Land use Planning and Transport Demand Management

Stefanie Holzwarth, Urban Mobility Unit, UN-Habitat

International Urban Training Center
IUTC Training Leaders For a Sustainable Future

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Urban Pathways

Land Use and Transport – Exploring the relationship

Modal split of all trips, world cities (%)

(Kenworthy, 2003)

	USA	ANZ	CAN	WEU	HIA	EEU	MEA	LAM	AFR	LIA	CHN
Non-motorized	8.1	15.8	10.4	31.3	28.5	26.2	26.6	30.7	41.4	32.4	65.0
Motorized public	3.4	5.1	9.1	19.0	29.9	47.0	17.6	33.9	26.3	31.8	19.0
Motorized private	88.5	79.1	80.5	49.7	41.6	26.8	55.9	35.4	32.3	35.9	15.9

USA US
ANZ Australia/New Zealand
CAN Canada
WEU Western Europe
HIA High income Asia
EEU Eastern Europe
MEA Middle East
LAM Latin America
AFR Africa
LIA Low income Asia
CHN China

Brainstorm:

What explains these differences?

1-2-ALL

- 1 minute alone
- 2 minutes in pairs
- Plenary discussion

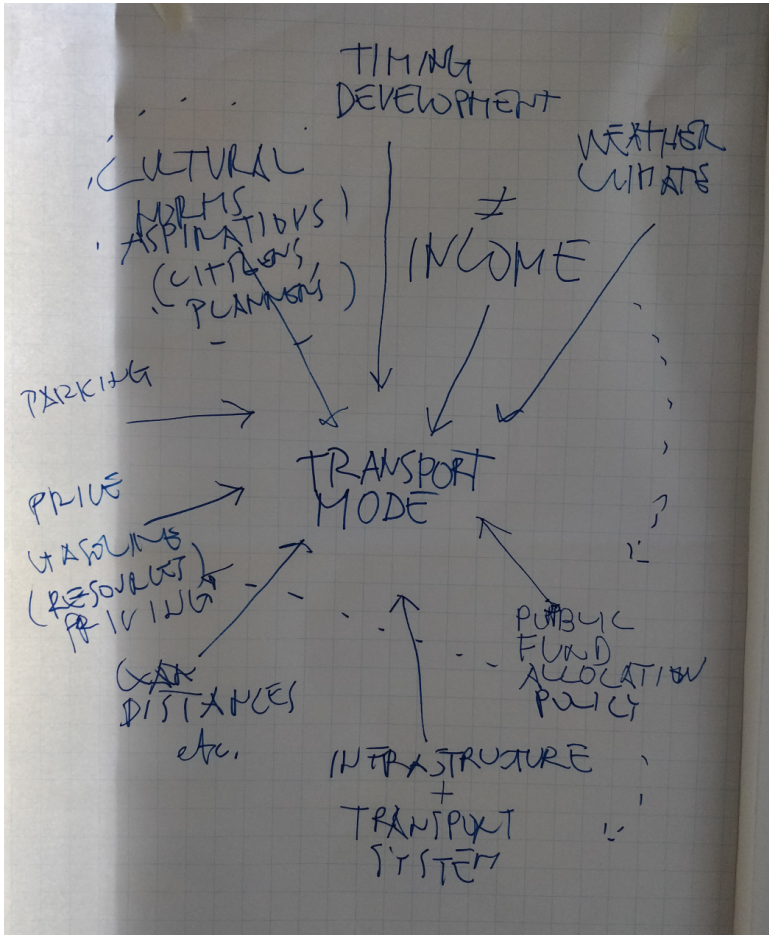
Opening Questions for a quick Brainstorm

Brainstorm Results (Example)
– "Mobility is a complex system":

e.g. Urban form, infrastructure, availability of transport systems, income, cultural norms, weather, public fund allocation etc.

>> All these factors explain different modal shares in different continents

>> Many cause effect relationships



What patterns/ relationships can you see?

Home-work trip characteristics in high income world cities

	Modal split (%)			Home-work distance (km)	Density (inh/ha)
	Car	Public transport	Non-motorized		
North America	86,4	9,0	4,6	15,0	14,2
Western Europe	42,8	38,8	18,4	10,0	49,9
High income Asia	20,1	59,6	20,3	10,0	152,8

(Kenworthy & Laube)

Patterns:

Non-motorized <- -> shorter distance/ higher density
Public Transport <- -> higher density
Car Usage <- -> longer distance/ lower density

Relationships:

Speed <- -> distance [car & PT vs. NMT]
Capacity <- -> density [car vs. PT] >>
higher density requires higher capacity due to limited space

Underlying mechanisms:

Acceptable travel time -> speed/distance
Mutual support -> capacity/density

Transport mode characteristics

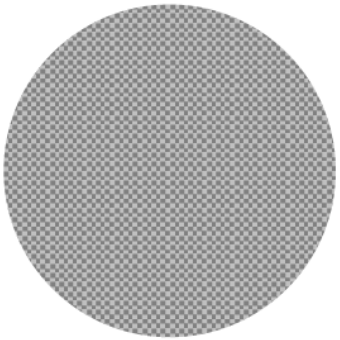
Transport mode	Average speed (km/h)	Maximum capacity (p/h)
Car (urban street ← → highway)	30 ← → 76	2.000 ← → 6.000
Public transport (bus ← → metro)	15 ← → 40	10.000 ← → 80.000
Non-motorized (walking ← → cycling)	5 ← → 12	19.000 ← → 14.000

(various sources, indicative)

>> Multiple Cause Effect Relationships

City Typologies – based on their transport mode

Non-motorized transport oriented city:
high functional mix



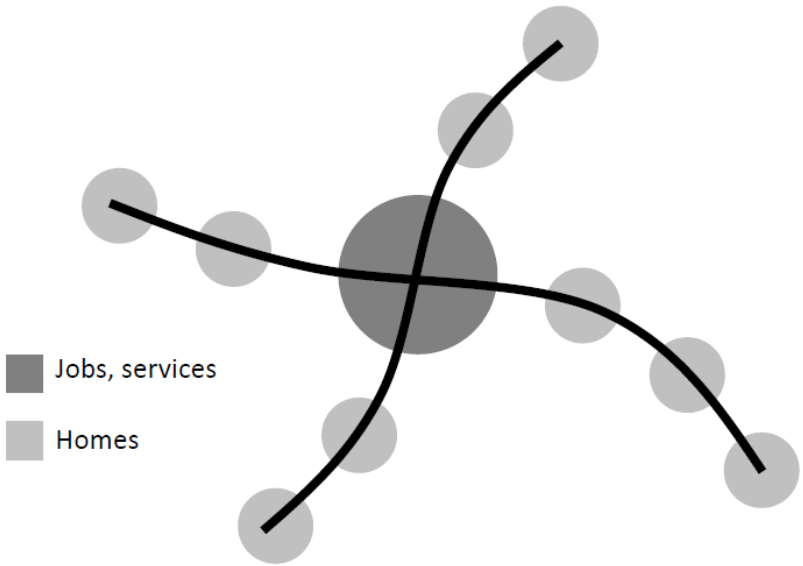
Jobs, services

Homes

Paris

City Typologies – based on their transport mode

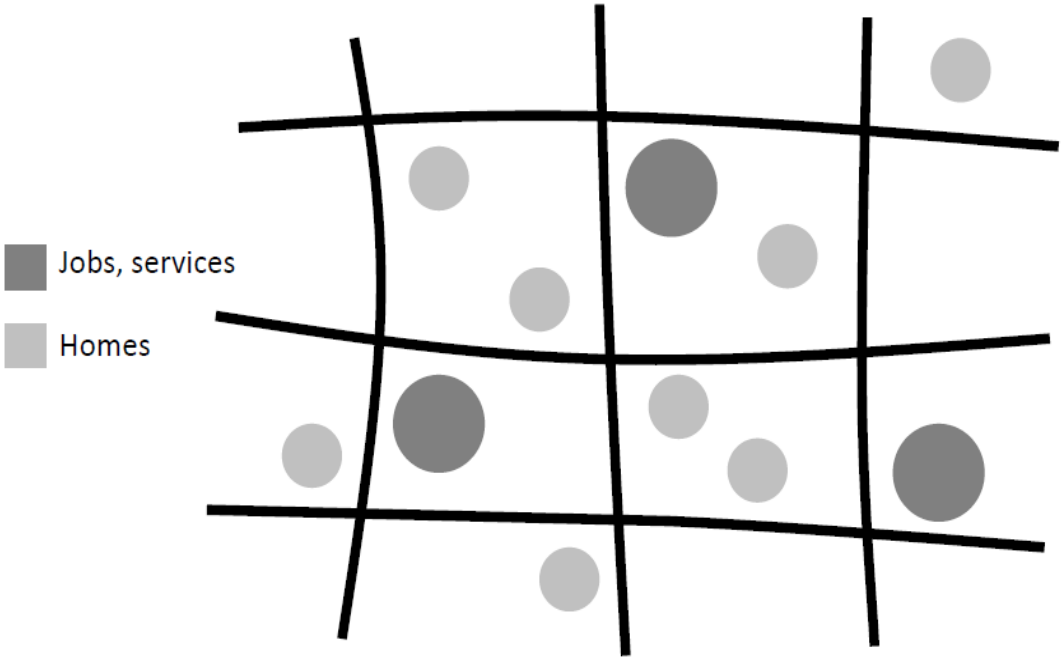
Public transport oriented city:
high functional separation, high density



Tokyo

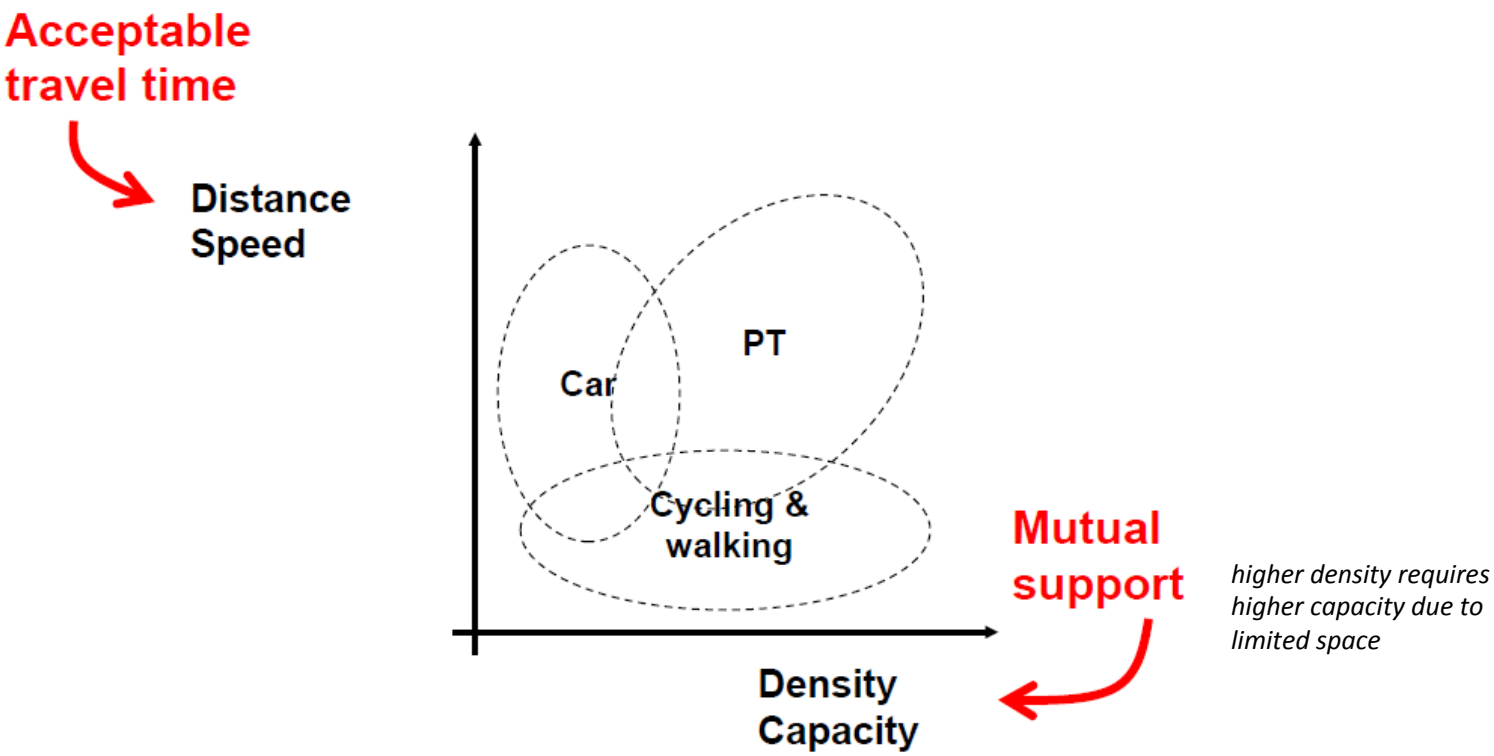
City Typologies – based on their transport mode

Car oriented city:
high functional separation, low density



Los Angeles

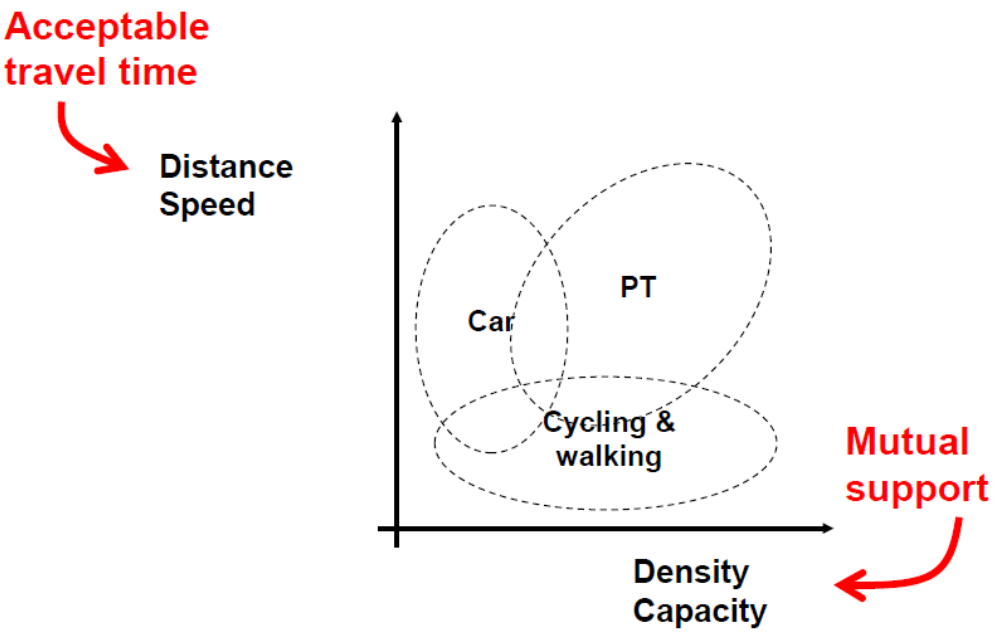
Linking Land Use and Transport



higher density requires higher capacity due to limited space

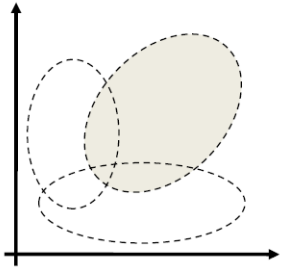
(Bertolini & le Clercq, 2003)

