

Bridge Over Troubled Waters: An Assessment of the China-Maldives Friendship Bridge

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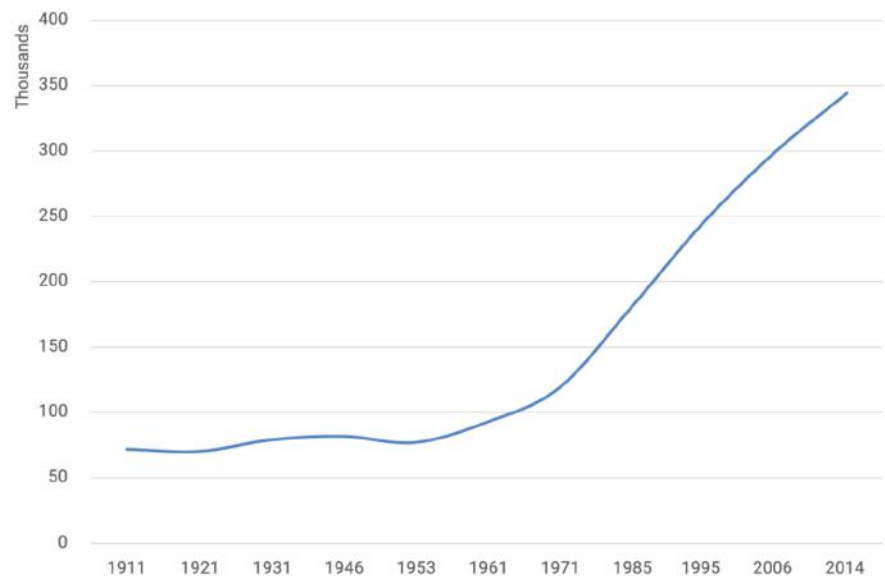
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1. Introduction

1.1 In 2022, the Maldives marks fifty years since the introduction of tourism to the country. Over the last fifty years, the country has fast moved from a fisheries and subsistence agriculture economy to a service-based economy catering increasingly to a higher end clientele. The impact of this modernisation can be seen in the overall increase in health outcomes for the country, and the subsequent impact on population, as shown in Figure 1 below.


Figure 1: Maldives population 1911-2014



1.2 In addition to increasing the total population size, there was also a significant redistribution of the population from the islands to the capital city Male'. As tourist resorts emerged, Maldivians (predominantly men) were no longer required to live on the islands they were born. The increased revenue from tourism also allowed the government to expand basic services, and in providing these services, (education, health, electricity, telecoms...etc), priority was given to the capital island, Male'. Head offices of tourism companies, along with logistics, trade and other services also set up their base on the capital too. The supporting economy surrounding this, from construction, restaurants, cafes created opportunities and jobs in Male' for the inhabitants of the other islands.

1.3 As a result, while the population of the country had grown roughly by 80% between 1985 and 2014 (from c. 180,000 to 324,000), the population of Male' had grown by 180% (from 45,000 to 129,000). This meant that the proportion of the total local population who lived in Male' increased from 25% in 1985 to 40% in 2014¹.


1. Date of Last Census

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- 1.4 Furthermore, there was also a significant influx of foreign workers to the capital city, which in 2014, numbered approximately 40,000. Therefore, by 2014, the island of Male' had approximately 170,000 people. This is estimated to have increased to 230,000 by mid 2021, according to the latest government figures (approximately 175,000 Maldivians and 55,000 foreigners)².
 - 1.5 Despite these large increases in population, the size of Male' island had not increased in any significant proportion, remaining at approximately 206 hectares, or roughly 2 sq km. This puts the population density of the island at approximately 80,000 per sq km. This is approximately double that of Manila (at c.46,000 per sqkm) and two and a half times that of Mumbai and Dhaka³ ; cities often regarded as some of the most densely populated in the world.
 - 1.6 Various attempts were made to accommodate the increase in population of Male'. This included reclamation of the island of Male' itself in the 1980s, followed by the designation of the island of Vilingilli from a hotel island to residential use in the late 1980s and early 1990s. However, neither of this was sufficient to cater for the demand with affordability of housing to become a key policy issue for the government of Maumoon Abdul Gayoom.
 - 1.7 In response, the government of President Gayoom initiated the Hulhumale' project – named after the airport island "Hulhule" and the capital Male'. This project, which began in October 1997 reclaimed 188 hectares of land in a lagoon north-east of Male' by 2004. It resulted in the initial settlement of approximately 1000 people in public housing. A further 240 hectares were added in 2015. As a result, there exists an island over twice the size of Male' within easy reach of the capital.
 - 1.8 Despite this large increase in land area, and multiple land-use plans, convenient connectivity between Male' and Hulhumale' has always been a barrier to realising the true potential of the island. For the first 10-15 years of Hulhumale's development, the island was connected to Male' through a ferry system based on diesel powered 'dhonis'. The journey lasted 30 minutes, which had to be supplemented further by bus, foot or by motorcycle to the residential areas of the island. For the people of Male', used to the convenience of travelling around Male' within minutes, this remained a significant barrier – especially as key facilities such as schools, hospitals, offices, restaurants and such – remained in Male'.
 - 1.9 Various visions for a bridge connecting the two islands were planned, particularly in the last few years of President Gayoom's presidency. The incoming president Mohamed Nasheed's government also supported the idea in principle⁴, but the economic circumstances following the 2008 financial crisis, the MDP's focus on addressing regional inequalities in the country, as well as the sudden and premature end to his presidency meant his government could not proceed on the matter.

