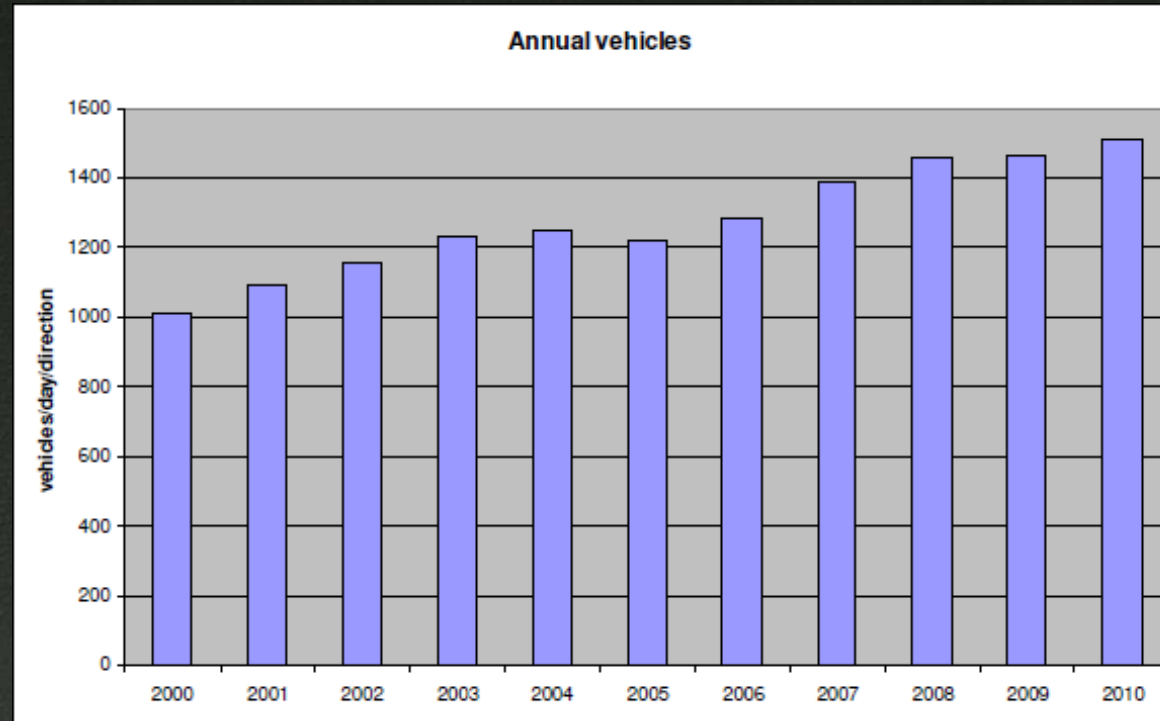


Malta-Gozo Tunnel

April 2012

Ferry Historic Vehicle Demand



- 1500 vehicles / day / direction in 2010
- A tunnel link would reduce the crossing time from 25 mins to 8 mins (car) and ave. journey time reduced by at least 40 mins
- A fixed-link tunnel would increase the demand to cross / transfer of ferry pedestrians to vehicles
- Toll level would affect future demand

Tunnel Vehicle Demand - Forecasts

Year	zero toll	ferry toll	1.5 x ferry toll	2 x ferry toll	3 x ferry toll
2021	4,000	2,700	2,500	2,400	1,600
2031	5,300	3,700	3,500	3,300	2,400
2041	6,900	4,900	4,700	4,500	3,500
2051	9,000	6,400	6,200	5,900	4,900

1 way tunnel daily traffic (AADT) – Base Case

Year	zero toll	ferry toll	1.5 x ferry toll	2 x ferry toll	3 x ferry toll
2021	5,300	3,400	3,100	2,900	2,000
2031	7,600	4,800	4,500	4,200	3,300
2041	10,600	6,600	6,300	6,000	5,100
2051	15,300	9,200	8,800	8,400	7,500

1 way tunnel daily traffic (AADT) – Base Case

- Forecasts based on growth in GDP, no. of Cars and Tourists
- Ferry frequency assumed reduced to 1.5 hr intervals
- Ave time by tunnel 1 hr less than by ferry
- Dangerous goods use ferry
- EU Directive – AADT(15) > 10,000 - then twin bore