City typology based on their transport mode

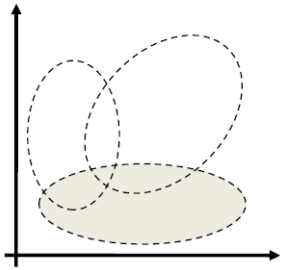


(Bertolini & le Clercq, 2003)

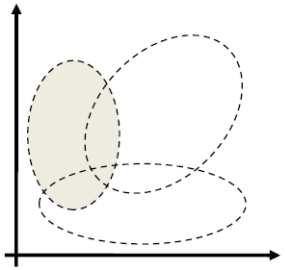
Tokyo



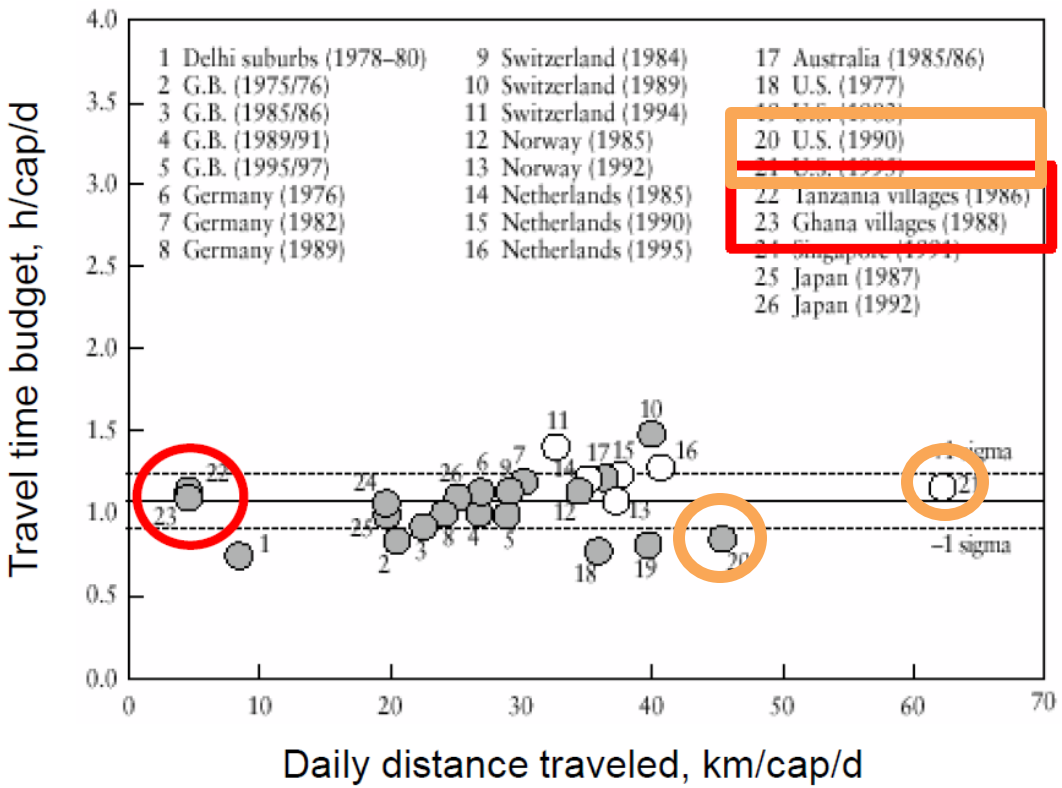
Paris



Los Angeles



Acceptable Travel Time has been constant – after 50 years investing in travel time savings!!



(Schafer, 2000)

- Relatively constant daily travel times over time
- But **distances** and **speed** has increased
- Often through increasing **car** ownership
- Urban **Sprawl** / pulling activities apart
- In turn, **maximizing speed** even more >> cities for cars

Higher Traffic Speeds and less congestion - Are these good goals?

Speed spreads the city and does not save time

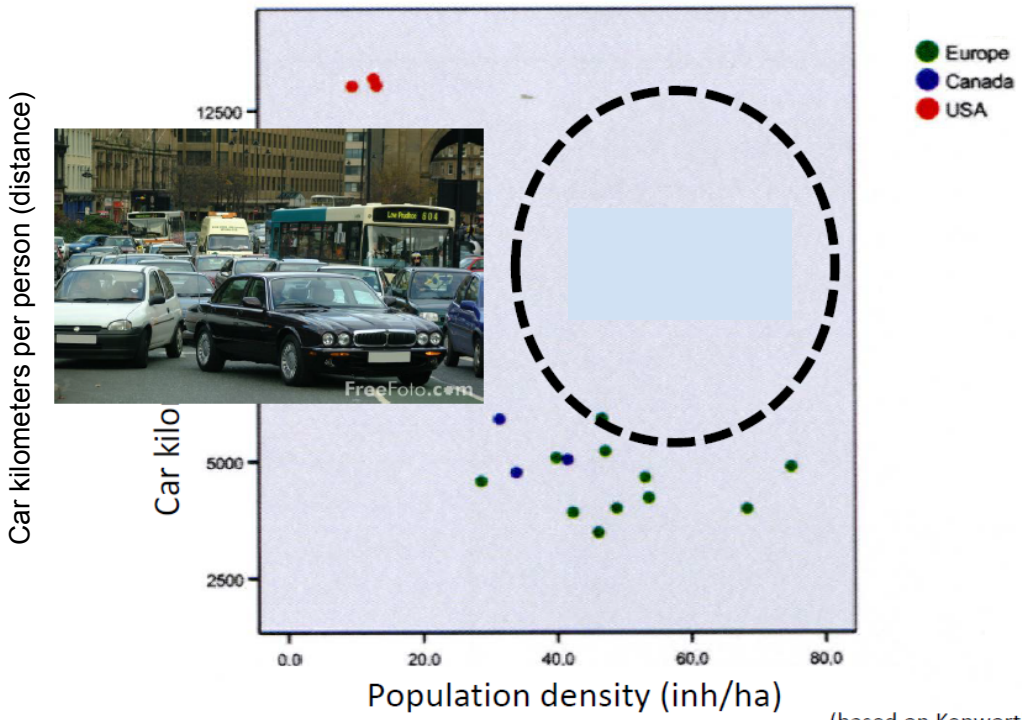
The fast city

The slow city

>> Which one do you prefer?

Threshold of Density – The "Car" Case

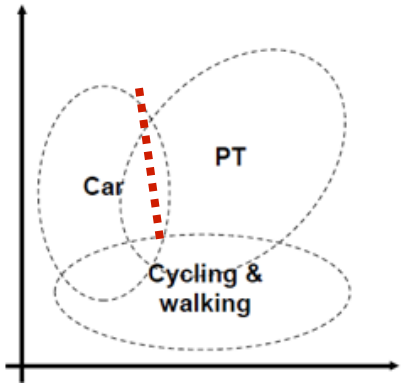
Mutual support → + car - density



(based on Kenworthy & Laube)

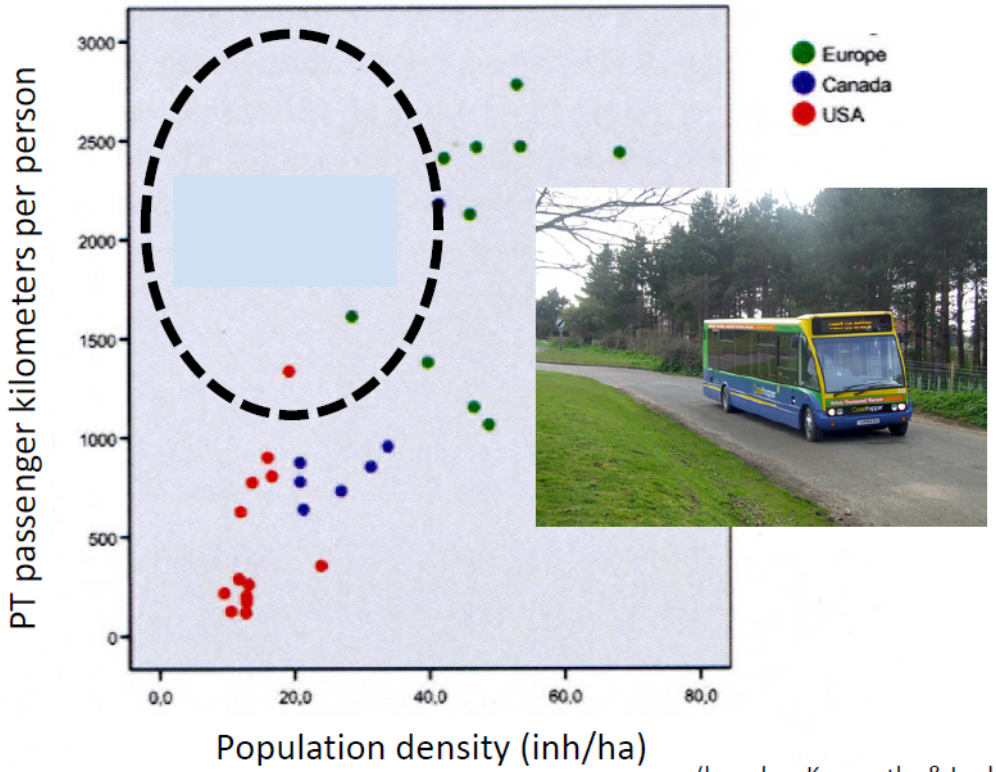
Example: Los Angeles, Chinese Megacities

There is a threshold of density for the car.



Threshold of Density – The "Public Transport" Case

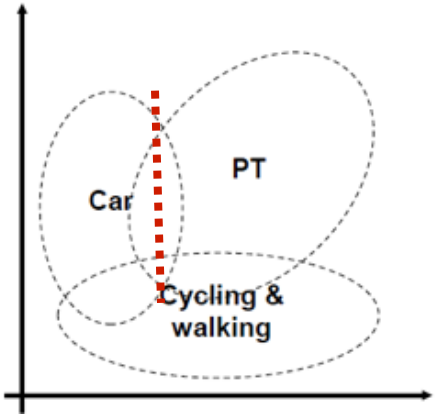
Mutual support → + PT + density



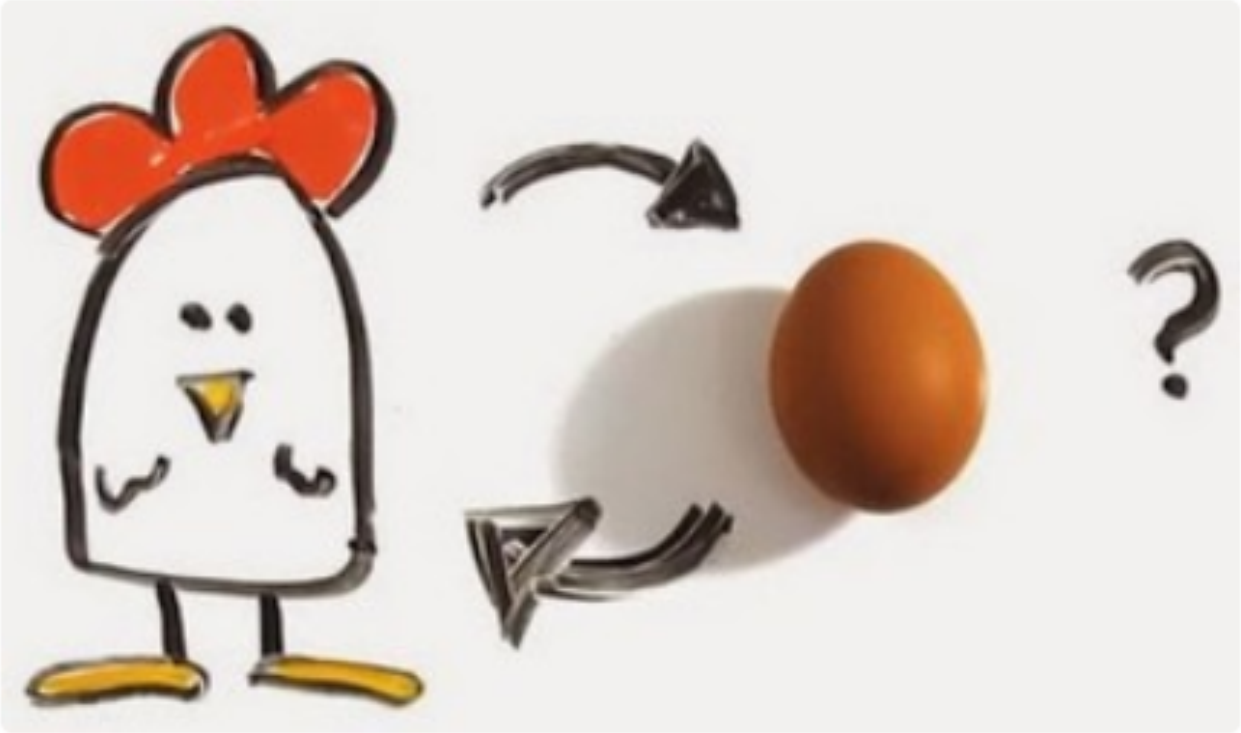
(based on Kenworthy & Laube)

