

would involve a metro tunnel linking Malta to Gozo as part of a national underground system.

Having been involved in major infrastructural projects in the UK, I have experienced the approach taken to infrastructure public transport projects overseas. Even though such projects are considered highly complex to implement, they are deemed achievable if based on detailed studies that clearly spell out the long term socio-economic and environmental benefits.

From a strategic perspective, it is evident that a physical connection between Malta and Gozo should not be seen in isolation but part of a nationwide public transport system.

Car Tunnel vs Metro Tunnel

There are two main strategic options available to form a permanent link between Malta and Gozo - either a vehicular connection for private cars or a metro connection forming part of a nationwide mass-transit system.

A car tunnel between Malta and Gozo will necessitate very long ramps either end of the tunnel to allow cars to drive down to the tunnel level under the channel, practically doubling the amount of land required for the under-sea tunnel itself.

This inherently makes a vehicular crossing from Nadur to Manikata costlier pro-rata and of larger detriment to the environment. It creates vehicular bottlenecks at either end of the tunnel, further putting strain on the existing road transport system, whilst causing considerable further pollution to the already poor air quality.

In contrast, a metro system would be predominantly at the same depth, gently dipping under the channel and having vertical access via lifts and escalators at metro stations to allow passengers to reach the train platforms; thus taking up less space pro-rata when compared to the car tunnel.

A metro tunnel link to Gozo would be an extension of a national mass transit system, thus providing an efficient, seamless, connection between Gozo and strategic nodes in Malta – including Malta International Airport (MIA), Mater Dei Hospital, University of Malta, and Valletta.

It would capture the densest zones of population (urban centres, tourist hotspots and business centres) with the shortest possible length of metro, and would consist of a single metro line, without the need of changing trains to reach any destination. The proposed metro stations would be located in urban centres – for example close to the bus terminus at Victoria (Gozo).

Project Finances and Cost per Trip

Car tunnel

By making comparative studies to other vehicular tunnels it is anticipated that the 13 km car tunnel currently proposed by the government between Malta and Gozo will cost approximately €700 Mn to build. There will also be additional costs likely amounting to approximately €30 Mn per year in inspections, operation and maintenance costs.

If an average of 6,500 vehicles will use the car tunnel every day (i.e. nearly 2.37 Mn vehicle trips per annum), the cost per vehicle to use the car tunnel on a 100-year return period is likely to be approximately €30 per return trip.

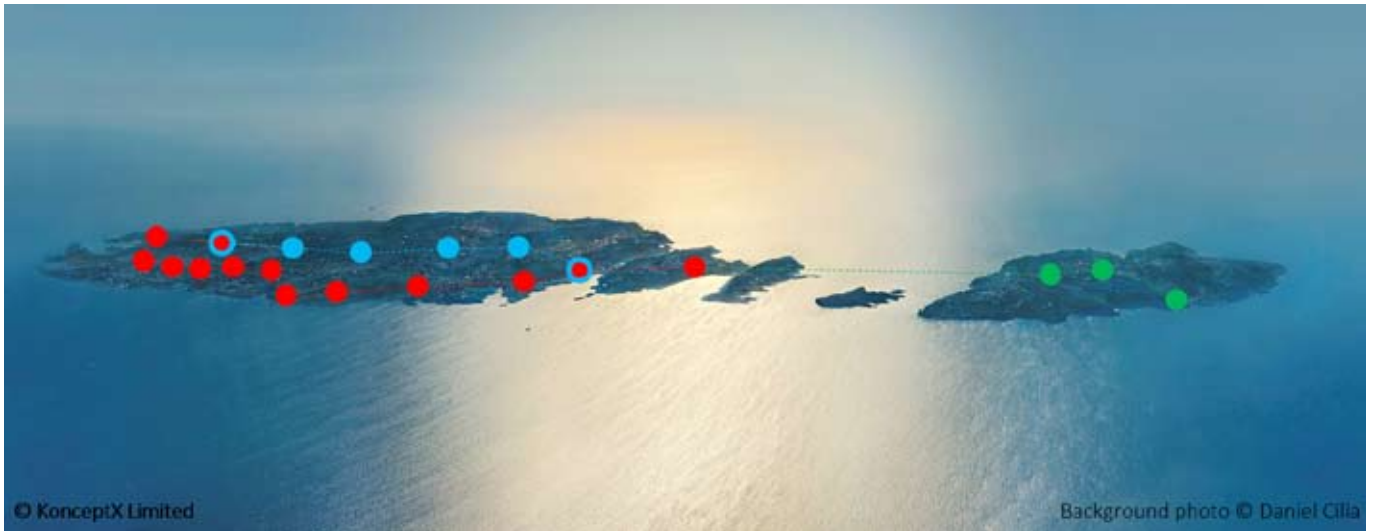
The cost per trip would be higher when one factors in the present value of decommissioning and other whole-life cycle costs. Unless funded by tolls, this will entail an ongoing capital cost to the government, paid by the taxpayer.

