



# Motorisation in paradise: the economics of land transport in Tuvalu

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Tuvalu is the world's smallest developing country with very limited, infertile and low-lying land resources, and is extremely isolated, even by South Pacific standards. Population densities in Tuvalu are effectively the highest in the South Pacific region, and among the highest in the world. As recently as the late 1980s, land transport was mainly provided by non-motorised vehicles, and transport development initiatives were focused on sea and air transport. However, in less than two decades, motorised vehicles now totally dominate road traffic on the main island of Funafuti where around 50 per cent of the total population of the country resides. This rapid motorisation has taken place despite the almost ideal conditions in Tuvalu for non-motorised road transport.

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Tuvalu is the world's smallest developing nation state, in terms of a combined measure of resident population and contiguous land resources (Mellor 2003). Its current population is estimated at 9,561 persons based on the preliminary results of the 2002 Census, of whom around 47 per cent (4,492 persons) now live on the two main islands of Funafuti Atoll. The total land area of Tuvalu is only 25.9 square kilometres split between nine island groups, some of which are made up of many tiny islets. The islands have extremely infertile soils, and all are low-lying, with elevations generally less than

three metres above sea level. Consequently Tuvalu is at considerable risk from natural disasters caused by cyclones and tsunamis, and potentially from longer-term environmental risks such as rising sea levels possibly related to 'global warming' effects.

Until quite recently, land transport was only of passing concern to public policymakers in Tuvalu. The country achieved independence from the United Kingdom in 1978, and early national planning documents barely mention land transport (Tuvalu 1978, 1980, 1984). Development attention in the transport sector



overall was focused on sea and air transport. However, by the late 1980s and subsequently, land transport has become of increasing concern, especially on the main island of Funafuti Atoll (Tuvalu 1988, 1995, 1998, 2004). This atoll consists of two main, inhabited islands (Fongafale, which is the main population, government administration and business centre as well as the site for the international airport, and Amatuku, which is the site for the Tuvalu Maritime Training Institute) and around two dozen islets which are generally uninhabited (and some are part of a nature conservation zone).

The combined total land area of Funafuti Atoll is just 2.79 square kilometres (Tuvalu 1992), and the available 'living space' is much less than this, given that the airport alone occupies about 0.2 square kilometres. There have been some minor new areas of usable land created on Fongafale through infilling with solid waste of the borrow pits left behind by the Allied forces when the airport was constructed during the Second World War. Some additional extra space has also been achieved through multi-story building construction, but this has been quite limited. The recent upgrading of the road network on Fongafale has effectively added some more usable land space, by linking it to the islet of Tengako to the north by an all weather causeway. However, such further possible extensions to the available land space on Funafuti appear unlikely, given the engineering costs involved to construct causeways and bridges to other islets on the atoll (though such links appear to be technically possible, both to the immediate north and south of Fongafale). Some investigations in the past have focused on possible land reclamation from the lagoon, but these appear to have been discontinued, undoubtedly due both to high costs as well as to expected adverse environmental impacts.

It is little surprise therefore that Tuvalu is among the most densely populated

countries in the world (Times Books 2000). On average, the country had a population density in 1991 of 353 persons per square kilometre (Tuvalu 1992), and the preliminary results of the 2002 Census indicate that it has since increased to 373 persons per square kilometre. However, as is well known, such average statistics must be treated with considerable caution. The 1991 Census in Tuvalu indicated that the average population density on Funafuti Atoll was 1,376 persons per square kilometre, and the 2002 Census preliminary results indicate that it has since increased to 1,610 persons per square kilometre. The population density is now possibly around 2,000 persons per square kilometre, when account is taken of space used for other purposes (such as the airport) and the numerous uninhabited islets of the atoll.

This population density is almost without comparison worldwide, and Tuvalu is effectively the most densely populated territory (in real terms) in the South Pacific region (Table 1). The only immediate comparison is with Nauru, but that country (though marginally larger than Tuvalu in total resident population terms, and only marginally smaller in actual total land area) consists of a compact, relatively high-standing and contiguous land area (albeit much denuded from phosphate mining), in sharp contrast to the widely dispersed, low-lying and fragmented land resources of Tuvalu. Also Nauru, at least until quite recently, was not widely recognised as a developing economy, given its financial wealth derived from phosphate mining, albeit that much of this wealth has apparently been subsequently squandered.