Tunnel Construction Methods

a) Bored Tunnels



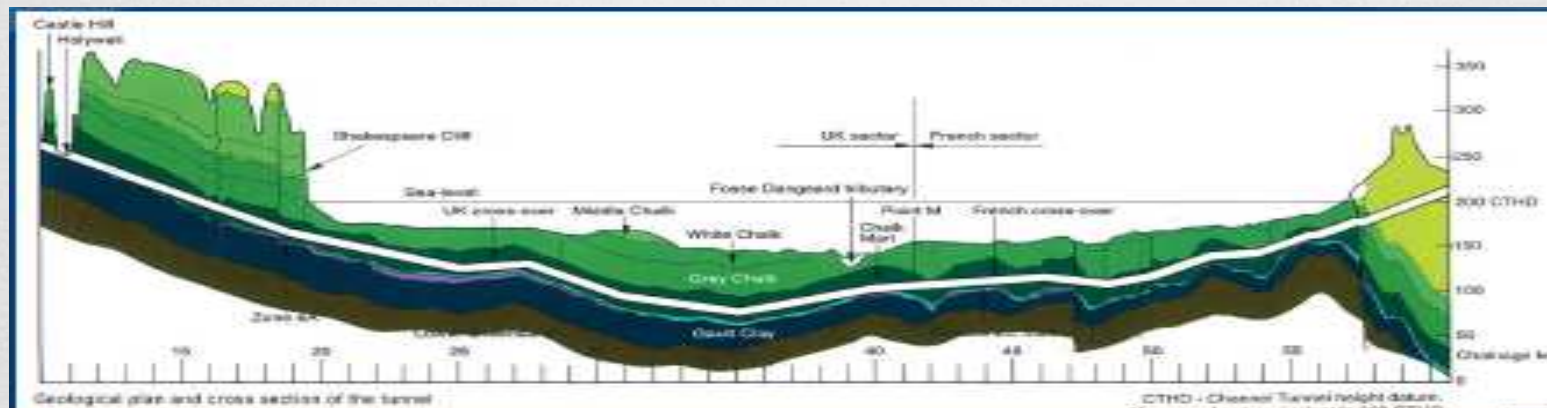
Tunnel Boring Machine



Road Header



Drill and Blast

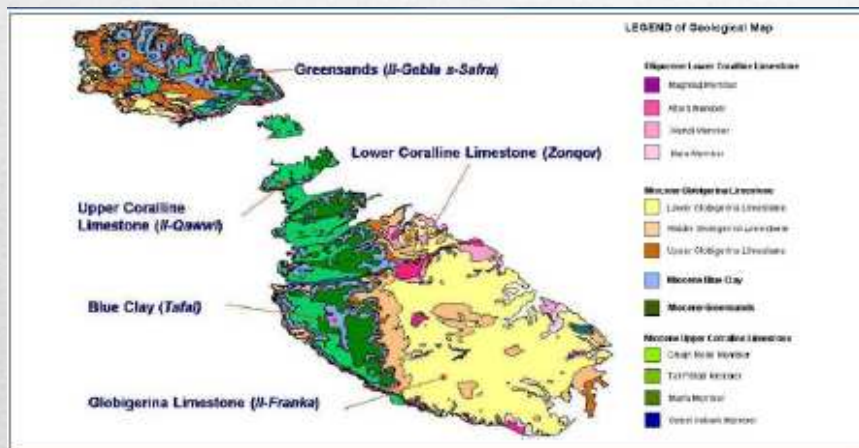




B) Immersed Tunnel Tube



Generally rivers, sea channels & harbours
<50m depth



- Desk study of available geological information and seismic activity reports
- Discussed with geological experts
- Extensive faulting north Malta and south Gozo
- Geological information at depth in channel is not available
- More geological and geotechnical information is needed
- Studies take significant time



Indicative Alignment Options

Option 1

10 km bored tunnel beneath Comino with tunnel portals on the southern slope of the Marfa Ridge in Malta and west of Nadur in Gozo

