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# **Lessons in Urban Transport Planning and Governance:**

Based on the Proposed Metro Rail System in Pune

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## Abstract

*This paper critically analyzes the decision making systems behind the proposed Pune metro rail system and its detailed project report, and exposes many weaknesses in both. The decision making system is seen to be ad-hoc, and not sufficiently transparent or participative. The detailed project report suffers from many serious methodological and analytical errors. This analysis and experience from other cities suggests that cities are increasingly seeking single large, big-budget solutions to their urban transport problems without exploring the many simpler, cheaper and more effective options that are available.*

## 1. Introduction

In early 2010, Pune Municipal Corporation (PMC) approved a proposal to build a metro rail system in Pune based on a Detailed Project Report (DPR) prepared by the Delhi Metro Rail Corporation or DMRC (DMRC 2009). This decision was taken despite numerous concerns raised by many citizens groups and experts about various issues such as the choice of gauge and its impact on system cost, throughput etc., financial burden sharing by citizens of Pune, impact of an over-ground metro on the city's heritage and skyline, impact of the proposed routes on buildings in the city and impact of the proposed FAR<sup>1</sup> increase (Various 2010, Parisar 2010). In this paper, we critically analyze both the decision making process behind approving the metro rail proposal and the metro rail proposal itself. The analysis also leads to broader questions regarding planning and governance of urban transport in the country.

The proposal initially approved by PMC was for two corridors of metro rail. Subsequently, due to a delay in arriving at an agreement with neighbouring Pimpri-Chinchwad regarding corridor I, PMC decided to proceed with corridor II which is entirely within its jurisdiction.

Corridor	Length	Over-ground stretch	Estimated cost (Rs cr)	Expected daily ridership		
				2011	2021	2031
I: PCMC-Swargate	16.5 km	11.5 km	4,911	348,387	397,228	443,849
II: Vanaz-Ramwadi	15 km	15 km	2,217	136,309	212,020	290,515

**Table 1: Details of proposed metro rail system**

Table 1 gives an overview of the proposed metro rail system (DMRC 2009). The capital costs are not inclusive of any taxes and based on September 2008 prices, and come to about Rs. 226 cr per km. Proposed peak hour headways for the corridors are about 3.5 to 4.5 minutes for corridor I, and 8 to 12 minutes for corridor II. The ridership estimates are based on dense (or super-crush) loading of 8 persons per sq m. The DPR predicts that at this ridership and cost, the proposed metro rail will have a positive socio-economic impact on Pune.

## 2. Decision making processes behind Pune metro rail

We reconstructed the timeline of various events that led to the approval of the metro rail proposal by the General Body of the PMC based on answers to a set of questions asked under the Right to Information Act. An analysis of these replies suggests that the DPR was

<sup>1</sup> Floor Area Ratio or Floor Space Index

commissioned without sufficient justification, the terms of reference for the DPR were weak and there were weaknesses in PMC's governance processes and engagement with citizens.

## **2.1 Ad-hoc decision making and weak terms of reference**

PMC commissioned DMRC to prepare a DPR for metro rail based on the views expressed at two meetings involving city MLAs in June and September 2006, and a previous study by RITES (RITES 2001). But the scope of work given to RITES for its report was only to forecast the demand for a high capacity mass transport network and identify suitable corridors for it. Thus, the RITES report was also commissioned presupposing the need for a high capacity network rather than to evaluate whether one was needed. The only other justification cited by DMRC is a guideline from the Ministry of Urban Development (MoUD) that all cities with a population of over 3 million should consider metro rails<sup>2</sup>. However, this guideline itself is questionable as the need for a metro rail is not dependent only on the city's population but also on city form, presence of a central business district etc. (Mohan 2008).

The terms of reference given to DMRC for the DPR only asked it to identify about 30 km of suitable corridors for a metro rail system. This is despite MoUD's guidelines for mass transit DPRs clearly stating that such DPRs should be part of an integrated, comprehensive plan, provide an analysis of alternatives, details of stakeholder consultations and details of feeder networks, parking and para-transit facilities<sup>3</sup>. Further, the 30 km figure mentioned in the terms of reference also appears to be without basis as even the earlier RITES report had only suggested an initial phase of 22.5 km.