2. <http://statisticsmaldives.gov.mv/yearbook/2021/>

3. Data from <https://worldpopulationreview.com/world-city-rankings/population-density-by-city>

4. <https://presidency.gov.mv/Press/Article/5818>

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- 1.10 The first tangible attempt to build a bridge between the two islands started under President Yameen, with an MOU signed with the Chinese government for a pre-feasibility for a proposed bridge in December 2014⁵. This was part of China's "Belt-and-Road" initiative, which saw significant outward financial assistance from China to the developing world.
- 1.11 By July 2015, the MOU on financing the construction of the project was finalised, with the price tag of the bridge put at \$300m⁶. The finance ministry at the time revealed that this would consist of \$100m grant aid from China, \$170m of loans at two per cent interest from the Chinese EXIM-BANK, with a further \$30m coming from the Government of Maldives. By December 2015, the project was officially 'launched' by President Yameen, and announced that the construction works to begin by March 2016. Physical construction works thereby proceeded over the next two years, and the bridge opened in September 2018⁷.
- 1.12 In addition to joining Hulhule to Male' by a bridge, land connectivity also required improving the existing link road between the Hulhule airport and Hulhumale'. A link road had existed prior to the building of a bridge, but that connection was one that only allowed access for public transport or designated taxis. The additional traffic projected as a result of this linkage required further investment for a link road. This was to be undertaken using a further \$30m China Exim Bank loan.
- 1.13 Along with the investment on the bridge and link road, significant private and public investment was also pumped into providing additional accommodation and infrastructure facilities in Hulhumale'. Notable among these included the opening of a private hospital, multiple guest-houses, and various light industry.
- 1.14 The combined effect of these investments has resulted in the population of Hulhumale' growing from the initial 1000 people in 2004 to a resident population of 50,000 in 2019⁸. However, this is still approximately 40,000 less than what was forecast by the HDC's original plans for Phase I, and it is expected a further 120,000 residents will move as part of Phase II⁹. Various plans, ranging from industrial zones, knowledge and IT parks, Yacht Marina and a Tourism Island is planned as part of this Phase II development. In addition, various commitments from existing Government departments and private parties have been quoted by HDC as evidence of employment opportunities that will be available directly on Hulhumale.
- 1.15 Furthermore, Hulhule' airport has been the subject of the most concentrated investment by the government of Maldives in the last 10 years. The need for investment at the airport, the main gateway through which tourists entered the country, was identified as early as 2008. Initially, President Nasheed awarded the airport to the Indian conglomerate GMR in 2010, but this was taken back by the Government of President Waheed in 2012.

5. Following a visit by the Chinese president Xi Jin Ping to the Maldives in September 2014

6. <https://maldivesindependent.com/politics/with-chinese-grants-and-loans-male-hulhule-bridge-inches-closer-to-reality-100706>

7. https://hdc.com.mv/app/files/2021/05/210517_HDC_Investor%20Presentation.pdf

8. Page 16 of the https://hdc.com.mv/app/files/2021/05/210517_HDC_Investor%20Presentation.pdf

9. Page 16 of the https://hdc.com.mv/app/files/2021/05/210517_HDC_Investor%20Presentation.pdf

- 1.16 Subsequently, the government has managed a development program that has seen investments of USD 1 billion, with close to USD 500 million on the airport company's current balance sheet as loans¹⁰ to modernise the airport. The staff of the airport come from the Greater Male' region, and land connectivity provides faster access for the staff. While the time savings might be less than the journey from Male' to Hulhumale', the convenience of the land connectivity is clear. Attracting additional qualified staff to work in the expanded airport would therefore be a direct benefit. Furthermore, the land connectivity also provides significant business and cargo related benefits, enabling more convenient transport to the significant quantity of items arriving by air freight to the country to storage facilities in Hulhumale'. In addition, the growing number of fresh fish processing facilities in Hulhumale' are also able to transport their produce more efficiently via the new road to the airport and airfreight it to various global markets.

10. [https://audit.gov.mv/Uploads/AuditReports/2021/08August/MaldivesAirportsCompanyLimitedFinancialYear2020\(0\)](https://audit.gov.mv/Uploads/AuditReports/2021/08August/MaldivesAirportsCompanyLimitedFinancialYear2020(0)). The value of total loans taken by the Government either directly or indirectly is in the region of USD 900m (see analysis below)

2. Impact Assessment of the Bridge

2.1 It is best practice for an impact assessment of large infrastructure projects to take place prior to the construction of the project¹¹. The Environmental Impact Assessment¹²(EIA) for the Male' – Hulhumale' bridge was the first attempt to conduct such an analysis, but it concentrated primarily on the engineering and environmental feasibility and impact of the project.

