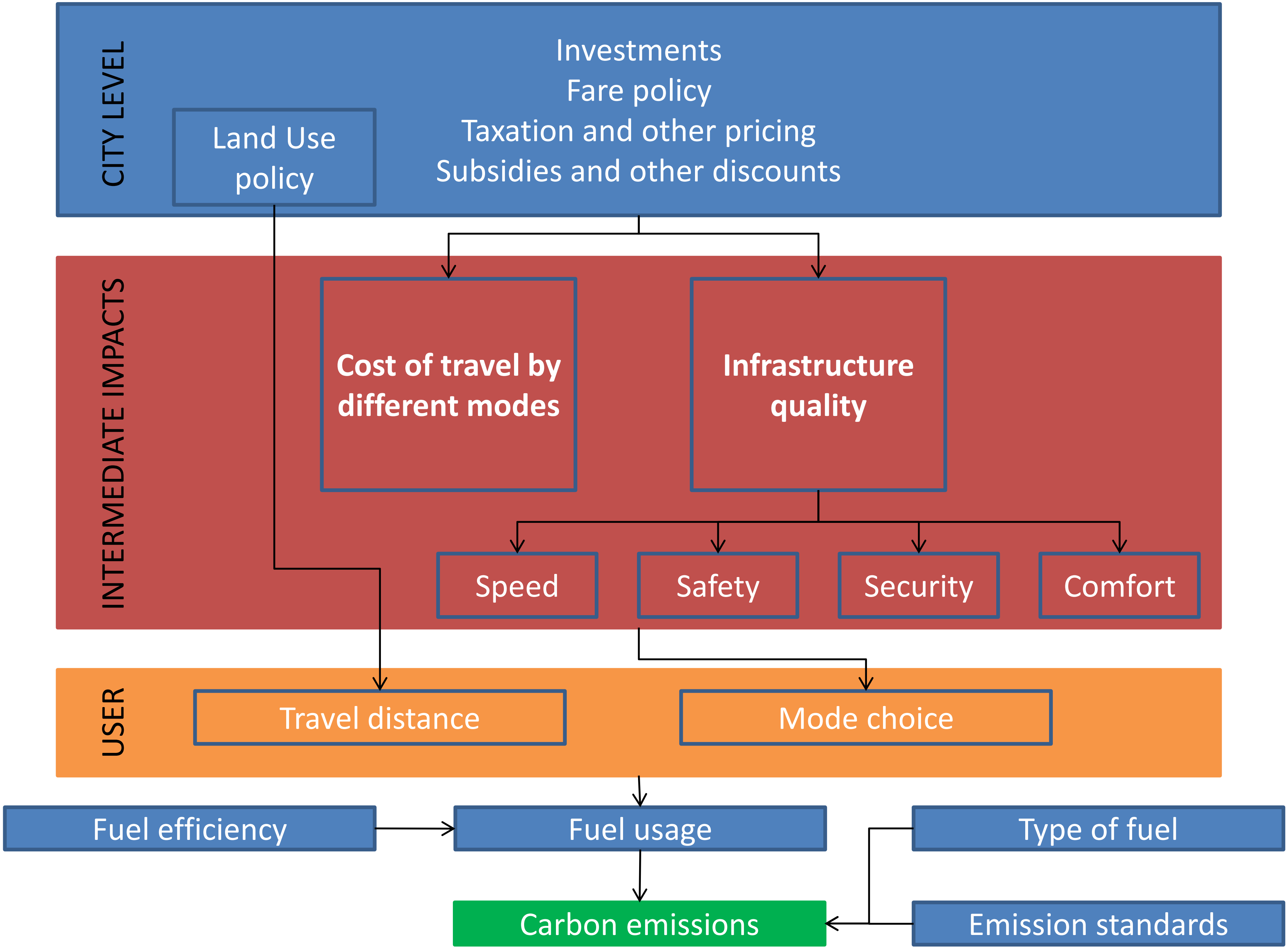
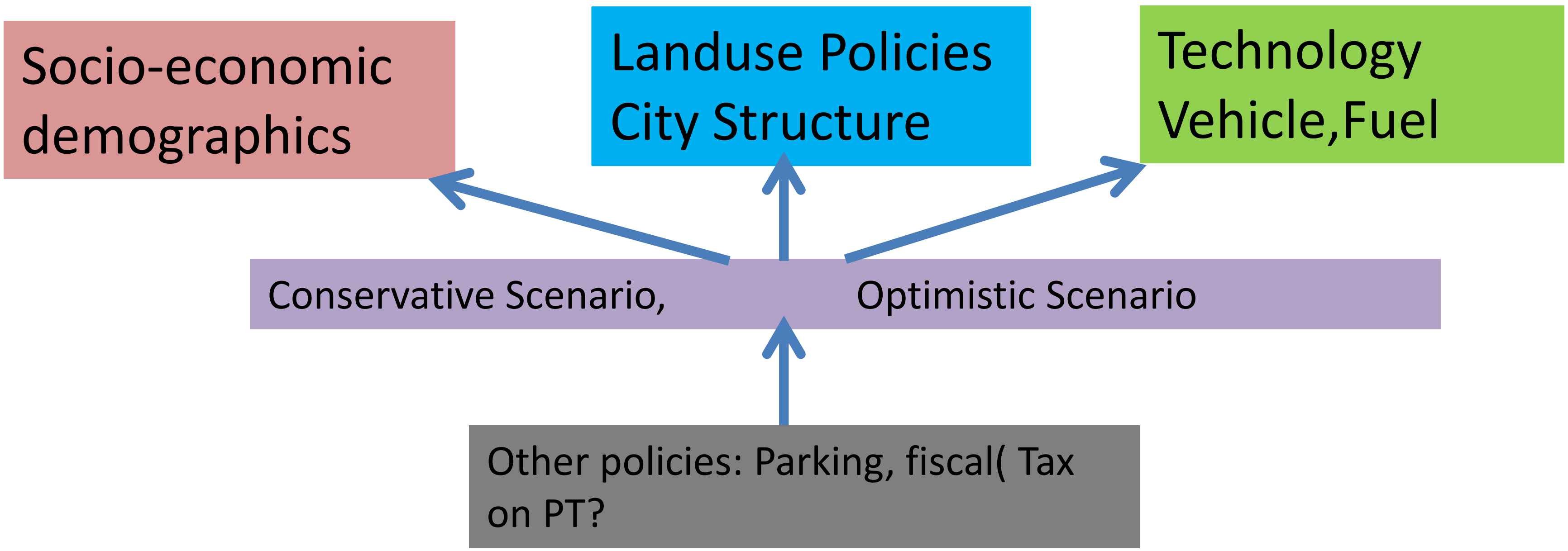
Scenarios for Low carbon Mobility Plans

