KERAJAAN MALAYSIA
JABATAN KERJA RAYA
MALAYSIA

PROJEK MEMBINA JAMBATAN DARI SEMPORNA KE PULAU BUM-BUM, SABAH

PEMBENTANGAN
CADANGAN REKABENTUK KONSEP
September 2013



Agensi Perlaksana:
KETUA PENGARAH KERJA RAYA
JABATAN KERJA RAYA MALAYSIA
IBU PEJABAT JABATAN KERJA RAYA
JALAN SULTAN SALAHUDDIN
50580 KUALA LUMPUR

Jurutera Perunding:
SRS CONSULTING ENGINEER
A-13-1 PLAZA GLORIA
NO 6, JALAN SS7/19
47301 KELANA JAYA
SELANGOR DARUL EHSAN

23 SEP 2013

Objectives

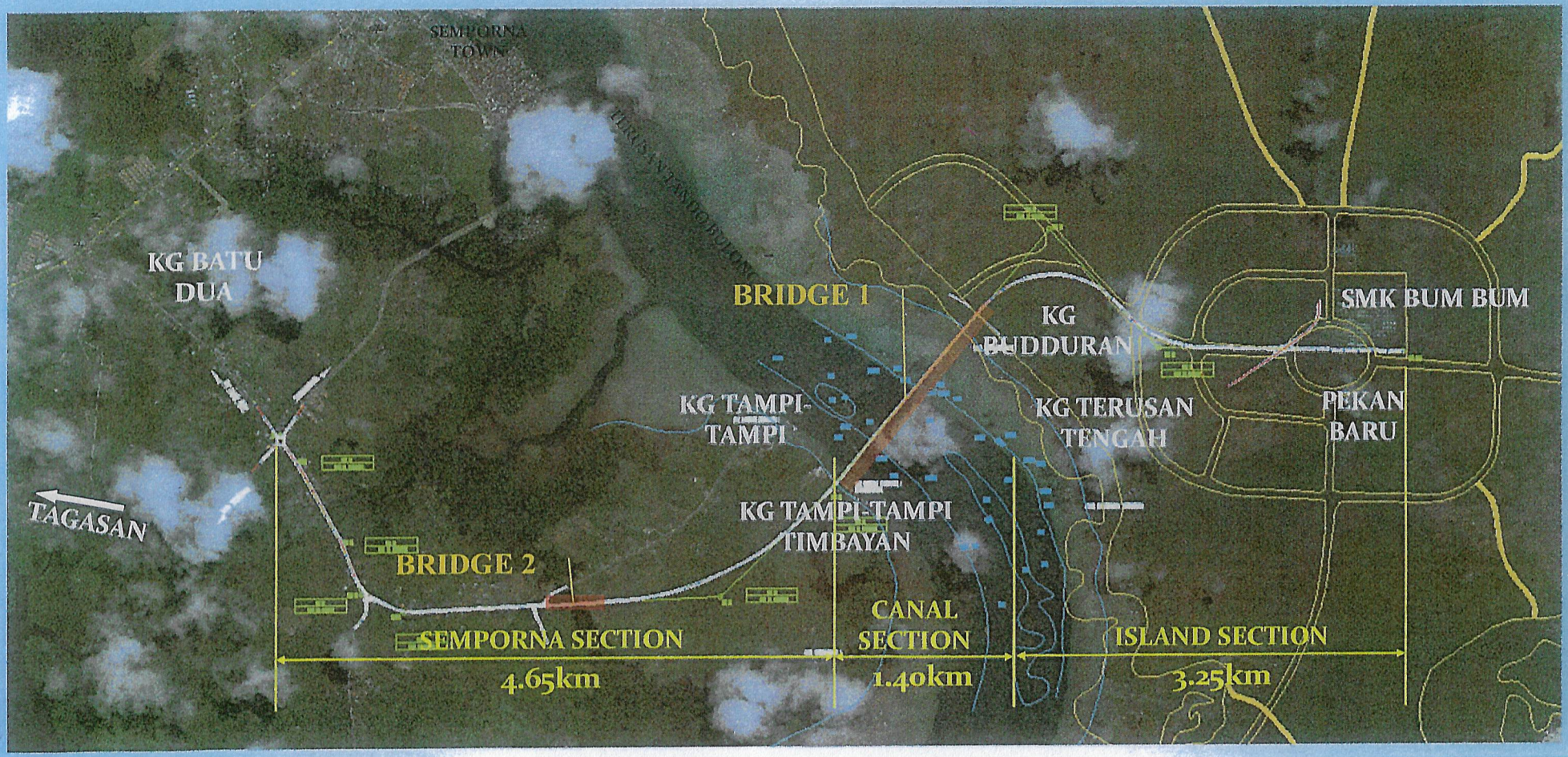
To present road alignment

To select type of bridge



Plan route

- Estimated total length 9.30km
- 2 new bridge, main bridge 1 = 1630m & bridge 2 =250m
- 1 existing roundabout upgrading
- 3 at-grade junctions



Typical section & design standard road classification

Design standard to follow:

REAM-GL2/2002 A GUIDE ON GEOMETRIC DESIGN

Road Classification:

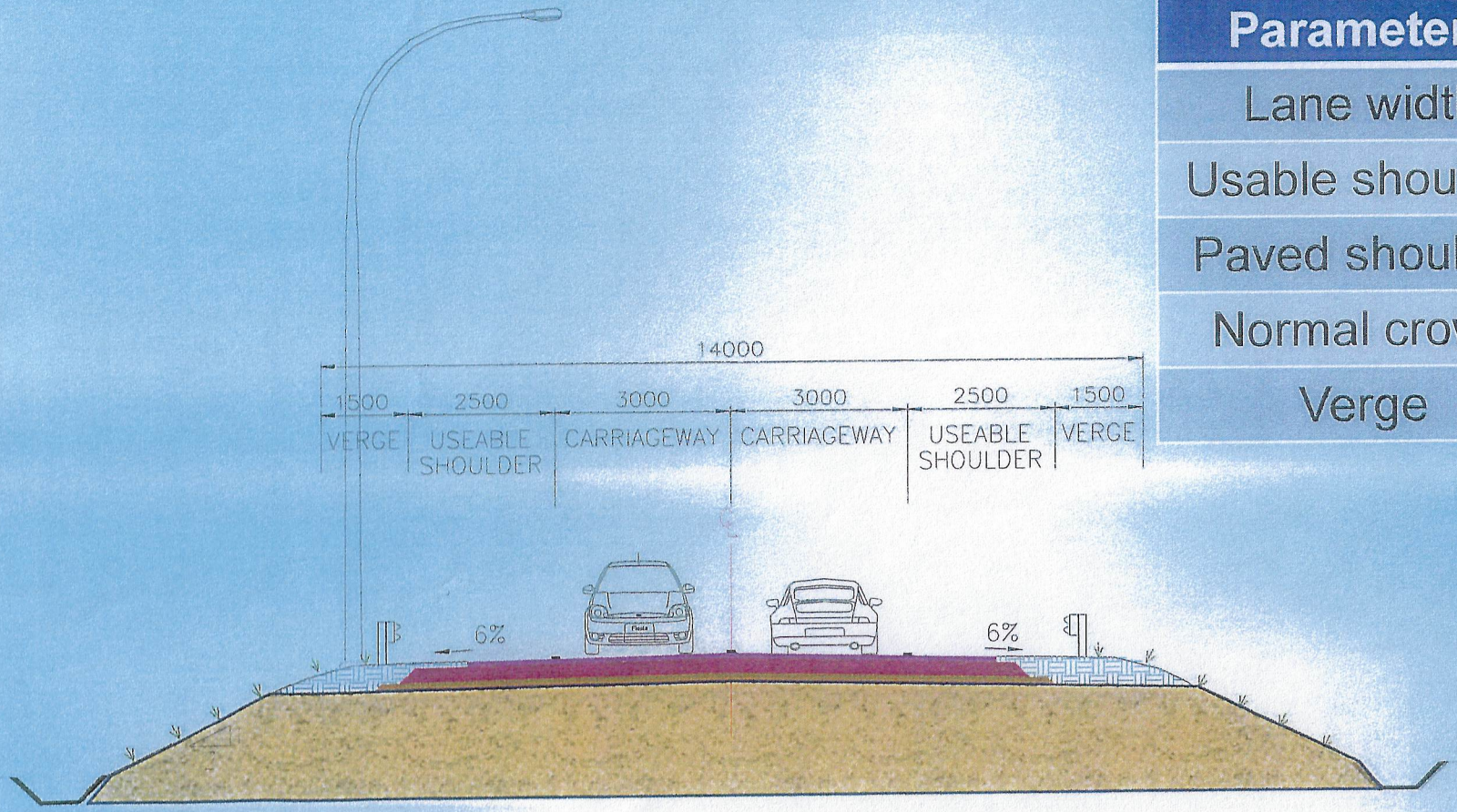
JKR R3

JKR R5 (bridge section)

