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Sustainable urban mobility within the framework of land-use and transport integration

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2 Why is integration necessary ?

Land use

Infrastructure

Management

Information

Awareness

Pricing

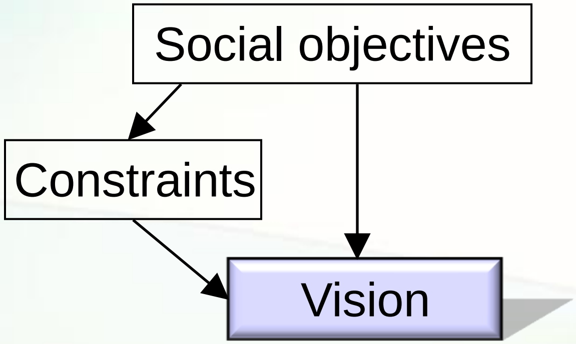
- No single policy instrument will be sufficient alone.
- There will be barriers to the implementation of most policy instruments.

3 Decision making process

I. Visioning level

Visioning: a big picture of objectives

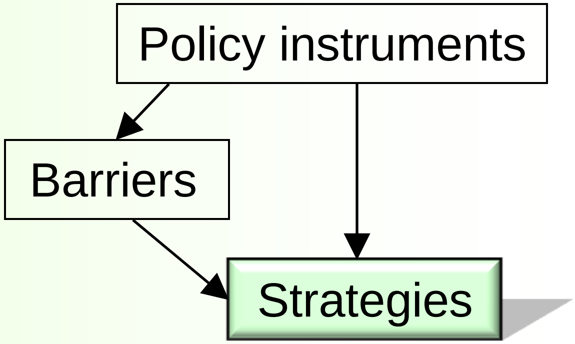
- Enhancing QoL and sustainability
- Location-efficient urban structure
- Quality mobility for social Inclusion



II. Strategic level

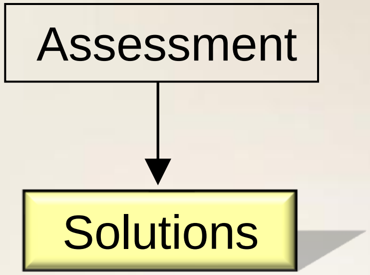
Strategy: a combination of instruments

- Land use and transport integration
- Restriction of car ownership and use
- Competitive public transport systems



III. Implementation level

- Timing of investment for mass transit systems
- Maximum utilisation of existing infrastructures
- Opening / promoting market for value capture



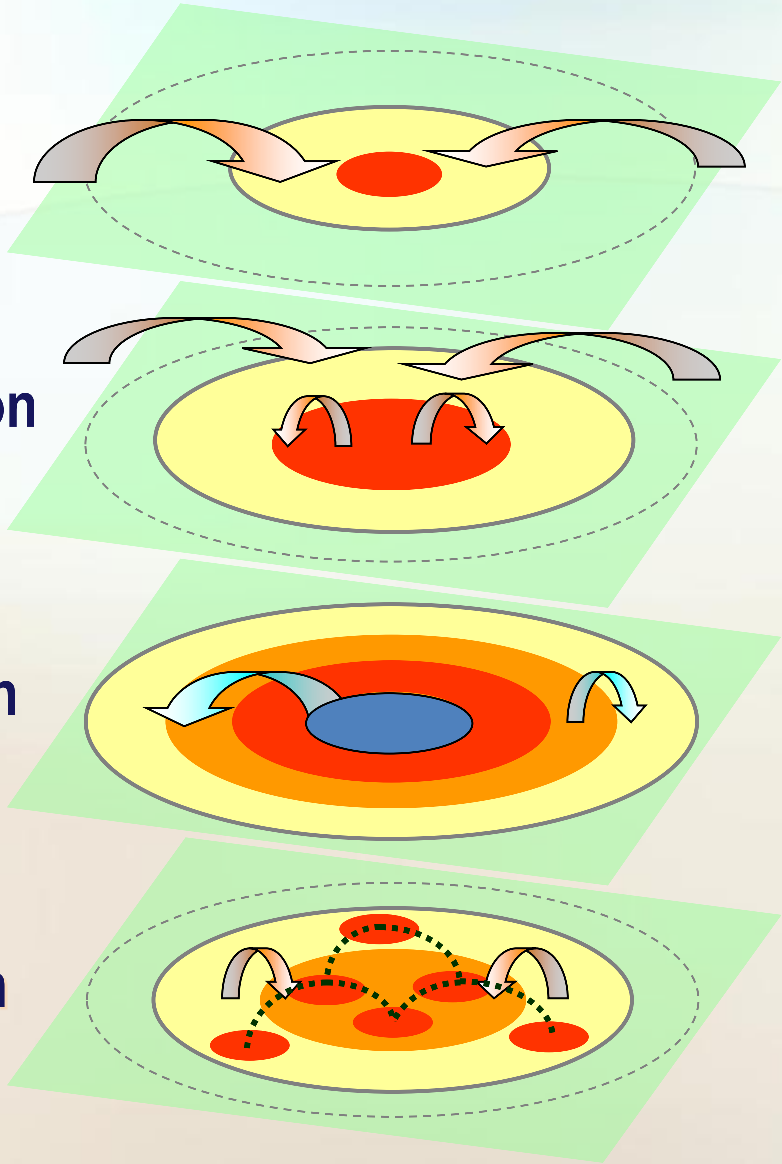
4 Changing roles of urban transport

Urbanisation

Suburbanisation

Disurbanisation

Reurbanisation



Urban concentration

Development of rail transport

Urban expansion with sprawl

Rapid motorisation

Long distance and fast travel

Decentralisation and decline

Continued motorisation

Collapse of public transport

Regeneration of urban cores

Emergence of new mobility

Neighborhood and slow travel

From urban sprawl to reurbanisation

6 Scenario building towards a revolution

- **Jump in fuel prices (2002)** ⇔ **Kyoto protocol for GHG**
- **Road pricing schemes (2003)** ⇔ **Unprecedented super-aging**
- **Bombing in tube and bus(2005)** ⇔ **Great East Japan earthquake**

Cycle revolution in London, etc.

individual

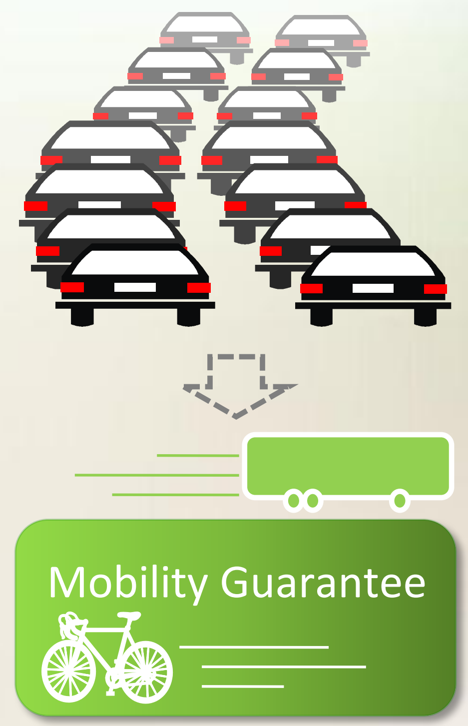
- Needs for spontaneous and self-supported mobility
- Driving time of special and irreplaceable value
- Relatively low cost of private car purchase and use

city

- Road space with a high priority to private car use
- Urban space that ensures door-to-door trips
- Dispersed city discouraging public transport use

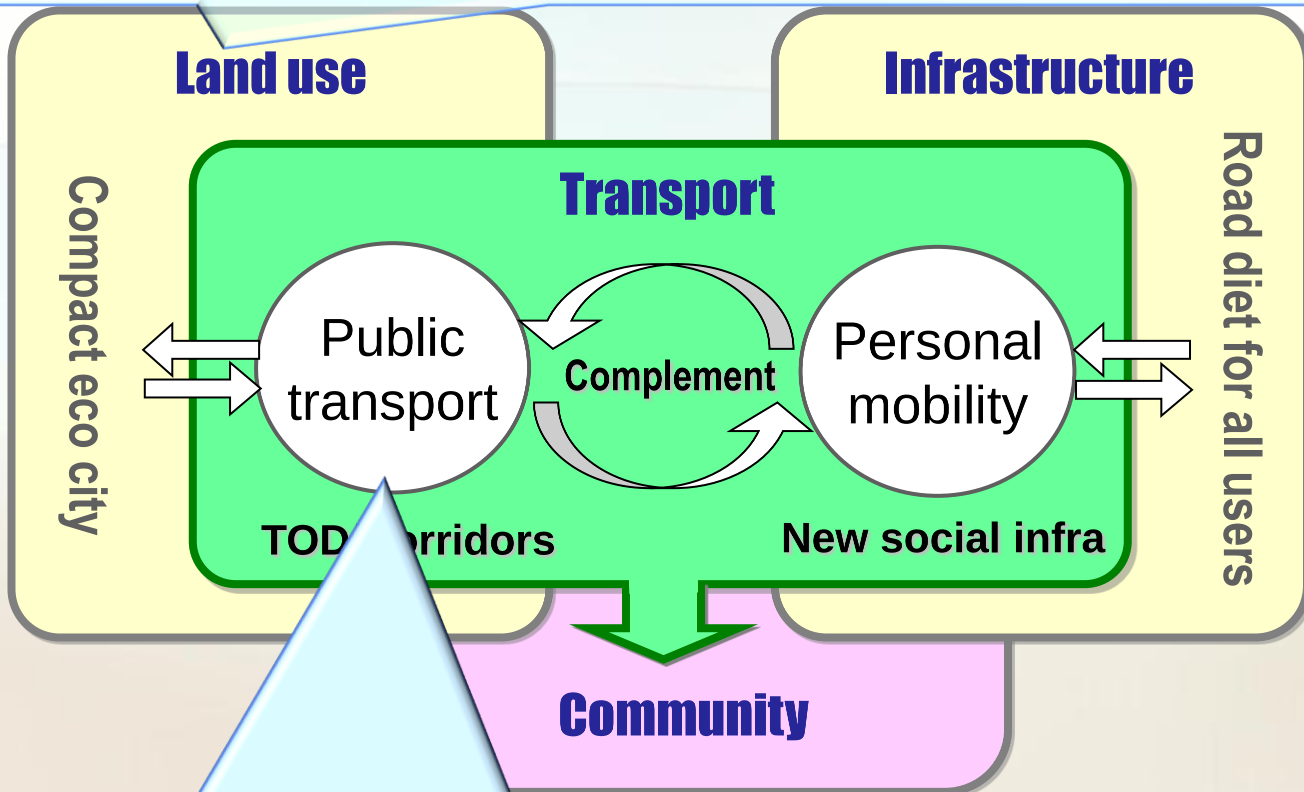
society

- Relatively low fuel price that enables daily car use
- Unawareness of externalities of private car use
- Inattentiveness to a super-aging society

