

## Frequent Route Map For Transit Users In Klang Valley, Malaysia

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**Abstract.** Public transit has gained significant attention among Malaysian citizens for the past few years. The increase in the number of private vehicles on the road leads to massive traffic jam especially during peak hours, thus causing them to consider switching towards public transit. Our mission in Prasarana Malaysia Berhad is to ensure that people can get stress-free experience while using public transports. One of the elements that contribute towards stress-free experience is passenger information system. In this paper, an alternative method to channel transit information to passenger is proposed that is by using frequent route map (FRM). In FRM, the frequency schedule of public bus is presented graphically on the GIS. The lower the operation frequency, the thinner the route line on the map will be and vice versa. As a result, the frequency schedule-GIS combination has made it easier for viewer to both identify the service availability and frequency.

### Introduction

Frequent route map (FRM) basically is a combination of route map and operation frequency schedule. Every route under operation is marked with unique color/thickness to indicate specific public bus frequency. Each route also can be marked with unique marker to indicate other information such as fares, intersections and nearby facilities.

Different from modern approach to channel transit information towards passenger which using electronic means (websites, mobile applications and electronic display), FRM uses static schematic map since it offers a visual tool for communicating spatial concepts for a quicker and safer orientation task for residents and tourists of a city [1]. On service provider's side, FRM can be placed at any strategic location whether at train, bus stations or even inside mobile applications. Since it is a static data, FRM is easy to be updated should there is a change in route by simply adjust the route marker. It also can be made available either on static signage at bus stops or mobile applications. On transit user/passenger's side, FRM helps them to plan their journey effectively by simply remembering their bus route by repeatedly referring to them. They can simply tell the bus frequency at particular route by referring to route's colour and thickness. FRM also helps transit users to easily determine whether the service is available at their area (accessibility). Putting up bus stop's name and nearest points of interest (POI) along the route can add more interactive element inside the FRM. In terms of Ultimately, FRM offers stress-free experience towards transit users by reducing their waiting times and give options to hop on other modes of transport if there is no transit service available in their area.

In this article, the authors will observe the viability of FRM for transit information in public bus services around Klang Valley (Malaysia). In the subsequent section, some of the problems faced by transit users regarding transit maps will be highlighted. Next, the recent implementations of FRM from all over the world will be covered extensively. Finally, based on the benchmarking done, we will propose a FRM model using simple route as an example and starter.

## Problem Statement

**From transit users' perception.** From June 2014 until May 2014, RapidKL has received numerous feedbacks regarding transit destination and frequency. According to Customer Experience and Contact Centre Unit (CECU), out of 21,356 feedbacks received from customers, more than 80.7% feedbacks are related with public bus frequency and scheduling. From this amount, more than 93% of them are related with enquiries about frequency of the bus that pass by the nearest bus stop or residential area.

A clear and accurate transit route map has been demanded heavily by transit users to plan their journey effectively. The pilot survey around transit operators in Klang Valley shows that the bus route map placed either in mobile applications, bus stops or rail stations do not show enough information for transit users. Most of the existing route map shows the U-shaped map with stops location are put along the line. The main disadvantage of this kind of map is it is not geographically accurate. Transit users cannot visually locate the nearest stop inside the map. The route map provided also does not show transit frequency at the particular route, making transit users difficult to estimate the arrival of the desired bus at station. Instead, the information about bus frequency and time of arrival (TOA) is provided in separated medium such as transit operator website and mobile application like *Moovit* and Google Maps.

**From Transit Operator's Perception.** Providing a route map that includes service frequency is time consuming and probably costly. This is due to the map designers have to consider all 166 bus and three rail lines to be included into the map design. In addition, the map needs to be updated manually should there is any changes in transit routes (either route service addition or cancellation). Recently, the transit frequency has been broadcasted in form of spreadsheet table and placed in every bus stands and train station. However, the frequency table published is not fully followed by the service operators due to external factors like traffic jams or service disruption [2].

## Literature Review

**Types of Maps.** Over the last decade, PIS have evolved from standalone simple audio and visual displays to multimodal integrated systems that keep passengers informed, safe, and entertained all along their journey in public transit systems. Today's passenger information and security systems encompass multiple technologies, including advanced visual displays, public address, emergency intercom, digital surveillance system, IP networks, wireless networks, video streaming, coders, decoders and many more. These systems deliver real-time information seamlessly on-board vehicles in stations, while controlled and managed from single control centre [2].