Therefore, it may be said that the DPR for Pune's metro rail was commissioned based on some ad-hoc recommendations and without any previous comprehensive multi-modal study of Pune's transport justifying the need for a metro rail<sup>4</sup>. Moreover, its terms of reference did not comply with the guidelines of MoUD and consequently the report submitted by DMRC did not consider alternatives, feeder services etc.

## **2.2 Governance processes**

The governance processes adopted during the decision making for Pune's metro rail also raise some serious questions:

1. PMC put up the metro rail DPR on its website soon after it was received. However, it did not actively seek public inputs and initiate a public debate about this. In fact, the appendix to the letter from PMC to Government of Maharashtra requesting approval for implementing corridor II mentions that since DMRC are proven experts regarding metro rail, their report needed no critical review by an independent committee (PMC 2010).
2. Six months after the DPR was submitted, the Standing Committee of the PMC approved it in just one day based on a request from the Municipal Commissioner. Some members of the Standing Committee admitted later at a public meeting that they approved the DPR without even reading it 'believing' it was in the city's best interests.

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<sup>2</sup> Response from DMRC to PMC regarding questions raised by the author in a letter dated 20<sup>th</sup> May 2009.

<sup>3</sup> The guidelines were released in November 2006 – 2 months before the contract between DMRC and PMC was signed.

<sup>4</sup> A Comprehensive Mobility Plan (CMP) for Pune was presented in 2008 (WSA 2008a), well after the metro rail DPR was commissioned in 2007. Hence the CMP cannot be used to justify commissioning the metro rail DPR.

3. PMC organized a ‘public hearing’ in June 2010 – which was very unstructured and disorganized – to understand citizen’s grievances about the proposed metro rail. PMC’s request to the Government of Maharashtra seeking permission to proceed with corridor II claimed that grievances raised at the hearing had been addressed satisfactorily (PMC 2010). However, as the following examples from the appendix to the request show, the answers were rather unsatisfactory.
  - a. It states that previous studies like the Comprehensive Mobility Plan (CMP) were studied to finalize routes for the metro rail and the metro rail was suggested in the CMP, though the CMP was commissioned *after* the metro rail DPR. Indeed, the metro rail DPR does not even mention the CMP, while the CMP refers to the DPR clearly pointing to their relative chronology.
  - b. It states that the viability of the project would be ensured by private funders who may fund 50% of the project cost. Such a statement coming from a public authority such as the PMC is of grave concern and displays a lack of understanding of the distinction between financial viability of a project and its social desirability<sup>5</sup>. Given that fare box revenues will not be sufficient for a reasonable return on investment<sup>6</sup>, investors would necessarily depend on some form of Government support in the form of viability gap funding, higher taxes, free or subsidized land concessions etc. – all of which would be paid by citizens.
  - c. It states that improvement and strengthening of PMPML (the city bus service) is continuing in parallel though PMPML has not had a full-time CMD for over a year and many posts on its Board of Directors have been vacant since its formation.
  - d. It states that the plan prepared by DMRC is a comprehensive transport plan though PMC’s own terms of reference to DMRC clearly state that its job was only to identify approximately 30km of metro rail along feasible corridors.
4. PMC agreed to extend the proposed corridor II to the current airport and Kharadi subject to demand, finance etc. These extensions seem arbitrary as there are no studies to justify them, particularly when a new airport has also been proposed for Pune.
5. PMC approved an FAR increase by 4, stating that it was required to increase metro rail ridership and raise finances for it. However, the DPR predicts a dense load of 8 persons per sq m with the current land use pattern, suggesting that corridor densification is not required for the desired ridership. If anything, the increased FAR would only increase congestion along these corridors. As the DPR states that only 6% of total revenue is expected from property development (table 12.4), FAR increase is not critical to finance the metro rail. This raises doubts about the true motives for the proposed FAR increase.

### 3. Critique of Pune metro rail DPR

In addition to *ad-hoc* decision making, weak governance and inadequate public engagement by PMC, our analysis also identifies serious shortcomings with the DPR submitted by DMRC (DMRC 2009). These include methodological errors and huge over-estimation of the benefits from the metro rail which are then used to demonstrate that it has a positive social impact. We had written to DMRC on 15<sup>th</sup> October 2010 requesting clarification on many of the points listed below but received no response from them until 10<sup>th</sup> December 2010.

