Abstract: Traffic in developing countries is characterized by local elements that contribute to traffic problems. The solutions to these problems have required alternative approaches to ensure their effectiveness. The Metro Manila Development Authority has implemented several schemes to address traffic problems. An experimental approach was adopted, soliciting mixed reactions from the public. This paper examines the Unified Vehicular Volume Reduction Program, the Truck Ban and the U-turn Scheme. It presents quantitative assessment of the programs; evaluating their effectiveness in alleviating congestion in Metro Manila. The paper discusses their applicability and transferability in other cities experiencing similar transport and traffic problems.

Key Words: alternative solutions, traffic problems

1. INTRODUCTION

1.1 Background

Metro Manila in the Philippines has a total land area of 636 square kilometers with a population of about 12 million. It is comprised of 15 cities and municipalities including the capital city of Manila. Collectively called the National Capital Region, it experiences continued growth, accounting for about 43.5% of the country’s GDP as of the year 2000. The combined population and economic growth of Metro Manila
has influenced adjacent towns in provinces surrounding the region. As such, there has been recent reference to the expansion as Mega Manila.

Like most other metropolitan areas, Metro Manila has its share of transport and traffic problems. These include traffic congestion and its by-products, such as pollution. These problems are linked primarily to economic development that has resulted in rising car ownerships. Note that Metro Manila accounts for about 35% of total vehicle registration for the Philippines.

In the late 1970’s, the government created the Metro Manila Authority (MMA) to manage various concerns of the cities and municipalities, including traffic management. Its successor, the Metro Manila Development Authority (MMDA) has been granted additional powers and the mandate to provide solutions to worsening traffic problems. As such, the MMDA has pursued the development of innovative schemes to alleviate or mitigate traffic problems. Among the schemes currently implemented are the Unified Vehicular Volume Reduction Program (UVVRP), the Truck Ban, the U-turn Scheme, the Organized Bus Route (OBR), and the unpopular “Wet Rag” Scheme for pedestrians.

1.2 Objectives and Scope

The study had the following objectives:

a. First is to present and discuss selected transport and traffic schemes implemented in Metro Manila;

b. Second is to provide a quantitative assessment of the selected schemes; and

c. Last is to discuss the applicability and transferability of such schemes in other cities or towns experiencing similar transport and traffic problems.

This paper will focus on three schemes that have been perceived as the most effective in reducing traffic congestion in Metro Manila. These are the UVVRP, the Truck Ban and the U-turn Scheme.

2. TRAFFIC SCHEMES

2.1 TDM and TSM in Metro Manila

Traffic management refers to a wide range of measures and programs designed to improve traffic flow and enhance traffic environment without substantial capital investment that may include ROW acquisition. The necessity for traffic management stems from the significant imbalance between demand and supply in traffic that results in chronic congestion and its derivatives – environmental degradation and decline in traffic safety.

Measures formulated to address Metro Manila’s traffic problems are based on established, conventional travel demand management (TDM) and transport systems management (TSM) schemes. However, the schemes have been adapted to local conditions and are still being modified to better address the requirements of Metro Manila travelers. The MMUTIS Technical Report No. 8 (1999) presents a comprehensive review of traffic management schemes implemented in Metro Manila.
from the 1970’s to the present. Among the schemes formulated and applied in various forms and extent are the following:

- Traffic signal control system (TEAM, SCATS)
- Flow management schemes (one-way systems, reversible lanes),
- Toll discounts (for the North and South Luzon Expressways),
- Bus management schemes (bus segregation, provincial bus restrictions, designated bus lanes), and
- Pedestrian-focused programs (overpasses, underpasses, discipline zones)

The UVVRP and the Truck Ban are TDM measures that have evolved since their introduction in 1995 and 1980, respectively. The U-turn Scheme is a TSM solution introduced in 2003 that was intended to promote uninterrupted flow in Metro Manila by reducing delay incurred at intersections (i.e., through intersection closure). The following sections focus on and describe these schemes in detail.

2.2 UVVRP

The UVVRP or the “number coding” scheme, as it is commonly called, is a travel demand management measure that has evolved since its first implementation in 1995. The original intent was to use this measure to address congestion brought about in part by the many road and rail infrastructure projects being implemented throughout Metro Manila in the 1990’s. However, due to its perceived success in decreasing traffic along Metro Manila arterials, the scheme’s implementation was extended and even expanded to include public transport vehicles like buses, jeepneys and taxis.