Transit route map is one of the portions of PIS that deliver transit information to passengers. These maps indicate important topological information on transportation such as connectivity and stops. We need a database with transportation information of the city or region under consideration to generate schematic maps automatically [3]. Strip maps is another option used to represent transit route, however, strip maps gained less attention due to it focuses on map users' attention on an individual route which is presented as a sequence of features and decision points along the route [3]. Recently, geographical information systems (GIS) map has been fully utilized to map transit route and points of interest (POI) for transit users viewing. A study by Zainol *et al.* shows that one of the GIS-based map i.e. Google Map proved to be effective in providing spatial information to users, but limited to well-known places only [4]. Hochmair concludes that transit users often rely on static route map posted at public transit stations to plan their route compared to browser-based public transit route planners [5]. One of the features of transit route map is color-coded lines/routes. Generally, routes/lines in transit route map has been put into real world implementation by categorizing each of them according to destination and name of service provider as have been reviewed by [4] and [5]. The color-coded transit lines has been proved effective to led to greater trip

planning accuracy, less perceived difficulty, less frustration, and higher confidence while using public transit [6]. Guo [7] stated that the transit route map can be a “*cost-saving tool for increasing transit users’ perception on transit system if implemented appropriately.*” These arguments have led to the generation of transit route map for major cities around the world [8]. In Malaysia, color-coded transit route map has been widely applied to differentiate routes and terminals. There are three rail lines under supervision of *Rangkaian Pengangkutan Integrasi Deras* (RapidKL) Sdn. Bhd. namely Kelana Jaya line, Ampang line and Monorail line. The other rail lines including Keretapi Tanah Melayu (KTM) and Express Rail Link (ERL) [9].

**FRM.** Apart from classifying the transit routes according to service operators, recent development shows transit routes also can be classified according to their frequency.

Hochmair suggest that a transit map equipped with headway information increases map effectiveness for unfamiliar users compared to conventional schematic maps [4]. An article from MacKechnie suggests that to show the connectivity, routes which have least frequency (More than 15 minutes) will be not shown in the map. In other words, transit users will only see routes that operate more frequently throughout the day than the threshold. However, such method will cause bad image on public transport operator since politicians believe that their communities do not get fair share of public transit resources [10].

Recent studies on improving the transit route map is on classifying the routes according to transit frequency. FRM has been implemented in various states around the world such as Vancouver [11], Cincinnati [12], Portland, Minnesota, Los Angeles and Brisbane & Adelaide (Australia) [13].

In Malaysia, there is little known about the viability of FRM. Thus in this paper, the focus is given on introductory of the concept of FRM to suit public transit operation in Klang Valley.

## Methodology

As have been reviewed by [13], FRM in major cities across the world have been generated by using schematic maps. In this article, Google Map with application “My Places” is used to generate FRM. A layering method is used by drawing lines and stops along the selected routes on the map. For beginning, the FRM sample will cover the routes in Area 1 (From *Titiwangsa* to *Maluri*).

Different routes are differentiated by using different colors on the map. To distinguish the frequency, the route with higher service frequency will use thicker line and vice versa. Table 1 below shows the classification of route frequency according to line thickness scale.

TABLE 1 Thickness Scale Table for Reference

Service Frequency (minutes)	Thickness scale
10	10
15	8
20	5
30	2

As an alternative, the same service on the same road will be combined to form a single line, which its thickness depends on the combined frequency from respective route. For initial purpose, the analysis will use service frequency on peak hours i.e. from 7.00 am until 9.00 am. In addition to actual map on Google Map, the FRM also is drawn in a schematic form as an alternative. The service frequency data is obtained from the published table available at bus and rail stations. Two types of maps are generated i.e. actual map and schematic map for comparison purpose.

## Results & Discussions

Table 2 shows the service frequency schedule in conventional form, extracted from GTFS file for route U25, U33, B114 and B103 on weekdays from 7.00 am until 9.00 am:

TABLE 2 Bus headway schedule during peak hours in conventional table form

<i>Service Route</i>	<i>Service frequency (minute)</i>
U25	20
U33	30
B114	15
B103	20

The data from headway schedules in Table 2 are translated into graphical form in GIS as shown in Fig. 1 and Fig. 2.

