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PERANPENELITIAN, PERENCANAAN, DAN PENERAPAN KEBIJAKAN PEMERINTAH DALAM PENGEMBANGAN TRANSPORTASI YANG BERKELANJUTAN

8-10 October 2010

PROGRAM STUDI TEKNIK SIPIL
FAKULTAS TEKNIK
UNIVERSITAS KATOLIK SOEGIJAPRANATA

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Judul	:	Study on Finding The optimum Location and Number of Traffic Counts in Accuracy of The Estimated Combined Model Trip Distribution-Mode Choice-Trip Assignment
Penulis	:	Rahayu Sulistyorini
NIP	:	19741004 2000032002
Instansi	:	Fakultas Teknik, Universitas Lampung
Publikasi	:	Prosiding Nasional
	:	ISBN: 979-95721-2-13
	:	Bulan Oktober dan Tahun 2010
Penerbit	:	Program Studi Teknik Sipil, Fakultas Teknik, Universitas Soegijapranata

Bandar Lampung, 21 Januari 2011

Mengetahui,
A.n. Dekan Fakultas Teknik
Universitas Lampung
Pembantu Dekan I

Dr. Eng. Helmy Fitriawan, S.T, M.Sc.
NIP. 197509282001121002

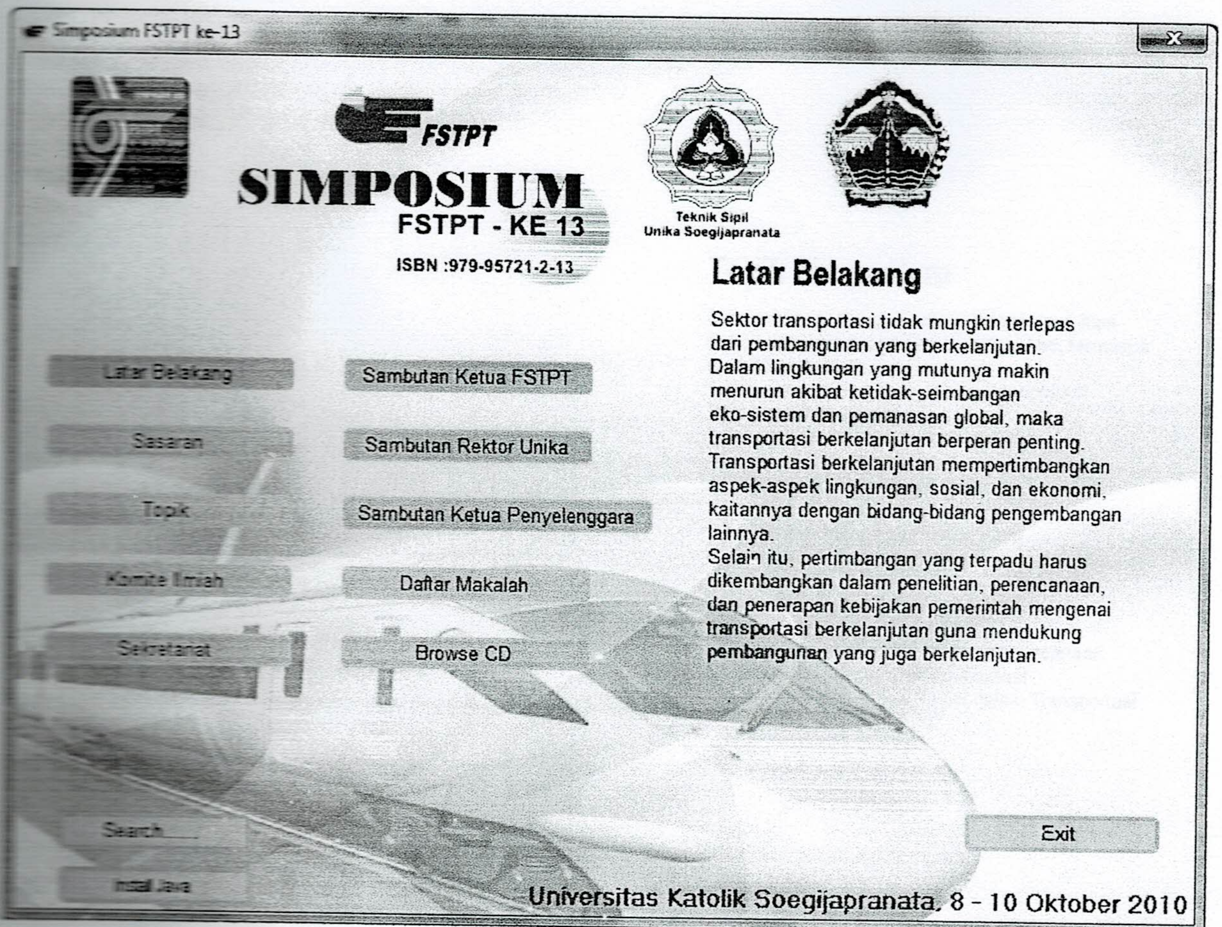
Penulis,

Dr. Rahayu Sulistyorini, S.T, M.T.
NIP. 19741004 2000032002

Menyetujui:

A.n. Ketua Lembaga Penelitian
Sekretaris Lembaga Penelitian Unila

Drs. Mardi Syahperi
NIP. 195801001980031001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Study on Finding The Optimum Location and Number of Traffic Counts in Accuracy of The Estimated Combined Model Trip Distribution-Mode Choice-Trip Assignment

Rahayu Sulistyorini
Department of Civil Engineering
University of Lampung
Jalan Prof. Sumantri Brojonegoro No.1,
Bandar Lampung 35145
Indonesia
Telp/Fax: +62-721-704947
sulistyorini_smd@yahoo.co.uk

Abstract

Origin-Destination (O-D) matrix is the main input which present traveling patern in a certain region plan. One of effective and economist method to define O-D matrix is estimation method based on traffic flow data which is included in Non-Convensional Methods. One of things that influences the accuracy level in estimation O-D matrix from traffic count data is traffic count location and number of traffic count. The objective of this study is to find some best locations or links that will be used as base to decide the location of traffic count survey and collecting data. The other findings is to know how many numbers of traffic count data that will be the optimum number to produce O-D matrix.

Travel pattern behavior is represented by combined model gravity-multinomial logit-equilibrium assignment. This model is described as functions of some parameters which estimated using least square estimation method. We try to calibrate the unknown parameters of the combined model so that to minimize the deviations between traffic flows estimated and the observed flow.