As a comparative study, the current toll to cross the 12.87 km long Fréjus vehicular tunnel between France and Italy is €58.80 one-way and €73.90 return (2020 figures). Similarly, the current levy to drive through the 11.61 km long Mont Blanc vehicular tunnel between France and Italy (used by ~ 5,000 vehicles per day) is €46.30 one-way and €57.80 return (2020 figures).

Both these tunnel projects were relatively easier to construct than the proposed undersea car tunnel proposed between Malta and Gozo.

The Malta metro

Even though the capital expenditure required for a national underground system would be more than a car tunnel between Malta and Gozo, the metro



KonceptX Malta metro system proposal – aerial photo.

would connect all Malta and Gozo, rather than just provide a localised link.

The entire metro project, including the anticipated 40 trains, would cost approximately €4 Bn.

Part of the capital costs of the metro link between Mellieha and Gozo (approximately €675 Mn) could be eligible for EU funds (e.g. Ten-T programme). €1.575 Bn would be financed by government bonds with maturity over 20 years. The remaining €1.75 Bn would be paid by the national coffers, amounting to €175 Mn per annum over 10 years, which is roughly the same amount the country has been spending per annum in road widening schemes in the past few years.

Assuming a local population of 500,000 and 2.5 Mn tourists per annum (i.e. same amount of tourists as 2019), and only one in four using the metro for a return trip every day, then this amounts to nearly 53 Mn people using the metro every year. This figure is deemed conservative when one considers that nearly 54 Mn people used public transport buses in Malta in 2018.

Based on this conservative estimate of annual ridership using the metro, the target revenue from ticketing would amount to €245 Mn per annum - based on a typical fare of €2 per metro trip (and capped at, say, €5 per day for unlimited daily use of the metro).

Revenue from advertisements on trains and stations, and from leasing space in stations for retail would generate a further €55 Mn per annum.

The total target revenue would therefore amount to €300 Mn per annum.

Considering maintenance costs on the whole metro system of €75 Mn per annum, energy costs of €15 Mn per annum, operating costs of €40 Mn per annum and a further contingency of €20 Mn per annum, the cost to run the metro would amount to €150 Mn per annum.

Given target revenue of €300 Mn per annum and costs of €150 Mn per annum, and considering €40 Mn per annum to service the government bonds, the payback period to cover the full capital cost would be only 30 years.

The payback period would be halved to 15 years if one considers other indirect cost savings, notably reduced loss of productivity (due to less time wasted by commuters in traffic) which would amount to nearly €75 Mn per annum, smaller health care costs due to drop in chronic respiratory illnesses (due to less pollution in environment because of reduced number of cars on the roads) and ameliorated well-being of population (due to reduced stress of commuters from being stuck in traffic).

In addition to the hundreds of workers involved in building the entire system, the metro would create direct employment for well over a thousand people, in addition to considerably more indirect employment to cater for complementary services.

Duration to Build the Metro

The metro would consist of a single line and built in three phases, using two tunnel boring machines.