Absolute population numbers, as well as population densities, are potentially very important statistics for transport planning, for all transport modes (sea, air, land). With larger absolute population levels, certain thresholds in terms of transport



infrastructure bottlenecks can be more readily addressed in both economic and financial terms. Obviously Tuvalu suffers seriously in this regard, and its minute absolute total population means it faces an extreme lack of scale economies in its transport infrastructure, especially for sea and air transport. This inherent difficulty is somewhat less for land transport, but obviously the difficulty remains. Similarly, population densities can be important, particularly for planning public transport systems on land.

When Tuvalu became independent in 1978, the country had no sealed roads. As recently as the mid 1980s, this situation continued. There are local reports that some significant road construction took place in 1987 on Funafuti Atoll during a 34-day visit by US military personnel, but the quality of the work done was apparently inferior, and

the beneficial effects of this upgrading work were soon dissipated. As recently as 1998, the Government of Tuvalu was actively seeking funding from Japan for upgrading the road network on Funafuti (Tuvalu 1998) and subsequently from the Asian Development Bank, and undoubtedly also from other potential donors from the international community.

Unfortunately, none of these potential donors had the common sense to recognise a potentially good investment, or (in the case of Japan at least) were already heavily committed financially to other, high priority infrastructure projects (such as the excellent new national hospital on Funafuti completed recently with funding from Japan). Tuvalu then decided to use its own financial resources (which have been significantly boosted in recent years from the sale of the

Table 1 **Comparative average national population densities of states and territories in the South Pacific region, 2000** (persons per square kilometre)

	Population density (persons per square kilometre)		Population density (persons per square kilometre)
Nauru	524	Fiji	43
Tuvalu	440	Palau	38
Marshall Islands	331	Lord Howe Islands	22
American Samoa	320	Easter Island	16
Guam	298	Solomon Islands	15
Federated States of Micronesia	163	Vanuatu	15
Northern Mariana Islands	147	New Zealand	14
Tonga	131	New Caledonia	11
Kiribati	113	Papua New Guinea	10
Tokelau	100	Niue	8
French Polynesia	70	Australia	2
Samoa	61	Pitcairn Islands	1
Norfolk Island	57	Chatham Islands	1
Wallis and Futuna	51		

**Note:** The higher population density shown in Table 1 for Tuvalu appears to be an error, based on a minor confusion in the Tuvalu 1991 Census, which gave two population totals for the country, namely a *de facto* (resident) population of 9,043 as well as a *de jure* (including Tuvaluans temporarily overseas) population of 10,114. The higher figure appears to have been used, which is misleading in this instance.

**Source:** Times Books, 2000. *The Times Atlas of the World*, Times Books, London.



**Table 2 Distribution of land resources by island group in Tuvalu and population densities, based on the preliminary results of the 2002 Census**

Island group	Land area (square kilometres)	Population density (persons per square kilometre)
Nanumea	3.87	172
Nanumaga	2.78	212
Niutao	2.53	262
Nui	2.83	194
Vaitupu	5.60	284
Nukufetau	2.99	196
Funafuti	2.79	1,610
Nukulaelae	1.82	216
Niulakita	0.42	83

**Source:** Tuvalu, Central Statistics Division, 2002. *Census 2002*, Government of Tuvalu, Funafuti.

international rights to use its national internet domain address '.tv') to invest in a major upgrade of the Funafuti road network, which has only recently been completed. Elsewhere in Tuvalu, the existing road network is exceedingly basic, with no sealed roads. The distribution of land areas by island groups is shown in Table 2, along with population densities.

The preliminary results of the 2002 Census indicate quite clearly that there has been a significant shift of population within Tuvalu in the inter-censal period. Population is estimated (based on the reported changes in the number of residents between 1991 and 2002) to have increased sharply on Funafuti (up 26.3 per cent) and even more on Vaitupu (up 41.9 per cent). There were smaller increases on Nukulaelae (up 18.7 per cent) and Niutao (up 13.2 per cent). Population declined on each of the other five island groups, some quite sharply. The estimated declines are Nanumea (down 6.8 per cent), Nanumaga (down 7 per cent), Nui (down 10.4 per cent), Nukufetau (down 19.3 per cent) and Niulakita (down 50.7 per cent). The detailed estimates are shown in Table 3.

