

A Localization and Traffic Density Short Term Forecasting in Non Motorised Vehicle Comprehensive Case Analysis

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Abstract- Non-motorized transport (NMT) is the use of a bicycle or walking to travel from one place to another. It is gaining popularity especially in the developed countries due to low transport externalities such as emissions and traffic congestion alongside its benefits to physical and mental health. The built environment, geography and weather, and socioeconomic factors significantly affect the use of NMT as a travel mode. This study reviewed some unique characteristics of NMT especially in developing countries to provide a clear understanding of the dynamics of NMT.

Keywords- Bicycle Non-motorised transportation Motor vehicles Pedestrian Sustainable transportation Walking.

I. INTRODUCTION

Non-motorized vehicles have played a major role in meeting the demand for door-to-door transport services in some south Asian developing countries. Popular non-motorized vehicles include Bangladesh's rickshaws and rickshaw-van, India's rickshaw-puller. These modes performed an important role in moving people and goods safely, efficiently and cheaply in the absence of so-called mass transport systems.

Non-motorized vehicles account for 70 percent of vehicle trips in India metropolitan, more than anywhere else in the world. Moreover the rickshaws contributed around 30 percent of the total value-added by the transport sector. This is more than double the contribution of all motorized road transport.

II. FUNDAMENTAL TRAFFIC PARAMETERS

In the study of traffic flow, two approaches immediately come to mind, i.e. macroscopic and microscopic. The macroscopic approach considers the traffic stream as a whole and this is evident in the use of fluid flow and heat flow analogies to describe the behavior and conditions of the stream.

The three fundamental parameters employed to describe macroscopic conditions are flow rate of volume (q), speed (u) and concentration or density (k). Greenshield⁵ suggested a linear relationship between speed and density. The microscopic approach considers the behavior of individual vehicles in the traffic stream. This approach is very popular especially in the development of models to explain the prevailing condition of traffic flow, when fundamental traffic parameters cannot clearly explained

the conditions. In this study both macroscopic and microscopic approaches used to analyze the observed data.

III. FORECASTING DATA

Forecasting is the process of making predictions based on past and present data. Later these can be compared (resolved) against what happens. For example, a company might estimate their revenue in the next year, and then compare it against the actual results. Prediction is a similar, but more general term. Forecasting might refer to specific formal statistical methods employing time series, cross-sectional or longitudinal data, or alternatively to less formal judgmental methods or the process of prediction and resolution itself.

Usage can differ between areas of application: for example, in hydrology the terms "forecast" and "forecasting" are sometimes reserved for estimates of values at certain specific future times, while the term "prediction" is used for more general estimates, such as the number of times floods will occur over a long period.

Risk and uncertainty are central to forecasting and prediction; it is generally considered good practice to indicate the degree of uncertainty attaching to forecasts. In any case, the data must be up to date in order for the forecast to be as accurate as possible. In some cases the data used to predict the variable of interest is itself forecast.^[1]

IV. SUMMARY STATISTICS

The final step in reviewing the existing program is to consider summary statistics, both those that are currently computed as well as those that may be needed. Permanent count locations should be providing count data 24 hours

per day, 365 days per year; however, this continuous data stream is often summarized into a few basic summary statistics, like annual average daily traffic.

Because of the greater monthly variability of non-motorized traffic, other summary statistics may be more relevant:

- Seasonal average daily traffic (includes those months that contain at least 80 percent of the annual traffic) (seasonal average daily traffic (SADT) is a traffic statistic used by the National Park Service in recreational areas that have very high seasonal peaking (e.g., very high use in summer with low use in winter));
- Average daily traffic by month and day of week; and
- Peak hour volumes for peak seasons (i.e., different user types in summer and winter for shared use paths).

III. DETERMINE THE TRAFFIC PATTERNS TO BE MONITORED

After reviewing the existing non-motorized program (both what is being done and what is needed), Step 3 is to determine those traffic patterns that are to be monitored. Part of this determination will depend upon the functional road classes and bicyclist and pedestrian facilities of interest.

For example, do State DOTs want to collect pedestrian and bicyclist count data on local streets, shared use paths, and pedestrian facilities that are considered off-system (i.e., not included on the State highway system)? In some cases, State DOT funding has been used for non-motorized projects on local streets and shared use paths through the Transportation Enhancements (TE) or Congestion Mitigation and Air Quality (CMAQ) funding categories.

