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Future Potential of Transportation and Urban Model Post COVID Era

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Dynamic Simulation Analysis of Impact on Teleworking Policy for After COVID-19 Using Land-Use and Transport Model: Case Study of Japanese City within Population Decline

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ATRANS Asian Transportation Research Society
IATSS International Association of Traffic and Safety Sciences

Introduction

Backgrounds

- **Information and communication technology (ICT) innovations spread teleworking around the world**

  Ex. many companies in the US are the share of teleworking workers who frequently work at home or other remote locations increases every year

- **In Japan, the penetration rate of teleworking is at a low level of 10% – 15%**

  -> Japan has been required that teleworking is spread gradually due to a population decline for the future

- **COVID-19 suddenly has promoted teleworking in Japan** due to prevention of spreading the infections

  -> Spread of infections changed the lifestyle in urban areas such as commuting, location choices, etc.

  -> **Land-use and transportation fields were impacted significantly**

Objectives

- This study developed **scenarios towards ICT advances and telev**
  declining population in Japan, and **simulated the impact of tho**
  periods using by land-use and transport model

Photo credit: Scientific American

Literature Review

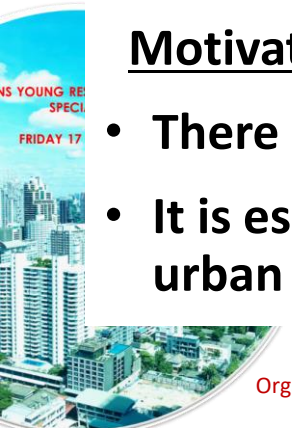
- Many existing studies have analyzed the impact of teleworking policy on land-use and transportation fields
- **Soler, et al. (2021): *"Teleworking and online shopping: Socio-economic factors affecting their impact on transport demand"***

  -> teleworking appears to have a high potential mainly in specific services sectors, affecting commuting patterns predominantly in large urban areas
- **Stoica, et al. (2021): *"The telework paradigm in the LoE ecosystem –A model for the teleworker residence choice in context of digital economy and society"***

  -> Mathematically based model for choosing the residence in the context of telework in the information society and digital economy

