

# Evaluation of Possibility of Expanding Sharing Bicycle Port Network using Existing Privately Owned Public Space by Space Syntax

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## 1.Introduction

With the increasingly of popularity of sharing bicycles as an urban transportation, the lacking of sharing bicycle port becomes a new problems. Yokohama City, with over 3 million population, with 19% of which is frequently bicycle users and 697 thousand bicycle trips occurred on daily basis, is only equipped with 70 ports[1]. And comparing to other cities with bicycle-sharing network, Yokohama is extremely low in density of sharing bicycle per 1,000 inhabitants with a number of 0.107. Comparing to Paris:9.6 Lyon:6.4, Copenhagen: 4, Barcelona:3.7, Yokohama is highly lack of Bicycle Ports. In the meantime, over 700 privately owned public space in Yokohama remained a low use rate. with its location advantages throughout the city.(Fig.1) Privately Owned Public Space is kind of a trade-off between local governments and the real-estate developers, utilising these space for sharing bicycle system can benefit both for the city:reduction in traffic congestion and less infrastructural investment and for the owner:attract more users coming to the space and relieve the current parking issues.This research taking Yokohama as a example to study the possibility of utilising privately owned public space to expand the sharing bicycle system called Yokohama BayBike System network.

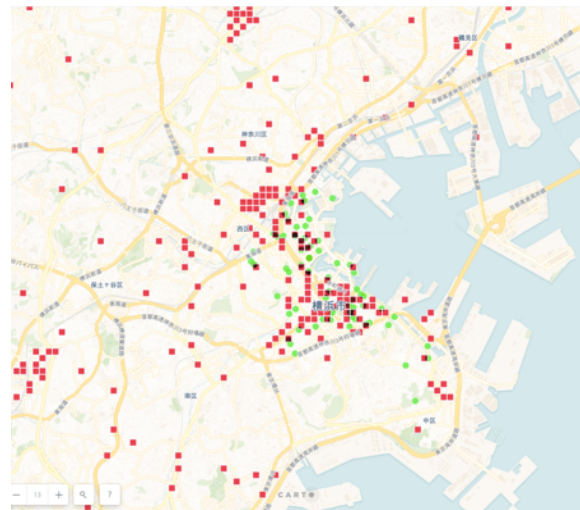
## 2. Related Work

Space Syntax is a analytical technique to investigate the human activities and structure of inhabited space in all diverse forms: building, settlements,cities or even landscapes[2]. And its validity in analysis of mainstream bicycle facility analysis and evaluation is already tested[3].

Sharing bicycle system used bike as one form of urban transformation to serve the needs of the first or last kilometre of user's commute[4]. The main concept of sharing bicycle system id the cycle users can take the bicycles whenever they need and leaves them behind when they arrive their destination. The density of the sharing bike system is very important for running the sharing bike system.

## 3. Analysis Method

Define the current Yokohama city into 2 tiers, Tier 1 is



■ Privately Owned Public Space  
● Sharing Bicycle Port

Fig.1 Current Situation of Privately Owned Public Space in Yokohama and Sharing Bicycle Port(made based on open data from Yokohama City )

for the city centre area current equipped with some sharing bicycle networks.Tier 2 current situation of privately owned is the outer area, currently without the sharing bicycle networks. For Tier 1, where sharing bicycle system network already existed, recommendation is made by following method to pick up the places suitable for extending the sharing bicycle networks. The road network of Yokohama City, privately owned public space and current existing bicycle ports are used as input data to generate a space syntax model.

To set up a space syntax model suitable for the analysis , the first step is to guarantee that all segments met properly, all vertices within 1m were snapped to a coincidental location and axial stubs less than 25% of line length is removed[2]. No facilities and roads were narrower than 1 m in the proposed area as a perception. Second, polylines were generalised within a tolerance of 35°. In this way, any two segments comprising a single polyline and meeting at less than 35° were replaced with a single straight segment. The value was validated as a maximum angle of continuity—any angles larger than this may reasonably be considered a change in



Fig.2 Situation of Sharing Bicycle Network with or without Privately Owned Public Space (made based on open data from Yokohama City, Buffer Zone=walking distance 10 minutes )

direction thus cannot be treated as continuity in this case [5]. Finally, the Yokohama City map was processed in Depthmap (Spacesyntax Software) using the segment analysis method. It is important to note that the process breaks polylines at each vertex. Therefore, each individual segment received a unique space syntax value for analysis. Within the map of choice, now the proper place for the sharing bicycle port can be selected and the bicycle stock consideration can also be proposed for bicycle volume according to the simulation.

#### 4. Result and Discussion

From current existing researches, travel distance by mode varies from country to country and city to city, 10 minutes is the upper limit of most people's walking distance (= 800m). Cycling distances generally fall within the 1km to 5km range. Utilising the privately owned public space can broaden the distance and range of visiting spots and travel distances of the sharing bicycle user when adding the privately owned public space into the sharing bicycle system network (Fig.2). In Tier 2 area, currently equipped with few bicycle port, the network can be established with the expanding bicycle spots. With the adding bicycle spots, the travel area can now covering all Yokohama area comparing to current network only covering 20%. In Tier 1 area, using the proposed method as a tool to expanding the existing network and propose bicycle stock consideration. For the map of choice measure (Fig. 3), the colour from blue to red, is represented as the bicycle volumes in the selected area. The more red the colour is, the larger the bicycle volume in the area, the more blue the colour is, the lesser bicycle volume is expected in the area. This can be used as a suggestion for the related areas' bicycle ports' stock consideration.

#### 5. Conclusion

This research recommends the implementation of expanded sharing bicycle ports using Privately Owned

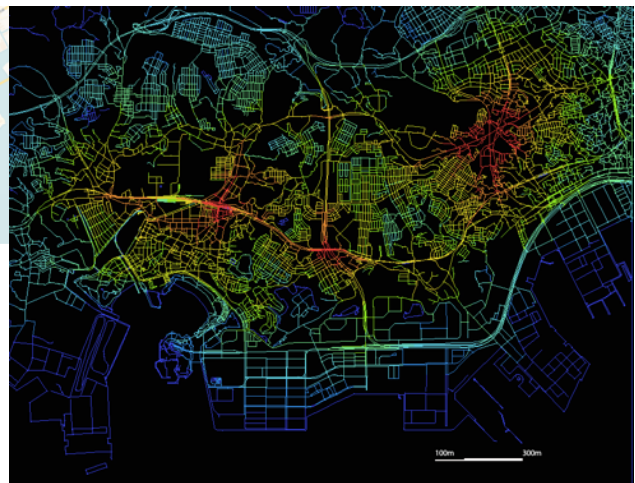


Fig.3 Map of choice measure for Tier 1(made based on open data from Yokohama City )

Public Space to best serve the needs of cycle users. Obviously, it will expand the current existing sharing bicycle networks. And it provide a method to provide recommendations to choose from the current Privately Owned Public Spaces, which will be served as the best location for sharing bicycle ports. In the future, we plan to combine the space syntax with sharing bicycle hub location inventory model to make more precise analysis and recommendation for bicycle ports choice.

#### Reference

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