

# **A Presentation On**

## **Futuristic Smart Cities – Light Rail Transit System as Future Urban Transportation**

**By J.K. Bhatti**

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# ABOUT THE SPEAKER

**Name :** Jugal Kishore Bhatti

## Qualification:

- ❖ BE (Civil), Punjab University Chandigarh in Year **1982-86**.
- ❖ M. Tech. IITD (Building Science & Construction Management) in year **1997-98**.
- ❖ International Executive Diploma in Project Mngt, GWU, USA, in year **2015**.
- ❖ MBA (Finance) IGNOU in year **2017**.

## Experience (36 Year):

- ❖ *11 Year: Tenders, Highway, Ropeway, Rly sidings, MGR in Thermal Plants.*
- ❖ *1.5 Year: M.Tech, IITD (Study Leave)*
- ❖ *4 Year: Airport/Runway works.*
- ❖ *8 Year: 7 ICPs (India-Pakistan, India-Bangladesh, India-Myanmar Border)*
- ❖ *1 Year: Radar/Antenna Building 18 IAF stations.*
- ❖ *6 Year: 3 Metro Projects. Jaipur, Noida & Pune Metro.*
- ❖ *3 Year: NHSRCL & CONCOR Works*
- ❖ *1.5 Year: Rly. Electrification works.*
  - *Bhatinda-Ferozpur 87Km (Punjab)*
  - *Mavli-Bari Sadri 82 Km (Rajasthan)*

**Note: Now all projects are operational.**

## Trainings Attended:

- ❖ Railway Technology.
- ❖ 2-D Drafting, Productivity tools, 3-D Modeling.
- ❖ QMS ISO 9001:2000 Lead Assessor Course.
- ❖ Construction Project Management.
- ❖ Management Development Programme on Rail Based Urban Transport.
- ❖ International Exe. Diploma in Project Mngt.
- ❖ Tunneling, Conc. Tech, Pile Foundations
- ❖ MDP on Strategic & Project Management.
- ❖ Defect Free Construction &
- ❖ Preventive Vigilance.



# STRUCTURE OF PRESENTATION

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## 1) Smart Cities (Indian Context):

- ❖ *Background.*
- ❖ *Need & Objective of Smart City.*
- ❖ *Core Infrastructure Elements.*
- ❖ *Strategy adopted in Smart City*
- ❖ *Coverage & Financing of Smart City.*
- ❖ *Dholera 1<sup>st</sup> Smart City in India (Example).*

## 2) Smart Cities (World Wide):

- ❖ *That did wonders.*
- ❖ *That failed.*

## 3) Why : LRT as Futuristic Urban Transportation.

- ❖ *LRT : Environment, Health & Safety (EHS) benefits*
- ❖ *Advanced mass transit system.*

## 4) Challenges, Conclusion & Recommendations.



# BACKGROUND

## 19th Century (1801-1900).....Century of Empires.

- ❖ *Was empire of Spanish, Mughals, French, German, Russian, Italian & Japanese. But after Year 1815 was mostly **British dominance**.*

## 20th Century (1901-2000).....Century of Nation States.

- ❖ *During this period, number of nation-states in the world were tripled.*

## 21st Century (2001-2100)....Is a Century of Cities.

- ❖ **100 Years** ago, <**20 cities** in world had population >**10Lakh**.
- ❖ Today >**450 cities** population >**10Lakh**.

## SMART CITY CONCEPT :

In Year 1997., there was a **World form on Smart Cities** who suggested:

- ❖ *That **50,000 Cities & Towns** be developed around the globe.*

Many countries adopted concept, but **2 difficulties** in Smart City Definition were:

- ❖ *Confusion &*
- ❖ *Clarity in approach.*

**As cities will continue to grow. It will face challenges & threats to sustainability on core systems. Hence, Smart Cities concept originated.**

# NEED OF SMART CITY

## INDIAN CONTEXT

During Yr-2011 Census, it was emerged :

- a) **31%** City population contribute **67% GDP**.
- b) By 2030, **40%** population may shift to Cities & contribute to **75% GDP**.

