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REVIEW

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DEMAND MANAGEMENT... AN ALTERNATIVE APPROACH TO RELIEVE TRAFFIC CONGESTION IN THE DEVELOPING COUNTRIES : ASIAN METROPOLISES CONTEXT

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INTRODUCTION

1. In a report on "Identification of Major Problems on Urban Transport in the ESCAP Region", published by ESCAP¹⁾ in 1990, one of the concluding remarks was...

"There were many problems which were common, to a greater or lesser degree to most of the cities."

These cities (Jakarta, Metro Manila, Islamabad, and Bangkok) exhibited extreme traffic congestions particularly during the peak periods brought about by high private cars usage, thus, frequent traffic congestion persisted outside the recognized peak periods.

2. Other than the mentioned congestion problems, this report also elaborated that several cities (Jakarta, Metro Manila, Bangkok) also have severe environmental pollution problems. These two serious problems will probably continue to haunt these developing countries' metropolises unless some drastic measures can be implemented.

3. While the world is now focusing on the environmental issue in particular the air pollution caused by the motorized transports, number of measures have been recommended to relieve this problem and one of which is to implement the mandatory usage of unleaded gasoline. However, this practice is only applicable in certain developed countries, many developing countries still cannot enforce their motorists to compulsorily use the lead free gasoline. One common excuse is that there are too many vehicles with engines still designed to use leaded gasoline.

4. Presuming that even the mandatory usage of leaded free gasoline can be implemented in every developing country but with the on going serious traffic congestions, air pollution generated from

the stand still engines particularly those poorly maintained vehicles, will continue to hamper the air quality in those metropolises. Moreover, implementing such policy on the compulsory usage of lead free gasoline means to solve only the tail end but not necessarily the root cause of the problem. On the other hand, if traffic congestion problems could be alleviated, then stand still engines which not only waste the energy but also contribute greatly to air pollution problems could be minimized if not totally eliminated. But how... how to solve the traffic congestion problems?

5. Perhaps, it would be more appropriate to inquire whether traffic problems can be solved in those developing countries' metropolises. Precisely, no one knows. After all, many developing countries still rely on the traditional approach of building more roads as their only alternative to solve their metropolises' traffic problems. This paper, on the other hand, attempts to propose another concept of alleviating traffic congestion problems through the already known but hardly implemented measure... the demand management. The suitable proposed demand management techniques will be highlighted together with the hindrances in implementing such techniques particularly in the Asian metropolises context. Moreover, certain feasible techniques will also be recommended in this paper.

DEMAND MANAGEMENT MEASURES

6. Actually, the concept of demand management is not new but it has been defined in different terminologies such as : *Road Demand Management (RDM)*, *Travel Demand Management (TDM)*, and *Transportation Demand Management (TDM)*. It is perhaps closely associated with the *Transportation*

Table 1 Transportation System Management, TSM Techniques

Approaches	Category	Technique	Methods that change demand to meet system capability			
			Reduce number of vehicles used	Reorient travel to off-peak hours	Reorient travel to alternate routes	Reduce total demand for travel
SOCIAL		Staggered Work Hours Shortened Work Weeks		×		×
ECONOMIC	Pricing and Regulatory Mechanisms	Road Pricing	×	×	×	×
		Parking Controls	×	×		×
	Restricting Access	Traffic cells Auto-Free Zones with Facilities for Pedestrians	×		×	
	Land Use Planning	New Towns Planned Neighborhoods Zoning and Building Codes	×			×
			×			×
Marketing	Incentives to Off-Peak Travel and Usage of Facilities Incentives to Mass Transit Usage	×	×			
Vehicle Occupancy	Carpooling and Other Forms of Ride Sharing Approaches	×				
SOCIO-TECHNICAL		Communication in Lieu of Travel				×
TECHNICAL	Traffic Engineering Techniques	Freeway Surveillance and Control Maximum Use of Existing Facilities			×	
	Transit Operations	Extended Area Services Priority Systems Expressways Priority Systems Arterials Circulation Systems	×			
			×		×	

Source : Reference 4

System Management (TSM), a term widely used in the United States and the *Traffic Management (TM)*, commonly used in the United Kingdom. In fact, many of the demand management actions were once referred to as *Transportation System Management* strategies, and had the same overall objective of trying to stretch the capacity of the existing transportation system, and avoid expensive new construction²⁾. Nonetheless, whichever title one may prefer, does not reflect its importance, but rather how one perceives the virtual concept of demand management.