Example: Cape Town BRT

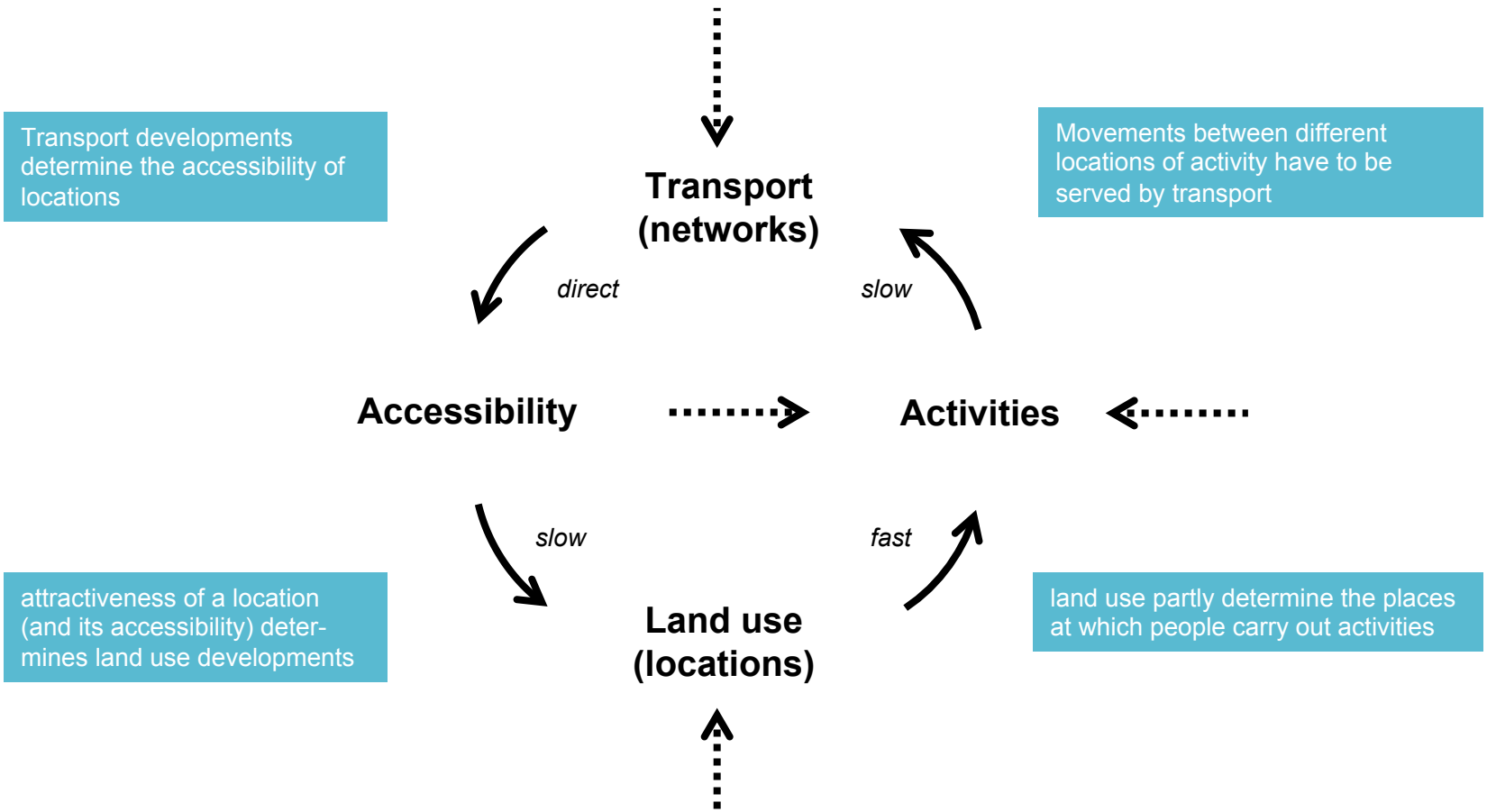
There is a threshold of density for public transport.



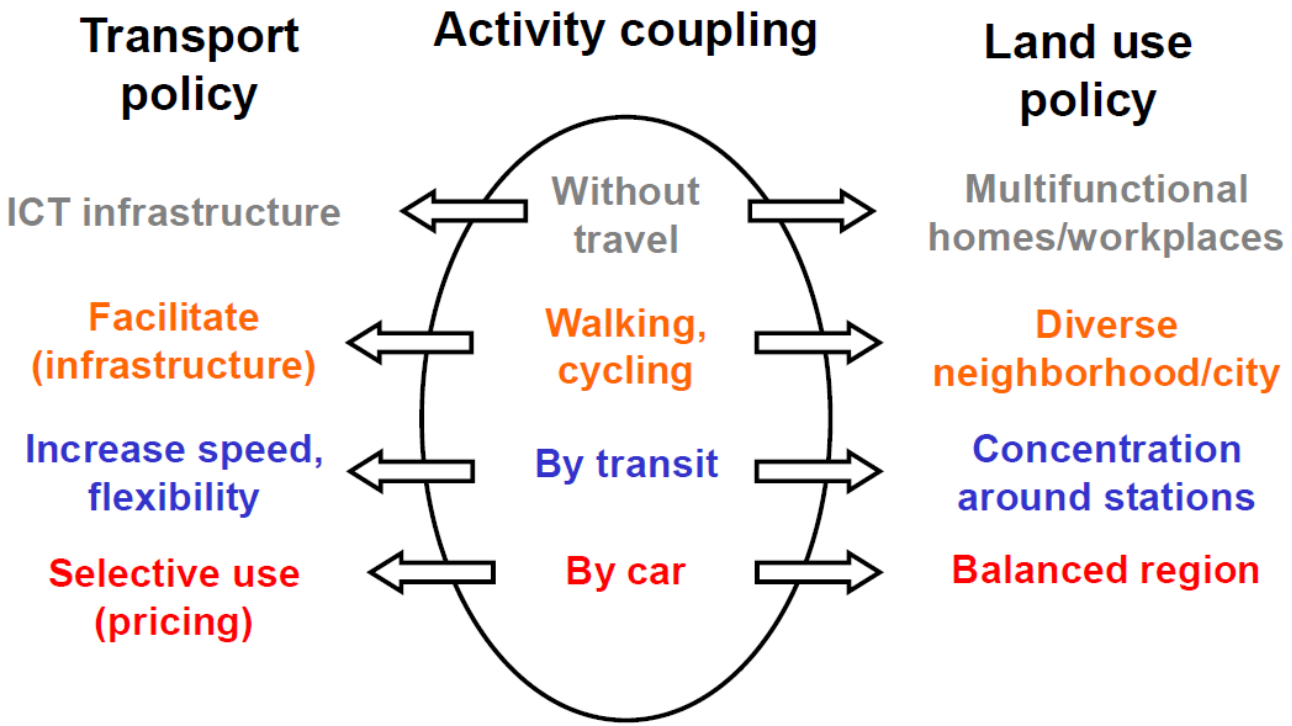
Chicken & Egg:
Transport - Land Use Feedback Cycle



Transport - Land Use Feedback Cycle



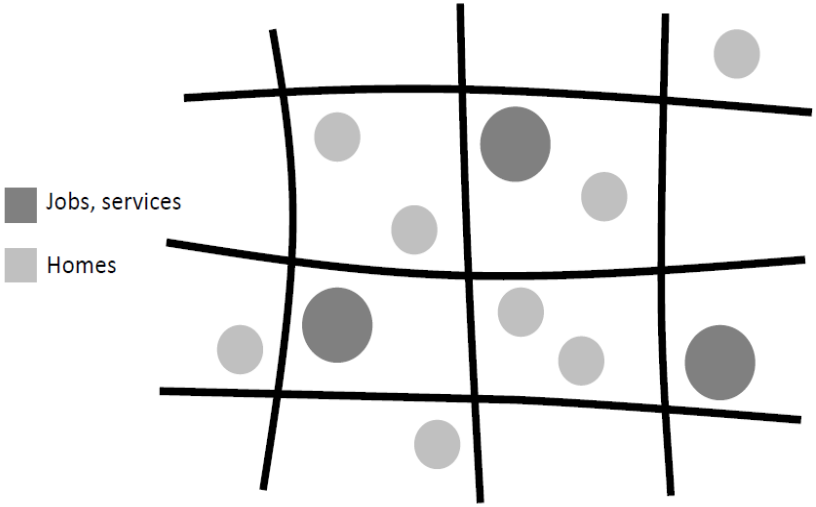
Mutually reinforcing policy combinations in transport/ land use



(Bertolini & le Clercq, 2003)

Let’s dive deeper – how does it look like if we plan for Car Oriented Cities?

Car oriented city:
high functional separation, low density



Los Angeles

The Urban Transport Challenges

Growing Economy

- Increased Car Ownership
- Increased Traffic Volumes
- Increased congestion

Road Safety

- Increased speed
- Increased conflicts among modes
- Increased accidents

Urban Sprawl

- More car dependency
- Increased trip lengths
- High costs for extending infrastructure and services

Energy Consumption

-Transport consumes 30% of total energy
- Increased demand for fossil fuel
- Increased GHG emissions

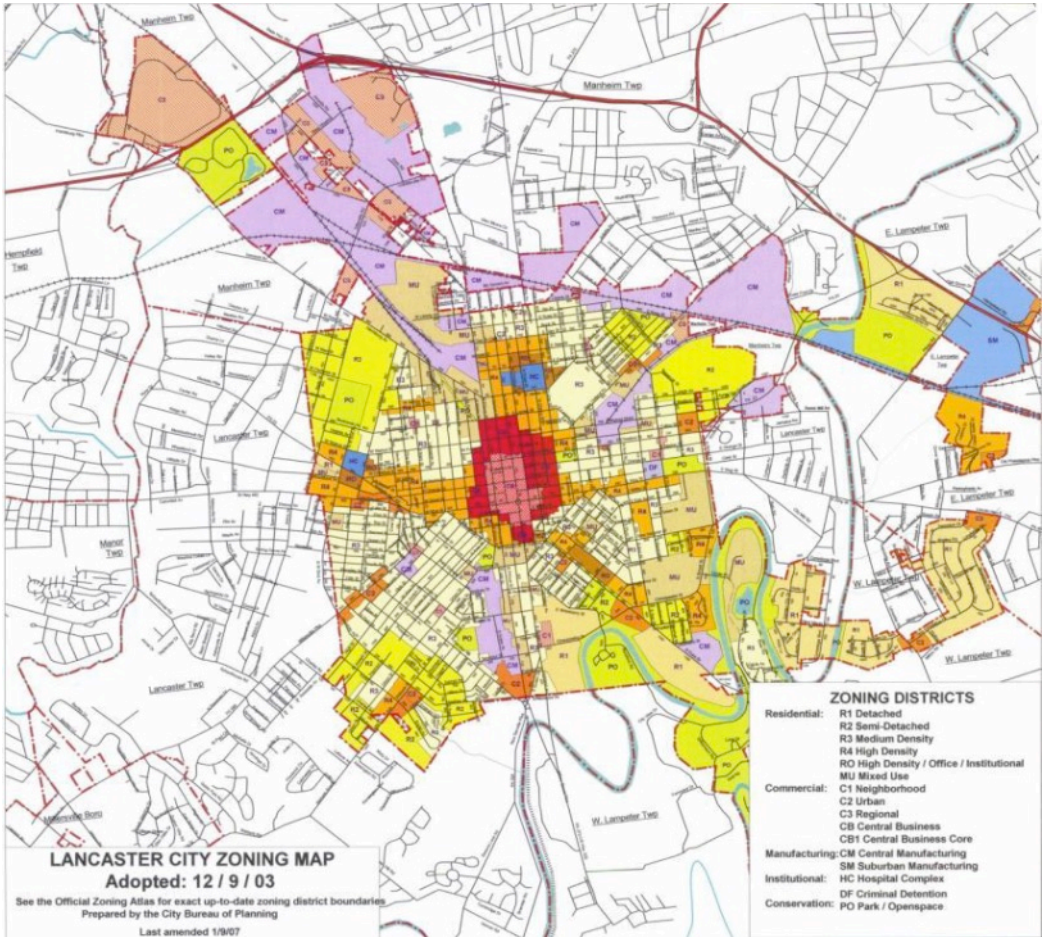
Climate Change

- Global warming
- Higher emission levels
- Air and noise pollution

Effects of Car Oriented Planning – Traffic concentrates on a few arterial roads

Typical zoning plan in a car oriented approach

- Large blocks of uniform land use. Minimal mixed use zones
- Uniform housing typology in each residential block
- Single business district



Sprawl and low density growth – Residential suburbs in the car-oriented planning

- Low rise, low density development consumes unending amounts of land
- Travel distances increase due to lack of mixed-use
- Increase in vehicular pollution
- Far away from the business district

Ulaanbaatar, Mongolia

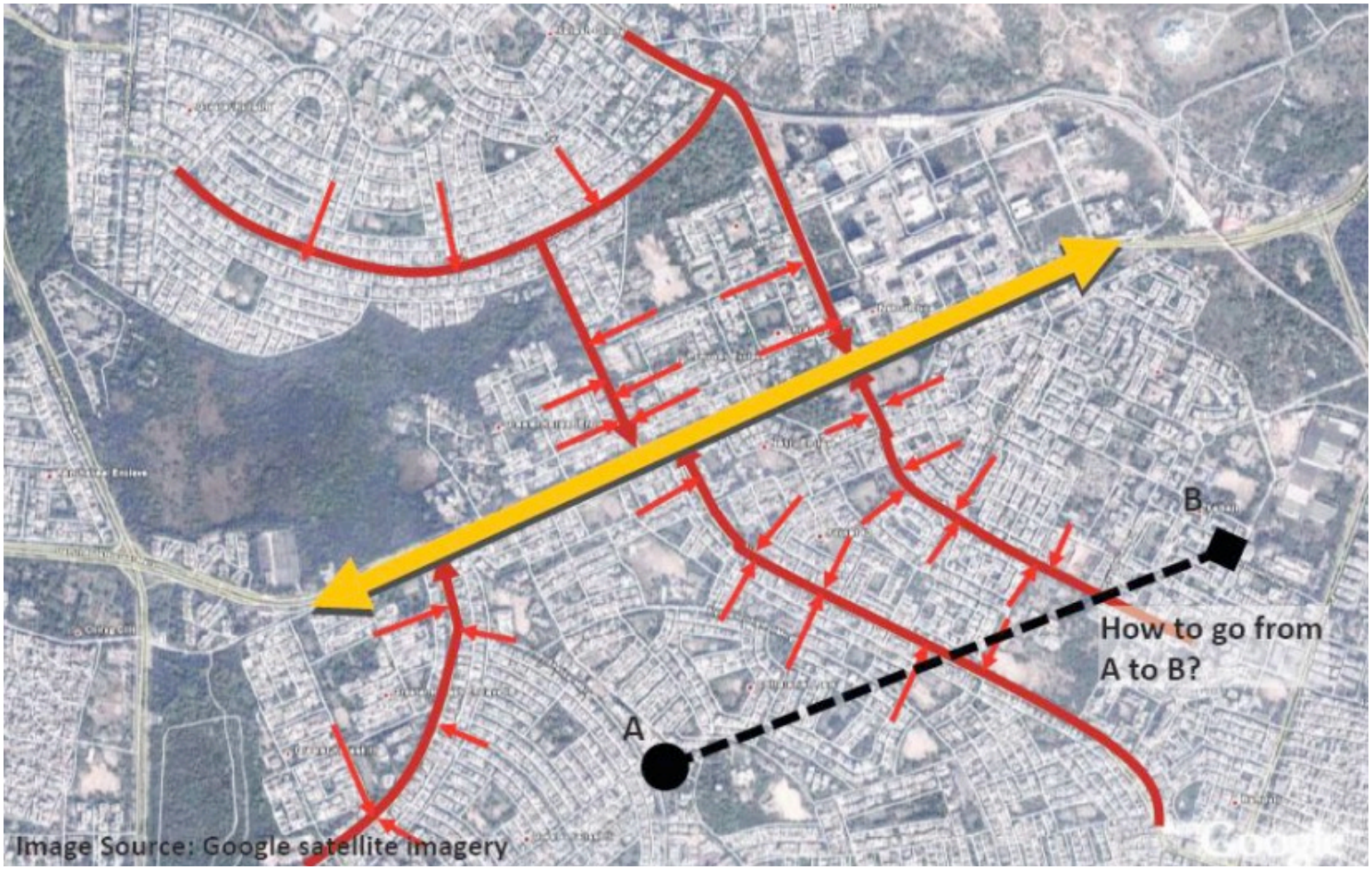
The Business District in the car-oriented approach

- Uniformly commercial / business land use. Far from residential areas
- High rise developments. Inhuman scale.
- Floating population. Shuts down at night, leading to problems of safety and security

Houston, TX, USA

Failure of Existing (Public) Transport Network

Traffic dependent on major arterial roads even for short Local Trips!