**“So, with limited echo system most of metro cities may get choked”.**

GOI (In 2014) approved Rs.980Cr for :

- i) Developing **100 Smart Cities**.
- ii) Rejuvenating/Renovating **500 Cities**.

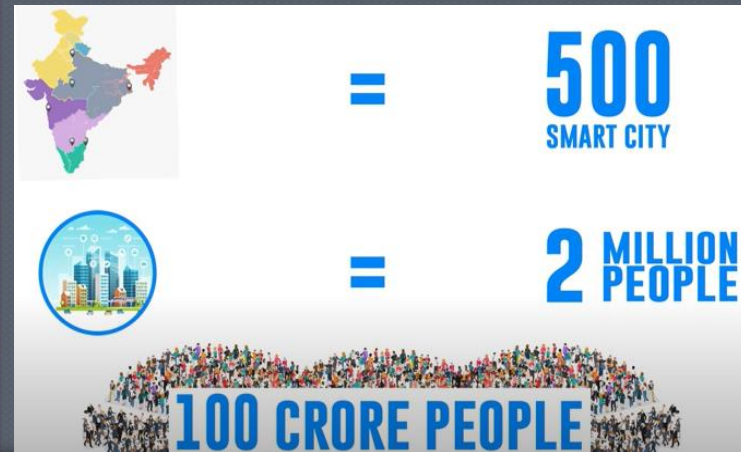
Assumption:

- ❖ If **1City** Can accommodate **20Lakh People**.
- ❖ Then **500Cities** if renovated can accommodate **100Cr. Population**.

## WORDWIDE CONTEXT

It is expected that:

- ❖ By **Year 2050** worldwide population may reach **990Cr**.
- ❖ **70%** of **990Cr** world population may shift to Cities.





# OBJECTIVES

Mission launched by Hon' PM of India on **June 25, 2015**.

## Main objective to Promote Cities:

- ❖ That provide **core infrastructure**.
- ❖ Give **clean & sustainable environment**.
- ❖ Give **decent quality of life** to citizens by smart solutions.



# CORE INFRASTRUCTURE ELEMENTS

## **Smart City Must Fulfill Following Basic Facilities:**

- ❖ Adequate Water Supply.
- ❖ Assured Electricity Supply.
- ❖ Sanitation, including Solid Waste Management.
- ❖ Efficient Urban Mobility
- ❖ Public Transport.
- ❖ Affordable housing, especially for poor.
- ❖ Robust IT connectivity & digitalization.
- ❖ Good governance & citizen participation.
- ❖ Sustainable environment.
- ❖ Safety & Security of citizens, women, children & elderly.
- ❖ Health & Education.



# STRATEGY

## Strategic components in Smart City Mission:

1	<b>Pan-City Initiative:</b>	<ul style="list-style-type: none"><li>❖ <i>At least one city has one smart solution.</i></li><li>❖ <i>This is foremost requirement.</i></li></ul>
2	<b>Area Based Development:</b>	<ul style="list-style-type: none"><li>❖ <i>First prepare Area Based Development Plan.</i></li><li>❖ <i>Then implement it.</i></li></ul>
3	<b>Retrofitting:</b>	<ul style="list-style-type: none"><li>❖ <i>Upgrade existing infrastructure.</i></li><li>❖ <i>Then reuse it.</i></li></ul>
4	<b>Re-development:</b>	<ul style="list-style-type: none"><li>❖ <i>If retrofitting not possible.</i></li><li>❖ <i>Then upgrade or repair it to Re-develop.</i></li></ul>
5	<b>Greenfield:</b>	<ul style="list-style-type: none"><li>❖ <i>Launch totally new project.</i></li></ul> <p><i>(<b>Note:</b> As there are no existing buildings or infrastructure in a greenfield projects. Hence, no need to dismantle or rebuild any existing structure).</i></p>