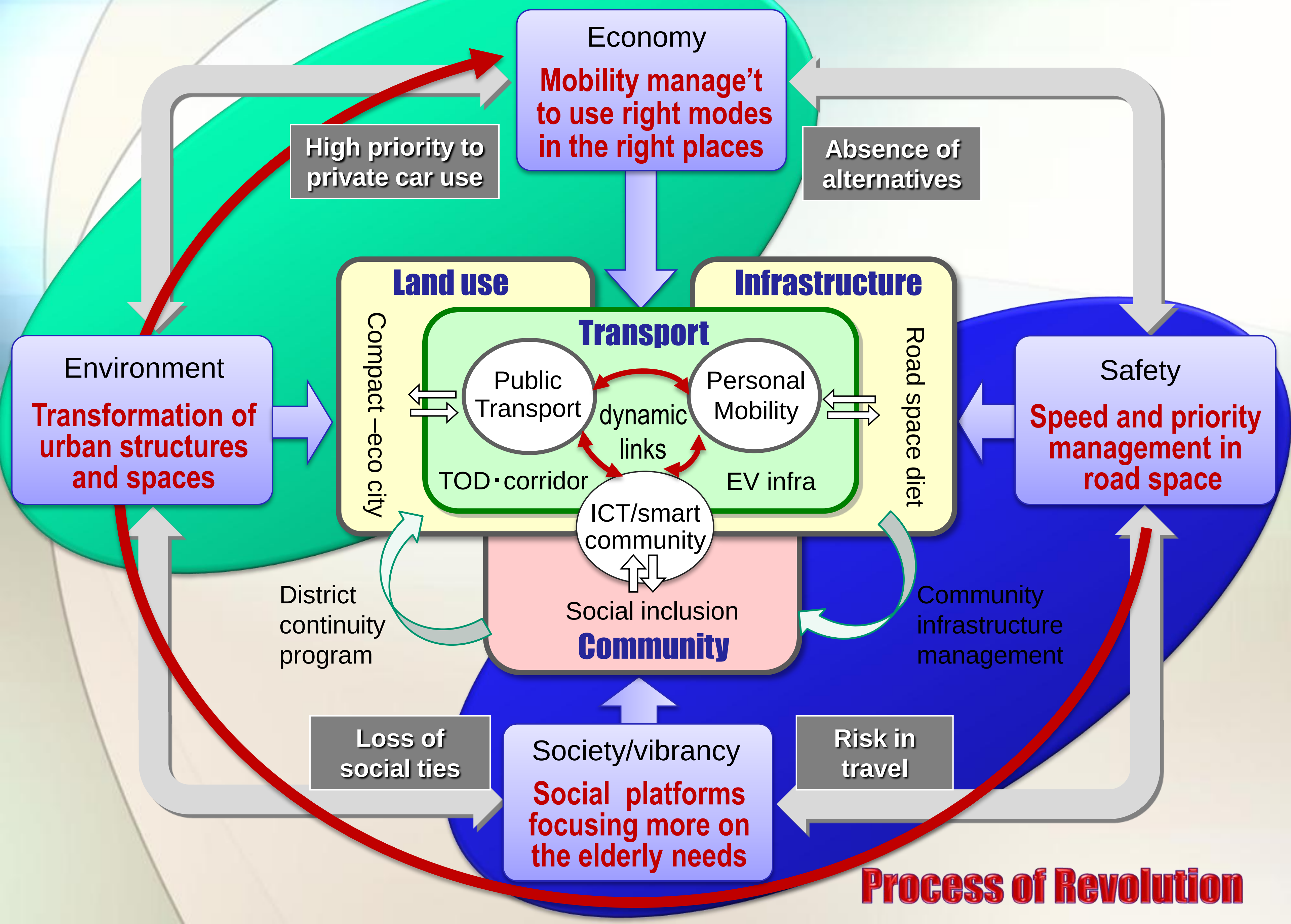


Management of UMS in the LUTI framework

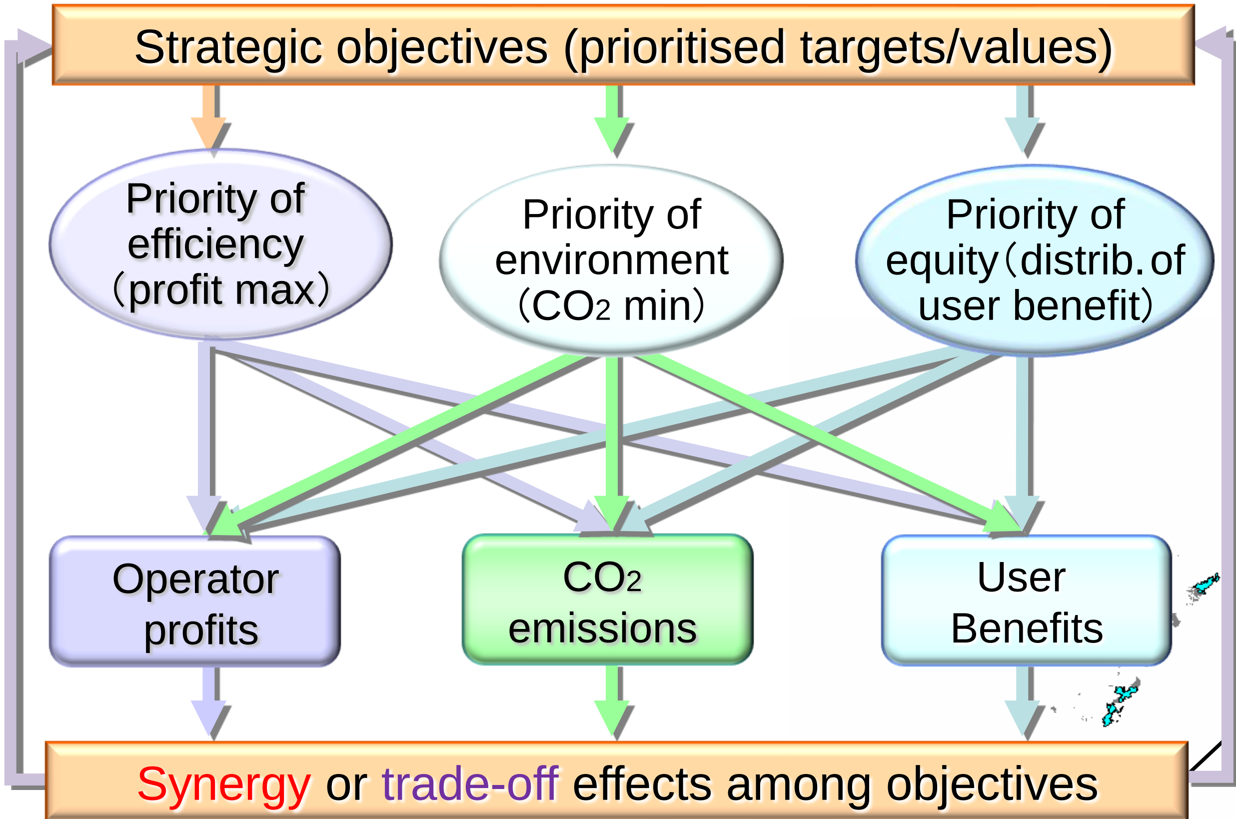
Management of urban mobility systems has to start with the location of activities, where the need for mobility is generated

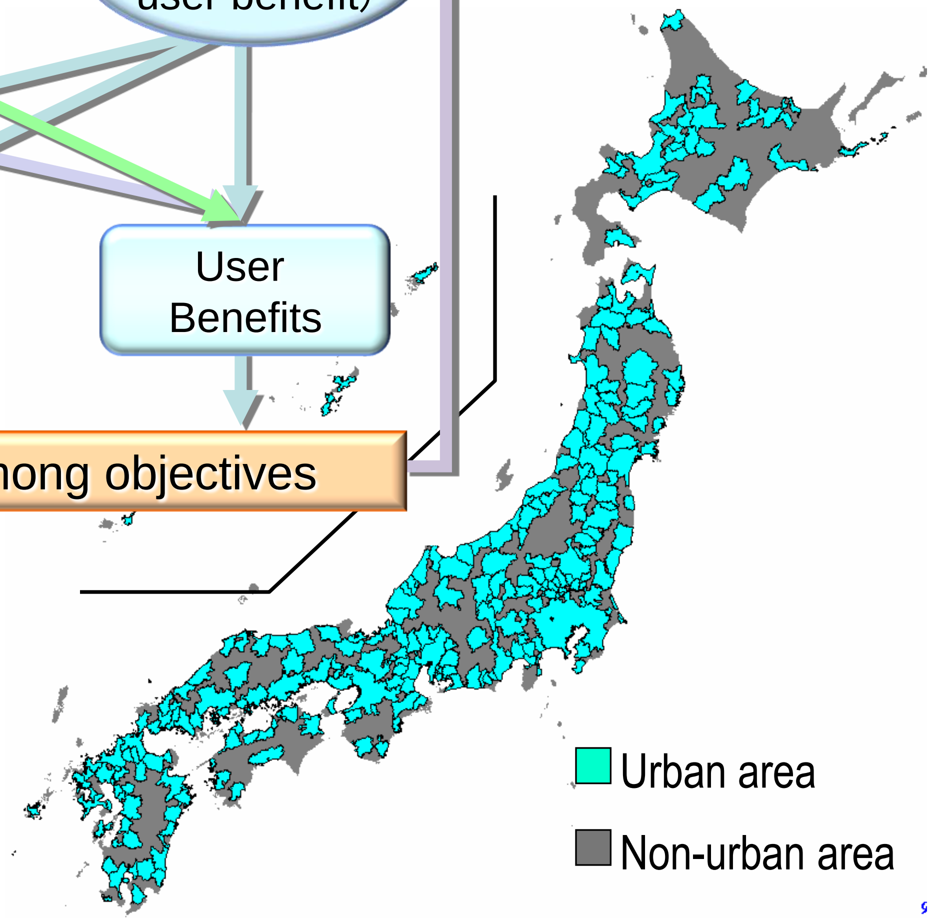


The linkage between a wide-spectrum of transport, land use and infrastructures are often neglected, and lack of their coordination undermines the sustainability of urban mobility systems, esp. PT.


Economy
Mobility manage't to use right modes in the right places
High priority to private car use
Absence of alternatives
Land use
Infrastructure
Transport
Compact –eco city
Road space diet
Public Transport
Personal Mobility
dynamic links
TOD・corridor
EV infra
ICT/smart community
Environment
Transformation of urban structures and spaces
Safety
Speed and priority management in road space
District continuity program
Community infrastructure management
Social inclusion
Community
Loss of social ties
Risk in travel
Society/vibrancy
Social platforms focusing more on the elderly needs
Process of Revolution

Cross-assessment in the strategic level





A technique for evoking strategies

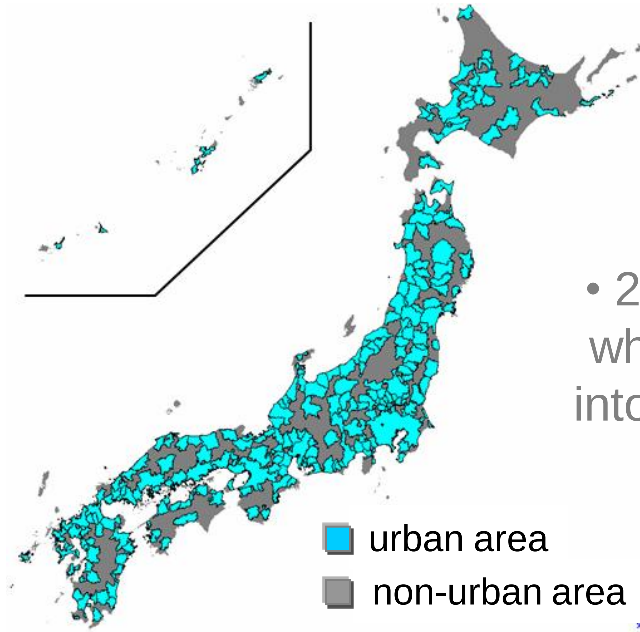
Most often used methods for evoking ideas

- Analogy 類比発想
- Forced association 強制連想
  - Reverse
  - Replace
  - Extremise

  part of elements, aspects or criteria.

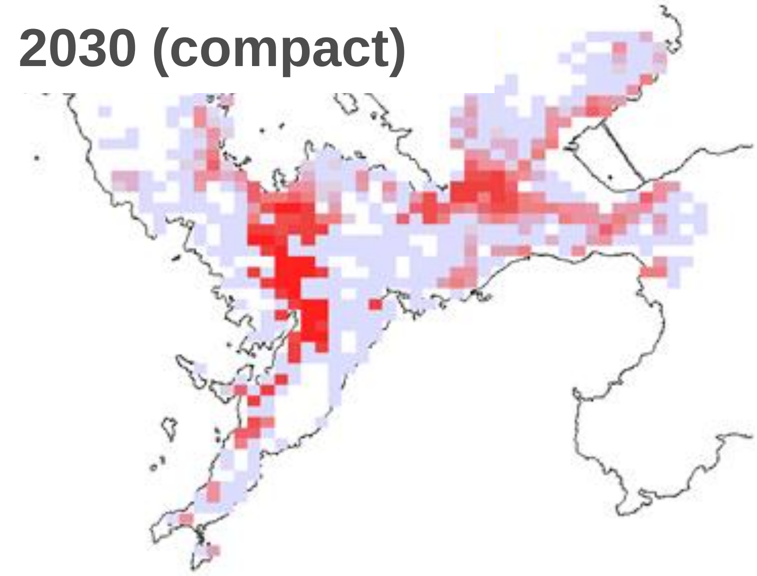
what happens if we ***extremely*** ***or thoroughly pursue*** some strategic objective among efficiency, equity and environment

11 Land use scenarios : up to 2030

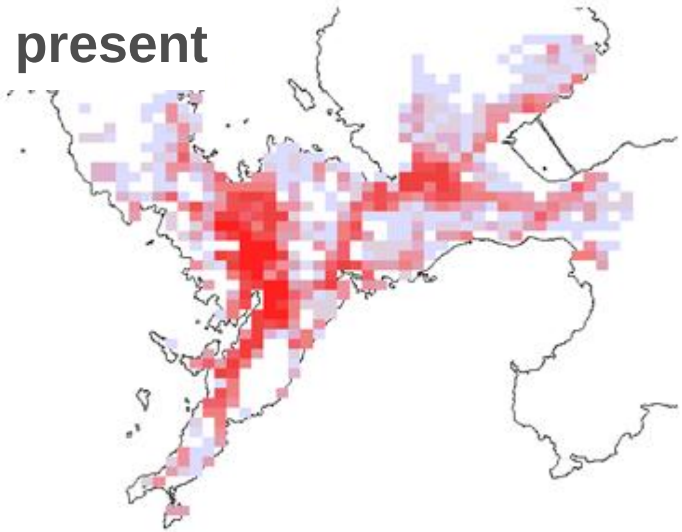


- 269 urban areas which are divided into 1km^2 grid cells

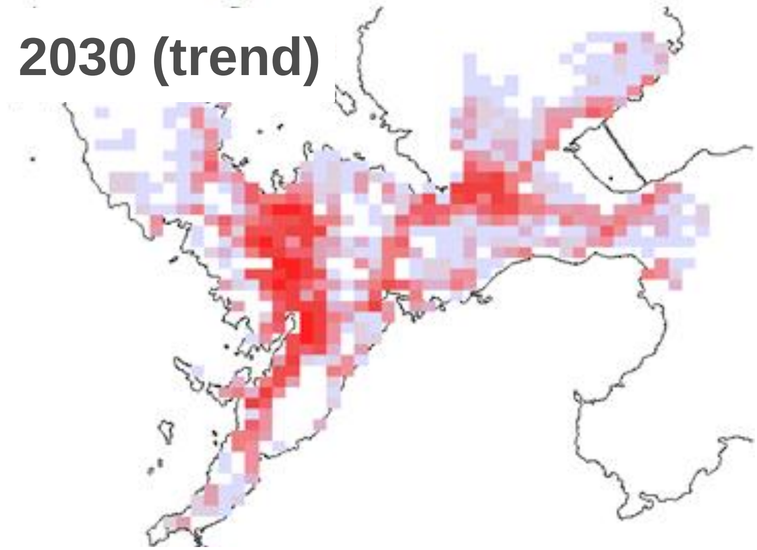
2030 (compact)



present



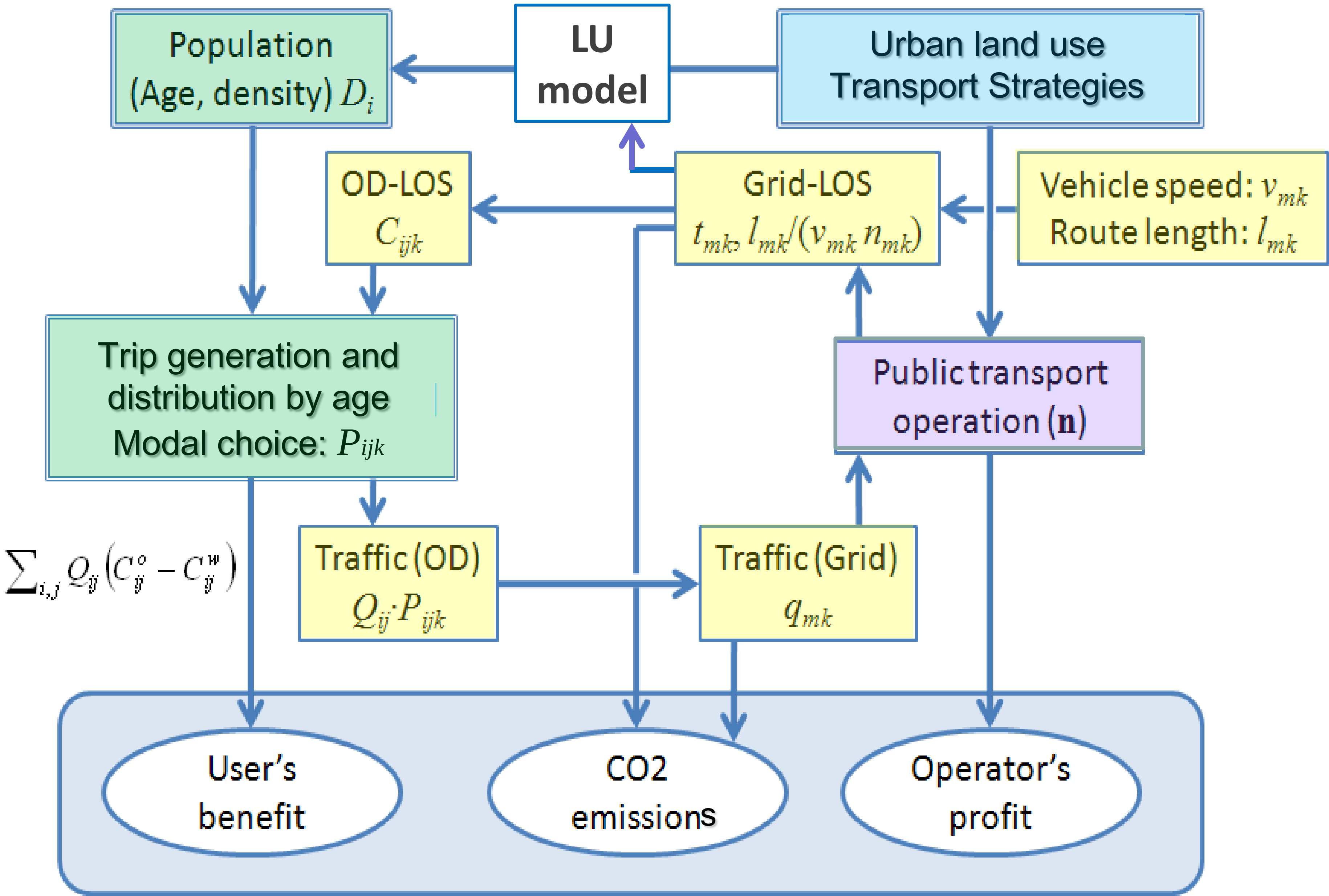
2030 (trend)



population

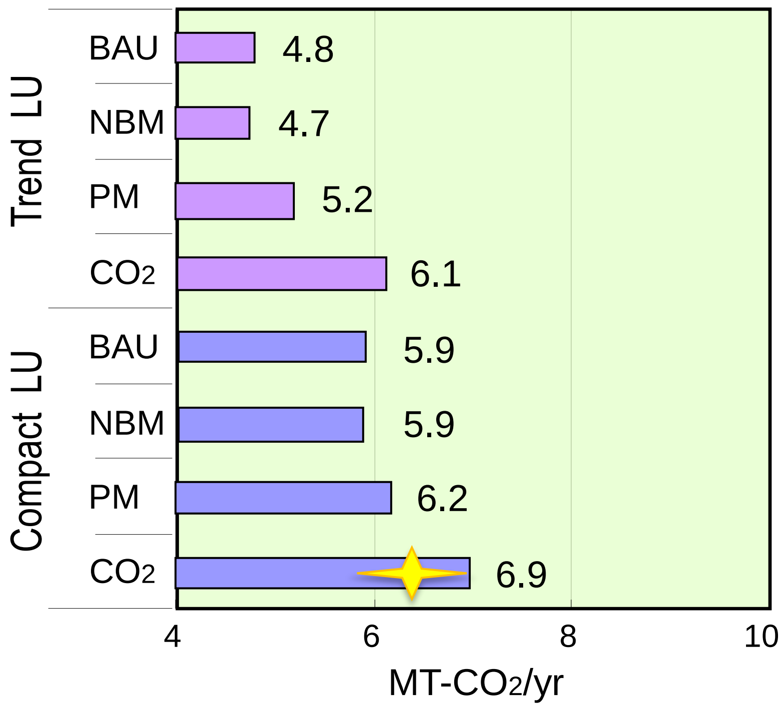
7,000	–	11,000
3,900	–	7,000
2,400	–	3,900
1,500	–	2,400
900	–	1,500
500	–	900
300	–	500
200	–	300
100	–	200
0	–	100

