An Assessment of the Public Necessity Concept for Estimating the Requirements for Public Transport Vehicles

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Abstract: The Philippines' Department of Transportation and Communications (DOTC) determines the number of public transport vehicles serving a particular route using a formula that is called Route Measured Capacity (RMC). This formula is based on the public necessity concept that was developed from Commonwealth Act 146 that is also known as the Public Service Act. This paper describes the development and application of this public necessity concept and the RMC formulas since the 1980s. Issues are also presented and discussed particularly in light of the concept and formula being assessed as no longer responsive to the current transport demand and the introduction of more advanced network approaches. In conclusion, this paper discusses the current use and future prospects for the formulas. This is in light of present efforts by the DOTC to come up with a network-based approach in determining the number of vehicles required to serve the estimated passenger demand.

Keywords: Public Transport, Route Measured Capacity, Public Necessity

1. INTRODUCTION

The number of public transport vehicles serving a particular route in the Philippines was determined using a formula that was developed by what is now the Road Transport Planning Division (RTPD) of the Department of Transportation and Communications (DOTC). This formula is based mainly on the passenger demand, seasonal factors, load factors, seating capacity and the number of round trips vehicles typically make during the day. The value derived from the formula is called Route Measured Capacity (RMC) and was applied to buses, jeepneys and UV Express vehicles, and for few instances even to tricycles. Once determined, the DOTC provided the number of public transport vehicles per route to the Land Transportation Franchising and Regulatory Board (LTFRB), which issues the franchises to operators.

The primary aim of this paper is to present the formulas used by the DOTC in determining the number of public transport vehicles that are supposed to serve particular routes given the estimated demand. The other objectives of this paper are the following:

- Review the basis used by the DOTC in determining the number of vehicles to serve particular routes in Philippine cities;
- Assess the Route Measured Capacity formula and its required inputs; and

- Discuss the future direction for the application of the RMC formula.

The reasons for assessing RMC are the following:

- Emergence of more scientific and technically advanced transport modeling programs;
- Reservations expressed by investors (i.e., transport operators or franchise holders) regarding the validity of the method; and
- Availability of updated and upgraded transport data for assessment of public transport routes.

2. PUBLIC NECESSITY CONCEPT

Prospective operators or companies for the provision of road public transport services are required to submit several documents to support their applications. Applicants or interested investors/ operators either individuals, companies or corporations proposing to operate public road transport services are required to prove that they are 1) Filipino citizen or Filipino dominated corporation, 2) financially capable to operate public transport services and 3) that there is public necessity. "Public Necessity" is to be proven during open court hearing for the franchise application by the Land Transportation Franchising and Regulatory Board (LTFRB) of the DOTC. This is in pursuance to and should be consistent to the pertinent provisions of the Public Service Act (Commonwealth Act No.146). From the time of the Board of Transportation (BOT), the precursor of the LTFRB, several processes to quantify "public necessity" were adopted. These are summarized hereunder. One of the requirements that should be proven in an open court hearing for a franchise application is "public necessity" for the service. From the time the Board of Transportation (BOT), the precursor of the LTFRB, was created and in pursuance to the pertinent provisions of the Public Service Act (Commonwealth Act No. 146), several processes to quantify "public necessity" were adopted.

2.1 Arbitrary Process

The applicant and the oppositions through their respective legal counsels argue in an open court hearing the merits of a franchise application. Witnesses are presented to prove the need for the service. This process, however, is bereft of technical basis.

2.2 BOT Regime

The "arbitrary process" continued to be adopted in resolving franchise applications until 1980. At the insistence of the Board, a BOT personnel is sent to the field to observe the state of public transport services. Since, during this period, the most used corridor was España Avenue in Manila, the personnel always conducted the observations along this road in front of the University of Santo Tomas. During the hearings, the personnel are called to stand as witnesses. Hence, the process remained arbitrary.

2.3 1981-Ministry of Transportation and Communication (MOTC)

In 1981 upon the creation of MOTC, moratorium on franchise applications was declared. Applications will only be accepted by the BOT upon presentation of an MOTC certificate or endorsement resolving that there is a need for additional services.

The Land Transport Planning Division (LTPD) of the MOTC, conducts field surveys to estimate the demand and supply of a given route. During this period the Route Measured

Capacity (RMC) method was conceptualized.

2.4 1981-LRT Line 1 operation

During this period the building of a transport database was completed through the Metro Manila Urban Transport Improvement Project (MMUTIP).

That study conducted a technical evaluation of the proposed LRT service along Taft and Rizal Avenues. It recommended the need to re structure the bus and public utility jeepney (PUJ) routes in these corridors to support the LRT operation.