The original programs involved only the main arterials of Metro Manila including its five circumferential and ten radial roads. These included the three expressways that connected the region to surrounding provinces in the north and south. All these are classified as national roads. The current program includes essentially all roads, with traffic enforcement units of cities and municipalities implementing the scheme for city and municipal roads. The MMDA enforces the scheme along most major roads.

The chronology of the development of UVVRP starts in 1995 when the MMDA Regulation No. 95-001 otherwise known as the “Odd-Even Scheme” was issued. The scheme bans private vehicles with less than three (3) occupants from plying restricted thoroughfares during AM and PM peak periods on particular days. Specifically, low occupancy private vehicles with license plates ending in odd numbers are banned on Tuesdays, Thursdays and Saturdays, while those with license plates ending in even numbers are banned on Mondays, Wednesdays and Fridays. Peak period is defined to be between 7:00 AM to 9:00 AM and 5:00 PM to 7:00 PM. The penalty was set at P 300 per offense. Exempted from this regulation are public transport vehicles, emergency vehicles, police and military vehicles, school buses, diplomatic vehicles and official media vehicles.

In 1996, the MMDA issued Regulation 96-004 otherwise known as the “Modified Odd-Even Scheme” in addition to the existing Odd-Even Scheme. The Modified Odd-Even scheme applied to public utility vehicles such as taxis, buses, public utility jeepneys, etc., which are banned from all streets of Metro Manila on particular days of the week from 9:00 AM to 5:00 PM based on the plate number ending of each vehicle, as follows: 1 and 2 on Mondays, 3 and 4 on Tuesdays, 5 and 6 on
Wednesdays, 7 and 8 on Thursdays, 9 and 0 on Fridays. This regulation took effect February 19, 1996 and covered all roads in Metropolitan Manila.

Also, in 1996 the Metro Manila Council, MMDA, adopted and promulgated MMDA Regulation 96-005 entitled the “Unified Vehicular Volume Reduction Program” regulating the operation of certain motor vehicles on all national, city and municipal roads in Metropolitan Manila and repealed MMDA Regulation Nos. 95-001 and 96-004. The UVVRP, commonly referred to as “color-coding”, was adopted from the previous “Odd-Even” scheme which was first implemented in December 1, 1995 by the MMDA together with the Philippine National Police. Under this scheme both public and private vehicles are banned for longer hours (i.e., between 7:00 AM and 7:00 PM). This regulation was first implemented last June 1, 1996 and is still in effect.

In early 2003, the MMDA temporarily suspended the UVVRP. The resulting mayhem, probably due to the abrupt reaction of car-users, forced the MMDA to restore the scheme. A variant of the scheme was later introduced with a window from 10:00 AM to 3:00 PM (i.e., the off-peak period within the day) when banned vehicles may travel. Not all cities and municipalities in Metro Manila, however, adopted the scheme due to its perceived detrimental effects on traffic in their respective areas. The prime central business districts of Makati and Mandaluyong prompted these cities to implement the UVVRP from 7:00 A.M. to 7:00 P.M. This created problems as many roads run through different cities and municipalities, especially the circumferential and radial roads. Thus, it is possible for a motorist to use his vehicle in a city adopting the off-peak period window and get apprehended in another city that enforced the UVVRP during the daytime.

### 2.3 Truck Ban

The truck ban is a scheme first applied in the late 1970’s to address the perception that freight vehicles are the main culprits in congesting Metro Manila roads. Trucks were prohibited from traveling along major arterials including the primary circumferential and radial road network for most of the day. Exemptions from the daytime ban were applied to roads in the vicinity of the port area where truck traffic was practically inevitable.

Figure 1 illustrates the coverage area of the truck ban. C1 to C5 refer to Metro Manila’s circumferential roads while R1 to R10 refer to the radial roads. These comprise the main arterials of the Metro Manila road network. Emphasis is given in the figure to the alternate truck routes (solid blue lines) and arterials along which the truck ban is strictly enforced (dashed red lines).