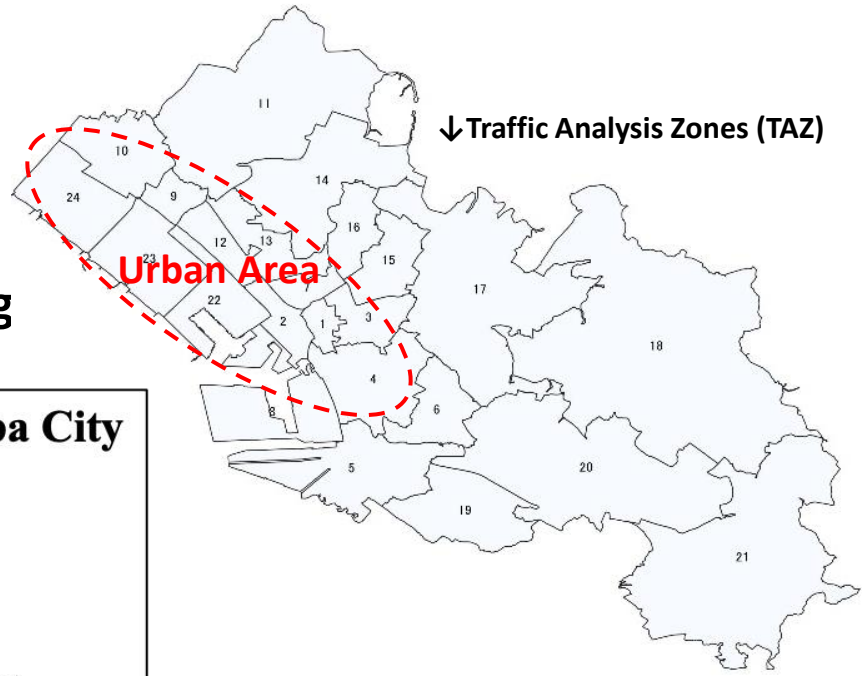
Motivations

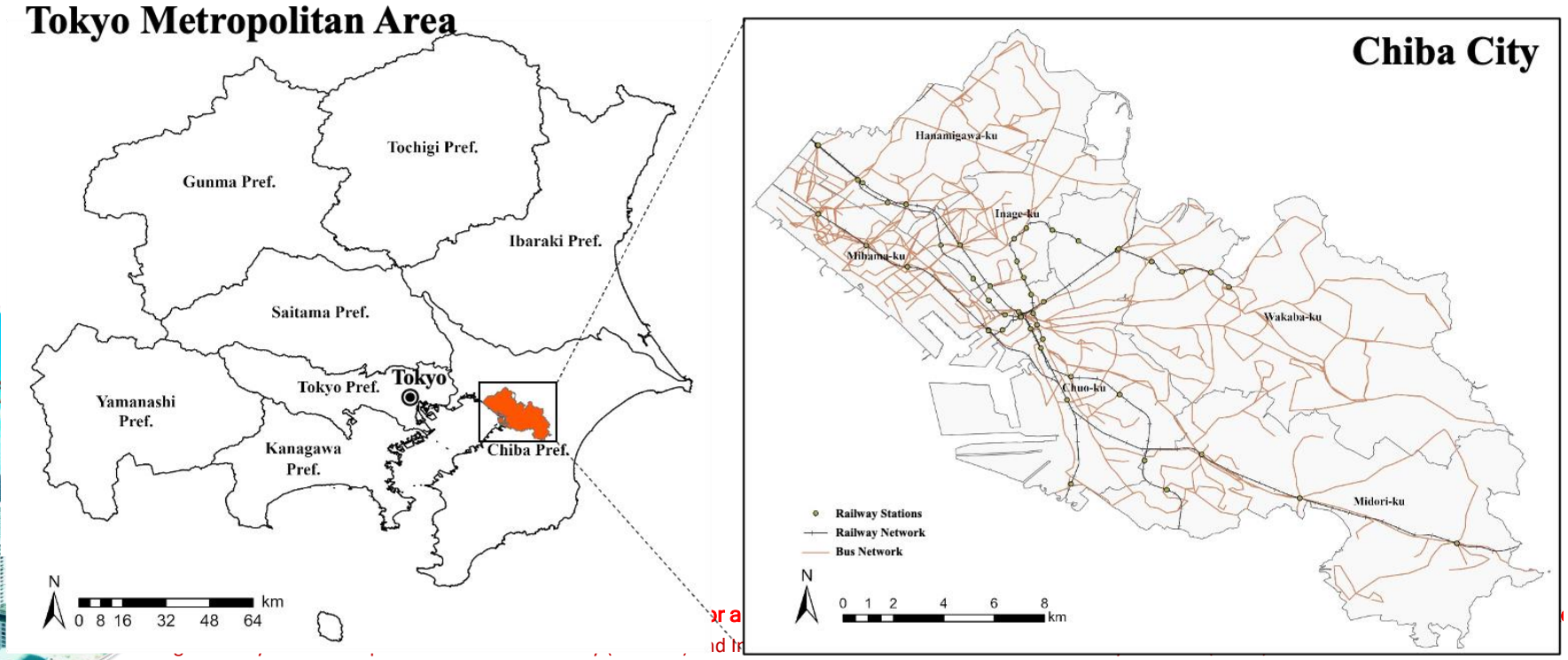
- **There has been little studies regarding the long-term policy impact on urban activities**
- **It is essential to simulate the long-term impact of policies because the effect of teleworking policies on urban activities does not affect immediately normally**



Methodology: Study Area

- Study Area：**Chiba City (Capital of Chiba Pref.)**
- Population (Nov. 2021)：**977,607 persons**
- Areas：**271.77km²**
- Last 30 years, **the working and young population have been decreasing**