Using the Public Transport Network, analyses of MMUTIP, the Bus and PUJ Rerouting Study along the LRT Line 1 and its Tributary Areas was done by MOTC. This sub project of the MMUTIP rationalized not only the Bus and PUJ routes along the LRT Line 1 but the whole of Metro Manila. The RMC concept was introduced at this point.

The result of that study was only implemented starting 1986 upon the creation of the Land Transportation and Franchising Regulatory Board (LTFRB).

2.5 LTFRB Regime

The route and demand/supply implemented in 1986 used the "network analyses method". Due, however, to increase in economic activities resulting from the more active economy of the country, several residential and commercial developments spouted not only in the cities of Manila and Quezon but several sub-urban centers were also developed. Naturally, demand for public transport services area expanded and the need increased exponentially.

At this period, the public transport network analyses of the Metro Manila trips done in 1984 is deemed not responsive anymore. Hence, route or line analyses of public transport services was designed and adopted by the Road Transport Planning Division (RTPD) of the DOTC in evaluating requests for RMC determination.

3. ROUTE MEASURED CAPACITY

3.1 Concept

The RMC concept was designed by the Road Transport Planning Division (RTPD) resulted to the hereunder presented formula. Route Measured Capacity (RMC) represents the "public necessity" requirements in the franchising procedure, it represents the number of services required in a given route therefore "in Bus or PUJ units", while in other countries it is represented as preferred "headway", it attempts to represent the demand in terms of unit(s) requirement.

RMC is an attempt to define the "seats required" of a given route. "Seat requirement" is a public transport analyses jargon widely adopted in the transport planning world. It represents the levels of service of a passenger service taking into consideration the trips generated and/or attracted by a certain route structure and proposing a certain level of operation while ensuring the viability of operation. All these analyses and inputs submit to market acceptability principles.

In the absence of an updated technical RMC formula, the formula devised by the RTPD remains in use today. This was, however, reviewed not only by consultants but by the Transport Training Center (TTC) now the National Center for Transportation Studies (NCTS) of the University of the Philippines. These reviews resulted in several improvements in the

formula including the preparation of technical inputs. The integrity of the RMC formula highly depends on the intention and integrity of the user.

3.2 Legal Basis

Memorandum Order No. 202 signed by Philippines President Corazon C. Aquino on November 24, 1988 under Section 1 stated: "public transportation in Metropolitan Manila shall be subject to among others the economic and practical needs of the area as defined by the Route Measured Capacity of the route".

Department Order No. 92-587 "Defining the Policy Framework on the Regulation of Transport Service" under paragraph eight says "the route measured capacity test or other similar tests of demand for vehicle/vessel fleet on any route shall be used only as a guide in weighing the merits of each franchise application and not as limit to the merits offered" and under paragraph nine "where there are limitations in facilities such as congested road space in urban areas, or at airports and ports, the use of demand management measures in conformity with market principles may be considered. Therefore, the RMC's were not fully implemented by LTFRB as it submits to the principle that RMC is a "guide."

3.3 Technical Basis

RMC refers to the desired level of service in number of bus units, jeepney units, or their combination and equivalent to "frequency" requirement in public transport analyses. In transport modelling, using transport models such as STRADA, it is the end result of several iterations of passenger demand, volume capacity ratio and vehicle operation characteristics proposed for the route. The public transport (PT) network analyses will result to the earlier mentioned "frequency" and the unit is expressed in terms of "in vehicle units per hour". In the case of the Philippines, since the authority issued to operate a public transport service is through franchising, per Commonwealth Act 146 it is granted on a per unit basis. Therefore, the "frequency" resulting from the PT network analyses has to be further analyzed and should be expressed in terms of "in vehicle units" either as bus units, jeepney units or their combinations. This conversion process adopts the RMC concept.

For Metro Manila, Regions 6, 7 and 8 comprehensive urban public transport services studies were conducted. A set of rationalized routes with their corresponding RMCs were authorized. However, to date these rationalized routes and RMCs were already updated using the formula presented in Section 3.4. For new residential, commercial and institutional developments, new developmental routes were authorized with developmental RMCs of fifteen (15) vehicle units.

