Study on Estimation of Impact of CO2 Emission Reduction with Transit Oriented Development in Khon Kean city

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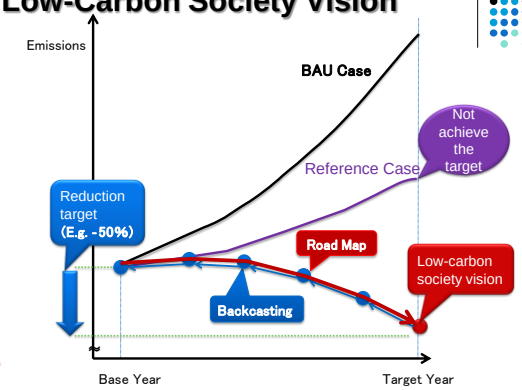
Background

- Introduction of bus rapid transport or BRT is expected to realize sustainable transport system in a middle sized city.
- However, CO_2 emission reduction by introducing BRT might be quite limited in a developing city, because an automobile has been in widespread use and population has been growing.
- Therefore, the low-carbon society vision including not only transportation system but also land use pattern or urban form which can realize significant CO_2 emission reduction is necessary.

Low-Carbon Society Vision



Literature Reviews

Fundamental Researches on Transport and Urban form

TANIGUCHI (1999)

They analyzed the relationship between population density and vehicle usage using a result of person trip data. As the result, increase in population density was verified to suppress the use of a vehicle.

MORIMOTO (1995, 2002)

They analyzed the relationship between energy consumption and transportation within the land use pattern in cities. As a result, they concluded that change from existing cities to compact city or Transit Oriented Development (TOD) is likely to contribute to reducing environmental impact.

Compact cities and TOD are considered valid.

Objectives

Based on the above…..

This study aims to evaluate an impact of Transit Oriented Development with BRT on CO2 emission reduction, which might be one of the concrete image of the future vision of low-carbon society.

Study Area

- About 450km from Bangkok
- Population is about 240,000
- Area of city is 230㎢

- Economic growth, Motorization
  →Delays in traffic facilities development→Traffic Congestion
- Currently 5 BRT lines were planed to develop by 2022

Methodology

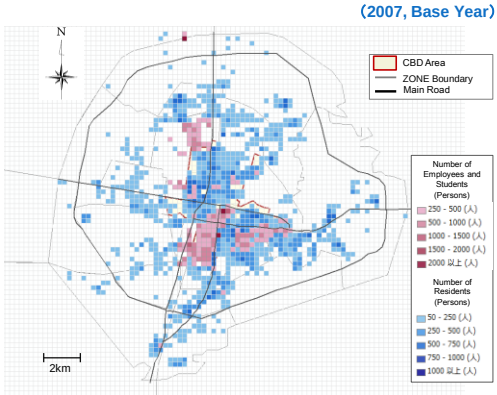
1. Set the present urban form using GIS
   - ◆Understand the land use
   - ◆Zone population is divided into 250m grid.
2. Set the future urban form
   - ◆Reference Case with BRT
   - ◆Low-Carbon Case with BRT&TOD
   - ◆Setting year is 2022 : All BRT lines will start operation
   - ◆New road network will not be constructed
3. Estimate traffic volume & travel speed by network
   - ◆Present Case
   - ◆Reference Case (with BRT, without TOD Case)
   - ◆Low-Carbon Case (with BRT and TOD Case)
4. Technical improvement
   - ◆Consider about technical improvement
5. Evaluate low-carbon case
   - ◆CO_2 Emission Reduction with and without TOD

Set the Urban Form Using GIS

- Urban form in Present Situation (2007, Base Year)
  - Identify the land use such as building location.
  - Zone population is divided into 250m grid by buildings location.
- Urban form in Reference Case (2022, with BRT, without TOD Case)
  - Setting year is 2022, because all BRT lines will start operation.
  - New road network will not be constructed.
  - Population distribution is expanded the present situation to much the estimated future zone population.
- Urban form in Low-Carbon Case (2022, with BRT and TOD Case)
  - Developing area is in the range of 500m from the BRT lines.
  - 2 km radius around the center of BRT pink line is set in CBD.
  - Residential population density is set to 3 levels by varying depending on the distance from the CBD area.

Urban form in Present Situation

(2007, Base Year)



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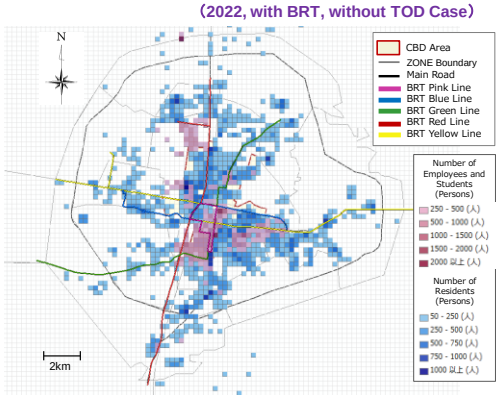
Urban form in Reference Case

(2022, with BRT, without TOD Case)



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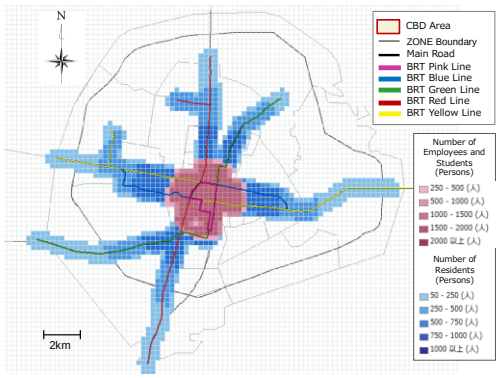
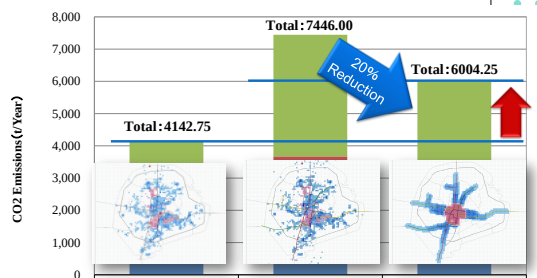
Urban form in Low-Carbon Case

(2022, with BRT and TOD Case)



Result of CO_2 Emission Reduction



	2007 Present Case	2022 Reference Case	2022 Low-Carbon Case
Bus	1025.65	3774.10	3518.60
Motorcycle	967.25	1102.30	992.80
Passenger Car	2149.85	2569.60	1492.85

Conclusion and Further study

- Low-Carbon Case achieves a 20 % reduction in CO_2 emissions compare to the Reference Case. However, result of CO_2 emission in Low-Carbon Case is increased about 20% from Present Case.

- We will consider about technical improvement.
- We will analyze the urban form in separated business district case with TOD. (Separated TOD Case)

Thank you for your attention !!