Table 1 summarizes the different versions of the truck ban being implemented in Metro Manila. Truck Ban 1 is enforced along EDSA, Metro Manila’s busiest arterial and often its most congested road. Designated as Circumferential Road 4 (C4) it has a 10- to 12-lane carriageway with a mass rapid transit line running along its median. Truck Ban 2 practically covers all other roads except sections of arterial roads that have been designated as truck routes.
The chronology of the truck ban scheme started in 1978. In recognition of the critical situation of traffic congestion in Metro Manila, the then Metropolitan Manila Authority (MMA) issued Ordinance No. 78-04, which prohibited cargo trucks, with gross vehicular weight (GVW) of more than 4,000 kilogram, from plying along eleven major thoroughfares in Metro Manila during peak traffic hours - from 6:00 A.M. to 9:00 A.M. and from 4:00 P.M. to 8:00 P.M., daily except on Saturdays, Sundays and holidays.

In 1990, the Department of Transportation and Communication (DOTC) issued Memorandum Circulars No. 90-367 and 90-375, changing truck ban hours to: between 7:00 A.M. and 10:00 A.M. on weekdays; 4:00 P.M. to 8:00 P.M. for Monday to Thursday; and from 4:00 P.M. to 9:00 P.M. on Fridays. In response to the appeal of the members and officers of the various truckers’ associations for an alternate route and a 2-hour reduction of truck ban, the MMA issued Ordinance No. 19, Series of 1991, amending MMC Ordinance No. 78-04. This issuance provided alternate routes to the truck ban routes and effected a 2-hour reduction of the truck ban period, thereby prohibiting trucks on the road from 7:00 A.M. to 9:00 A.M. and from 5:00 P.M. to 8:00 P.M.

In 1994 the MMA issued Ordinance No. 5, Series of 1994, further amending Ordinance No. 78-04 as amended by Ordinance No. 19 Series 1991. The Ordinance restricts trucks from traveling or passing along 10 major routes from 6:00 A.M. to 9:00 A.M. and from 5:00 P.M. to 9:00 P.M. daily, except on Saturdays, Sundays and holidays. The Ordinance also provided for an “all-day” truck ban along Metro Manila’s major arterial road, the Epifanio Delos Santos Avenue (EDSA), from 6:00 A.M. to 9:00 P.M. daily, except Saturdays, Sundays and holidays.

In 1996, the MMDA, in its desire to further reduce traffic congestion even on Saturdays, issued Regulation No. 96-008 amending MMA Ordinance No. 94-05, imposing truck ban from Monday to Saturday, except Sunday and holidays. An MMDA Regulation No. 99-002, amended Ordinance No. 5, Series of 1994, wherein the “gross capacity weight” was amended from 4,000 to 4,500 kilograms.

2.4 U-turn Scheme

The U-turn scheme primarily involved the use of median openings along busy arterials to approximate roundabout operations. It is actually comprised of two schemes: the “Big Rotunda Scheme” and the “Clearway Scheme.” The former involves the geometric improvements including the construction of median opening pairs and the closure of intersections using temporary barriers. The latter is considered a derivative of the rotunda scheme, in that uninterrupted flow was promoted along arterials, hence the use of the word “clearway”. The scheme was primarily envisioned to speed up traffic along Metro Manila’s clogged arterials.

The comprehensive application of the scheme resulted in the closure of many intersections and the suspension of traffic signal operations in favor of the system of median openings. Figure 2 illustrates the typical configuration of an intersection that was closed upon the implementation of the U-turn scheme. The set-up meant that the combined volumes of vehicles approaching an intersection would converge and in
effect be diverted into a single stream towards the U-turn. Four weaving sections were created as converging flows eventually diverge as a substantial volume turn at the median opening.

3. EVALUATION OF TRAFFIC SCHEMES

3.1 Analysis of UVVRP and Truck Ban

3.1.1 Scenario Building

The UVVRP and the Truck Ban are implemented at the same time and in the same area. As such, it is neither appropriate nor practical to assess these schemes individually, with the assumption that their application is mutually exclusive. Six scenarios were considered in the assessment of the programs. These include the following:

1) Scenario 1 – (base case) current conditions with UVVRP and truck ban but trucks are not exempted from the UVVRP;
2) Scenario 2 – with UVVRP and truck ban but trucks are exempted from the UVVRP;
3) Scenario 3 – with UVVRP but without truck ban and truck exemption from UVVRP;
4) Scenario 4 – with UVVRP and truck exemption but without truck ban;
5) Scenario 5 – without UVVRP and but with truck ban; and
6) Scenario 6 – without UVVRP and truck ban.