### The Tuvalu transport sector

Sea transport is the traditional means of transportation in Tuvalu, for intra-atoll, inter-island, and international transport of passengers and freight. However, air transport has developed significantly in recent decades for international movement of passengers, as well as for higher value freight. Until quite recently, land transport in Tuvalu was of little concern to public policymakers, and barely rated a mention in national planning discourse in the early years after independence of the country in 1978.

Complex and challenging issues remain to be tackled in the sea transport sector, including the adequacy and suitability of operating vessels, operational safety, and berthing, handling and storage facilities. The country's main international seaport on Funafuti was last upgraded more than 20 years ago (with aid from Australia) and there are serious concerns at the present time about the structural integrity of the existing wharf, presumably due to lack of adequate maintenance of the structure and related facilities. Elsewhere, wharfage infrastructure,



as well as cargo handling and cargo storage facilities, are generally considered to be inadequate, even dangerous, on the outer islands of the country (Tuvalu 1995). The Vision 2015 national planning document (Tuvalu 1998) highlighted the need to improve internal shipping; port and wharf facilities; and reef channel projects, to improve shipping access to each island.

Air transport is similarly a complex and challenging sector. The first regular international air services commenced in 1964, provided by Fiji Airways linking Fiji to Tuvalu (then known as the Ellice Islands) and Kiribati (then known as the Gilbert Islands) (Tuvalu 1992). In subsequent years, several other operators have intermittently provided international air services to Tuvalu, but none of these have proved to be financially sustainable. Similarly, a domestic seaplane service operated within Tuvalu for several years in the early 1980s (with international aid support) but was discontinued in 1983 due to ongoing financial losses. The airport on Funafuti underwent a major upgrade in the early 1990s with international aid, but

there remain significant concerns over the structural integrity of the airport pavement, as well as in regard to navigational facilities at the airport and some inherent safety concerns related to the near proximity of buildings and other structures and features adjacent to the airport, understood not to be in accordance with generally acceptable international standards for sideways clearances for safe landing and take-off.

Based on local sources, the first conventional motor car in Tuvalu is understood to have been imported only as recently as 1982, in conjunction with the Queen's visit. Even in the late 1980s, the country had no sealed roads; pushbikes were the most common form of transport, and the country had limited need for road transport (Tuvalu 1988). Nevertheless, land transport in Tuvalu has grown in importance over the subsequent 15 years at an extremely rapid rate, especially on Funafuti, as detailed further below. And, to the undoubted chagrin of cycling enthusiasts worldwide, pushbikes are increasingly an uncommon sight in the country, especially on Funafuti.

**Table 3 Estimated population distribution by island group in Tuvalu, based on the preliminary results of the 2002 Census**

Island group	No. of households (number)	Population estimate (persons)	Population density (persons per square kilometre)
Nanumea	128	664	172
Nanumaga	119	589	212
Niutao	143	663	262
Nui	108	548	194
Vaitupu	237	1,591	284
Nukufetau	118	586	196
Funafuti	639	4,492	1,610
Nukulaelae	68	393	216
Niulakita	8	35	83
Tuvalu	1,568	9,561	373

**Source:** Tuvalu, Central Statistics Division, 2002. *Census 2002*, Government of Tuvalu, Funafuti.



## Land transport in Tuvalu

Accurate data on the current land transport fleet in Tuvalu are not readily available. This paper draws on three main sources, namely the preliminary results of the 2002 Population Census, data obtained from Funafuti Town Council records in July 2003, and a series of road traffic surveys undertaken on Funafuti in July 2003 (which are believed to be the first such surveys ever undertaken in the country). Other possible data sources, including vehicle and petroleum import statistics, police (vehicle roadworthiness and road accidents), motor vehicle insurance data, hospital records of road accidents, and driver licensing records either are incomplete or are yet to be fully investigated, but do not appear to be prospective. For example, it would be interesting to obtain more data on the condition of imported motor vehicles, especially cars, given apparent efforts by government to limit the import of secondhand and reconditioned cars, but such data are not currently available.

