Estimation of Trip Generation from Residential Area in Bangkok

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Background

- According to the recent urbanization, even the open spaces reserved for water impound were being developed into residential quarter. Traffic generated from such area has increased beyond the capacity of Soi and became the main cause of traffic congestion in Bangkok.

- In order to find the solution for traffic congestion on the main road, the estimation of generated traffic volume from Soi is essential.
Background

Road network in Bangkok

Is combined with sub street that connected to the main Road called “Soi”

Along with the rise in population, more houses are being developed in “Soi”

Large amount of traffic is generated from “Soi”

Traffic congestion on the main road

Lack of good planning

A lot of dead-end Soi

Number of household in Soi increased

Traffic congestion on main road

Origin: Google map
To be able to understand the Traffic jam problem more clearly in order to find the solution for traffic congestion on the main road, the estimation of generated traffic volume from Soi is essential.

The existing statistic data of population, household, vehicle possession, etc. is insufficient to estimate the generated traffic volume.

Find the new generated traffic estimation method that does not require statistic data.

Traffic generated from Soi is estimated by household questionnaire and satellite image.
There were an existing research about characteristics of urban structure and vehicle use in Bangkok.

Household configuration, occupation and income are the factors of which vehicle and in what number the household will have in possession.

It is considered that there the traffic generated by the different house type varied.
Method of study

Houses are classified into three types

Generated trip base for each house type is calculated

Numbers of each type of houses are calculated by satellite images

The Generated Trip Base is multiplied by the calculated numbers of households

The generated traffic volume from “Soi” is estimated

Verification

Actual generated traffic volume
Questionnaire survey

To obtain the Generated Trip Base from each house type, the home visit questionnaire survey was conducted.

Investigation date
16th – 18th December 2009

Questions
- Household’s composition
- Individual attribute
- Transportation mode

Area with Soi of various scales is selected

The survey was conducted in 4 Sois connected to Lat Phrao road, 15 km north east from the centre of Bangkok.

Origin: MapMagic [Bangkok and 7 nearby provinces 2009]
Calculation of Generated trip base

- Generated trip base is calculated from average value of the traffic generated from each household of each house type in one day.

Car generated trip is high for Single house

Car generated trip is low for Condominium

It assumed that most of the condominium residents are students, who don't have a car.
The generated traffic came out from “Soi” during the two hours of the morning peak was estimated by using the following mathematic expressions

\[
y = \beta \sum_{i=1}^{3} \alpha_i x_i
\]

- \( y \): Generated traffic volume at Soi’s exit during the peak of two hours in morning (trip)
- \( \beta \): Peak rate during the peak of two hours in morning
- \( \alpha_i \): Generated Trip Base according to house type (Trip / Household)
- \( x_i \): Number of household according to house type (household)
- \( i \): 1 = Single house 2 = Condominium 3 = Shop house

The peak rate \( \beta \) is the average value of the Generated trip during 2 hours peak in the morning (7:00 – 9:00 am) from all Sois. Therefore \( \beta = 0.63 \)
Sois selected for Generated trip estimation

In order to verify the generated trip estimation model’s accuracy, another five Sois along Lat Prao Road were selected.

To exclude unwanted traffic, only dead-end Sois were selected.

The numbers of household in each Soi is calculated.

Generated trip is estimated.

The estimated value is compared with the actual measured value for verification.

Origin: MapMagic [Bangkok and 7 nearby provinces 2009]
Household calculation

- Calculation method

**Single house**
- Counted lot by lot using satellite image

**Condominium**
- The building’s area is divided by average lot area

**Shop house**
- For condominium, multiplied by number of floors

<table>
<thead>
<tr>
<th>House Type</th>
<th>Average Lot Area (m²)</th>
<th>Sample (Buildings)</th>
<th>Standard Deviation (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condominium</td>
<td>29.44</td>
<td>11</td>
<td>4.98</td>
</tr>
<tr>
<td>Shop House</td>
<td>57.39</td>
<td>5</td>
<td>9.02</td>
</tr>
</tbody>
</table>

The numbers of household of each house type in Soi
Traffic Volume Survey

In order to verify the Generated trip estimation model, the traffic volume survey was conducted in five dead-end Soi connected to Lat Prao Road that were used in generated trip estimation. The reason that only dead-end Sois are selected is because the traffic measured at dead-end Soi’s entrance will be the actual traffic generated from that particular Soi.

