3.4. Dead Sea Parkway Development

The Parkway is divided into 3 sections for the study according to its topographic characteristics and others as follows:

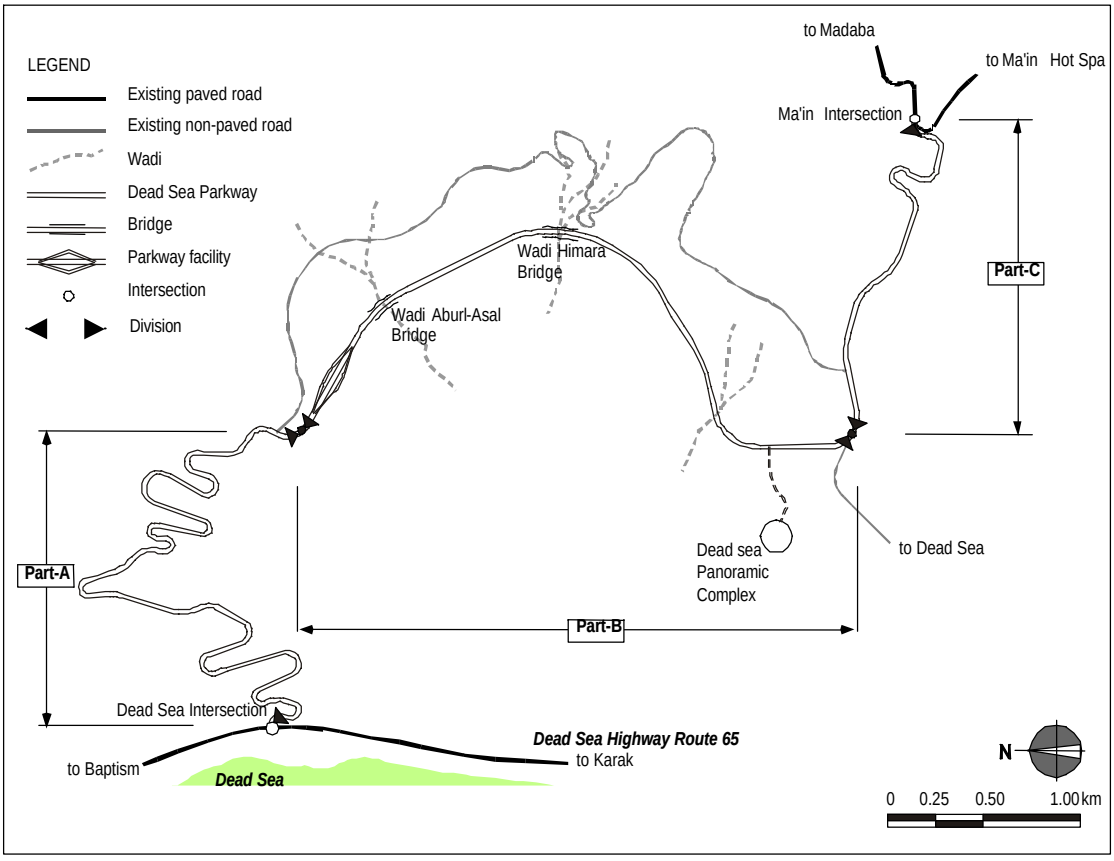
Part-A: The topography of the first part of the corridor is mountainous and the difference in elevation is almost 470 m within a straight distance of almost 1.4 km, which gives an average natural ground slope of more than 30%.

Part-B: The topography of the second part is generally considered hilly with some sections of flat terrain. The only difficult section in this part is where the proposed route intersects Madash Himara Wadi and its branches at Sta. 7 + 300 approximately.

Part-C: This section is improvement of the existing on-lane road. The existing road cannot serve the large tourist buses since it is badly damaged with steep slopes and small radius curves. Therefore, it was requested by MOTA and MPWH to be implemented together with the original Parkway and agreed by JICA although this was originally out of the scope of the Parkway sub-project.

The sub-division of the Parkway is shown in Figure 3.4.1, which shows the final route of the Parkway.

