

अश्विनी भिडे
व्यवस्थापकीय संचालक, मुंबई मेट्रो रेल कापोरेशन

लोकमान्य सेवा संघ, पार्ले
दिनांक - २० सप्टेंबर २०१९
Why Metro?
Mumbai Traffic Scenario

- **Mumbai Suburban:**
  - 80 Lakh people travel daily with
  - Super crush density of 12 passengers/sq.mt.

- **BEST:**
  - 38 Lakh people travel daily
  - Average speed 8-10 km/Hr

- **The Modal Share of Public Transportation**
  - 88% in 1991
  - 78.1% in 2005
  - 65.3% in 2017

- **Increase in private vehicles:**
Mumbai Traffic Scenario 2017

* Source: CTS for Mumbai Metropolitan Region (MMR)- Jan 2019, MMRDA
Mumbai Traffic Scenario 2017

* Source: CTS for Mumbai Metropolitan Region (MMR)- Jan 2019, MMRDA
Private vehicle Population of MMR, Veh/1000 persons

* Source: CTS for Mumbai Metropolitan Region (MMR)- Jan 2019, MMRDA
Rise of App-Based Cabs in Mumbai

- Traditional Taxi/Auto service quality, operators behavior articulated commuters to prefer app based services that offer;
- Popularity soared despite surge pricing.
- Resulted into more vehicles on the road

**Graph:**

- Total number of tourist cabs in the city: 59,917
- Total kaali peelis in the city: 55,343
- New registrations for tourist cabs: 22,688

**Source:** Regional Transport Office, Mumbai
Mumbai Traffic Congestion and Average Speed

Comparison with Metropolitan Cities

- Mumbai: Congestion 8.1, Average Speed 34.9
- Shanghai: Congestion 30.5, Average Speed 11.2
- Tokyo: Congestion 16.2, Average Speed 11.2
- New York: Congestion 16.2, Average Speed 30.5
- London: Congestion 16.2, Average Speed 34.9

* Source: CTS for Mumbai Metropolitan Region (MMR)- Jan 2019, MMRDA
First the good news
Mumbai has higher green cover than any other mega city

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>SGNP</td>
<td>89.6</td>
<td>80.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aarey Milk Colony</td>
<td>55.0</td>
<td></td>
<td>19.2</td>
<td></td>
</tr>
<tr>
<td>Rest of city</td>
<td>4.8</td>
<td></td>
<td>15.0</td>
<td>6.6</td>
</tr>
</tbody>
</table>

SGNP has ~55 lac mature trees and additional 3.5X saplings & regenerations

# Trees per Sq. Km.

Source:
- Tokyo: The Urban Forest of Tokyo(Article published online on 27.3.2012 by Sheauchi Cheng, Keizo Fukunari and Joe R. McBride)
- London: Data taken from London Datastore

Despite excluding 55+ Lacs SGNP trees

<table>
<thead>
<tr>
<th># Trees per Sq. Km.</th>
<th>Mumbai</th>
<th>London</th>
<th>Tokyo</th>
<th>New York</th>
</tr>
</thead>
<tbody>
<tr>
<td>7,888</td>
<td></td>
<td>5,089</td>
<td>191</td>
<td>841</td>
</tr>
</tbody>
</table>
Despite this Mumbai is amongst the most polluted mega city.
Air pollution & # vehicles in Mumbai have grown rapidly

More vehicles on road > More time to travel due to congestion and long distances > Poor public transport