The assessment of scenarios involved the use of the updated traffic model for Metro Manila. The model was originally developed under the Metro Manila Urban Transportation Integration Study (MMUTIS, 1999) but did not incorporate transportation infrastructure constructed and completed after 1999. In particular, the model did not include 2 new mass transit lines, interchanges and geometric improvements (including road widening) completed until 2004. As such, updating of the input parameters and assumptions were first undertaken for the model before scenarios could be assessed using model runs. Calibration and validation of the model involved the use of recent traffic volume counts in Metro Manila as well as rail ridership information from the three operating transit lines.

3.1.2 Modeling assumptions

The zoning system from the MMUTIS study was utilized and is shown in Figure 3. The model uses a 181-zone system covering the entire Metro Manila as well as adjacent municipalities in the provinces of Rizal (to the east), Bulacan (north), Laguna (south) and Cavite (southwest). A total of 94 zones represent the administrative boundaries of Metro Manila while the rest correspond to external zones.

The link and node system used in the model was updated in 2005 (Vergel and Tiglao, 2005) from the original MMUTIS study and is shown in the Figure 4. Links represent national roads in the Metro Manila as well as major city roads. Nodes are the intersections of these links. Approximations of interchanges were incorporated in
the system. In particular, updates to the network include the following roads and rail transit lines:

- **Road Network**
  - Primary and Secondary Road Network
  - Expressway Network
    - North Luzon Expressway
    - South Luzon Expressway
    - Manila-Cavite Expressway
    - Metro Manila Skyway (Makati-Bicutan)

- **Rail-Based Mass Transit Lines**
  - LRT Line 1 (Monumento – Baclaran)
  - MRT Line 3 (Monumento – Taft Avenue)
  - LRT Line 2 (Santolan – Recto)

The procedure for modeling used by MMUTIS was adopted by this study. The modeling approach involves a 3-stage incremental traffic assignment process where public trips are loaded first on the network using a transit assignment procedure. Then, truck and private traffic were loaded in turn on the network using highway-type assignment. OD characteristics were also updated to incorporate developments since 1999 including changes in trip behavior due to the presence of new transit lines and improvements to road infrastructure.

Once the appropriate model inputs have been setup, the traffic assignment process is fairly straightforward except for the more tedious work of ascertaining the right model parameters for each scenario. The output of the traffic assignment procedures under each scenario are finally processed in order to evaluate and assess the performance of the network, as well as, establish the various cost implications employed as performance indicators. Calibration and validation of outputs for the base scenario utilized recent traffic volume data throughout Metro Manila and adjacent areas.

### 3.1.3 Performance indicators

Several parameters were employed as performance indicators for the evaluation of alternative scenarios to the present conditions. These include cost and traffic flow parameters. Cost variables include vehicle operating costs and time costs. Traffic flow parameters include volume to capacity ratio and speed.

The vehicle operating cost, or VOC, is a monetary measure for direct costs incurred during the usage or operation of the motor vehicle. The VOC varies according to various factors like vehicle type and age, speed, grade, traffic conditions and curvature. There are three components of the VOC, namely:

a) **Distance Dependent Operating Costs** – increase more or less directly with the distance driven; in other words, the cost per vehicle-kilometer is relatively constant (e.g. fuel, ties, oil, maintenance and repairs, and that portion of depreciation attributable to wearing out);

b) **Speed Dependent Operating Costs** – some operating costs that are distance-dependent as influenced by speed; and
c) Time Dependent Costs – vary with time and are constant over a given period such as one year, or as stated in costs per vehicle-kilometer, vary with the number of kilometer driven annually; for example, driver’s license and registration fees, garage rent, insurance, and obsolescence.

In 1996, the Metro Manila Urban Transportation Integration Study (MMUTIS) was able to establish vehicle operating costs for road-based public and private transport. These were used in the assessment of various scenarios for the development of a transportation master plan for the region.

MMUTIS found that the Department of Public Works and Highways (DPWH) assumed that the working (business) time is valued at the full rate plus employers’ on costs, and commuting time is valued at 50% of the wage rate. However, the value of leisure time was not considered by DPWH in determining cost savings. There is some local evidence on willingness to pay for transport improvements, but it is either corridor-specific, choice-specific, or based on a ‘stated intention’ survey, and is therefore inappropriate for use in a Metro Manila-wide, multi-modal context.