Keywords: combined model, optimum location, optimum number of traffic count

1. INTRUDUCTION

1.1 Background

Origin-Destination Matrix is description of the movement pattern in certain periods of time in a certain area. There are two methods to obtain the matrix, conventional and unconventional. Conventional method is the most commonly used, however the method need high cost due to the requirement of long period observation, high accuracy in data analysis and large number of employers. Meanwhile, the unconventional method is another method in obtaining origin-destination matrix using traffic count data that need relatively lower cost than the conventional method with undoubted accuracy level.

Tamin (1988) declared, when an O-D matrix is assigned on to the network, a flow pattern is produced. From examining this flow pattern, one can identify the problems that exist in the network and some kind of solution may be devised. An O-D matrix gives a very good

indication of travel demand, and therefore, it plays a very important role in various types of transport studies, transport planning and management task.
The traffic flow is important information as a main data in estimation process of Origin-Destination Matrices. The advantages that found by using traffic flows data are derived from low cost, less time and traffic counts data are routinely collected by many planning bodies and authorities which makes easily available and the evolution can be followed.

In process to estimate origin–destination matrices, we have to concern that although traffic counts are very attractive to use as a database in estimating O-D matrices, there are still some problems associated with their use.

- **Inter-dependence**, the flows of traffic movement in a certainly link, basically, are the accumulations or total number of flows from the other links that come in to that links. In principle, usually we need counts only some independent counts in some links or locations in order to find the information of flows of all links. Therefore, from an economic point of view and the principle of flows, some efforts are needed in choosing the appropriate links or location to be counted.

  Figure 1 shows that flows on link **5–6** are the summation of flows on link **1–5** and on link **2–5**, then there is no additional information can be extracted by counting flows on link **5–6** because of the flow continuity condition, $\overline{V}_{56} = \overline{V}_{15} + \overline{V}_{25}$.