# 100 SMART CITIES

<b>1<sup>st</sup> List: 20 Cities: (Issued in Jan,2016)</b>	<i>Bhubaneshwar, Pune, Jaipur, Surat, Kochi, Ahmedabad, Jabalpur, Vishakhapatnam, Solapur, Bhuvangiri, Indore, Coimbatore, Kakinada, Belgaon, Udaipur, Guwahati, Chennai, Ludhiana, Bhopal &amp; areas under NDMC in New Delhi.</i>
<b>2<sup>nd</sup> List: 13 Cities: (Issued in May,2016)</b>	<i>Lucknow, New town in Kolkata, Bhagalpur, Dharmshala, Chandigarh, Faridabad, Raipur, Ranchi, Warangal, Agartala, Imphal, Port Blair &amp; Panaji.</i>
<b>3<sup>rd</sup> List: 27 Cities: (Issued in Sept,2016)</b>	<i>Agra, Ajmer, Amritsar, Aurangabad, Gwalior, Hubbaly-Dharwad, Jalandhar, Kalyan-Dombivali, Kanpur, Kota, Kohima, Madurai, Mangalore, Nagpur, Namchi, Nashik, Raurkela, Salem, Shivamogga, Thane, Thanjavur, Tirupati, Tumakuru, Ujjain, Vadodar, Vellore &amp; Varanasi.</i>
<b>4<sup>th</sup> List: 30 Cities: (Issued in June,2017)</b>	<i>Trivandrum, Naya Raipur, Rajkit, Amravati, Patna, Karim Nagar, Muzzafarpur, Puducherry, Gandhinagr, Srinagar, Sagar, Karnal, Satna, Bengaluru, Shimla, Dehradun, Tiruppur, Pimpri Chinchwar, Bilaspur, Pasighat, Jammu, Dahod, Tirunelveli, Thootukkudi, Tiruchrapally, Jhansi, Aizwal, Alahabad, Aligarh, Gangtok.</i>
<b>5<sup>th</sup> List: 9 Cities: (Issued in Feb,2018)</b>	<i>Silvassa, Dadra &amp; Nagar Haveli, Erode, Diu, Daman &amp; Diu, Biharsharif, Bareilly, Itanagar, Moradabad, Saharanpur, Kavaratti, Lakshadweep.</i>

S.N.	NAME OF SMART CITY	PROGRESS (%)	REMARKS
1	Ahmedabad (Gujarat)	86%	Dholera Special Investment Region (DSIR), India's 1st Greenfield Biggest Smart City.
2	Bhopal (MP)	92%	
3	Surat (Gujarat)	83%	
4	Udaipur (Rajasthan)	74%	
5	Bhubaneshwar (Odisha)	76%	
6	Indore (MP) & Varanasi (UP)	70%	



# COVERAGE & FINANCING

## Coverage:

- ❖ **Implementing Agency** : Ministry of Urban Development(**MoUD**)
- ❖ Plan **100 Cities** (5Years) & be **evaluated** by **MoUD**.
- ❖ **Smart City selection** : On *Equitable Criteria*.
- ❖ Equal weightage (**50:50**) to urban population & nos of towns in State/UT.
- ❖ *So each State/UT will have Smart Cities at least **1 (One)** in each.*

## Financing:

- ❖ In 5 Years, **Rs.48,000 Cr** be shared by Central Govt. Equal amount be shared by State & Urban Local Bodies (ULB).
- ❖ **Rs.1,00,000 Cr** (Rs.100Cr per city per YrX**100** Smart Cities).
- ❖ Mission be operated as Centrally Sponsored Scheme (CSS).



# INTEGRATED COMMAND & CONTROL CENTRES (ICCC)

❖ **ICCC are “Nerve Centres” of O&M.**

## Responsible for:

- ❖ *Controlling & Monitoring water & power supply.*
- ❖ *Sanitation & Traffic movement.*
- ❖ *Integrated building management.*
- ❖ *City connectivity & internet infrastructure.*
- ❖ *Linked to Crime & Criminal Tracking Network systems.*
- ❖ *Share on line data & information related to smart services.*
- ❖ *Management of COVID Crisis, people in quarantine etc.*

## NOTES:

- *For 100 Smart cities **100 ICCCs** are reqd.*
- *So far **80 ICCCs** have developed & rest **20** are in progress.*