Figure 3.4.1 Outline of Dead Sea Parkway



Source: JICA Study Team

3.4.1. Selection of Corridor and Route

In the JICA Master Plan Study conducted in 1996, 4 alternative corridors were proposed for the Park way and the SAPROF Study by OECF selected 2 options from the 4 alternatives. The JICA D/D study of this sub-project is to start selection of an optimum corridor from the options selected in the SAPROF Study

(1) Study on Corridor Options by SAPROF Study

Corridor Option 1: North of Wadi Abu el Asal Corridor

This Option makes use of better topographical conditions to the north of Wadi Abu el Asal. It includes improvement of dirt road sections wherever appropriate from the Ma'in Spa Road to the Wadi Abu el Asal Area, and new road construction down to the Zara Area. The grade is gentler than the other option. It is thought that this route will be able to accommodate large vehicles.

Corridor Option 2: Branch route from existing Ma'in Spa - Zara Road

A new alignment is needed on the ridge and on the steep slope. This Option requires a new alignment with less difficult topographical conditions close to the existing one. The grade is rather gentler. But it is thought that though large vehicles can operate on the road, but they need special attention.

(2) Selection of a Corridor Option

The comparison of the corridor Options is shown in Table 3.4.1 with the various comparison criteria.

Table 3.4.1 Comparison of Corridor Options

	Corridor Option-1	Corridor Option-2
Road length	Approx. 13.0km	Approx. 8.5km
General gradient of topological conditions	Almost flat for first xxxkm on the plateau, and little bit gentler after the plateau	Almost flat for first 2km on the plateau, but 1:2 after the plateau
Workability of construction	smaller earth work volume than Option-2 is required.	Larger earth work volume than Option-1 is required and possibility of landslides
Construction cost	Cheaper considering the above, even though the length is longer	More expensive, even though the length is shorter
Maintenance	Easier and cost will be cheaper	Difficult and cost of future damage may be expensive.
Environmental aspect	Not so different	Not so different
Alignment	Can avoid steep grade area near Wadi Himara and Abu el Asal	Difficult to avoid such area
Possibility of Planting	Already afforested, even small area	Difficult to afforest

Source: JICA Study Team

Based upon the above studies and also results of site inspection, Corridor Option 1 was selected as the final corridor for further study.

For the selected corridor a 600m wide topological survey was conducted along the corridor and soil investigation with borehole survey was also conducted. The soil investigation was conducted only in the Part-B area, since transportation of the equipment is difficult to the Part-A area due to difficult topological conditions.

The soil investigation for the Part-A area is agreed by MPWH to be conducted by the contractor prior to the actual construction work on site. To cover the lack of geotechnical information in the Part-A area, geotechnical surveys including an intensive desk study on the

available data and site walkover visits were conducted for Part-A and B. In the walkover surveys critical areas with respect to geotechnical factors (such as potential areas of instability, areas of deep cuts and bridge sites) are identified.

Based upon the study of existing information and the walkover survey, it is possible to lay down broad guidelines for the design of earthworks and foundations. The site investigation provides further data at particular locations.

Environmental Impact Assessment (EIA) was also conducted to examine impacts on the natural and human (archeological) conditions in the area surrounding the corridor according to the OECF Environmental Consideration Guidelines under coordination with General Corporation of Environment Protection (GCEP) of Ministry of Municipality, Rural Affairs and Environment (MMRAE).

Table 3.4.2 shows the category of the archaeological sites in the area by significance identified in the EIA Study.

Table 3.4.2 Category of Archeological Site

Category		Number of sites
Category-I	Significant sites	23
Category-II	Sites of minor significance	21
Category-III	Cemeteries and single burials	28

Source: JICA Study Team

(3) Study of alternative routes in the Corridor

Based on the result of the topological survey and EIA, several alternative routes are set and study made according to the various criteria to evaluate the selection of an optimum route in the corridor. Some alternative routes are set by section of the Parkway; 4 alternatives and 6 options for Part-A and Part-B respectively. Part-B is divided into 2 options for Section-1 and 4 for Section-2.

(4) Selection of the final route

The evaluation criteria are 1) Archeology, 2) Ecology, 3) Hydrology, 4) Geology, 5) Geometry, and 6) Earthwork. According to the criteria, a scoring system is adopted for the evaluation as shown in Table 3.4.3 (1) (2) and Table 3.4.4 (1) (2) for Part-A and Part-B respectively.