Design Speed proposed at 80km/hr

Typical section & design standard road classification

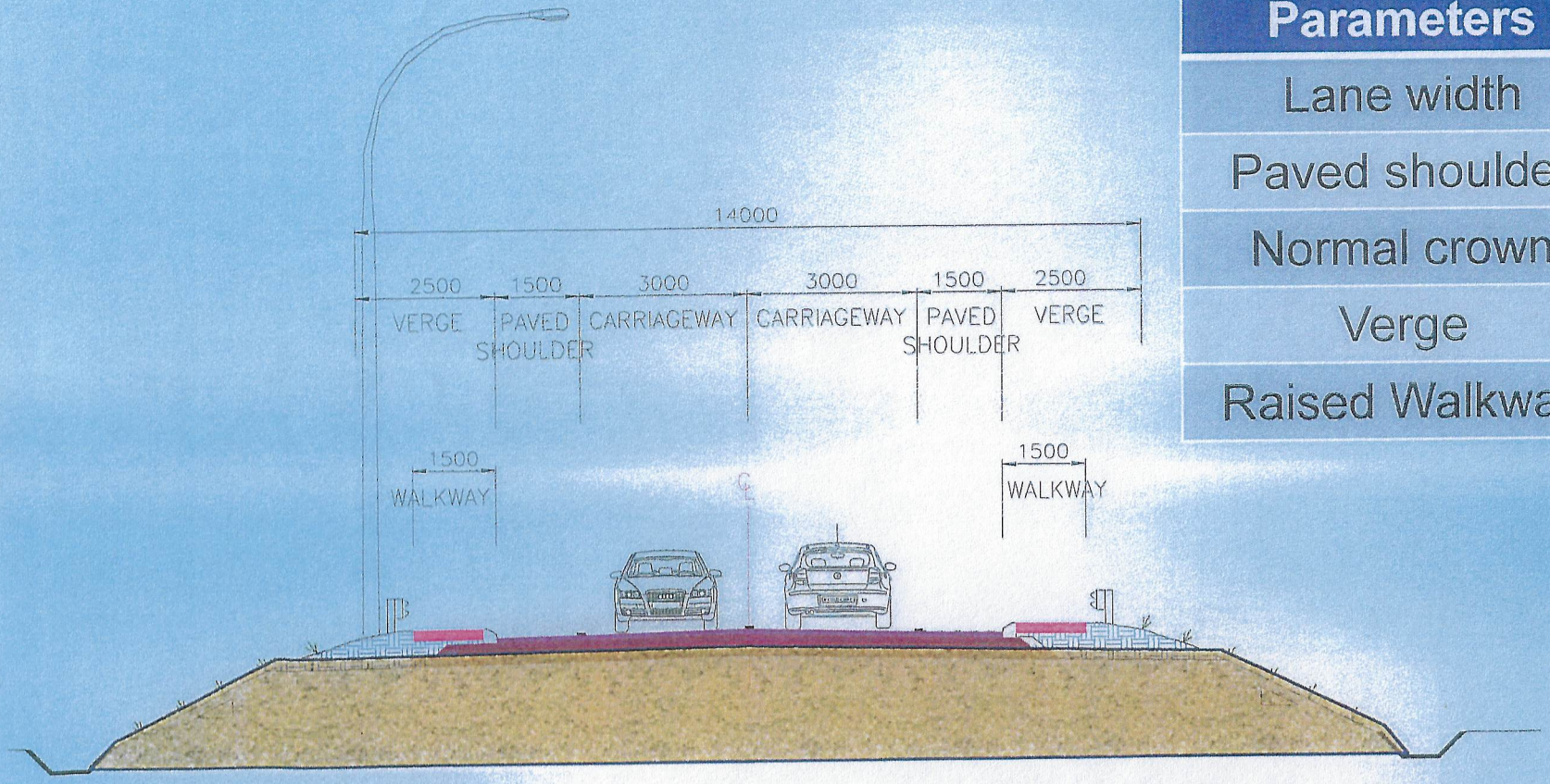
Cross section Parameters	Width
Lane width	3.00m
Usable shoulder	2.50m
Paved shoulder	1.50m
Normal crown	2.50%
Verge	1.50m



Typical main road concept

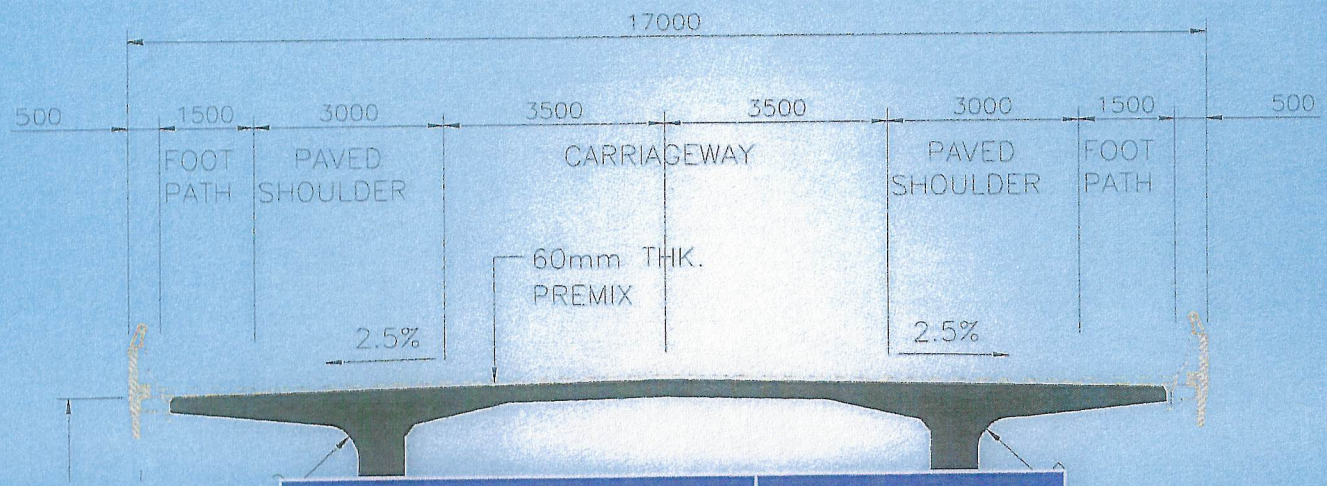
Typical section & design standard road classification

Cross section Parameters	Width
Lane width	3.00m
Paved shoulder	1.50m
Normal crown	2.50%
Verge	2.50m
Raised Walkway	1.50m



Typical main road & walkway concept at built-up areas

Typical section of bridge deck



Cross section Parameters	Width
Lane width	3.50m
Shoulder	3.00m
Footpath	1.50m
Normal Crown	2.50%