Since there is no generalized local evidence available, the assumption used in the revised model is that all non-work time (commuting and leisure) is valued at 50% of working time. The local evidence indicates that this seemingly high proportion of work time value assumed for leisure and commuting time is not warranted in the Manila context.

The principal source of value of time for different traveler types is the MMUTIS Household Interview Survey conducted in 1996. The table below presents the value of time in peso per hour for different traveler types. A trip is also specifically characterized as a business or a non-work trip. It was also reported by MMUTIS that the value of time is P432.39/vehicle-hour for public transport and P60.42/vehicle-hour for private transport.

Volume to capacity ratio (VCR) and speed were also considered as performance indicators in the evaluation of scenarios. Both parameters are used as measures of effectiveness for assessment of level of service (LOS) of road facilities. These parameters refer to the volume, capacity and the travel speeds of links included in the model. Higher VCR values indicate a trend towards congestion and correspond to lower link travel speeds, and vice versa.

3.1.4 Assessment of the UVVRP and truck ban scheme

The traffic assignment procedure produced link-level outputs, namely traffic volume (in passenger car units or PCU), link speeds, volume-to-capacity (VCR) ratios and trip lengths in terms of PCU-km and PCU-hour. The link-level results can be aggregated to the level of traffic zones or the entire study area that can be evaluated as performance indicators to establish the overall impact of combinations of traffic restrictions. Thus, the average VCR and speed values are overall weighted values derived from all links in the model.
Modeling results generally indicate that only Scenario 3 is better than the base scenario. This assessment is clear from the figures in Table 2 where the average VCR decreased by 2.2% and the average speed increased by 1.1%. The values appear to be small but are significant considering that the values are consolidated VCR’s and speeds.

Tables 3 and 4 validate Scenario 3 as being a suitable consideration. Daily vehicle operating costs and time costs for this scenario are lower than the base case. The lower costs are consistent for all three vehicle categories – public, private and truck.

The differences between the alternative scenarios and the base case were also computed and are shown as savings in Tables 5 and 6. Values only emphasize Scenario 3 to be better than the current condition. Thus, results point strongly to the irrelevance of the truck ban. On the other hand, the same results confirm that UVVRP is still very much relevant and that the program should cover trucks.

Removing the UVVRP while maintaining the truck ban (Scenario 5) may lead to more congestion as indicated by an 8.8% increase in the average VCR and a 6.7% decrease in average speed. Repealing both UVVRP and truck ban (Scenario 6) is a slight improvement over Scenario 5 since it is expected that without the truck ban, truck traffic will naturally circulate throughout the network, finding alternate routes should they encounter congestion. Needless to say, cost implications do not favor these scenarios.

### 3.2 Analysis of U-turn Scheme

#### 3.2.1 Capacity and conflicts

Closing an intersection under the big rotunda or u-turn scheme results in the re-direction of some traffic streams into the associated u-turn slot. If the combined traffic volume exceeds the section capacity, the level of service will deteriorate as a bottleneck develops. In this situation, the capacity of the U-turn slot may be the controlling capacity at the road section approaching the section where the median opening is located. Moreover, this approach section also becomes a weaving section, which may result in the further reduction of the road’s capacity.

The capacity of U-turn slots under the scheme has been estimated (NCTSFI, 2004). Wider arterials yield values as high as 1,310 vehicles per hour while narrower thoroughfares have U-turn capacities of about 920 vehicles per hour. These values are influenced by both road and traffic characteristics, including the required turning radii of vehicles. Note that trucks, buses and even jeepneys (the predominant mode of public transport in the Philippines) need larger spaces for negotiating u-turns.

Capacity is also influenced by weaving activity in the vicinity of median openings. Current researches are looking into the weaving characteristics of sections including weaving speed and lane changing behavior.
3.2.2 Traffic safety

Safety is preferably studied using accident data, but unfortunately there has always been a problem of availability and reliability of accident data in Metro Manila. Traffic accident reporting is often deficient in that many accidents are not reported when the parties involved agree to a compromise settlement among themselves, without involving the public authorities or third parties. Often, this practice is even encouraged or facilitated by traffic enforcers themselves who do not want to assume the perceived burden of preparing an accident report. As such, accidents are generally underreported. A study conducted by the NCTSFI (2004) undertook interviews to assess perceptions on the U-turn scheme. Feedbacks and observations related to the implications of the U-turn program on the safety of road users are listed below:

- Occurrences of side swiping at the weaving sections while negotiating the U-turn;
- Increased propensity of lane changing and swerving, with lane discipline, which is not necessarily a strong suit of Filipino drivers, further deteriorating as more and more drivers switch lanes more often than maintain their lanes;
- Aggressiveness and recklessness seem to have increased with drivers simply doing away with using left or right light signals when switching lanes;
- Barriers and facilities placed at the U-turn slot are observed to have numerous hit marks indicating frequent collision with vehicles; and
- Pedestrians who are given the right-of-way to safely cross at formerly signal-controlled intersections now experience difficulty in finding safe acceptable gaps to cross the highway particularly at numerous places without elevated pedestrian crossing; the removal of islands at many intersections also deprived pedestrian temporary safe refuge from vehicles when crossing.

3.2.3 Travel speed

While it is possible to develop simulation models for U-turn schemes, a more practical approach is by way of before-and-after studies. It should be emphasized that this methodology can be employed only if data prior to implementation of a certain infrastructure or policy is actually available. As such, if traffic is deemed normalized after implementation (i.e., in certain cases this may take anywhere from a few weeks to a few months after implementation), data collection should be undertaken and before and after studies engaged.

Travel time and delay surveys using GPS and conventional methods confirm the claims of the MMDA that travel speeds increased with the implementation of the U-turn scheme along these corridors. This increase can be clearly seen from the improvements in travel and running speeds during the critical peak and off-peak periods. These results are shown in Figure 5 and 6, respectively.
The graphs in Figures 5 and 6 represent typical results of field surveys conducted along major Metro Manila arterials where the U-turn scheme has been implemented. The average travel speeds have significantly improved, thereby increasing the level of service along the corridors.

3.2.4 Assessment of the U-turn scheme

The U-turn scheme, by design and concept, will theoretically result in improved travel speed because the stopped delay normally encountered by drivers at signalized intersections is eliminated. Results of speed studies (NCSTFI, 2004) along selected thoroughfares where the scheme had been implemented showed improved travel speed along major through traffic. This favorable result attests that, to some extent, the MMDA is realizing its goal of better traffic flow in Metro Manila.

It could not be denied that many issues and concerns accompany the implementation of the scheme. Note that an increase in total vehicle-kilometers traveled, and the subsequent increase in total vehicle emissions and fuel consumption, may be additional impacts resulting from traffic diversion rather than by an improvement of the traffic situation.

The scheme is also perceived to create more vehicular conflicts compared to signalized control due to the proliferation of weaving in traffic. This translates into a higher accident potential for motorists. Currently, accident data related to the implementation of the U-turn scheme is still not reliable due primarily to under-reporting of incidents. However, any effective and fair evaluation of any traffic management scheme must include an objective assessment of the safety aspect and not be limited to indicators of traffic flow efficiency.

4. CONCLUSIONS

4.1 Summary of Findings

This paper examined three programs implemented in Metro Manila. It was able to present and discuss the UVVRP, the truck ban, and the U-turn scheme. A detailed quantitative evaluation of the selected schemes was also presented. The assessment showed that relevance and effectiveness of the UVVRP. The truck ban is shown as unnecessary in relation to the continued implementation of the UVVRP. Meanwhile, the U-turn scheme was assessed in terms of its capacity and safety implications. Lessons learned and recommendations derived from the discussions in this paper are presented in the subsequent sections.

4.2 Lessons Learned

Vehicle restraint programs such as the UVVRP will always be effectual if such are comprehensive and properly enforced. That is, the program must be strictly applied to private, public and goods vehicles alike. Exemptions are generally only given to emergency vehicles (e.g., ambulances, fire trucks and police cars) and other similar service vehicles (e.g., utility company vehicles).
The truck ban is only effective for roads with significant truck traffic. It may be effective as a short-term measure yet would be unnecessary should a more comprehensive scheme like UVVRP be implemented. In addition, the economic costs of restricting commodity flow are always a major consideration that needs to be balanced with any form of a truck ban scheme. Still, both TDM measures evaluated in this paper provide flexible and versatile options for managing congestion.