Part-A

Studying thoroughly Table 3.4.2 and the construction cost study, the following are found:

- Alternative-I and III score highest in total.
- One major deficit of Alternative I is its Geometry where sharp curves with radii below 50m, and down to 30m, form more than 50% of its entire length. Reverse and broken back curves form a major feature of this alternative.
- Two main disadvantages of Alternative III are the crossing of four Category-I Archaeological sites in addition to the volume of cut, which is relatively large and increases construction cost.

However, regarding the crossing of the Category-I Archeological site, it may be possible to adjust the alignment in the detailed alignment study and the disadvantage of the sharp carves in Alternative-I is considered more serious. Thus, Alternative III is selected as the best among the 4 alternatives introduced.

Table 3.4.3 (1) Evaluation of Alternative Route of Part-A (1)

Alt.	Archeology (A)	Ecology (B)	Hydrology (C)	Total Score (A)+(B)+(C)
I	**4**	**4**	**1**	**9**
	- Crosses 2 Category-I* and 1 Category-II sites**	- Crosses one highly sensitive wadi, opens up two highly sensitive areas and crosses several medium sensitive wadis.	- Route OK. - Wadi crossings = 3 (2 pipe culverts+1 bridge) - Main flood protection works are required at two locations	
II	**1**	**1**	**3**	**5**
	- Crosses 5 Category-I* and 1Category-II sites**	- Crosses four highly sensitive wadis, opens up large highly sensitive areas and crosses several medium sensitive wadis.	- Route OK. - Wadi crossings = 8 (7 pipe culverts+1 bridge) - No main flood protection works are required	
III	**2**	**3**	**4**	**9**
	- Crosses 4 Category-I* and 1 Category-II sites**	- Crosses two highly sensitive wadis, opens up large highly sensitive areas and crosses several medium sensitive wadis.	- Route OK. - Wadi crossings = 7 (6 pipe culverts+1 bridge) - No main flood protection works are required	
IV	**3**	**2**	**2**	**7**
	- Crosses 3 Category-I* and 1 Category-II sites**	- Crosses three highly sensitive wadis, opens up two highly sensitive areas and crosses several medium sensitive wadis.	- Route needs to be adjusted. - Wadi crossings = 7 (6 pipe culverts+1 bridge) - No main flood protection works are required	

Note: * Category-I site to be avoided, but if not possible, they must be excavated and documented.
** Category-II site to be avoided but if not possible, field inspection must be carried out during construction.

Table 3.4.3 (2) Evaluation of Alternative Route of Part-A (2)

Alt.	Geology (D)	Geometry (E)	Earth Works (F)	Score (D)+(E)+(F)
I	**4**	**1**	**4**	**9**
	- Shorter length in Lisan - Marl Gravel Formation	- No. of curves less than 50m. Radius = 18	- Cut (m^3) = 97,516	
II	**1**	**2**	**3**	**6**
	- Long section within the Lisan - Marl Gravel Formation	- No. of curves less than 50m. Radius = 9	- Cut (m^3) =144,358	
III	**3**	**4**	**2**	**9**
	- Second Shortest length in Lisan - Marl Gravel Formation	- No. of curves less than 50m. Radius = 5	- Cut (m^3) =264,263	
IV	**2**	**3**	**1**	**6**
	- Long section within the Lisan - Marl Gravel - Formation in addition to expected large cut	- No. of curves less than 50m. Radius = 7	- Cut (m) =495,463	

Source: JICA Study Team

Part-B

The major feature of Part-B is the two bridges in two different locations in addition to the existence of more than 10 Category-I Archaeological sites. Furthermore, a stretch of a Roman Road was recently discovered near Wadi Hammara and running very close to Archaeological Site No.2. The general terrain of Part-B is generally considered flat to hilly except for the two locations where for some technical reasons bridges are used.

1) Options-A and B in Section-1 of Part-B

- Two options are identified in this section as previously discussed and results are tabulated and shown in Tables 3.4.4 (1) and (2). The following could be detected from the table:
- Option-A has major advantages of less earthwork quantities and better geometry where flat curves are the main feature of this option.

