Public Transport Research: *Emerging Issues*

4th International conference on Future Urban Transport: *Access and mobility for the cities of tomorrow*

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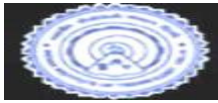
VREF COE

Sustainable Urban Transport in Less Motorised Countries:Research & Training



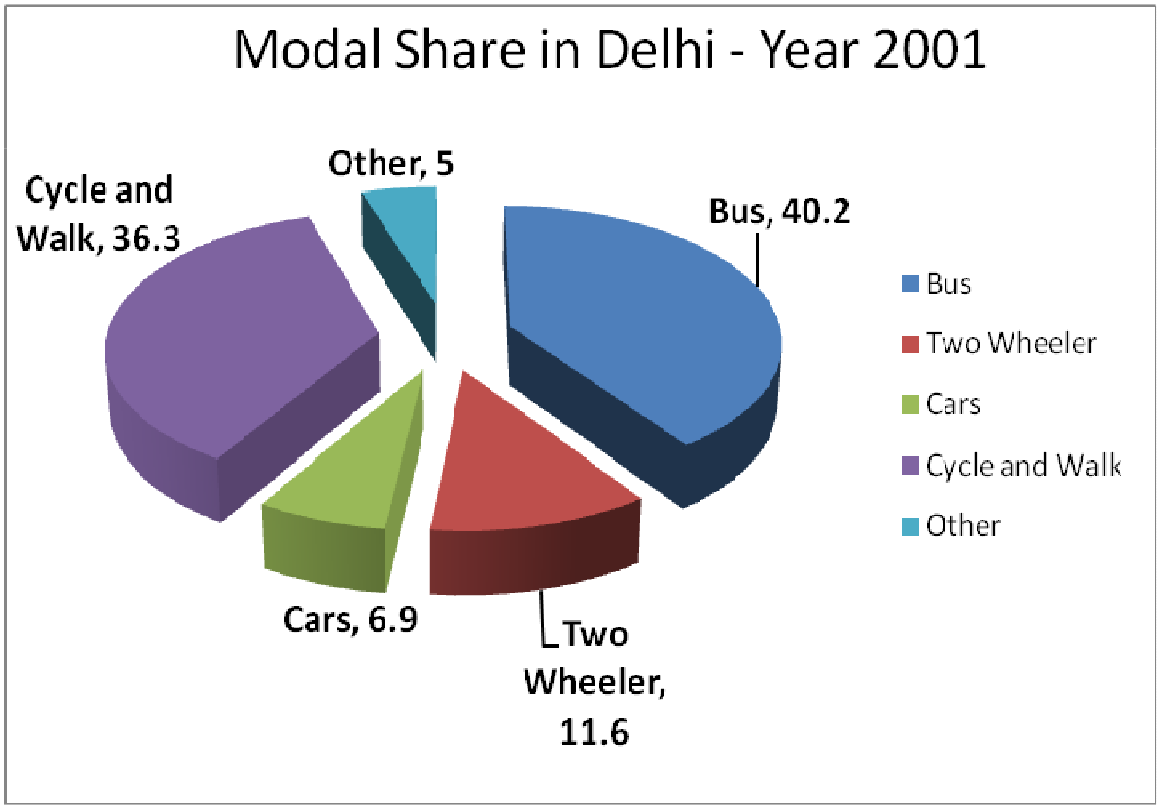
Indian Institute of Technology Delhi

Public Transport Research: Emerging Issues

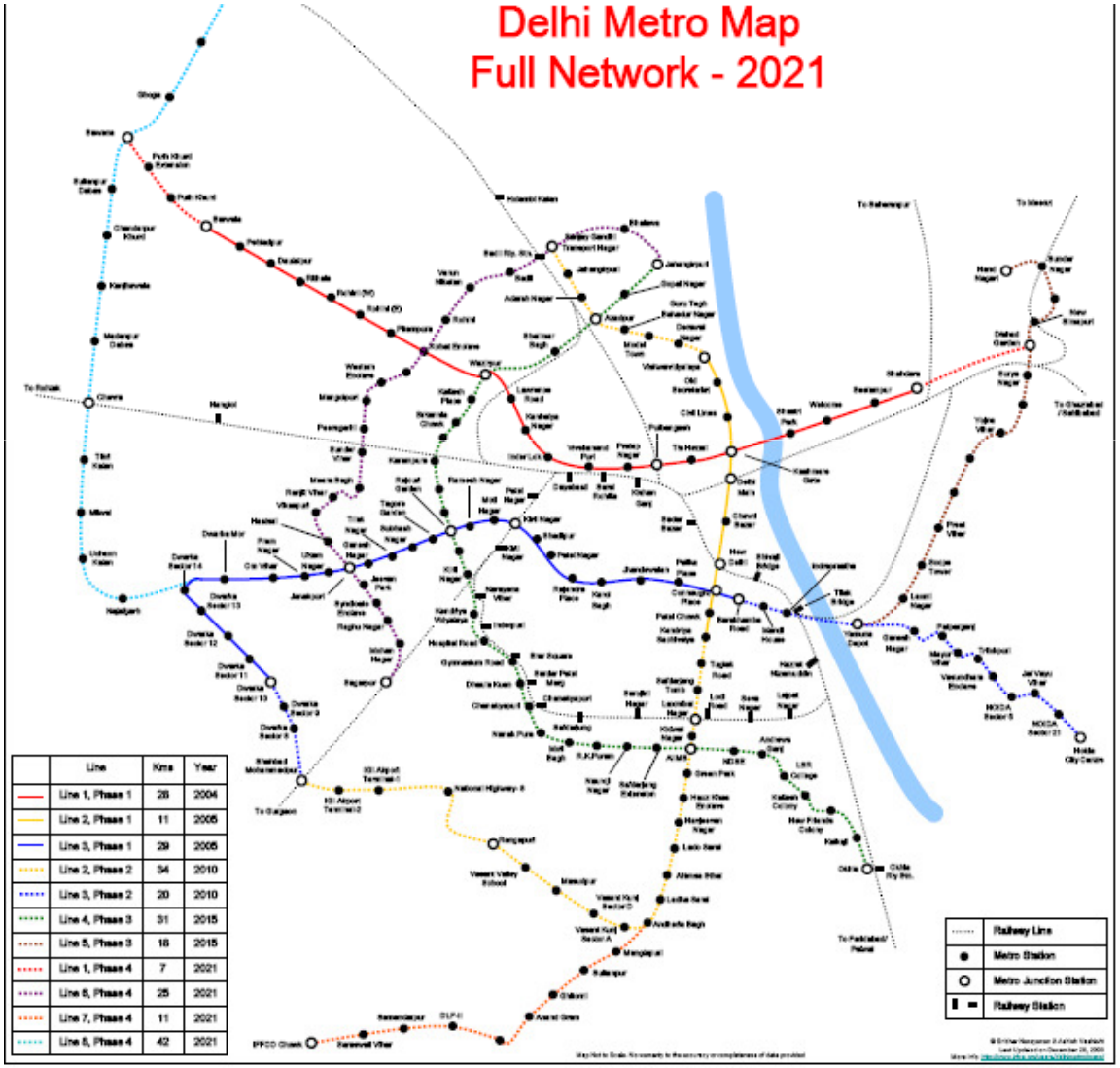
- Does public transport benefit people who do not have access to personal motorized vehicles?
- How can we improve estimates of public transport demand?
- Can transport pricing result in optimal road usage?
- Does safety risk reduce with increase in public transport vehicles?

Does public transport benefit people who do not have access to personal motorized vehicles?

- Public transport improves mobility and accessibility, therefore socio economic well being.