2.2 It noted the following broad economic advantages and disadvantages of the project¹³.

Advantages:

- Opportunity to boost economic activities in Male' and Hulhumale through a physical link.
- A more reliable and convenient mode of transport between Hulhumale, Male' and the airport.
- Reduced costs of transport for both the public and commercial sector.
- Direct and indirect employment opportunities.

Dis-advantages:

- Money diverted from more immediate social needs in the Male' region such as waste management, upgrading hospitals and social housing as well as increase in national debt of "\$170 million" loan for the project.
- Project could become a 'white elephant' if the planned airport upgrade does not happen on time.
- Traffic congestion in Male' and Hulhumale and increase in accidents.
- Adverse environmental impacts.
- Public concerns about disruption from the construction period – local land traffic in Male' area as well as sea traffic in the bridge area.
- Further migration from outer atolls to Male'.

2.3 Overall, the document noted that:

*"In summary, the presence of a bridge will be a welcome boost to the economic activities and mobility between Male' and Hulhumale'. Its economic and social benefits are expected to be extremely positive in the long run. However, the bridge **may not be considered an immediate necessity at this state of development in the Maldives, given the numerous more urgent investments required in the social and economic sector. Thus on economic and social grounds, the "no-project" option is viable in the short-term.** However, given that the bridge is a presidential election campaign promise by the present Government and since bilateral negotiations with the Chinese Government is at an advanced stage, the "no-project" option is not viable on political grounds"*¹⁴


11. See for example guidance from the UK Government on Impact Assessment – section 4.8 - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938046/The_Green_Book_2020.pdf

12. Environmental Impact Assessment of the Proposed Hulhule Male' Bridge Project. Prepared by China Shipping Environment Technology, China and CDE Consulting Maldives. Page 196 Available online at <https://www.yumpu.com/en/document/read/55255708/hulhule-male-bridge-project>

13. As above, pp 195

14. Ibid pp 195



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- 2.4 The authors of the report therefore implied that the forecasted budget spent may have been better spent on other “more urgent investment”, but they do not outline what these alternative investments are.
- 2.5 It is instructional therefore that while the above advantages and disadvantages were listed, an economic cost-benefit analysis was implicitly regarded as being unnecessary given the decision to go ahead with the bridge was made on ‘political grounds’. No attempt at the benefits of the project was undertaken at the evaluation stage.

Overall approach to cost-benefit analysis taken in this study

- 2.6 The starting point of any impact assessment is to identify the ‘with’ project impact and the ‘without’ project counterfactual. This latter refers to the societal outcomes that would realistically have happened in the absence of the land-based connectivity between Male’, Hulhule’ and Hulhumale’.
- 2.7 To clarify this further, we would need to identify three categories of events and their associated costs and benefits:
- A. Outcomes / events, including additional spending, that happened as a direct result of providing land connectivity
 - B. Outcomes / events, that would have likely happened irrespective or unrelated to providing connectivity
 - C. Outcomes / events that would have happened as an alternative to the transport solution that the bridge would have provided (e.g. potentially enhanced / additional marine transport services)
- 2.8 The overall approach taken in this paper is that developments in Hulhumale’ island itself, including the various expansions under the different phases, fall into category (b) outlined above. However, all individually discernible spending on the land connections into Hulhumale’ will form as part of the costs associated with this project. Notably, this means that the cost of upgrading the link road between Hulhumale’ and Hulhule airport is to be included as part of the costs.¹⁵
- 2.9 Identifying part (c) above is perhaps the most speculative element of the counterfactual. One view of this could be an enhanced sea transport option, possibly the development of larger roll-on-roll-off ferry system with easier movement for all types of vehicles. This latter would require significant investment (ferry terminals, ferries, maintenance facilities... etc), and estimating either the costs or the potential benefits of such a scheme is outside the scope of this study. However, it is likely that the time for travel between Male’ and Hulhumale’, as well as the convenience / personal control over journeys time, would continue to be better for land travel compared to even an enhanced sea transport option.

15. However, this was not a truly greenfield project given that there already existed a land connection between Hulhule and Hulhumale’ prior to the bridge, the \$30m cost is likely to be an under-estimate of the true cost of connecting the two islands.



- 2.10 As a result, the counterfactual assumed in this analysis is the continuation of the pre-bridge “dhoni” based ferry system as the primary means of transporting people and goods between the three islands (Male, Hulhule’ and Hulhumale’).
- 2.11 In a standard cost benefit analysis, the overall benefits and costs of a project will be calculated for each year of the project, and the net benefit per year would be added up using an appropriate discount factor. However, this methodology is not possible here because there are no publicly available information on a number of components:
- A. Details of the loans taken (interest rates and period of loan)
 - B. High proportion of grant component in the total cost of the project
 - C. Maintenance costs of the bridge and related infrastructure
 - D. Expected benefits (in terms of time savings, jobs generated, changes in land-value)
- 2.12 Therefore the approach taken in this study would be to estimate indicative annualised costs (based on assumed loan conditions), and provide indicative benefits based on other publicly available information