The first phase, linking Mellieha to MIA via St Paul's Bay, Bugibba/Qawra, Pembroke/Paceville, St Julian's, Sliema, Msida (Mater Dei Hospital and University of Malta), Valletta, Paola, Tarxien, Zejtun and Birzebbuga would be 25 km long with 13 stations, taking 5 years to construct.

The second phase, linking MIA to St Paul's Bay via Qormi, Mriehel, Birkirkara and Mosta would be 10 km long with 4 stations, taking a further 2 years to build.

The third phase, linking Mellieha to Gozo, would be 15 km long with 3 stations, taking another 3 years to construct.

Detailed studies (including geotechnical, environmental and archaeological studies)

would take 5 years prior to commencement of construction works. A total duration of 15 years from commencement of studies to completion of entire metro system.

Thus, if the studies were to start tomorrow, the bulk of the metro (i.e. Phase 1) would be ready in just 10 years' time.

Speed and Efficiency

The proposed metro would address the key challenge facing Gozitans – that of being able to commute to key destinations in Malta quickly and reliably, and as importantly of being able to return to Gozo rapidly at the end of the day. Irrespective of weather conditions.

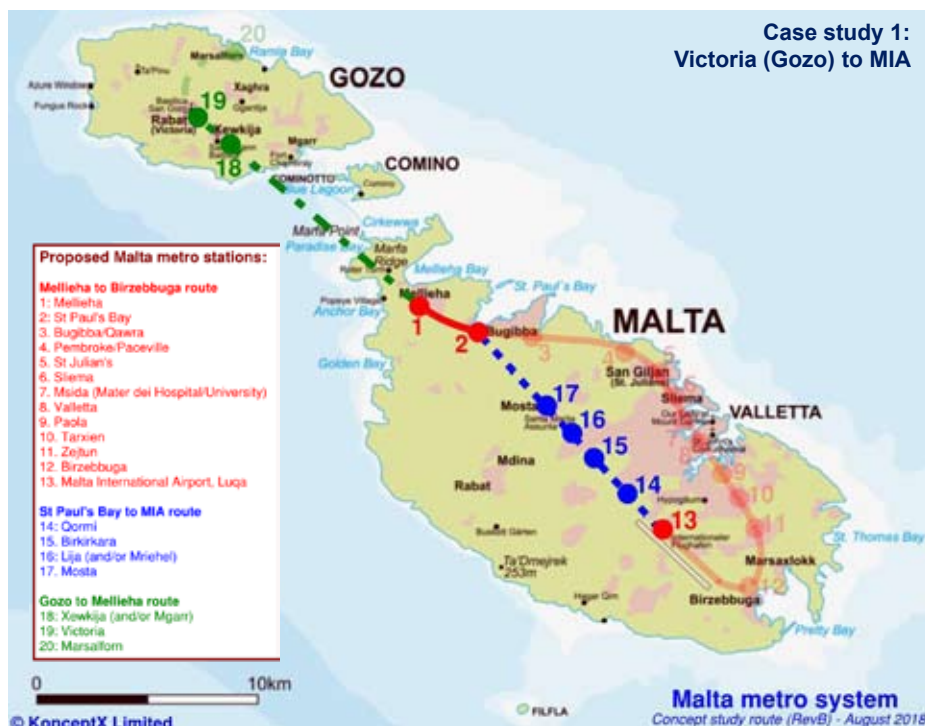
It would take merely 32 minutes by tube from Victoria Gozo to the airport (MIA), and just 36 minutes from Victoria Gozo to Mater dei Hospital/ University, with a train departing every 5-10 minutes.

Case study 1:

Victoria (Gozo) to MIA:

32 mins.

- Victoria – Xewkija: (2km), 2.5min
- Xewkija – Mellieha: (12km), 9min
- Mellieha – St Paul's Bay: (5km), 4.5min
- St Paul's Bay – Mosta: (5km), 4.5min
- Mosta – Lija: (2.5km), 3min
- Lija – Birkirkara: (2km), 2.5min
- Birkirkara – Qormi: (2km), 2.5min
- Qormi – MIA: (3.5km), 3.5min



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Duration by metro from Victoria (Gozo) to Malta International Airport.