3.4 RMC Formula and Inputs

The RMC formula is given as

$$RMC = \frac{PD \times SF}{UR \times VLF \times ASC \times NRT} \quad (1)$$

Where:

PD : Passenger Demand of a proposed route obtained from OD table (Network Analyses) or Passenger Load Check Survey (Route Analyses)

SF : Seasonality Factor (converts the daily passenger demand from the survey into annual average daily passengers - AADP); Data Source is the DPWH

NRT : Number of Round Trips (Average of Inputs by operator during survey) or determined using route length and average travel speed

ASC : Average Seating Capacity (Output from the occupancy Survey)

UR : Utilization Ratio

$$UR = \frac{units\ in\ operation}{actual\ \ fleet\ size} \tag{2}$$

VLF : Viable Load Factor

Alternatives for VLF computation:

$$\text{a.}\ VLF = \frac{C_a + l_a}{S_c \times f} \tag{3}$$

Where:
C_a = Average Cost/bus-km/day
l_a = Reasonable Profit/bus-km/day
S_c = Average Seating Capacity/bus
f = Fare/Seat-km

or

$$\text{b.}\ VLF = \frac{Gross\ Revenue}{f \times RL \times S_c} \tag{4}$$

$$Gross\ Revenue = Operating\ Expense + Net\ Income \tag{5}$$

$$Operating\ Expense = \frac{Average\ Vehicle\ Operating\ Cost}{Total\ Distance\ Travelled/Day} \tag{6}$$

Where:
C_a = Average Cost/bus-km/day
l_a = Reasonable Profit/bus-km/day
S_c = Average Seating Capacity/ Bus in Route
f = Fare/seat-km., based on LTFRB rates
RL = Route Length

Net Income and *Average Vehicle Operating Cost* are based on financial data submitted by the operators of public transport vehicles. For buses, *VLF* is computed based on operators' (i.e., bus companies) revenues while for jeepneys it is based on the driver's daily income. The

latter is applied because of the prevalent practice of jeepneys being rented or leased to the driver by owners on a daily basis.

NRT Computation:

$$NRT = \frac{Service\ Period}{TAT} \tag{7}$$

Where:
TAT = Turn Around Time

$$TAT = \frac{Route\ Length \times 2}{Average\ Travel\ Speed} + terminal\ waiting\ times \tag{8}$$

3.5 Data Collection for the RMC Formula

The estimation of travel demand and the need for new public transport services (e.g., buses, jeepneys, etc.) along particular routes necessitated the use of the RMC formula and the surveys required to substantiate it. The survey methods were established by the DOTC and the process used to be directly administered by the department through the Road Transportation Planning Division (RTPD).

The RTPD sent out personnel to undertake RMC surveys in the different regions with the cooperation of LTFRB, its field personnel, and the LGUs concerned. They used various methods of assessing local and regional travel frequency, passenger preferences, load factors, vehicle operating features, and estimates of the number of PUVs needed, and prepared reports and recommendations backed up by data tables, graphs, and brief narratives.

4. EXAMPLE OF APPLICATION OF THE RMC FORMULA

The RMC was first used in 1982 on the estimation of the number of jeepney units of public utility jeepney routes in Iloilo City in Panay Island in Central Philippines and in Olongapo City near the U.S. Subic Naval Base in Central Luzon. Later on, RMC was also tried on three-wheeler public transport (tricycles) operation in Tarlac City.

This section shows an example application of route measured capacity formula using a sample computation of an inter-city (provincial) bus route in Mindanao island based on a 1999 survey of the Road Transportation Planning Division of the DOTC.

4.1 Viable Load Factor (VLF) Computation

Using the formula (per kilometer) of VLF (Equation 3), the required data include average cost per bus-km per day, reasonable profit per bus-km per day, average seating capacity per bus and fare per seat-km. In order to obtain the average cost of bus operation normalized in terms of bus-km per day, data on operational characteristics are obtained from the survey of bus operators operating along the route, as shown in Table 1. The survey instrument requires the operators to submit their data in terms of expenses per bus unit per day. A challenge here is on how to allocate and account the costs to the respective routes if the bus operator is operating more than one route and type of service (e.g. air-conditioned or ordinary).

Table 1. Example computation of average cost per bus-km per day

Route: Davao City-Surigao City/Type of Service: Air-conditioned Route Length: 409 km/431 km											
	Fuel	Oil	Tires	Repair& Maintenance	Tax	Insurance	Admin. Cost	Salaries	Terminal	Others	Total
Bus Co. A	3.71	0.12	1.61	0.20	0.22	0.21	0.15	1.98	0.52	-	8.72
Bus Co. B	3.39	0.35	2.02	0.90	0.39	0.02	1.17	1.20	0.46	-	9.90
Average Vehicle Operating Cost, C_a (PhP/bus-km)											**9.31**

A passenger load check or occupancy count survey is conducted to estimate the average load factor of public transport vehicles operating in the route. It is usually conducted at strategic locations where the passengers who would be riding are expected to have destinations mostly at the terminal point of the route. The bus company, route, license plate number, number of passengers and seating capacity data are observed during the surveys. Table 2 shows the average seating capacity, average occupancy and average load factor by company and by type of service for the sample route (Davao City-Surigao City).