"With" Project Impact

The Costs of the Bridge

- 2.13 To undertake the cost analysis, we need to understand both the capital construction cost of all components of the infrastructure, as well as the operating costs associated with that infrastructure. As noted above, we are including the costs associated with both the bridge and the refurbishment of the Airport – Hulhumale’ Link Road.
- 2.14 As originally reported in the media, the financing of the bridge alone had three components; a grant component from the government of China, a low interest loan component from the Chinese Export Import bank and financial contribution from the Maldivian government. It was originally reported that the loan value would be USD 170 million, but this was prior to the feasibility of the project. According to the latest Finance Ministry data, the loan associated with the bridge is significantly lower than this amount, at Chinese Yuan 455.6 million or USD 68 million¹⁶.
- 2.15 In the 2019 budget document¹⁷, explanatory text is provided outlining the total construction cost of the bridge. In addition to the bridge, further development took place on the link road connecting the airport (Hulhule’) and Hulhumale’ island. This was funded through a USD 31m loan from the Industrial and Commercial Bank of China (ICBC)¹⁸.

16. Available at <https://www.finance.gov.mv/public-finance/debt-management/debt-statistics> . Note even the Environmental Impact Assessment referred to above mentioned a loan value of USD 170 million, but the latest debt figure implies the loan is at \$68m. This difference may be a result of potential savings that were achieved between the initial MOU stage and the final implementation stage.

17. <https://www.finance.gov.mv/public-finance/national-budget> - 2019 Approved Budget Book (Dhivehi version) P103

18. <https://www.finance.gov.mv/debt-management/debt-statistics> - outlined in the file “Active Sovereign Guarantees”

	Component	Source of Finance	Cost Estimate USD
1	Bridge Loan Amount	China EXIM Bank	72 million
2	Grant Assistance	Chinese Government	108 million
3	Airport-Hulhumale Link Road Upgrade	Industrial and Commercial Bank of China	31 million
4	Government of Maldives Finance Contribution	Government of Maldives	13 million
	Total Estimate		224 million

2.16 The total capital costs associated with the bridge is therefore estimated at USD 224m. Excluding the grant component, the true ‘cost’ of the bridge to the Maldivian public is USD 116m.

2.17 To what extent the grant assistance components should be counted as a true cost is a matter of debate and context. This is not a cost that the country is burdened with in terms of future payments. The benefits therefore do not have to justify or balance these costs. However, ignoring these costs would not provide a sufficiently robust grounds through which to compare the project to other projects.

2.18 There is however less clarity over the maintenance costs associated with the bridge. No direct figure for this is included in official figures. To understand this better, we have therefore consulted with industry experts as well as government sources, and we estimate the maintenance cost of the bridge to be USD 5m per year.

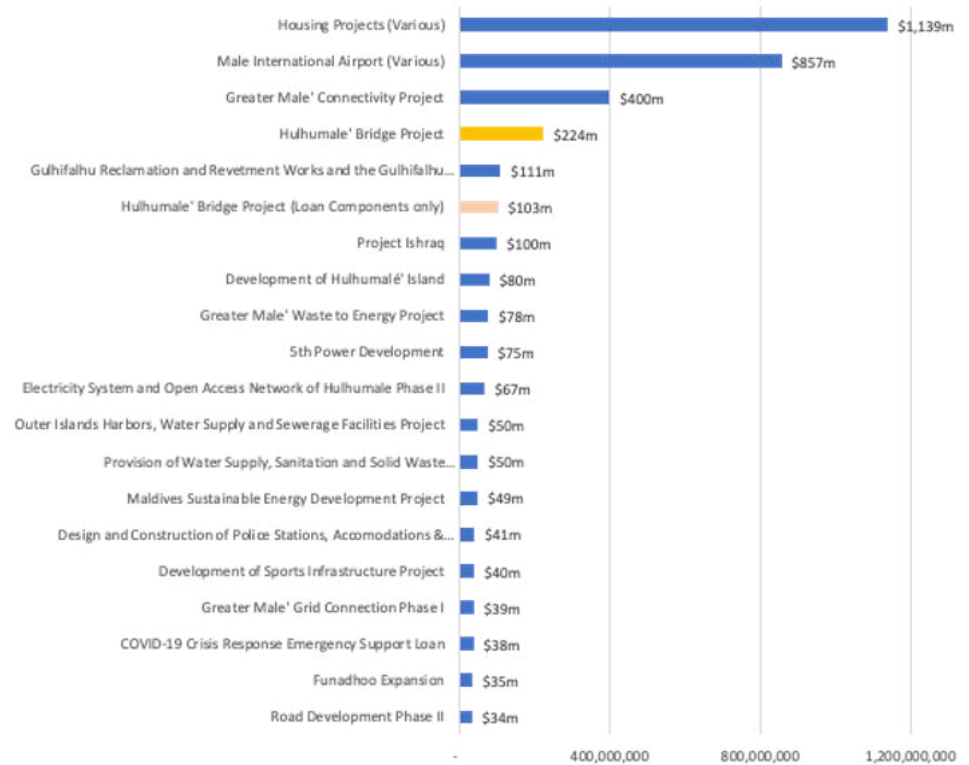
Capital Costs in Context

2.19 The above capital costs can be put in context by comparing it to the loan portfolio/government projects currently being undertaken by the Government¹⁹.