Option 2

8.2km bored tunnel beneath Comino with tunnel portals on the southern slope of Marfa Ridge in Malta and North of Mgarr in Gozo

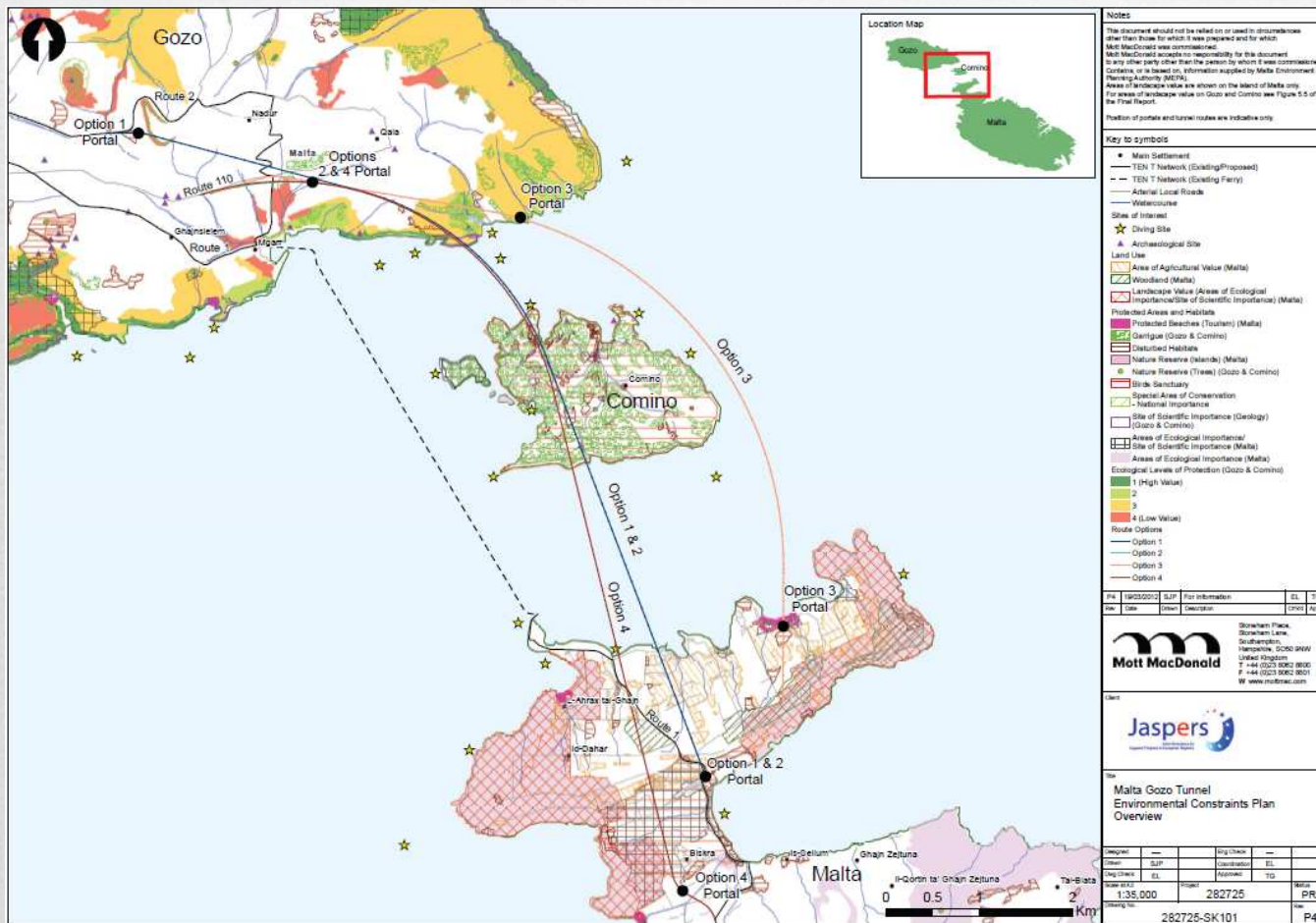
Option 3

6km pre-fabricated immersed tunnel lying partially within the seabed to the east of Comino with tunnel portals near Armier Bay in Malta and Ffondoq ir-Rummien in Gozo.