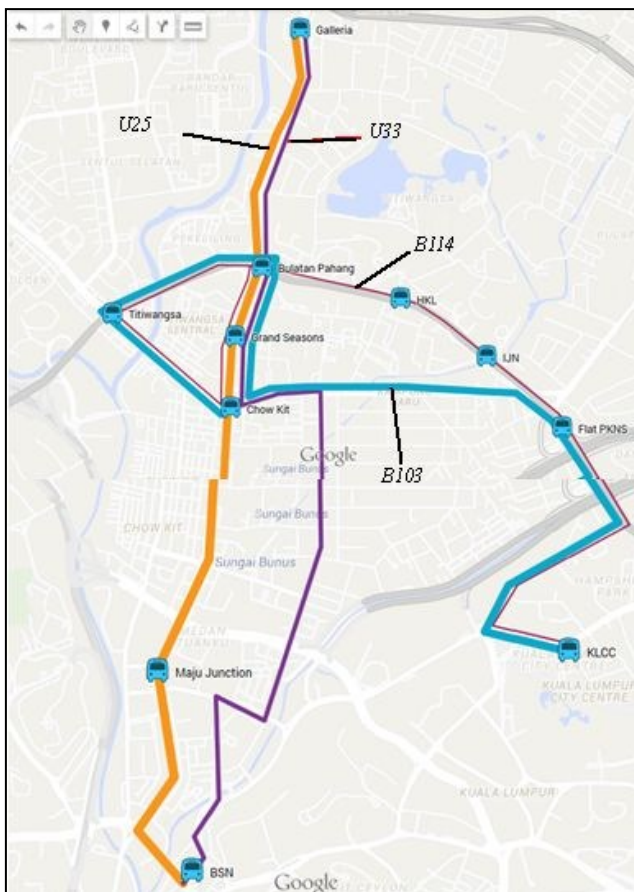


Figure 1 FRM For Routes In Peak Hours

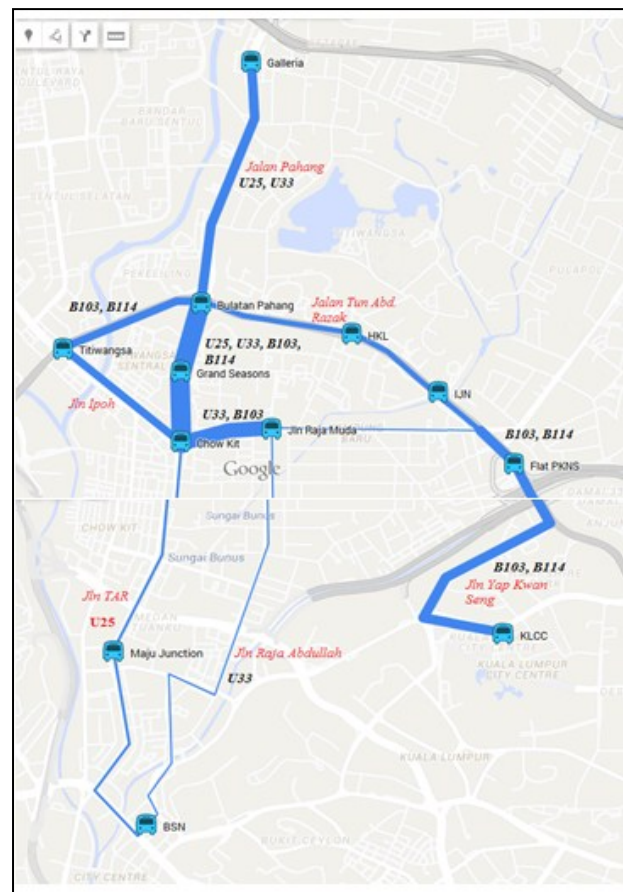


Figure 2 FRM when the route services on the same road are combined

From Fig. 1, it is observed that the service frequency of each route has been translated into graphical form on GIS map. It can be observed that the service frequency for each route can be easily distinguished by looking at the thickness of the line. The thicker the line, the more frequent the service, thus passengers will have to wait shorter time at that road. The types of routes are differentiated by using different color on the line. At Fig. 1, between 7.00 am and 9.00 am, bus route U25 is less frequent compared to U33, B114 and B103. Transit users who intend to use U25 during this time period will have an option whether to keep waiting or choose another transit mode to get to destination. Fig. 2 shows the FRM in alternative form. In Fig. 2, roads that have overlapping

services are combined, forming a single line. The thickness of the combined line still depends on how frequent the service at that area. However, the service frequency on the combined line is a result of addition of service frequency from each service. For example, at between Bulatan Pahang and Chow Kit, there are four buses with different routes are serving there namely U25, U33, B103 and B114. The arrival time from each bus is overlapped, thus yielding seven minutes headway regardless which bus is arriving. From Fig. 1 and Fig. 2 also, it can be observed that some destinations on the map can be reached by taking any bus. For example if passenger wishes to go to Bulatan Pahang from Galleria, he can either use bus U25 or U33. The thicker the combined line, the more frequent the service will be, regardless of bus number.