19. Projects funded through external loans directly to the Government of Maldives, or to State Owned Enterprises on which Sovereign Guarantees have been provided

3. Capital Costs in Context

Figure 2: Comparing the bridge project to other government loans



3.1 The largest portfolio of loans currently on the Government’s books is the construction of housing units, the vast majority of which is in Hulhumale’ island. Over USD 1.1 billion of loans have been taken for the construction of at least 26,000 housing units, spread across 13 separate projects. The second largest portfolio of loans are the 10 loans taken by the Government for the upgrade of the Airport, valued at c. USD 860 million. In contrast, the entire Hulhumale Bridge Project costs (including grant component) is \$224 million, but the loan component is less than c.8-9 times that of the airport.

3.2 This is important because as outlined above, the Hulhumale’ Bridge Project is an important enabler for the success of both the airport and Hulhumale’ real estate. These two elements combine to account for over USD 2 billion of loans, which makes up 32% of the USD 6.2 billion foreign loans taken by the Maldivian Government. Therefore, one could argue that the bridge project is a key success factor for almost 1/3rd of the current Maldivian projects undertaken using debt.

- 3.3 The other important factor that emerges from comparing the Hulhumale Bridge project to the existing loan project portfolio is the comparison with the Grater Male' Connectivity Project. This refers to the additional bridges and related infrastructure between Male' and the western islands of Thilafushi and Gulhifalhu financed by the Indian Government. Currently this is expected to be undertaken on a loan value of over four times that of the Hulhumale' Bridge project²⁰. While the distance covered by this bridge is longer, it must be noted that no publicly available cost-benefit analysis of the project currently exist.



20. <https://economictimes.indiatimes.com/markets/stocks/news/exim-bank-to-provide-400m-for-maldives-project/articleshow/80868835.cms>



Establishing Annualised Costs

- 3.4 As outlined above, the precise financing terms of the components of this bridge is not in the public domain. Therefore, the aim here is to establish the annualised cost of a capital project under assumed project costs. More specifically, the exercise will aim to establish how much the country would have to pay for principal and interest payments for the project, had it been undertaken under various funding scenarios. This provides a more reasonable estimate from which to compare the project to either total private sector expenditure, or public sector expenditure that the government undertakes.
- 3.5 In addition to looking at an estimate of how the project was actually funded, we also look at what would have been the costs if the project were funded through alternative mechanisms or scenarios.
- 3.6 In particular, we look at the hypothetical situation in which this project did not receive the grant component from the Chinese government. This provides an indication of the total annual amount saved due to the grant, but also provides insight as to how much such a project would have to benefit in order for it to be undertaken on a more realistic or commercial basis.
- 3.7 In our base case scenario, we look at a representative set of lending terms of the China Export Import Bank loans, i.e. 20 year loan term with an interest rate of 3.6%²¹. This also compares to publicly available information on loan terms provided by China to Maldivian State Owned Enterprises, which have been noted in their Audit Reports.
- 3.8 For the local government component, we assume the interest rate on this would be similar to rates the Government can borrow on the open market. The most relevant such example was the “Sunny Side Bond” issued by the Government in 2017, which had a coupon rate of 7% per annum.
- 3.9 The total capital costs annualised over a 20 year period is equal to USD 8.5 million. Adding a further USD 5 million of maintenance costs puts the total annual cost of the bridge at USD 13.5 million per year.

21. Based on Data from <https://www.aiddata.org>



	Component	Cost Estimate USD	Annual Cost (Base Case)
1	Bridge Loan Amount	72 million	5.1 million
2	Grant Assistance	108 million	0
3	Airport-Hulhumale Link Road Upgrade	31 million	2.2 million
4	Government of Maldives Finance Contribution	13 million	1.2 million
Capital Cost per year			8.54 million
5	Maintenance Cost		5.0 million
	Total Cost		13.54 million

3.10 In the following scenario, we look at the total costs had it been financed without the grant component, which was instead financed through concessional loans. Under this scenario, the project would have an annualised cost of USD 21.2 million per year.

	Component	Cost Estimate USD	Annual Cost (Base Case)
1	Bridge Loan Amount	72 million	5.1 million
2	Grant Assistance	108 million	7.6 million
3	Airport-Hulhumale Link Road Upgrade	31 million	2.2 million
4	Government of Maldives Finance Contribution	13 million	1.2 million
Capital Cost per year			16.2 million
5	Maintenance Cost		5.0 million
	Total Cost		21.2 million

3.11 The third scenario looks at how things would be if the government had undertaken the entire project without access to concessional loans and using government bonds instead. Using the 7% annual borrowing costs, this implies a total capital cost of USD 21m, which comes to a total annual cost of USD 26 million.



3.12 The final scenario we look at is if the project was procured using purely private financing. While in the context of the Maldives, this may sound unrealistic, private financing of large infrastructure projects through public-private partnerships is a common model used elsewhere. Furthermore, we have also noted that large private investments in the Maldives have taken place that are of greater magnitude than the bridge project. This scenario therefore provides an indication of how much annual revenue would be required for the private sector to finance this.

3.13 Under this scenario, using the Bank of Maldives lending rate of 11%, the project would have an annual capital repayment cost of USD 28 million, and a total annual cost of USD 33 million.