Once the non-motorized network to be monitored has been defined, one should determine the most likely types of traffic patterns that are expected on this network. In most cases, the non-motorized network will include facilities that have a mix of commute, recreational, and utilitarian trips. Depending upon the relative proportions of these different trip types, distinct traffic patterns will emerge. These patterns should be used in the Step 4 to establish seasonal pattern groups. The most common way to determine typical traffic pattern groups is through the visual analysis and charting of existing data. Continuous count data is preferred for this step, but short-duration counts (multiple full days, but not two-hour counts on a single day) may also be used with caution.

IV. ESTABLISH SEASONAL PATTERN GROUPS

In the previous step (Step 3), existing non-motorized data was used to determine the traffic patterns that are to be monitored. In Step 4, this information is used to establish

unique traffic pattern groups that will be used as the foundation for the monitoring program.

In some cases, non-motorized count data may not be available in Step 3 to determine the most likely traffic pattern groups. In these cases, previous analyses of non-motorized data from previous studies or of similar locations should be used as a starting point.

Once more non-motorized data is gathered in your region, these traffic pattern groups can be refined based on your local data.

Previous (but limited) research indicates that non-motorized traffic patterns can be classified into one of these three categories (each with their own unique time-of-day and DOW patterns):

- Commuter and work/school-based trips – typically have the highest peaks in the morning and evening;
- Recreation/utilitarian – may peak only once daily, or be evenly distributed throughout the day;
- Mixed trip purposes (both commuter and recreation/utilitarian) – has varying levels of these two different trip purposes, or may include other miscellaneous trip purposes.

For example, Figures 4-16, a-b-c shows typical traffic patterns for a permanent monitoring location that has a higher percentage of commuting-based trips:

- The time-of-day patterns (16a) show strong peaks during the morning and evening, with less traffic during mid-day.
- The DOW patterns (16b) show more traffic occurring during the weekdays than the weekends, and the pattern is consistent across all months.
- The month-of-year patterns (16c) show less variation throughout the year than Figures 4-14 and 4-15, regardless of season or climate.

V. DETERMINE APPROPRIATE NUMBER OF CONTINUOUS MONITORING LOCATIONS

Very little is known about spatiotemporal variation of non-motorized traffic, and what is known is very location-specific and difficult to generalize nationwide. In most cases (where no non-motorized counting currently exists), the number of count locations will be based on what is feasible given existing traffic monitoring budgets.

If equipment budgets are not constrained, then a rule of thumb is that about three to five continuous count locations should be installed for each distinct factor group (based on trip purpose and seasonality). The number of permanent count locations can be refined and/or increased as more data is collected on non-motorized traffic.

VI. INTRODUCTION OF ARTIFICIAL NEURAL NETWORKS

Artificial neural networks (ANNs), usually simply called **neural networks (NNs)**, are computing systems inspired by the biological neural networks that constitute animal brains.

Neural computing is an information processing paradigm, inspired by biological system, composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems. Artificial neural networks (ANNs), like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons. This is true of ANNs as well.

An ANN is based on a collection of connected units or nodes called artificial neurons, which loosely model the neurons in a biological brain. Each connection, like the synapses in a biological brain, can transmit a signal to other neurons. An artificial neuron receives a signal then processes it and can signal neurons connected to it. The "signal" at a connection is a real number, and the output of each neuron is computed by some non-linear function of the sum of its inputs. The connections are called *edges*. Neurons and edges typically have a *weight* that adjusts as learning proceeds.

The weight increases or decreases the strength of the signal at a connection. Neurons may have a threshold such that a signal is sent only if the aggregate signal crosses that threshold. Typically, neurons are aggregated into layers. Different layers may perform different transformations on their inputs. Signals travel from the first layer (the input layer), to the last layer (the output layer), possibly after traversing the layers multiple times.

VII. RESULT SIMULATION

1. Data Collection:

The results of applying these flags are shown below in table. For the bicycle user daily traffic counts, the most common errors are consecutive zeros followed by observations falling outside the rolling mean confidence boundary and then observations needing manual review and only four observations with an excessive value flag (greater than 2,500 daily bicycles).

A similar outcome is shown with for the pedestrian, user, and vehicle traffic with the greatest number of error flags being assigned to observations with excessive zeros following by the rolling mean and excessive values. For all of the nonmotorized traffic counts, about 75% had no errors detected and are considered usable. Of the 24% with

a detected error, 14% were due to the detection of consecutive zeros which is associated with known equipment failures.

The annualization process will be able to interpolate these missing data when, as is the case for most of the permanent count sites, sufficient data exists to estimate seasonal adjustment models using the SARM approach.

