

# 11<sup>TH</sup> CONFERENCE ON COMPETITION AND OWNERSHIP IN LAND PASSENGER TRANSPORT

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## ***A MULTI-MODAL PUBLIC TRANSPORT SOLUTION FOR MALE, MALDIVES***

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### **ABSTRACT**

*Male, the island capital of the Maldives, an archipelago of over 1000 islands in the Indian Ocean faces chronic traffic congestion. This 2 sq km island is home to over 100,000 people. There is a taxi service comprising of around 450 vehicles and a dhoni (ferry) service amounting to over 100 vessels to neighbouring islands. Male, which is fast becoming a small urban centre faces typical peak period traffic issues. The vehicle fleet is dominated by motor cycles which still contribute to traffic congestion in narrow streets. The taxi system which comprises of individually owned taxis registered with a 'call centre', provide limited services but fails during peak demand periods especially on rainy days. There is very little coordination between the ferry and taxi services.*

*The paper is based on the results of a detailed urban transport planning study carried out in Male Urban Area which included passenger interviews, vehicle counts and travel time surveys covering all modes of motorized and non-motorized travel.*

*This paper investigates the introduction of a mini-bus transport system that would provide easy transfers between ferries and major traffic generators and attractors. The contribution of a mini-bus service in the long-term is also discussed with respect to implementation of traffic demand management measures. This paper discusses the most appropriate type of vehicle that could be used and the potential framework for ownership and management of such a system taking in to consideration the multi-modal*

connectivity and also the service parameters for the operation of a successful minibus service.

The paper also analyses the present operation of the ferry services and investigates its ownership and operation parameters for efficiency and cost effectiveness. The paper reports reasons for the varied efficiencies seen on the different routes and the impact the informal and loosely regulated service providers have on the key performance indicators of these services. It also compares cost between different ferry services and studies the relationship between the ownership structure, technology levels, productivity and fare.

## INTRODUCTION

Male, the island capital of the Maldives, is an archipelago of over 1000 islands in the Indian Ocean. This 2 sq km island is home to over 120,000 people. Male Urban Area is made up of five main islands as follows:

- Male – the primary island on which most commercial, administrative and residential activities take place and also the most motorised island.
- Hulhule – the airport island with no residential population
- Villingili – a newly formed residential island where the use of private motorised vehicles are prohibited
- Hulhumale – a newly developed residential island where private vehicles are allowed but has no land connection to the main island
- Thilafushi – an island with only commercial activities

There is a taxi service comprising of around 450 vehicles in Male and a dhoni (ferry) service amounting to over 100 vessels operating between the islands. Only Hulhumale has a small bus transport service. The motorized vehicle fleet which is mainly made up of motor cycles amounts to over 20,000. As a result, Male, which is fast becoming a small urban centre, faces typical peak period traffic issues.

The paper is based on the results of a detailed urban transport planning study carried out in Male Urban Area in 2006. This included passenger interviews, vehicle counts and travel time surveys covering all modes of motorized and non-motorized travel.