Analytical framework

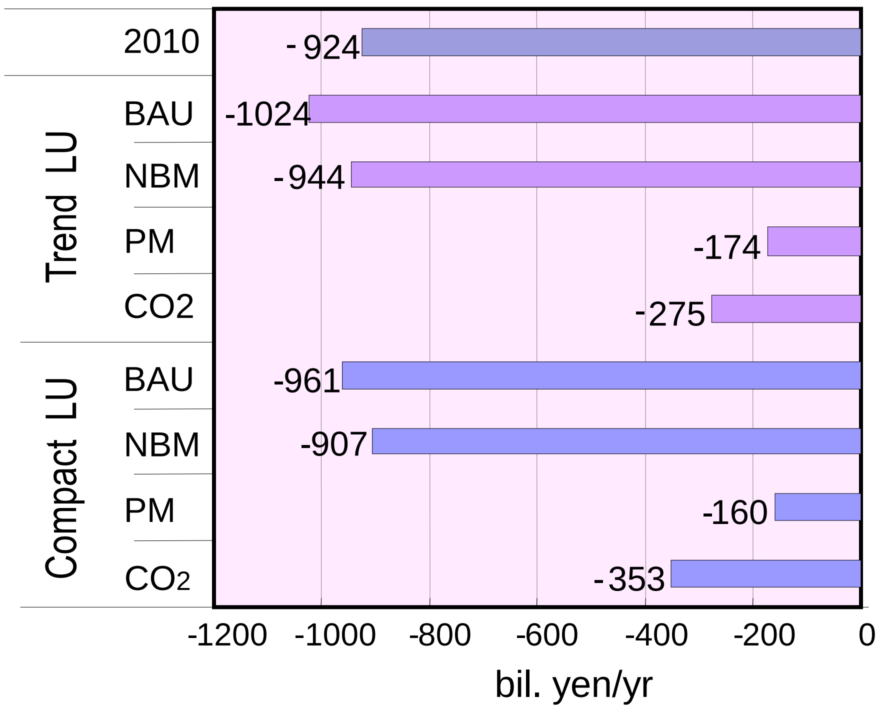


Results of cross-assessment in nation(2)

Emissions reduction: 2010-30



Financial balance in 2030



NBM : Net user benefit maximisation

BAU : Business as usual

PM : Profit maximisation of public transport operator

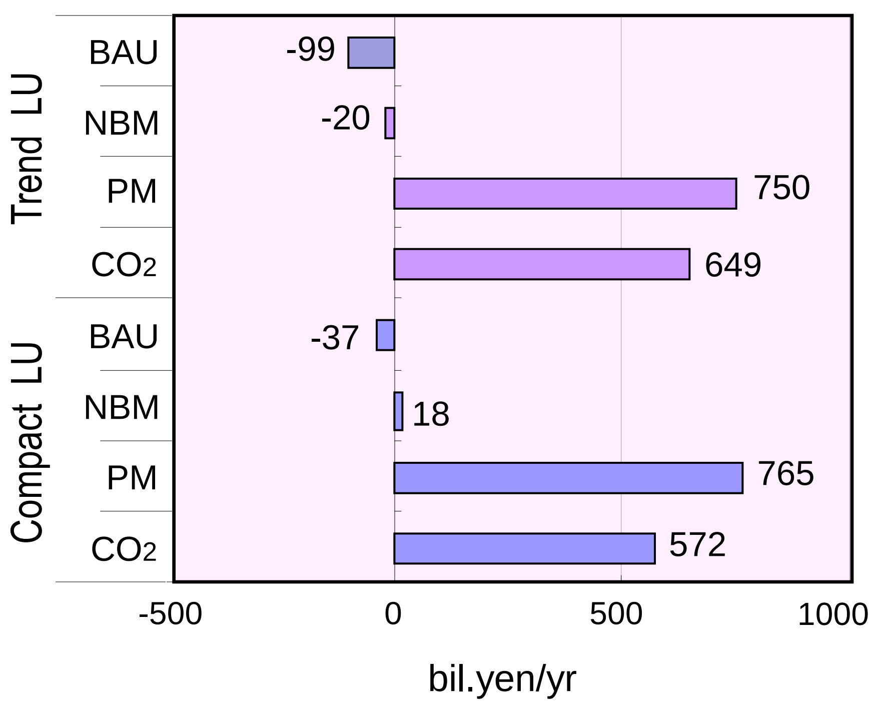
CO_2: CO_2 emissions minimisation

CO_2 > PM > BAU > NBM

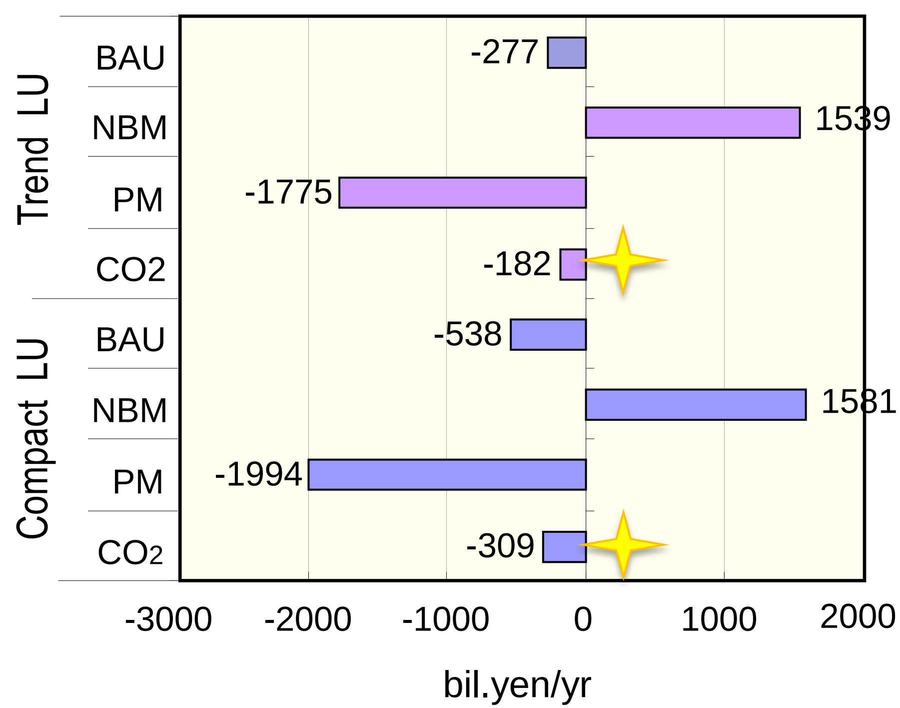
PM > CO_2 > NBM > BAU

Results of cross-assessment in nation(2)

Change in profits : 2010-30



Change in benefits : 2010-30



PM ＞ CO_2 ＞ NBM ＞ BAU

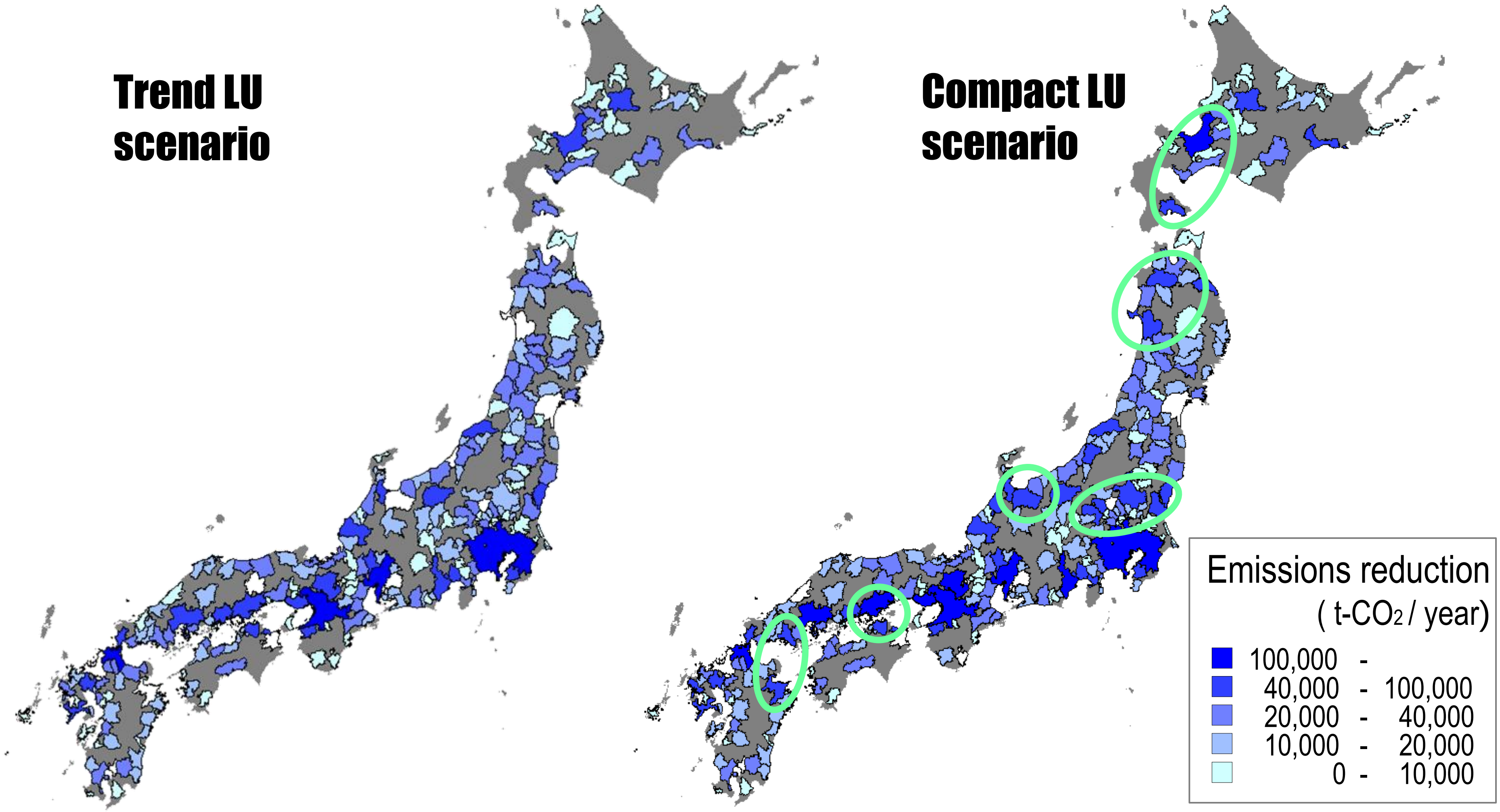
NBM ＞ CO_2 ＞ BAU ＞ PM

CO_2 reduction has favorable (the 2nd best) effect on economic and social performance.

Spatial distribution of strategy outcomes (1)

Emissions reduction by CO_2 minimisation strategy

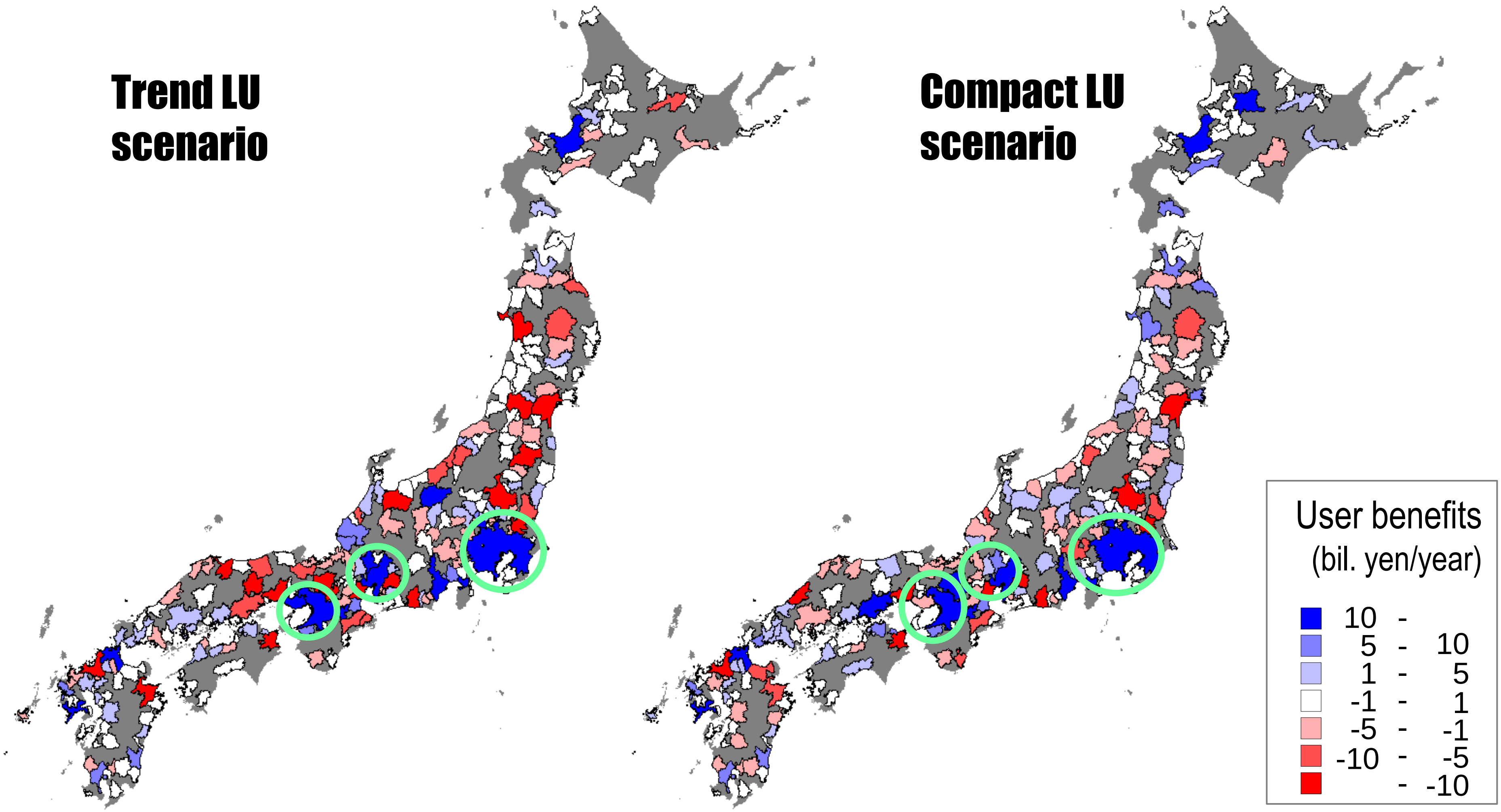
The CO_2 min strategy can **decrease** emissions in most cities, especially in large cities.
The LU compaction will contribute to more reduction in regional urban centres.