Table 1. Data Collection.

User Type	Error Code Type	Observations with Error	Total Observations	% of Daily Observations with Error Flag
Bicycle	Manual Error Check	130	10,605	1.00%
	Excessive Value	4	10,605	0.00%
	Rolling Mean	1,069	10,605	10.00%
	Consecutive Zeros	1,996	10,605	19.00%
	No Error	7,406	10,605	70.00%
Pedestrian	Manual Error Check	60	5,513	1.00%
	Excessive Value	201	5,513	4.00%
	Rolling Mean	395	5,513	7.00%
	Consecutive Zeros	646	5,513	12.00%
	No Error	4,211	5,513	76.00%
User	Manual Error Check	34	6,587	1.00%
	Excessive Value	261	6,587	4.00%
	Rolling Mean	420	6,587	6.00%
	Consecutive Zeros	556	6,587	8.00%
	No Error	5,316	6,587	81.00%
Vehicle	Manual Error Check	53	6,727	1.00%
	Rolling Mean	319	6,727	5.00%
	Consecutive Zeros	1,745	6,727	26.00%
	No Error	4,610	6,727	69.00%
Total Nonmotorized	Manual Error Check	224	22,705	1.00%
	Excessive Value	466	22,705	2.10%
	Rolling Mean	1,884	22,705	8.30%
	Consecutive Zeros	3,198	22,705	14.10%
	No Error	16,933	22,705	74.60%

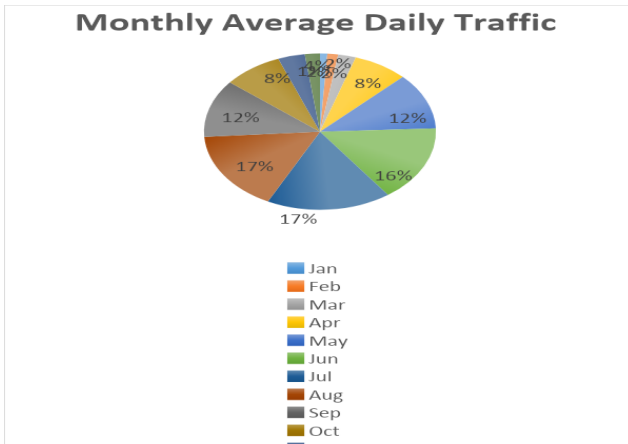


Fig 1. Monthly Average Daily Traffic.

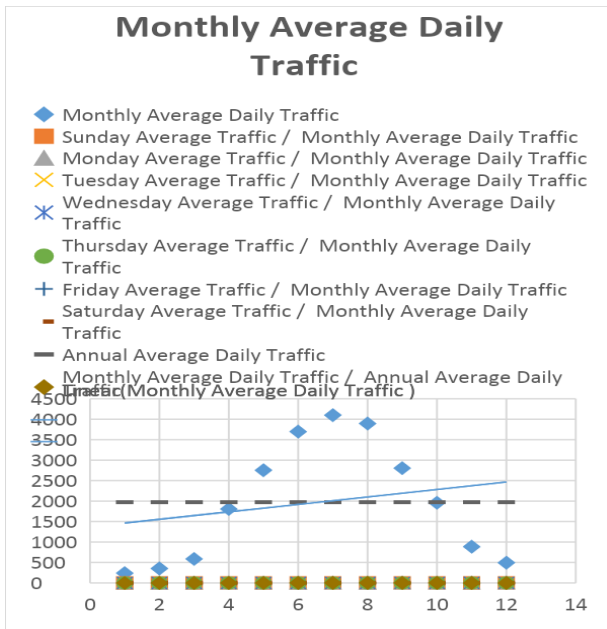


Fig 2. Average Model per day.

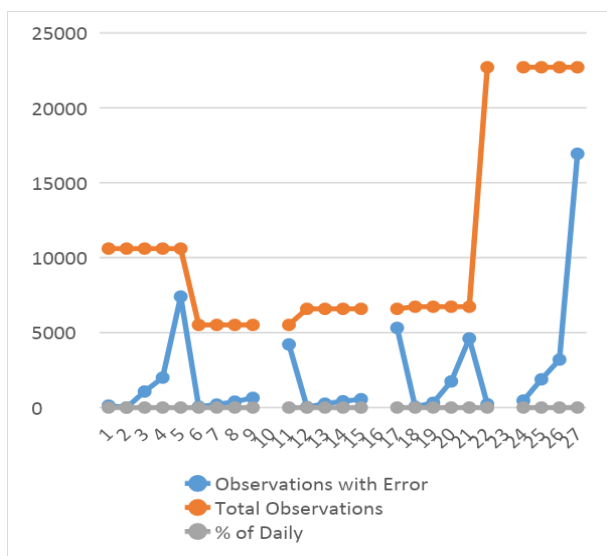


Fig 3. Error generation.