G.Tiwari

Indian Institute of Technology Delhi


CITY LEVEL
Investments
Fare policy
Taxation and other pricing
Subsidies and other discounts
Land Use policy
INTERMEDIATE IMPACTS
Cost of travel by different modes
Infrastructure quality
Speed
Safety
Security
Comfort
USER
Travel distance
Mode choice
Fuel efficiency
Fuel usage
Type of fuel
Carbon emissions
Emission standards

Scenarios



- Trip Generation(BAU, 2030,2050?)
  - Demographics
  - Employment
  - Income?

Landuse & infrastructure for NMT and PT
1. Dedicated NMT (pedestrian, Bicycles, CS; OS)
2. Dedicated Public Transport(CS;OS)

- Trip distribution
  - City Structure (landuse mix integrating LI-households)
  - Activity locations ,(Density assumptions)

- Mode Choice (Utility)
  - Vehicle ownership
  - Trip length, distance, time(speed)
  - Accessibility: Spatial, economic
  - Safety, security(perception)

- Route Choice
  - Speed
  - Safety, security, comfort

Modal Shifts

Variables	Coefficient estimate	Robust Std. error	Robust T statistic	Robust P value	Exp (β) (Odds)	avg value
Initial log likelihood -6084.0 No of model parameters 17 No of observations 3396 Final Log likelihood -4037.705 Rho -squared goodness of fit 0.336						
CAR	Remaining to own mode 0.86 Shift to bicycle 0.14					
ASC1	-0.312	0.825	-0.38	0.71		
TT	-0.437	0.0326	-13.42	0.00	0.65	30
TC	0.220	0.0111	19.88	0.00	1.25	55
SF	1.40	0.147	9.53	0.00	4.06	1
COM	1.77	0.137	12.85	0.00	5.87	1
M2W	Remaining to own mode 0.65 Shift to bicycle 0.35					
ASC3	1.44	0.192	7.49	0.00		
TT	-0.201	0.0102	-19.64	0.00	0.82	30
TC	0.0609	0.00401	15.16	0.00	1.06	30
SF	1.65	0.122	13.56	0.00	5.21	1
COM	1.74	0.111	15.65	0.00	5.70	1
PT	Remaining to own mode 0.55 Shift to bicycle 0.45					
ASC5	1.96	0.296	6.63	0.00		
TT	-0.160	0.00780	-20.56	0.00	0.85	30
TC	-0.131	0.00752	-17.38	0.00	0.88	8
SF	2.42	0.200	12.15	0.00	11.25	1