Case Study 2:

Victoria (Gozo) - Valletta:

36mins.

- Victoria - Xewkija: (2km), 2.5min
- Xewkija - Mellieha: (12km), 9min
- Mellieha – St Paul’s Bay: (5km), 4.5min
- St Paul’s Bay - Bugibba: (2.75km), 3.5min
- Bugibba - Paceville: (6km), 5.5min
- Paceville – St Julian’s: (1.5km), 2.5min
- St Julian’s - Sliema: (1.5km), 2.5min
- Sliema - MDH/UoM : (1.5km), 2.5min
- MDH/UoM - Valletta: (3km), 3.5min



Duration by metro from Victoria (Gozo) to Valletta.

This would eliminate the need of Gozitans relocating to Malta to work or study there, thus encouraging Gozitans to remain in the sister island, helping revert the brain drain which has trickled steadily out of Gozo over the past decades.

A metro link to Gozo would also enhance the sister island's vision as an eco-island destination, allowing tourists to reach the island directly from the airport after landing and spending a quality holiday in Gozo.

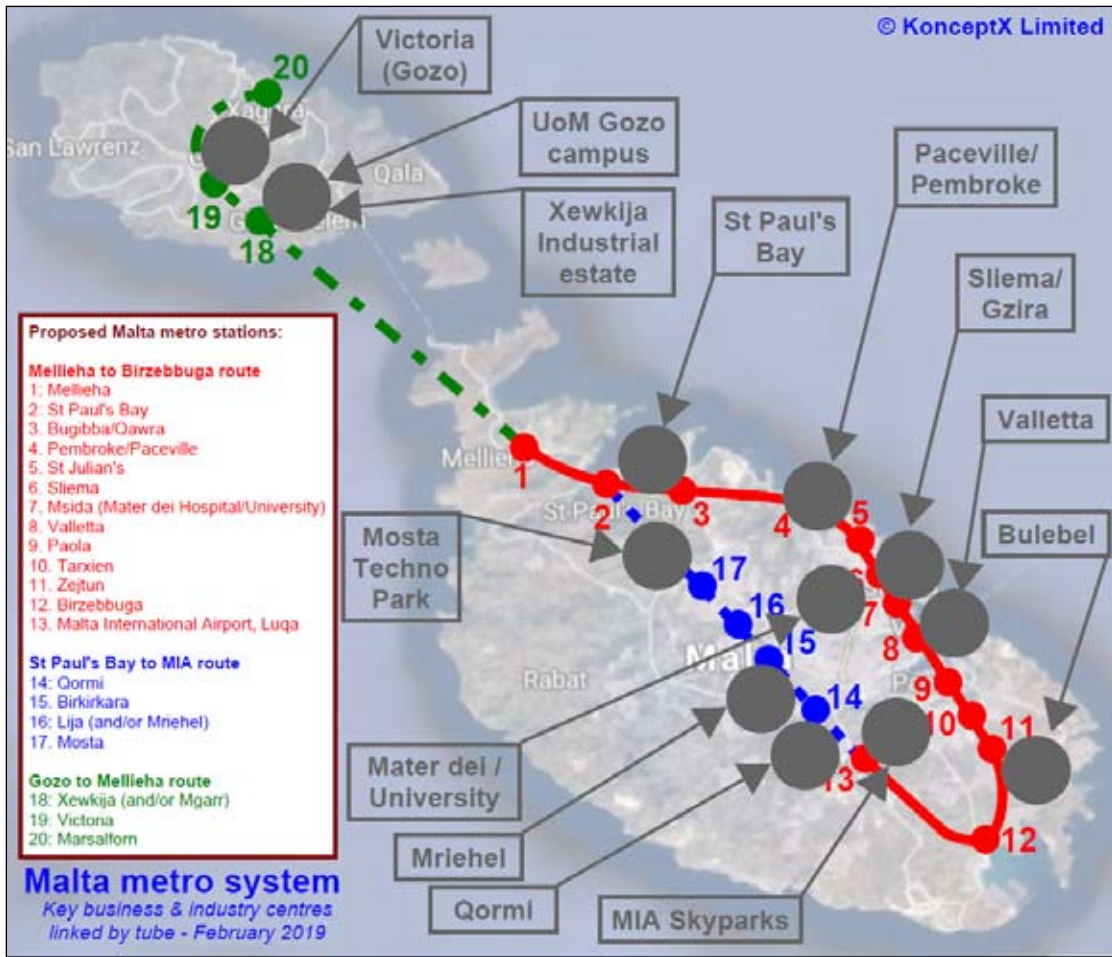
Projects like the Bart's Hospital in Gozo would take a pivotal regional dimension once the metro is up and running. This key hospital would be linked physically to Mater dei Hospital in Malta, just over half an hour commute away. The same principle would apply to UoM Gozo campus. The metro link to Gozo would also encourage businesses to set up offices in Gozo, with possible target government tax incentives to encourage businesses to open there.