Table 3 shows the computation of the viable load factor for the Davao City-Surigao City route (air-conditioned) according to Equation 3. The average cost of bus operation came from the operators' survey (Table 1) while the average seating capacity per bus came from Table 2 from the passenger load check survey. A reasonable profit of 12% is assumed such that it is 1.12 of the average cost of bus operation per bus-km/day. The fare rate per kilometer of PhP0.489 per seat-km is obtained from the fare rates from the regulatory agency (Land Transportation Franchising and Regulatory Board). A resulting viable load factor of 0.34 for this route and type of service was estimated.

Table 2. Example computation for average load factor

Route: Davao City-Surigao City							
Bus Company	No. of Samples	Type of Service	Average Seat Capacity	Average No. of Passengers on board	Average Load Factor		
					By Co./ Type of Service	Per Bus Company	By Service Type (Samples)
Bus Co. B		Air-conditioned	-	-	--		Aircon (3)
	15	De Luxe	63.00	21.73	0.34	0.38	0.23
	3	Ordinary	62.00	37.33	0.60		
Bus Co. A	3	Air-conditioned	**61.00**	14.33	0.23		De Luxe (25)
	6	De Luxe	58.67	26.67	0.45	0.46	0.38
	14	Ordinary	58.86	30.73	0.52		
Bus Co. C		Air-conditioned	-	-	-		Ordinary (17)
	4	De Luxe	55.25	24.00	0.43	0.45	0.52
		Ordinary	57.00	27.00	0.47		

Table 3. Example computation of viable load factor (VLF)

Route: Davao City-Surigao City/Type of Service: Air-conditioned					
Route Length (km)	(2) C_a (PhP/bus-km)	(3) l_a (12% of C_a)	(4) S_c (seats/bus)	(5) f (PhP/seat-km)	(6) VLF [(2)+(3)]/[(4)×(5)]
409	9.31	1.12	61.00	0.489	0.34

4.2 Computation of RMC and Recommended Bus Unit Requirements

The RMC formula (Equation 1) would require the following inputs: passenger demand, seasonality factor (based on annual average daily traffic from the Department of Public Works and Highways traffic counts), utilization ratio, viable load factor, average seating capacity and number of round trips per day. Table 4 summarizes some of the input data.

Table 4. Actual passenger count, seasonality factor, number of round trips

Route: Davao City-Surigao City/Type of Service: Air-conditioned					
Route Length (km)	Actual Passenger Count (both directions)	Seasonality Factor (AADT) from DPWH	Viable Load Factor (VLF)	No. of Round Trips	Average Seating Capacity
409/431	1,107	1.155	0.34	0.50	61.00

The number of round trips is set to 0.5 indicating that a bus can only travel in one direction per day due to the length of the route.

The utilization ratio is estimated as the number of units currently in operation divided by the actual fleet size as per franchise records:

$$UR = \frac{units\ in\ operation}{actual\ fleet\ size} = \frac{49}{70} = 0.70 \tag{9}$$

The total passenger demand (1,107 passengers per day) is further multiplied by 0.48 in order to allocate for the directional passenger demand. Based on the passenger preference survey of services, the value of 0.23 was further multiplied to the directional passenger demand to reflect the share of passengers using the air-conditioned type of service of the route.

The route measured capacity (RMC) is then estimated to be:

$$RMC = \frac{1{,}107 \times 0.48 \times 0.23 \times 1.155}{0.70 \times 0.34 \times 61.00 \times 0.50} = 19\ units\ per\ day \tag{10}$$

Table 5 shows the actual fleet size based on franchising records of the regulatory agency, which is the LTFRB and the bus unit requirements based on the RMC formula. The table indicates that for the bus route, there are 70 bus units as per franchise records including all types of services. It can also be seen that the computed RMC of 19 air-conditioned bus units is added to the 60 ordinary/de luxe bus units totaling to 79 bus units for the route. The decision therefore is that there are still 9 bus units that can be opened for application for franchise combining both air-conditioned and de luxe/ordinary bus units.

Table 5. Actual fleet size and recommended bus unit requirements

Route: Davao City-Surigao City				
Fleet Size		Bus Unit Requirements		Remarks (Additional Units)
Existing Based on Franchise Records	Actual Existing Operating Units	Air-conditioned	De Luxe/Ordinary	
70	49	19	60	May be opened for application (9 units)

5. ASSESSMENT

In 1999, a series of surveys were conducted across the country to assess the validity of the moratorium imposed on franchise applications. The assessment process involved the estimation of the number of units of public transport vehicles required to serve specific routes. Along the way, surveys determined the existence of illegally operating transport (i.e., operating illegally because they did not have franchises).