7. Not only different titles are being used, various measures are also being recommended depending upon the individual's perspective. Some of the previous researchers' works are highlighted in this paper. Many of these recommended strategies are aimed to alleviate the traffic congestion problems through the improvement of management on vehicle demands. However, it must be noted that not all researchers admitted that demand management is a solution to traffic congestions. Grigg³⁾, for an example, stated in his

article that RDM is not the solution to congestion. On the contrary, Rosenbloom⁴⁾ proposed two basic solutions to alleviate the peak period traffic congestions: *change demand to meet system capability or change system capacity to meet demand*. The concept to change the demand to meet the road capacity has been categorized into four major alternatives:

- Reducing the number of vehicles used to meet the existing travel demand by increasing vehicle occupancy;
 - Reorienting travel to off-peak periods;
 - Reorienting travel to less congested alternative routes;
 - Reducing the total demand for travel itself;
- Utilizing these alternatives, Rosenbloom presented 22 techniques to reduce or redistribute demands. These techniques were classified under 4 major approaches, namely: social, socio-economic, socio-technical and technical as shown in **Table 1**.

8. Besides Rosenbloom, Flynn and Glazer⁵⁾ described the 7 TDM strategies used in ten U.S. cities. The approaches vary widely, ranging from

Table 2 Demand Management Measures

Strategy	Method	Technique
Improved Asset Utilization	Peak Spreading	Staggered hours Flexible hours Working week changes Fare or toll differentials Parking cost differentials Parking availability differentials
	Vehicle Occupancy	Ride sharing Van pools HOV lanes Parking priority Park and ride schemes
Physical Restraint	Area Limitation	Traffic cells Traffic mazes Area Licenses/permits Cordon collars
	Link Limitations	Access metering Signal timing Reduced capacity Public transport priority
	Parking Limitations	Parking space limits Parking access controls
Pricing	Road Pricing	Tolls Area entry fees/licensed
	Parking Prices	Short term priority policies Higher entry costs
	Taxes	Higher fuel taxes Parking taxes Higher ownership taxes
Urban and Social Changes	Urban Form	More compact cities Efficient urban development
	Social Attitude	Community information & awareness Community education
	Technical Change	Communication substitutes Transportation development

Source : Reference 6

an emphasis on voluntary participation in established area wide, ride sharing programs to strict requirements on developers and employers. These 7 distinct strategies were : *region wide ride share agencies ; developer requirements ; transportation fees ; incentive ordinances ; transportation management organizations ; employer ride share ordinances ; comprehensive TDM ordinances.*

9. The Federal Highway Administration²⁾ in their report "Evaluation of the Effectiveness of Travel Demand Management Programs" summarized three major TDM strategies as : *improved alternatives ; incentives and disincentives ; work hours management.* While Wayte⁹⁾ classified TDM measures into 4 groups covering 35 techniques as shown in **Table 2**. Wayte's four TDM classifications include : *improved asset utilization ; physical restraint ; pricing ; urban and social changes.* On the other hand, Tanaboriboon⁷⁾ classified 66 TDM techniques implemented in various countries/cities into 6 TDM strategies namely : *traffic constraints ; public transportation improvements/priorities ; peak-period dispersion ; ride sharing ; parking*

controls ; and land use control.

10. Lists of researchers' previous works on demand management can continue endlessly as this demand management concept becomes more and more significant in alleviating the traffic congestion problems. Nonetheless, it is not an intention of this paper to list all demand management techniques being implemented elsewhere, instead this paper intends to elaborate the need together with the hindrances in implementing demand management in the Asian Metropolises context.