# DHOLERA SMART CITY

## Dholera Smart City : Highlights:

- ❖ **Located in Gujarat.**
- ❖ **Cost :** Rs.95000Cr.
- ❖ **Started :** Year 2011 & 86% completed
- ❖ Has Multi transport system.
- ❖ Dholera International **Airport.**
- ❖ **Sea Port.**
- ❖ Delhi Mumbai **Express highway.**
- ❖ Ahmadabad **Mono Rail.**
- ❖ Well connected with **DFC.**
- ❖ **Unique sensor based Traffic Management System.**
- ❖ **Have ICD & SCADA Centre.**

## Admn. cum Business Centre(36000 Sqm. Area) which includes :

- ✓ All development agencies.
- ✓ All Command & Control Centre.
- ✓ Skill development centre.
- ✓ Single window clearance.

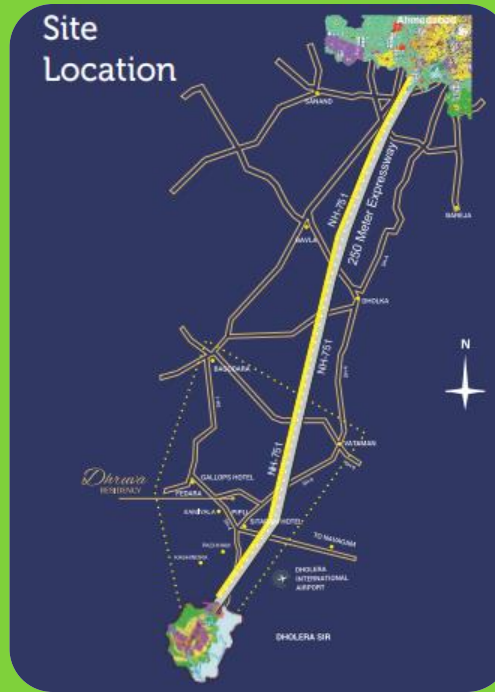
## DHOLERA IS :

- ❖ **1<sup>st</sup> Smart city in India, 6 times bigger than Shanghai.**
- ❖ **Comparable with world class smart cities of Dubai, Amsterdam (Netherland) & Venice city (Italy).**

## Mono Rail (Benefits):

- ❖ Proposed Mono Rail (Dholera to Ahmedabad).
- ❖ Cost:<MRTS (Constructional, Operational & Passenger)
- ❖ Space : Less & can take sharp curves.
- ❖ Speed: Mono Rail (40-60 KMPH) & MRTS (90KMPH).
- ❖ Coaches: Mono Rail (4-5Nos) & MRTS (6-8Nos)
- ❖ Rakes: Cheaper than Metro Rakes.
- ❖ Capacity :If <10,000 passengers in one hour. (Whereas in MRTS >40,000 shall be required)

*NOTE: Once Mono Rail Capacity of 10,000 passengers be achieved shall be 100% successful. So for any Smart Cities Mono Rail or Light Rail is better option.*



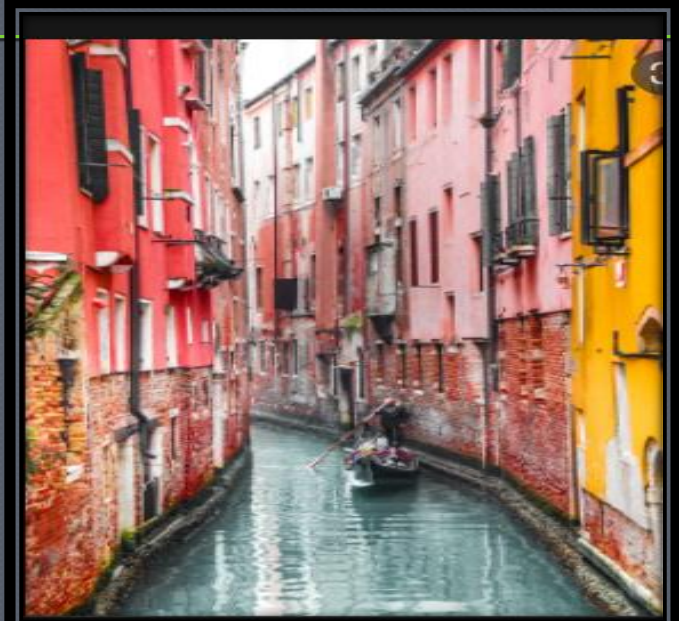


# SMART CITY : DID WONDERS

## VENICE CITY (ITALY)

### Smart City in real terms:

- ❖ City built on **>100 islands** in a lagoon in Adriatic Sea.
- ❖ **No roads but just canals.**
- ❖ **Unique** environmentally, architecturally & historically.
- ❖ **Set of services** make city safer.
- ❖ **Sensors, IT & 5G** network all make **city liveable.**