Surveys revealed demand and supply gaps for some routes, and these were used to update RMCs in the provinces. In Metro Cebu, for example, the RMC or number of franchised public transport vehicles was designed together with the rationalization of routes in 1990s. These had to be updated in order to address the increase in passenger demand by 1999 (DOTC, 1999).

RMCs were also updated for some bus routes and AUV service routes in Davao City (DOTC, 1999). Again, this was done in order to address the increase in the passenger demand as the city continued to grow rapidly and many new areas are developed.

For Metro Manila, RMC values were updated for selected routes until August 2010. These routes are mostly jeepney routes that have been modified due to traffic management schemes in Metro Manila as well as those affected by the operations of the LRT lines (i.e., LRT Lines 1 and 2).

Meanwhile, failures were discovered in the RMC formula. Among these flaws determined from the surveys and their outcomes are the following:

- Route analyses done by DOTC uses passenger demand resulting from surveys conducted. The veracity of the survey maybe questionable.
- The variables inputted in the RMC formula are sometimes provided by investors (i.e., public transport operators) and therefore can be self-serving. It is not easy to validate the data submitted in such cases.
- The integrity of using RMC highly depends on the integrity of the user and the inputs. It is best that electronic data processing be adopted.

The RMC formulas continued to be employed for the determination of the number of public transport vehicles to be approved for developmental routes. These are new routes serving newly developed areas such as residential subdivisions or industrial parks where there are also new roads and therefore no public transport services. Such developmental routes were the exception to the moratorium imposed on additional public transport vehicles for existing routes. The RMC for a new or developmental route is generally assumed to be fifteen (15) vehicle units, based on iterations assuming an average passenger trip length of seven (7) kilometers for buses, five (5) kilometers for jeepneys, and a desired headway assumed to be 15 minutes.

6. CONCLUSION

The following conclusions are drawn from the experience pertaining to the use of the RMC concept and formulas:

a. The integrity of RMC concept highly depends on the integrity of the user and the data inputted. Calculations are affected by the assumptions made by the person doing the RMC computations. Many of these assumptions have not been documented thus making published RMC values untraceable with respect to the formulas. These include assumptions for the viable load factor, the estimation of ridership and the number of round trips.
b. The RMC was treated by LTFRB more as a guide in franchising. Therefore, its use was not fully implemented with variations in the manner by which the computed number of vehicles is used. This practice has been problematic for public transport in general because of the significant variations by which the number of public transport vehicles have been determined and approved. The observation is that in many instances, it seems that the approved number of vehicles is arbitrary rather than objective.
c. A moratorium on the issuance of RMC for existing routes was declared by DOTC since August 2010. However, until the present, the policy pertaining to the use of the RMC still remains enforced. That is, that RMC can only be used to validate the number of public transport vehicles along existing routes or to determine the number for developmental routes.
d. For network analysis, the RMC concept may still be applicable provided the passenger demand was based on the O/D data.

Few, if any, formal studies in the past until the recent studies on Mega Manila (DOTC, 2012) have mentioned or even attempted to present and explain the RMC formulas in this paper. The standing notion is that the RMC formulas are basically to be used as a guide only. This is, however, far from the truth as the formulas have been used in the past by both the DOTC and the LTFRB in determining the number of public transport vehicles along established and proposed routes moratorium notwithstanding. Many if not most of these applications of the RMC formulas use passenger demand estimated from field surveys, and do not necessarily employ OD data nor have they taken into consideration the overlapping of routes, which can be the case in many cities. There have also been many assumptions on case-to-case situations that have not been properly documented. These and other factors have led to a high variability as well as a rather arbitrary approach in the application of the formula and its outcomes (i.e., the number of vehicles required along specific routes).

The RMC formulas in themselves are based on quantifiable parameters and require reliable input data in order for the outcomes to be reasonable and meaningful. While there are calls for the abolition of the use of the formulas, it can be argued that these still represent a simpler and direct approach to determining the required number of vehicles for public transport routes. Perhaps a remedy for its misuse is to come up with specific guidelines including how to go about when assumptions need to be made on certain parameters such as the VLF and the demand. Perhaps, too, the use of the formulas can be limited to cases where there are minimal route overlaps like the case of rural or provincial routes. The use of the RMC formulas for urban areas needs to be assessed to address issues pertaining to overlapping. It can be used as a supplement to network-based approaches that the DOTC is currently working on that will be the main basis for public transport planning in the future.

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