16 Spatial distribution of strategy outcomes (2)

User benefit by CO2 minimisation strategy

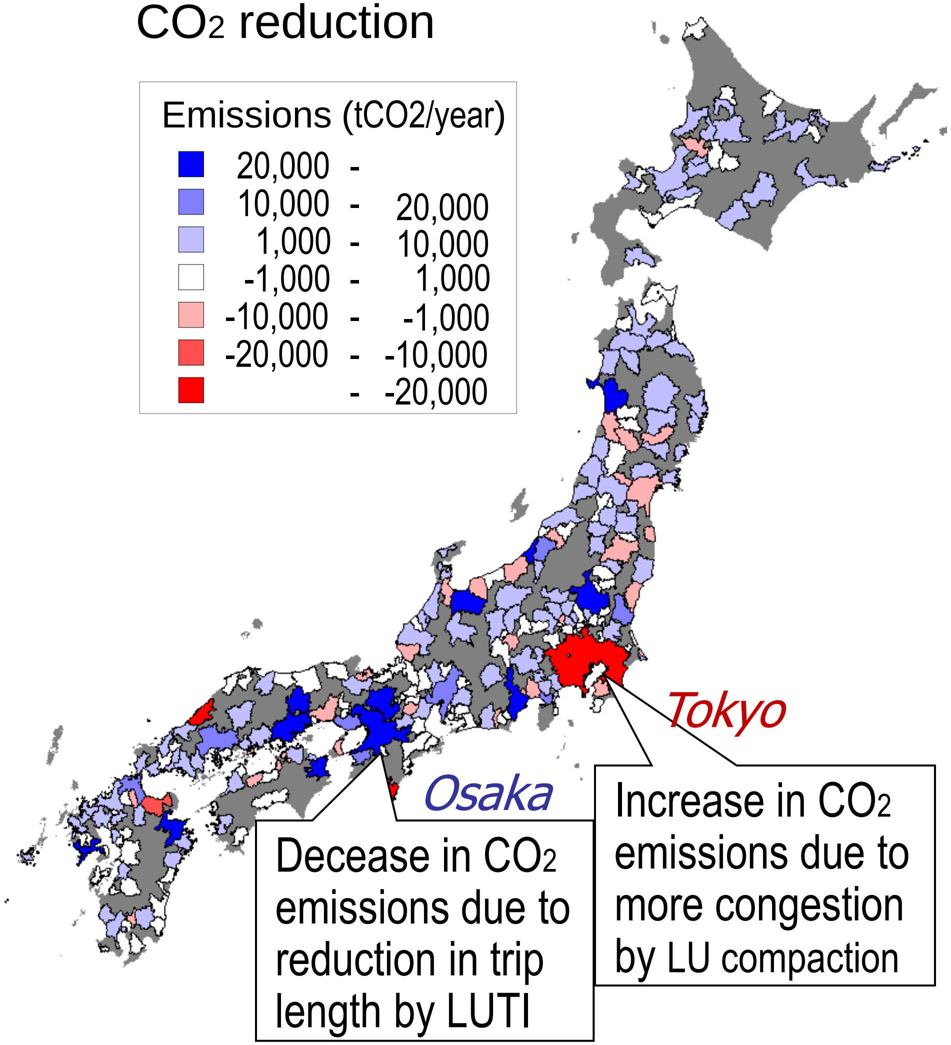
The CO_2 min strategy can **increase** user benefits in large cities, but **decrease** them in many small cities. The LU compaction will alleviate the benefit loss in small cities.



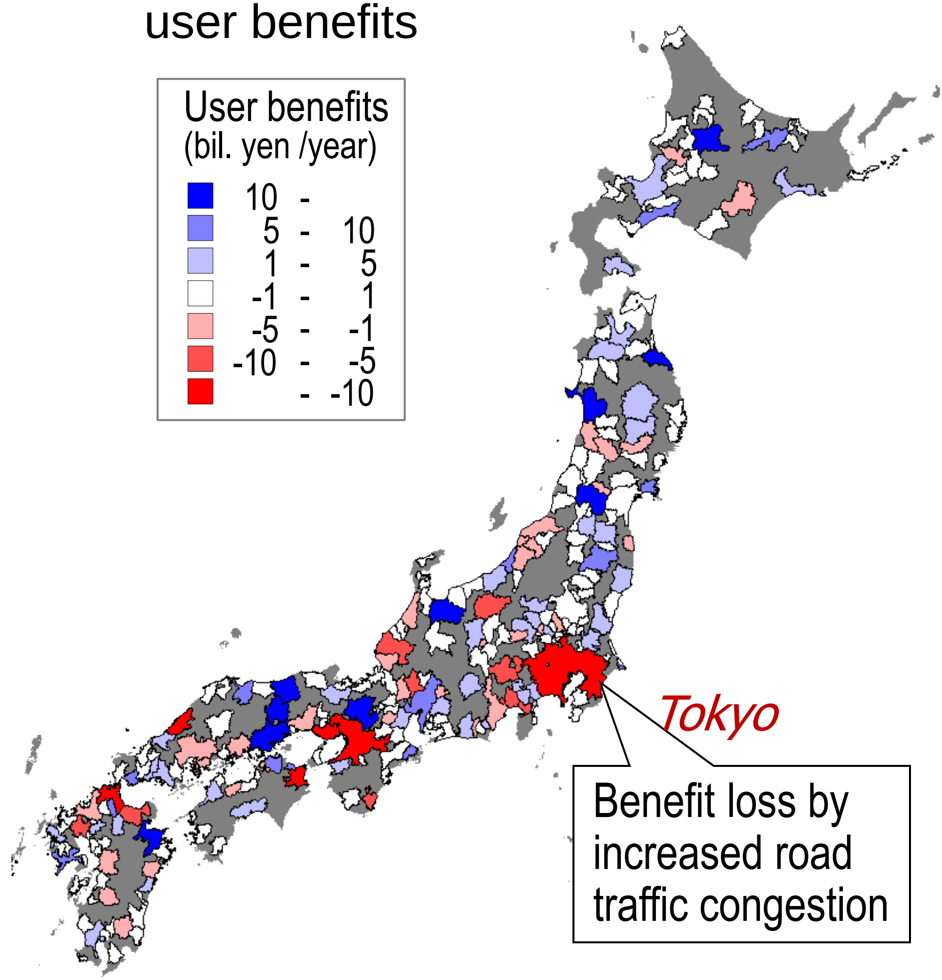
Spatial distribution of strategy outcomes (3)

Difference: compact scenario - trend scenario

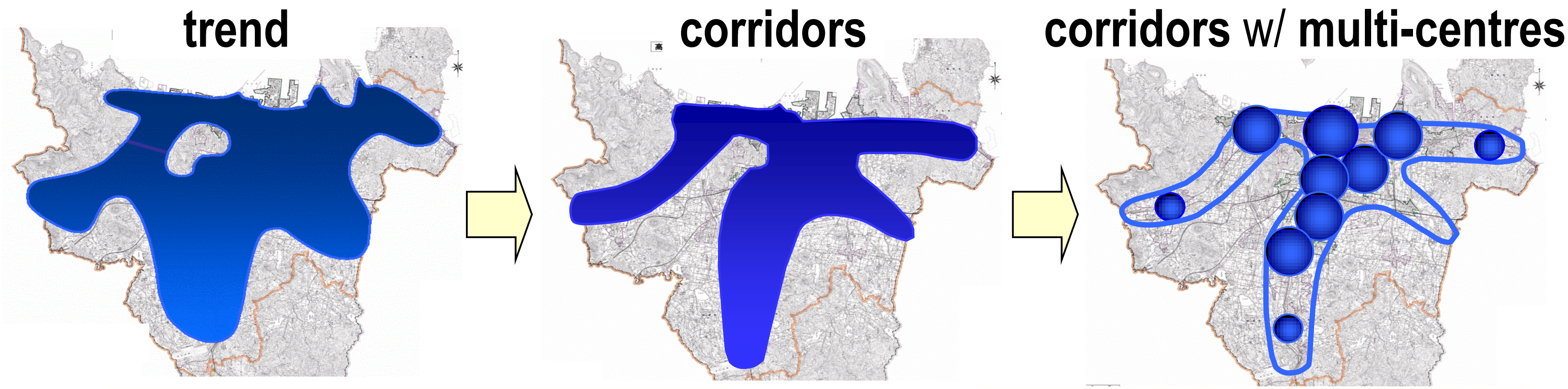
Difference in CO_2 reduction

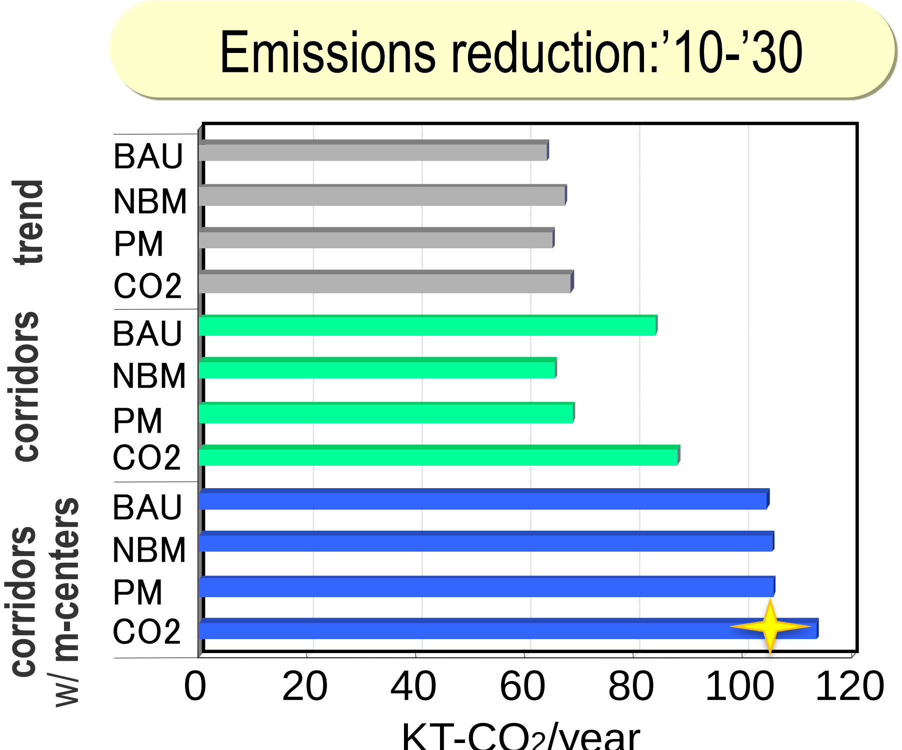


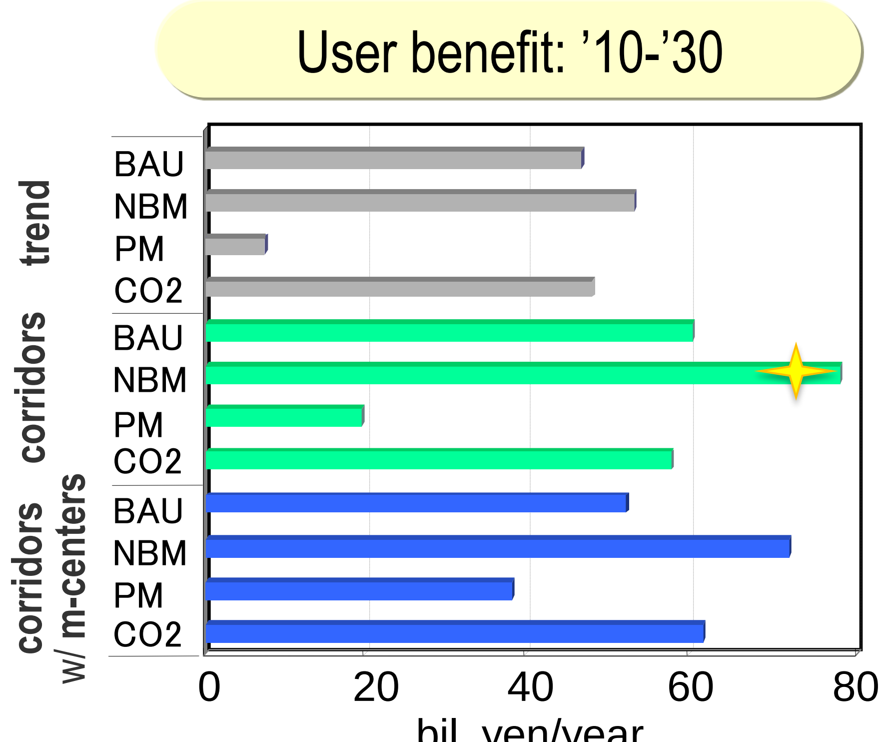
Difference in user benefits



18 Predicted impacts of the LUTI scenarios







Summary of the cross-assessment

Cross-assessment at the nation level indicates:

- Three value factors of efficiency, equity and the environment do not necessarily conflict with each other.