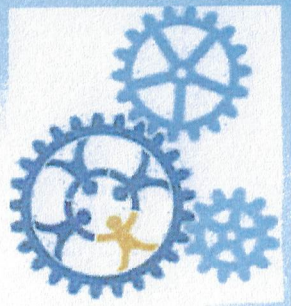
***note : The bridge deck width was decided after meeting with District Officer of Semporna.**

Selection Criteria

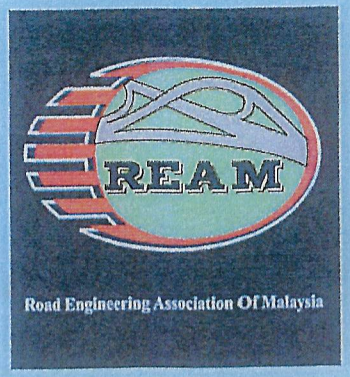
The selection on the type of structure for the proposed bridge shall be based on :

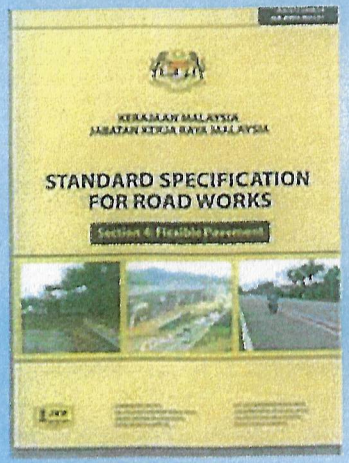
- Functional suitability
- Constructability
- Impact on environment
- Logistic and Material Availability
- Cost of construction



Functionality





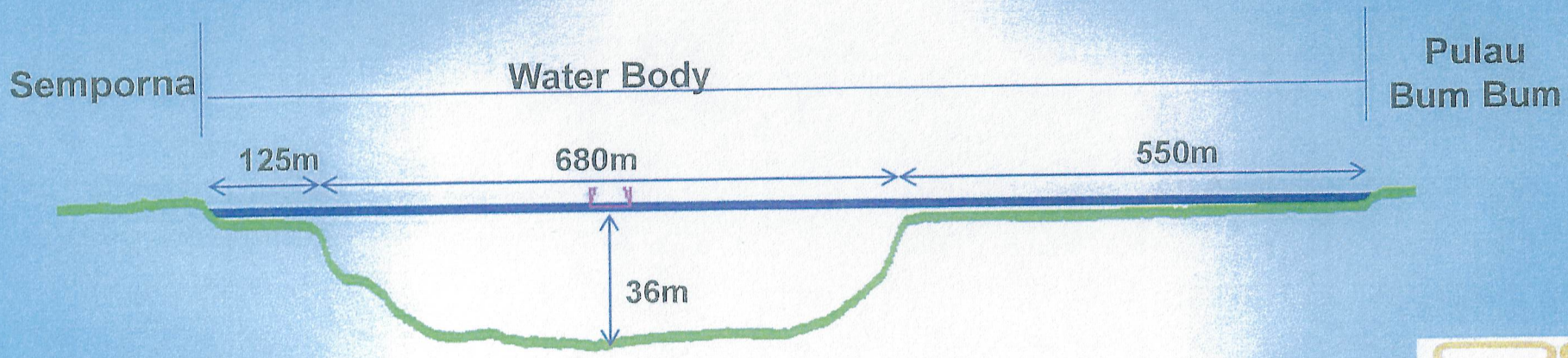
All options to suit the design function specified in the TOR and fulfil all requirements set by the local authorities

All proposed bridge options shall be designed to current code of practice

Constructability

The critical part of construction activity is in the construction of sub-structures in deep water with the depth of water up to 36m.

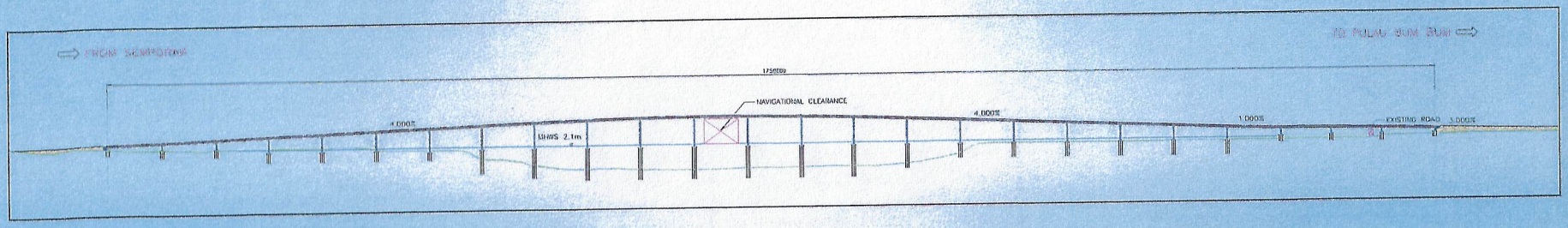
Therefore it is necessary to minimise the number of sub-structures in the deep water.