Road Infrastructure in the car-oriented approach

- Massive roads, with costly infrastructure like grade separation
- Requires huge tracts of land
- Unidirectional traffic congestion: towards the business district in the morning and towards the suburbs in the evening

Ontario Highway 401, Canada –

So what is the impact of the car-oriented approach to land use and transport planning?

Everybody has to buy a car

Me in Nairobi until 2018

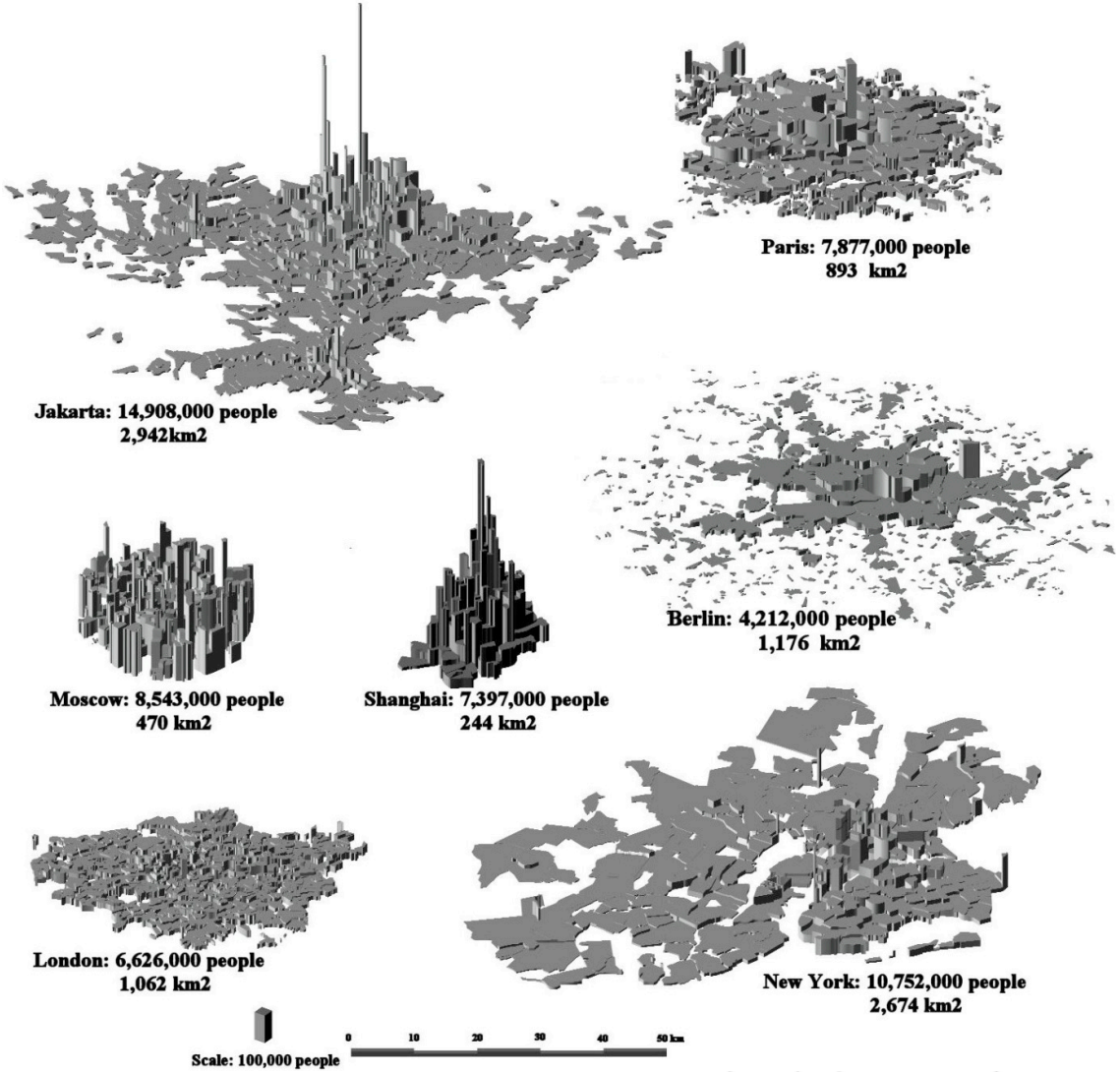
Me in Nairobi now

High density / Compact development

High density does not necessarily mean high-rise

- Mid-rise development (say 80% residences in 6-10 storey apartments) is optimal

- It is important to note that most S. Asian cities already have high densities



Densities in 7 major cities at the same scale in a 3 dimensional view

High density can be a blessing and a curse!

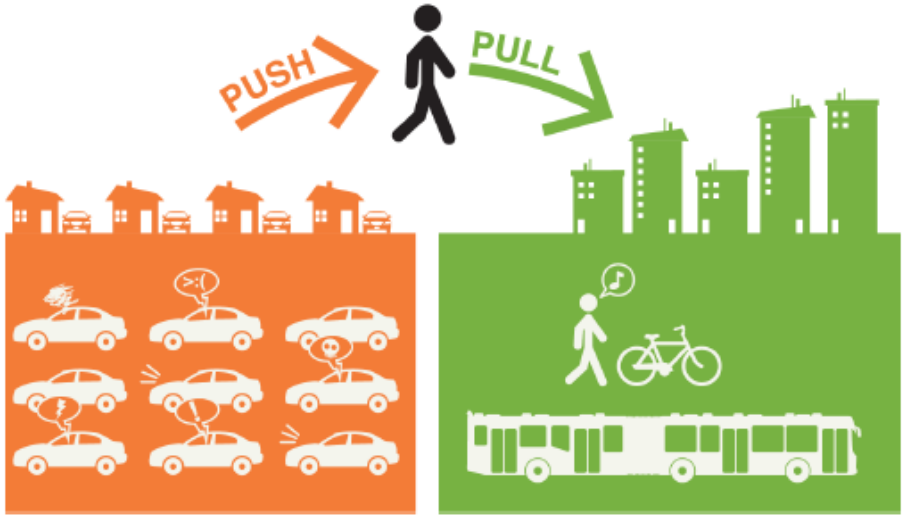
High density and mixed land use encourages walking and public transport

High densities and limited space for streets might constrain supply of public transport and adequate walking facilities

Name advantages and disadvantages of a dense city? 1-2-All

Transport Demand Management (TDM)

- Maximizes the efficiency of the urban transport system by discouraging unnecessary private vehicle use and promoting more PT and NMT
- Influences travel behaviour in order to reduce or redistribute travel demand



Examples of TDM Measures

Improve Transport Options	Economic Measures	Smart Growth and Land Use Policies	Other Programs
Public transit improvements	Congestion pricing	Smart growth	School and campus transport management
Walking and cycling improvements	Distance-based fees	Transit-oriented development	Freight transport management
Mobility management marketing programs	Commuter financial incentives	Location-efficient development	Tourist transport management
Rideshare/commute trip reduction programs	Parking pricing	Parking management	
HOV priority lanes	Parking regulations	Car-free planning	
Flextime/telecommuting	Fuel tax increases	Traffic calming	
Carsharing services	Transit encouragement	Transport planning reforms	
Taxi service improvements			
Guaranteed ride home program			
Shared bicycle services			

(A. Broaddus, T. Litman, G. Menon 2009, Transportation Demand Management, Eschborn, Germany)

Developing a comprehensive TDM Strategy

- include an appropriate set of measures;
- identify synergistic effects, that are greater than the sum of TDM measures implemented individually;
- include both positive ("pull") incentives, such as improved travel options, and negative ("push") incentives, such as road and parking fees.

	PUSH	PULL
Policy/Regulatory/ Economic Measures	**Restrict car access** ■ road pricing ■ congestion pricing ■ sales tax/import duty ■ registration fee/road tax ■ car quota system ■ parking pricing ■ parking management ■ plate restrictions ■ low emission zones ■ 20 km per hour zones	**Improve transit services** ■ integrated system and fare structure ■ network of priority transit corridors **Incentives for commuters** ■ parking spot cashout ■ tax reduction for transit pass ■ tax reduction for biking and walking
Physical/Technical Measures	**Reduce car mobility** ■ reduce parking supply ■ traffic cells ■ traffic calming **Road space reallocation** ■ reconnect severed neighbourhoods **Restricted traffic zones** ■ pedestrianonly zones	**Improve quality of transit service** ■ bus rapid transit system ■ bus lanes ■ bus priority ■ light rail and commuter rail services **Improve bus infrastructure** ■ quality vehicles ■ comfortable bus stations ■ easy to find route and timetable information, bus information at bus stops, train arrival information at stations **Improve bicycle infrastructure** ■ bicycle lanes and parking ■ bicycle route signage and maps **Improve pedestrian infrastructure** ■ safe sidewalks and crosswalks ■ pedestrian zone **Improve mobility options** ■ car sharing services ■ shared bicycle services ■ improved taxi and pedicab/rickshaw services
Plan/Design Measures	**Integrated land use planning** ■ regional spatial planning ■ transit oriented development ■ car parking planning standards to ■ complement transport policies	**Planning for nonmotorised transport** ■ street design for bicycles/pedestrian traffic ■ connectivity of streets ■ maps and wayfinding aids
Support Measures	**Enforcement** ■ fines, tickets and towing	**Public awareness** ■ marketing transit/explaining need for TDM measures ■ events like Car Free Day

Transit-Oriented Development
-
Public Transport integrated with Walking and Cycling

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Urban Pathways

Brainstorm: What do you (as the customer) want from Public Transport?

- ✓ Convenience
- ✓ Easy Access
- ✓ Comfort
- ✓ Frequent Service
- ✓ Rapid journey
- ✓ Safety & Security
- ✓ Customer Service
- ✓ Affordability
- ✓ Have a network

Public Transport should be designed around the customer and not around a technology

The conventional vs. the participatory approach

Step 1. Choose technology

Technology chosen due to manufacturer lobbying efforts

Design chosen to please existing operators

Technology chosen to help property developer

Step 2. Fit city to the technology

Reduce size of network due to financing limitations

Charge higher fares in attempt to pay for expensive system

Operate infrequent services to reduce operating losses

Require large subsidies for lifetime of system's operation

Step 3. Force customer to adapt to technology

Extensive marketing campaign to convince customers that system is in their interest

Which one is which?

Step 1. Design a system from customer's perspective

Rapid travel time

Few transfers

Frequent service

Short walk to station from home / office

Safe vehicle operation

Secure environment

Comfortable and clean system

Friendly and helpful staff

Full network of destinations

Low fare cost

Step 2. Evaluate customer-driven options from municipality perspective

Low infrastructure costs

Traffic reduction benefits

Environmental benefits

Economic / employment benefits

Social equity benefits

City image

Step 3. Decision

Technology decision based on customer needs and municipality requirements

Different MRT options available

Heavy urban rail

Monorail

Underground metro

Selection Criteria for MRTs:

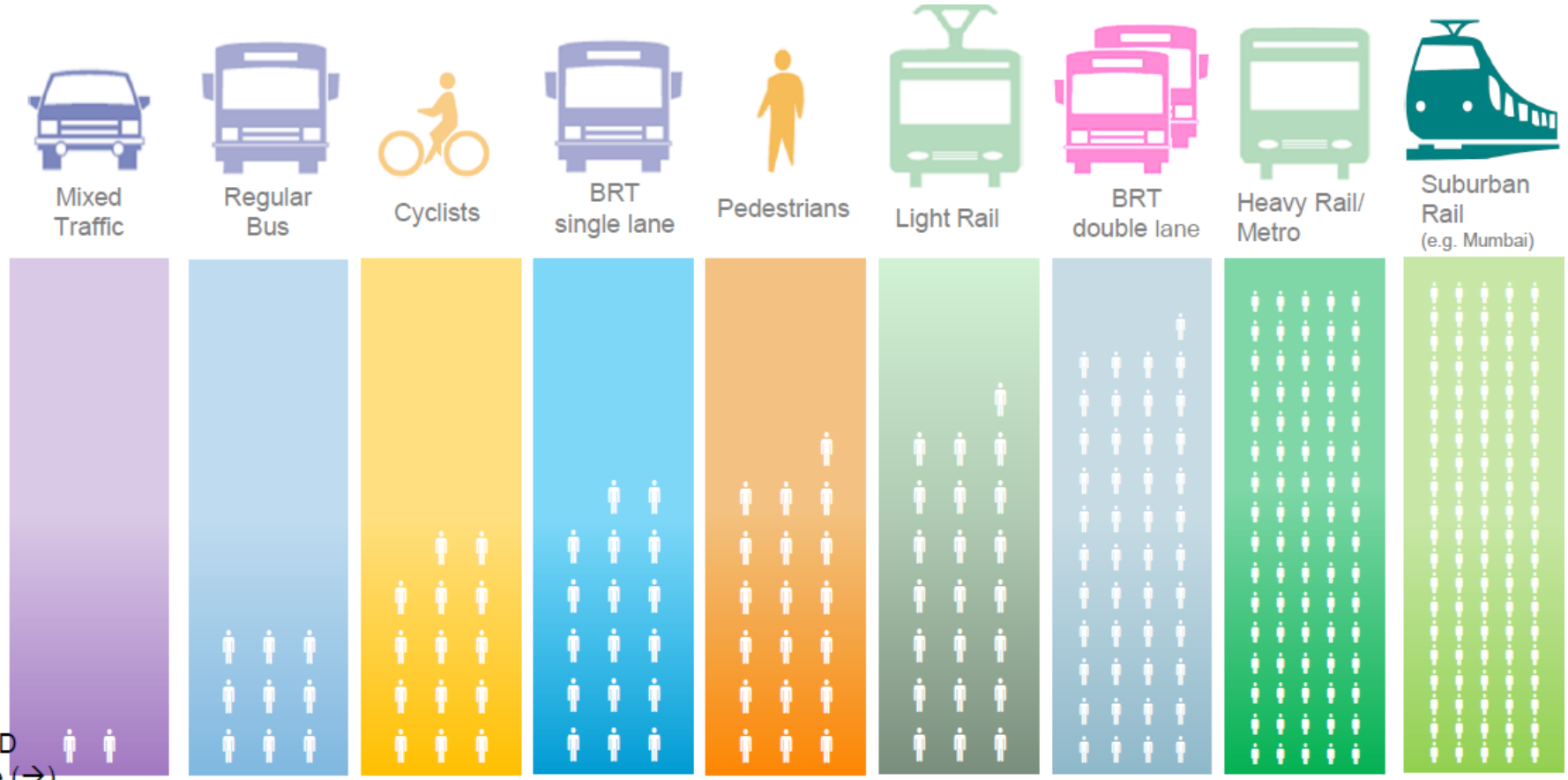
- Availability of the mode to meet demand
- Cost
- Right-of-way availability
- Environmental impact
- Journey time
- Safety
- Comfort
- Flexibility
- Reliability
- Fare
- Technical sophistication
- Implementation complexities
- Image

Light rail

BRT

Personal rapid transit

Choosing modes – Carrying Capacity (people per hour on 3.5 m wide lane in city - PPHPD



	Mixed Traffic	Regular Bus	Cyclists	BRT single lane	Pedestrians	Light Rail	BRT double lane	Heavy Rail/ Metro	Suburban Rail (e.g. Mumbai)
PPHPD Range (→)	1500-2000	5000	14000	9000	19000	18000 – 20000	??	40000 – 60000	60000 – 90000
Maximum PPHPD achieved & where (→)	2000	8000	14000	17000, Curitiba	19000	20000	43000, Bogotá	80000, HKK	>100000, Mumbai

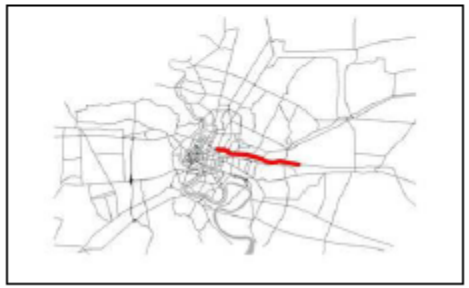
No System Dominates – it depends on what your city needs / what citizens are looking for

Financial Benefit – What a city can have for 1Bn USD?