<table>
<thead>
<tr>
<th>Year</th>
<th># Vehicles (lacs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>28.2</td>
</tr>
<tr>
<td>2015</td>
<td>25.7</td>
</tr>
<tr>
<td>2014</td>
<td>23.3</td>
</tr>
<tr>
<td>2013</td>
<td>21.9</td>
</tr>
<tr>
<td>2012</td>
<td>20.3</td>
</tr>
<tr>
<td>2011</td>
<td>18.7</td>
</tr>
<tr>
<td>2010</td>
<td>17.7</td>
</tr>
<tr>
<td>2009</td>
<td>16.7</td>
</tr>
<tr>
<td>2008</td>
<td>16.1</td>
</tr>
<tr>
<td>2007</td>
<td>15.0</td>
</tr>
<tr>
<td>2006</td>
<td>13.9</td>
</tr>
<tr>
<td>2005</td>
<td>13.0</td>
</tr>
<tr>
<td>2004</td>
<td>12.0</td>
</tr>
<tr>
<td>2003</td>
<td>11.2</td>
</tr>
<tr>
<td>2002</td>
<td>10.7</td>
</tr>
<tr>
<td>2001</td>
<td>10.3</td>
</tr>
</tbody>
</table>

Source: MoRTH Statistics

Transport Emissions

- PM 2.5: 19%
- PM 10: 11%
- NOx: 29%

Source: Based on CPCB Envis centre

Before Ola, Uber Era

- 80% rise in PM10 levels between 2007 and 2018
- 60% reduction needed to meet clean air standard
Total PM2.5 Emissions by Sector 2018-2030

* Source: UrbanEmissions.info

Rail Based Maas rapid Transit System is the only way out to deal with pollution & congestion
Mumbai Metro will save lives; and also save trees
Cannot afford to waste a single day

10 deaths per day due to local train accidents caused by over-crowding which run 3X their capacity

Most Mumbaikars cannot afford other transport modes. Most don’t have time to wait.

They take not just precious lives, but with ~300 kgs wood from 2 fully grown trees having 2 ft. girth. approx. 6000 trees / yr too! <for tree lovers>
1. Versova Andheri Ghatkopar (11.4 km)
2. Dahisar - D.N. Nagar - Bandra - Mandale (2A & 2B) (42.2 km)
3. **Colaba - Bandra – SEEPZ (33.5 km)**
4. Wadala - Ghatkopar - Mulund Thane-Kasarvadvali (32.3 km)
4A. Kasarvadvali - Gaimukh* (2.7 km)
5. Thane (Kapurbawadi) - Bhiwandi – Kalyan (24.9 km)
6. Samarth Nagar- Jogeshwari-Kanjurmarg–Vikhroli (14.5 km)
7. Andheri (E) - Dahisar (E) (16.5 km)
8. Andheri - CSIA - Mankhurd - NMIA Fast Corridor * (35 km)
9. Dahisar E - Mira Bhyandar& Andheri - CSIA*(13.5 km)
10. Gaimukh- Shivaji Chowk (Mira Rd)* (9.2 km)
11. Wadala - Azad Maidan* (12.7 km)
12. Kalyan – Dombivali – Taloja* (20.7 km)
13. Shivaji Chowk-Virar*(20.7 km)
14. Kanjurmarg-Badlapur*(20.7 km)

**MO.** Monorail: Chembur-Wadala- Gadge Maharaj Chowk (20 km)

**Total : 357.1 km**

**Operational:** 30 km (Metro 1 & Mono Phase 1 &2)

**Under execution:** 163 km (Metro 2 to 7)

**Under planning:** 164 km (Metro 4A & 7A to 14)
Future Transport: Modal Share

- Rail Based Mass Rapid Transport System: Suburban Rail + Metro: Predominant mode of transport

- Modal Share of Public transport expected to increase from 65% to 71.3% by 2031 and 74.8% by 2041

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Mode of Transport</th>
<th>2017</th>
<th>2031</th>
<th>2041</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>in Lakhs</td>
<td>% of Total</td>
<td>in Lakhs</td>
</tr>
<tr>
<td>1</td>
<td>Sub-urban</td>
<td>81.1</td>
<td>43.2%</td>
<td>69.4</td>
</tr>
<tr>
<td>2</td>
<td>Metro &amp; Mono</td>
<td>4.1</td>
<td>2.2%</td>
<td>83.6</td>
</tr>
<tr>
<td>3</td>
<td>Bus</td>
<td>37.5</td>
<td>20.0%</td>
<td>17.1</td>
</tr>
<tr>
<td>4</td>
<td>Motorised Transport</td>
<td>65.1</td>
<td>34.7%</td>
<td>66.7</td>
</tr>
<tr>
<td></td>
<td>Total (in Crores)</td>
<td>1.88</td>
<td></td>
<td>2.37</td>
</tr>
</tbody>
</table>