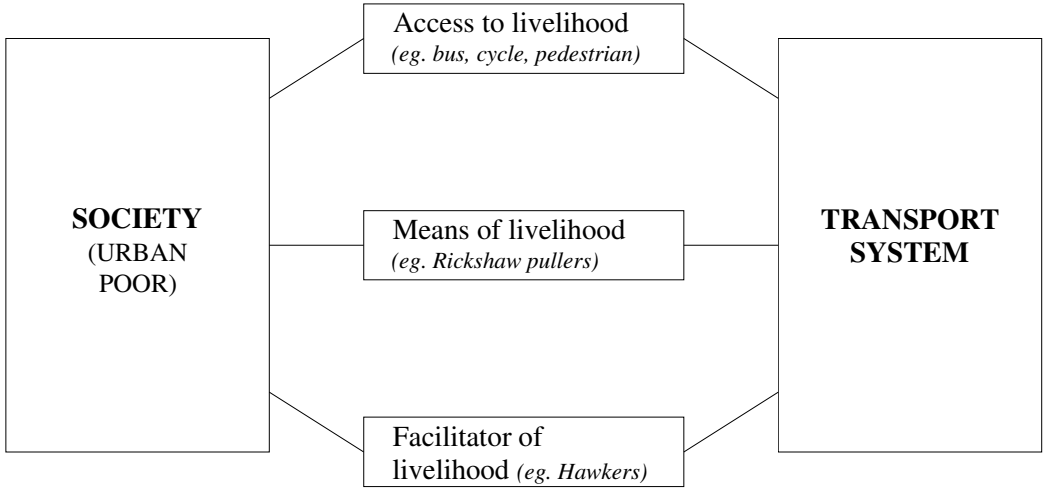


300 km of Metro network planned for Delhi, Phase I, 65 km completed

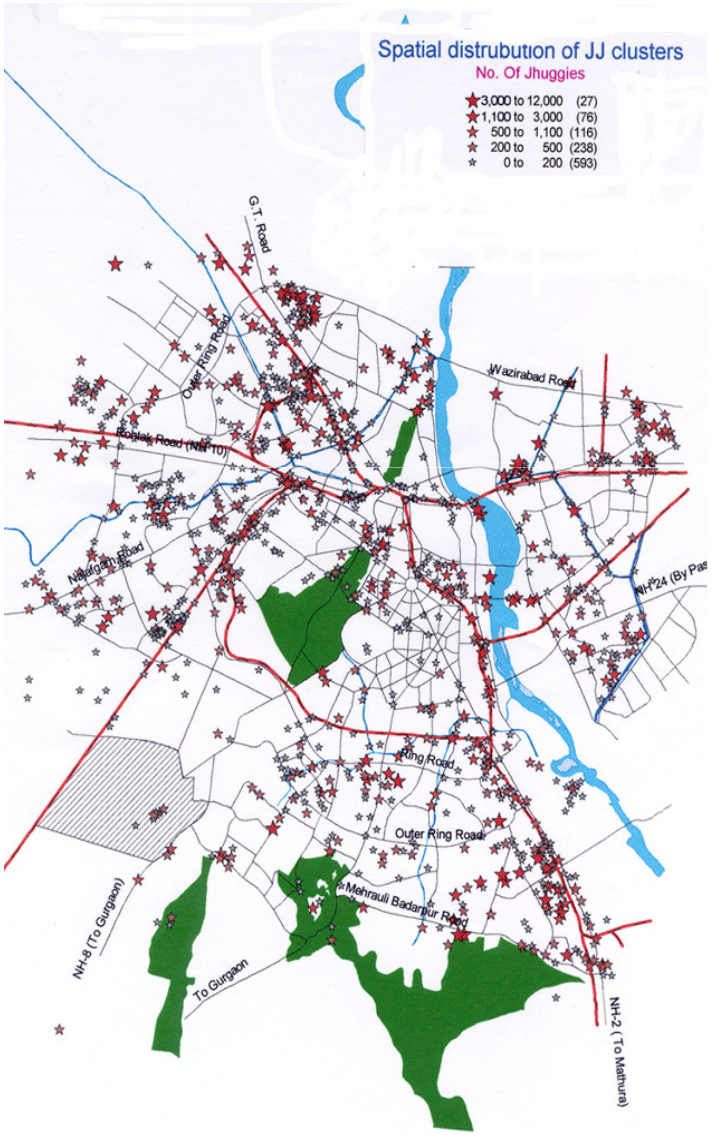


Public transport systems in the presence of informal settlements

DEPENDANCY CONSTRUCT: SOCIETY AND TRANSPORT SYSTEM



Source: Arora,2007



Distribution of Jhuggi Jhopri Clusters in Delhi

Impact of metro on households(LI) in the vicinity of metro

- poor households along the metro-line, no significant impact on their socio-economic and travel profile.
- After the introduction of metro availability of buses have reduced (several bus-routes were realigned by policy to improve metro ridership).
- Considering that only 8% trips are on bus and 77% walk, 4% cycle and 6% rickshaw, it is unlikely that these trips will be replaced by metro trips.