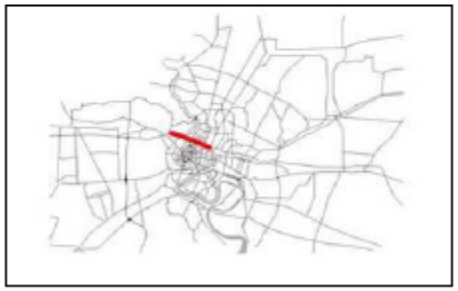
Example from Bangkok, Thailand

426 kilometres of BRT

40 kilometres of LRT



14 kilometres of elevated rail



7 kilometres of subway

BRT
US$ 0.5 – 15 millon / km

Tram
US$ 10 – 25 millon / km

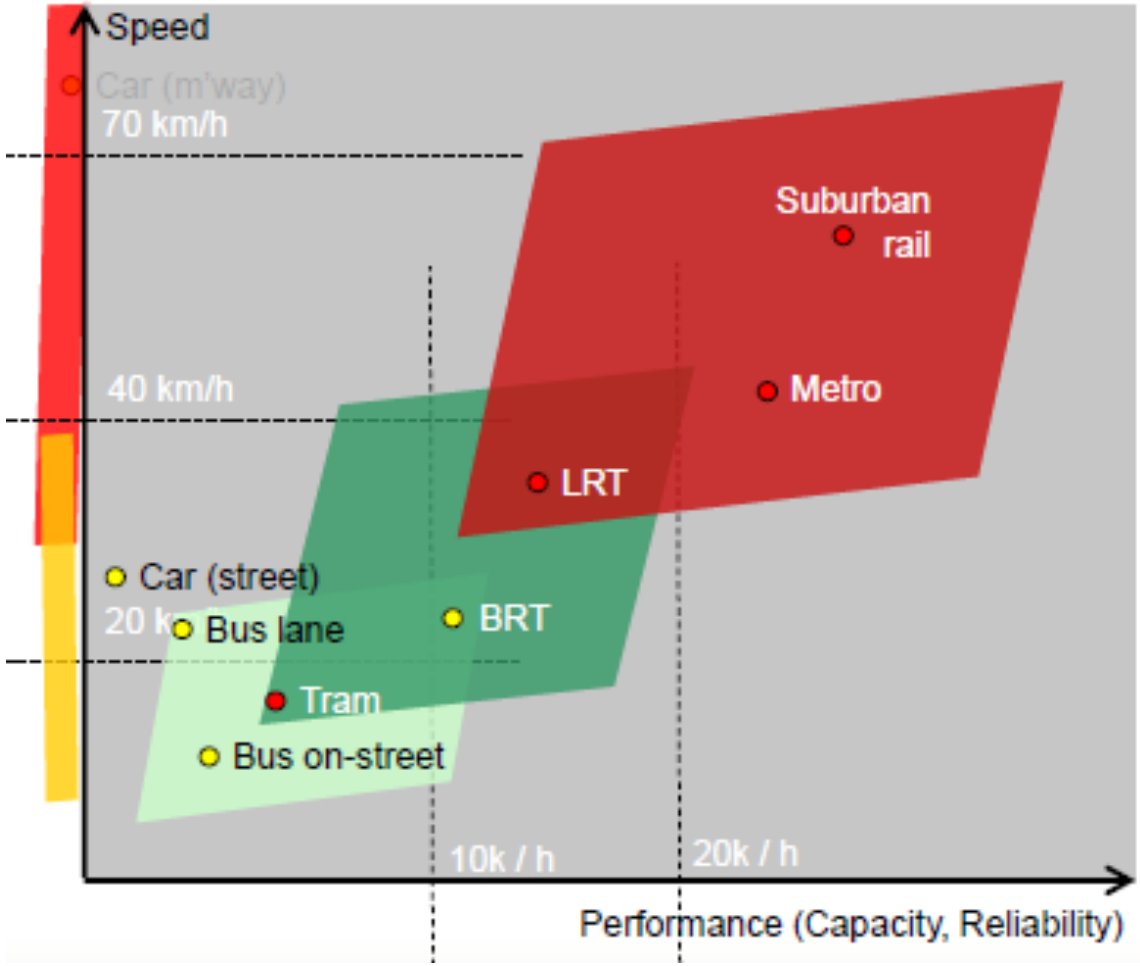
Light Rail Transit (LRT)
US$ 15 – 40 millon / km

Urban commuter rail
US$ 25 – 60 millon / km

Elevated rail
US$ 50 - 125 millon / km

Metro
US$ 60 millon – 320 millon / km

Selection Criteria for MRTs: Performance/Speed



Transit-Oriented Development

Just being adjacent to transit doesn't mean it's "transit-oriented"

So what is ToD?

- TOD brings **compact, mixed-use** development within **walking/ cycling distance** of **high capacity rapid transit** >> create compact city regions with short commutes

- If well planned and designed, corridors present a spatial context for designing a **network of TODs**

Density

Connectivity

Diversity

Placemaking

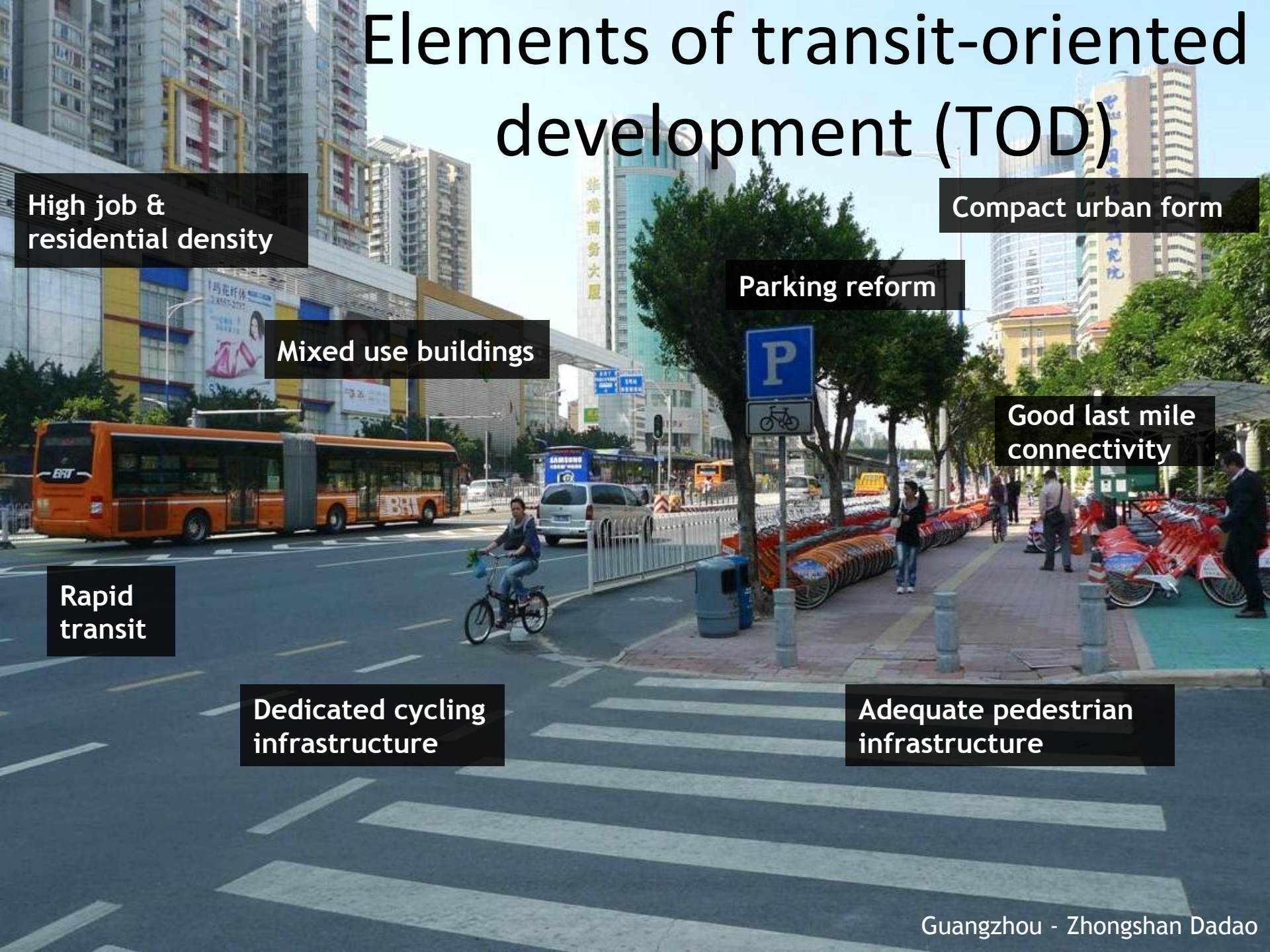
High Quality Transit is accessible by foot

RAPID TRANSIT

=

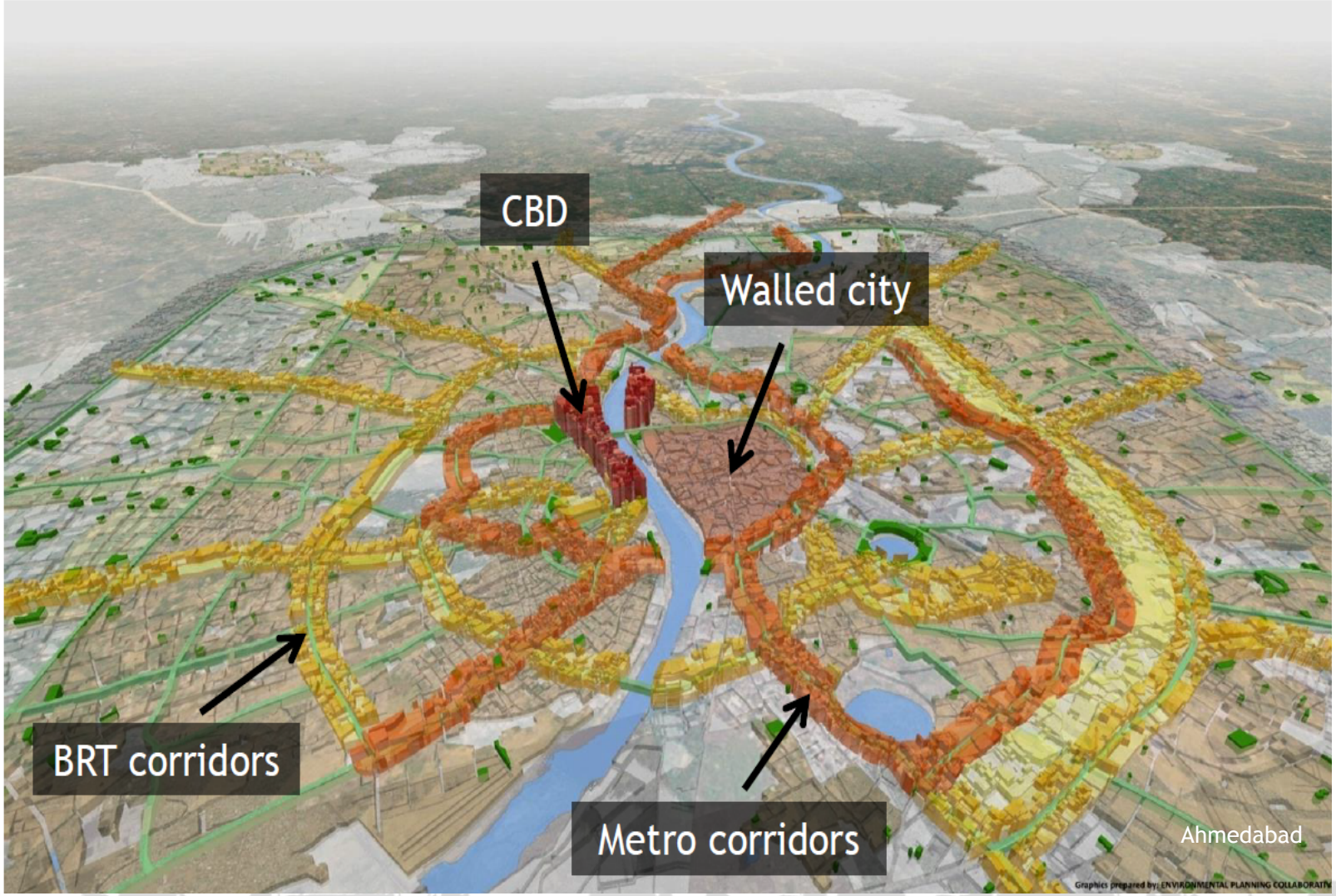
HIGH-QUALITY
HIGH-CAPACITY
HIGH-SPEED
CUSTOMER-ORIENTED
PUBLIC TRANSPORT

Elements of transit-oriented development (TOD)