Table 3.4.4 (1) Evaluation of Options of Part-B (1)

Option	Archeology (A)	Ecology (B)	Hydrology (C)	Score (A)+(B)+(C)
A	**2** - Does not cross any known sites.	**1** - Crosses one major wadi and involves major cut/fill disturbance.	**1** - Largest catchment area	**4**
B	**1** - Passes close to and potentially crosses one Category I Site.	**2** - Crosses five smaller tributaries as opposed to one large wadi. - Cut/fill disturbance is less	**2** - Large catchment area - Better wadi crossing	**5**
C	**1** - Crosses 2 Category-I* sites including Site No. 2 which should be avoided at all costs.	**1** - Further down stream. Highest cut and fill disturbance and crosses two major wadis	**4** - No, of crossings = 2 (BC)	**6**
D	**2** - Crosses 2 Category-II** sites passes close to Site No. 2 (Category-I) and crosses 4 category-III sites.	**2** - Next route upstream, cut/fill disturbance is relatively high and crosses one high sensitive wadi	**3** - No, of crossings = 4 (2BC + 2PC)	**7**
E	**4** - Crosses 1 Category-II** and 2 Category-III sites - best avoiding 2 Category-I sites	**3** - Second furthest upstream. Lower cut/fill disturbance	**2** - No, of crossings = 7 (2BC + 5PC)	**9**
F	**3** - Crosses 1 Category-II** site and 2 category-III sites, but comes close to 1 Category-I site (No. 41)	**4** - Furthest upstream. Lower cut/fill disturbance	**1** - No, of crossings = 7 (2BC + 5PC)	**8**

Note: * Category-I site to be avoided, but if not possible, they must be excavated and documented.

** Category-II site to be avoided but if not possible, field inspection must be carried out during construction.

Source: JICA Study Team

Table 3.4.4 (2) Evaluation of Options of Part-B (2)

Option	Geology	Geometry	Earthworks	Score
	(D)	(E)	(F)	(D)+(E)+(F)
A	**1**	**2**	**2**	**5**
	- Flatter wadi crossing - Maximum disturbance to wadi banks	- Flatter curves - One reverse curve	- Cut (m^3) = 40,000	
B	**2**	**1**	**1**	**4**
	- Sharper wadi crossing - Maximum disturbance to wadi banks	- Sharper curves - Two reverse curves	- Cut (m^3) = 43,000	
C	**1**	**4**	**3**	**8**
	- Steep wadi crossing - Maximum disturbance to wadi banks	- shorter	- Cut (m^3) = 81,870	
D	**4**	**3**	**4**	**11**
	- Flattet wadi crossing - Minimum disturbance to wadi banks	- Second shortest - Broken back curve	- Cut (m^3) = 54,260	
E	**2**	**2**	**2**	**6**
	- Steep wadi crossing - Moderate disturbance to wadi banks	- Long alignment - Sharp curve - Reverse curve	- Cut (m^3) = 99,000	
F	**3**	**1**	**1**	**5**
	- Steep wadi crossing - Acceptable disturbance to wadi banks	- Long alignment - Sharp curve - Reverse curve	- Cut (m^3) = 109,900	

Source: JICA Study Team

- Option-B has major advantages in terms of shorter bridge required when crossing the main wadi, and this of course reflects on the construction cost.
- Option B has one major disadvantage of having two successive sharp reverse curves, which is not recommended especially when having a bridge as in this case. This option also crosses or passes by one Category I Archaeological site.

Taking all the above into consideration in addition to studying the said tables carefully, Option-A is recommended as section of the optimum route for this part.

2) Options-C, D, E and F in Section-2 of Part-B

Four options are identified and evaluated as shown in Tables 3-4-4 (1) and (2). The following are the main findings of these comparison tables:

- Option-D is ranked first in terms of Geology, Geometry and Earthworks whereas Option-F is ranked last.
- Option-E and F are ranked first in terms of Archaeology and Ecology but are ranked last in terms of Geometry and Earthworks.
- Option-C is ranked last in terms of Archaeology and Ecology as it hits and crosses one of the major important Archaeological sites in the study area.
- Option-C is ranked last in terms of Geology and first according to Hydrology due to the number of wadi crossings.

In terms of Geometry, Options-E and F are ranked last due the route which consists of reverse and broken back curves at a very sensitive location (bridge)

When studying the costs, Option-D has the least construction cost, taking into consideration that the construction cost for the four options is very close and falls within a 10% margin.

For all the above, Option-D is recommended as part of the optimum route for Part-B.