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<sup>5</sup> Indeed, the infamous Dabhol power project (Enron) was also deemed viable by its promoters but at great cost to citizens!

<sup>6</sup> For example, it is estimated that only about 60% of Delhi metro’s revenues come from the fare box.

### 3.1 Methodological problems

The methodological problems in DPR submitted by DMRC are listed below.

1. DMRC commissioned a report from IIT Bombay to project ridership along potential metro rail corridors (IIT Bombay 2008). To do this, IIT Bombay used a 'stated preference survey' asking citizens for their preferred mode of public transport from among various alternatives. Such surveys need to be carefully designed as they can introduce a bias in a respondent's answer. But the IIT Bombay survey used a leaflet which stated that Pune's metro will provide "cost of travel comparable to bus fare, trains will run at convenient frequency of 3 minutes during peak hours and comfortable sitting in A/C environment". None of these claims holds true in the DPR<sup>7</sup>. Therefore, the ridership figures were estimated from a deeply flawed consumer survey, which advertised a service that was very different from the service that was actually designed.
2. The commuter survey also asked respondents to choose between the *proposed* metro rail and *current* frequencies and capacities of existing modes. This ignores the possibility that frequencies and performances of both the existing bus system and suburban rail system can be significantly improved at a fraction of the cost and time required for the metro rail. In other words, the metro travel demand was forecasted by comparing an ideal yet-to-be-implemented metro rail with the current state of other neglected and under-funded public transport services.
3. Public transport modes such as the metro rail are considered desirable because they can wean people away from their private vehicles. For this, various public transport modes must complement each other and not compete. But, the DPR is silent about integrating the metro rail with other public transport modes. In fact, the two proposed corridors compete with the proposed BRT and existing suburban rail along their entire length<sup>8</sup>.

In addition to these methodological errors, the report also contains many data anomalies and inconsistencies which raise more questions about the quality of the DPR from DMRC.

### 3.2 Cost-benefit analysis

One of the key justifications given by the DPR for its proposal is a socio-economic cost-benefit analysis which shows that the socio-economic benefit of the project outweighs its costs<sup>9</sup>. The costs considered in the DPR are the capital and operational costs, while societal benefits are said to arise from various categories such as savings in time, fuel, vehicle maintenance cost and infrastructure maintenance cost. It is questionable how much productive use can be made of the few minutes saved per trip by a person, and whether items such as reduced vehicle maintenance costs should even be considered. Moreover, the costs considered in the DPR do not include costs such as the cost of capital.

Even if we overlook these discrepancies, the cost-benefit analysis given in the DPR is flawed. The DPR estimates total benefits to society from the metro rail in 3 horizon years – 2011,

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<sup>7</sup> The fare table given in the DPR indicates that metro rail fares are higher than bus fares for over 80% of the trips. Corridor II (to be implemented by PMC) has a peak hour frequency of 8 minutes even in 2031, while even corridor I has a peak hour frequency of only 4 minutes in 2031. The ridership figures in the DPR were based on dense loads of 8 persons / sq m and not comfortable sitting in A/C.

<sup>8</sup> Corridor I recommended by the DPR completely overlaps with BRT routes 1 and 3A (Nigdi to Katraj) stated in the DPR for the BRT system, and also overlaps the existing suburban railway line for 75% of its length. Corridor II is fully covered by BRT routes 2, 2A and 5A as given in the BRT DPR. However, DMRC claims that the overlap is only for "small lengths" (see footnote 2).

<sup>9</sup> See Chapter 13 of (DMRC 2009). In particular Table 13.7 lists the benefits of the project.

2021 and 2031. We show that the benefit claimed for 2011 is vastly over-estimated – the same analysis also applies to the other years. We analyze the three categories (time savings, vehicle maintenance savings and fuel savings) with the largest claimed benefits and provide alternative estimates using data from the DPR itself such as trip length distribution and metro rail ridership, augmented with a set of conservative assumptions such as fuel cost of Rs. 60 / litre, average mileage of 45 kmpl and annual maintenance cost of Rs. 3000 for two-wheelers, and 10 kmpl and Rs. 15000 for cars<sup>10</sup>. Other assumptions made are explained at appropriate locations below.