On the other hand, the car tunnel currently proposed by the government would likely limit the maximum speed to ~ 30 km per hour during the crossing, which would entail over 25 minutes to drive from Nadur to Manikata, to then join the slow-moving, polluting, traffic when one emerges from the car tunnel; thus making door-to-door commute during peak times easily over an hour and a half – which one can argue would hardly be any improvement time-wise from the current situation faced by Gozitans to cross to Malta, and considerably more expensive to do so than existing.

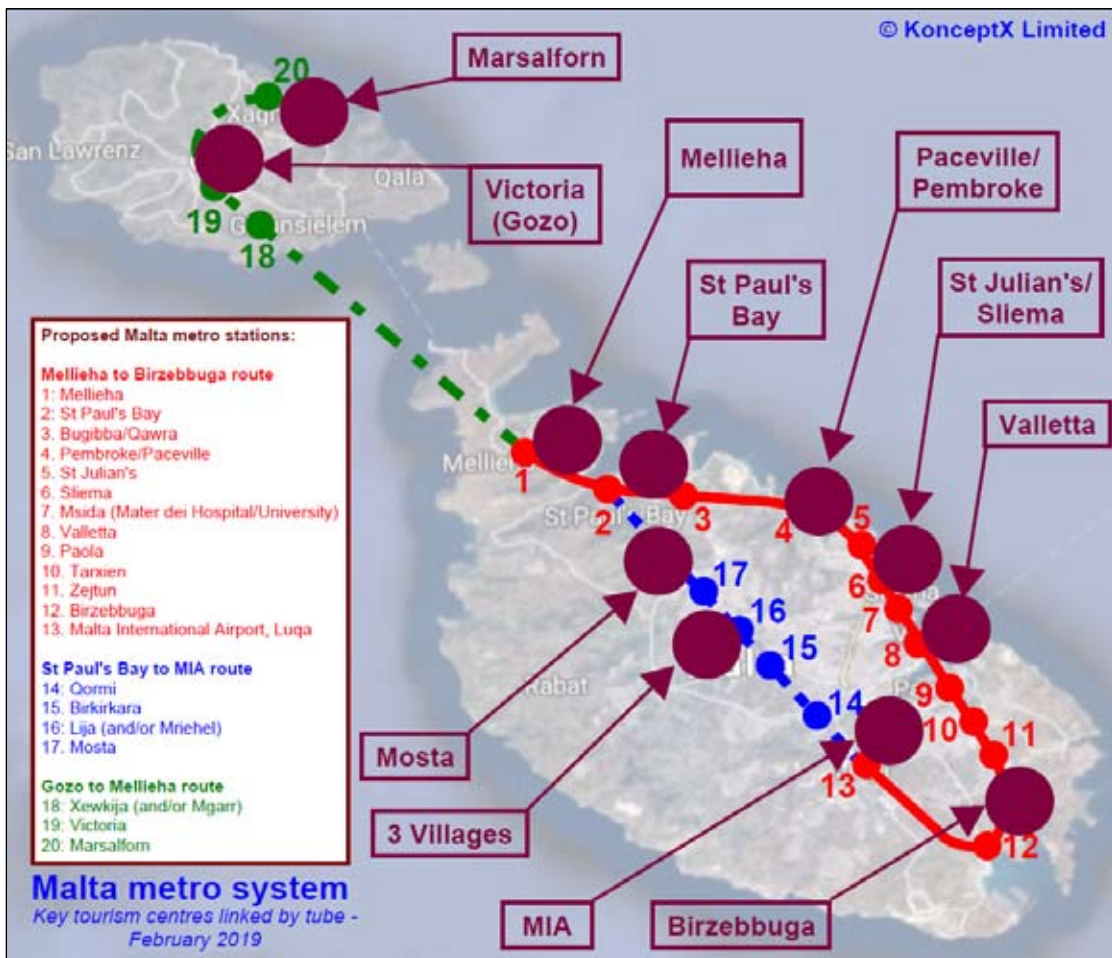
A 36-minute €2 trip by metro from Victoria Gozo to University of Malta, say, is thus much faster, cheaper, convenient and healthier to Gozitans than the car tunnel alternative.