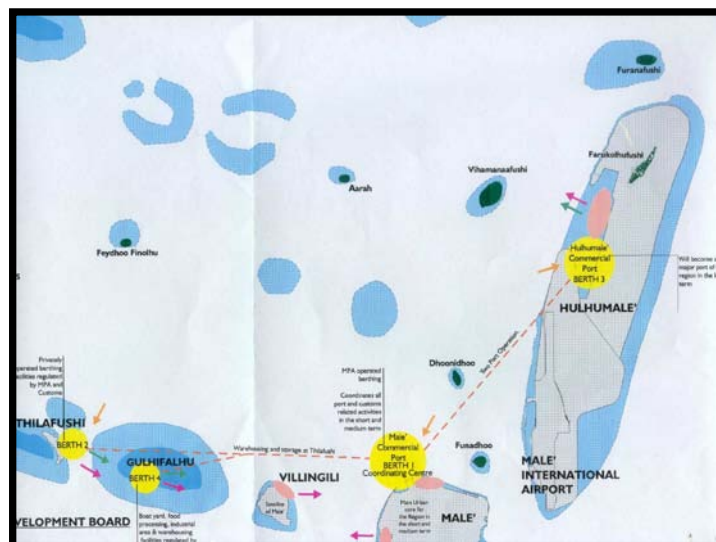


Figure 1: Male Urban Area

## **VEHICLE TRAFFIC PATTERNS**

The Male traffic patterns show a longer traffic day of about 17 hours, extending from 6 AM to around 11 PM. The traffic flow is quite uniform as most roads carry only around 5 to 6 percent of the daily traffic during each hour. This is possibly due to the short distances of travel and workers' keeping some what flexible working hours as is the common practice in the Maldives. According to an Origin-Destination matrix that was developed, there are an estimated 37,500 motor cycles and 12,500 car/taxi return trips per day in Male. Therefore the vehicular trip rate in Male is estimated to be around 0.4 return vehicle trips per person per day.

### **Trip Purpose**

Analysis was done on the purpose of these trips made by passengers of the vehicles. It was found that out of the 67% of work related travel; home based work trips made up 17%, work related trips made up 15%, and work based other trips made up 35% of travel. The balance trips were home based other trips. In this case, work trips refer to those that are undertaken for work or business purposes while home based work trips refer to trips to and from work.

## **PEDESTRIAN TRAFFIC PATTERNS**

Most of the major roads have between 10,000 to 20,000 pedestrian movements per day. It was also found that around 30% of roads have more pedestrians than passengers travelling in vehicles. These roads are in commercial areas, areas adjacent to the ferry terminals and in the CBD. Furthermore, it was found that more than 100 of the 873 road links in Male have more than 1000 pedestrians and vehicle users per hour. Due to socializing and shopping patterns in Male, the heaviest pedestrian movements were observed during 2000 to 2100 hours.

OD surveys estimated that there are 58,000 pedestrian return trips within Male' on a week day. On analyzing the road *nodes* (junctions), it was found that at 117 of the 673 road nodes in Male', the pedestrian flow was greater than the vehicle flow. 109 nodes had more than 1000 users per hour. The pedestrian return trip rate per person per day is thus estimated to be 0.5.

## **ROAD SPACE UTILIZATION**

The average vehicle passenger occupancy rate was observed to be comparatively low ranging from 1.35 in motor cycles to 1.81 in cars and vans on roads in Male'.

When comparing facilities provided for different road users, pedestrians are provided only 3% of the road space, even though they made up 34% of the total number of road users in Male'. On the other hand, 4-wheeled passenger and goods vehicles which make up only 25% of the traffic flow, take up 66% of the road space. Therefore it can be concluded that a disproportionately high amount of limited road space is taken by these vehicles for both circulation and on-street parking. The road inventory survey found that 70% of all cars and vans in Male' are parked on the street during the day time, while the percentage for motor cycles was less at 53% and for taxis it was 48%.

## **TRAVEL CHOICE**

It was found that the most predominant mode of transport used in Male was walking (48%). In fact non-motorized trips including the 3% of bicycle trips made up a total of 51% of trips. When considering the motorized modes, the motor cycle dominates with 31% of the share, with taxis and ferries making up 8% and 7% respectively. Private vehicles presently contribute only 2%, while buses carry just 1% (as they are operational only in Hulhumale).

## **TRAVEL COST**

Household Income and Expenditure data were also collected from households. The total cost for all households for personal travel was thus estimated as Maldivian Rupees (MRf) 108 million per annum (approx 1% of GDP). It is pertinent to note that the use of private vehicles make up MRf 67.4 Mn of this amount, followed by taxis as an MRf 27 million industry and operation of ferries as a MRf 12 million business. When adding goods transport the total transport contribution to the economy could be around 2-5% of GDP. Prorated cost for transport in Male' Urban Area would be at least 4-10% of the GDP of the Maldives.

## **VEHICLE OWNERSHIP**

The household survey indicates that the total number of vehicles in Male Urban Area was 22,303 of which 77% were motor cycles and 14% were bicycles. Four wheeled vehicles made up only 9% or just around 2,000 vehicles in 2006.