# SMART CITIES...DID WONDERS

## New York (USA):

- ❖ **Excellent Water**, Waste & Traffic, Tourism, Mobility Mngt.
- ❖ **Automated Meters** keep track of water usage & give city residents a clear snapshot of water consumption.
- ❖ **Smart sensors** monitor waste levels to air quality.
- ❖ **Kiosks on streets** give city inf. & phone charging).



## San Jose (California):

- ❖ **Use New Technologies** to solve longstanding problems.
- ❖ **Use air quality & sensors** to monitor atmosphere quality.
- ❖ **By Studying available data**, can reduce pollution & increase quality of air & cut down sound pollution in the city.



## Washington DC (USA):

- ❖ **Video cameras analyse data** to identify who & what is moving through city, including cars, buses, pedestrians & bikes.
- ❖ **Make better decisions** on how to direct traffic & identify where more resources are needed, such as bike lanes.
- ❖ **Ultimately smart city** is able to collect & analyze, the more city officials can find ways to **improve the infrastructure**.





# SMART CITIES...DID WONDERS

## Burlin (Germany):

- ❖ Facilities to drive starting to destination in “**autopilot**” mode.
- ❖ Technologies, sensors, cruise control, GPS navigation tech., lasers etc.



## Singapore:

- ❖ City of Future, 40 Years ahead of time, most liveable in Asia (Singapore, Helsinki & Zurich 3 smartest cities in world).
- ❖ Planners kept **80%** space for future.
- ❖ Introducing worlds first **driverless taxi system**.
- ❖ Plans to introduce driverless cars & buses etc.
- ❖ **Singapore Police Force** started using **special drones** to conduct aerial searches. Can reach 60meters height. Engineers equipped them with powerful sirens & a searchlight & 10 times powerful than car headlights.





# AMSTERDAM CITY (NETHERLAND)

- ❖ Stockholm, London, Paris & Singapore are **rich in waterways**. Roboat make these cities smart.
- ❖ As Traffic on land is complex than on water. So autonomous boats like ***Roboat is Future***.





# SMART CITIES...THAT FAILED

1) **Lavasa (India)**: Was to be built as a theme park. Designed for **250,000** inhabitants but in **mid 2018** only **10,000** remained. Earlier named **Hill of paradise** but failed miserably.

**Lesson Learnt:** *Political people involvement resulted in non taking approval from Govt.*



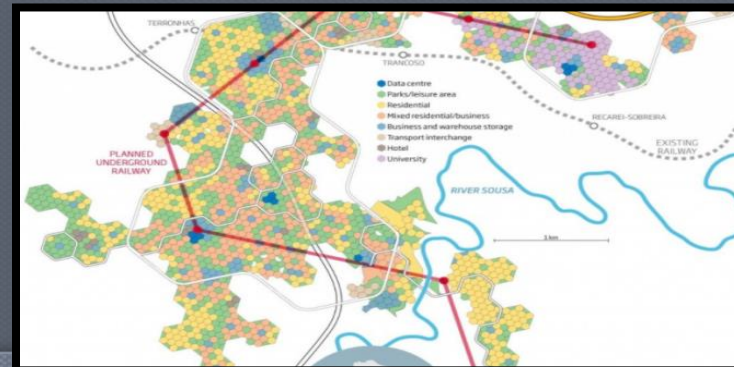
2) **Santander (Spain)**: Famous for city with highest sensors in world. In 2009 has **12,000 sensors** if compare with (Serbia, Germany & UK) who total had **20,000**. **But half finished & failed.**

**Lesson Learnt:** *Smart cities nothing if they simply decide to install sensors.*



3) **Planit Valley (China)**: Never managed to take off. Known as “**Portuguese Silicon Valley**”, expected to in house **2,25,000** people.