Encourage Intensification of uses along rapid transit corridors

Add density along transit corridors/ circular connections



Integrate different MRT options

Medellin

Integrate different Transport options

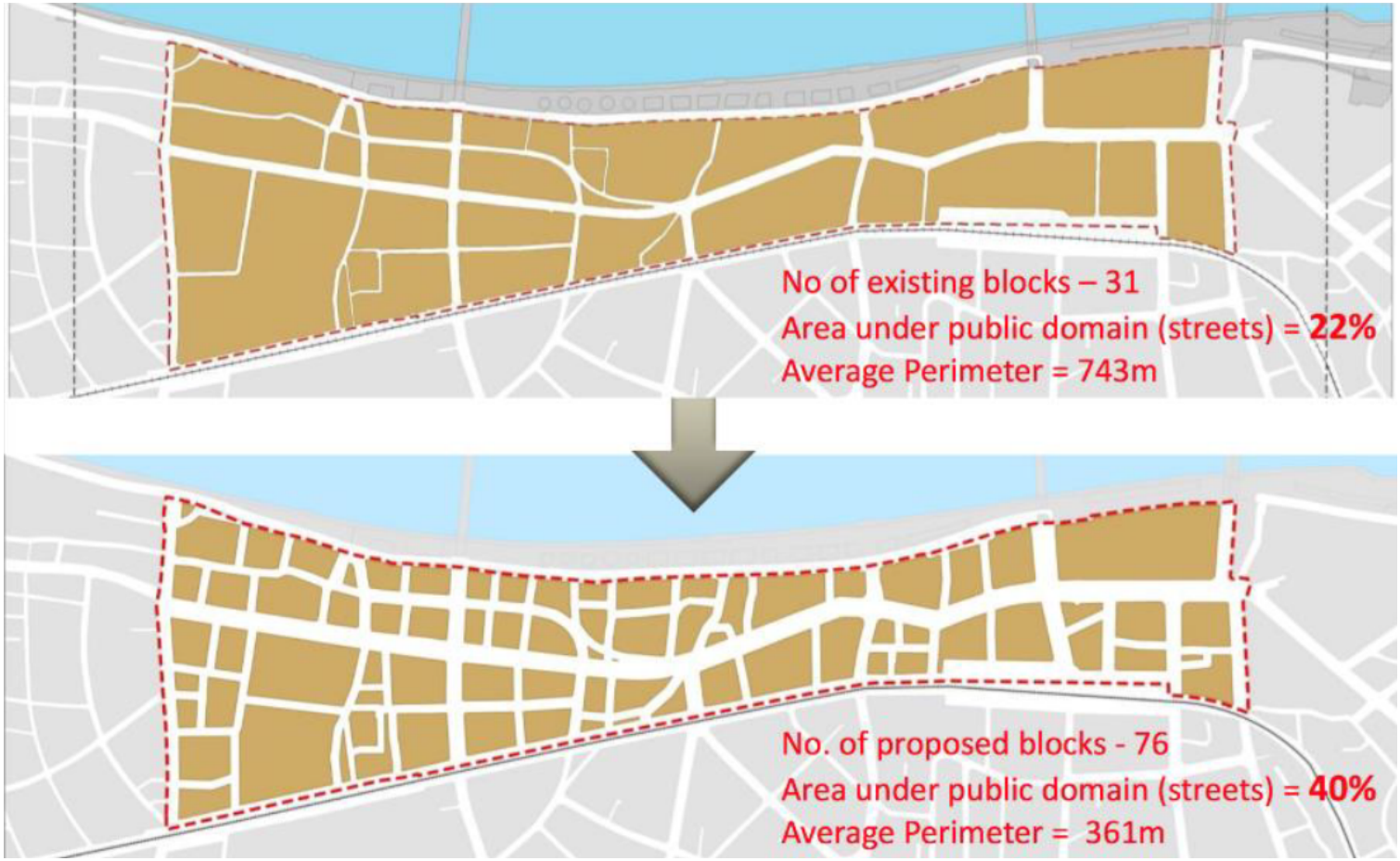
Integrate different Transport options

Cycle parking at transit stations

2.2

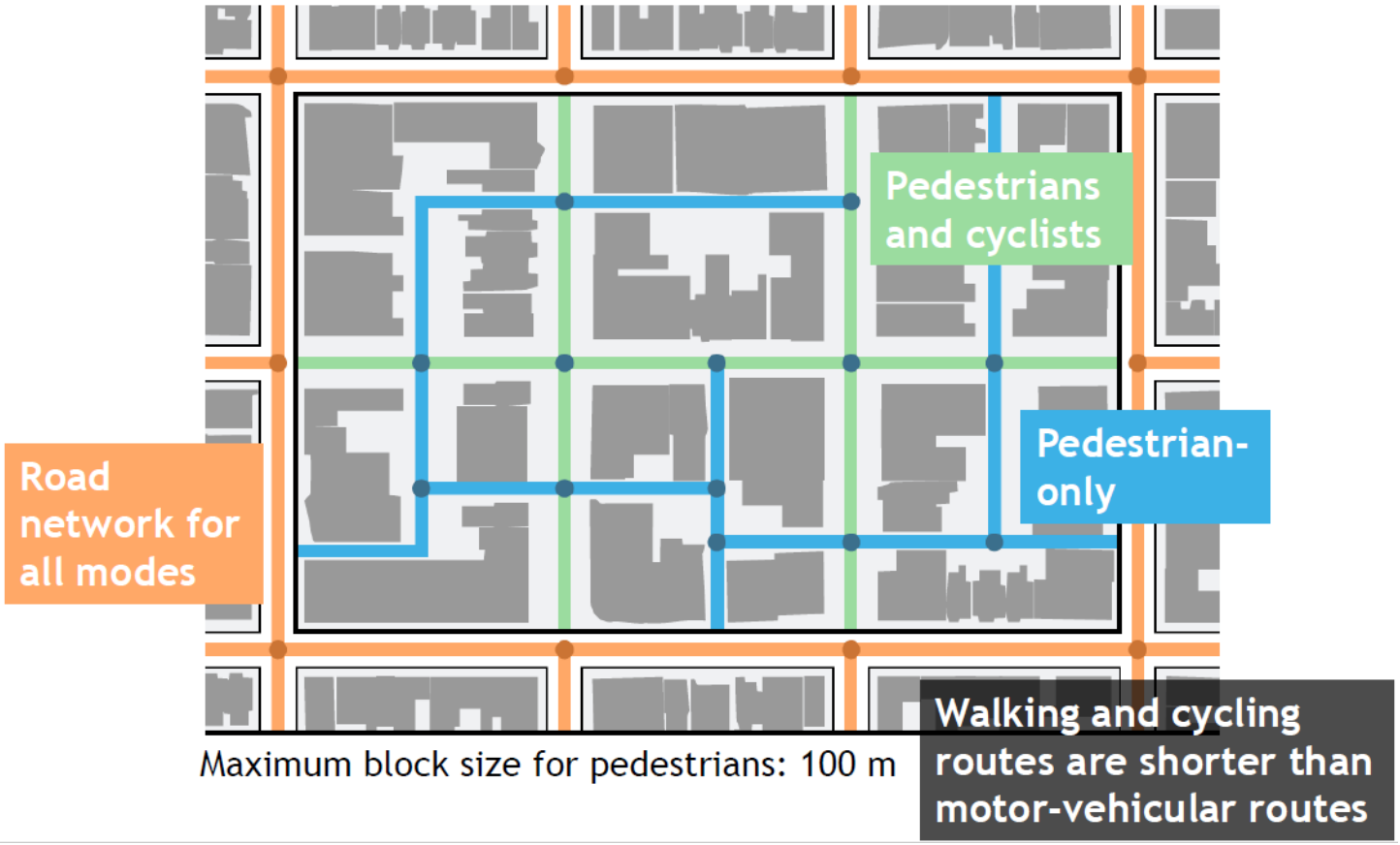
Cycle parking in paid area of BRT

Fine grid of streets with smaller blocks

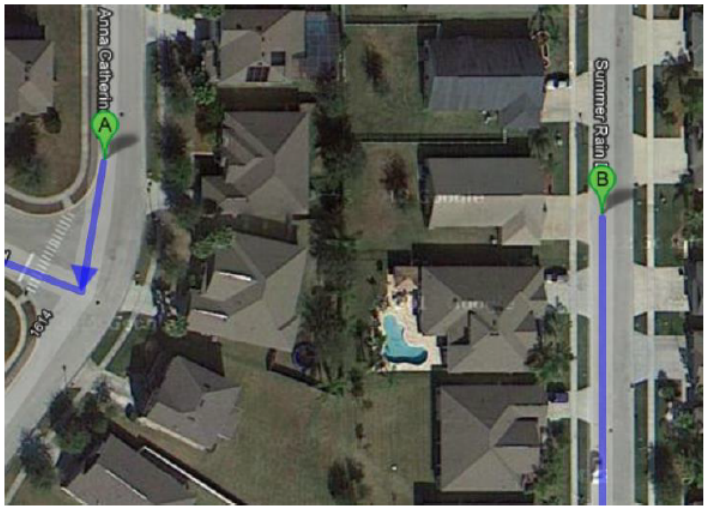


Ahmedabad

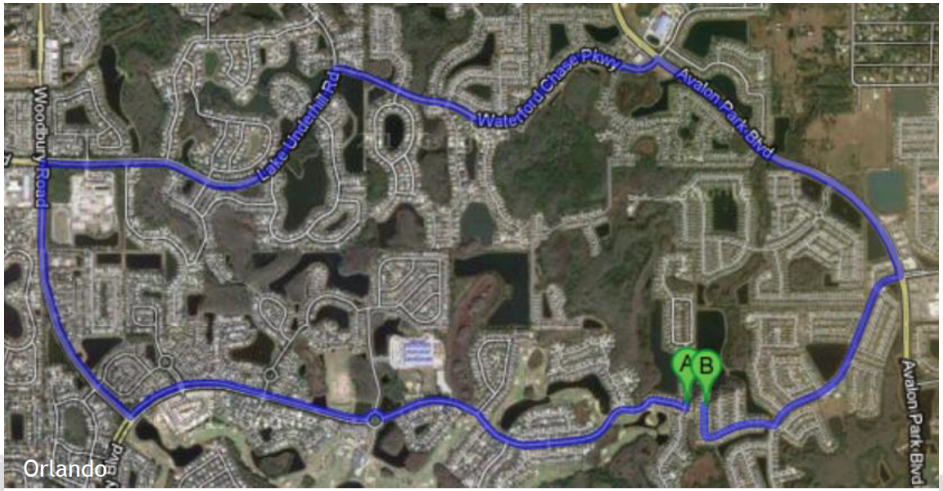
Prioritised connectivity for NMT users



Smaller Blocks are important

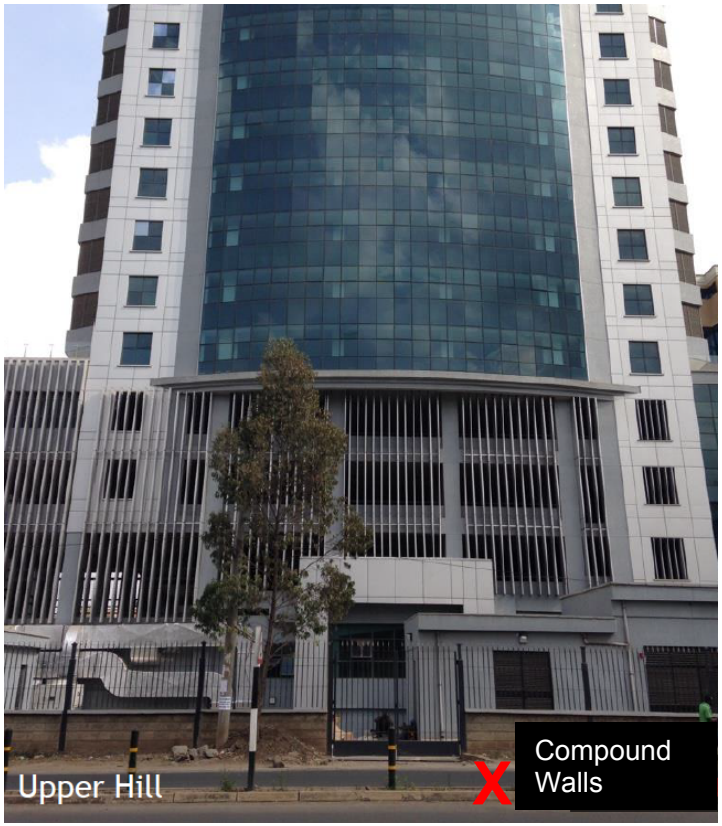


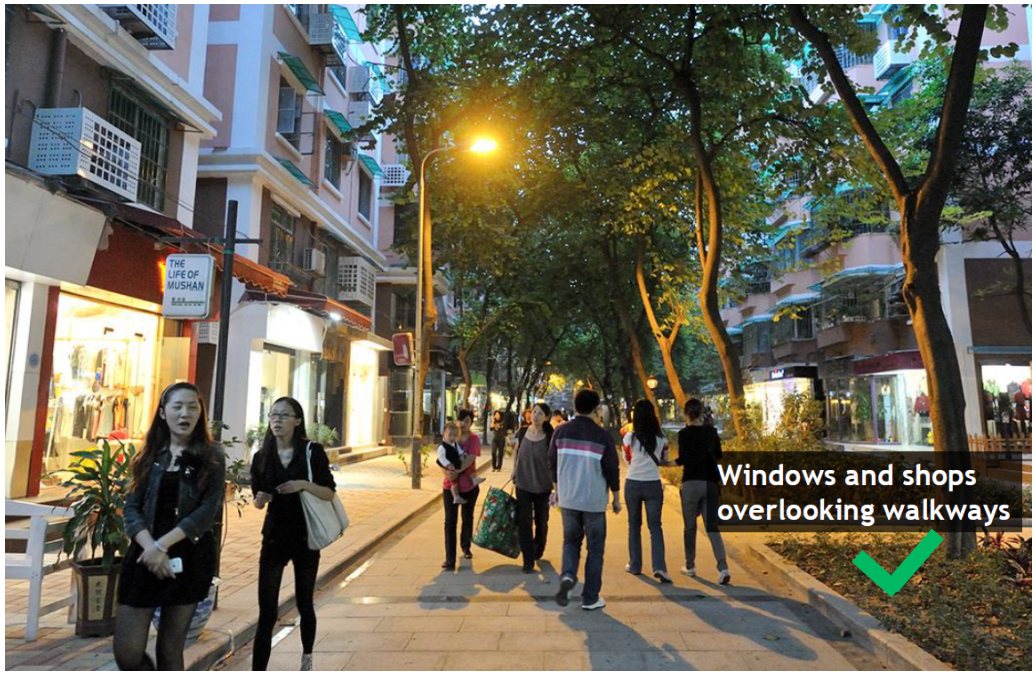
Dense network of direct short paths to improve accessibility…