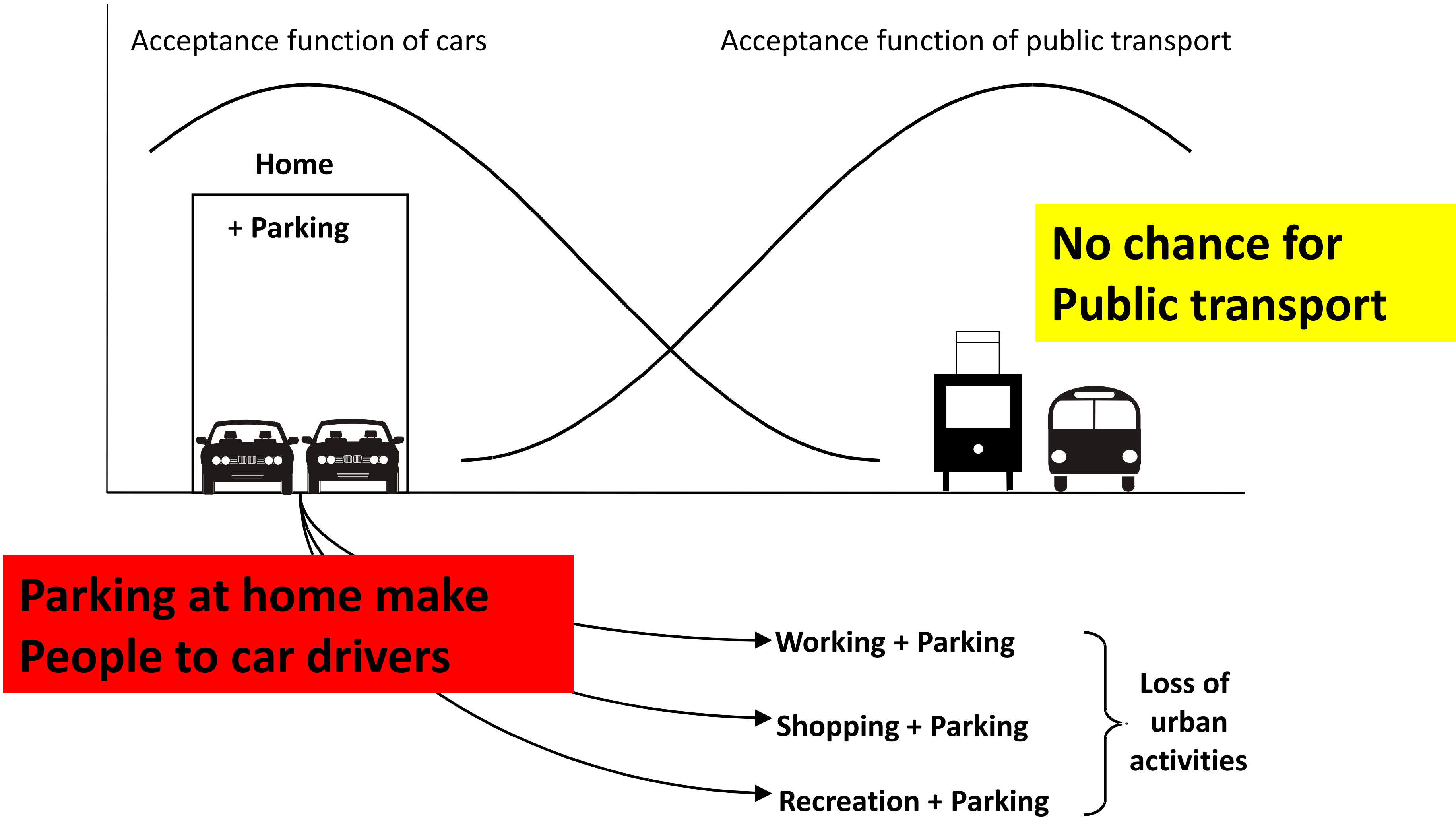
Elasticity

Direct elasticity at most common values

Remaining to modes / LOS	tt	tc	safety	comfort
CAR users not shifting	-1.784	-1.694	0.196	0.2478
M2W users not shifting	-2.099	-0.639	0.577	0.609
PT users not shifting	-2.182	-0.471	1.089	0.7425

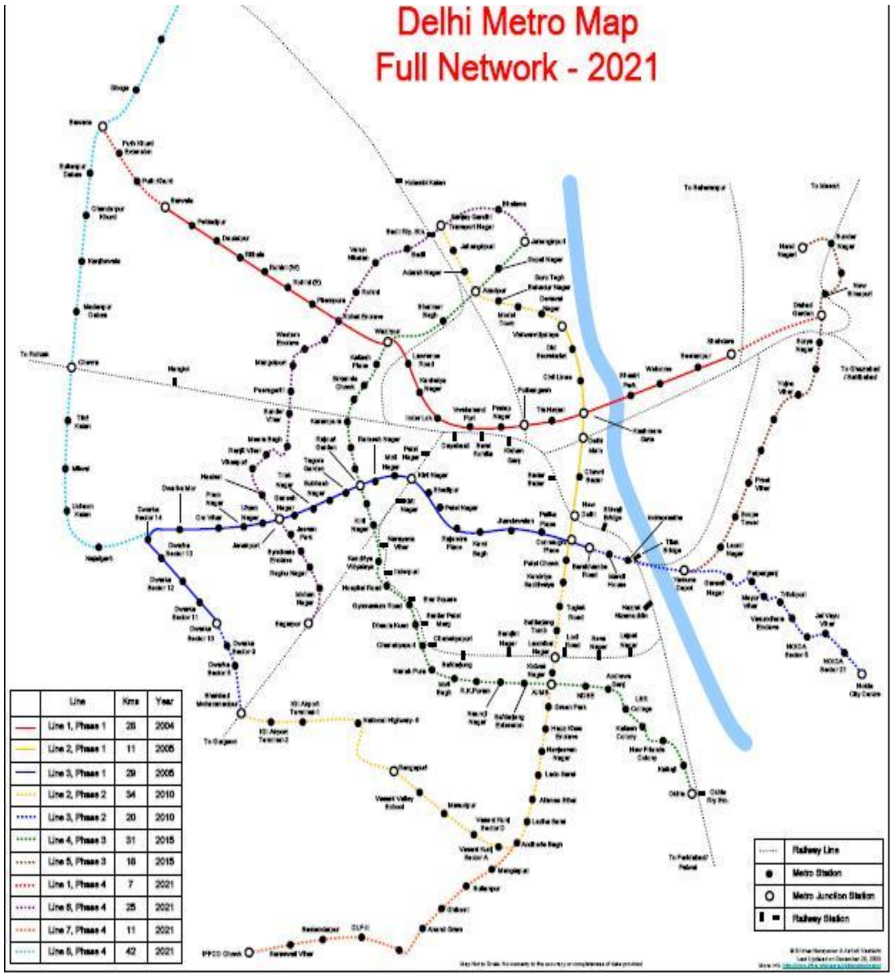
- **Car** - travel time and cost are elastic for car users. (car restrictive policies like large fiscal disincentives or high fuel prices and parking pricing, congestion pricing)
- **M2W** – Travel time is elastic. (modal shift is by prioritizing bicycle and improving its network and infrastructure quality for enhanced speed)
- **PT -** safety aspect and travel time are highly elastic. (increased safety and security for bicycle users by lighting, physical segregation and secure parking along with dedicated corridors)