3.14 The following table summarises the various annualised costs under the various scenarios

Base Case	Scenario 2 (No Grant)	Scenario 3 (All Government)	Scenario 4 (All Private)
USD 13.5m	USD 21.2m	USD 26.1m	USD 33.1m

3.15 While these hypothetical scenarios may appear unlikely, they are useful to provide additional colour on the value of the bridge. Second, the alternative scenarios, when combined with the benefits below may also help to provide additional colour on the value of the bridge. For example, if the quantifiable annual benefits from the bridge are equal to USD 33 million per year, we could potentially argue that the benefits are sufficient to even justify the project as a private enterprise. For example, if further research shows that a willingness to pay, combined with the increase in traffic on the bridge and roads, is of a value equal to USD 33 million, then the bridge project would have even been viable as a private initiative²².

3.16 Furthermore, note that the above is for a period of twenty years, when it is quite reasonable to expect that the total life-span of the bridge will be considerably longer than this period. In other words, the above annualised costs are expected to cover the capital costs (and routine maintenance) costs of the bridge for twenty years. However, given that the bridge will likely last significantly longer than 20 years, the annual benefits over the initial twenty years does not necessarily have to equal these costs for the project to be of value. For the purpose of this analysis however, we have assumed a 20 year life-span as this represents the term of the majority of the financing of the project.

22. Even if this is a benefit that could not have been forecast and therefore would have been highly unlikely to have happened in the year that it did.

4. Measuring Benefits

- 4.1 There are two broad categories of benefits that are often considered in transport investment appraisals. The first attempts to quantify the “user” benefits the ‘with project’ world compared to the ‘without project’ world and refers to the benefits for those who use the infrastructure. The second category looks at the wider economic benefits that come from the increased travel that is taking place due to the infrastructure – i.e. benefits not directly related to the usage of an infrastructure as such.

User Benefits

- 4.2 To calculate user benefits, one would need three overall elements. First, the total number of journeys made in the two ‘with’ and ‘without project’ worlds. Second, the monetary value of the journey to the passengers, either through a toll they pay or through a willingness to pay survey. An alternative to this could be a monetised value of time per passenger, and the time saved in the journey between the ‘with’ and ‘without’ project world.
- 4.3 The project feasibility study forecasted the following traffic (in passenger car units²³) on the bridge²⁴:

Table 3: Daily vehicle movements assumed in the EIA

Daily Vehicle Movement (PCU)			
	2018	2024	2032
Automobile Equivalent	3,314	5,924	7,218
Bus	285	536	658
Motorcycle	5,465	9,598	11,818
Total	9,064	16,058	19,694

- 4.4 We can use the above traffic forecasts to estimate the total number of annual vehicle and passenger movements on the bridge for the next 20 years²⁵. This is shown below (by type of journey)

23. Relative measure of different types of vehicles where a normal car is traditionally assumed to be a 1, while heavier vehicles like trucks are greater than one (e.g. 4). The precise scoring mechanism used in the study is not available and therefore broad international standards of these have been used.

24. Bridge Feasibility Project: pp 18 Table 2.1

25. As well as using standard estimates of PCU / vehicle ratio, straight-line forecast between the years mentioned in the feasibility report, as well as assumptions on number of passengers per type of vehicle, and growth rate.

Table 4: Table 4: Forecast of traffic based on the EIA


Vehicle Journeys (Millions)	2020	2025	2030	2035	2040
Cars / Equivalent	3.82	5.55	6.29	7.03	7.77
Bus	0.67	1.01	1.15	1.28	1.42
Motorcycle	7.49	10.81	12.33	13.85	15.37
Total Passenger Journeys	11.98	17.37	19.77	22.17	24.56

- 4.5 In order to check the reasonableness of the above forecasts, a starting point would be to measure actual traffic figures on the bridge since opening. Data on this is however not available from public statistics²⁶.
- 4.6 However, by looking at data on ferry transport between Hulhumale' and Male' before and after the bridge, along with estimates based on domestic air travel and number of airport workers, we can establish that the above 12m starting estimate is a reasonable, and perhaps even a conservative, estimate of actual total traffic journeys that is taking place on the bridge today²⁷.
- 4.7 As can be seen, the traffic of the bridge is largely expected to more than double between 2020 and 2040. In light of the significant growth potential that Hulhumale' holds, and HDC's own projection of a population of 120,000 people by the end of the Phase II, this too can in fact be regarded as a conservative assumption.
- 4.8 As with the actual traffic data, there is no data or research on willingness to pay. Therefore, monetising the benefit of the above traffic flow to compare to the costs is not possible. This makes conducting a conventional cost-benefit analysis very difficult. What we can get are therefore only indicative cost per user based on the annualised costs outlined for the various 'build' scenarios.
- 4.9 This shows that on average, over the course of a twenty year period, the project is estimated to result in approximately 20 million journeys per year. The base case costs scenario results in an annualised cost of USD 15.54m per annum, which therefore implies a per journey cost of USD 0.68 per journey. Naturally, if the bridge results in higher actual traffic, the per journey costs is likely to reduce.
- 4.10 Without a willingness to pay survey, there is little indication as to whether this USD 0.62 per journey is either too high or too low. Therefore, we can only arrive at indicative estimates of the value of the bridge to the population.