Investigation date

During 16th – 18th December 2009
7:00~9:00

<table>
<thead>
<tr>
<th>Lat Phrao 63</th>
<th>Walk (Trips)</th>
<th>Motorcycle (Trips)</th>
<th>Para-Transit (Trips)</th>
<th>Car (Trips)</th>
<th>Total (Trips)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lat Phrao 63</td>
<td>317</td>
<td>163</td>
<td>115</td>
<td>263</td>
<td>858</td>
</tr>
<tr>
<td>Lat Phrao 67/2</td>
<td>50</td>
<td>8</td>
<td>0</td>
<td>39</td>
<td>97</td>
</tr>
<tr>
<td>Lat Phrao 69</td>
<td>66</td>
<td>23</td>
<td>36</td>
<td>190</td>
<td>315</td>
</tr>
<tr>
<td>Lat Phrao 80/3</td>
<td>225</td>
<td>47</td>
<td>0</td>
<td>146</td>
<td>418</td>
</tr>
<tr>
<td>Lat Phrao 91</td>
<td>73</td>
<td>95</td>
<td>100</td>
<td>80</td>
<td>348</td>
</tr>
</tbody>
</table>
Estimation Results & Verification

- The estimated generated trip during two hours peak and the actual measured generated trip are verified

![Bar chart showing estimated vs actual values for different transport modes at various locations.](chart.png)

- Only few error

- Estimation is reliable

- Generated trip estimation for each transport mode

- Error margin is high
Estimation Results & Verification

- Error margin of estimated value from generated trip during two hours peak and the actual measured generated trip

![Bar Chart]

- Total: 0.44
- Walk: 0.70
- Motorcycle: 0.68
- Car: 0.52
- Para-Transit: 0.65

Error margin is high

Generated trip estimation
Only few error
Estimation is reliable
Generated trip estimation for each transport mode

Coefficient of Variation

- Total
- Walk
- Motorcycle
- Car
- Para-Transit
Results of this study

- The compared results of the estimated value and the actual measured value clarified that all transport modes generated traffic volume estimation is possible.

- After the generated trip base for each house type was calculated, more understanding about tendency of each house type is achieved.
Future issues

- In order to improve the accuracy of the estimation, it is important to cross investigate the shape and structure of Soi and how and in what modes people prefer to transport in Soi.

- It is important to validate whether that the generated trip base estimation model can be use to estimates traffic in Bangkok’s other area.
Thank you for your valuable time
住宅タイプの世帯構成人員

対象: 4ソイ、88世帯
一軒家

対象: 3ソイ、91世帯
コンドミニアム

対象: 4ソイ、107世帯
ショップハウス

計: 3.07
計: 1.69
計: 2.54

世帯構成人員（人／世帯）

一軒家 コンドミニアム ショップハウス

計: 3.07
計: 1.69
計: 2.54

対象: 4ソイ、88世帯

対象: 3ソイ、91世帯

対象: 4ソイ、107世帯

一軒家

計: 3.07
計: 1.69
計: 2.54

世帯構成人員（人／世帯）

男 女
住宅タイプの職業構成

一軒家

対象：4ソイ、88世帯

コンドミニアム

対象：3ソイ、91世帯

ショップハウス

対象：4ソイ、107世帯

公務員
会社員
自営業
主婦
技術者
学生
無職
その他
住宅タイプの収入構成

一軒家
対象：4 ソイ、88世帯

コンドミニアム
対象：3 ソイ、91世帯

ショップハウス
対象：4 ソイ、107世帯

収入なし 6,000B未満 6,000-9,999B 10,000-19,999B 20,000-29,999B 30,000B以上
各住宅タイプの所有車両数

- 一軒家: 4ソイ、88世帯
- コンドミニアム: 3ソイ、91世帯
- ショップハウス: 4ソイ、107世帯

- 自動車
- バイク
<table>
<thead>
<tr>
<th>Soi Number</th>
<th>Peak Rate</th>
<th>Average</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lat Phrao 63</td>
<td>0.62</td>
<td>0.63</td>
<td>0.08</td>
</tr>
<tr>
<td>Lat Phrao 67/2</td>
<td>0.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lat Phrao 69</td>
<td>0.67</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>Lat Phrao 80/3</td>
<td>0.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lat Phrao 91</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>