Apart from service frequency, FRM also indirectly shows service availability around. Transit users can then know whether there is a bus service available nearby their current location.

Ultimately, the FRM can be produced either in printed format and placed at strategic locations at bus stops or LRT stations. The map also can be made available in mobile applications or operator's website. It is easy to be updated should there is any change in route or service frequency.

## Conclusion

The frequent route map has a huge potential to boost transit users' riding experience. It serves two purposes i.e. to show the service frequency in the form of route thickness and to show the connectivity of places nearby public bus routes. The proposed FRM will serve as a starting point for future improvement either in terms of information accuracy or graphical representation.

## References

- [1] S. Avelar and L. Hurni, "On the Design of Schematic Transport Maps," *The International Journal for Geographic Information and Geovisualization*, vol. 41, no. 3, pp. 217-228, Sep. 2006.
- [2] A. A. Abdullah and R. M. Talip, "Rapidkl Bus Service in City Center , Kuala Lumpur , Malaysia : An Epitome of Good Service ?," *International Journal Of Academic Research In Business And Social Studies*, vol. 3, no. 4, pp. 333-349, 2013.
- [3] A. M. MacEachren, *How Maps Work: Representation, Visualization, and Design*. Guilford Press, 2004, p. 513.
- [4] H. Hochmair, "The Influence of Map Design on Route Choice from Public Transportation Maps in Urban Areas," *The Cartographic Journal*, vol. 46, no. 3, pp. 242-256, Aug. 2009.
- [5] H. Md Isa, S. M. S. Ismail, and N. A. Ahmad Tajedi, "Passenger Information Systems For Public Transport In Klang Valley, An Overview," in *Malaysian Universities Transport Research Forum Conference*, 2013, vol. 2013.
- [6] H. C. Garland, J. J. Haynes, and G. C. Grubb, "Transit Map Color Coding and Street Detail Effects on Trip Planning Performance.," *Environment & Behaviour*, vol. 11, no. 2, pp. 162-184, 1979.
- [7] Z. Guo, "Mind the Map! The Impact of Transit Maps on Travel Decisions in Public Transit," *Transportation Research Part a-Policy and Practice*, vol. 2011, no. 45, pp. 1-25, 2011.
- [8] J. Xie, "This Architect Has Painstakingly Standardized the World's Subway Maps," *CityLab*, 2014. [Online]. Available: <http://www.citylab.com/design/2014/04/architect-has-painstakingly-standardized-worlds-subway-maps/8843/>. [Accessed: 26-May-2014].
- [9] S. M. Suhaizan, A. A. Azlianor, K. Massila, A. M. H. Lim, and A. Fauziah, "Destination-Oriented Route in Integrated LRT Web-Based System for Tourism," in *Proceedings Of The International Conference On Electrical Engineering And Informatics*, 2007, pp. 1098-1101.
- [10] C. MacKechnie, "Transit Network Map Design," *About.com*, 2014. [Online]. Available: [http://publictransport.about.com/od/Transit\\_As\\_Life/a/Transit-Network-Map-Design.htm](http://publictransport.about.com/od/Transit_As_Life/a/Transit-Network-Map-Design.htm). [Accessed: 27-May-2014].

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- [11] T. Link, "Metro Vancouver's Frequent Transit Network," 2014. [Online]. Available: <http://www.translink.ca/en/Plans-and-Projects/Frequent-Transit-Network.aspx>. [Accessed: 02-Apr-2014].
  - [12] J. Kessler, "Transit Guide Explains Cincinnati Bus Riding Basics," *UrbanCincy*, 2011. [Online]. Available: <http://www.urbancincy.com/2011/01/transit-guide-explains-cincinnati-bus-riding-basics/>. [Accessed: 03-Apr-2014].
  - [13] W. Jarrett, "How Flexible Should Bus Service Be? Frequent Networks As A Tool For Permanent Change," in *11th Conference On Competition And Ownership In Land Passenger Transport*, 2009, no. September, pp. 20-25.