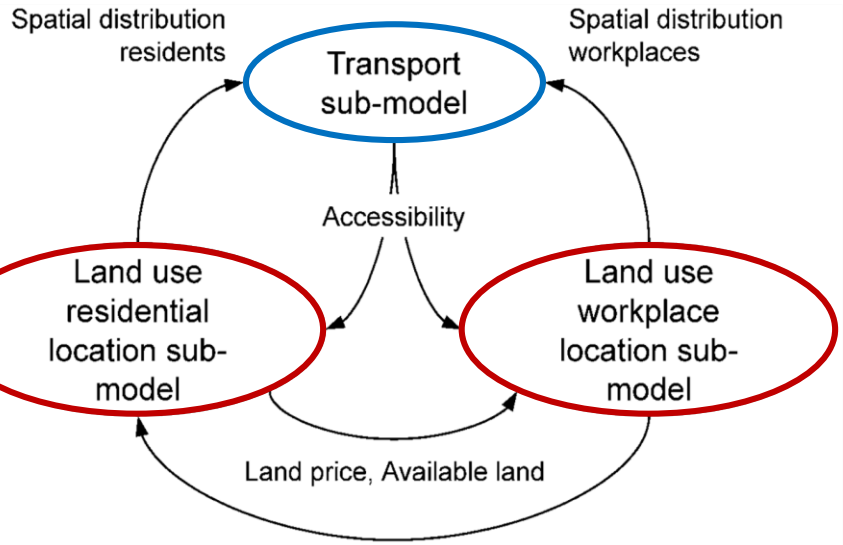




- For the simulation, this study was divided city areas into 24 TAZs
- 24 TAZs are based on Tokyo Metropolitan Are Person Trip Survey

Methodology: Land Use & Transport Model "MARS"

- **M**etropolitan **A**ctivity **R**elocation **S**imulator (MARS)
  - ➢ One of the LUTI models based on the principle of System Dynamics and implemented in Vensim® software
- The MARS is composed of **two sub-models (Land-Use & Transport)**
  - ➢ **Land-use sub-model:**
  - ① Simulating the development of new housing and workplace within the different zones
  - ② Simulating population migration within the different zones based on attractiveness each zone
  - ➢ **Transport sub-model:**
  - ① Simulation by 3 steps: **trip generation, trip distribution, modal choice**
  - ② 6 transportation modes: **Pedestrian, Bicycle, Car, Motorcycle, Rail, Bus**
  - ③ 2 purposes of trips: **Work (HWH), Others (HOH)**