### 3.2.1 Time savings

According to the DPR, the most significant reported benefit accrues from the value of time saved by shifting to metro rail from other modes. Each metro rail trip is estimated to save 45 minutes in 2011 and the claimed money-equivalent savings of the aggregate annual time saved adds up to 56% (Rs. 524 cr) of the total claimed annual benefit (Rs. 934 cr). This includes not only time saved in travel but also the walking and waiting time for one's transport and money/time equivalent of factors such as travel comfort.

Many reports, including a study commissioned by DMRC, state that Pune's average peak hour road speed is about 20-25 kmph, while the speed of the proposed metro rail is 33 kmph (WSA 2008a, WSA 2008b, IITB 2008, DMRC 2009). The DPR also states<sup>11</sup> that 75% of journeys are shorter than 9km. Assuming an average speed of 20kmph for other modes, 75% of journeys would take a maximum of 27 minutes by other modes and 16 minutes by metro rail. Therefore, the travel time saving is just 11 minutes for 75% of the journeys.

Metro rail users who have shifted from two wheelers or cars would not save any time in walking to the metro rail station and waiting for a train – in fact, they would lose time. Given that peak hour ridership estimated for the metro rail is based on dense loads of 8 persons per sq m, they would also not gain anything from added travel comfort. Therefore, the maximum saving for all such metro rail users would be at most 11 minutes over 75% of journeys, with actual savings even lower due to reduced time savings and comfort.

Users who have shifted from buses could perhaps have some time-equivalent saving due to higher waiting times and discomfort factors, though their walking times are likely to increase since bus stops are likely to be closer to homes and offices than metro rail stations. Even the higher waiting time and discomfort factors are questionable because: a) peak hour headway of the proposed metro rail corridors is only 4 and 8 minutes in 2031, which a bus system can easily match and b) the metro rail is designed for dense loads of 8 persons per sq m which is comparable to buses at peak hour. Even if we conservatively assume that all bus users pay a penalty of 15 minutes per trip (10 minutes for waiting and 5 minutes for discomfort), 75% of bus users switching to metro rail would have a time-equivalent saving of only 26 minutes<sup>12</sup> as their journeys would be less than 9 km.

This suggests that the time-savings component presented in the DPR is vastly over-stated. A detailed analysis (see Section 3.2.4) shows that even if all the metro rail trips are by users who switched from buses (thus providing maximum time savings), the total time savings in 2011 comes only to Rs. 273 cr or just 52% of the claimed Rs. 524 cr savings.

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<sup>10</sup> Further, we assume that the vehicle maintenance cost of users who would have used a two-wheeler or car in the absence of the metro rail will reduce by 50%.

<sup>11</sup> See table 12.6 of the DPR.

<sup>12</sup> 11 minutes as saved by car and two wheeler users and 15 minutes additional penalty for buses.

### **3.2.2 Fuel savings**

The DPR estimates Rs. 123 cr savings in 2011 to come from fuel savings by considering a modal shift to metro rail from other modes. This does not account for behavioural changes such as induced travel and longer commutes that may result because of the introduction of a metro rail system. Even if one ignores such oversights, the claimed benefits in this category are still over-estimated<sup>13</sup>.

Based on the assumed fuel efficiencies for two-wheelers and cars, and actual bus fares projected for 2011, our estimates show that fuel savings are only to the tune of Rs. 37 cr (30% of claimed benefit) under a reasonable scenario of 35% of metro rail users switching from buses, 40% from two-wheelers and 25% from cars. It is only in a scenario where about 65% of the metro rail users switch from cars (thus providing the greatest fuel savings), that the estimated fuel saving come close to the claimed saving. But note that such a metro rail usage pattern would greatly reduce time savings.

### **3.2.3 Vehicle maintenance savings**

The second highest category of claimed savings (Rs. 161 cr in 2011) comes from savings in vehicle maintenance costs. Using our assumption of a 50% reduction in vehicle maintenance cost of persons switching to the metro rail from their vehicles, the estimated savings in this category is only Rs. 60 cr in 2011 (37% of the claimed benefit) when 35% of metro rail users come from buses, 40% from two wheelers and 25% from cars. The claimed savings become possible only when about 85% of metro rail users have shifted from cars. Note once again that such a share of shifts from cars greatly decreases time savings.