Option 4

9.2km bored tunnel beneath Comino with portals to the west of Mellieħa in Malta and north of Mgarr in Gozo.

Indicative Alignment Options Environmental Constraints



Bored Tunnels Option 1,2 4

- vertical alignment would be well below the seabed
- main environmental impact would be at the tunnel portal locations

• No impact on the island of Comino

Immersed Tube Tunnel Option 3

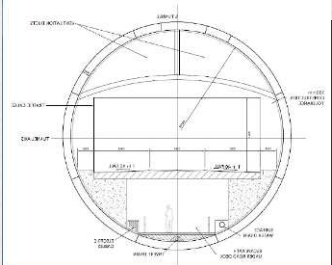
- Impact on seabed
- Disturbance at coast

Tunnel Configuration – One or Two Bore ?

Immersed Tube Tunnel (Option 3)

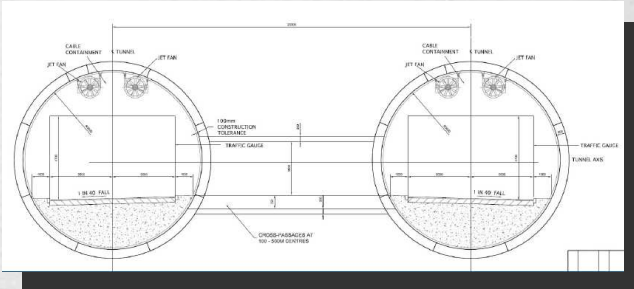
EU Directive 2004/54/EC

– ...for tunnels at the design stage, a 15-year forecast shows that the traffic volume will exceed 10 000 vehicles per day per lane, a twin-tube tunnel with unidirectional traffic shall be in place at the time when this value will be exceeded.



Twin tube tunnel better for :

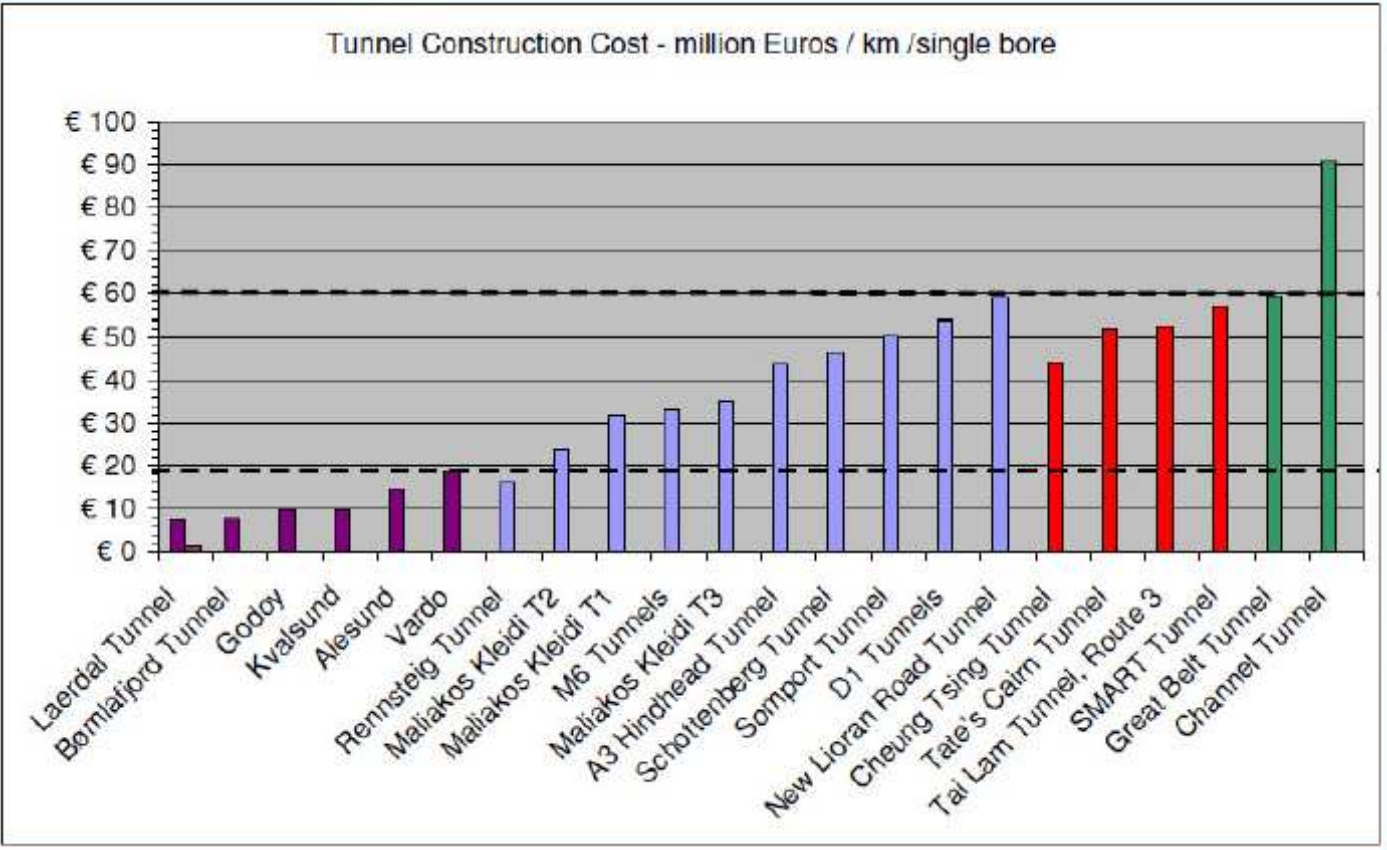
- avoiding head-on collisions
- dealing with incidents
- avoiding complete closure for maintenance
- BUT more expensive.