However, a stretch of Old Roman Road was discovered after extensive study of the Archaeological Sites with the presence of a representative from the Department of Antiquities in Wadi Hammara Area.

(5) Addition of Part-C to Parkway

This section is for improvement of the existing one-land road. The existing road cannot serve the large tourist buses since it is badly damaged with steep slopes and sharp curves. Therefore, it was requested by MOTA and MPWH to be implemented together with the original Parkway and this was agreed by JICA and may be by JBIC, although this was originally out of the scope of the Parkway sub-project. For this section, a 100m wide topological survey was conducted by MOTA/MPWH along the center line of the existing road.

The final route of the entire Parkway is shown in Figure 3.4.2.

3.4.2. Design Development

For the selected route of the Parkway, design developments such as definitive design, preliminary design and detailed design were conducted.

(1) Parkway alignment design

Horizontal alignment

Horizontal alignment study is made according to the following design criteria:

1) Design speed: 30kph and 50kph (30kph for difficult parts)
2) Reverse hrz. curve: radii range between 30m to 725m for the 30kph design speed
3) Spiral Curve: minimum lengths of 40m (minimum super-elevation runoff) for all horizontal curves with radii less than 400m
4) Spiral Curve: minimum lengths of 50m (minimum super-elevation runoff) for all horizontal curves with radii less than 1000m
5) Minimum radius: 80m for horizontal curves

Vertical alignment

The vertical alignment design criteria adopted are:

1) Design speed: 30kph and 50kph, but for a design speed of 30kph absolute minimum grade applied is 0.3% while the minimum grade used is 2.0%
2) Maximum vertical slope: 10.5% for Part-A and B, but 14% for Part-C

Minimum vertical curvature (K) for crest vertical curves applied is 3 while the minimum used for this design speed is 7.9. Minimum vertical curvature for sag vertical curves for a design speed of 30kph is 4 while the minimum used is 6. For a design speed of 50kph, the same minimum vertical slope is applied while the minimum used is 1.63%. Minimum applied K value for crest vertical curves is 9-10 while the minimum used is 13.2. Minimum applied K value for sag vertical curves is 11-12 while the minimum used is 12.5.

(2) Pavement design

The pavement design is determined according to the following:

Traffic conditions

- Service Period: 20 years.
- Average Daily Traffic in each direction: 5000 VPD.
- % of small buses: 15%
- % of big buses: 10%
- % of trucks: 2%

Weight

- Assuming the average weight of small vehicles: 2 tons
- The average weight of big buses: 6 tons
- The average weight of trucks: 15 tons
- The back axle: carrying 2/3 the weight.
- Using the equivalent 8.2 lane factors for: Pt = 2.5 and SN =3

Pavement structure

According to the above study, the pavement structure applied to the sub-project is as shown below:

- 5cm thick Compacted Bitumen Wearing Coarse.
- 5cm thick Compacted Bitumen Binder Coarse
- 20cm thick Compacted Crushed Aggregate Base.
- 20cm thick Sandy Gravel Sub - Base Layer

(3) Cross section elements

The cross section of the Dead Sea Parkway generally comprises of two lanes and two shoulders. The lane width is 3.7m while the width of the shoulder is 1.8m for the 30kph-design speed stretches and 2.4m for the 50kph-design speed stretches.

Normal crown is considered with 2.0% cross slopes for the road and 4.0% for the shoulders.

A typical cross section is indicated in Figure 3.4.3.

(4) Intersections

At-grade intersections are provided at the junctions with Dead Sea Highway No. 65; named "Dead Sea Intersection" and with Madaba-Ma'in Section; named "Ma'in Intersection".

(5) Parkway facility

As planned in the SAPROF Study a parkway facility is provided at the edge of the cliff after climbing up from the Dead Sea Intersection. The Parkway facility consists of two asphalt

paved parking areas with two landscape areas accessed by two 4m roads (one for each direction). The parking in each direction is designed to accommodate at least ten cars in addition to separate parking spaces for buses.

(6) Bridge

The locations and the length of the bridges are as shown below:

- Wadi Abu El-Asal Bridge, 90m long at Sta. 6 + 000 approximately, and
- Wadi Hammara Bridge, 120m long at Sta. 7 + 000 approximately.

The selection of superstructure and substructure of a bridge in any particular site depends on technical and economic considerations (i.e. number and length of span, alignment and site layout, method of construction, material and construction technique available).