THE NEED TO APPLY TDM MEASURES IN ASIAN METROPOLISES

11. Attempts to alleviate traffic congestions and bring order out of chaos in the Asian Metropolises, in the past and even now, are focused mainly on the traditional concept of building more roads which seems to be the only known solution. Many were concerned greatly on the movement of vehicles and placed much less emphasis on the movement of people. However, they must come to realize that for financial,

Table 3 Modal Share of Motorized Trips in Selected Asian Countries

Country/Area	Number of Motor Vehicles in '000s		
	1984	1986	1988
Hongkong (licensed)*	259	267	316
Japan	59 900	65 500	70 400
Republic of Korea	948	1 309	2 035
Indonesia	1 583	2 167	2 204
Malaysia*	3 947	4 461	4 783
Philippines	787	885	927
Thailand	799	2 040	2 450
Bangladesh	38	87	93
China	2 035	2 500	4 643
India	2 860	3 430	3 480
Nepal	26	32	36
Pakistan	596	795	590
Sri Lanka	215	229	254

Note : *Government data
 Source : UN/ESCAP, State of the Environment in Asia and the Pacific 1990, pp. 130, updated final version, 1992, Bangkok

Table 4 Asia's Car Population As Compared With Other Continents

Continents	People per Car		
	1970	1980	1990
Asia	517	290	121
Latin America	37	19	15
Western Europe	5	3	3
United States	2	2	2

Source : Asiaweek, February 1993

environmental, social and particularly political reasons, expansion and/or construction of the road networks may not be easily achieved. Worst still, the fast escalating number of vehicles have reached beyond the capacity of the existing infrastructure facilities causing not only the severe congestions and environmental problems but impair the economy of the country. The evidences of the fast escalation in vehicular demands in Asia are presented in **Tables 3** and **4**.

12. In theory, if road capacity cannot be increased then demand should be reduced, but in reality it may not be possible to simply reduce demands. On the other hand, if demands can be managed to best suit the limited capacity then traffic congestion problems can be minimized to certain extent, if not all. As such, they should put more emphasis towards the reduction of auto-

mobile trips especially in the highly congested areas. Improvement of the higher capacity transport modes, particularly the public transportation system together with certain restraint measures on the automobile usages are vital. In addition, they should also focus on the alternatives of giving higher priority to those transportation modes which use the road space more efficiently and effectively. To sum up, they must attempt to manage the demand to best suit within the limited facilities, i.e. the best utilization of the limited road space available. Thus, application of transportation demand management concept which seeks to make the best possible use of the roadway facilities for the safe and efficient movements of traffic are needed.

HINDRANCES IN IMPLEMENTING DEMAND MANAGEMENT MEASURES

13. Perhaps there is no single best solution to solve traffic problems nor to control the traffic demands. In fact, it may be more appropriate to inquire whether they can really control the traffic demands. Citing Singapore for an example, inspite of their tough and drastic measures of which no other Asian metropolises can even implement, still Singapore is experiencing growth in private automobile ownerships each year. Even with their unique measures like: *area licensing scheme, quota system, weekend car program, private car ownership restraint policies through various tax schemes, etc.*, number of vehicles are still increasing as shown in **Table 5**. When the fast growing economic development in any country takes place together with the more prosperous and higher standard of living of their citizens, escalation of automobile ownerships can be expected. Worst still, many Asian people tend to believe that owning an automobile is a social status. They drive not only for mobility needs but a status symbol as well. However, these facts do not imply that Asian metropolises should reconsider their policies in implementing demand management strategies. Instead, they must continue in attempting to implement such controversial techniques inspite of their past failures, as these may be one of the best unattended alternatives in alleviating their metropolises' chaotic traffic conditions. But..... what would be the appropriate demand management measures for the Asian metropolises to implement without any hindrance.

14. It is not an easy task to recommend any demand management technique without any resistance. In general, demand management can always become a very sensitive issue and may involve high political tensions. Oftentimes, there are more

Table 5 No. of Vehicles Registered in Singapore

End of Year	Total	Car*	Rental Cars	Taxis	Buses	Good Vehicles	Motorcycles & Scooters	Others
1982	440 276	179 635	4 515	10 283	7 585	94 632	136 899	6 727
1983	476 288	202 092	4 168	10 673	7 985	102 533	141 569	7 268
1984	491 322	217 119	4 159	11 062	8 283	108 631	134 693	7 375
1985	486 760	221 279	4 030	10 941	8 717	107 146	127 564	7 083
1986	473 659	220 566	3 314	10 677	8 638	103 429	120 387	6 648
1987	471 124	222 487	3 081	10 552	8 733	102 643	116 544	7 084
1988	491 808	237 801	3 140	10 473	8 924	106 843	117 570	7 057
1989	520 537	257 371	3 135	10 652	9 126	111 940	120 996	7 317
1990	542 352	271 174	3 343	12 239	9 448	115 536	122 525	8 087
1991	559 304	283 746	3 665	12 705	9 478	118 209	122 410	9 091
1992	557 584	285 500	3 879	13 445	9 658	119 335	116 532	9 235