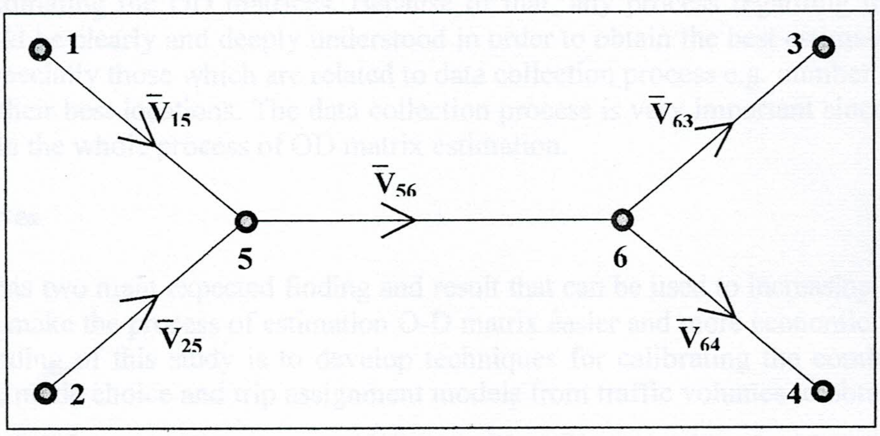


Figure 1 A simple network with link counts (Source: Tamin, 2000)

In principle, we need counts for only **3 (three)** independent counts in order to find the flows of all links in **figure 1**. Therefore, from an economic point of view, some efforts are needed in choosing the appropriate links to be counted **(Tamin, 2000)**.

- **Inconsistency**, in practice, the problem of inconsistency in link counts may arise when the observed volume does not satisfy the flow continuity conditions. This inconsistency in counts may arise due to human or machine counting errors and counting at different time or dates. As a result of all this, no solution for the O-D matrix can be estimated that reproduces all this inconsistent traffic count. One possible way to remove this problem is by choosing only independent links for counted.

- In practice, the problem of inconsistency in link counts may arise when the flow continuity conditions are not satisfied by the observed volumes. In the case of **figure 1**, it may well happen that the observed flows are such that:

$$\overline{V}_{56} \neq \overline{V}_{15} + \overline{V}_{25} \quad (1)$$

or

$$\overline{V}_{15} + \overline{V}_{25} \neq \overline{V}_{63} + \overline{V}_{64} \quad (2)$$

This inconsistency in counts may arise due to human or counting errors and counting at different times or dates. As a result of all this, no solution for the OD matrix can be estimated that reproduces all these inconsistent traffic counts. One possible way to remove this problem is by choosing only independent links for counted (**Tamin, 2000**).

It is mentioned that the unconventional method uses traffic count information as the main input for estimating the OD matrices. Because of that, any process regarding the traffic counts should be clearly and deeply understood in order to obtain the best estimates of OD matrices; especially those which are related to data collection process e.g. number of traffic counts and their best locations. The data collection process is very important since it is the first action in the whole process of OD matrix estimation.

1.2 Objectives

This study has two main expected finding and result that can be used to increasing accuracy level and to make the process of estimation O-D matrix easier and more economic. The first expected finding of this study is to develop techniques for calibrating the combined trip distribution, mode choice and trip assignment models from traffic volumes to obtain the O-D matrix.

The other expected finding is to know how many numbers of traffic count data that will be the optimum number to produce O-D matrix and to find some best locations or links that will be used as base to decide the location of traffic count survey and collecting data. In this case, the optimum number of traffic count data is a minimum number of set data that can give much information of traffic flow and can produced high level of accuracy of O-D matrix.

2. ORIGIN-DESTINATION (O-D) MATRIX ESTIMATION

Origin-Destination (O-D) Matrix is a fundamental information obviously required by most of techniques and methods for solving the transportation problems as well as by many urban and regional transport planning policies. The conventional methods to obtain the O-D matrix require very large surveys such as home and roadside interviews which are very expensive, labor intensive, lengthy, time disruptive to trip makers, and also subject to large errors. The need for inexpensive methods, which require low-cost data, less time and less manpower, generally called as unconventional method is therefore obvious due to time and money constraint. Traffic counts, the embodiment and the reflection of the O-D matrix, provide direct information about the sum of all O-D pairs which use those links.

The Transport Demand Model Estimation (TDME) approach assumes that the travel pattern behaviour is well represented by a certain general transport model, eg. a gravity or gravity-opportunity model. Once, the parameters of the postulated transport demand models have been calibrated, they may be used not only for the estimation of the current O-D matrix, but also for predictive purposes. The latter requires the use of future values for the planning variables.