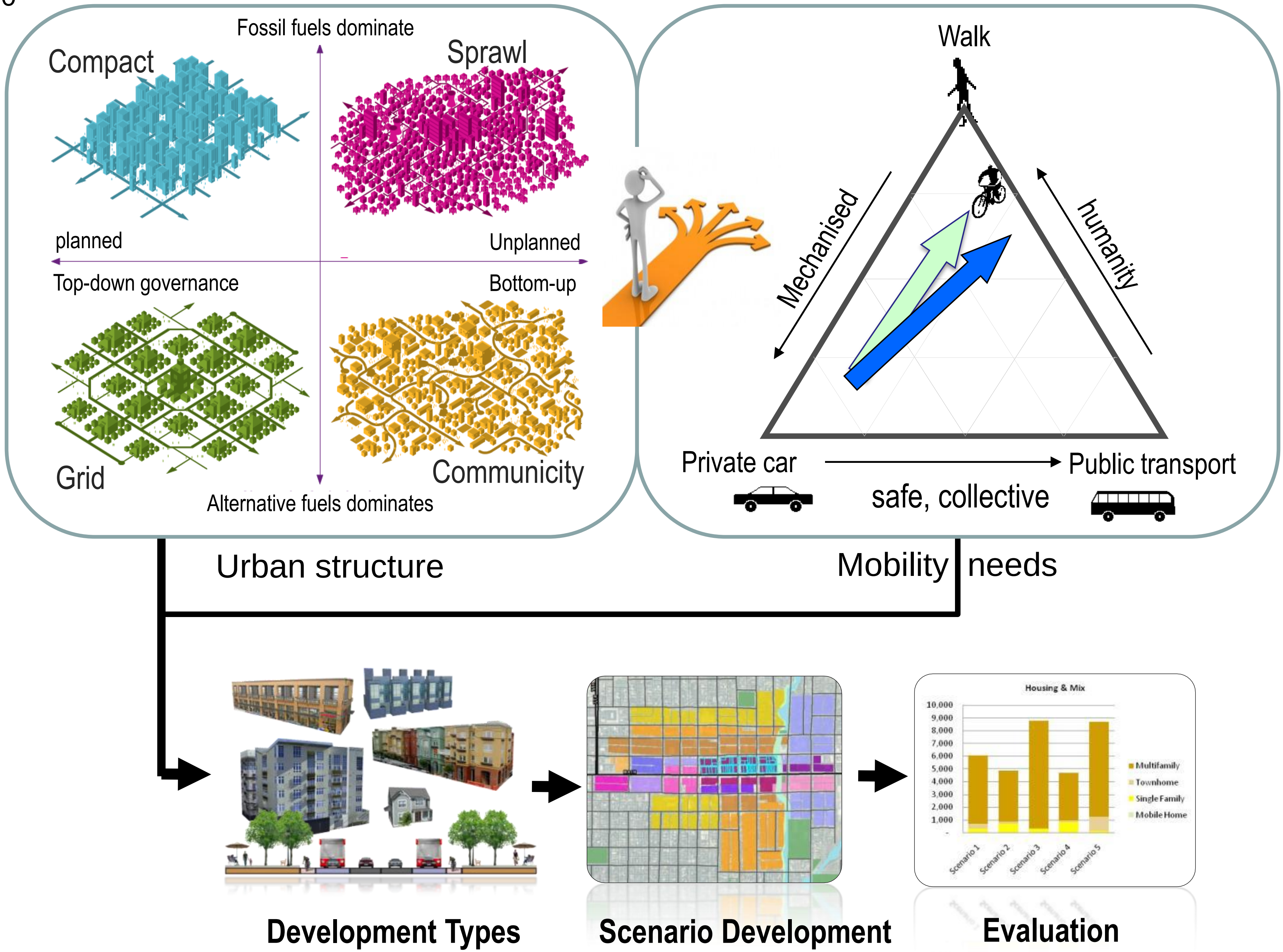
  1) the CO_2 emissions reduction targets can contribute to improved financial balance of public transport and user benefits.
  2) a strategic combination of the CO_2 minimisation and the profit maximisation is expected to bring synergetic effects.

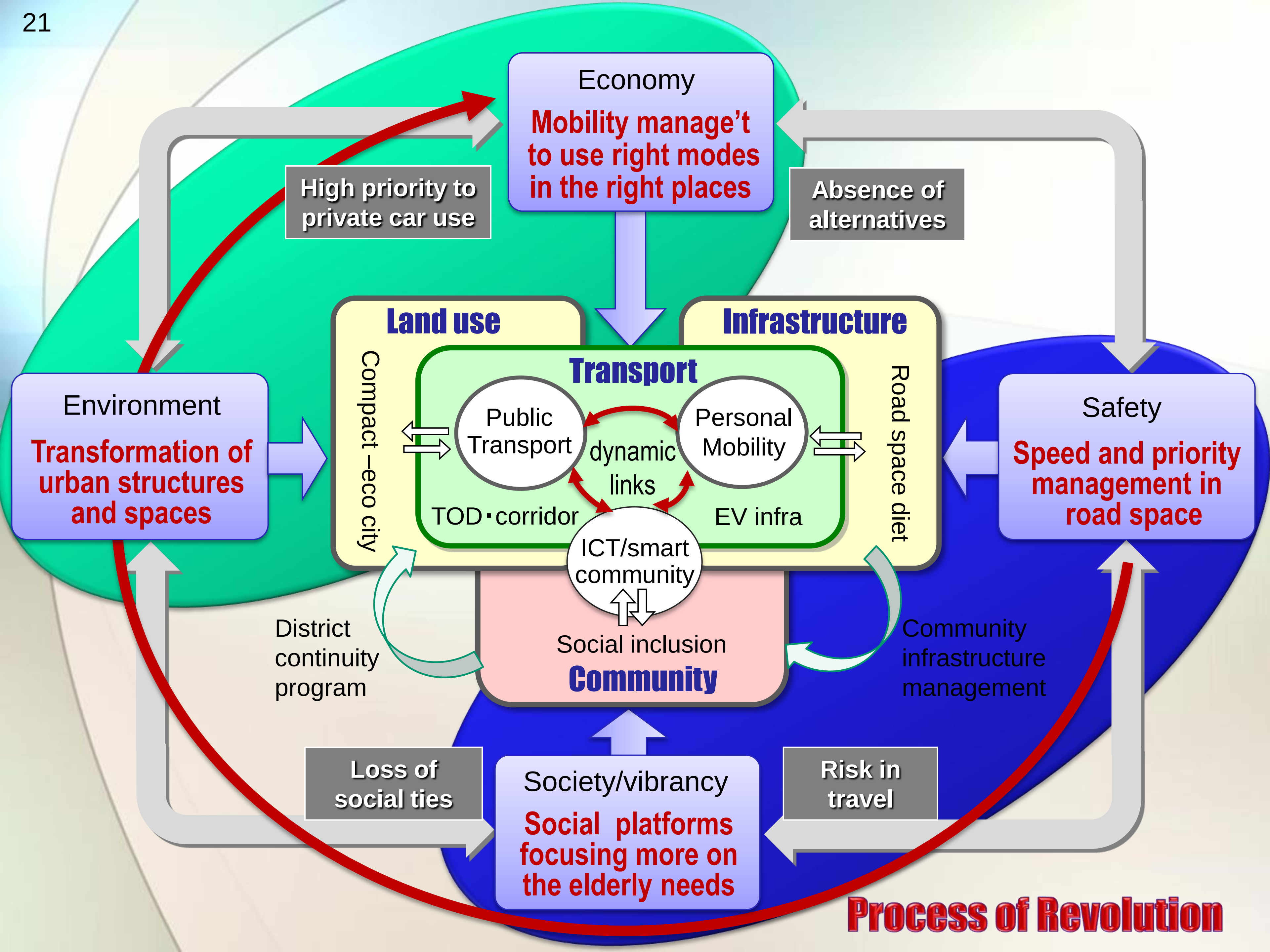
- The spatial analysis in 269 urban areas indicates that

  1) the CO_2 minimisation strategy is effective for emissions reduction and improving benefits in large cities, but the relationship of these two outcomes are a trade-off in small cities,
  2) urban compaction in small cities can alleviate the trade-off.

Investigation of the impacts of alternative LUTI scenarios

- Corridors: the highest user benefits
- Corridors with multi-centres: the highest CO_2 reduction


Fossil fuels dominate
Compact
Sprawl
planned
Unplanned
Top-down governance
Bottom-up
Grid
Communicity
Alternative fuels dominates
Walk
Mechanised
humanity
Private car
Public transport
safe, collective
Urban structure
Mobility needs
Housing & Mix
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
Multifamily
Townhome
Single Family
Mobile Home
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Development Types
Scenario Development
Evaluation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dynamic links
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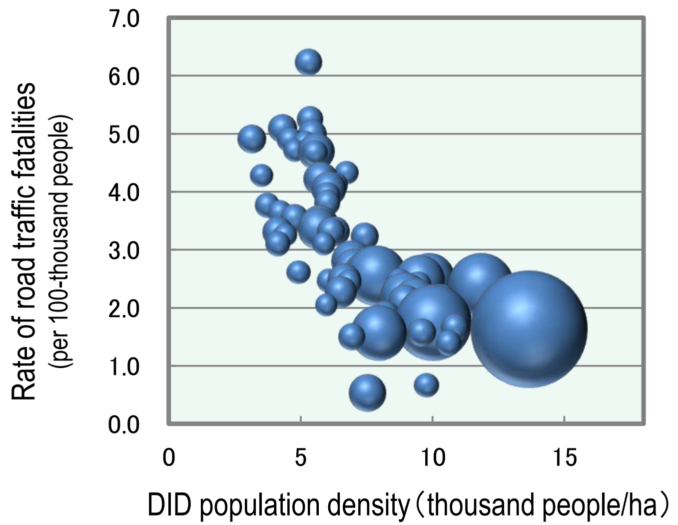
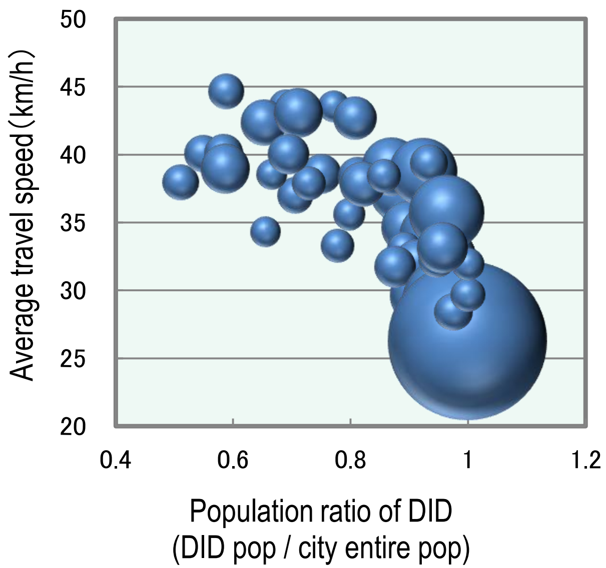
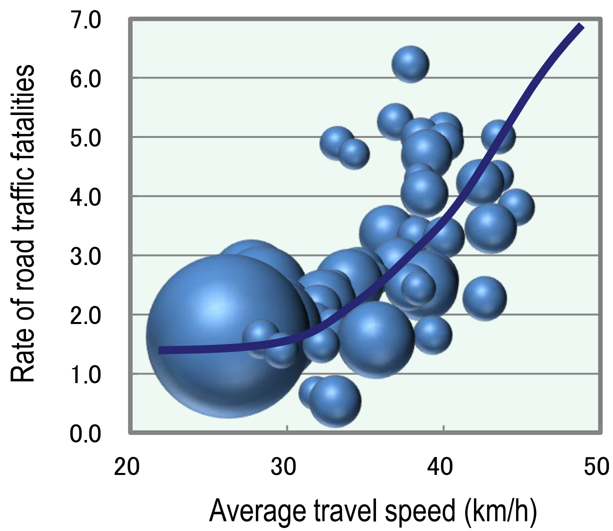
Social platforms focusing more on the elderly needs
Risk in travel
Process of Revolution

22 Urban density, travel speed and rate of fatalities





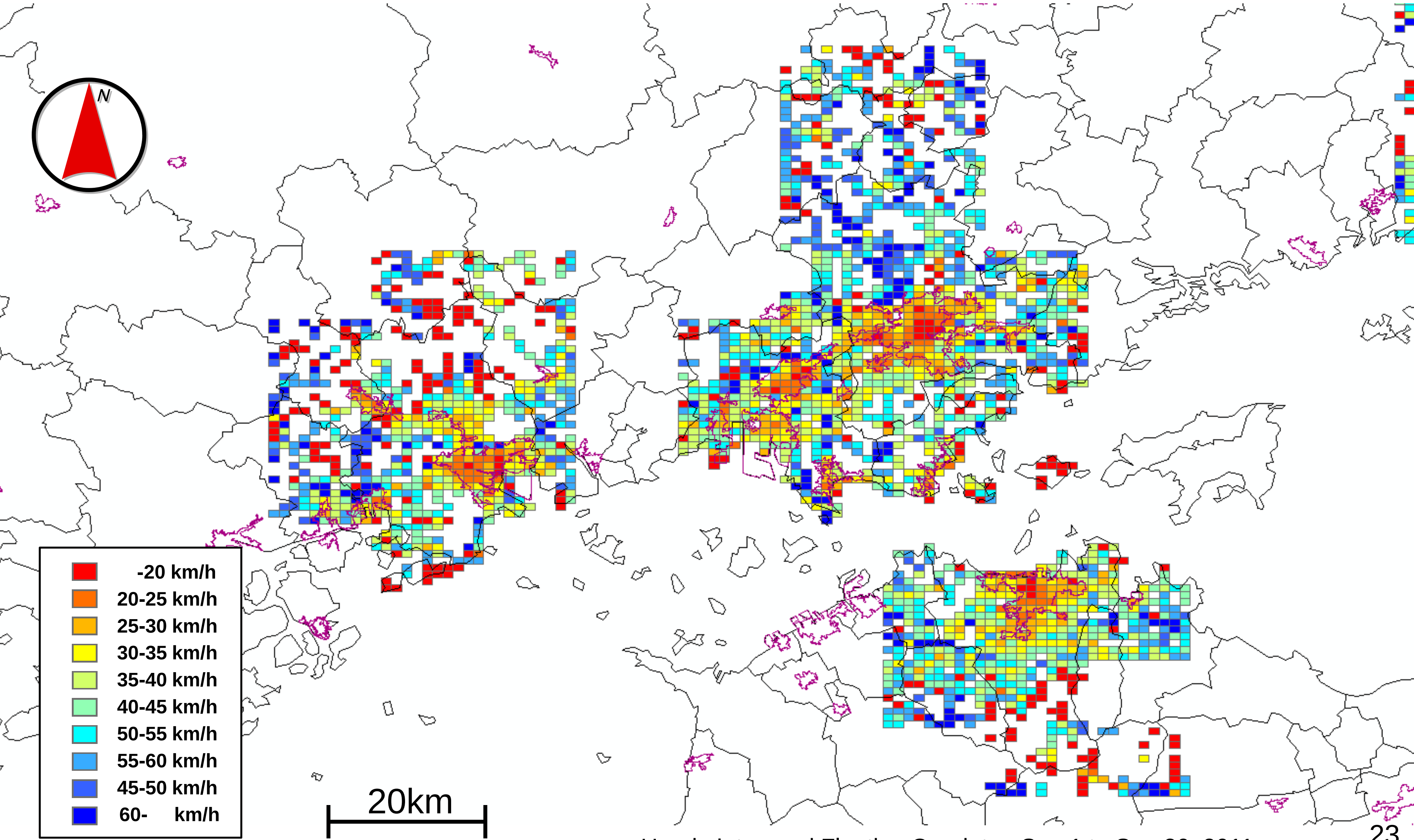


city	Rate of fatalities	DID ratio of pop	DID pop density	Pop rate of aging
Takamatsu	6.22	0.511	5320	0.202
Gifu	5.24	0.706	5367	0.208
Fukuyama	5.08	0.550	4331	0.199
Miyazaki	5.00	0.690	5422	0.191
Utsunomiya	4.98	0.751	5450	0.168
Kurashiki	4.90	0.585	3170	0.190
Wakayama	4.88	0.779	4600	0.221
Koriyama	4.82	0.681	5183	0.178
Shimonoseki	4.70	0.656	4786	0.255
Hamamatsu	4.68	0.587	5604	0.199
Nagano	4.67	0.663	5541	0.216
Otsu	4.32	0.772	6749	0.175
Yokkaichi	4.28	0.666	3520	0.186
Okayama	4.21	0.653	5798	0.190
Kochi	4.11	0.808	6358	0.208

road traffic fatalities during 2008-2010
in 65 cities with a population more
than 300 thousand.