Note : * Include private cars and company cars
Source : Yearbook of Statistics, Singapore, 1992

antagonists than supporters. Thus, the primary obstacle is how to overcome political pressures arising from such controversial demand management techniques. Many government are reluctant to implement even on trial basis due to the fear of strong public opposition. The often cited excuses are the intrusion of the citizens' privacy and the lack of democracy. Other than these excuses, many government also face similar resistance from charging the public in utilizing the road facilities. For years, number of Asian metropolises have been allowing their community to utilize the public facilities without any charge or even with some charges, they are very nominal which is almost negligible. Another great barrier to overcome especially if any demand management strategy through fiscal measures are going to be applied.

15. Oftentimes, many motorists misunderstand the actual concept of demand management and mistakenly conceive demand management as only to restrict the private automobiles. In a survey conducted in Bangkok⁸⁾ on the awareness of TDM, only 65% of the total commuters interviewed claimed that they know TDM not only as a means to restrict the private cars. Thus, there is a need to create proper public awareness on the significance of TDM. Commuters should not be misguided that TDM means only to restrict the rights to possess vehicles. As such, implementing TDM could lead to a less public resistance.

PROPOSED MEASURES FOR ASIAN METROPOLISES

16. It may be more appropriate to distinguish the needs to relieve traffic congestions and propose the possible demand management techniques

between developed and developing countries. In the developing countries, the urgency to control traffic demands are much more required than the developed countries. Ability to construct or expand the infrastructure facilities may not be easily attained due to the limited financial resources and other obligations needed, such as: improvement on social welfare, education, rural development and particularly the concentrated spending on national defense. In fact, as elaborated by ESCAP⁹⁾ that in the developed countries, the growth of population, traffic and technology took place over a much longer period of time in a more favorable economic, institutional and social conditions giving a much more conducive atmosphere for solutions. Furthermore, they are facing more difficulties in applying any demand management measures due to the government's great concern on its stability which may result from strong public resistance. Realizing these facts, it might be too ambiguous to recommend measures that may not be practical and easy to implement. Instead, only the feasible and attainable measures will be considered in this paper.

17. Although number of researchers firmly support the application of traffic restraints through road pricing schemes, it is not that simple task to accomplish this measure even among the developed countries themselves. As reported in the Netherlands and Sweden and other European cities that they have recently completed major feasibility studies into some form of road pricing, but they have postponed the implementation in light of adverse public reaction or avoiding further technological development⁹⁾. Perhaps at present no other metropolises in the Asian developing countries

could possibly implement the traffic restraints and restrictions measures as successful as Singapore. The Singapore's well known area licensing scheme, which is proved to be very successful both in reducing traffic congestions and generating extra revenues, will surely be difficult to introduce in other countries. Many government have been reluctant to embark on area licensing technique inspite of its clear advantage in dealing with traffic congestions and revenues generated. They all face the lack of strong will to withstand public opposition. The uncontrolled and mixed land use of residences and commercials in the central area of any metropolises is one of the reasons that could create strong public opposition particularly from residents residing within the premise. Moreover, strict law enforcement would definitely be needed to effectively implement such scheme. However, the common problem that usually surfaces in the developing countries is the insufficient numbers of policemen to enforce all regulations. One of the reasons that Singapore can successfully implement all their various demand management schemes is the strong and efficient enforcement, even that they still provide preventive measures for possible forgery and further impose a drastic penalty. As such, traffic restriction and traffic restraint measures may not be realized at present especially for those metropolises who have never been able to implement any controversial measure. Perhaps, it is more appropriate to inquire whether it is timely to implement the direct demand management such as traffic restraint/restriction measures in the Asian developing countries' metropolises or whether it is too premature to impose such techniques.