Consider a study area which is divided into N zones, each of which is represented by a centroid. All of these zones are inter-connected by a road network which consists of series of links and nodes. Furthermore, the O-D matrix for this study area consists of N² cells. [N²-N] cells if intra-zonal trips can be disregarded. The most important stage for this transport model estimation based on traffic counts is to identify the paths followed by the trips from each origin to each destination.

The variable p_{id}^{lk} is used to define the proportion of trips by mode m from zone i to zone d travelling through link l. Thus, the flow on each link is a result of:

- trips by mode m from zone i to zone d (T_{id}^{k}), and
- the proportion of trips by mode m from zone i to zone d whose trips use link l which is defined by p_{id}^{lk} ($0 \le p_{id}^{lk} \le 1$).

The flow (V_l^k) in a particular link l is the summation of the contributions of all trips by mode m between zones to that link. Mathematically, it can be expressed as follows:

$$V_l^k = \sum_i \sum_d T_{id}^k p_{id}^{lk} \qquad (3)$$

Given all the p_{id}^{lk} and all the observed traffic counts ($\hat{V}_l^m$), then there will be N² unknown T_{id}^k's to be estimated from a set of L simultaneous linear equations (1) where L is the total number of traffic (passenger) counts. In principle, N² independent and consistent traffic counts are required in order to determine uniquely the O-D matrix T_{id}^k. (N²-N) if intra-zonal trips can be disregarded. In practice, the number of observed traffic counts is much less than the number of unknowns T_{id}^k's. Therefore, it is impossible to determine uniquely the solution. In general, it can be said that there will be more than one O-D matrix, which will satisfy the traffic counts. One possible way to overcome this problem is to restrict the number of possible solutions by modelling the trip making behaviour. (Tamin, 2000).

3. COMBINED TRIP DISTRIBUTION-MODE CHOICE (TDMC) MODEL

For the purpose of public transport demand estimation, this idea can be extended to the development of a practical estimation approach to calibrate the combined trip distribution and modal choice (TDMC) model using traffic (passenger) counts and other simple zonal planning data. This approach assumes that either trip distribution or modal choice models are represented by certain model forms.

As usual, the traffic (passenger) counts are expressed as a function of the TDMC model. In this case, the TDMC model is represented a function of a model form and relevant parameters. The parameters of the postulated model are then estimated, so that the errors between the estimated and observed traffic (passenger) counts are minimized.

If we using Gravity (GR) model as a trip distribution model and Multi-Nomial Logit (MNL) model as a modal choice model, it can be expressed as:

$$T_{id}^{k} = A_i O_i B_d D_d f(C_{id}) \frac{\exp(-\gamma C_{id}^{k})}{\sum_m \exp(-\gamma C_{id}^{m})} \quad (4)$$

$$V_l^{k} = \sum_i \sum_d T_{id} \frac{\exp(-\gamma C_{id}^{k})}{\sum_m \exp(-\gamma C_{id}^{m})} p_{id}^{lk} \quad (5)$$

$$V_l^{k} = \sum_i \sum_d (O_i A_i B_d D_d f(C_{id})) \frac{\exp(-\gamma C_{id}^{k})}{\sum_m \exp(-\gamma C_{id}^{m})} p_{id}^{lk} \quad (6)$$

4 RESEARCH STAGE

To achieve the objectives outline in the preceding section, the research is divided into distinct stages (see **figure 2**). Seeking the best location and optimum number of traffic count, some criteria that described below should be deeply considered. These factors are: Inter-dependence, Inconsistency, Proportion of flows in a link, and the other important criteria. Therefore, this proportion factor of route choice is very useful to calculate the number of flows of vehicle or traffic in a certain links or route. In this case, a link that has a bigger number of proportions of flows between zones will has more information about flows than the other one that smaller or equal to zero. in finding the best location, beside use the above factors, we must considering the other criteria or factors that can influence, especially by looking some aspects and condition of that location or links.