*Source: CTS for Mumbai Metropolitan Region (MMR)- Jan 2019, MMRDA*
Mumbai Metro Line 3: Alignment

- **33.5 km (fully underground)**
- **Stations**: 27 (26 U/G+1 At Grade)
- **Completion cost**: Rs 23,137 Cr.
- **Soft loan (JICA)**: 57.2%
- **Contribution – GoI/GoM/Others**: 42.8%
- **EIRR**: 17.93%
- **FIRR**: 2.71%
- **Implementation**: Phase I: Dec. 2021
  Phase II: June 2022

<table>
<thead>
<tr>
<th></th>
<th>2021</th>
<th>2031</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ridership</td>
<td>14 Lakh</td>
<td>17 Lakh</td>
</tr>
<tr>
<td>Headway (CP-BKC)</td>
<td>4 min</td>
<td>3 min</td>
</tr>
<tr>
<td>Coaches</td>
<td>248 (31x8cars)</td>
<td>336 (42x8 cars)</td>
</tr>
</tbody>
</table>
Connecting the Unconnected

- **Serves six CBDs**
  - Nariman Point, Cuffe Parade (WTC), Fort, Worli/Lower Parel, BKC & SEEPZ / MIDC

- **Connects areas not served by suburban rail**
  - Nariman Point, Cuffe Parade, Kalbadevi, Worli, BKC, Airport & SEEPZ/ MIDC

- **Interchange with existing public transport**
  - CST (CR), Churchgate, Mumbai Central (WR), Marol Naka (Line 1), Mahalaxmi (Monorail), Mumbai Central (ST)

- **Airport connectivity**
  - Domestic Terminal, International Terminal(T2)

- ~ 30 Employment clusters/Govt /Pvt. Offices
- ~ 12 Education Institutions
- ~ 11 Major Hospitals
- ~ 10 Major Transportation Hub
- ~ 25 Religious & recreations structures
- ~ 3 million Population in influence zone

In Emergencies on Suburban Provide Evacuation
Mumbai Metro Line 3: Salient Features

- 8 coach Trains
- Carrying capacity of each train: 2400 passengers
- Energy Efficient Modern Rolling stock (25 Kv AC traction) with regenerative braking system
- Platform Screen Doors & Automatic Train Protection
- 2-level stations provided with Escalators & lifts designed for physically challenged
- Centralized control of Train Operations World Class standards
- Fully Air conditioned Stations and trains
- Centralized control of train operations.
- ITS for train operation and intermodal integration.
- Commercial speed – 35 kmph
Mumbai Metro Line 3: Project Benefits

**Environmental**
- 35% Reduction in traffic
  (456,771 less vehicle trips/day)
- Reduced fuel consumption
  (save 243,390 l/day)
- Reduction in air pollution by 2.61 lakh ton per year
- As per UNFCC auditor’s report: 2.61 lakh ton/year
  (United Nations Framework Convention on Climate Change)
- Reduction in noise pollution

**Safety & Security**
- Platform Screen Doors
- Closed Door Cars
- Women Safety & Security
- Continuous Surveillance (24x7)
- No Trespassing possible

**Economic**
- Repositioning of Mumbai on Worldwide competitiveness
- Additional Employment During and After construction
- Improved Productivity

**Comfort & Reliability**
- End to End Air Conditioned Travel
- Higher Frequency 100% Time Adherence
- Eliminate Peak Hour delays, Reduced Travel time
Scope of Work and Project management