In Male' Urban Area there is a clear positive linear relationship between the vehicle ownership and household income. There was however an inversely linear relationship for bicycles and a maximum rate of ownership for taxis at an average household monthly income of between MRf 15,000 to 20,000 per month. Motor cycles and cars show an elasticity to income greater than one, where the rate of increase in car ownership exceeds the rate of increase in household incomes. The growth in vehicle fleet has been consistently high, varying between 10 to 25 percent per annum. It is very probable that this growth trend will continue for the next decade or so unless some interventions occur.

A very conservative estimate of 50% population increase has been made for the next 15 years in Male Urban Area, accompanied by an approximate 60% increase in per capita incomes during this period. This will result in the total vehicle fleet increasing from around 20,000 to 60,000 which would be a 200% increase in 15 years. Even if this was solely confined to motor cycles, it would still cause severe constraints on road space for circulation and more importantly for parking.

## **FERRY SERVICE**

Ferry services have long been a part of the Maldivian passenger transportation system. Being a country consisting of a number of small to medium islands in the Indian Ocean, it is well suited for passenger and goods movements by ferry. A survey was conducted on four different short-distance ferry services operating between the islands within the

Male Urban Area to find out the pattern and travel behavior of urban ferry users. These services were:

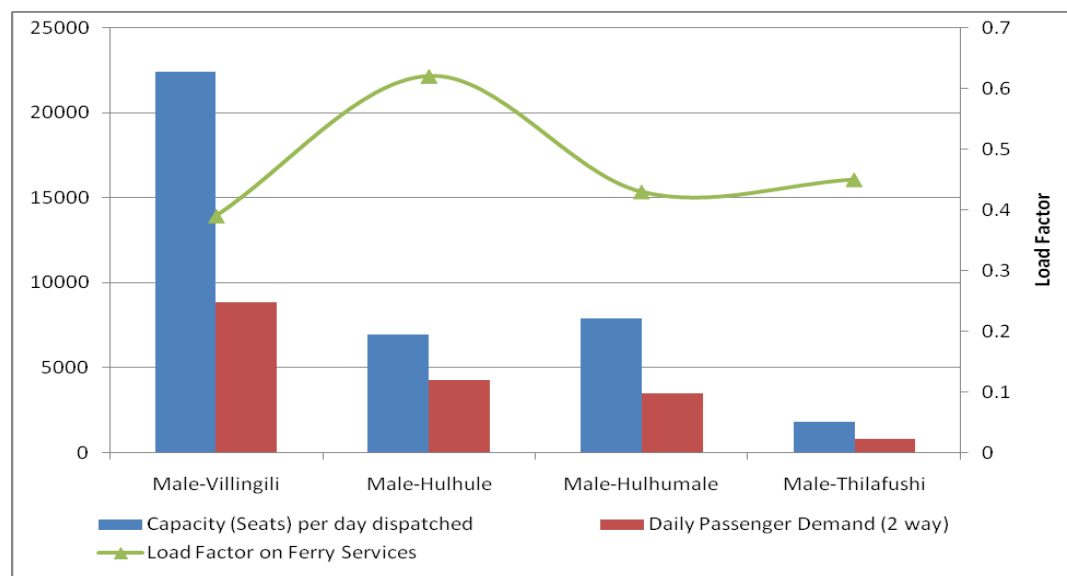
- Male to Hulhumale Ferry
- Male Villingili Ferry
- Male- Hulhule Ferry
- Male- Thilafushi Ferry

All the above services except the Male-Hulhule ferry were operated as monopolies by the State owned Maldivian Transport & Construction Corporation (MTCC). In the case of the Male-Hulhule ferry service this service was provided by a number of individual operators working as an association or cartelized union as opposed to a company,

The surveys carried out on these services that included passenger counts, passenger interviews and travel time surveys were used to analyze the demand and capacity of the ferry services, quality of the services, utilization of vessels and characteristics of the ferry service valued by the users.