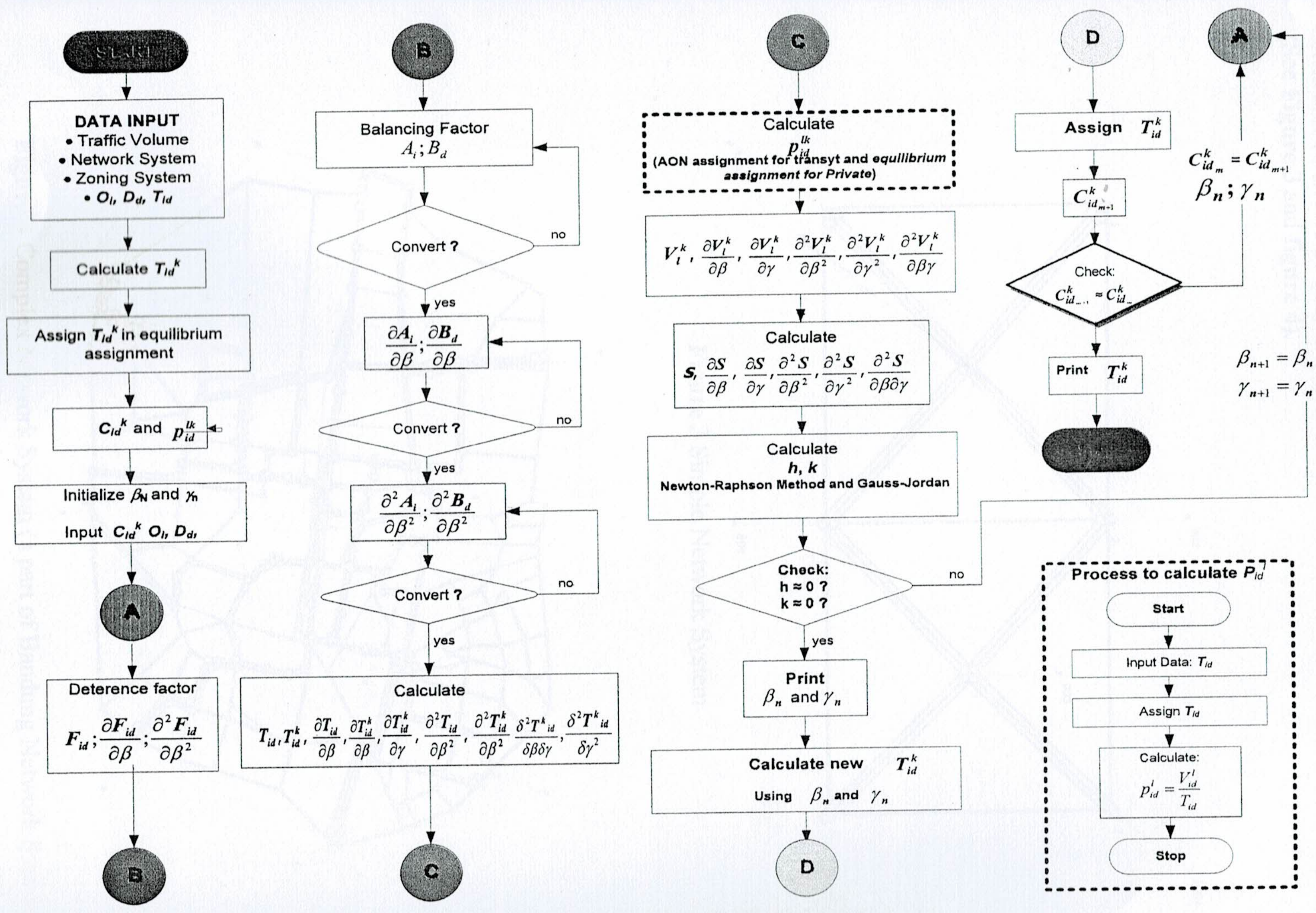


Figure 2 Calibration Process

5. MODEL VERIFICATION

Model have been tested in simple and complex network, which consists of 6 zones and 12 zones and considers 30 and 535 links to be selected for the best location of traffic counts. (See **Figure 3** and **figure 4**).