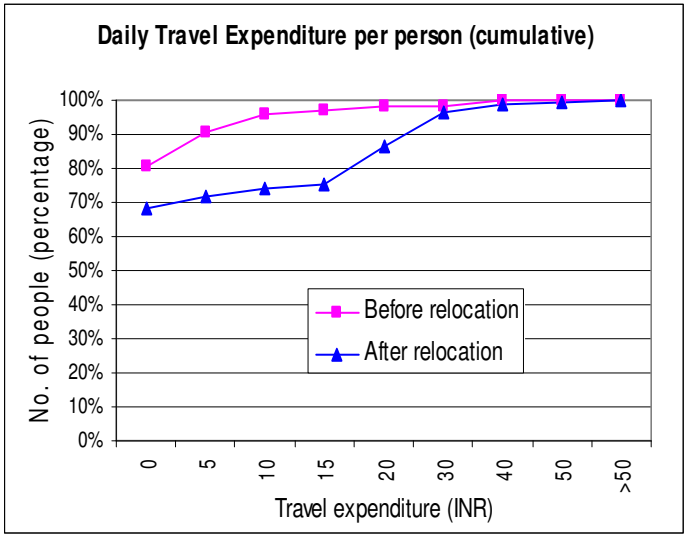
Results of T-tests (paired two sample for means)		
Change in parameter after metro	**At 95% confidence level**	**At 99% confidence level**
HH Income	significant	not significant
Distance to amenities	not significant	not significant
Travel Distance	not significant	not significant
Travel Time	not significant	not significant
Travel Cost	not significant	not significant

Source: Arora,2007

Impact of metro on households(LI) relocated to facilitate construction of metro a significant impact on the indicators of accessibility, mobility and SEWB.

- Decreased land-use accessibility :distance to education, health services and other urban services have increased for 52%, 63% and 52% of the households

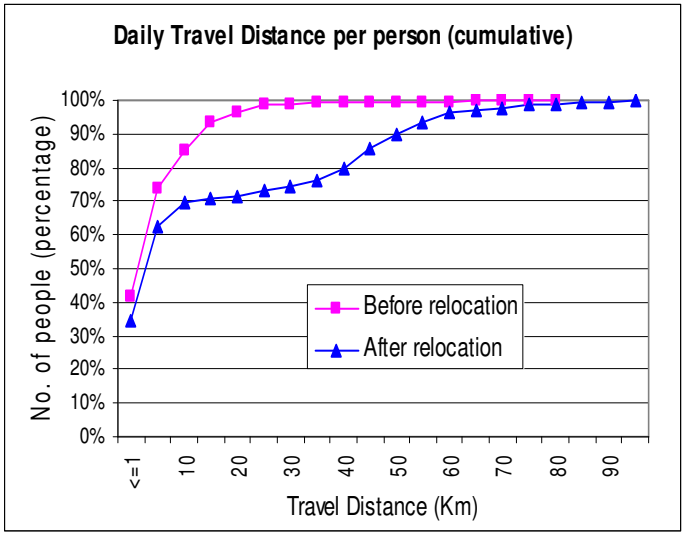
- The transport accessibility has deteriorated even more as distance to bus stop has increased for 72% of the households and the bus frequency has decreased, on an average, from 5 min to 63 min (almost 13 times).



Source: Arora,2007

Impact of metro on households(LI) relocated to facilitate construction of metro

- mobility of the households increased significantly. PCTR for work has increased for 49% of the households, decreased for 30%, implying change in the number of trips made for work in the households.
- The share of NMVs has decreased for 59% of the households.
- The mobility indicators for travel to work – distance, time and cost – have increased for 83%, 82% and 61% of the households respectively.
- SEWB indicators most adversely affected are female literacy (21% decrease), residency (100% decrease), Household income per person (66% decrease)



Source: Arora,2007

How can we improve estimates of public transport demand?