Nevertheless, the broad picture is relatively clear. First, the motorised vehicle fleet in Tuvalu is heavily concentrated on Funafuti, and to a much lesser extent on Vaitupu. Second, the dominant motorised mode is motorcycles, which have grown rapidly in numbers in recent years, as has the whole motorised fleet. Bicycle traffic has declined markedly on Funafuti, especially in recent years. Vehicle ownership in Tuvalu, especially on Funafuti, is high by developing economy standards, despite the small size of the country and its extreme isolation.

A broad indication of the overall growth of the vehicle fleet, and its disposition within the country in recent years, is shown at Table 4. Motorcycle numbers have grown rapidly in recent years throughout the country; cars and other motorised vehicles have grown significantly on Funafuti; while bicycle numbers in Tuvalu have grown at a more modest rate over the 15 year period 1987–2002, and primarily on the outer islands of the country (Table 4). The broad composition of road traffic on Funafuti is illustrated at Table 5.

**Table 4 Estimates of the vehicle fleet in Tuvalu, 1987 and 2002**

Island	Year	Motorcycles	Cars	Other vehicles	Bicycles
Funafuti	1987	97	8	19	215
Funafuti	2002	550	76	59	259
Vaitupu	1987	35	0	4	249
Vaitupu	2002	208	11	2	248
All others	1987	15	-	-	476
All others	2002	255	5	8	685
Total	1987	147	8	23	940
Total	2002	1,013	92	69	1,192

**Notes:** 1. Other vehicles include vans, pickups, trucks and buses.

2. Data for 2002 are based on household ownership of vehicles, and are assumed to underestimate actual numbers, due to some government and corporately owned vehicles (including buses) not being included in the household census totals.

**Sources:** 1987 data are reportedly from Island Council records (Tuvalu 1988). 2002 data are from preliminary results of the 2002 Population Census.




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**Table 5 Road traffic on Funafuti, 2003**


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Vehicle type	Percentage of traffic volume
Motorcycles	73
Cars	10
Trucks, vans and so on	7
Buses	4
Taxis	3
Bicycles	3
Total	100

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**Source:** Based on four road traffic counts undertaken in and around the central area of Funafuti in July 2003. Counts are for total traffic (all directions) and were classified by vehicle types (motorcycles; cars; taxis; buses; trucks, vans and other vehicles; and bicycles) and vehicle registration plates (AO series; FTC series; other number plates; no number plates/unreadable number plates). Counts were for three-hour periods in the mornings, typically 7am to 10am. These are believed to be the first formal road traffic surveys ever undertaken in Tuvalu.

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Not surprisingly, the morning peak hour on Funafuti centres around 8am, in line with the formal opening time of government offices, the major employer on the island. However, actual traffic volumes remain extremely modest by international standards. The highest recorded hourly flow (total both directions) was 284 vehicles (including bicycles), between 7.30am and 8.30am at the Funafuti Town Council.

#### **The vehicle fleet on Funafuti**

The responsibility for vehicle registration, including bicycles, on Funafuti rests with the Funafuti Town Council. In general, based on the traffic surveys undertaken in 2003, most motorised vehicles appear to have been registered at some time or other with the Funafuti Town Council. However, around 3 per cent of vehicles had no number plates, or their number plates were unreadable. Another 3 per cent had other number plates, which could include plates issued on other islands of Tuvalu; plates issued in other countries (such as for construction contractors' vehicles from Fiji and elsewhere currently based on Funafuti); and possibly

some diplomatic plates or special government plates.

Prior to 1999, Funafuti Town Council issued plates using a system based on the year of issue, with no differentiation between vehicle types. A typical plate would be one of the taxis currently operating on Funafuti, namely 'FTC 228 98', indicating that it was the 228th vehicle registered by the Funafuti Town Council in the year 1998. Commencing in the latter half of 1999, a new system was introduced, with all new vehicles being registered with a plate number commencing with the letter 'A' followed by five digits (again with no differentiation between vehicle types). A typical plate would be another of the taxis currently operating on Funafuti, namely 'A 01166', indicating that it was the 1,166 vehicle registered under the new system. Evidently when the new system was introduced, some vehicle owners kept their existing FTC plates, while others obtained new A-series plates.