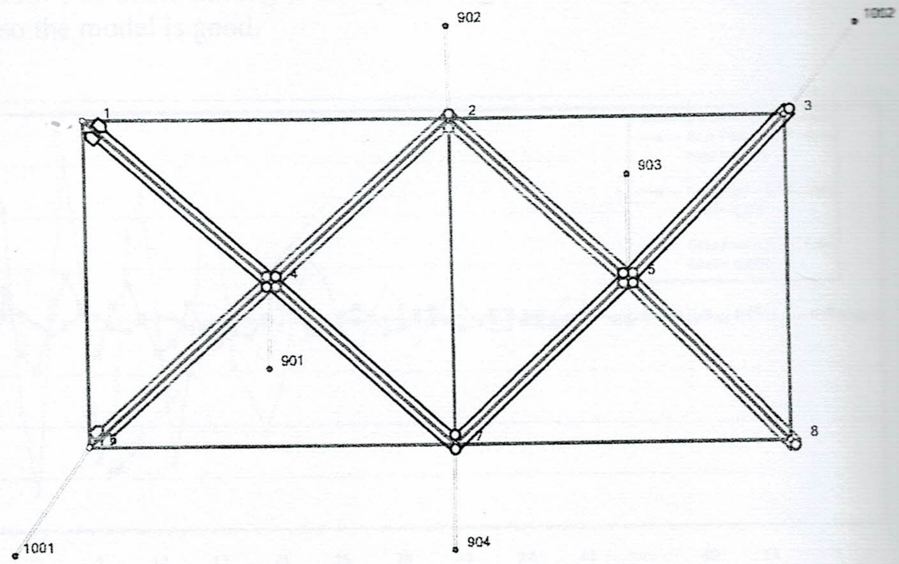


Figure 3 Simple Network System

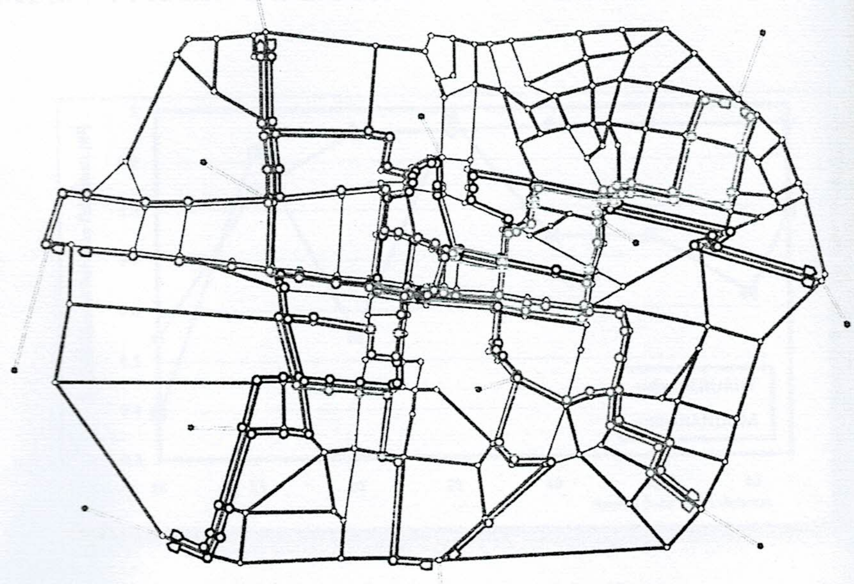


Figure 4 Complex Network System (a part of Bandung Network System)

The convergence of (β) and (γ) value is depend on starting value of (β) and (γ). If the value is far from solution, it need iteration more to achieve convergen level. **Figure 5** show the relationship between the number of iteration and the value of (β) and (γ). If we put (β) = 0,05 and (γ) 0,015 as starting value, it can achieve convergen level at 26^{t} iteration. If we put (β) = 0,06 and (γ) 0,02as starting value, it can achieve convergen level at 44th iteration. Finally, if the starting value for (β) = 0,03 and (γ) 0,001 , it can achieve convergen level at 58th iteration. The other finding is at any starting value of (β) and (γ), it must be result the solution, so the model is good.