The U-turn scheme is an example of a program whose initial success was mistakenly interpreted as proof that it would be applicable, adaptable and eventually succeeds in other locations. The average peak period travel speed in Metro Manila in 1996 was 10 kilometers per hour. In 2001, the MMDA reported an improvement with average travel speeds reaching 15.1 kilometers per hour. After implementation of the U-turn scheme, it was reported (NCTSFI, 2004) that peak period travel speeds reached 23 kilometers per hour along major arterials. Thus, the improvement in travel speed was claimed as an affirmation of the effectiveness of the U-turn scheme on top of other programs that were already being implemented at the time.

In reality, a lot of other factors (e.g., road geometry and traffic characteristics) were disregarded or ignored. Thus, it is also good case of a measure limited by the infrastructure and situation in place. Successfully implemented along Metro Manila’s wide arterials, the deficiencies of the program were exposed when it was applied to other roads. Road section capacities along the locations of median openings were significantly reduced while more vehicular accidents resulted from increased weaving activity. The price of improved speeds along arterials has been an upsurge in pedestrian accidents. This happened because facilities like pedestrian overpasses that needed to be in place when intersections were closed were only provided as an afterthought.

Sadly, traffic signals along major thoroughfares were shut down to give way to U-turns because it was perceived that the system’s frequent breakdowns were to blame for chronic congestion. It was found (NCTSFI, 2005) that perceived flaws in both hardware and software that often lead to network congestion are really attributable to deficiencies in operations and maintenance of the system coupled with poor understanding of its capabilities. Note that it has been shown before that traffic signals were very effective in alleviating traffic congestion in Metro Manila (Regidor and Felias, 2003). As such, it would have been worthwhile and economical if the traffic signal system was given its fair chance of succeeding before the U-turn scheme was implemented.

4.3 Recommendations

The traffic schemes implemented in Metro Manila have met with various degrees of success. The assessments presented in this paper validated the effectiveness of these programs. However, the same evaluation has shown their limitations in so far as their applicability is concerned. As such, it is always important to remember that each measure should be designed mindful of the distinctive characteristics of a city. It is not necessarily true that the success of certain programs or measures can be replicated. Such must be seen as strategies that are meant to evolve as trip or traffic characteristics continuously change.
Like most TDM and TSM measures applied in other cities around the world, Metro Manila’s traffic schemes present examples of good and bad practices. The UVVRP is a scheme that is highly recommended for short, medium or even long-term implementation. This is primarily due to the flexibility of the program in terms of its execution that includes its adaptability to various situations. It presents a good example of a strategy that has evolved as transport infrastructure improvements are introduced while continued economic development influences changes in trip behaviors.

The truck ban’s exclusivity to freight vehicles makes its applicability somewhat limited to roads with significant truck traffic. Regular assessment of the traffic situation should always be carried out to monitor the effectiveness of the truck flow restrictions. At present, the truck ban on Metro Manila is undergoing review and there is a proposal to modify the scheme to accommodate high value commodities. Such flexibility is required rather than a general comprehensive restriction that will prove to be counter-productive in the context of economics.

TSM measures like the U-turn scheme can be quite effective in the short-term but with consequences in other aspects as a result of inadequate assessment of prerequisites before a measure can be implemented. The experience of having to undergo traffic experiments to determine the best possible configurations of median openings has been costly in terms of economic losses due to accidents and congestion. Moreover, the aftermath of constructing median openings and installing concrete barriers along avenues and boulevards have left ugly streetscapes in Metro Manila. These could have been avoided if authorities analyzed the possible outcomes of the scheme’s implementation via simulation or other tools or techniques available.

In the end, administrators should carefully weigh the advantages and disadvantages of programs formulated or adapted to specific areas or entire cities. Formulation, adoption or adaptation of schemes requires careful consideration of local conditions. Prerequisite elements should also be addressed even if there are cost implications (e.g., the need to construct overpasses or provide additional signs). After all, the key to effective program implementation is if it is able to address the principal concerns that necessitated its development in the first place.