### **3.2.4 Benefit comparison**

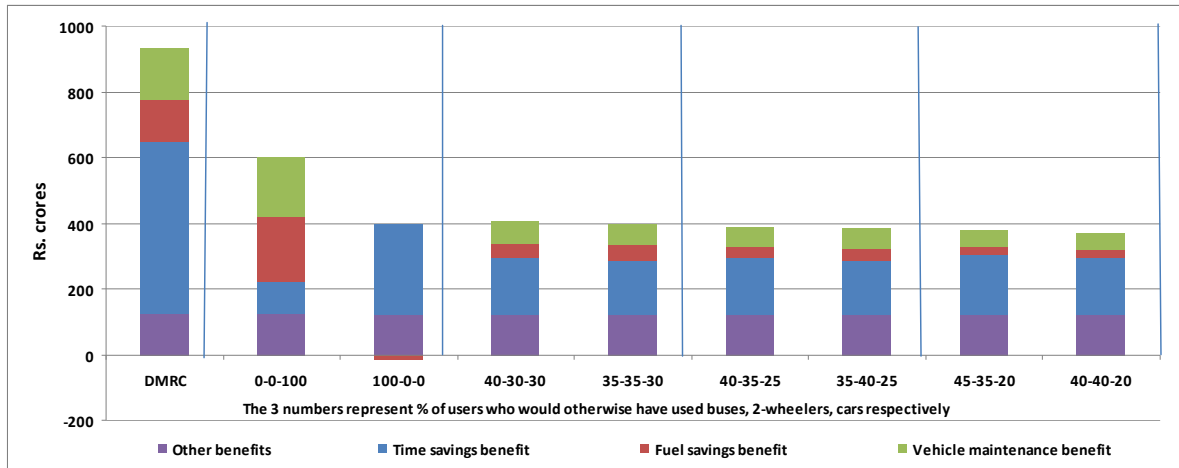
We now consider different possible ridership scenarios for the proposed metro rail and estimate likely benefits in 2011 and compare them against the benefits claimed by the DPR. Each scenario represents a particular combination of shifts from buses, two-wheelers and cars to metro rail<sup>14</sup> and benefits under these scenarios are calculated using the DPR's methodology in spite of our reservations about it.

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<sup>13</sup> In the absence of a response from DMRC for an explanation of this figure, we assume that the claimed benefit in this category is the sum of fuel costs saved by commuters using the metro rail instead of their own vehicles, and saved fare box costs for those shifting from buses.

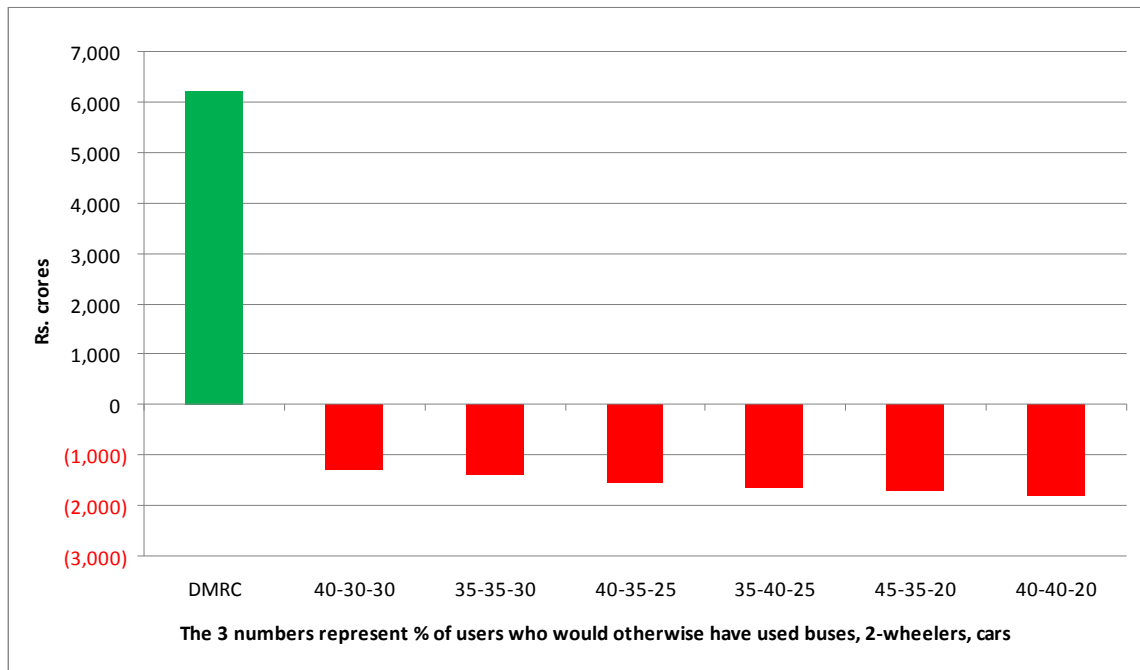
<sup>14</sup> The DPR does not provide a breakdown of percentage shift from other modes to metro rail.