- much of the effort associated with public transport trips is performed to simply reach the system and the final destination. Access and egress stages (together with wait and transfer times) are the weakest part of a multimodal public transport chain and their contribution to the total travel disutility is often substantial

  (Bovy & Jansen,1979)

Including Access and egress trip details in public transport demand models

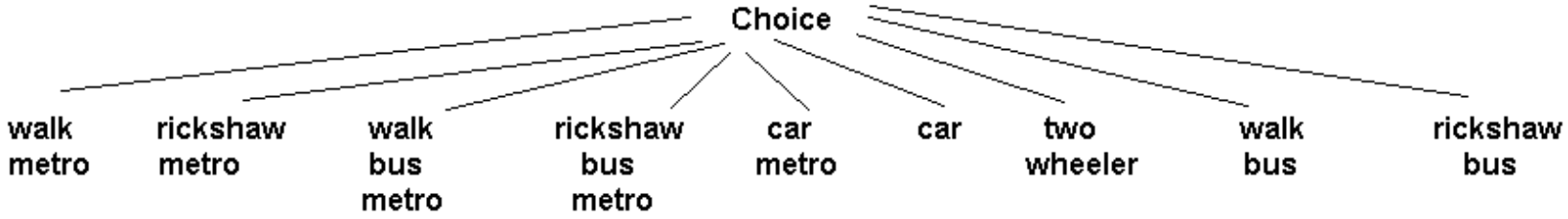
- Access distance for metro users ~ 45%, bus users is 15%
- Access time is 67% of total time for metro users, 27% for bus users

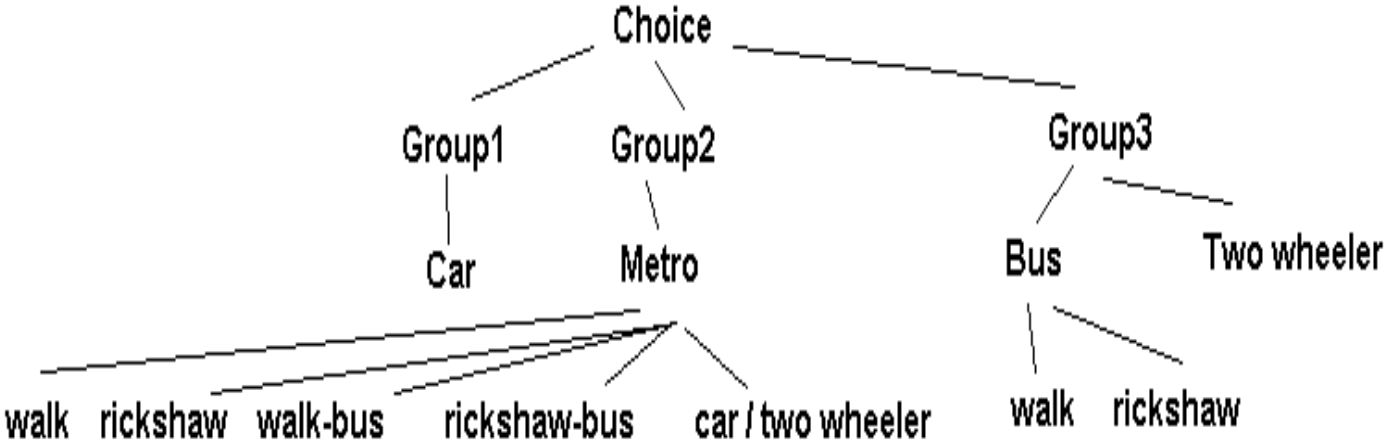
Particulars	Metro Users	Bus Users
Access + Egress Distance	8.38 Km	2.45 Km
% of Total Distance	44.99 %	14.44 %
Access + Egress Time	31.69 minutes	17.44 minutes
% of Total Time	67.44 %	27.08 %
Average no. of Transfers	3.81	3.53

Transit specific zoning

	Database set -1	**Databse set - 2**
Zoning	208 zones based on major arterial roads (RITES, 2001)	2201 zones based on service area of transit stop/station
Collectors	Trips starts and/or ends from geometrical centroids of each zone and artificial collectors to connect the centroid with transit stop/station	Trips starts and/or ends at/from the node inside each zone and therefore no artificial collectors.
Volume Delay Functions	Average speed of each mode has been adopted from observation.Speed for each mode differes but remains same on all type of roads.	Speed data for each mode on different type of roads have been extracted from the commuter's survy data.
Transit headways	All transit routes have the same headway of 1 minute.	Each bus route and metro route headway information has been incorporated.