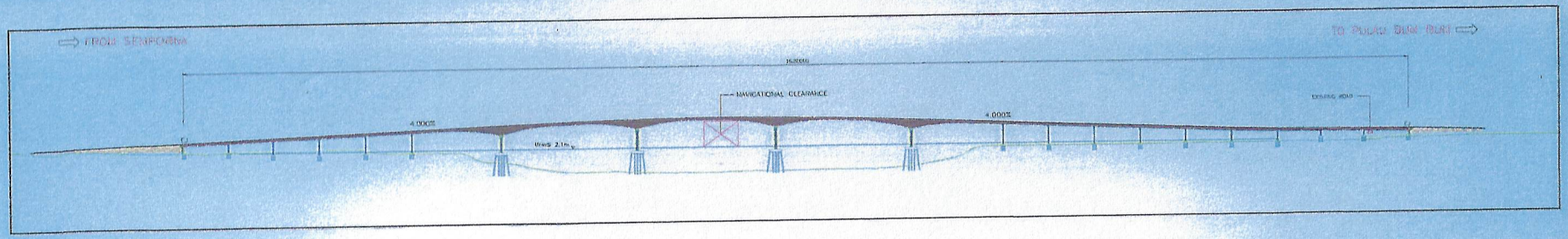


Environmental Impact

Environmental impact depends on the number of sub-structure in the water.

More sub-structure in water will have more environmental impact and retarding flow.





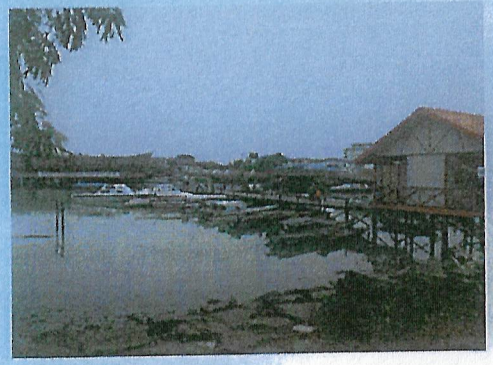
Maintainability

Structure expose to saline environment.

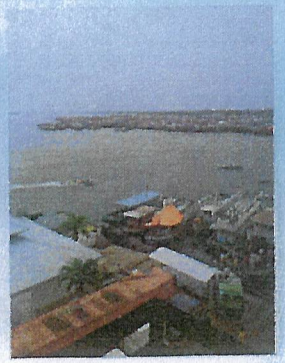
More sub-structure in contact with water needs more maintenance.

Similarly more joints in the super-structure will require higher maintenance.

Steel structure need higher maintenance as compared to concrete structures.