**Figure 1: Estimated savings under various scenarios of shifts**

Figure 1 presents the benefit under different scenarios. The DMRC scenario represents the benefit claimed in the DPR, while scenario x-y-z represents x% of metro rail users coming from buses, y% from two-wheelers and z% from cars. The 0-0-100 and 100-0-0 scenarios represent the extreme scenarios where all metro rail users come from either cars or buses respectively, and correspond to the maximum overall estimated benefit and maximum benefit from time saved. This is followed by six scenarios, each representing a ‘reasonable’ modal shift. As can be seen, the estimated benefit in all scenarios is considerably lower than claimed in the DPR. The highest estimated benefit is in the extremely unrealistic 0-0-100 scenario which is also 36% lower than claimed. The estimated savings in all other scenarios (including the 100-0-0 scenario<sup>15</sup>) is only about 40% of the claimed savings, thus establishing that the benefits claimed in the DPR are highly exaggerated.



**Figure 2: NPV of DMRC DPR under the different scenarios at 12% discount rate**

<sup>15</sup> In this scenario, fuel saving is negative because bus fares are mostly lower than metro rail fares.

### 3.2.5 Desirability of the metro rail system

Based on the presented cost and benefit flows, the DPR concludes that the proposed project has an overall socio-economic return of about +5% at a 12% discount rate, and hence is good for the city. We calculate the socio-economic NPV of the metro rail (also at 12% discount rate) using our benefit estimates and the costs given in the DPR under different scenarios (Figure 2). As can be seen, the proposed metro rail has a negative socio-economic NPV in all scenarios according to our estimates, in spite of our conservative assumptions. We have also not considered issues such as not achieving the projected ridership as seems likely (Mohan 2008)<sup>16</sup>. This raises serious questions about the DPR and whether the proposed metro rail is desirable at all for Pune.

Given the serious flaws in the DPR suggested by our analysis, it should be critically reviewed by the Government of Maharashtra and Government of India. In addition, the Delhi metro's under-achievement of ridership and questions asked about its accountability and governance by the Comptroller and Auditor General strongly indicate that DMRC project reports must not be accepted on faith by city administrations (CAG 2008).

## 4. Lessons for urban transport planning and governance

The problems highlighted above are not unique to Pune but indicative of broader concerns regarding urban transport planning and governance in the country. There appears to be a worrying fascination for expensive 'big-ticket' projects which are seen as silver bullets that will address the mobility problems of a city. Thus, cities such as Kochi, Chandigarh, Ludhiana and Thiruvananthapuram<sup>17</sup> are actively considering metro rail, though the estimated population in 2010 of Ludhiana, the largest of these cities, will only be 2.2 million<sup>18</sup> – well below even the arbitrary criterion of 3 million apparently laid down by MoUD. This fascination for large projects leads to total neglect of other smaller, cheaper, easier-to-implement and often more critical modes of transport such as walking, cycling and bus systems. For example, PMPML, the bus system which today serves over a million commuters daily (50% more than the combined 2031 ridership of the proposed metro rail corridors), has not had a full-time CMD for over a year now and it does not have space for its depots<sup>19</sup>, and pedestrian and cycling infrastructure continues to crumble<sup>20</sup>. Similarly, Kochi's suburban rail and ferry services serving all islands languish for lack of Rs. 200 cr investment, even as a metro rail for one route is proposed at a cost of about Rs. 4400 cr (Parisar 2010). This trend of promoting big budget projects without clear accountability for measurable improvements in delivered transport services at minimal cost needs to be urgently reversed.