Multi-Mode Transport Systems

The proposed metro would supplement other modes of public transport, including ferries, buses and



Key business nodes connected by metro system proposal.



Key tourism nodes connected by metro system proposal.

cycling. The complementary nature of a mass transit system with other forms of public transport would entail a likely increase in demand for ferries across harbour regions, and also between Malta and Gozo - particularly for freight transport and vehicles.

The national bus framework would be reconfigured as a system of shuttle non-stop buses on dedicated bus lanes from metro stations to other towns not on the tube line. For example, Three Cities to Paola, Rabat (Malta) to Mosta, Siggiewi to Qormi, Naxxar to Mosta.

Furthermore, free bicycle rental hubs would be located close to metro stations, similar to schemes adopted in London, Paris and other major cities. Free electric shuttle ‘cabs’ (similar to the ones implemented in Valletta in the past year) would also be available outside metro stations to transport less mobile people to their final destinations.

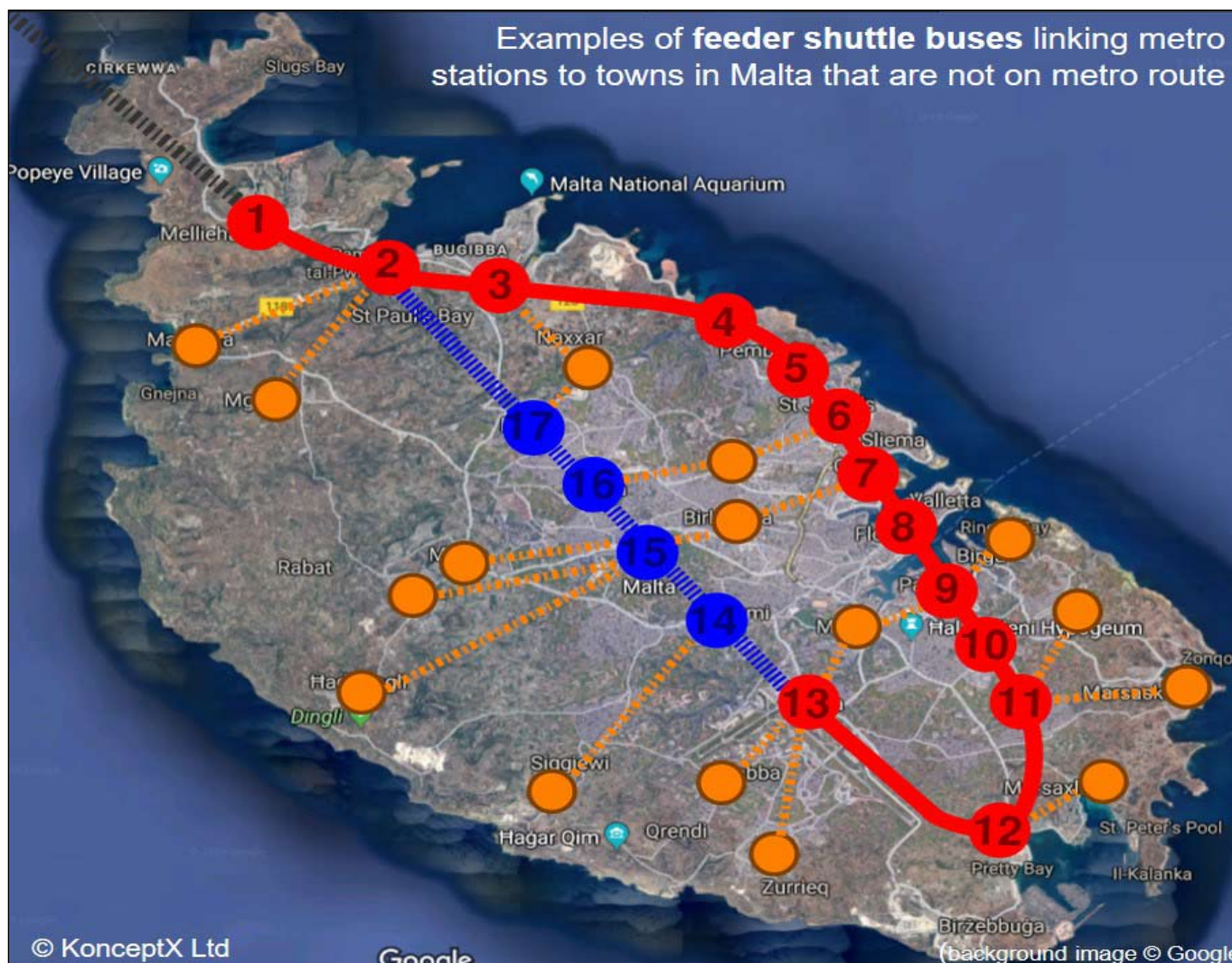
In contrast, the proposed car tunnel will compete with the ferry service, with the latter possibly going

out of service in a relatively short span of time after the car tunnel is completed. There is a risk that Gozo would be cut off, with no connection to Malta, should a fire occur in the car tunnel and the tunnel closed for a few months, if not years, thereafter to carry out necessary renovation works. This is what happened in the Mount Blanc car tunnel which had to close for 3 years for renovation works after the fatal 1999 fire.