❖ General Consultants on board for 7 years: Consortium of
  • Aecom Hong Kong
  • Padeco Japan
  • LB USA
  • Egis Rail France

❖ Civil contracts:
  • 8 Civil Packages including car depot package
  • 55 km tunneling:
    17 Tunnel Boring Machines, 11 TBM shafts
  • 26 underground stations:
    7 off road, 19 below roads;
    7 NATM, 19 Cut & Cover
  • Car depot at Aarey

❖ System contracts:
  1) Traction and Power Supply
  2) Lifts and Escalators
  3) Rolling Stock
  4) Signaling and Telecommunications
  5) Automatic Fare Collection
  6) Tunnel and Station ventilation
  7) Security Systems
  8) Depot Equipment
  9) Track work

❖ Consortia of Indian and International bidders
❖ Selection through international competitive bidding

MMRC’s in-house team
Importance of the Car Depot

• Car Depot is mandatory & essential facility for smooth operation of any Metro system where all Metro trains not only parked but also maintained for safe operations.

• It is an essential part of the system without which it is impossible to commission or run safe operations. It is the starting point for train operation every day.

• A Car Depot serves Metro trains akin to a “home” for any human being.
Importance of the Car Depot

1. Workshop and Inspection Bays
2. Stores for essential spares
3. Rolling Stock Cleaning Facility to provide outside and inside cleaning
4. Stabling Lines for 31 trains (8 car each) and various other auxiliary vehicles (Catenary Maintenance Vehicle, Self-Propelled diesel driven rail cum road vehicle)
5. Train Driving Simulator, Maintenance simulators of various functions like rolling stock, Signalling, E&M, Electrical.
6. Operations Control Centre and Depot Control centre
7. Maintenance base for requirements of the entire main line
Why at Aarey?

1. No other technically feasible option available

2. All other options studied and evaluated. Have even given finality at Supreme Court level

3. Most optimally placed operations wise

4. The location is surrounded by Jogeshwari-Vikhroli Link Road (JVLR), Goregoan-Powai Link Road (GPLR), and Marol-Maroshi road. These roads carry approximately one lakh of vehicles daily.

5. Allotted the bare minimum space required to operate the facility, safely and smoothly
Why at Aarey?

The proposed location is surrounded by Jogeshwari-Vikhroli Link Road (JVLR), Goregoan-Powai Link Road (GPLR), and Marol-Maroshi road. These roads carry approximately one lakh of vehicles daily.
Is Metro Car Depot eating into the entire green lungs of Mumbai?

**Metro 3 Car Depot at Aarey Colony: Facts**

Sanjay Gandhi National Park: **12000 Ha**

Aarey Colony: **1287 Ha**

Land needed for Metro 3 car depot: **30 Ha**

Green cover retained within depot: **5 Ha**

Only 17% land out of 30 Ha has tree cover rest is grazing land.
About 333.50 Ha is already Developed/Occupied for other purposes.
EXISTING SLUMS IN AAREY
Metro 3 Car Depot at Aarey Colony: Facts

- Total Trees in MCGM area: 29.57 Lakh
- Total Trees in 1287 Ha Aarey Milk Colony: 4.83 Lakh (Tree census 2017-18)
- Trees affected by Metro 3 Car Depot: 2700 only
- Trees to be transplanted: 460
- Trees to be cut: 2240 and 6 times more trees to be planted as compensatory plantation

Identified 2700 trees

Would have absorbed 64 MT CO₂ per year

Mumbai Metro Project

64 MT CO₂ reduction will be achieved in just 197 trips i.e. 4 days of peak Hours operations

1280 MT CO₂ reduction will be accomplished in just 3948 trips i.e. 80 days at peak

Would have absorbed ~1280 MT CO₂ in their life time
Why not at other locations?