Fire and Life Safety - Considerations

- Serious Incidents in Europe (e.g. Mont Blanc Tunnel Fire)
- Mechanical Ventilation System
- Emergency exits at between 100m and 500m centres.
- Crossovers at 1500m if 2 bore.
- Public address system.
- Emergency stations at 150m centres containing a telephone and 2 fire extinguishers.
- Fire hydrants for use by the emergency services, at 250m minimum intervals.
- An uninterruptible power source.

Range of Construction Costs



- Large variation of unit costs 9m to 90m Euros / km single bore
- Dependant on a number of factors i.e. geological conditions, tunnel length, contractual, economic and market conditions, regulatory requirements, working practice and local environmental conditions.

Construction Costs for Malta–Gozo Road Tunnel

Option	Type	Length (km)	Cost range (2010 prices)
1	Single bore (3-lane bidirectional tunnel)	10.0	€190m-€600m
	Twin bore (2 lane unidirectional tunnel)		€342m-€1080m
	Single bore(2 lane unidirectional tunnel)		€210m-€620m
2	Single bore (3-lane bidirectional tunnel)	8.2	€156m-€492m
	Twin bore (2 lane unidirectional tunnel)		€280m-€886m
	Single bore(2 lane unidirectional tunnel)		€172m-€508m
3	Immersed tube (twin tube configuration)	6.0	€438m-€684m
4	Single bore (3-lane bidirectional tunnel)	9.2	€175m-€552m
	Twin bore (2 lane unidirectional tunnel)		€315m-€994m
	Single bore(2 lane unidirectional tunnel)		€193-€570m

- Generally considered feasible
- Geology fundamental but largely unknown
- Tolls from tunnel could cover operating cost with significant surplus
- Tunnel could be considered with EU / national grants and / or private sector funding
- Environmental impact on sea bed and coastal landscape on Gozo would make immersed tube tunnel option challenging
- Impact of location of portals needs considering carefully

- Full Feasibility Study of alternative (fixed / non-fixed) link concepts
 - Tunnel
 - Bridge
 - Causeway
 - Upgraded ferry Service
 - Do Nothing
- Malta-Gozo Link is on revised TEN-T and studies eligible for 50% co-financing by EU