Decision making in most urban local bodies (ULBs) continues to be non-transparent and non-participative, as shown by the experience of Pune and Hyderabad (Ramachandraiah 2009), resulting in projects being finalized without the citizens having any say in them. To make matters worse, most ULBs lack the capacity to plan, analyze, and manage complex projects, which results in faulty project proposals being accepted. Decision making also often tends to be *ad-hoc* rather than scientific, as exemplified by the arbitrary extension of corridor II of

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<sup>16</sup> Interestingly, the expected ridership page on the Delhi metro website is still 'under construction' as of 10<sup>th</sup> December 2010 (See [http://delhimetrorail.com/projectsupdate/expected\\_ridership.aspx](http://delhimetrorail.com/projectsupdate/expected_ridership.aspx))

<sup>17</sup> From the projects listed on DMRC's website and <http://www.zeenews.com/news667685.html> accessed 17<sup>th</sup> Nov 2010

<sup>18</sup> Even assuming a generous 5% p.a. population growth since the 2001 census.

<sup>19</sup> "Depots can house only half PMPML fleet", Indian Express, Pune, November 15<sup>th</sup> 2010

<sup>20</sup> "Here pedestrians tread on loose, broken tiles", Times of India, Pune, September 25, 2010 and "City's cycle plan must look at safety first", Times of India, Pune, November 1, 2010

Pune metro rail and by periodic proposals for schemes such as sky-bus or monorail<sup>21</sup>. Similarly, there are also no clear criteria for when metro rails should be over- or under-ground, with decisions seemingly made based on situational expediencies.

Despite guidelines to the contrary from MoUD, transport planning in most Indian cities is done in separate project silos with different modes being treated independently rather than as parts of a single integrated solution. Ideally, transport planning must also be integrated with land use planning and agencies such as Urban Metropolitan Transport Authorities must be set up to address transport planning across municipal jurisdictions. However, given the current 'departmental' nature of ULBs and lack of suitable capacity and manpower in them, the possibility of such organizations becoming effective soon seems remote.

## 5. Conclusions

Indian cities, with the help of DMRC, are planning to invest about Rs. 2 trillion<sup>22</sup> in metro rail systems. But our analysis shows that the DPR prepared by DMRC for Pune has many serious analytical and methodological flaws, making the proposal highly questionable. Therefore, there is an urgent need to revisit all proposed metro rail projects and critically review them. An independent expert group should conduct the review based on clear, objective criteria and examine all aspects such as their justification, governance, accountability, viability and integration with other modes, and the review findings should be publicly debated.

India is urbanizing rapidly but its urban governance institutions, systems and capacities have not kept pace. This gives rise to the problems presented above, resulting in big, expensive projects that often do not deliver the promised benefits and neglect of cheaper, quicker alternatives that may be more beneficial. This needs to be addressed urgently. ULBs must be reformed to make them transparent and directly accountable to citizens, and undertake integrated, comprehensive, least-cost planning considering supply and demand side options. Otherwise, it is very likely that there would be large investment in urban transport projects with very little benefits, and our cities will grow increasingly grid-locked and unlivable. In turn, this could well put the brakes on the country's much-touted economic growth story.

## 6. Acknowledgements

The author acknowledges the valuable feedback and comments from his colleagues at Parisar, Girish Sant, Sudhir Chella Rajan, Sriraman Siva and anonymous referees. However, the usual disclaimer applies.

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<sup>21</sup> "Civic body nod for 30-km inner ring road, 52 km monorail", Indian Express, Pune, Apr 15, 2010

<sup>22</sup> "India to invest Rs. 200,000 cr in metro rail in 10 yrs": <http://www.zeenews.com/news562710.html> accessed 17th Nov 2010

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