### Demand & Capacity

Ferry capacity is defined as the total number of seating spaces that can be deployed by the ferry system over a period of time. When analyzing against the observed demand it was found that only during short periods of the day was the capacity reached in ferry operations. In fact there was evidence of over supply and a mis-match of supply as there is no demand based scheduling of services. Figure 2 shows the capacity, demand and load factor in terms of seats dispatched on each service for both directions per day.



**Figure 1 :** Capacity (Seats) per day dispatched

Furthermore, an analysis on utilization of the vessels in respect of the percentage of time (for travel with passengers, docking, loading etc) as against the total time it was deployed for service has also been shown in Figure 3. Accordingly, in all three of the services operated by the MTCC, the ferries are utilized for between 60 to 70 percent of the time they are available, while in the case of the Male’ -Hulhule ferry, this drops to less than 20%. This is due to the high number of vessels, and a very inefficient dispatching system where a cartel has determined that vessels be dispatched from both ends simultaneously and sent back empty to the beginning.

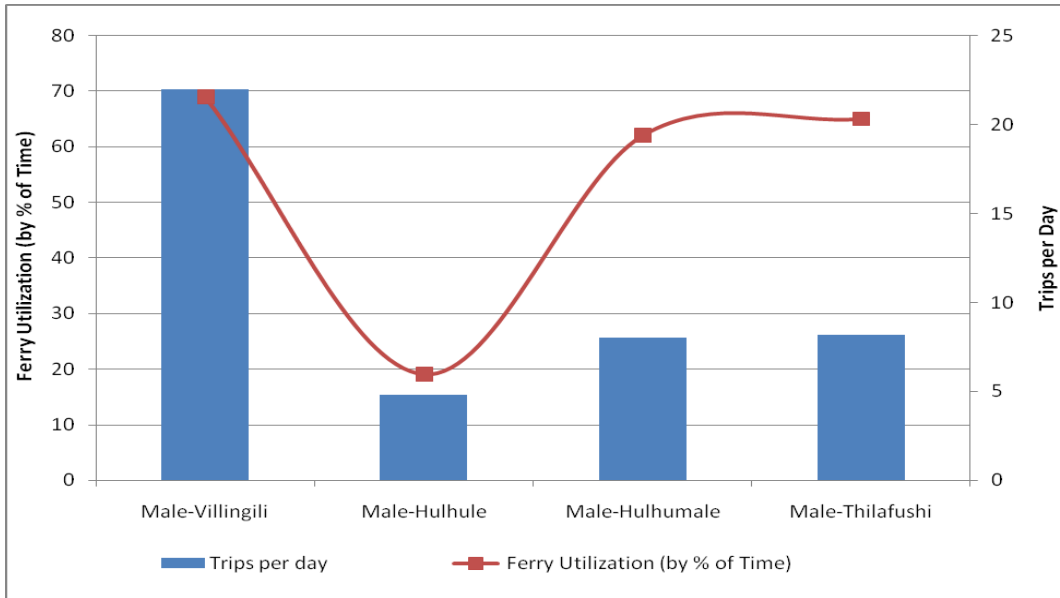


Figure 2 : Ferry Utilization (by % of Time) and Trips per Day

**Service Characteristics**

Figure 4 shows the fare of a one way ferry trip compared to travel time. Since all ferries uses the same type of vessel, travel time approximately represents travel distance as well. In this case, a linear relationship was observed for the services operated by the MTCC which demonstrates that they were costing ferry services on a cost plus profit basis given that there was no other competitor or any form of effective price competition. On the other hand, the Male-Hulhule’ service operated by the individual ferrymen is severely over-priced at 10 MRf for a 8 minute trip. According to Figure 4 this service should be priced at around 3 MRf per passenger. It is now priced at 10MRf which means that passengers overpay MRf 1.41 million per year.