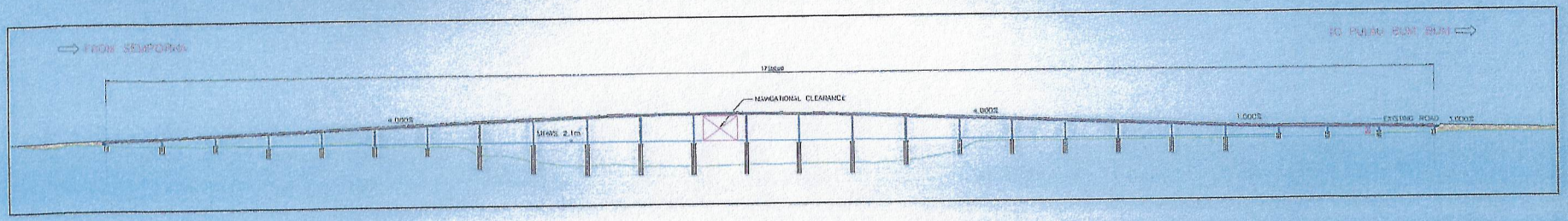


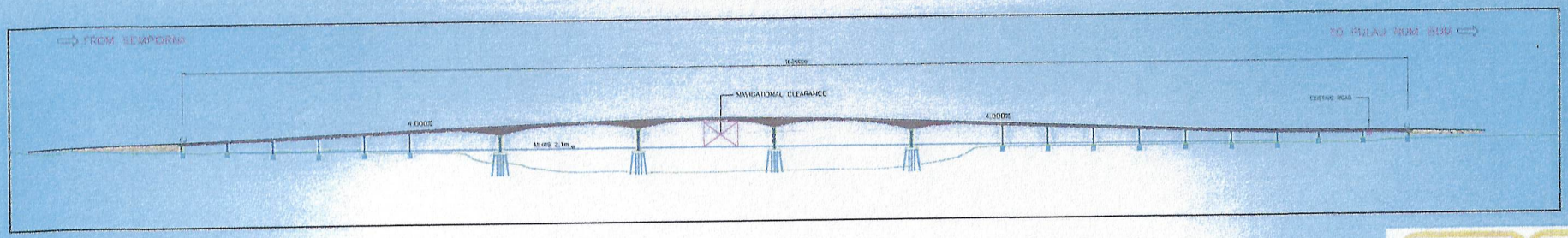
Hazard risk



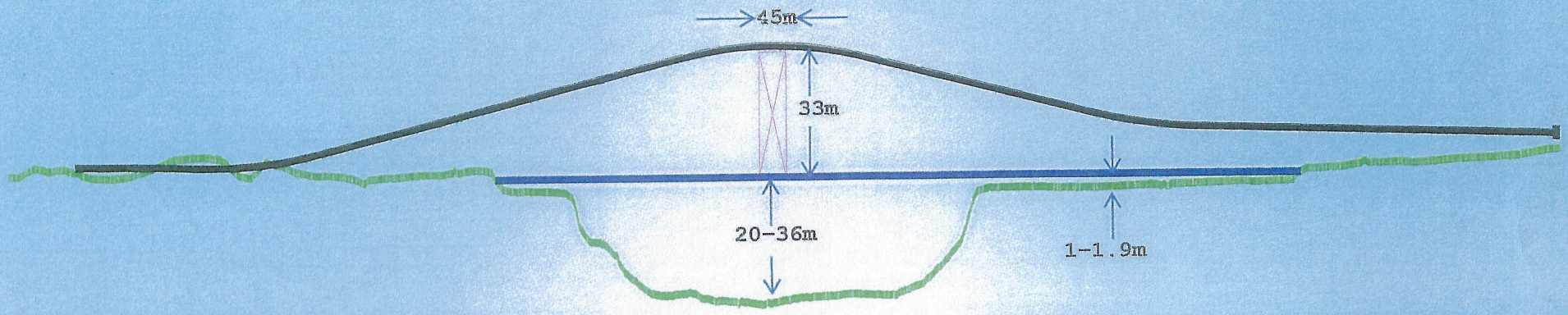
Less number of sub-structure in the water will have lower risk of ship collision.

Less number of sub-structures will mean that the size of sub-structure is bigger. Therefore the sub-structure will have better resistance against the tsunami and seismic.





Bridge profiling

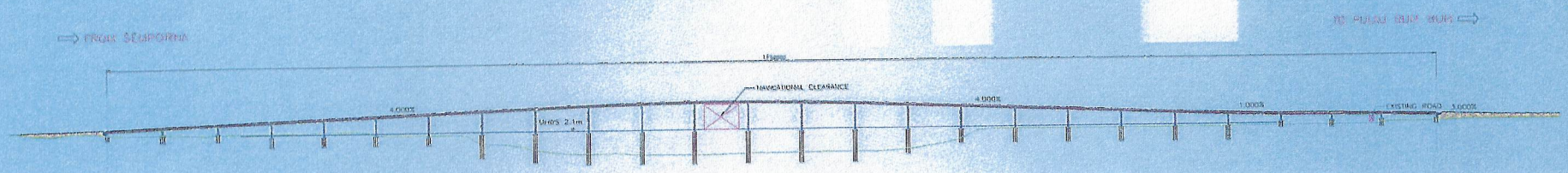


Principal Features

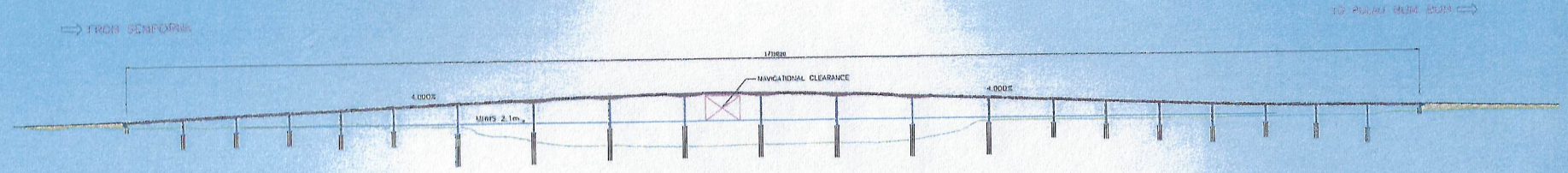
- Estimated Length of the bridge 1680m.
- Length of deep section of the channel is approximately 680m
- Shallow section length approximately 120m + 550m
- Navigational clearance requirement by the authorities is 33.0m high and 45.0m wide (Column spacing should not be less than 60m)
- Shallow section depth varies from 1.0m to 1.9m
- Deep section varies from 20m to 36m deep.

Category 1 – Spine Beam

(Form of super-structure as agreed upon by PM)



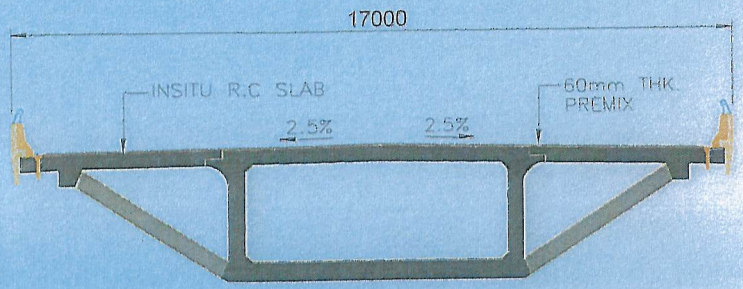
Option 1	70m Typical Span
Estimated Cost	RM 287m