A current difficulty in estimating the motorised vehicle fleet on Funafuti is that the Funafuti Town Council does not appear to have a consolidated list of all vehicles



registered. Moreover, while vehicle owners are supposed to renew the registration of their vehicles on an annual basis, available Funafuti Town Council records suggest that only around 10 per cent (or even less) do so. As of July 2003, Funafuti Town Council had apparently issued a total of 1,208 A-series plates, though only 115 plates had been renewed in 2003, being 96 A-series plates and 19 FTC-series plates. These renewal data suggest that around 83 per cent of all registered vehicles have A series plates (assuming that A series and FTC-series plate holders are equally inclined to observe the law, and to reregister their vehicles). A similar result was obtained from the July 2003 traffic surveys, which indicates that 83 per cent of all motorised road traffic had A-series plates.

On this basis, and assuming that most vehicles registered under the A-series were still operational (and that the total number of vehicles issued with A-series plates on Funafuti was indeed 1,208 as of July 2003), then the total motorised vehicle fleet on Funafuti is estimated to be currently around 1,400 vehicles in mid 2003. At first glance, this estimate appears to be at odds with the 2002 Census estimates shown in Table 4. It does seem likely however that the census estimates are low, as indicated above. In addition, there has undoubtedly been very rapid growth in motorised vehicle numbers on Funafuti in very recent times, in particular following the completion of the new, and comprehensive, sealed road network on the island. Nevertheless, there must also remain some uncertainty as to the number of motor vehicles issued with A-series plates by Funafuti Town Council since 1999, given some evident irregularities in plate numbers observed on Funafuti, the unsatisfactory state of Funafuti Town Council's record keeping, and the lack of compliance by citizens with annual vehicle registration renewal requirements. It seems possible also that some vehicles originally imported to, and

registered in, Funafuti have been relocated to other islands in Tuvalu.

Assuming however the above estimates are broadly correct, the available data suggest that the motorised fleet on Funafuti has grown at an average compound rate of 16 per cent per annum over the 16-year period from 1987 to 2003. Undoubtedly, this growth rate has fluctuated from year to year, but seems to have been exceptionally high in recent years, following the upgrading of the road network on Funafuti. If further analysis of the data confirms this growth estimate, it must surely represent one of the most rapid rates of motorisation anywhere in the world (albeit that this growth has occurred from a low base).

With respect to the bicycle fleet on Funafuti, the 2003 road traffic surveys indicate there is only very minor use of bicycles on the island at the present time; only around 3 per cent of road traffic surveyed consisted of bicycles (Table 5). Moreover, while in theory bicycles are supposed to be registered with the Funafuti Town Council, as of July 2003, Funafuti Town Council records indicate only 20 bicycles are registered with them, compared to the 2002 Census estimate of 259 bicycles operating on the island. Again, these data suggest that only around 10 per cent (or less) of citizens observe the law and register their bicycles, similar to the apparent situation with motorised vehicles, as detailed above.

#### **Public transport on Funafuti**

Funafuti has a surprisingly good public transport system, based on a fleet of small, but conventional, buses provided by Funafuti Town Council. Being densely populated, and effectively totally linear geographically, conditions are almost ideal for road-based public transport. There is also a sizeable fleet of conventional motor taxis (though without meters—fares are negotiated), estimated at nine vehicles in mid





2003 serving a resident population of some 4,500 persons. Taxi operators pay the same vehicle registration fees as conventional motor cars, and there appear to be no barriers to entry to the industry. So far as is known, 'informal' public transport operators (such as based on motorcycles, 'mini-buses', or private motor cars) do not operate, and it is not uncommon for motorised vehicles to stop and offer to transport pedestrians to their destination, free of charge.

#### **Road safety on Funafuti**

While road accidents evidently do happen, they appear to be relatively rare occurrences on Funafuti. This fortuitous situation appears to be mainly the result of an excellently designed road network, which incorporates best practice speed control devices (road humps) to calm road traffic. Also the relatively low traffic volumes undoubtedly assist in this respect. Other conventional road safety devices are effectively unknown however; safety helmets for motorcyclists are unknown, as is the wearing of seat belts in motor vehicles.