23 Spatial Pattern of Vehicle travel speeds

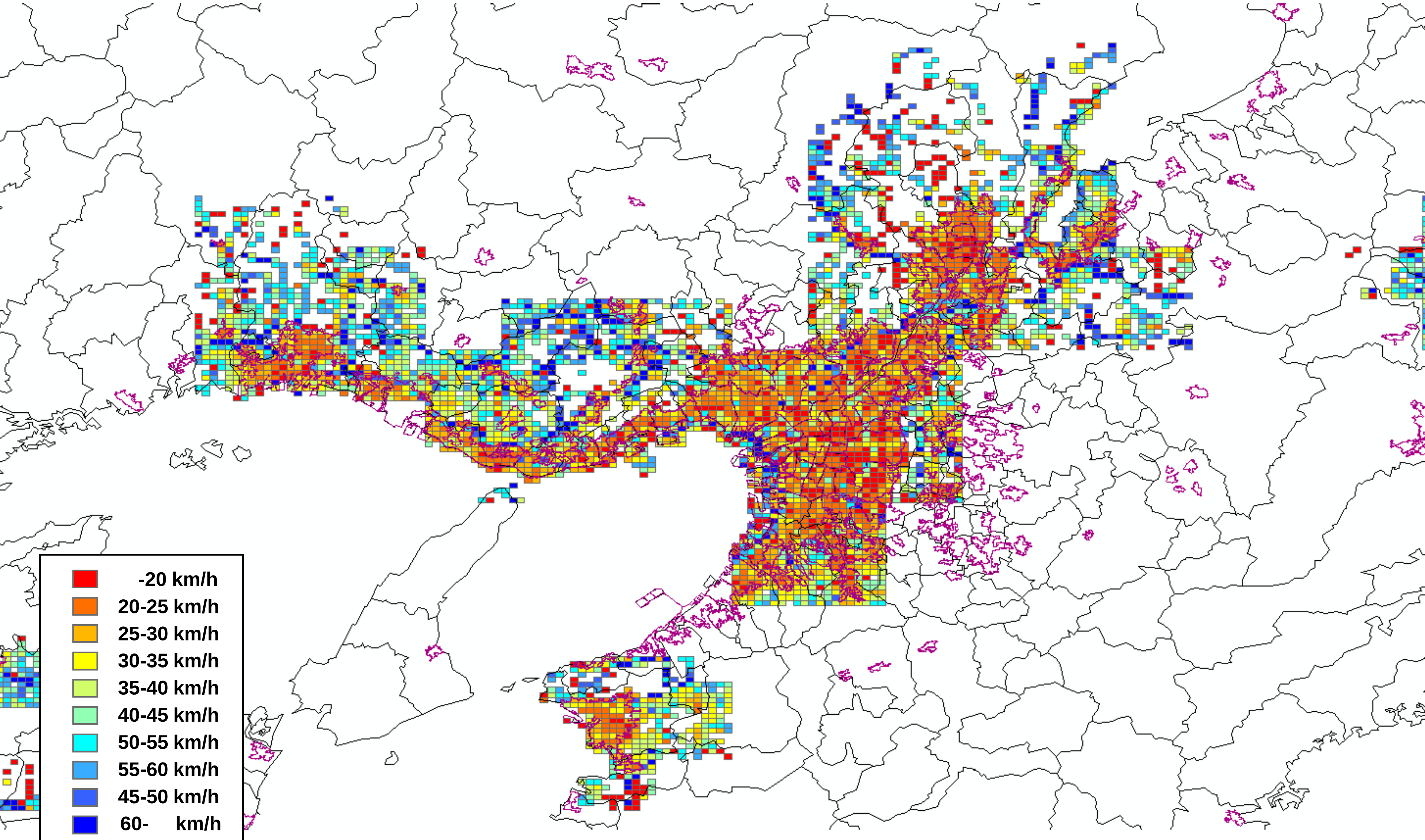
The highest fatality area in Japan



Honda Inter-navi Floating Car data : Sep 1 to Sep 30, 2011

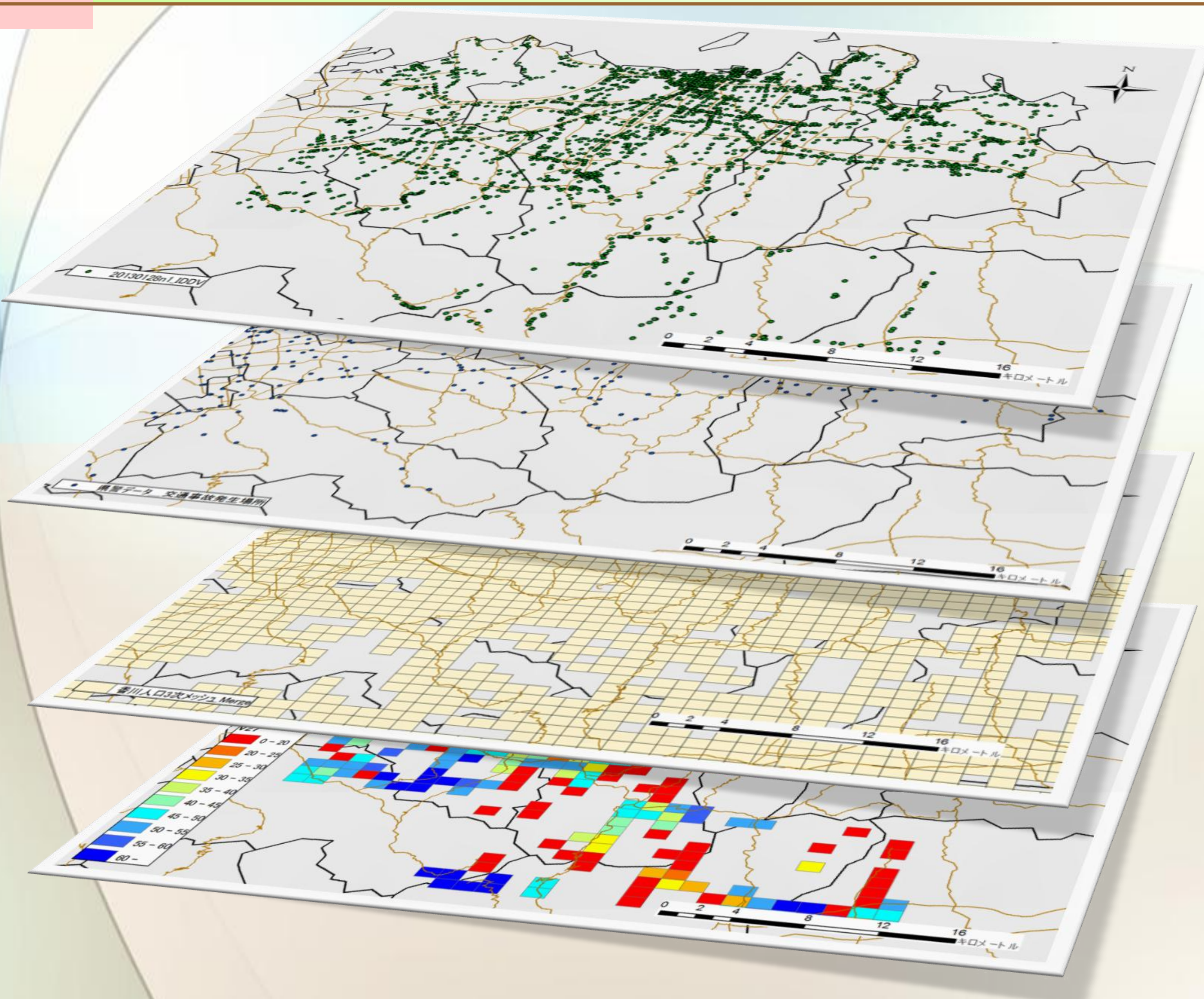
Spatial Pattern of Vehicle travel speeds

Osaka Metropolitan Area



Honda Inter-navi Floating Car data : Sep 1 to Sep 30, 2011

Layers of Geographical Data for Analysis



Road traffic fatalities and injuries

Road traffic volume

Population distribution

Travel speed distribution

Benefit Factors affected by travel speed

- Benefit of fatality reduction

$$C_n = -\Delta n_m \times 2.26 \times 10^8$$

Δn_m：change in road traffic fatalities

Economic value of life：226 million yen

- Benefit of time saving

$$C_t = -\Delta t_m \times 5.76 \times 10^4$$

Δt_m：change in travel time

Economic value of time: 40 yen per minute

- Benefit of environmental improvement

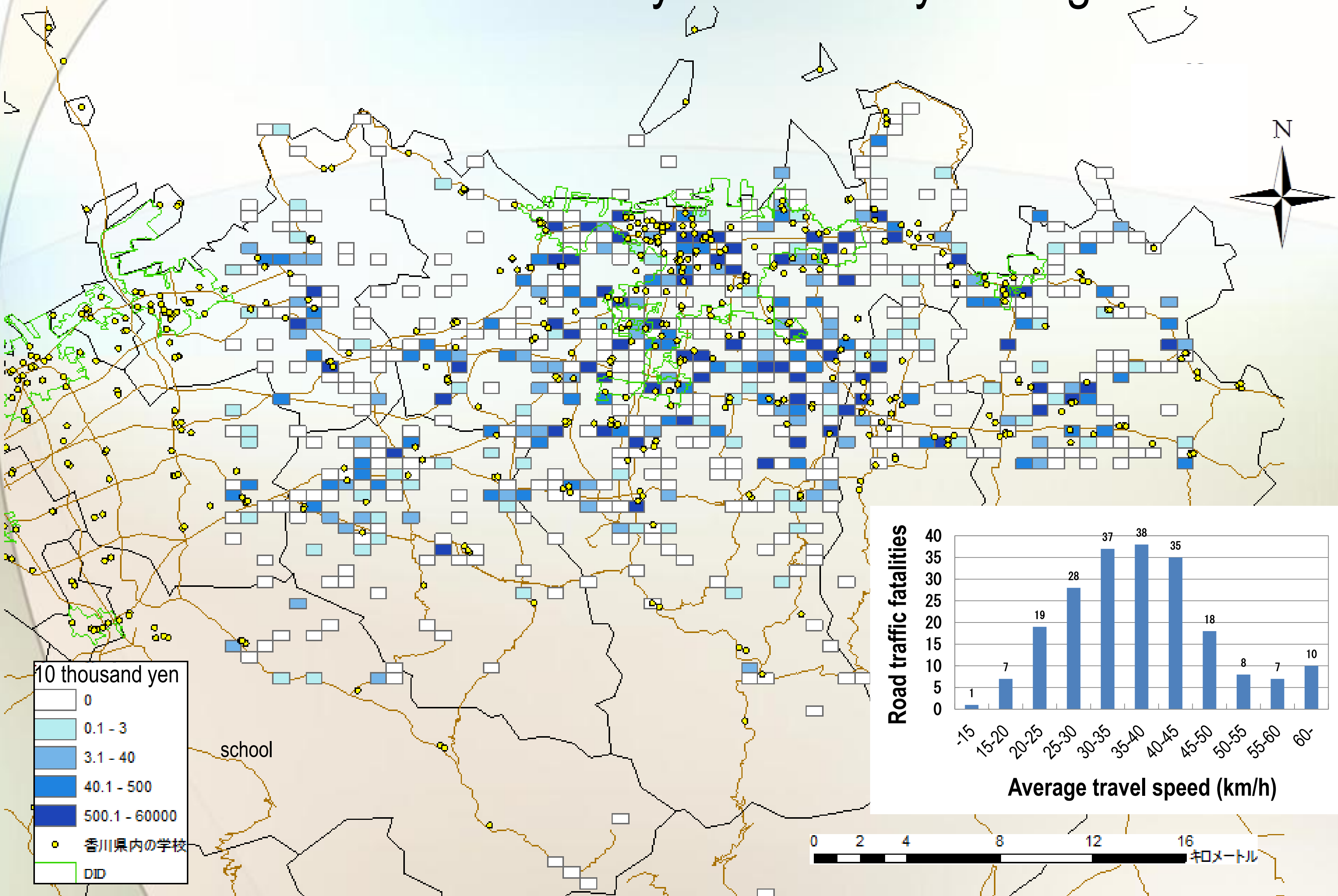
$$C_{CO_2} = -\Delta CO_{2\,m} \times 3.46 \times 10^4$$

ΔtCO_{2m}： change in CO2 emissions

Reduction cost ：34,560yen/c-tom

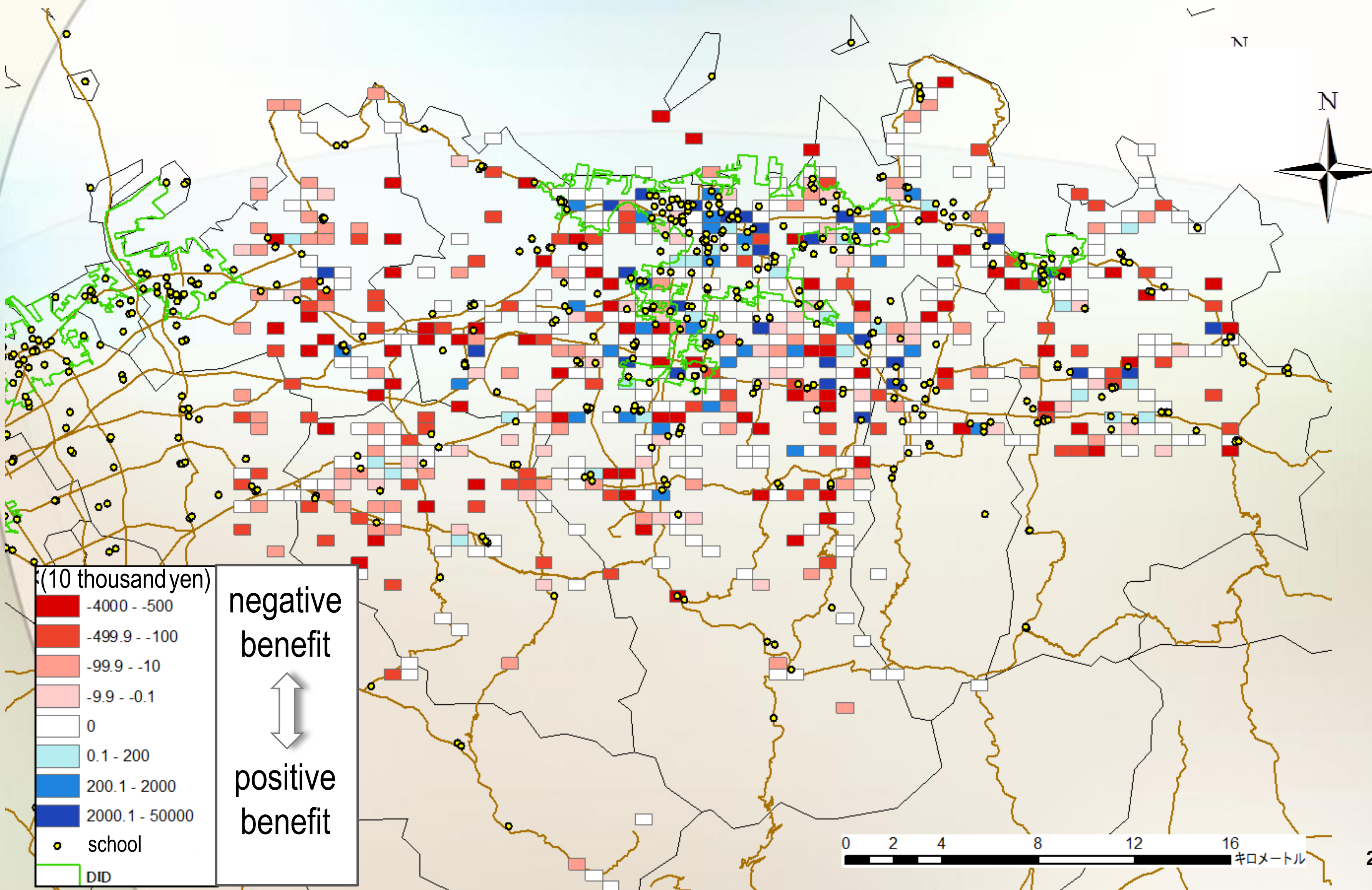
Benefit Distribution of speed management

Benefit in road fatality reduction by 1km^2 grid



Benefit Distribution of speed management

Total benefit by 1km^2 grid



Conclusions

- The outcome-based evaluation through cross-assessment will help clarify the direction of strategic objectives and the significance of land use and transport integration.