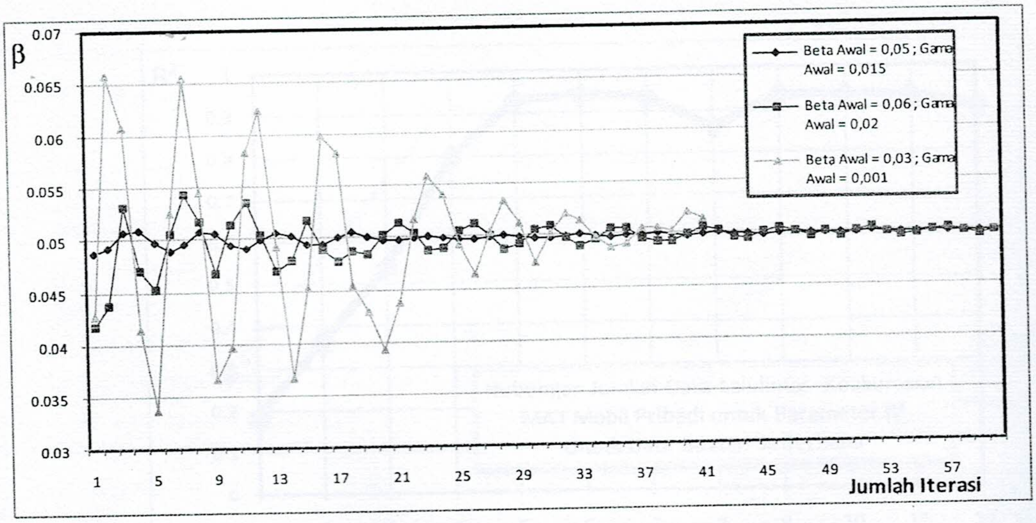


Figure 5 The value of β in each iteration with any starting value of (β) and (γ)

6. OPTIMUM NUMBER AND LOCATION OF TRAFFIC COUNTS

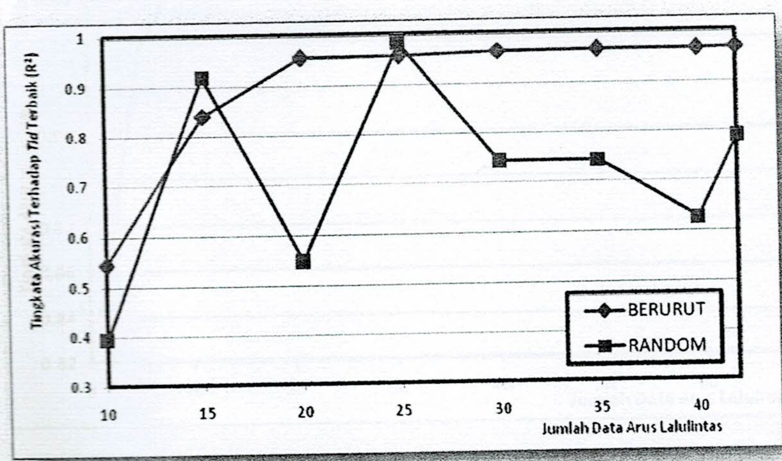
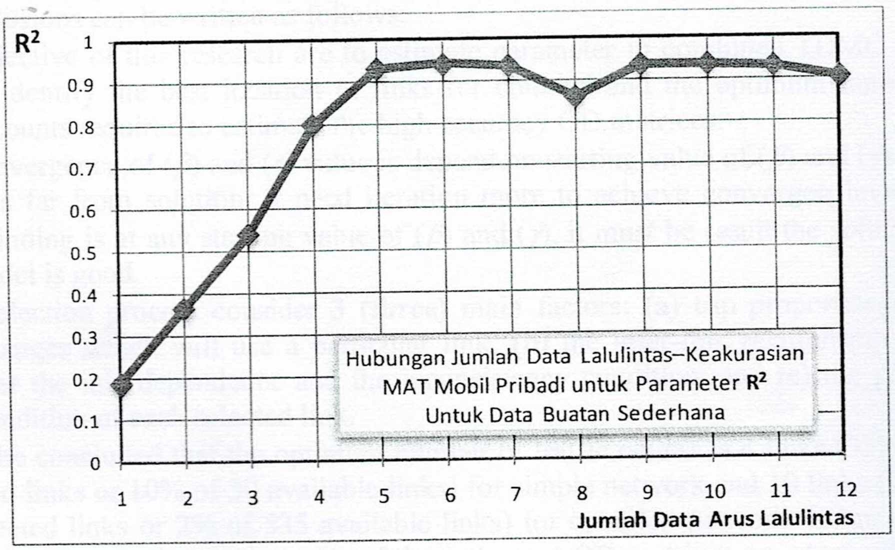
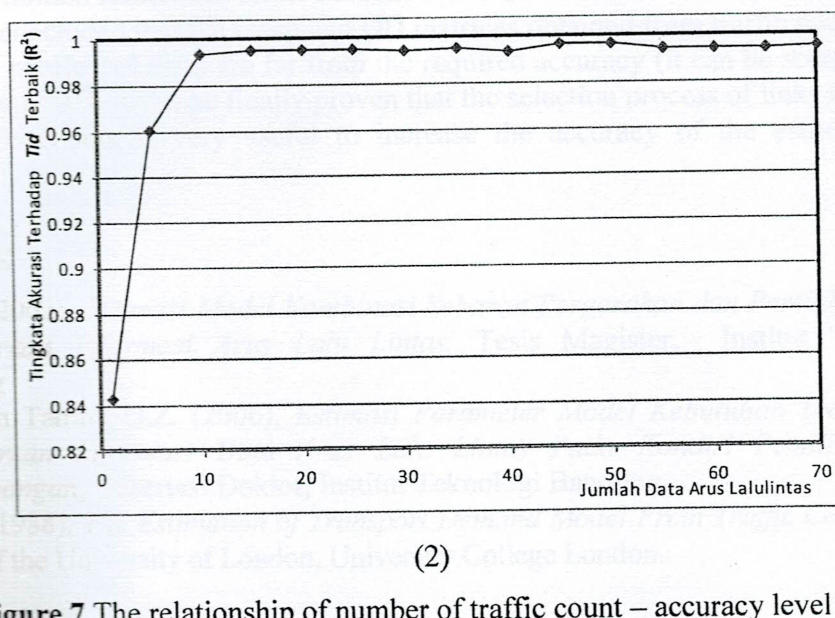