Environment, Archaeology and Safety

The metro would be located at roughly the same depth, with no need of ramps, thus for example not damaging the fertile Pwales valley in Malta and the pristine countryside between Mġarr and Nadur in Gozo. The metro would also result in a reduction of cars, with ensuing less pollution and an ameliorated environment.

The metro would be deep enough not to disturb yet undiscovered archaeological remains, and would be



Examples of feeder shuttle bus links from metro stations - Malta.

subject to detailed archaeological surveys before the exact metro route and station locations are confirmed.

The depth of the metro, the predicted ground conditions and the construction methodology used would not affect the structural integrity of the overlying buildings, with only localised pockets of ground stabilisation required, if any. Furthermore, the construction methodology of the tunnels, which forms sealed tubes, would entail negligible impact on the water table.

The metro would be seismically designed, including the subsea tunnel between Malta and Gozo. Strategies for seismic fault crossing have been implemented in more onerous seismic zones along active faults (e.g. recent metro crossing under the Bosphorus Sea in Istanbul).

The risk of a safety hazard (e.g. fire) in the tunnel is proportionate to the number of vehicles crossing and is therefore considerably less with a metro tunnel – as only ten trains would cross the tunnel each way every hour, on average. Furthermore, the risk of a train derailing is significantly less than a car crashing, as the trains would travel on guided rails and be controlled from a central computerised system.