Considering the above mentioned factors, several bridge types and arrangements were analyzed and evaluated, with economy and construction difficulty being the most important factors considered in the selection and evaluation process. It is recommended to use the arrangement of:

- Pre-stressed pre-cast girders with a cast-in-place slab deck for the super-structure of the bridge.
- Hammerhead shaft piers for the substructure of the bridge.

(7) Other necessary facilities

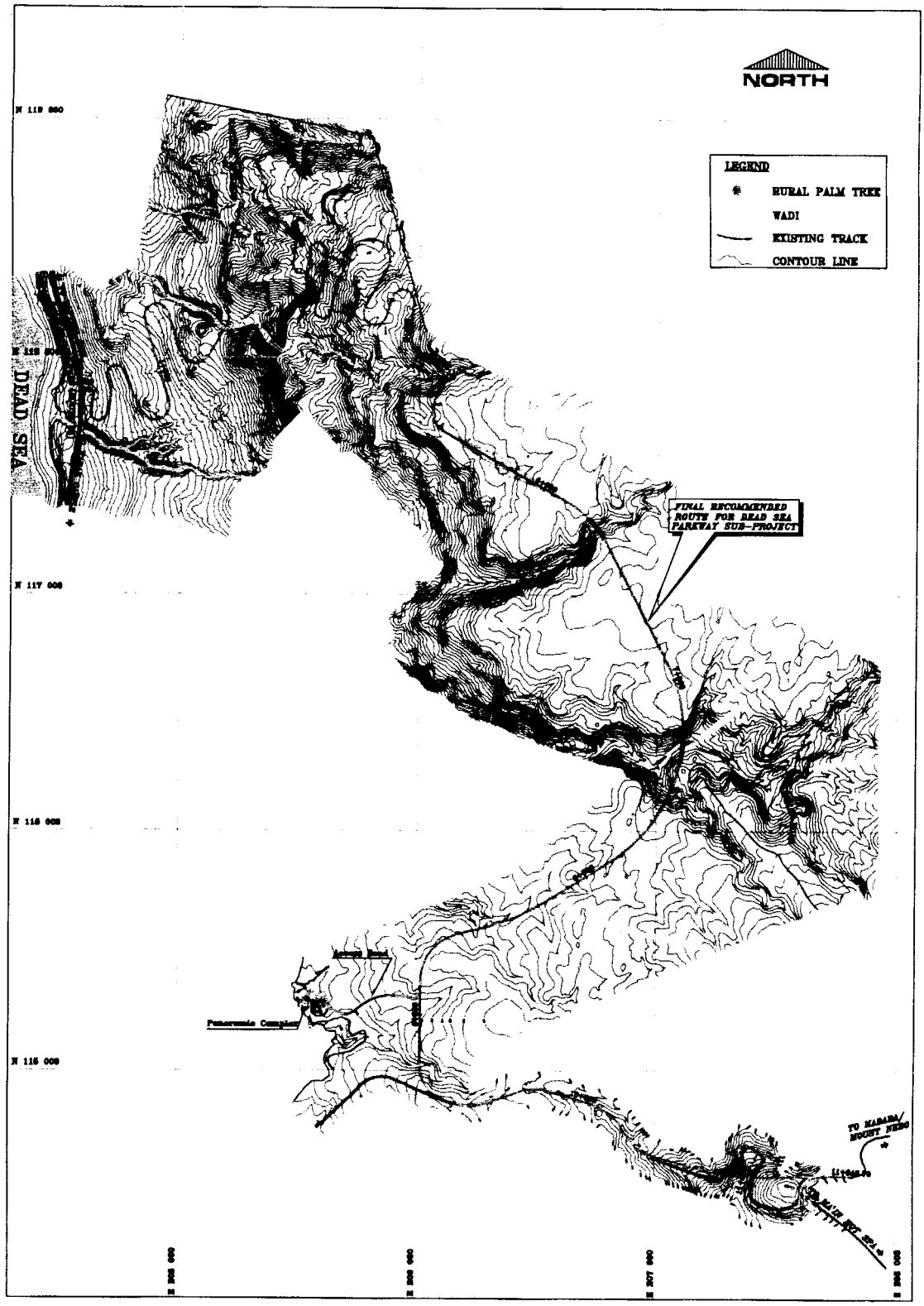
In addition to the items regarding the parkway mentioned above, the following facilities are provided according to the standard and code as well as the design criteria:

- Culverts and road side ditches
- Retaining wall
- Guard rail
- A parkway facility is provided at the edge of the cliff after climing up from the Dead Sea Intersection.
- Signage

(8) Drawings and List of Sub-project

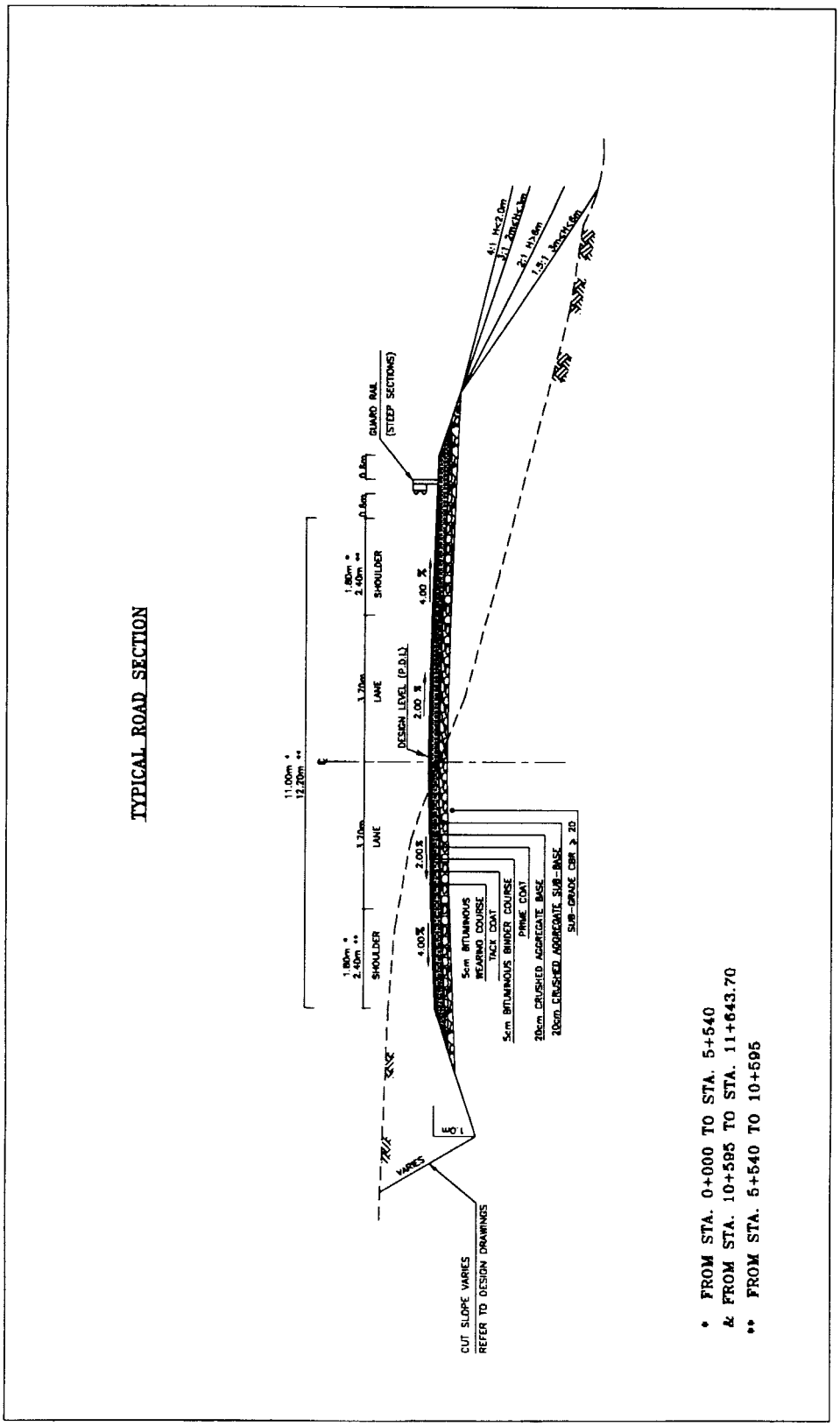
As for the results of the design developed according to the planning and design policy and design concept, final alignment of the Parkway and typical cross section are shown in Figure 3.4.2 and Figure 3.4.3 respectively.