Schematic of Structure of the MARS

Methodology: Scenario Settings & Simulation

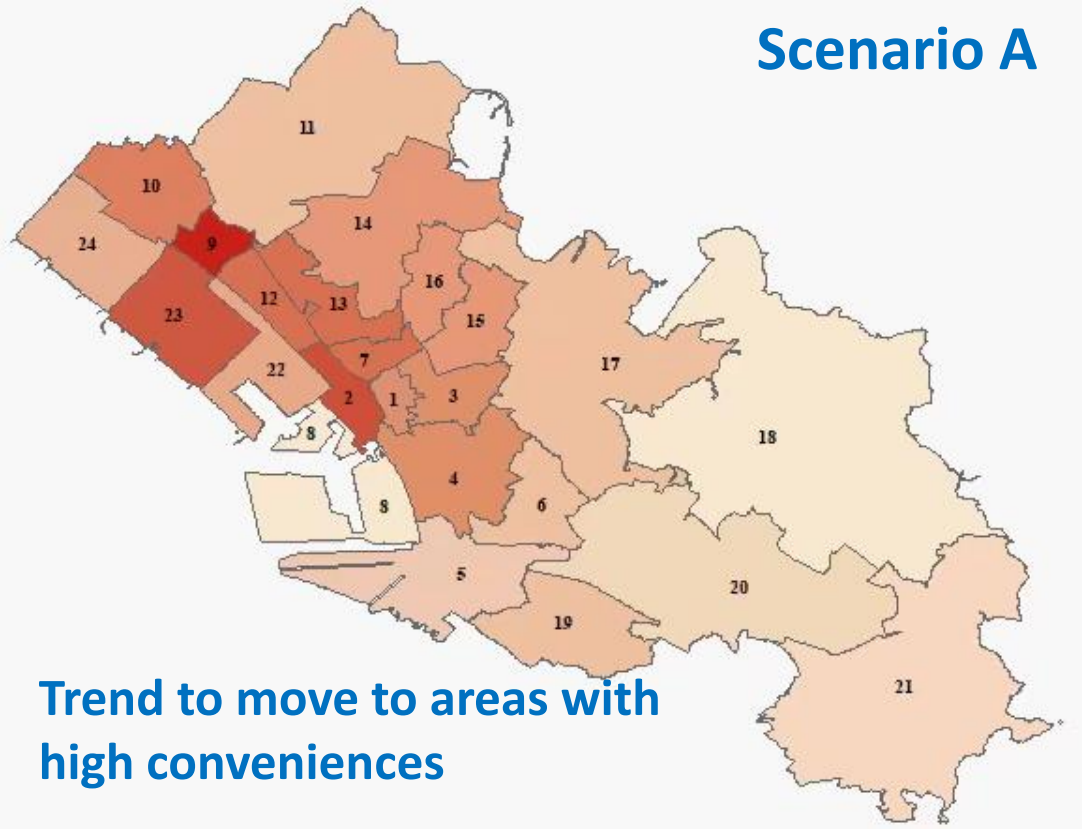
- This study established **2 scenarios for "New Normal" lifestyle** as below;

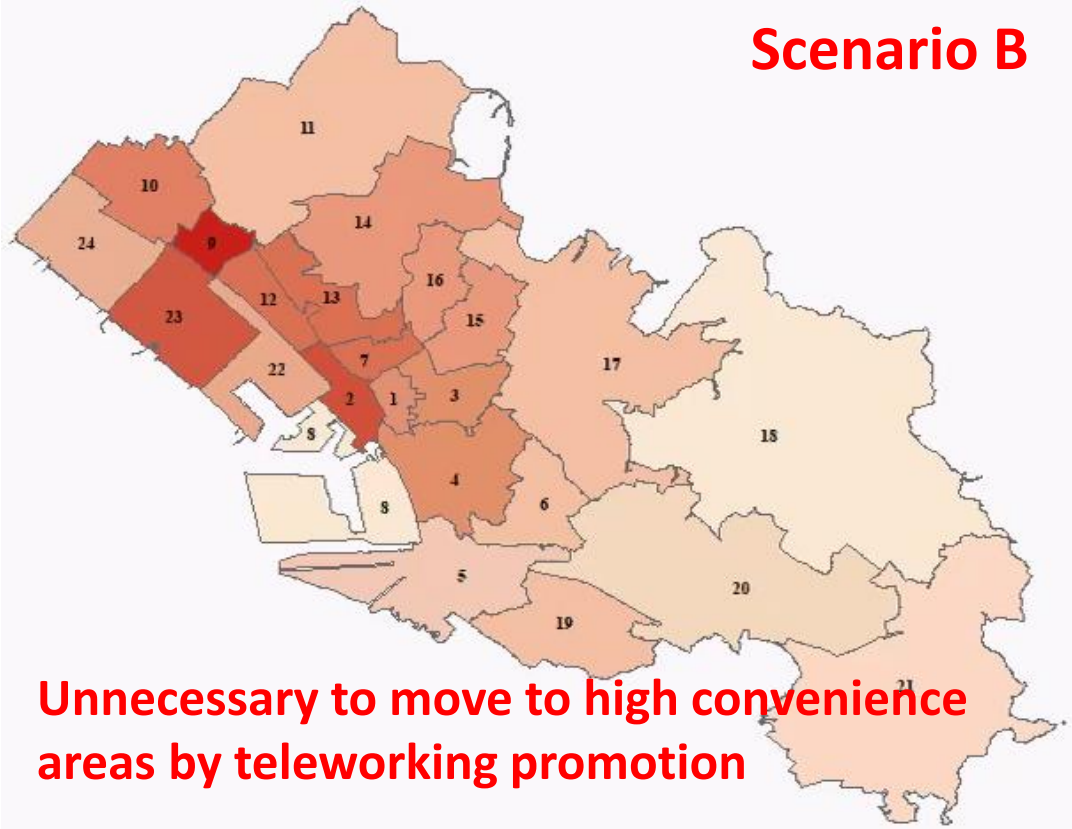
Scenario	Purpose of Scenario	Actions
A	・No implementation of policies ・BAU scenario	No Actions
B	・To maintain urban service levels using ICT on the assumption of a new lifestyle for the post-COVID-19 era	**・Gradual reduction in commuting trips by 2060 due to teleworking popularization (Goal: reduction by 50%)** **・Removal of administrative facilities and libraries by digitalization (ICT advances)**