#### **Environmental impacts of road traffic**

Limited reference has been made in the past to the possible adverse environmental impacts of increasing road traffic on Funafuti, specifically air pollution from vehicle exhausts and noise pollution (South Pacific Regional Environment Programme 1994). Such concerns appear to be minor, given the low road traffic volumes, and the ambient conditions on Funafuti with regular sea breezes, though undoubtedly more could be done to improve vehicle operating standards to reduce exhaust emissions and vehicle noise.

The recent National Summit on Sustainable Development in Tuvalu gave only limited attention to road transport issues (Tuvalu 2004). Several resolutions are, however, pertinent (if problematic).

- upgrade the standard of roads and bridges on all islands, extend the sealed road network to other islands in the country, and investigate the viability of building bridges or causeways to other islands.
- build standard footpaths or sidewalks to improve pedestrian safety, review the need for 'speed humps', and strengthen the Traffic Patrol Unit to minimise all road accidents.
- provide more regular public transport services to reduce the problem of traffic congestion.
- prohibit the import of all motor vehicles manufactured before 1996 (due to the global ban on CFCs) and strengthen the quota on motor vehicles imported to Tuvalu. Such a measure would be in line with apparent efforts by government in the past to restrict the import of second hand cars, by imposing higher tariffs and duties on such vehicles.

#### **Non-motorised transport in Tuvalu**

Bicycles (and also hand carts) continue to play a significant role in the land transport sector in Tuvalu, albeit that their role has evidently declined significantly on Funafuti in recent years (Table 4). Bicycles were still the dominant road vehicle in 2002, in terms of the absolute number of operating vehicles. Nevertheless, bicycles appear to be rapidly 'losing out' to motorised vehicles, particularly motorcycles, and there seems little doubt that these latter vehicles will soon become the dominant road vehicle in Tuvalu in terms of the absolute number of operating vehicles. The 2002 Census results also indicate a total of 334 hand carts operating in Tuvalu, up from the estimated 215 operating in 1987. These continue to play an important, if modest, role in localised transport for products such as fish and ice.



Current road traffic on Funafuti largely consists of motorcycles, while bicycle traffic is negligible (Table 5). Several factors have no doubt contributed to this clear trend, such as the improved and expanded road network; rising incomes such as from Tuvaluan seaman working offshore in the merchant marine service; and the increased available land area on Funafuti with longer travel distances making non-motorised transport less attractive. Undoubtedly also, the speed (time savings) and convenience of motorised transport, as well as possible 'social status' considerations, provide further impetus to this trend. These various factors obviously combine to overcome the higher operating costs of motorised transport compared to non-motorised travel. It is perhaps ironic that this is despite the obvious fact that Tuvalu provides almost 'ideal' conditions for non-motorised travel, with flat terrain and good pavement conditions (at least on Funafuti), relatively short distances, low motorised traffic volumes (making non-motorised transport safer), and ambient climate conditions reasonably conducive to bicycle use.

### Conclusions and recommendations

As recently as the late 1980s, land transport in Tuvalu was dominated by non-motorised vehicles, and transport development concerns were focused on sea and air transport. In less than two decades, this situation has changed markedly. Motorcycles, and to a lesser extent cars, trucks/vans, buses and taxis, are the primary means of road transport, particularly on Funafuti where around half the total population of the country now lives. On the main island of Funafuti, pushbikes represented only 3 per cent of road traffic surveyed in 2003. The available data indicate that the motorised vehicle fleet on Funafuti

has grown at an average compound rate of 16 per cent per annum over the period 1987–2003, representing an exceptionally high growth rate in world terms. This rapid rate of motorisation has occurred despite the fact that Tuvalu provides almost ideal conditions for non-motorised road transport.

The main recommendation of this analysis is that a comprehensive and effective motor vehicle registration system needs to be established in Tuvalu. Clearly it is important for public policy purposes to have accurate knowledge of the number of motorised vehicles in the country. A proper system of annual renewals of vehicle registrations is essential, based on a simple yearly registration label which can readily be enforced. At the present time, the available data indicate that only around 10 per cent (or less) of vehicle owners regularly renew the registration of their vehicles, representing poor and unfair governance arrangements, as well as representing a significant loss of public revenue and contributing to the lack of precise knowledge of motor vehicle numbers. It would also be useful for government to introduce a regular system of yearly road traffic surveys on Funafuti to monitor the growth of road traffic volumes and characteristics.

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