18. Attempts to solve any problem through the restrictive or prohibitive measures would definitely be the simplest tool, however, it would certainly draw resistance if no other alternatives being provided. Though on-street parking restriction is one of the proper measures to help alleviate the traffic congestion problem in any metropolis, alternative parking places especially the off-street parking facilities cannot be neglected and must be adequately provided to the local commuters. One undeniable fact is that number of Asian Metropolises tend to utilize their residences for other purposes such as : business outlets, restaurants, clinics, etc without any concern on the provision of parking spaces. This mixed land use practice is quite common in the Asian developing countries' metropolises. So how could one prevent the parking when business must be carried on especially when no alternative parking lots are available in the nearby vicinity? This reason coupled with the lack of strict law enforcement have so far hindered

the successful implementation of on-street parking restrictions in many metropolises. Unless they can provide alternative parking places, demand management through parking control techniques may not be a feasible solution yet.

19. Other than the mentioned demand management strategies, another approach is to influence the travel patterns of the motorists and this could be achieved through the land use control strategy. As Ogden¹⁰ expressed the significance of land use strategy as "to attempt to affect travel demand or behavior by looking only at the transport system is like trying to clap with one hand!". Effective land use planning and control can minimize the transport demands. For an example, demand for transport can be reduced through the relocation of major traffic generators away from the congested areas. However, in the developing countries, land use planning and actual implementation are two distinguished features. Planning can be easily fulfilled but implementing such plans seem almost impossible to achieve. In other words, land use control is still far from being effective. Moreover, most of the lands have already been developed. To emphasize any changes in the land use pattern within the metropolis as to affect the quantity and mode of travel are perhaps even much more difficult to undertake. In fact, these problems become more pronounced by quoting some of the World Bank reports on urban transport¹¹.

... "Land use control in developing countries generally has proved to be ineffective, however, and its implementation is beset by many serious difficulties. These include a lack of proper enforcement, wide and blatant disregard for regulations, and public opposition. Where some measure of control has been exercised, results often have been contrary to expectations. This is mainly because of the many complex factors involved with land use planning and the difficulties of adapting regulations to rapidly changing circumstances-- a feature of developing countries..."

20. Demand management measures especially those traffic restraint techniques will never be materialized without adequate public transportation system that can ensure sufficient public mobility needs. In spite of the fact that number of automobiles are fast escalating in many metropolises, public transportation system still remains as a major mode to cater the services for the needs of the communities especially in the developing countries. However, one common syndrome which has been faced by many metropolises is the lack of adequate and proper public transportation system. In most of the developing countries, their main public transportation mode, which is bus transit,

does not function to the expectation of the commuters. Overcrowded buses, poor and unreliable services, excessive waiting time, insufficient fleet size are commonly noticed in these metropolises¹²⁾. Oftentimes, they were forced to offer the services at an extremely low and unreasonable fare rate resulted to the inefficient and ineffective services. Consequently, they are facing the common problem of losing both passengers and revenues even though many people still rely on their services. Worst still, not many metropolises stress on the significance of bus priority despite the fact that bus can serve much larger demands than private vehicle. Reiterating the previous mentioned statement that they still place much less emphasis on how to move people.

21. It becomes crystal clear that there is an essential need to recommend measures to improve public transportation system in the Asian developing countries' metropolises. Improvement techniques should include all efforts made to make public transit more attractive than ever, so that modal shift from private vehicles to public transport could become a reality. Its purpose is to divert traffic demands from private automobiles to public transit and/or to prevent them from being diverted to automobiles. Moreover, improvement techniques should also include the provision of transit priority such as: transit preferential lanes, priority at signalized intersections, etc. In addition, improvements also emphasize on the more attractive fare structure and on transit station and terminal by facilitating a more convenient transferring between different modes.

22. All these recommended measures could perhaps be carried out immediately and may not require substantial investment. However, these definitely require the serious attention from each respective government. On the other hand, in order to move large quantity of commuters effectively in a short time, a rail based mass transit system is required. In fact, it would become extremely difficult for any metropolis with more than 5 million inhabitants to provide adequate mobility without a rail mass transit system. Nevertheless, provision of rail mass transit system requires tremendous investment and could easily be subjected to political intrusions. Serious considerations and strong will of the concerned authority must be exerted to overcome this hindrance. If all mass transit services can cater the needs of the public, to their expectations and perhaps with proper tactics and appropriate strategies, then the traffic restraints measures can even be introduced.