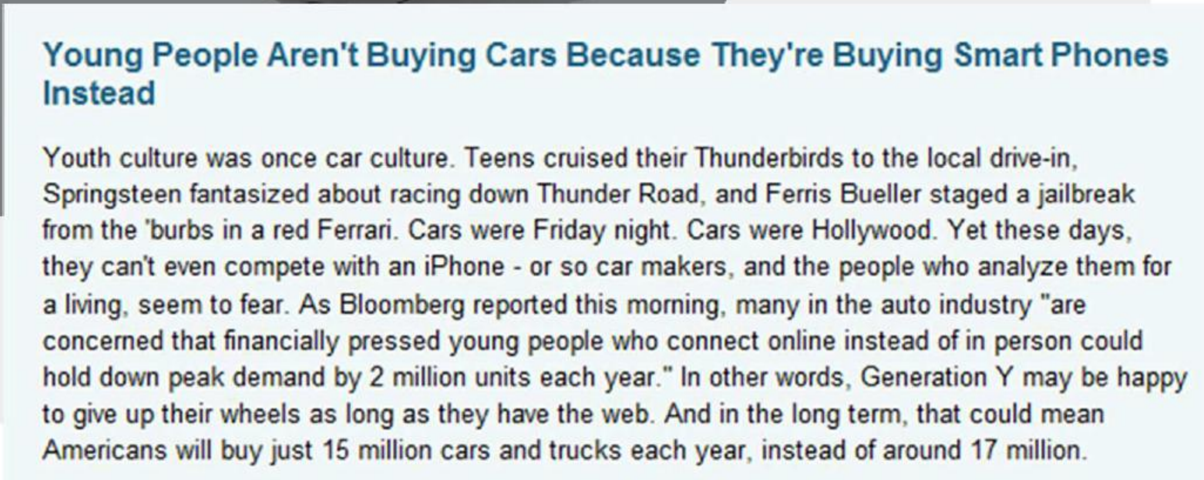
- It is required to step up the concepts and visions of urban transport with the common understanding on the socio-economic benefits of speed and priority management.

- It is expected to create flexible mobility systems that meet the situation of a city for the long term co-evolution of land use, transport, infrastructure and community.

Thank you for your attention!

The end of car culture

Source: Immers 2012

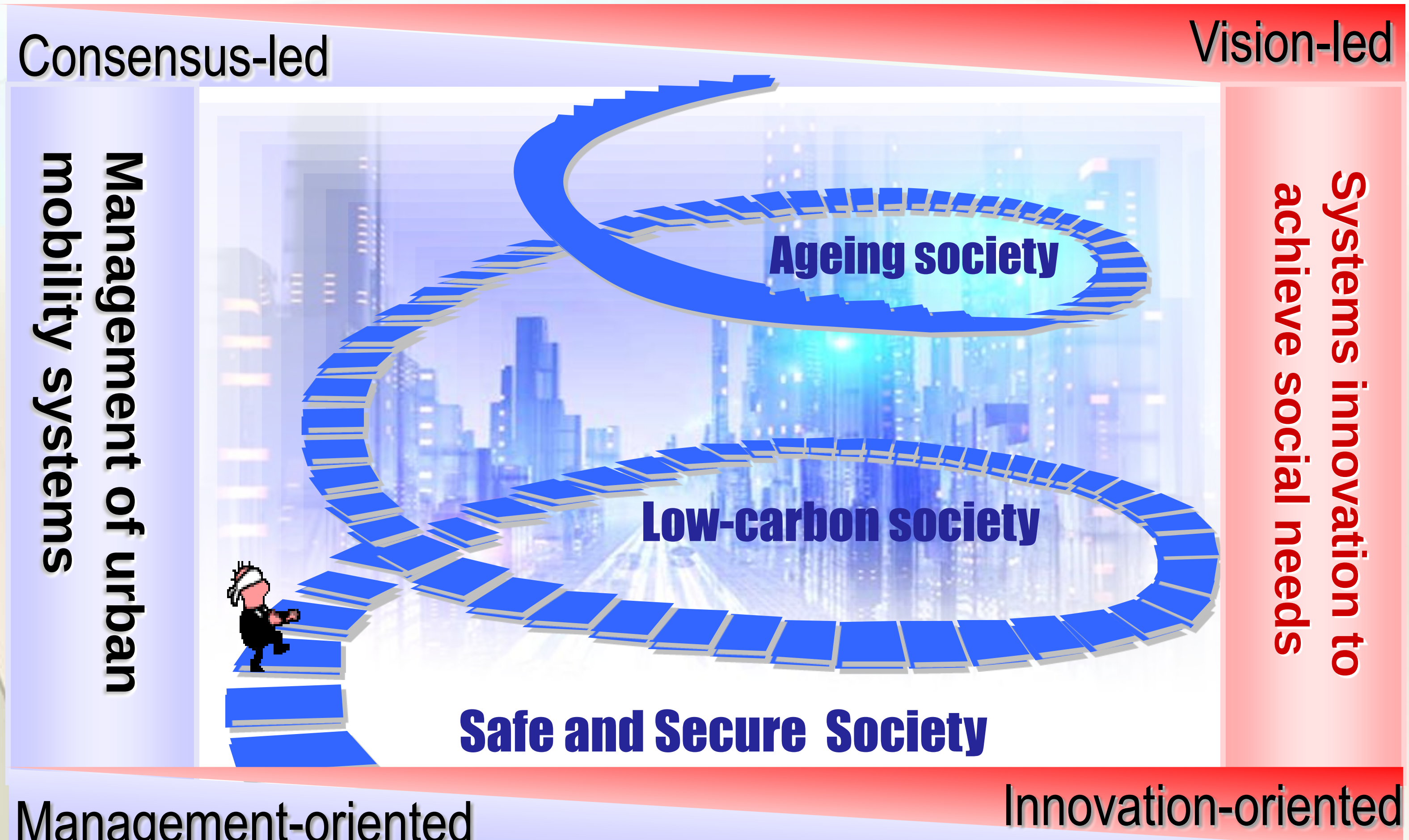


Young People Aren't Buying Cars Because They're Buying Smart Phones Instead

Youth culture was once car culture. Teens cruised their Thunderbirds to the local drive-in, Springsteen fantasized about racing down Thunder Road, and Ferris Bueller staged a jailbreak from the 'burbs in a red Ferrari. Cars were Friday night. Cars were Hollywood. Yet these days, they can't even compete with an iPhone - or so car makers, and the people who analyze them for a living, seem to fear. As Bloomberg reported this morning, many in the auto industry "are concerned that financially pressed young people who connect online instead of in person could hold down peak demand by 2 million units each year." In other words, Generation Y may be happy to give up their wheels as long as they have the web. And in the long term, that could mean Americans will buy just 15 million cars and trucks each year, instead of around 17 million.

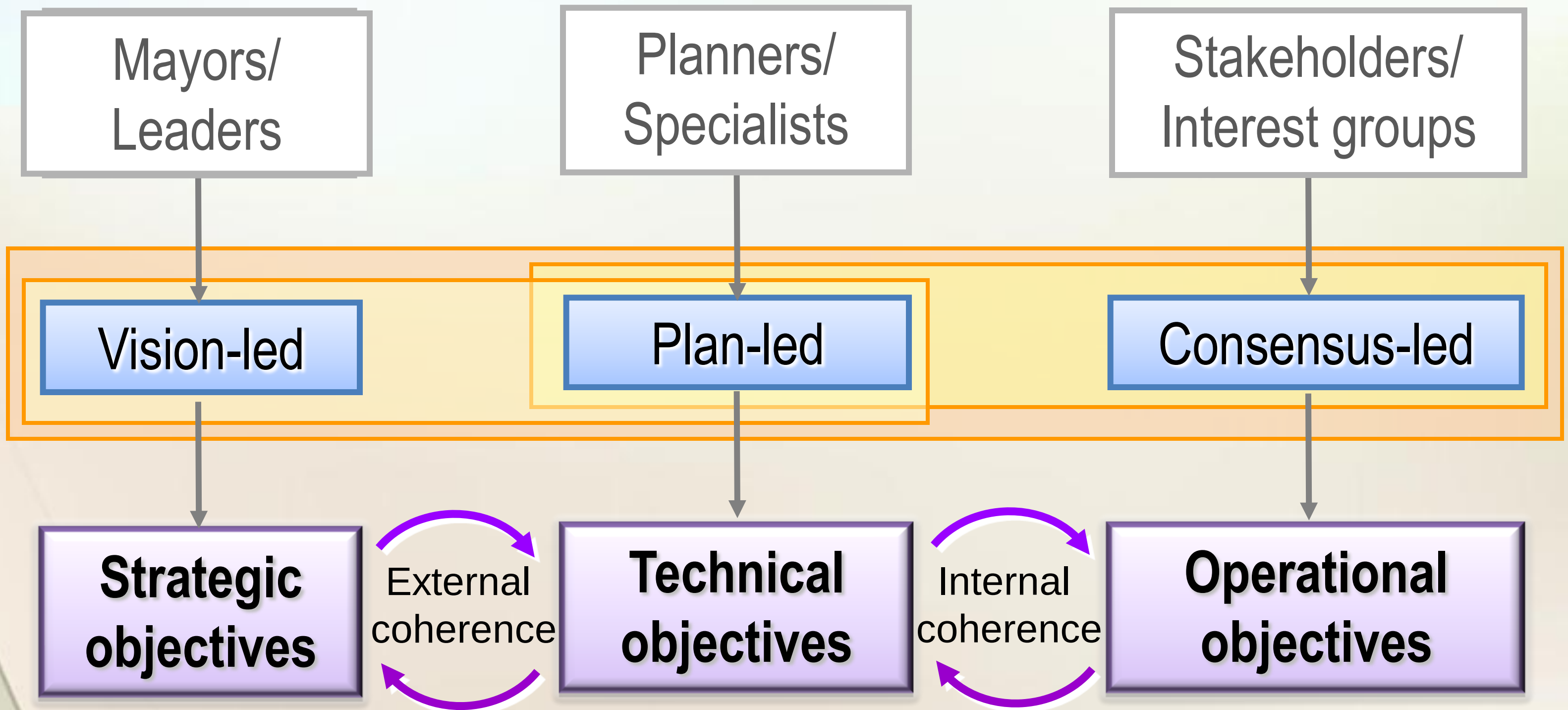
Challenges of sustainable urban mobility

Less **preferences** and **choices**, more **constraints**
Less **forecasting**, more **backcasting**
Less **details**, more **essentials**

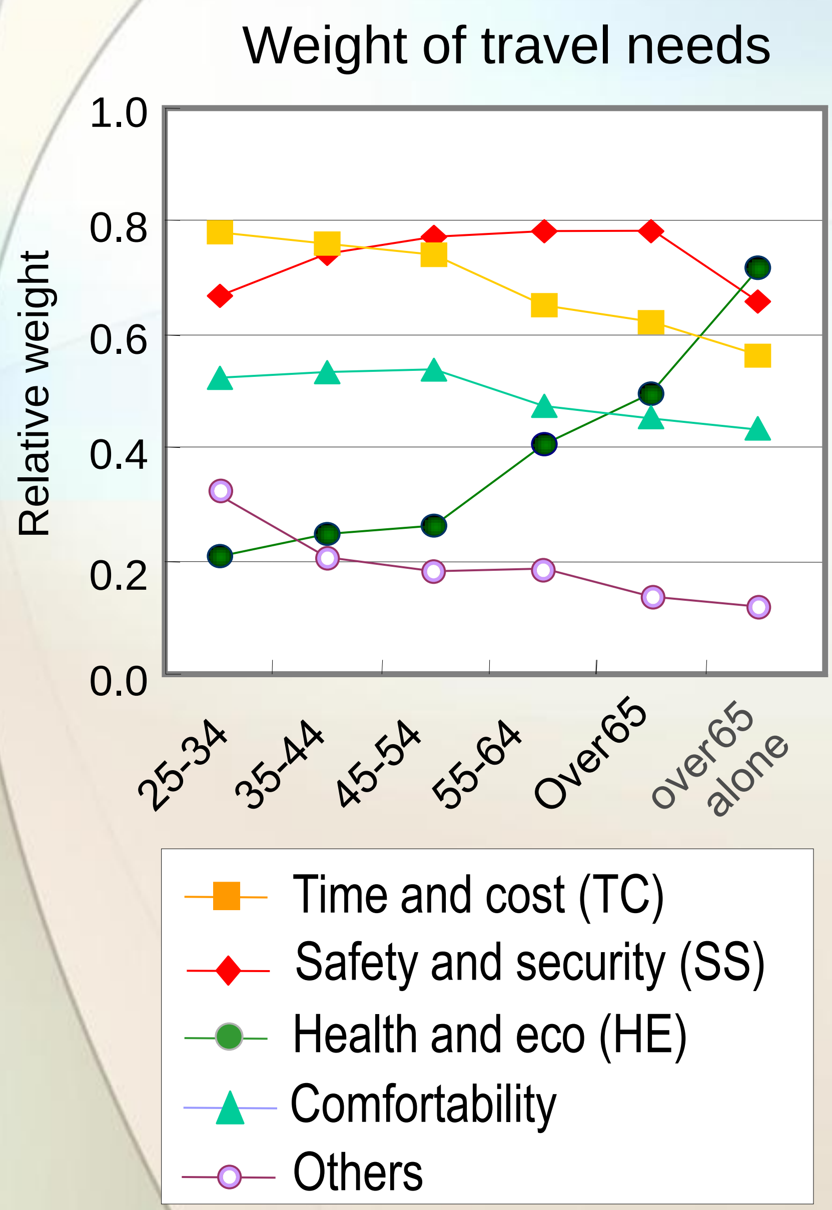


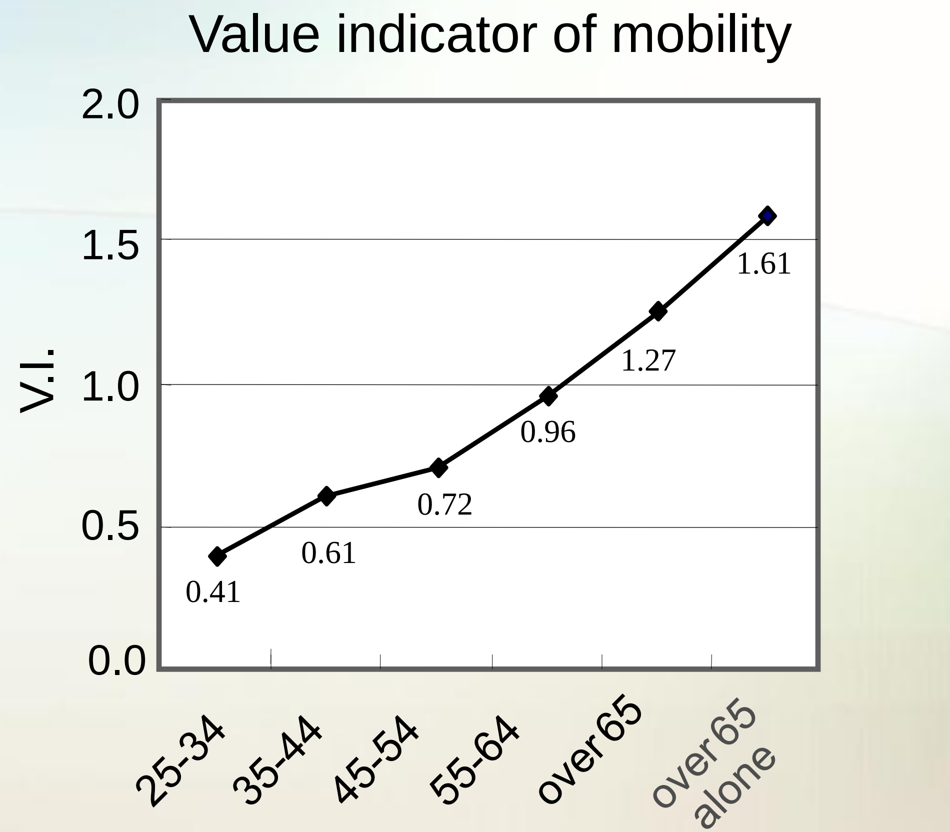
Outcome-based Evaluation for sustainability