- Model simulation period: **50 years (2010 to 2060)**
- First ten years (2010 to 2020) were simulated for validation of the model application

Results: Population Density (Every 10 years)

- Scenario A: **population density in urban areas was higher** than in suburban areas
- Scenario B: **residents tend to live in suburban areas because teleworking promotion eliminated the need to commute to workplaces** primarily distributed in the urban areas

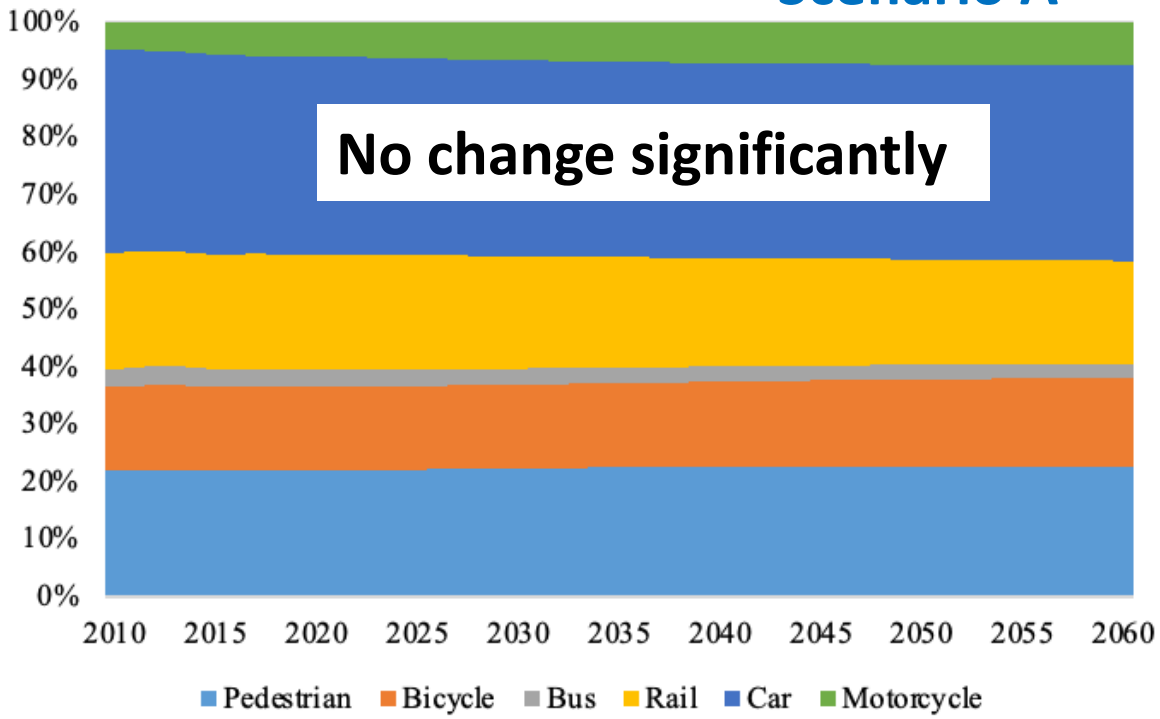




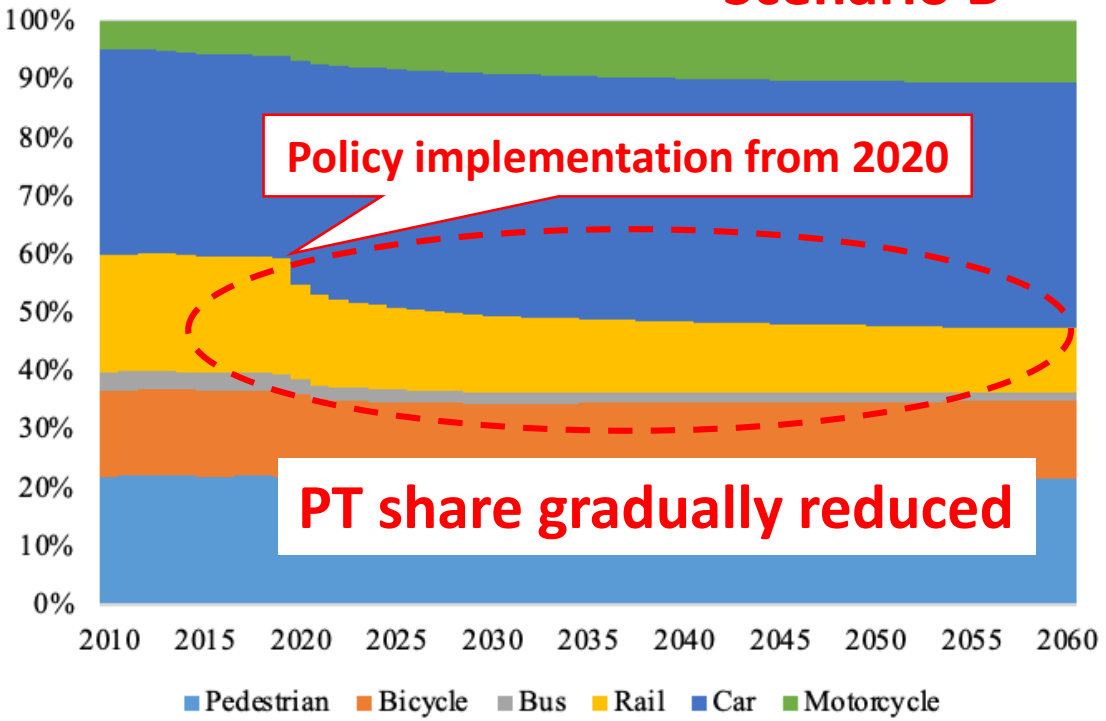
Results: Modal Split

- **Scenario A**: there is almost no change in modal split under the population decline
- **Scenario B**: **proportion of public transportation decreased significantly from 2020 later** because the number of commuting trips gradually reduced due to the implementation of teleworking policy

Scenario A



Scenario B



Conclusion and Findings

- **Findings showed that teleworking policy and ICT advances affect land-use and transportation** as below;
- **Population density (Land-use field):**

  -> **residents trends to live in suburban areas** due to unnecessary to commute to the urban areas
- **Modal split (Transportation field):**

  -> **Percentage of public transportation riders decreased significantly due to commuting trips decreased**

  -> **Percentage of car and motorcycle users increased due to converting from public transportation**
- **Conclusion:**

  -> In cities with a population decline, **the more diffusion of teleworking and ICT advances will keep the expanded residential areas while maintaining the convenience level of the suburban areas** due to unnecessary commute and move to the urban areas

  -> However, **the teleworking policy will be a high possibility to develop a car-dependent city**

  -> **Hard teleworking policy will be a possibility to impede realizing a sustainable city such as a compact city**

Thank you very much for your kind attention