**Lesson Learnt:** *If developers not able to create a united team, not possible to attract investment.*





# FUTURISTIC SMART CITIES

**BIODIVER CITY : PENANG MALAYSIA**



**FOREST ARCHIPLAGO CITY:INDONESIA**



**MILLENNIUM CITY : PHILIPINES**



**COPENHAGEN CITY : DENMARK**





# TYPE & CHOICE OF METRO

TYPE	DESCRIPTION	CHOICE OF METRO
<b>Metro Rail (MRTS)</b>	<ul style="list-style-type: none"> <li>❖ Fully segregated (At grade, elevated &amp; U/G).</li> <li>❖ <b>Capacity 40,000 to 80,000</b> passengers per hour per direction (PPHPD).</li> </ul>	<ul style="list-style-type: none"> <li>❖ Capacity <b>40,000 to 80,000 PPHPD</b>.</li> <li>❖ When rapid service, higher quality ride &amp; service regularity due to grade separation is required.</li> </ul>
<b>Mono Rail</b>	<ul style="list-style-type: none"> <li>❖ Track of <b>Single Rail</b>.</li> <li>❖ Elevated &amp; <b>trains</b> suspended from it.</li> </ul>	<ul style="list-style-type: none"> <li>❖ When <b>lower capacities</b> are required.</li> <li>❖ But maintenance cost shall be higher.</li> </ul>
<b>Light Rail Transit</b>	<ul style="list-style-type: none"> <li>❖ At grade <b>segregated from main carriageway</b>.</li> <li>❖ Light Rail is modern version of Tram ways.</li> </ul>	<ul style="list-style-type: none"> <li>❖ Light Rail &amp; Tram Ways both <b>operate at road &amp; reserved corridor</b>.</li> <li>❖ Reduced speed &amp; capacity at same grade.</li> </ul>
<b>Tram Ways</b>	<ul style="list-style-type: none"> <li>❖ At grade <b>not segregated</b>.</li> <li>❖ <b>Move in mixed traffic</b> conditions.</li> </ul>	<ul style="list-style-type: none"> <li>❖ Without horizontal separation will have reduced speed and hence reduced capacity.</li> </ul>
<b>Bus Ways &amp; BRTS System</b>	<ul style="list-style-type: none"> <li>❖ <b>Demarcated Bus lanes</b> along main carriageway with <b>segregated corridor for buses</b>.</li> <li>❖ BRT &amp; LRT at grade require linear pathways.</li> <li>❖ Reduce space for other traffic on existing road.</li> </ul>	<ul style="list-style-type: none"> <li>❖ Capacity <b>10,000-15,000 PPHPD</b> on single lane but can be enhanced with additional lanes.</li> </ul>
<b>Regional Rail</b>	<ul style="list-style-type: none"> <li>❖ <b>Connecting outskirts</b> to centre of the city.</li> <li>❖ Caters to passenger services within a larger urban/metropolitan area .</li> </ul>	<ul style="list-style-type: none"> <li>❖ More halts at less distances compared to Railways but higher speed than metro rail.</li> <li>❖ Delhi-Meerut (90Km).</li> <li>❖ Delhi-Panipat (111Km)</li> <li>❖ Delhi-Alwar (180Km)</li> <li>Note : Above shall reduce congestion on roads.</li> </ul>

**Note: Above capacities of different systems is a guiding parameter. Whereas choice of mode will depend on overall feasibility of transport system.**



# WHY : LIGHT RAIL TRANSIT SYSTEM

## Metro Lite or Light Rail Transit System:

Also called as LRT, Metro Light or Mass Tram System. Sharpest Curve is 75Mtr.