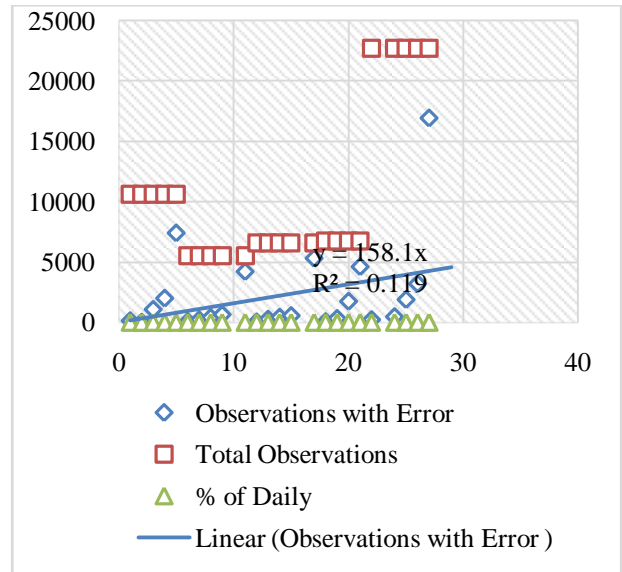


Fig 4. Average model-2.

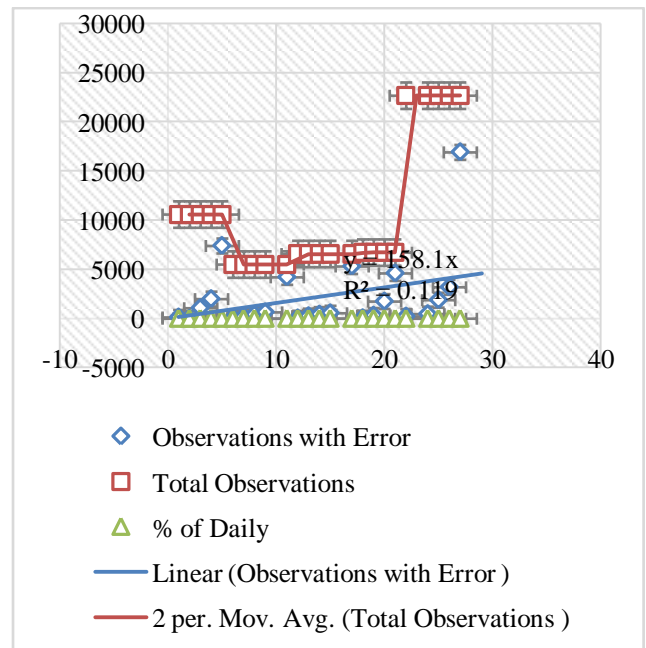


Fig 5. Error Model-2.

VIII. CONCLUSION

The use of sustainable non - motorized transport in Malaysia may elevate the environmental awareness in the country. However is not easy to implement due to the clogging up of central business districts with cars, and the recent economic crises. Sustainable transportation seems to mean that it is the right time now to implement non-motorized transportation as an integral part of the transportation system. The decision will also be an opportunity for the design and development of as well as motorized nonmotorized facilities including the layout of buildings and infrastructure.

Most INDIAN cities give priority on non-motorized vehicles on certain streets and intersections when

designing green phases at traffic lights. Some one-way streets have been transferred into two-way streets for non-motorized moreover non-motorized vehicles are exempted from many turn restrictions for cars. Some cities have dedicated car parking space to non-motorized lanes or non-motorized parking. In case of MP the same move can be done by upgrading the non-motorized facilities.

MP needs to focus on designing networks in neighborhood areas and focuses on linking with existing road infrastructure to improve non-motorized quality. These can be achieved by implementing model the of non-motorized transportation.

IX. FUTURE SCOPE

Pedestrian Operating Costs In deriving operating costs for walking the basic principle should be the same as that followed in the case of non-motorised traffic. Thus operating costs for non-commercial or owner-carrier pedestrian traffic will be determined energy costs (which in turn will vary by terrain and load), whilst on a commercial basis the operating costs will be determined by the wage rate of porters.