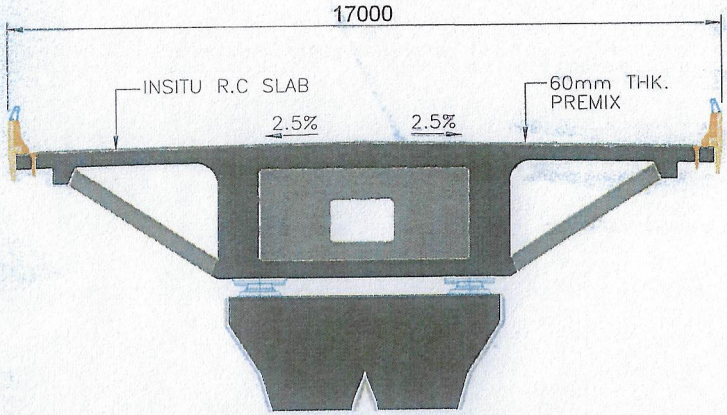
Option 2	70m Approach + 100m Main Span Over Deep Water
Estimated Cost	RM 307m

Category 1 – Spine Beam

Bridge section – Option 1 & 2



Section at mid-span



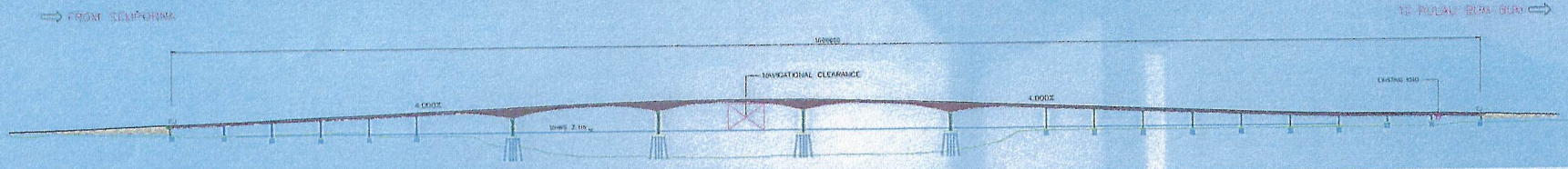
Section at pier

Principal Features

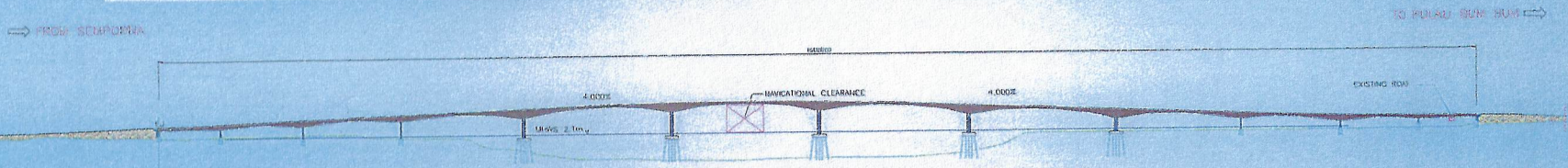
- Type of deck proposed is 3.0m deep Spine Beam.
- Spine Beam appearance is pleasing and lighter in weight.
- Segmental construction for repetitive spans.
- Methods of construction by balance cantilever.

Category 2 – Balanced Cantilever Box

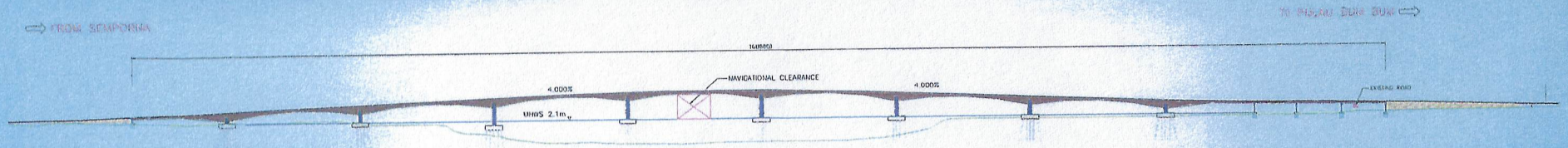
(Other alternative options studied)



Option 3	60m Approach + 180m Main Span
Estimated Cost	RM 321m



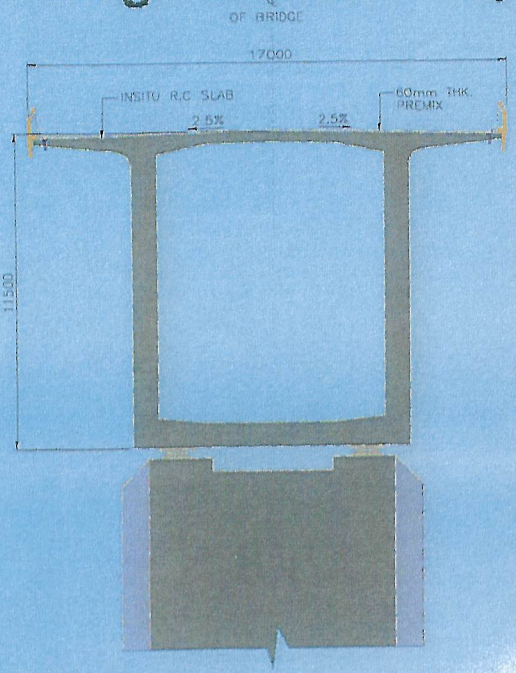
Option 4	Variable Length and Variable Depth
Estimated Cost	RM 347m