### ❖ **Cost: Reduction up to 40%.**

✓ *Light Metro : Rs.150-200 Cr. Per KM.*

✓ *Neo Metro : Rs.70-80 Cr. Per KM.*

### ❖ **Less Construction & O&M Cost.**

### ❖ **Less Transmission losses (Energy Saver).**

- ❖ Fully constructed at GL with side platforms.
- ❖ Have dedicated tracks.
- ❖ Both side fencing & Travel parallel to roads
- ❖ No concourse or ticketing platform.
- ❖ Has CBT Signalling System & not in trams.
- ❖ Ticket checking staff is more in LRT.
- ❖ Space & Speed : < Normal metro.
- ❖ Speed & capacity : >Tram.
- ❖ Coaches : Less up to 3 Nos.
- ❖ Can accommodate 300 persons.
- ❖ Exclusive right-of-way & Separated from traffic.
- ❖ Needs less Resources & facilities.
- ❖ Act as Light Rail Transit System & like trams.
- ❖ Useful if more public/less transp. System.
- ❖ Accompanied with best coaches/rubber tyres.

***“Best for Smart cities for lesser ridership”***

**MRTS Metro:** Run on viaduct or UG & needs proper tracks, stations & is very costly affair. Sharpest curve is **120 Mtr.**

### **Cost, O&M & Transmission Losses: High**

✓ *MRTS (Ele.) : Rs.250Cr. Per KM.*

✓ *MRTS (U/G) : Rs.450 Cr. Per KM.*





# LIGHT RAIL TRANSIT SYSTEM : EHS BENEFITS

## Environmental Benefits:

- ❖ Decrease of use of private vehicles resulted in decrease in air pollution & Green House Gas emissions. ***So, is Environment Friendly.***
- ❖ Electric powered light rail reduces Carbon Footprints & meet sustainable development objectives. ***Thus promotes use of renewable energy sources.***
- ❖ Helps **Paris Agreement** i.e. to keep mean global temperature below **2 °C**.

## Health Benefits:

- ❖ LRT is comfortable, Cheap, fast & reliable mode results as **more productive**.
- ❖ Less noise compared to other Modes of transport.
- ❖ Compact city planning reduce urban sprawl & preserve green spaces.
- ❖ Ensure protection of natural areas & enhancing the overall livability of cities.

## Safety Benefits:

- ❖ Safe as manned by CISF, ACs give **75%** fresh air circulation & sanitized regularly.
- ❖ Contribute to vibrant, accessible & environmental urban environment.

## SUMMARIZING ABOVE:

- 1) **LRT System** make cities sustainability, greener, livable & resilient both for present & future generations.
- 2) **AI system** detect all traffic pattern, accidents finally increase safety.



# LRT UNDER CONSIDERATION

- ❖ **Kolkata** has proposed **Light Rail Transit** as MRTS for city.
- ❖ **“WB Govt. & SREI Infrastructure Finance”** both has also signed a MOU to set up **Light Rail Transit System**.
- ❖ **UP Govt** (Yr:2020) approved 27.84Km LRT at **Gorakhpur**:
  - ✓ *Corridor-1: Shaym Nagar-Subha Bazar 16.5Km & 16 stations.*
  - ✓ *Corridor-2: Gulhera-Kachehary Chowk 10.46Km & 11 stations.*
  - ✓ *Nos of coaches: Initially 2.*
  - ✓ *Project Cost : Rs.4672 Cr.*
- ❖ **DMRC** did survey for light metro between **Shastri Park & Kondli** & working on plan to build a new corridor on which **low-cost light metro** will run.
- ❖ **Rail Bus** is being planned in **50Cities** in India.



# METRO LITE -LRT



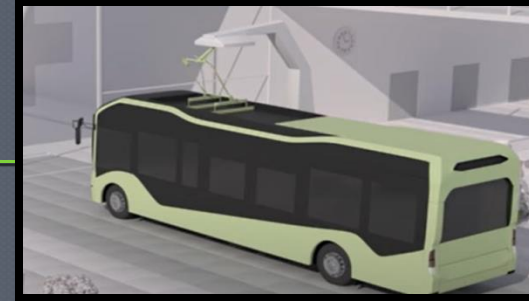


# ADVANCED MASS TRANSPORT SYSTEM

- 1) Using **silence & emission free buses**, public transport be brought closer. **So, future is electric.**
- 2) Few countries started **Pod taxi system**. In India **Gurgaon** shall also be starting Pod Taxi Service.
- 3) Public transportation of **Berlin (Germany)** is user-friendly (**324 cars for 1000 inhabitants**).