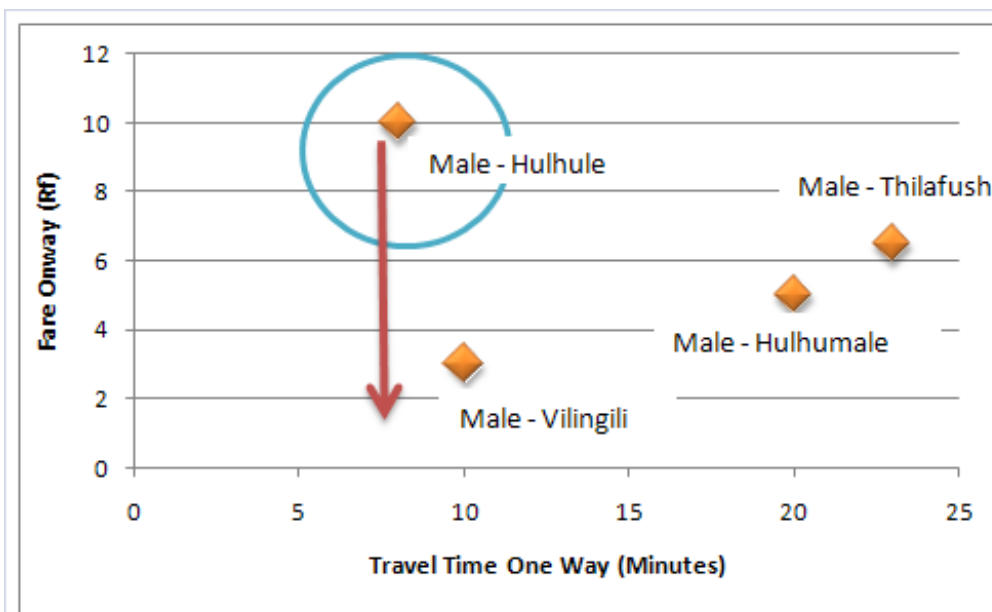


Figure 4: Ferry Travel Time vs Fare

This is typical of individual operators in an unregulated market where entry and exit mechanisms are not functioning properly. There are at present 52 registered vessels with approximately 40 of them operating daily. This means that all these vessels have to be sustained even if they are not really necessary. As per demand computation, this service actually needs only 8 vessels to provide the required frequency. Around 40 surplus vessels have to be accommodated every day in order to provide business opportunities and employment. This however costs the passengers around MRf 440,000 per vessel per year due to higher fares. This is one of the consequences of allowing individual entrepreneurs in provision of transport services where there is unemployment.

As a result of the high fares on the Male'- Hulhule service, several institutions are operating their own ferry services as chartering a vessel for this purpose is a much cheaper option even though load factors on these private services are extremely low.

### **Quality of Ferry Services**

According to the passenger data analysis, in all ferry services, around 20 to 30 percent of passengers have termed these services as being uncomfortable. Between 10 to 40 percent of passengers' state that the ferry service is too slow for their linking. In this analysis, the frequency or the cost was not highlighted as a problem. Surprisingly, even the Male-Hulhule service which has a relatively higher fare was not highlighted as being too costly. This is possibly due to the fact that most passengers do not perceive the high cost as they are not regular commuters in the sense that they are only traveling to and from the airport.

### **TAXI SYSTEM**

The taxi service in Male was satisfactory, but could not handle high peaks or (more particularly spikes) particularly on rainy days. It was noted that there was no other form of public transport system to serve the traffic spikes that were created by ferry terminals, hospitals or schools. This has resulted in the increase of private vehicle and taxi use, causing heavy local congestion around popular schools, ferry terminals and the CBD area.

The taxi system comprises of individually owned taxis that are registered with a 'call centre'. Taxi permits that are sold annually are purchased by drivers at a premium. It is clear that while taxis provide a service, but they are in no way adequate as a regular commuting service especially during rainy weather, special holidays or events that require high capacity transport. Moreover there is no coordination between the ferry and taxi services.