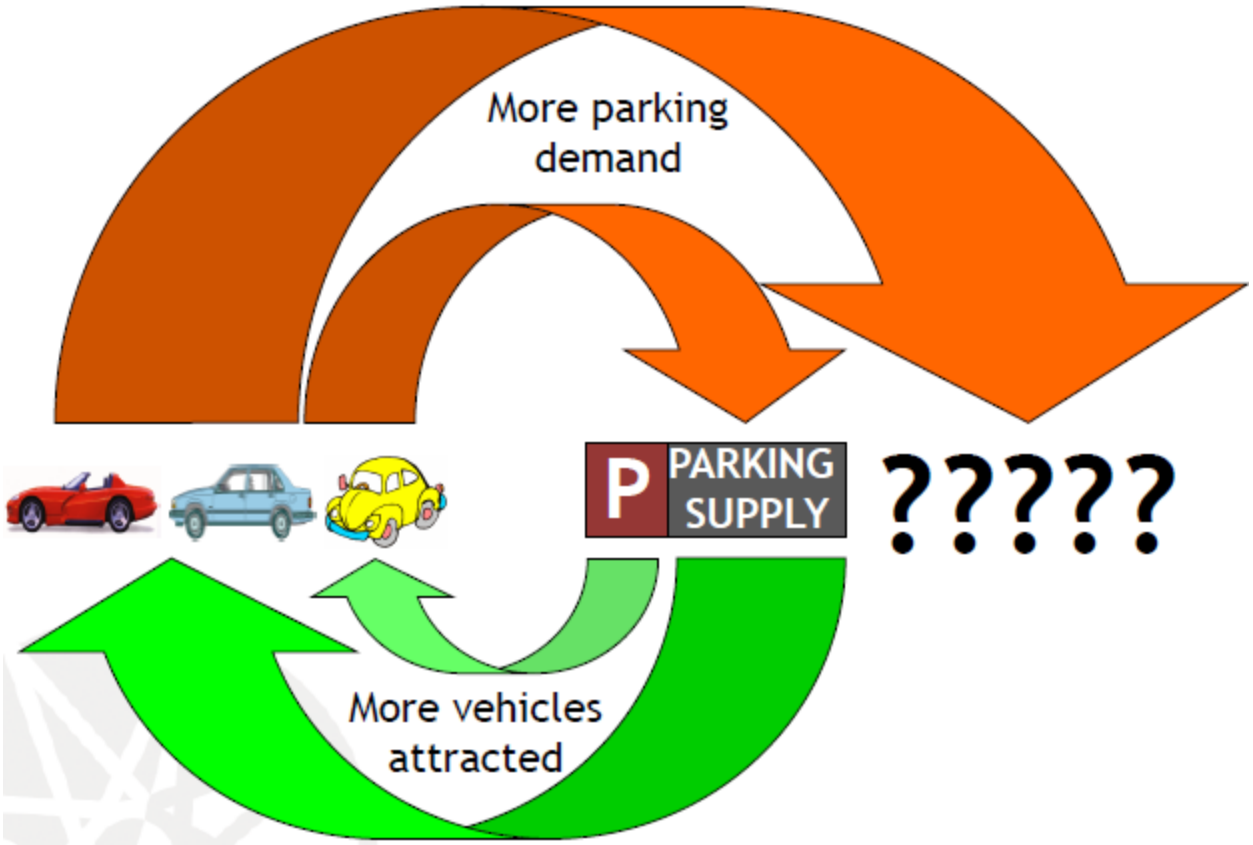
…12 km walk

Building design regulations that promote street life





Lower supply of parking in areas well served by rapid transit




First of all, parking is a commodity, not a right. It comes with a price.
I bought a car but the government hasn't given me a free place to park!
I bought an air conditioner but the government hasn't given me a free house in which to install it!

What should the government provide?

Car parking spaces for a few?

OR

Walking, cycling & public transport for all?

Parking Policy

Parking policy: Old school

1. Increase in private vehicle use is a given.
2. Parking is a public good. People need it.
3. Govt contantly increases supply of subsidized public parking space—especially through multi-level parking.
4. Govt pushes private buildings to create more private parking space through regulation.
5. Govt creates more road infrastructure to cater to the ever increasing number of vehicles attracted to parking.

Parking policy: Smart cities

1. It is impossible to cater to unending parking demand.
2. Parking is a commodity, not a public right
3. Restrict total supply of parking in every zone: paid parking (on/off street) and private parking (in buildings)
4. Govt charges high user fee for available parking spaces to dissuade excessive motor vehicle usage
5. Govt spends the substantial revenue generated to improve public transport and walking/cycling facilities for all citizens

Utilize the gained space for the PEOPLE

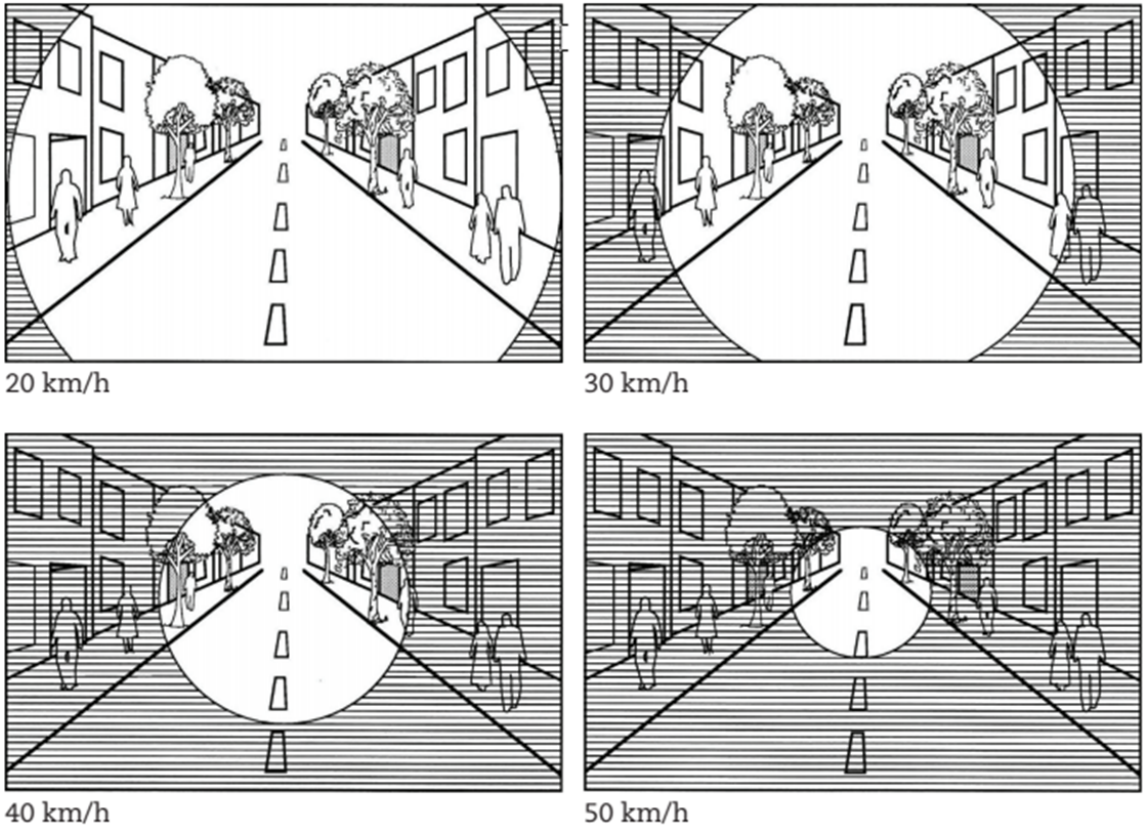
- Introduce parking regulation and management; introduce a cap on parking supply/ eliminate parking maximums

Prevent accidents through speed control

Example Paris

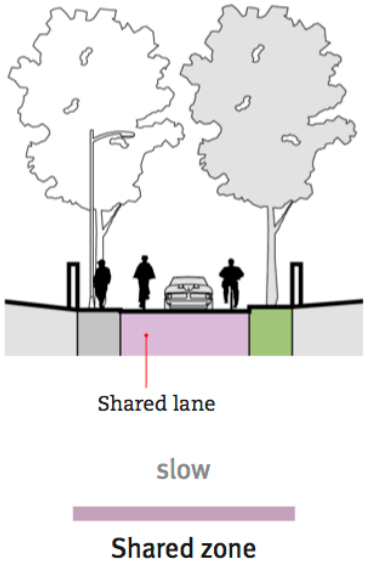
Prevent accidents through speed control

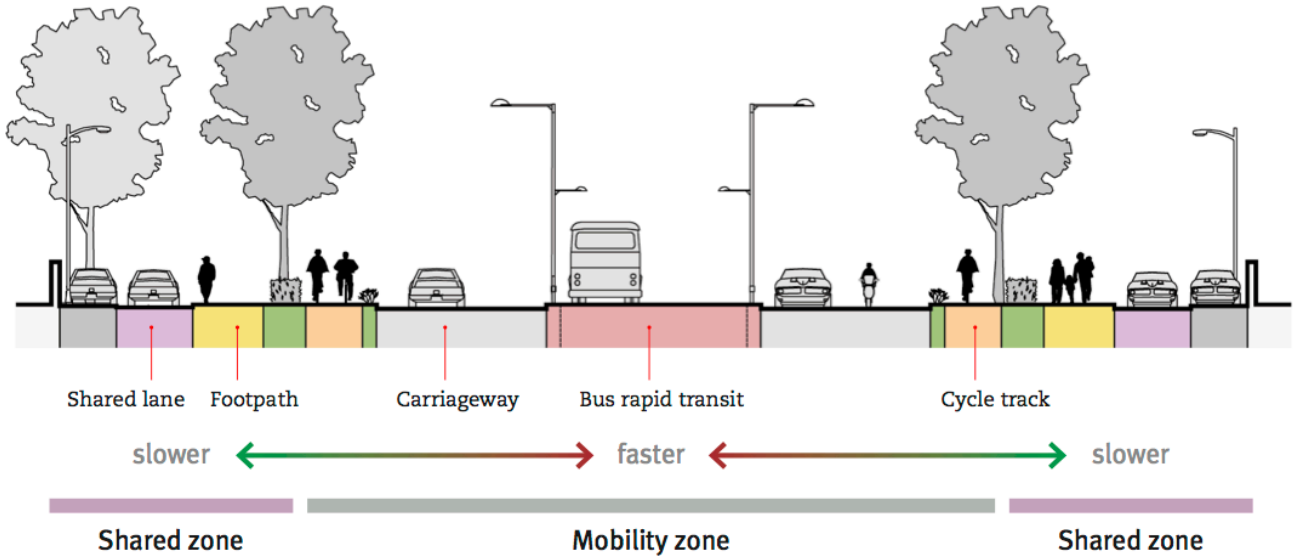
Keeping vehicle speed low is crucial for pedestrian/cycling safety



Source: ITDP

All streets need slow zones

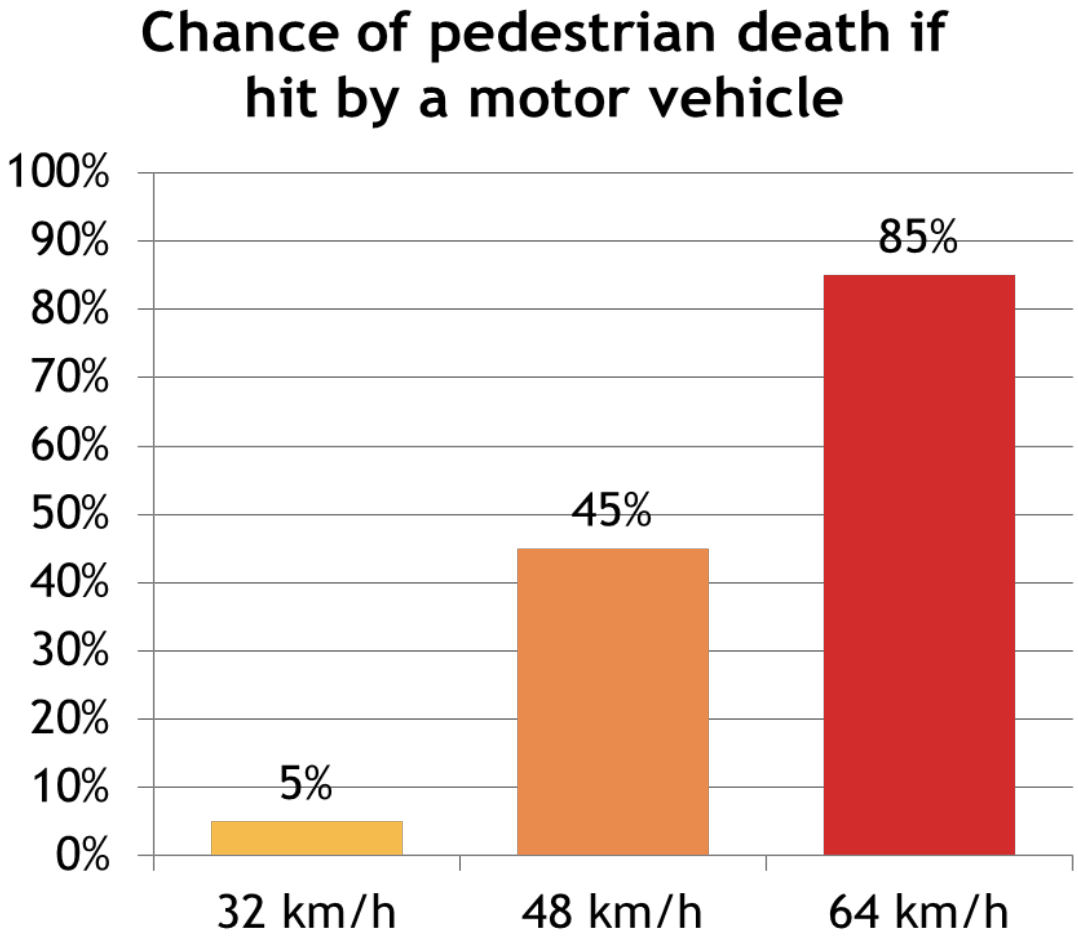




For narrow ROWs, the entire width should be designed as a slow zone

On wider streets, a separate slow zone is necessary

Slower Speed saves lives



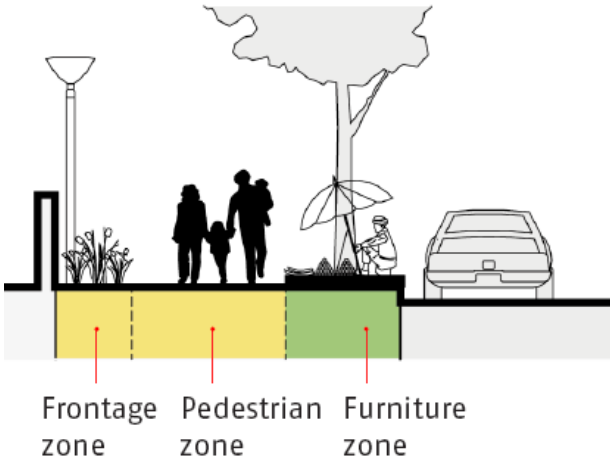
Motor vehicle speeds above 30 km/h significantly increase the risk of fatalities

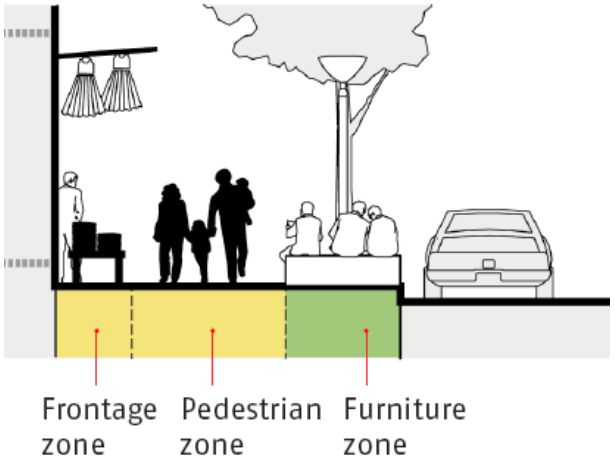
UN-Habitat/ ITDP guide for improved street design