*Based upon engine size & CO2 emissions the German Govt. imposes a heavy **Vehicle Tax**. So people are less attractive to purchase large cars for their own use.*

- 4) **90% Hong Kong's** population uses public transit system (**double checker buses**) which is clean, safe, fast & efficient.
- 5) In **Tokyo**, nearly **8.66 million** passengers per day use rail transport.





# CITIES OF FUTURE (WORLD IN 2050)

## 1) Masdar City UAE :

- ❖ **World's 1<sup>st</sup> City** with **Zero Carbon & Waste**. It shall be 15degree cooler & most sustainable city on earth.



## 2) Liuehou, China:

- ❖ Smart high tech cities to forest cities.



## 3) Xiong' An, China:

- ❖ Self Sufficient city & **80%** energy from solar system.



## 4) Oceanix Concept City, China:

- ❖ Rising sea levels may affect **90%** of coastal cities. So concept of floating City for 10,000 people developed.



## 5) Amaravati, India:

- ❖ Pollution free City, 60% covered with greenery/water.



## 6) New Clarke City, Philippines:

- ❖ Pollution free City, using green energy.



# FUTURE TRANSPORT

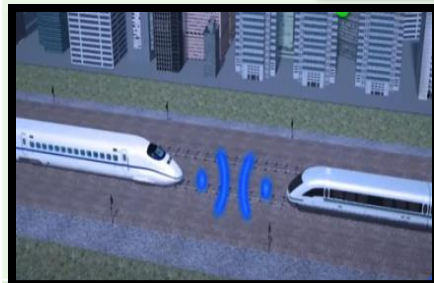
**Dubai** is planning to introduce Flying Drone Taxi Service.



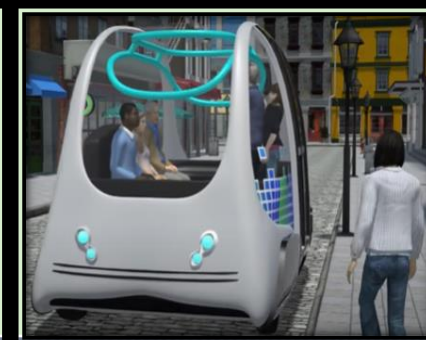
**UK Rail** planning that smart phones be replaced with biometrics with finger prints & eye scans. So passengers be identified & charged accordingly.



**UK Rail** developing trains that will communicate to avoid conflicts at junctions. This will allow frequent services & fewer delays.



**Driverless Toboxy buses** likely to be started. Wherein passengers be able to order ticket from their phone after registering details & photo. Then face be recognized.





# SMART CITY ...CHALLENGES

**Huge Cost** : Rs.7Lakh Cr is required in a span of 20Years. Too difficult for Govt. to finance. ***So looking for cooperation from private sectors.***

**Organization**: Due to involvement of many stakeholders & depptt, cities are interested to function by their own. ***This necessitates sign-off of many stakeholders with increased likelihood that an initiative gets derailed.***

**Cost allocation**: How operation expenses are allocated, who benefits & how to divide responsibilities critical questions. ***Without clearly addressing such questions, smart city programs stall.***

**Benefits to citizens**: Executive management, mayors & councillors have to answer to citizens. ***So are much confused of making investments in programs that don't directly 'touch' citizens with visible benefits.***

**Technology development**: *Evaluating new technologies is time consuming process & cities don't move too fast which creates a cascading flow of new technologies. This obstructs implementation.*

**Lastly, how future smart cities not only be smart. But shall be sustainable & resilient is a big question?**



# CONCLUSION & RECOMMENDATIONS

## Light Rail Transit System:

- ❖ *Needs Low Capital cost.*
- ❖ *High reliability.*
- ❖ *Rails can be laid separately or on roadways.*
- ❖ *If no train then can be used as normal road.*

*Hence, if light metro on need basis be opted at Smart Cities. Then be a substantial cost cutting & in parallel metro shall also be sustainable.*



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**Thank you for your kind attention.**