26. Senior government officials and HDC officials interviewed as part of this research also did not have the figure on hand and did not believe there were mechanisms in place to measure this.

27. As outlined in the overall principles of cost-benefit analysis section, a true impact assessment would look at the marginal increase in traffic on the bridge versus what would have happened via the alternative in the counterfactual world. For simplicity we have assumed here that all of the increase in travel that is seen on the bridge is primarily a result of the bridge itself. While it is perhaps reasonable to estimate that some of that increase would have happened in the counterfactual world of "only ferry" travel, we have assumed that the magnitude of increase in traffic between the destinations is a direct result of the bridge and link-road.




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- 4.11 To start with, according to the latest Household Income and Expenditure Survey of the Maldives, there are approximately 42,000 households in Male', with 2.7 income earners per household. The average income per household in Male' is approximately MVR 38,600 (or \$ 2,498) per month. This implies that total "household" expenditure in Male' is approximately \$1.3 billion per annum.
- 4.12 This puts the overall annual cost of the bridge under the base case scenario at approximately 1% of total expenditure of those living in Male', (i.e. USD 13 million / 1,300 million). Even the hypothetical scenario 3 (private model) cost of USD 26 million puts the figure at 2% of total expenditure. Not including the fact that this only relates to private household expenditure, this represents a very small percentage cost for the transformative nature of the project on everyday life in Male'²⁸. Absent a formal willingness to pay survey, one question to consider would be to see if households in Male' would pay between 1% and 2.2% of their total expenditure a year to get the benefits of the bridge.
- 4.13 A second way in which to consider the potential 'value' offered by the connectivity would be to consider the annual costs as a percentage of the overall government spending. This in turn is an indication of the willingness to pay by a population for their collective needs. The approved budget for 2022 in the Maldives is MVR 37 billion (or USD 2.4 billion). The annual cost of the bridge therefore represents 0.54% of the national budget under the base case scenario. Even if we assume that the entire project was financed (excluding grant component) as per scenario 2, this still represents less than 1% of the total state budget for 2022. If we look into individual components of the 2022 budget, the annualised costs of the bridge represents approximately 8% of spending allocated to just the "Transport" related recurrent expenditure.
- 4.14 Therefore, in the context of the willingness to pay, it is not unreasonable to estimate that land connectivity between Hulhumale' and Male' represents a relatively small amount of existing expenditure.

Wider Economic Benefits

- 4.15 Estimating wider economic benefits of the bridge relates to the multiplier effect on the economy as a result of the bridge, in terms of jobs and income generated. Given the lack of data, conducting a comprehensive multiplier effect is not possible. However, it is possible to outline the qualitative process through which the impact of the bridge is likely to benefit the economy.
- 4.16 As outlined above, it must be noted that Hulhumale' as a real-estate asset existed irrespective of the land connectivity with Male'. What it has allowed is more convenient access, thereby making the island more attractive as a place to live and conduct business.

28. Note the analysis presented here only looks at 'current' real income. In the future, it is not unreasonable to assume that incomes in the country will increase (both real and nominal), but absent any long-term income forecast, we have not included this in our analysis. It is not unreasonable to assume that even real income in the future would be greater than today, and with the project having fixed interest payments, we can assume that the cost of the bridge as a percentage of real income would fall even further in the future.

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- 4.17 Given that Male' continued to be the area where most people and businesses were based, the land connectivity had the effect of providing additional land to a very crowded island. As a result, one would expect real estate prices in Male' to reduce, thereby resulting in a redistribution of wealth from landowners in Male' to landowners in Hulhumale'.
- 4.18 For businesses, this has resulted in additional land at lower cost, allowing light industrial activities to start and flourish in Hulhumale'. For individuals, this has meant the availability of additional apartments, but now within reasonable commuting time from Male'. Furthermore, businesses have also invested in cafés, restaurants and other retail outlets, providing additional sources of jobs, income and ultimately growth.
- 4.19 Quantifying these impacts has been difficult for two reasons. Firstly, the bridge has been open for a relatively short period of time. Second, the last two years have seen the impact of COVID and economic activity has been duly impacted from it.
- 4.20 There is however very strong anecdotal evidence emerging that Hulhumale' has certainly started to equal Male' as a destination for locals to live in. This comes from the latest rounds of auction for sea-front property in Hulhumale' in 2022. When the first plots of beach front property in Hulhumale' was auctioned around 2010, the price of the properties were in the range of MRF 900 per square foot. By 2017, prior to the construction of the bridge, prices of new beach front property auctioned for MRF 4000 per square feet²⁹. In 2022, after the construction of the bridge, and the first after which the bridge opened, property prices were in excess of 7500 MRF per square feet³⁰. The 26 plots of land, ranging from 1,600 to 2,600 square feet was estimated to have earned HDC MRF 422 million (or approximately USD 27 million), and local media reports HDC as expecting to earn a further MRF 574 (USD 37 million) from the remaining 34 plots of land.
- 4.21 It must be noted that land value in Male' has remained at approximately MRF 6,000 per square foot during this period. Therefore, the latest bid is perhaps the first time in which land in Hulhumale' has exceed that of Male'. It may therefore signal the start of a period in which Hulhumale' is the more preferred real-estate destination of the two islands.