### **PUBLIC OPINION ON PROPOSED INTERVENTIONS**

The householder's responses to selected interventions to improve transport were also collected and analyzed. As shown in Figure 5, the responses to the different interventions that were posed to the householders have varied. The best response was for the introduction of mini buses where all wards in Male reported acceptable levels

ranging from 60 to 90 percent. Controlling the import of new vehicles had the least support, while improving traffic management measures such as having more one-way systems and removal of on-street parking had better support especially by those in the islands of Villingili and Hulhumale'. Interestingly, the responses to allow more use of cars sharply contrast between Hulhumale which supports it while Villingili opposes it. On the other hand, improving quality of ferries with a corresponding increase in fares was supported by households in Villingili but opposed by those in Hulhumale' if it meant a corresponding increase in fare.

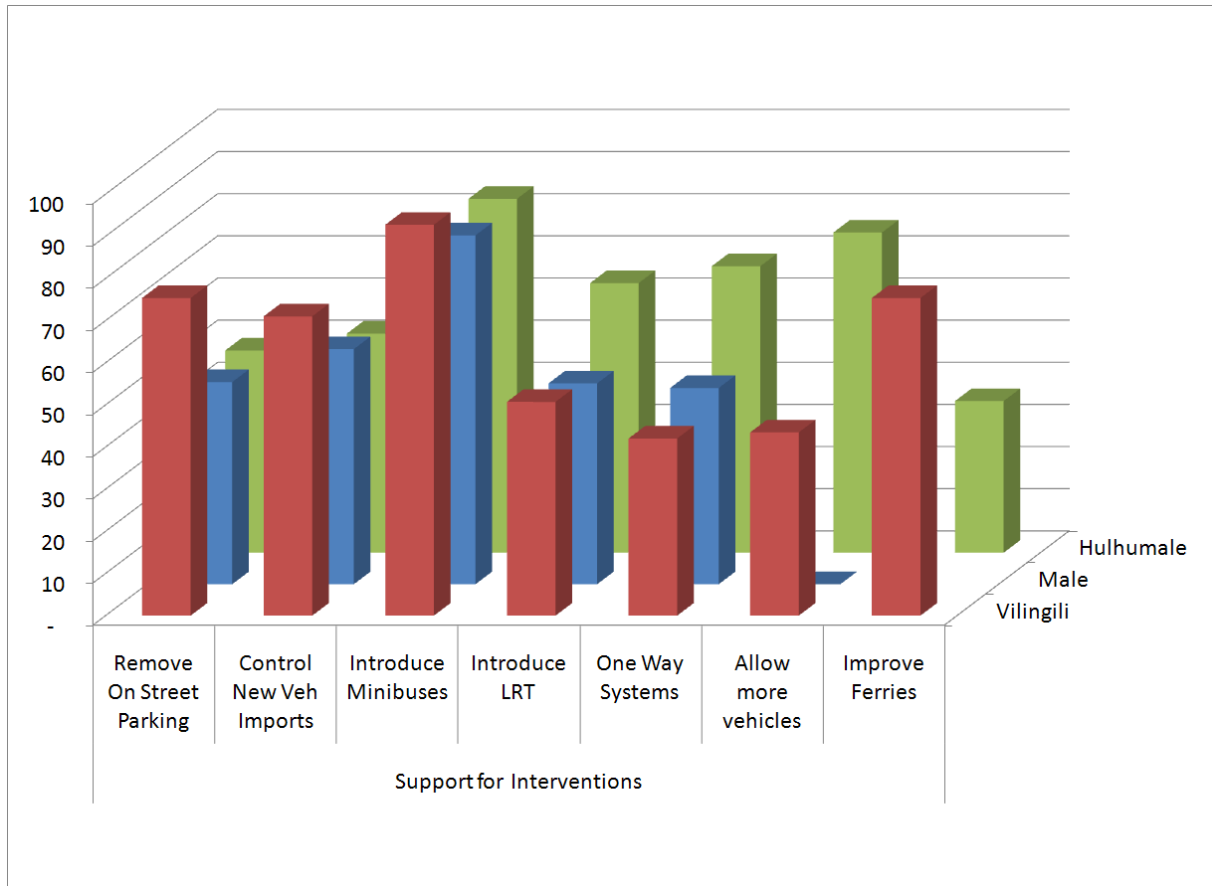


Figure 5: Public Opinion on proposed interventions

## CONCLUSIONS

This paper concludes by identifying a number of unique characteristics with respect to overall travel patterns in the Male Urban Area. These may be summarized as follows:

- The Male Urban Area has approximately 120,000 people, but its vehicle ownership is quite high at around 220 per 1,000 people signifying a moderately motorized society. However 77% of this fleet are motor cycles while only 9% are four wheeled passenger vehicles.
- The vehicle trip rate in Male is around 0.4 return trips per person per day while pedestrian trips are around 0.5 return trips per day. While overall mobility is somewhat comparable to smaller cities, the ratio of pedestrian to motorized trips is considerably higher.



- c) Around 15% of the road links have more pedestrians than passengers in vehicles. In fact 48% of all movements observed were by walking. However in the entire road system in Maldives only 3% of the road space was provided for pedestrian facilities signifying the lack of attention to walking which a feasible option given the compact nature of the land area.
- d) Male has a long traffic day of around 17 hour duration. Its traffic peaks in the CBD are experienced between 8 and 9 PM which becomes the busiest shopping and socializing period of the day. The day time traffic peaks are mostly uniform as work hours are somewhat flexible and workers, whom of which mostly have short distances to travel, do not leave around the same time.
- e) The rapidly increasing fleet of motorized vehicles utilizes a high proportion of road space for circulation and parking. Due to limited space for off street parking 70% of all cars and vans were found parked on street during day time.
- f) There is no public transport service in Male'. The closest to this being the taxi operation, though reasonably efficient was still costly and not readily available during peak periods and becomes totally dysfunctional during rainy days. The taxis are owned by individuals who register with a 'call centre' which directs inquiries for hires to them. Registrations of the number of taxis and fares are regulated by government.
- g) Male island is connected to four other islands that make up the Male Urban Area. These islands are only connected by motorized ferries. There are around 12,000 passengers carried between the islands every day.
- h) Much of the longer pedestrian trips could be diverted to a form of public transport. This includes around 10,000 ferry passengers who walk to/from their places of work/study in Male' to the ferry terminals.
- i) A seamless door-to-door transport service for the community can be introduced by providing integrated ticketing for ferry & access mode and also by introducing a high quality minibus service to connect ferry terminals to major traffic attractors.
- j) Ferries carry around 12% of the total trips in MUA. Three of the four services are operated as a monopoly by a state owned company. There is evidence that the overall quality of these ferries could be improved without increasing fares since some costs may be reduced by better scheduling as most services have poor load factors of around 40 percent.
- k) In the case of the Hulhule service, it is operated by individual ferry owners and the informal union in effect has become a cartel. Fares on this route are at least 200% over priced when compared to the other services which are also over priced due to the excess capacity offered. There are 52 vessels for this service which requires only 8 which in effect reduces ferry utilization on this route to 20%.

- l) In addition there is a need to restructure the supply on the Male-Hulhule service by introducing competition or competitive tendering for services.
- m) Other services need regulatory supervision in ensuring improvements to quality of service. Encouraging regulated competition may be one such possibility. The passenger feedback reported that around 50% of ferry passengers consider that ferry operations are too slow and uncomfortable. This in addition to the rather basic comfort levels provided in ferries but also includes the quality of terminals and their opinion is also influenced by the poor access facilities to terminals.
- n) There appears to be scope for improving scheduling and re-examining vessel size mix to be used in these services, especially taking into account the variations in demand peaks during the weekend.
- o) Most importantly, it was found that the majority of ferry passengers walk to and from terminals due to the absence of a regular public transport system in Male’.
- p) In terms of interventions that have been proposed to improve transport in Male, the introduction of a mini bus system received the highest preference while measures at controlling vehicle imports received the lowest public support. Other vehicle restraint measures received some support as did a proposal for a Light Rapid Transit (LRT) system.

## **ACKNOWLEDGMENT**

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## **REFERENCES**

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