Mode choice of vehicular trips





Estimated PT trips

- 3 to 4.3 million trips per day (15 to 23% of the total vehicular trips) . DMRC estimation ~12.6 million trips by (DMRC, 2004)
- 26 to 38% trips feasible only if rickshaw is available for access and/or egress trips. 31 to 38% trips dependent on bus for feeder trips.
- If bus has competitive headways with metro, more trips are on buses
- 35 to 37% metro trips depend on walking while in case of bus, 75% bus trips are dependent on walking.

PT is dependent on NMVs

Transport pricing can result in optimal road usage(parking, vehicle use tax, congestion tax)

- successive combination of pricing instruments yield more welfare gains than introducing them in isolation. when improved parking is introduced as the single pricing instrument, the welfare gain is 0.03% over the reference situation.
- when it is combined with optimal private and public transport pricing, the welfare gain increases to 4.69% over the reference period.

TRIP

Conflict between long term and short term signals

- optimal public transport pricing, as long as peak car use is not priced correctly, requires to be increased in both the peak and off-peak period though the increase in peak period is larger.

- Once optimal road pricing is introduced, peak public transport prices require to be increased again.

- This conflict between short and long-term signals has to be traded off with the welfare gain that can be achieved by using very low public transport prices in the peak.

Optimality Indicators

Mode of transport	Occupancy persons	Energy consumption Kj/pass-km	Co emission gm/pass-km	Fatalities/million pass-km
Scooter	1.3	706	9.2	19.21
Car	2.2	1825	6.5	3.17
Bus(Diesel)	40	267	.26	.4
Train(EMU)	1080	88	.12	0

Fatalitiy does not include access trips.

Public transport- Bus and Train/metro to be given priority

Does safety risk reduce with increase in public transport vehicles?

	Vehicle-Mix	Vehicle-Mix (incl ped)	Occupancy	People-Mix
Pedestrian	-	0.32	1	0.32
Bicycle	0.12	0.08	1.05	0.08
Bus & Truck	0.09	0.06	40	2.55
Car	0.34	0.23	2.2	0.51
Scooter	0.32	0.22	1.15	0.25
Auto Rickshaw	0.13	0.09	1.76	0.15
Total	1.0	1.0		3.9

Threat (Impacting Vehicle)

▼Victim▼	Pedestrian	Bicycle	Bus & Truck	Car	Scooter	AutoRickshaw	Single Veh	Total
Pedestrian	0	0	574	238	65	13	0	890
Bicycle	0	0	148	42	12	3	0	205
Bus & Truck	0	0	30	0	0	0	54	84
Car	0	0	29	9	0	1	12	51
Scooter	0	0	328	95	15	4	30	472
Auto Rickshaw	0	0	16	15	0	0	8	39
Total	0	0	1124	400	92	21	104	1741

Risk imposed by buses

- Buses are the impacting vehicle in most road deaths (65%), followed by cars (23%).
- Pedestrians are the most common victims (51%), followed by scooter riders (27%).
- For both, pedestrians and scooter riders, however, buses represent the primary threat.

Risk imposed by buses

- Shifting car occupants to buses causes an additional 65 pedestrian deaths (pedestrian crashes with buses.
- Because there are fewer cars, there are two fewer car related deaths. However this is outweighed by 57 additional deaths due to crashes with buses.
- The net result is an additional 60 deaths amongst all road users.

Bus system must be accompanied with safe infrastructure for pedestrians (access trips)

Conclusion

- *Public transport issues must be addressed as a complex system.*
- *It is heavily dependent on NMVs.*
- *The solutions must integrate impacts on non users, details of access trips, fiscal and institutional policies and safety concerns of pedestrians.*

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