Examining the sustainability of urban mobility systems through a cross-assessment model to support the decision making in the visioning and strategic level



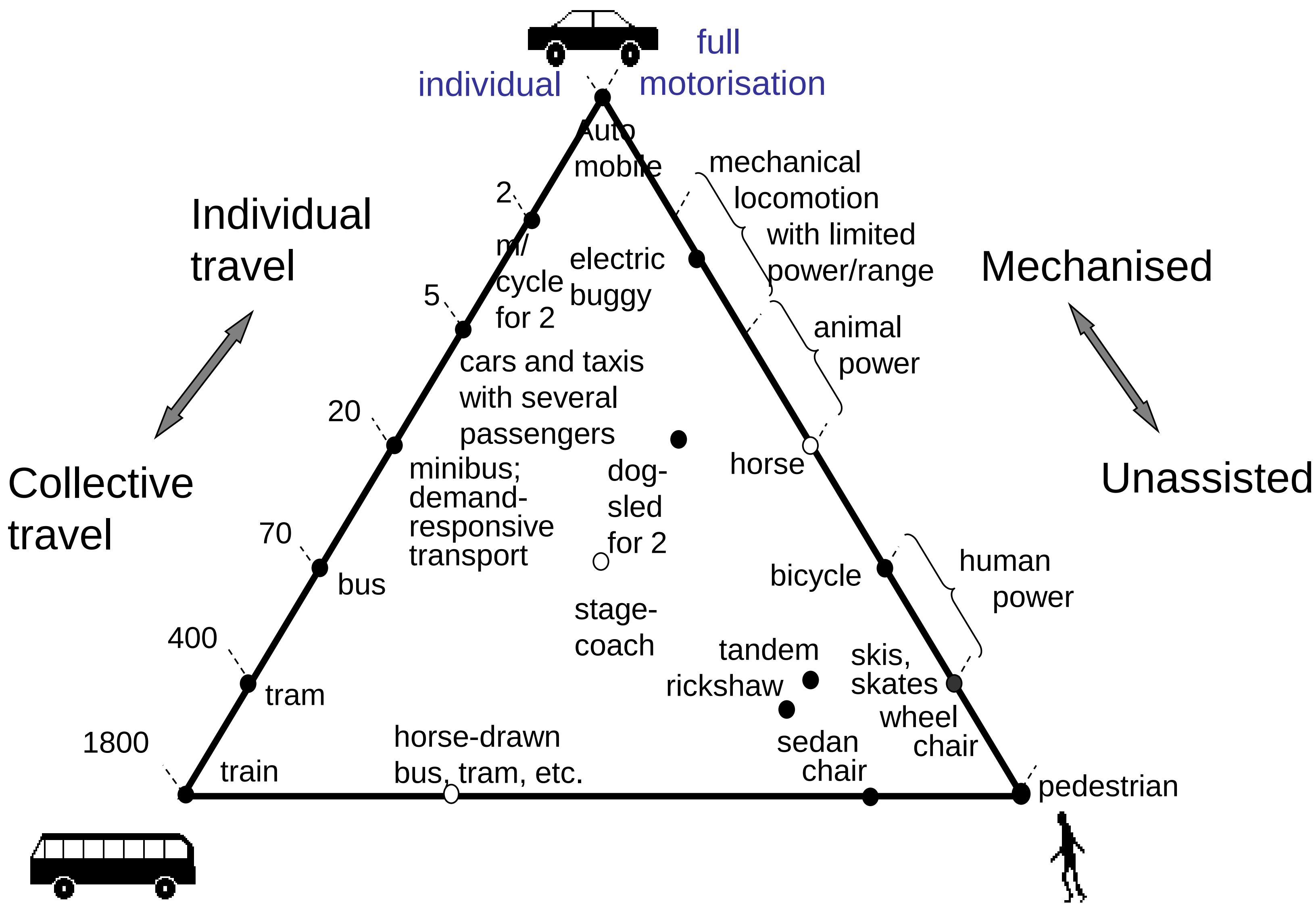
34 Change in values of daily mobility with aging



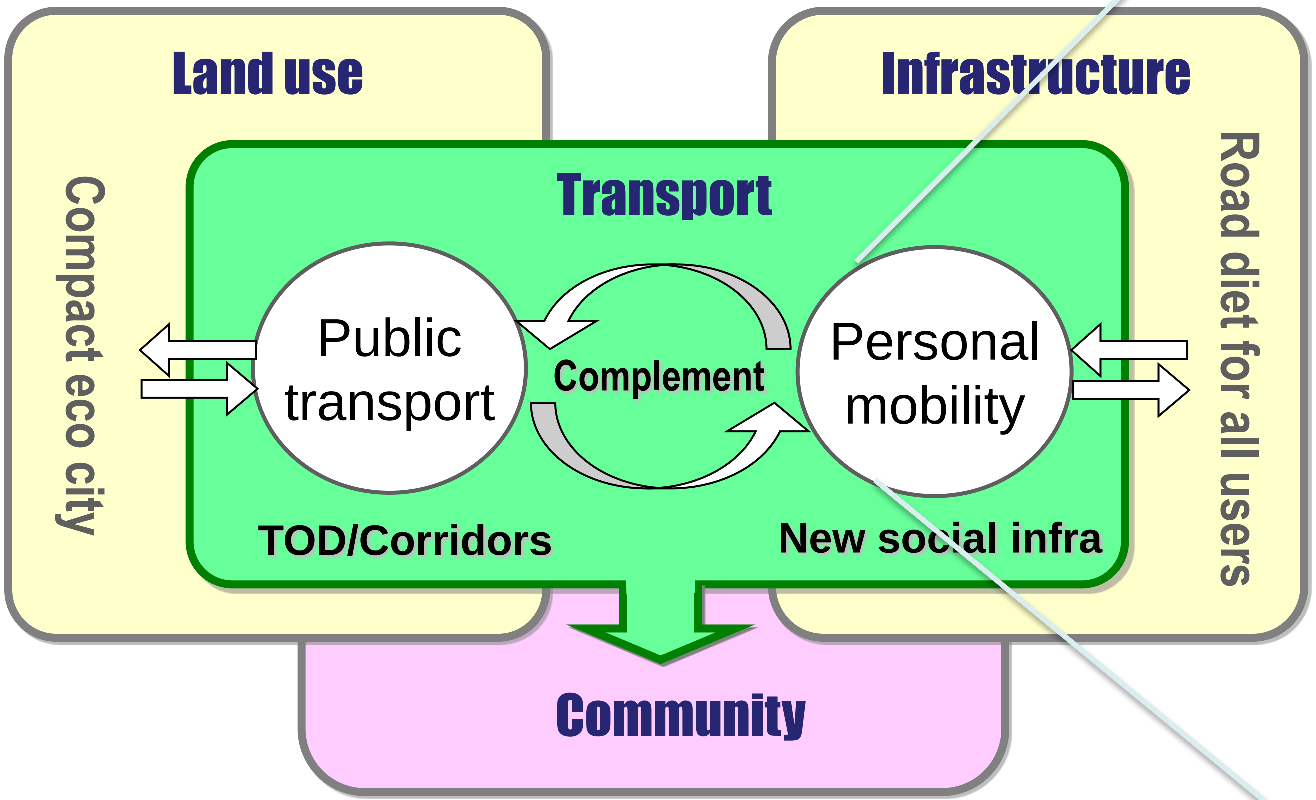


$$\text{V.I.} = \frac{\text{W of } \textbf{SS} \times \text{W of } \textbf{HE}}{(\text{W of } \textbf{TC})^2}$$

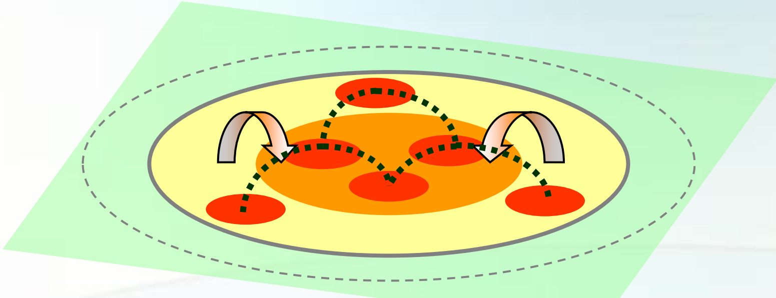
Mode-gram


individual
full
motorisation
Auto
mobile
mechanical
locomotion
with limited
power/range
Individual
travel
Mechanised
2
m/
cycle
for 2
electric
buggy
5
animal
power
cars and taxis
with several
passengers
20
Collective
travel
minibus;
demand-
responsive
transport
dog-
sled
for 2
horse
Unassisted
70
bus
bicycle
human
power
stage-
coach
400
tram
tandem
rickshaw
skis,
skates
wheel
chair
sedan
chair
1800
train
horse-drawn
bus, tram, etc.
pedestrian

Emerging micro EV in Japan



New mobility measures for reurbanisation



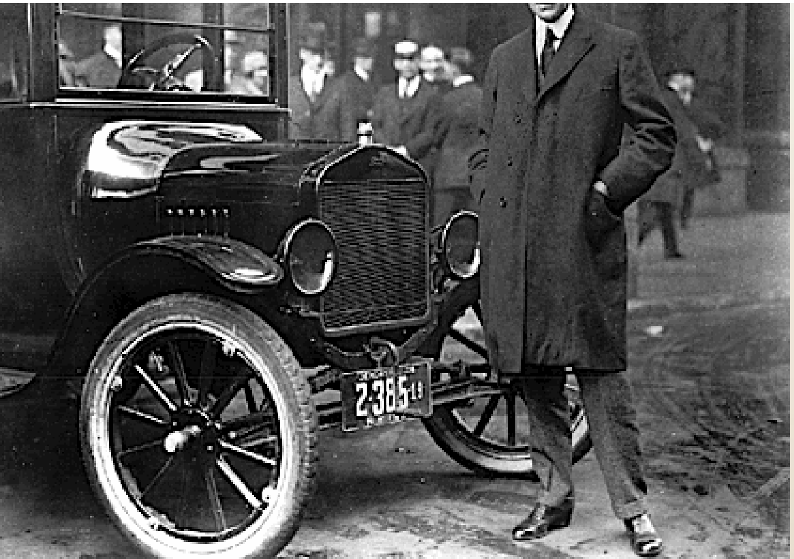
Regeneration of urban cores

Emergence of new mobility

Neighborhood and slow travel

Paradigm shift of car-town relationships

Unchanged car-town relationships since the era of horse-drawn carriage (D-to-D)



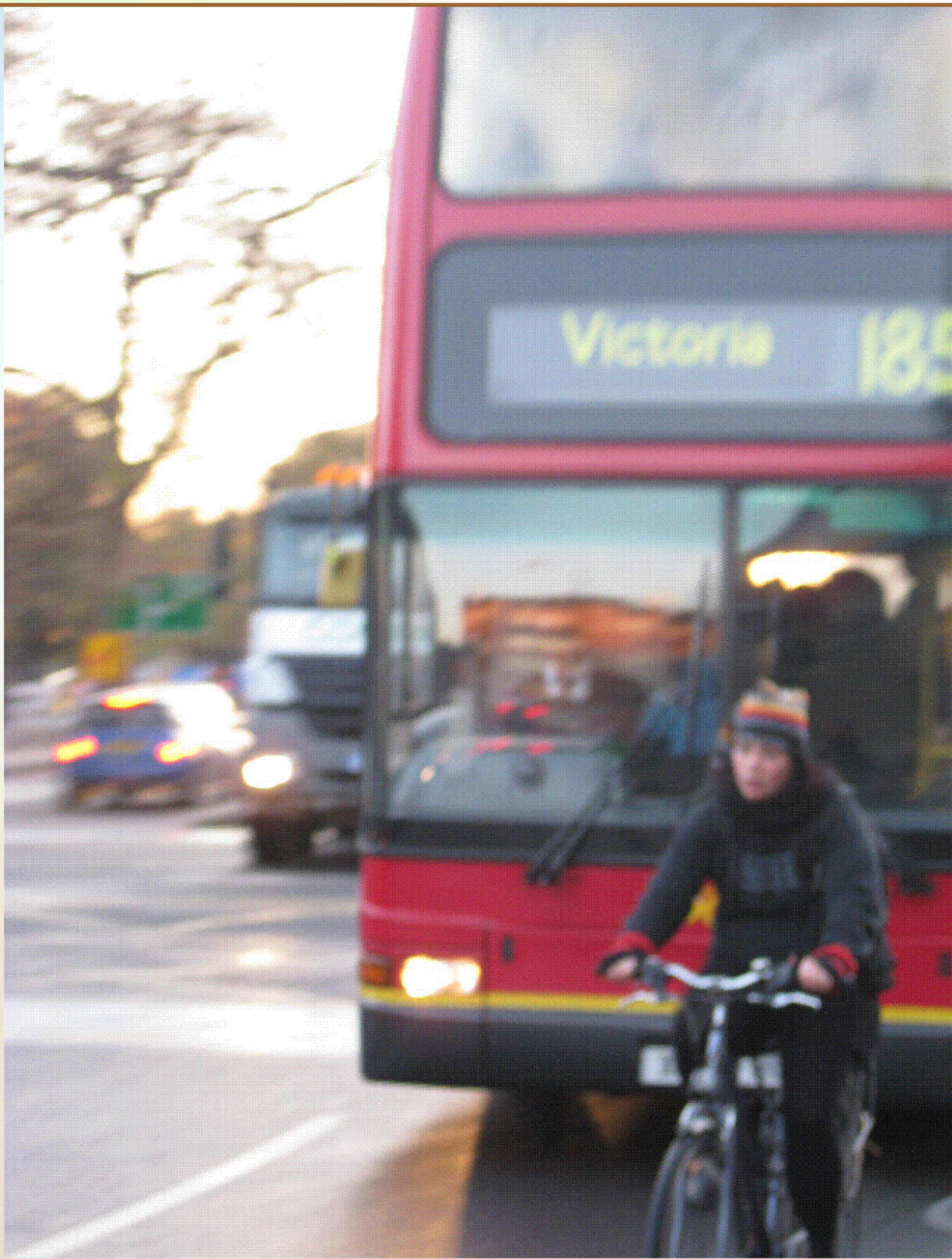
Mobility measures promoting commobility

Micro EV as a mobility suit sensibly designed for the elderly explorer and with indigenous identities

EVE : EV Explorer

Priority in road space as a meta rule

Wheelchair／Baby carriage
Pedestrian
Bicycle（Eco/Health）
Bus（Public transport）
Taxi(Public transport）
Truck（goods transport)
Private car



Outbreak situation of traffic fatal accident