Figure 6 The relationship of number of traffic count – accuracy level ($\mathbf{R^2}$) with random and sorted method

The optimum number of traffic count can be determined by analysing the relationship between number of traffic counts and the level of accuracy of the estimated OD matrix based on that counts. The level of accuracy of the estimated matrices will be determined by comparing those matrices with the initial matrix (matrix estimated by using all selected traffic counts). This process will be conducted in 2 (two) conditions representing the sensitivity between the number of traffic counts and the link rank, namely: sorted condition and random condition. It can be seen from those figures that the better accuracy of the estimated OD matrices are obtained under sorted condition rather than under random condition. (**Figure 6**)



(1)



(2)

Figure 7 The relationship of number of traffic count – accuracy level (R^2)
(1. Simple Network, 2. Complex Network)

It can be seen from **figures 7 (1)** that the use of 4 links has relatively the same accuracy with the use of 12 links for both conditions (sorted and random). It can be concluded here that the optimum number of traffic counts is 4 links (33% of 12 selected links or 10% of 30 available links). **Figure 7 (2)** show that the optimum number of traffic counts is 10 links (14% of 71 selected links **or** 2% of 535 available links**).**

7. CONCLUSION AND RECOMENDATION

Several conclusions can be written as follows:

- The objective of this research are to estimate parameter in combined TDMC model and to identify the best location of links for counted and the optimum number of traffic counts required to estimate the high accuracy OD matrices.
- The convergence of (β) and (γ) value is depend on starting value of (β) and (γ). If the value is far from solution, it need iteration more to achieve convergen level. The other finding is at any starting value of (β) and (γ), it must be result the solution, so the model is good.
- The selection process consider **3 (three)** main factors: **(a)** trip proportion of trip interchanges which will use a particular link, **(b)** the inter-link relationship which consider the interdependence and the inconsistency condition, and **(c)** the physical link condition of each selected link.
- It can be concluded that the optimum number of traffic counts is 4 links (33% of 12 selected links or 10% of 30 available links) for simple network and 10 links (14% of 71 selected links or 2% of 535 available links) for complex network. It can also be concluded that the better accuracy of the estimated OD matrices are obtained under sorted condition rather than under random condition.
- It can be concluded that the estimated OD matrices obtained from traffic counts taken from the unselected links are far from the required accuracy (it can be seen from the low value of R^2). It can be finally proven that the selection process of links to be used for traffic counts is very useful to increase the accuracy of the estimated OD matrices.

REFERENCE

Purwanti, O. (2002), *Estimasi Model Kombinasi Sebaran Pergerakan dan Pemilihan Moda Berdasarkan Informasi Arus Lalu Lintas,* Tesis Magister, Institut Teknologi Bandung

Suyuti, R. dan Tamin, O.Z. (2006), *Estimasi Parameter Model Kebutuhan Transportasi Berdasarkan Informasi Data Arus Lalu Lintas Pada Kondisi Pemilihan Rute Keseimbangan*, Desertasi Doktor, Institut Teknologi Bandung

Tamin, O.Z. (1988), *The Estimation of Transport Demand Model From Traffic Counts*, PhD Dissertation of the University of London, University College London.

Tamin, O.Z., et al (2001), *Dynamic Origin-Destination (O-D) Matrices Estimation From Real Time Traffic Count Information,* Graduate Team Research, University Research for Graduate Education (URGE) Project