A. At DPR Stage (2011)
Following sites having vacant areas of the requisite size along the alignment have been identified for setting up of depots;
   i. Mahalaxmi Race Course
   ii. Exhibition grounds at BKC
   iii. Kalina University land
   iv. Aarey milk colony land,

B. Committee Stage (2015)
   In addition to above following 4 options were explored by the technical committee;
   i. Backbay reclamation
   ii. Mumbai Port Trust land
   iii. Dharavi
   iv. Sariput Nagar near JVLR and;
   v. Kanjur Marg at the intersection of JVLR and Eastern Express Highway

All locations were examined on merits by experts and ruled out, except Aarey & Kanjur Marg on basis of inadequate land area and technical suitability, environment, legal/ownership constraints as well as regulatory constraints.
Why not at Kanjurmarg?

- **Kanjurmarg was never an option at DPR stage.** However, the citizen’s group suggestion was accepted by the technical committee and recommended State Government to make land available within 3 months.

- There is title dispute pending in Bombay High Court since 1996 involving private parties and State Government wherein Bombay High Court issued Status Quo orders in 1997.
Why not at Kanjurmarg?

• However, MMRC through State Government made sincere efforts to vacate the stay and release the land for car depot for one and half year, couldn’t succeed.

• As case was not resolved in reasonable time State Government allowed MMRC to opt for Aarey Milk colony site for Car Depot.

• Incidentally the case is still not resolved.
Why not at Kanjurmarg?

• Kanjurmarg option was given up after it was not possible to absorb the delays in getting land and also the additional time required dealing with the marshy land.

• Such complex projects are not open ended without timelines for individual activities.

• Thus while Line 3 project cannot use the said land, the same land pocket can be used for another metro line project if that fits into their respective commissioning dead lines.
Decisions at apex courts

Following claims have been thoroughly examined by Hon’ble Courts in various petitions filed and rejected on merits after hearing both the sides:

➢ Aarey is “Forest”:
Rejected by Bombay High Court in case of 2766/2017 and NGT 34 of 2015

➢ Change of Land use from NDZ to Car Depot is illegal:
Rejected by Bombay High Court in case of 2766/2017

➢ Shift Metro-3 Car Depot from Aarey Milk Colony to any of the alternate sites:
Rejected by Hon. Supreme Court (Ref SLP (C) No. 31178/2018, I.A.No 33819/2019)
Other objections and redressal

1) **Eco Sensitive Zone**: Not true, Car Depot land outside ECZ

2) **Illegal tree cutting**: Not true, no tree is cut without tree authority permission, 5 ha tree patch trees will remain unaffected

3) **Tribal community**: No tribal/Adivasi residence at all in car depot land
4) **Concretization of Depot would lead to flooding of Mithi river?**

- Depot site is unpaved in 75% of its area, that will allow the rain water to directly seep into the ground. All water ways passing through this area towards Mithi river are also channelized by proper SWD system approved by MCGM.

- Thus, the assumptions that 7.5 Ha paved area will lead to flooding of Mithi river if not correct.
Mitigation Measures

• **Transplantation**: 1,576 trees, 659 survived (45%), 1,266 new trees planted against 633 non survived trees

• **Compensatory Planation**: 14,346 trees
  - Trees of 6” to 12” girth & 12’ to 15’ ft height (Tree Authority Norms)

• **Plantation under CSR**: 9,500 trees
  - Trees below 5’ height (Forest dept Norms)
Mitigation Measures

• **Total Plantation: 23,846 trees**
  • Native species like Site Ashoka, Kadamb, Kaduneem, Arjun, Mohagani, Behada, Karanj, Kanchan
  • Locations: Aarey colony, Mankhurd, Kanjurmarg, Powai, Vidyanagari, BKC, Marol, SGNP
  • MOU with SGNP for plantation and maintenance for 7 years

• **Restoration of trees** at station locations after project completion: 3,000
  • Nurseries appointed

• **Project Neighbourhood**: 25,000 saplings
Tree Plantation
Tree Plantation
Tree Plantation
Transplanted Trees
How can we make Future Transport sustainable?