TRAVEL TIME Travel time impacts of the project on pedestrians and NMTs should be reflected in the appraisal. TRN 15: Valuation of Time Savings provides guidance regarding obtaining appropriate values for use in the economic assessment. In deriving estimates of travel time impacts it is important to consider the following two points.

REFERENCES

- [1] Weinert JX, Ma C, Yang X, Cherry CR. Electric Two-Wheelers in China: Effect on Travel Behavior, Mode Shift, and User Safety Perceptions in a Medium-Sized City. *Transp Res Rec.* 2007; 2038(1): 62–68. <http://doi.org/10.3141/2038-08> View Article Google Scholar
- [2] Pucher J, Buehler R, Seinen M. Bicycling renaissance in North America? An update and re-appraisal of cycling trends and policies. *Transp Res Part A Policy Pract.* 2011; 45(6): 451–475. <https://doi.org/10.1016/j.tra.2011.03.001> View Article Google Scholar
- [3] Li Z, Wang W, Shan X, Jin P, Lu J, Yang C. Analysis of bicycle passing events for LOS evaluation on physically separated bicycle roadways in China. *TRB 2010 Annual Meeting*; Washington D.C.2010. p. 1–16.
- [4] Jamson S, Chorlton K, Carsten O. Could Intelligent Speed Adaptation make overtaking unsafe? *Accid Anal Prev.* 2012; 48: 29–36. [pmid:22664665](https://pubmed.ncbi.nlm.nih.gov/22664665/) View Article Pub Med/NCBI Google Scholar
- [5] Asaithambi G, Shrivani G. Overtaking behaviour of vehicles on undivided roads in non-lane based mixed traffic conditions. *J Traffic Transp Eng.* 2017; 4(3): 252–261. <https://doi.org/10.1016/j.jtte.2017.05.004> View Article Google Scholar
- [6] Richter T, Ruhl S, Ortlepp J, Bakaba E. Prevention of Overtaking Accidents on Two-lane Rural Roads. *Transp Res Proc.* 2016; 14: 4140–4149. <https://doi.org/10.1016/j.trpro.2016.05.385> View Article Google Scholar
- [7] Liu Q, Sun J, Tian Y, Xiong L. Modeling and simulation of overtaking events by heterogeneous non-motorized vehicles on shared roadway segments. *Simul Model Pract Theory.* 2020; 103: 102072. <https://doi.org/10.1016/j.simpat.2020.102072> View Article Google Scholar
- [8] Khan SI, Raksuntorn W. Characteristics of Passing and Meeting Maneuvers on Exclusive Bicycle Paths. *Transp Res Rec.* 2001; 1776(1): 220–228. <https://doi.org/10.3141/1776-28> View Article Google Scholar
- [9] Barmounakis EN, Vlahogianni EI, Golias JC. Vision-based multivariate statistical modeling for powered two-wheelers maneuverability during overtaking in urban arterials. *Transp Lett.* 2016; 8(3): 167–176. <https://doi.org/10.1179/1942787515Y.0000000020> View Article Google Scholar
- [10] Guo Y, Sayed T, Zaki MH. Examining two-wheeler' overtaking behavior and lateral distance choices at a shared roadway facility. *J Transp Saf Secur.* 2019; 1–21. <https://doi.org/10.1080/19439962.2019.1571549> View Article Google Scholar
- [11] Zhao D, Wang W, Li C, Li Z, Fu P, Hu X. Modeling of Passing Events in Mixed Bicycle Traffic with Cellular Automata. *Transp Res Rec.* 2013; 2387(1): 26–34. <https://doi.org/10.3141/2387-04> View Article Google Scholar
- [12] Vlahogianni EI. Modeling duration of overtaking in two lane highways. *Transp Res Part F Traffic Psychol Behav.* 2013; 20: 135–146. <https://doi.org/10.1016/j.trf.2013.07.003> View Article Google Scholar
- [13] Bella F, Gulisano F. A hazard-based model of the motorcyclists' overtaking duration. *Accid Anal Prev.* 2020; 141: 105522. [pmid:32283329](https://pubmed.ncbi.nlm.nih.gov/32283329/) View Article Pub Med/NCBI Google Scholar
- [14] David G. Kleinbaum MK. *Survival Analysis: A Self-Learning Text.* New York: Springer; 2012.
- [15] Washington SP, Karlaftis MG, Mannering FL. *Statistical and Econometric Methods for Transportation Data Analysis*, 2nd edition. Boca Raton, Florida: Chapman & Hall/CRC; 2010.