Separation of activities is the result of individual optimization of parking



Parking at home and at destinations destroy all human scale structures and activities

300 Kms of Metro 2021



	Line	Kms	Year
	Line 1, Phase 1	28	2004
	Line 2, Phase 1	11	2005
	Line 3, Phase 1	29	2005
	Line 2, Phase 2	34	2010
	Line 3, Phase 2	20	2010
	Line 4, Phase 3	31	2015
	Line 5, Phase 3	18	2015
	Line 1, Phase 4	7	2021
	Line 6, Phase 4	25	2021
	Line 7, Phase 4	11	2021
	Line 8, Phase 4	42	2021

Rickshaw as feeder mode for 30% metro trips

Mode	Year 2021 Speed on road increases	Year 2021 Speed on road decreases
Walk metro	1113254 (37%)	1510287 (35%)
Rickshaw metro	496644 (16%)	651761 (15%)
Walk-bus-metro	637264 (21%)	832761 (19%)
Rickshaw-bus-metro	346810 (12%)	506014 (12%)
Car/TW-metro	417928 (14%)	837140 (19%)
Total Metro trips	3011900 (100%)	4337964 (100%)

10 km decrease in vehicular speeds, ~ 25% increase in metro ridership

ROAD CONGESTION IS GOOD FOR METRO !!

Estimated PT trips

- 3 to 4.3 million trips per day (15 to 23% of the total vehicular trips).
- 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.
- 70% PT trips will be 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

TRIPP

Possible Impact on CO_2

(woodcock J et al, Lancet, 2009)

London Population **2006 = 7.5m** **2030 = 9.0m** **Delhi Population** **2004 = 14.8m** **2030 = 26.0m**	**London**			**Delhi**		
	Aggregate Transport CO_2 Emissions (tonnes)	Transport CO_2 Emissions Per Person (tCO_2/person)	CO_2 Emissions Reduction on 1990 (%)	Aggregate Transport CO_2 Emissions	Transport CO_2 Emissions Per Person (tCO_2/person)	CO_2 Emissions Increase on 1990 (%)
2006 London **2004 Delhi**	9,647,900	1.3	-2.50%	6,146,651	0.4	97%
2010 BAU	9,935,897	1.3	0%	8,268,298	0.5	165%
2030 Scenario 1 BAU	10,381,318	1.2	4.80%	19,550,693	0.8	526%
2030 Scenario 2 LCD	6,480,565	0.7	-39%	17,069,668	0.7	447%
2030 Scenario 3 AT	6,120,306	0.7	-43%	10,458,736	0.4	235%
2030 Scenario 4 ST	3,608,226	0.4	-65%	9,327,207	0.4	199%

Landuse & infrastructure for NMT and PT
1. Dedicated NMT (pedestrian, Bicycles, CS; OS)
2. Dedicated Public Transport(CS;OS)

1. Dedicated NMT: CS- 10%, 20% arterial rds
   OS- 100% arterial rds

Should this be decided through consultation?

2. Dedicated Public Transport: CS: metro,
   OS: BRT, metro

- Trip distribution
  - City Structure (landuse mix integrating LI-households)
  - Activity locations ,(Density assumptions)
- Mode Choice (Utility)
  - Vehicle ownership
  - Trip length, distance, time(speed)
  - Accessibility: Spatial, economic
  - Safety, security(perception)
- Route Choice
  - Speed
  - Safety, security, comfort

Technology(CS; OS)

Vehicle Technology

Fuel Technology

- Vehicle Technology
  - Electric vehicles cars, two wheelers, bus
  - Fuel efficient vehicles

- Fuel Technology
  - Low carbon fuels (“clean” electricity)

Technology(CS; OS)
Vehicle Technology
Fuel Technology

- Vehicle Technology
  - Electric vehicles cars, two wheelers, bus
    - CS: 5-10% of EVS in vehicle fleet
    - OS: 30% of EVS
  - Fuel efficient vehicles
    - CS: GOI roadmap
    - OS: ?
- Fuel Technology
  - Low carbon fuels (“clean” electricity)
    - CS:CNG for PT
    - OS:??