References


Table 1. Details of present truck ban

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<tr>
<th>Truck Ban 1 (EDSA only)</th>
<th>6 AM to 9 PM everyday except Sundays and Holidays</th>
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<tr>
<td>Truck Ban 2 (10 major routes)</td>
<td>6 AM to 9 AM and 5 PM to 9 PM everyday except Sundays and Holiday</td>
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<td>Definition of Cargo Truck</td>
<td>“Cargo truck” as used in the ordinance refers to motor vehicles</td>
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<td>Violation and Penalty</td>
<td>Fine of not less than 500 pesos but not more than 2000 pesos or by imprisonment of not less than 7 days but not more than 30 days or both</td>
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Table 2. Comparison of modeled scenarios with base case

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<th>Scenario</th>
<th>Performance Indicators</th>
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Table 3. Daily Vehicle Operating Cost

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<tr>
<th>Scenario</th>
<th>VOC (in ₱ 1,000 pesos)</th>
<th>Public</th>
<th>Private</th>
<th>Truck</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>165,022</td>
<td>109,017</td>
<td>27,254</td>
<td>301,294</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>174,750</td>
<td>115,443</td>
<td>28,861</td>
<td>319,053</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>162,094</td>
<td>107,083</td>
<td>26,771</td>
<td>295,948</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>171,383</td>
<td>113,219</td>
<td>28,305</td>
<td>312,907</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>179,506</td>
<td>118,585</td>
<td>29,646</td>
<td>327,737</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>176,716</td>
<td>116,742</td>
<td>29,186</td>
<td>322,644</td>
<td></td>
</tr>
</tbody>
</table>

Public: ₱3.197/km; Private and Truck: ₱2.640/km
Table 4. Daily time cost

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Public</th>
<th>Private</th>
<th>Truck</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2,462,174</td>
<td>1,118,250</td>
<td>279,563</td>
<td>3,859,987</td>
</tr>
<tr>
<td>2</td>
<td>2,607,304</td>
<td>1,184,164</td>
<td>296,041</td>
<td>4,087,510</td>
</tr>
<tr>
<td>3</td>
<td>2,418,485</td>
<td>1,098,408</td>
<td>274,602</td>
<td>3,791,495</td>
</tr>
<tr>
<td>4</td>
<td>2,557,075</td>
<td>1,161,352</td>
<td>280,338</td>
<td>4,008,765</td>
</tr>
<tr>
<td>5</td>
<td>2,678,265</td>
<td>1,216,393</td>
<td>304,098</td>
<td>4,198,756</td>
</tr>
<tr>
<td>6</td>
<td>2,778,253</td>
<td>1,197,492</td>
<td>299,373</td>
<td>4,133,515</td>
</tr>
</tbody>
</table>

Public: $47.70/hr; Private and Truck: $27.08/hr

Table 5. Daily VOC savings with respect to base scenario

<table>
<thead>
<tr>
<th>Scenario</th>
<th>VOC (in $1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public</td>
</tr>
<tr>
<td>2</td>
<td>(9.727)</td>
</tr>
<tr>
<td>3</td>
<td>2.928</td>
</tr>
<tr>
<td>4</td>
<td>(8.361)</td>
</tr>
<tr>
<td>6</td>
<td>(11.694)</td>
</tr>
</tbody>
</table>
Table 6. Daily time cost savings with respect to base scenario

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Time Cost (in ₦ 1,000)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public</td>
<td>Private</td>
<td>Truck</td>
<td>Total</td>
</tr>
<tr>
<td>2</td>
<td>(145,130)</td>
<td>(65,914)</td>
<td>(16,478)</td>
<td>(227,522)</td>
</tr>
<tr>
<td>3</td>
<td>43,689</td>
<td>19,842</td>
<td>4,961</td>
<td>68,492</td>
</tr>
<tr>
<td>4</td>
<td>(94,901)</td>
<td>(43,101)</td>
<td>(10,775)</td>
<td>(148,778)</td>
</tr>
<tr>
<td>5</td>
<td>(216,091)</td>
<td>(98,142)</td>
<td>(24,536)</td>
<td>(338,768)</td>
</tr>
<tr>
<td>6</td>
<td>(174,476)</td>
<td>(79,242)</td>
<td>(19,810)</td>
<td>(273,528)</td>
</tr>
</tbody>
</table>

Captions for Figures:

Figure 1. Coverage of the truck ban scheme
Figure 2. Illustration of a typical intersection transformed under the U-turn scheme
Figure 3. Zoning system considered for scenario modeling and analysis
Figure 4. Link and node system considered for scenario modeling and analysis
Figure 5. Typical sectional travel speeds during the critical peak period
Figure 6. Typical sectional travel speeds during the off-peak period
Figure 5

Figure 6