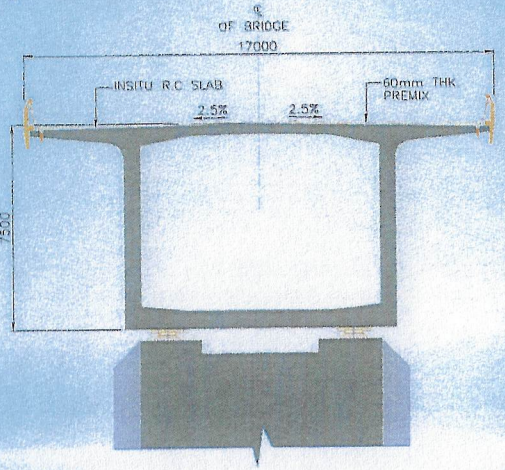


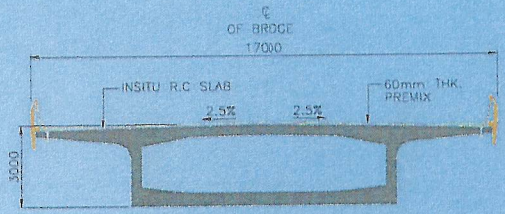
Option 5	180m Typical Span
Estimated Cost	RM 353m

Category 2 – Balanced Cantilever Box

Bridge section – Option 3, 4 & 5







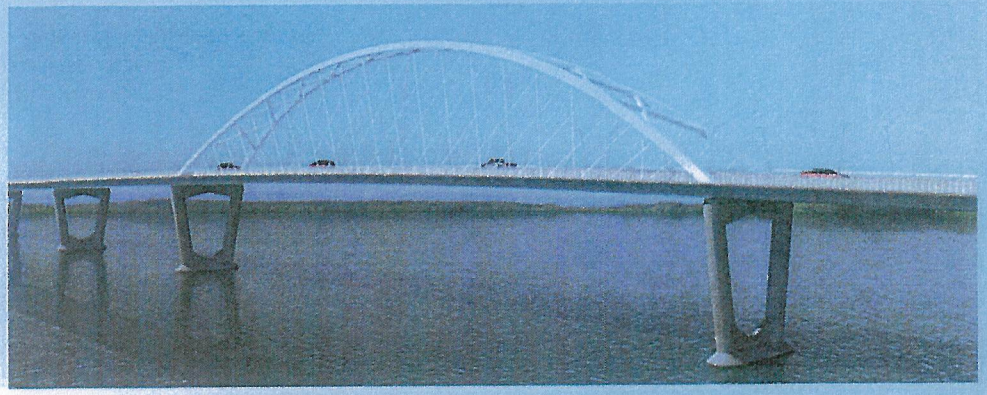


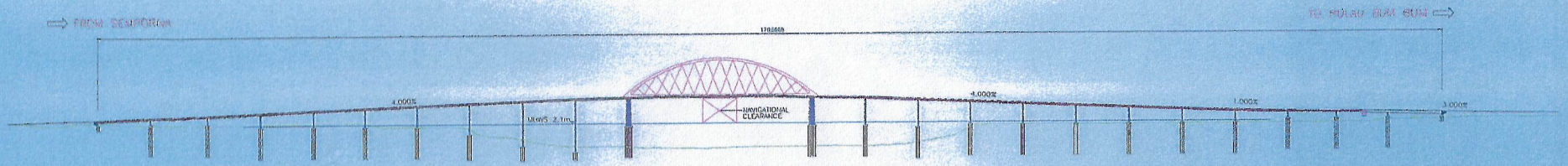
Principal Features

- Type of deck proposed is Variable Depth Segmental Box
- Variable Depth Box can span longer hence less number of sub structure
- Cast in-situ segmental construction
- Methods of construction by balance cantilever

Category 3 – Steel Arch Structure

(Other alternative option being studied)





Option 6	60m Approach + 250m Main Span Over Deep Water
Estimated Cost	RM 427m

3D concept image







Comparison Table

Categories	Category 1		Category 2			Category 3
Options	Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6
Construction Cost	RM 287m	RM 307m	RM321m	RM 347m	RM353m	RM427m
Functional	5	5	5	5	5	5
Constructability	3.5	3	3	3	3	2
Aesthetic	4	4	3.5	4	4	4
Environment	2	3.5	3	4	4	3.5
Construction Time	4 (3yr)	3.5 (3.5yr)	4 (3yr)	3 (4yr)	3 (4yr)	3 (4yr)
Cost	5	4	3.5	3	2.5	1.5
Maintainability	3.5	4	3.5	4	4	2
Ship Impact	2	3.5	4	4	4	4
Tsunami	2	3	3.5	4	4	3.5
Wind	4	4	3.5	3.5	3.5	3.5
Seismic	2.5	4	4	4	4	2
Total	**37.5**	**41.5**	**40.5**	**41.5**	**41**	**34**
%	**68%**	**76%**	**74%**	**76%**	**75%**	**62%**

Recommendation

Option 1 which is 70m spine beam bridge is the cheapest of the six options.

Options 2 and 4 which are 100m spine beam bridge and 180m balanced cantilever box have highest rating base on comparison matrix.

Option 2 is recommended based on

- Highest matrix ranking
- Lower cost compared to option 4 and only second lowest compared to all other options
- Close to project development budget
- Falls in line with PM's preferred form of structure

Thank You



SRS
consulting engineer
(Civil & Structural Consulting Engineers - BEM: 925 S/P)