The car tunnel on the other hand will cause irreversible damage to the environment and fertile

agricultural land, with the long access ramps leading to the tunnel cutting into the superficial soils which may contain yet unfound archaeological remains. Furthermore, each car traversing the car tunnel poses a safety risk – i.e. 6,500 risk hazards every day. In the case of a fire, people will need to leave their car and walk considerable kilometres to reach the nearer end of the tunnel. This would be highly distressing especially if one is travelling with children or elderly people.

Construction and Waste

The geology under most of Malta makes tunnelling for an underground metro line less complex, and there are feasible methods of using the inert waste from such projects in environmental friendly measures.

The total amount of inert waste generated would be ~4 Mn m³. Subject to detailed environmental studies, the inert waste could be used for land reclamation to form a nature reserve, similar say to the Mizieb woodland in North-West Malta.

This could be complemented by an offshore wind farm and/or an offshore solar farm with the renewable energy created connected to the grid, thus offsetting the energy demands of the metro system and complementing the sustainability credentials of the whole project.



Examples of feeder shuttle bus links from metro stations – Gozo.

An important case study is the new London Crossrail metro project where 3 Mn tonnes of inert material from excavations were used to create Wallasea Island nature reserve.

Another influential case study is the offshore Kagoshima Nanatsujima Mega Solar power plant in Japan which sits on a platform of reclaimed earth.

The above measures could help transform the Maltese islands into a carbon-neutral island, as a sustainable vision for Malta 2030.

Examples of Metro Systems in Small Cities

Comparative studies were made to other metros servicing cities that are similar or smaller in size to Malta.

Lausanne (140,000 inhabitants) in Switzerland is the smallest city in the world to boast a metro. Its metro is 14 km long with 28 stations. Over 45 million people use the metro every year (2013 figures).

The metro in Rennes (220,000 inhabitants) in France is 10 km long with 15 stations, and having an annual ridership of over 33 million (2013 figures). A new 14 km stretch of new metro line (with 15 additional stations) is currently under construction. Rennes is the second smallest city in the world to have a metro, after Lausanne.

The metropolitan city of Catania (in Sicily, Italy) has 320,000 people. The metro stretches across the most populated parts of the city and is 9 km long with 11 stations. It has an annual ridership of ~ 5.7 million people (2018). The metro is currently being extended.

The metro in Brescia (Italy) is 14 km long with 17 stations, serving a population of 200,000 people. 18 million people used the metro in 2018.

A Promising Future for Gozo, if we Change Course Now

The government recently issued pre-qualification questionnaire (PQQ) for interested tenderers in relation to the currently planned car tunnel

between Malta and Gozo. This PQQ may give the perception that the government's decision on this matter is done and dusted, with no way of altering its course.

However, there is still ample time to revert this decision so that a physical link to Gozo, if it is to be done, would only accommodate a metro tunnel as an extension of a national metro system.

This argument is enhanced by the fact that most of the studies carried out to date by the government for a car tunnel between Malta and Gozo would be of relevance if said tunnel would accommodate a metro instead of cars. The diameter of a metro tunnel would be nearly the same as that for a car tunnel, and the alignment of the undersea tunnel between Malta and Gozo would be nearly the same too.

The government has also publicly stated in the past months that it has commissioned studies for a metro but that this would serve the inner harbour regions in Malta only. It is high time that the government re-evaluates this position so that a proposed metro would connect the main residential, tourist and business zones in Malta, and extend to Gozo. This would then negate the need of a car tunnel between Malta and Gozo.

For the economy and quality of life to keep on thriving in decades to come, Malta urgently needs to invest in vital mass transit infrastructural projects to accommodate mass public transport systems. A Malta metro that extends to Gozo ticks all the right boxes. A car tunnel to Gozo does not fit the bill.

This is the most urgent decision to be taken for Malta's future. A combination of strong leadership and long-term vision is paramount to implement such vital infrastructural mass transit projects.

Dr Konrad Xuereb, is a Director at KonzeptX, an architectural and structural engineering firm with offices in Malta and London. He holds a doctorate in structural engineering/future-proofing buildings from University College London.