• More efficient and smart transport network: connecting the unconnected

• Commuter centric Transport: Safer, faster, more comfortable and sustainable

• Economic activity will be governed by the modifies public transport network

• Interchange stations to be new development nodes

• Transit oriented development to get a boost

• Multimodal integration and station area planning to be important
How can we make Future Transport sustainable?

- Last mile connectivity to be ensured in a planned manner
- Station Area Planning
- Rise in Electric vehicles
- Integrated and smart parking
- Extensive use of technology: Common mobility card, Smart cards, Transport Apps, On line journey planners etc
- More scope for pedestrianisation
- With enhanced Public Transport Capacity and more efficient connectivity ideas like Congestion Charge, restriction on private vehicles could be a reality
Mumbai Metro 3: Progress of Construction

TUNNELLING

➢ All 17 TBM working
➢ 34 Km of tunneling completed (62%)

STATIONS

➢ Work in Progress at all 26 Underground stations
➢ Secant piling 99 % (Stn Box) & 51 % (Entry/Exits)
➢ Excavation 76 % completed
➢ Base slab construction 41% completed
➢ Concourse slab construction 14% completed
➢ Mezzanine/ Plant room Slab construction 14% completed
➢ Roof Slab construction 3% completed

DEPOT

➢ Work in progress in 10 Ha of land (50% approx.);
➢ Earth work, SWD & Boundary wall completed in available area.
➢ Work to commence in remaining area after the tree cutting permission from MCGM.
Progress of Project

Cuffe Parade
Progress of Project

Vidhan bhavan
Progress of Project

[Image of construction site with text: Vidhan bhavan]
Progress of Project
Progress of Project

Hutatma Chowk
Progress of Project
Progress of Project

Grant Road Station
Grant Road Station
Progress of Project
Progress of Project
Progress of Project

Acharya Atre Chowk
Progress of Project

MUMBAI CENTRAL
Progress of Project

MUMBAI CENTRAL
Progress of Project

MUMBAI CENTRAL
Progress of Project
Progress of Project

EXCAVATION - MAHALAXMI
Progress of Project

Siddhivinayak
Progress of Project

Siddhivinayak
Progress of Project
Progress of Project
Progress of Project
Progress of Project

Shitaladevi
Progress of Project
Progress of Project

Dharavi
Progress of Project
Progress of Project

Vidya Nagari
Progress of Project

Santacruz
Progress of Project

Santacruz
Progress of Project
Progress of Project

Sahar road
Progress of Project

CSIA-T2 Station
Progress of Project

CSIA-T2 Station
Progress of Project

Marol
Progress of Project
Progress of Project
Progress of Project
Progress of Project
Progress of Project
Progress of Project
Progress of Project

Cross Passage Work
Progress of Project
Progress of Project

Naya Nagar Shaft
Progress of Project
Construction Sequence and Methodology: Tunneling

Tunnel Boring Machine: Total 17 TBMs for Metro 3
Construction Sequence and Methodology: Tunneling

Overview of Launching Shaft site
Construction Sequence and Methodology: Tunneling

Lowering of the Cutter Head
Construction Sequence and Methodology: Tunneling

Lowering of the Cutter Head
Progress of Project
Progress of Project
Progress of Project
Progress of Project
Progress of Project
Progress of Project

1<sup>st</sup> Breakthrough – CSMIA-Terminal-2 station
Progress of Project

17th Breakthrough
On going Construction: Casting Yard
Progress of Project

CASTING YARD
Progress of Project

Maintenance Workshop Building -
To Summarise

➢ A safe, efficient, comfortable and reliable public transport is a desperate need of MMR

➢ Saves lives, improves health and wealth

➢ Unlocks long term Environmental benefits

➢ Enormous economic benefits

➢ Employment and Business opportunities

➢ Faster and professional implementation

➢ Proactive support from the citizens and all the stakeholders

➢ One day’s delay and the exchequer looses Rs 4.23 Cr
Thank you for your kind attention