23. If one would accept the concept of moving people rather than moving vehicles as their

strategic policy to alleviate the severe traffic congestions in his/her metropolis, then this could possibly be best achieved through the movements of more efficient and higher capacity modes of not only public transportation system but also the high-occupancy vehicles or share ride of private automobiles. Ride sharing strategy could be formed in terms of the widely known car pooling and van pooling. This concept of car/van pooling is commonly practiced in many developed countries but is slowly being implemented in the Asian developing countries' metropolises like Jakarta and Kuala Lumpur. In Jakarta, since April 1992¹³⁾, motorists are required to pass several main thoroughfares with not less than three persons in their cars during the specified morning peak period of 6 : 30-10 : 00 hours. In Kuala Lumpur, from the beginning of 1994, specific roads in the city would be designated only for the high-occupancy vehicles¹⁴⁾. Besides the mandatory tactics being implemented in Jakarta and Kuala Lumpur, car pooling can also be promoted through incentives such as permission to use the priority lanes, designated parking spaces, etc. as generally practiced in the western countries.

24. Other than the commonly known concept of car/van pooling this paper highly recommends that provision of staff buses, which is similar to the van pooling concept, should also be considered. While most of the government agencies do have their vans or buses, these vehicles should be utilized to provide services to their employees. Provision of staff buses will not only help alleviate the insufficient capacity of road networks to some extent but could help lessen the common parking space problem in those offices. Moreover, this could enable the government to improve their image and gain public confidence in solving the serious urban congestion problem and could be a good indicator for private sectors to follow, thus, will further lessen the congestion problems.

25. One can never deny the fact that common problems being faced among developing countries is the lack of adequate budget to solve traffic problems. This financial constraint has led to the shortage of not only manpower but proper facilities as well. Besides, their traditional practice which is extremely difficult to overcome, is the free usage of public utilities. Citizens take for granted that it is the duty of the government to provide such free services. This not only causes less revenues generated but also encourages more usage of the facilities. Road usage as already mentioned are also victimized under this circumstance. Moreover, many developing countries are facing the same phenomenon that even though car price is expen-

Table 6 Cost Of One Liter Of Unleaded Gasoline

Name of City	Cost per 1 liter (US \$)
Jakarta	0.33
Bangkok	0.34
Kuala Lumpur	0.43
Sydney	0.61
Taipei	0.62
Singapore	0.71
Hongkong	1.06
Tokyo	1.12

Source : Asiaweek, July 1993

sive, possessing and maintaining are extremely cheap. Taking Thailand for an example, each year the car owner needs to pay the annual road tax equivalent to only 0.15% of the car price¹⁵⁾. Furthermore, as practiced in certain developing countries, revenues generated from transportation related taxes like highway, vehicle, or gasoline taxes are not necessarily allocated specifically for transportation related projects. Thus, it is highly recommended that certain fiscal measures especially those related to the possession of vehicles such as : high annual licensing fee, high price of gasoline, etc., should be implemented to discourage the usage of private automobiles. A country which effectively applied the vehicles usage restraint measure through high price of gasoline is Korea, where gasoline price was US\$ 4.50/gal in 1985¹⁶⁾. Nevertheless, high price of gasoline may affect the country's economy as price of commodities could possibly rise. As such, due consideration should be given regarding this side effect especially on the commercial vehicles. On the other hand, it is interesting to note that gasoline price in developing countries are generally lower than that of the developed countries as shown in **Table 6**. Yet, ironically traffic problems in developing countries' metropolises are much more pronounced compared to the developed countries.

26. In order to minimize public resistance to fiscal measures, they must be assured that extra revenues generated from these measures will be solely used for transportation related projects. Additional taxes collected must not be absorbed into the general governmental funds as commonly practiced, instead these extra taxes are to be utilized directly for the improvement of any related transportation projects. Therefore, motorists would be conscious of getting better value of their money, not just simply paying taxes.

CONCLUSION

27. Demand management had been mentioned and cited as one of the appropriate solutions to alleviate traffic congestions in the Asian Metropolises for decades. Although some may not truly understand the actual concept of demand management and were misguided that demand management means only to restrict the people's freedom to possess cars, many have realized the significant need of demand management in alleviating their chaotic traffic congestions. However, realization alone may not help in alleviating any problem. Until.... until they learn to distinguish between realization and implementation, demand management will probably remain just a theory, reinforcing a proven proverb that....

"demand management is easier said than practiced".

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