Footpath design: A zoning System

Clear demarcation of 3 zones:

1. **Pedestrian zone:** continuous space for walking (minimum 2 m)
2. **Frontage zone:** buffer between street-side activities and the pedestrian zone
3. **Furniture zone:** space for landscaping, furniture, lights, bus stops, signs and private property access ramps





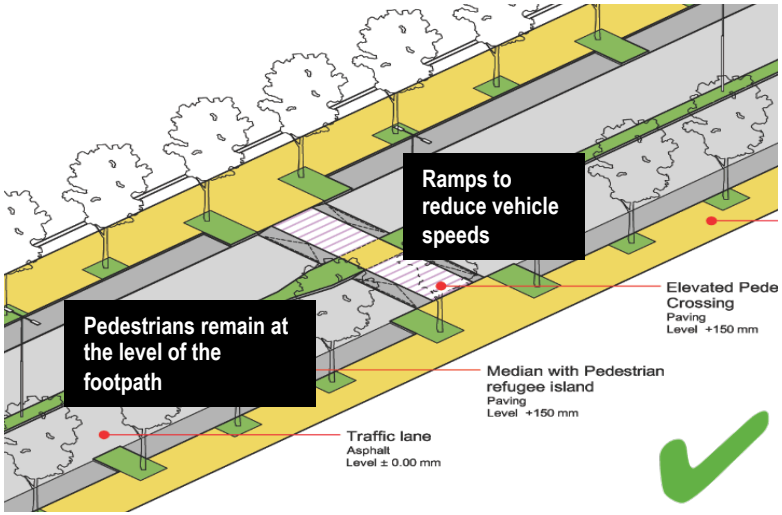
Great example: Chuncheon

Great example: Chennai

Great example: Chuncheon

Tactile Design to ensure accessibility for all

Design Example: Crossing



Safe At-Grade Crossings

- Pedestrians remain at level of footpath
- Ramps

Great example: Chuncheon

Elevated pedestrian crossing forces cars to slow down

Great example: Chuncheon

Ramps helps Elderly to move around town


ITIRE ZO

If possible, avoid: Foot overbridges & subways

- In an attempt to increase motor vehicle speeds, at-grade pedestrian crossings are frequently replaced by foot overbridges or subways

- But these facilities are often inaccessible and have drawbacks, such as (**Brainstorm**):

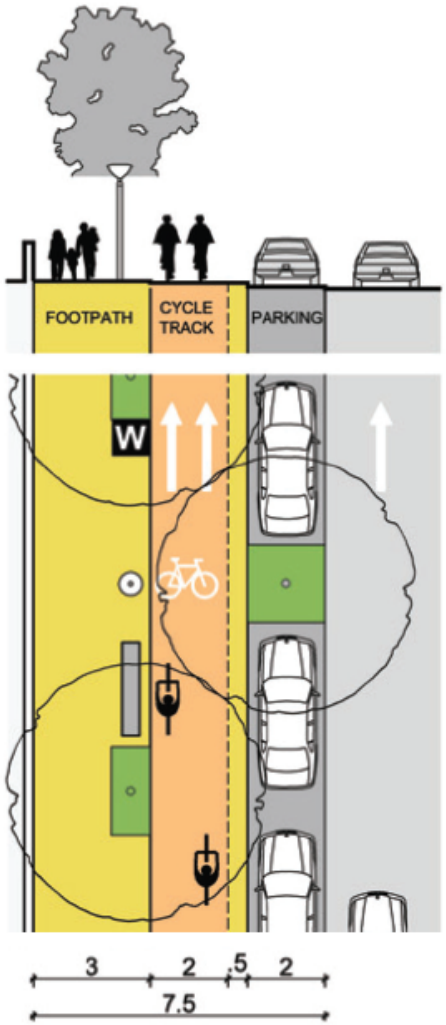
Increase in travel time
Lack of universal access
Obstructions on footpaths
Prohibitive cost
Harassment and other crimes
Increased vehicle speeds

Preferred choice by pedestrians: At grade crossing

✘ Foot overbridges often obstruct footpaths and cycle tracks, making them completely inaccessible.

✘ Footbridges often represent a wasted investment. When presented with a choice, pedestrians prefer to cross at street level.

Cycle tracks require a width of 2 m or one-way movement and should be raised above the carriageway



Cycle tracks require a clear width of 2 m for one-way movement. Cycle tracks should be raised above the carriageway.

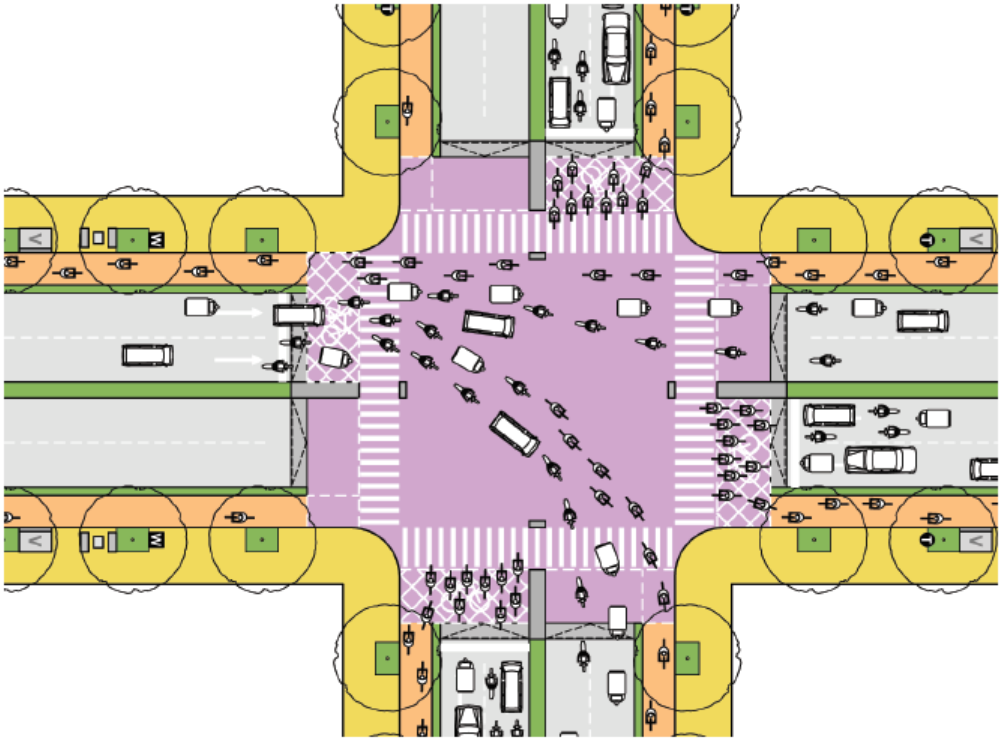
✔ This cycle track is physically separated from the carriageway and is wide enough for cyclists to overtake one another.

✘ Painted cycle lanes are not clearly visible in the streetscape and do not offer a safe riding environment.

Great example:
Chuncheon


REPLACE IT

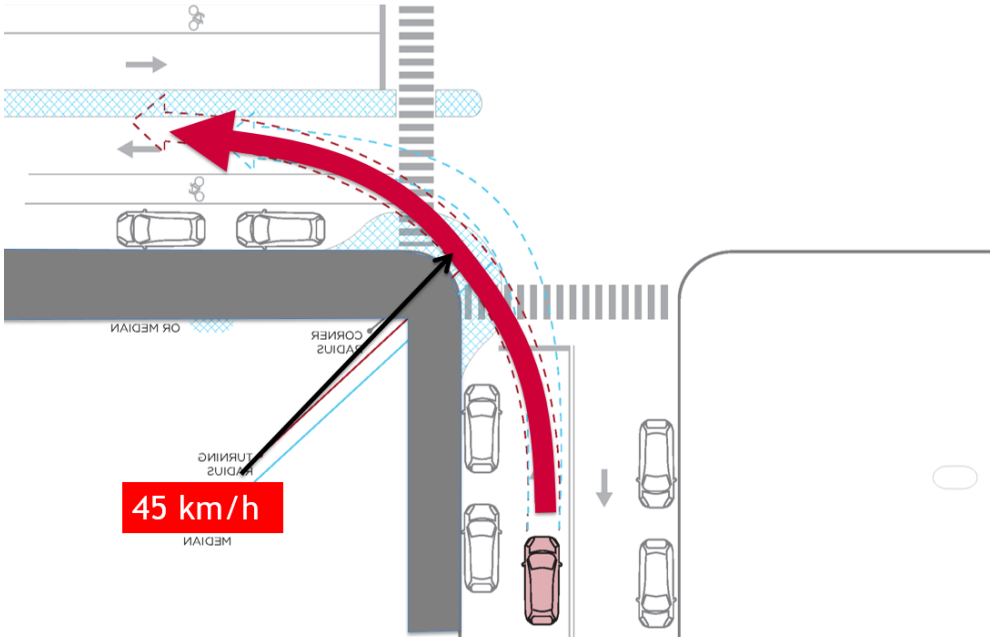
Safe Intersection Design

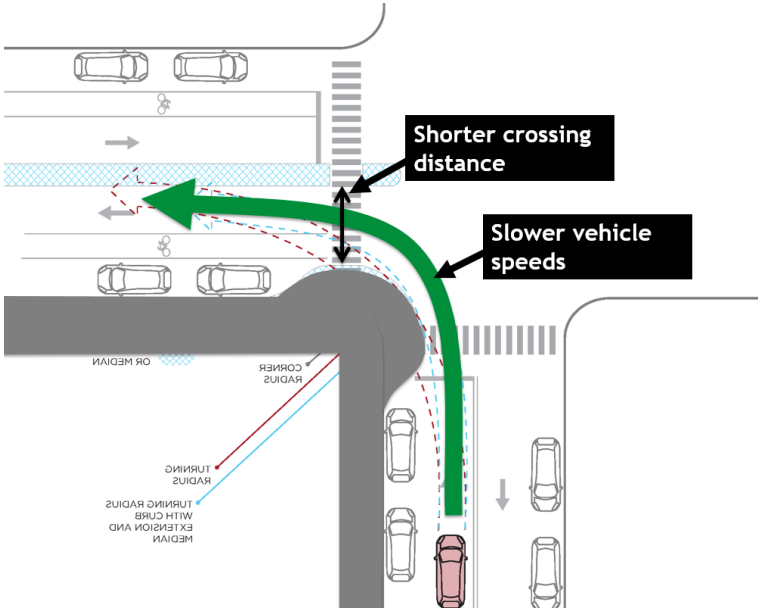


An intersection should be sized to minimize crossing distances for pedestrians and cyclists while accommodating left turns of a design vehicle (e.g., a 12 m bus).

- direct, intuitive pedestrian crossings
- reflect pedestrian desire lines, avoid detours
- crossing distances should be minimised
- pedestrian refuges large enough to handle observed pedestrian volume

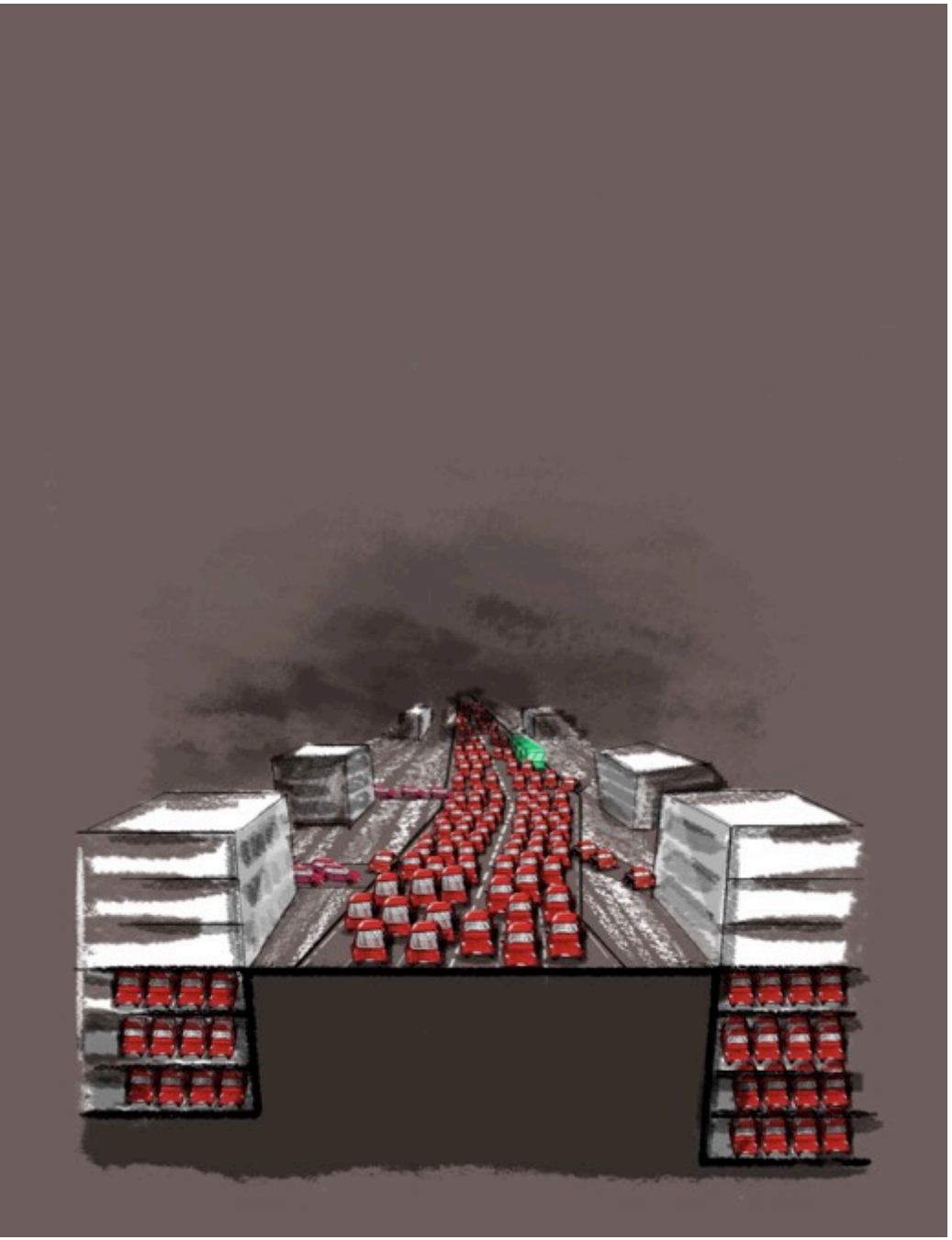
Sharp corner forces cars to slow down





Source: ITDP

UN-Habitat Project Example: Bucaramanga



Cities for cars

Build roads

Add traffic jams

Add pollution

Add road deaths

Cities for people

Add transit
Add density
Cut parking
Better quality of life!

Thank you!

Stefanie Holzwarth
stefanie.holzwarth@un.org
+254702721027
Urban Mobility Unit, UN-Habitat

International Urban Training Center
IUTC Training Leaders For a Sustainable Future

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Urban Pathways