29. <https://maldivesindependent.com/business/government-offers-land-for-sale-in-hulhumale-126201>

30. <https://psmnews.mv/en/96703>

5. Environmental Cost


- 5.1 As shown in Table 4 above, land connectivity is likely to add an additional 20 million journeys by 2030. While some of this replaces ferry transfers, the net effect is clearly a significant increase in carbon emissions due to land transport.
 - 5.2 Forecasting carbon emissions into the long-term becomes difficult due to assumptions about future fuel efficiencies of vehicles. Furthermore, forecasting the wider carbon footprint that emerges from the wider economic activity generated by the bridge is outside the scope of this project.
 - 5.3 This is further complicated by the building of the bridges connecting the western part of Male' to Villingili and Thilafushi. It is yet unclear how traffic will move once this stretch of connectivity is built.
 - 5.4 However, what is clear is that there will be significant increases in vehicle movements. This has important implications for the country in two important ways.
 - 5.5 First, there has to be significant attention paid on how to attract more people on to public transport. Currently, while there is a bus service popular on the route between Male' and Hulhumale', the primary method of traffic movement has been through private vehicles (motorcycles and cars). More attention would have to be paid on greater use of public transport in the next phase of infrastructure development.
 - 5.6 Second, the primary means by which other countries chose to make their private transport 'greener' is to electrify the vehicles. However, the Maldives currently has little energy generation through non-fossil fuels. Therefore simply changing the make-up of their vehicles from fossil fuels to electricity would not be sufficient to mitigate the impact. Rather, wholesale generation of electricity through more renewable sources would be required.
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6. Conclusions and Policy Objectives

Key Findings

- The Hulhumale' bridge is a vital and transformational infrastructure asset that appears to provide a solution to a key problem that Maldives has faced: overcrowding of the capital city. It was delivered on time with little apparent delay.
- The total cost of the Hulhumale Bridge and related infrastructure is estimated at USD 224 million. Of this USD 108 million was provided as grant assistance, while the remaining was funded through concessional finance.
- The bridge is also closely related to the viability of loans that amount to 1/3rd of the country's loan portfolio – i.e. the development of the country's main international airport and the significant loans taken to build housing on Hulhumale'.
- The annual cost of repaying the loans is forecast to be c. USD 7m per year for 20 years. There is no publicly available information regarding the maintenance cost of the bridge, and we have assumed this to be c. USD 5 million per year. This puts the total annual cost of the bridge at approximately USD 13.5 million per year.
- The original environmental impact assessment estimated an average of c. 20 million journeys per year for the period. Therefore, the total per journey costs are in the range of \$0.68 per journey.
- Without a formal 'willingness to pay' survey, it is difficult to estimate whether this is a reasonable amount. Instead, what we can do is estimate what this means in terms of overall private household spending in Male'. This puts the annual cost of the bridge at between 1% and 2.2% of private sector spending.
- An alternative way to look at it would be as a proportion of total government spending. This was estimated at USD 2.7 billion for 2023³¹ and thus the annualised cost of the bridge represents less than 0.5% of the total budget. This is estimated to go even lower for future years.
- Estimating the wider economic impacts of the bridge is challenging given the lack of data. However, a useful indicative result is the change in land prices in Hulhumale' immediately before and after the opening of the bridge. Beach front land prices in Hulhumale' have increased by 87% between 2017 and 2021, and land prices there now are comparable, if not marginally higher, than in Male'.

31. <https://www.finance.gov.mv/National-Budget>

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- Estimating the carbon impact of the bridge is also challenging, especially in light of the bridge being built to the west of Male' and its resulting impact on overall traffic movements. However, without attention to switching more transport from private to public, as well as making existing private transport greener, the carbon impact from the infrastructure is likely to be significant.

Policy Considerations

- There appear to be no direct government agency that monitors traffic over the bridge. This is an important determinant of not just the overall viability of the project, but also issues related to the maintenance and repair of the bridge. Furthermore, future governments may want to explore the potential of having a user-charge over the bridge (for example for heavy goods vehicles) and this would require greater monitoring of the traffic and movements of the bridge.
 - The lack of any criteria or guidelines on the measuring of the costs and benefits prior to undertaking a large project such as this is of concern. While the technical analysis of the project was considered, the economic analysis was an afterthought. The authors even maintained that this was decided on 'political' grounds and therefore any economic analysis was regarded as unnecessary.
 - While in this instance, the project does appear to have a broadly positive impact and provide value for money, having little to no economic impact assessment prior to approval is worrying. The overall regulations on the consideration of large investment projects, particularly ones that involve taking on additional sovereign debt, would significantly benefit from a requirement for independent economic analysis. This is in line with international best-practice.
 - The environmental costs of the bridge can be significant and plans to mitigate this should be thought through from early on. In particular, attention on how to move more traffic to public transport and how to make existing private vehicles greener will need to be prioritised if the country is to achieve its carbon neutrality goals.
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