Figure 3.4.2 Final Alignment of Parkway



Source: JICA Study Team

Figure 3.4.3 Typical Cross Section of Parkway



Source: JICA Study Team

3.4.3. Construction Plan

Since the site of the sub-project is in an are remote from Amman and in an environmentally sensitive area, the construction plan should be carefully established by the contractor, and accepted by PMU and agencies concerned. The following are major points to be taken into considerations in the construction plan. The site for the temporary facilities can be located in the sub-project site but necessary utilities such as electricity, water supply and telephone are difficult to obtain in this area.

(1) Utilities for construction

Water supply

Since there is no existing water supply system to the location, the contractor should obtain water under his own responsibility. As an option the water can be brought from the Madaba Municipality with tank lorry, but the contractor should provide a water reservoir.

Electrical supply

Electrical supply is also not available in the location at this moment. However, it is planned to obtain power with new cable installation from the transmission line along the section of Madaba-Ma'in road. The cable can be utilized for the temporary power supply if the construction sequence is well managed.

Telecommunications

For the telephone, it may be practical to utilize mobile telephones. However, for the facsimile line and also internet/e-mail lines a cable line may be required. Permanent telephone lines for the Panoramic Complex are also installed, being branched from the Main line along the Madaba-Ma'in Spa road. If the construction sequence allows it, this telephone line could be utilized.

Toilet and Sewerage

The sewage should be carefully treated in the location, since it is an environmentally sensitive area. There are two alternative: 1) shipped out by vacuumed car from Madaba Municipality from a cesspool to be constructed, or 2) to provide a sewage treatment plant to meet the Jordanian standards and regulations. The discharge point of the treated water to wadi should be coordinated with Jordan Valley Authority. A plan of the overall sewerage treatment system should be submitted to and approved by the agencies prior to the construction on site.

Disposal of excess soil and debris

The excess soil and debris should be properly disposed of to an area(s), which should be designated under the coordination with the relevant agencies. The necessary measures to mitigate environmental impacts should be taken under the contractor's responsibility.

(2) Soil investigation for Part-A

Since soil investigation has not been conducted in the design stage due to the difficult accessibility for borehole equipment for Part-A, the investigation should be conducted in the construction stage. According to the results of the investigation, the design should be reviewed, especially for the gradient of the slope for earth cutting, foundation of retaining walls, etc.

(3) Construction road

Th standards of the construction road are recommended as follows:

1) Capacity: 10t dump truck

2) Width: lane 3.0m, shoulder 0.5m both sides, total 4.0m

3) Longitudinal gradient: Maximum 15%

4) Pavement: Asphalt pavement, 3.0cm thick, to be applied for the steep gradient portion (more than 12%)

For Part-A the existing trails can not be used as the construction road due to their steep gradient. Since this Part crosses the steep slope of cliff, the construction road needs many temporary culverts and retaining walls, similar to the permanent facilities. These temporary culverts and retaining walls will obstruct the construction of the permanent facilities, therefore, it is recommended to construct the permanent facilities in advance. The construction road should avoid locations of the archeological site and environmental impacts.

(4) Specific Note

The location of the sub-project is in a remote area and in the same location as the Dead Sea Panoramic Complex, another component of this Project. It is essential that the contractor's for the two sub-projects cooperate in the operation of some plant, such as concrete mixing plant and asphalt plant, and large size/capacity equipment and machines, in order to reduce the costs of the temporary works. Furthermore, it is recommendable that the 2 sub-projects should be combined into the one package for the implementation in order to more effectively reduce the cost of the temporary works. This may be possible since the tender management and construction supervision are conducted by MPWH.

(5) Environmental considerations

Environmental considerations should be taken into account in the preparation of the construction plan. Table 3.4.5 and Table 3.4.6 show results of the environmental study made on the sub-project.

Table 3.4.5 Potential Impacts

factors	actions	impacts	stage	term	type
Water Pollution	- wastewater from plant, temporary facilities and accommodation - landslide from slope of cut and embankment	- water pollution in the wadis by wastewater and landslide - negative effects on the aquatic invertebrates	construction	short	direct
Waste Pollution	- construction materials - increasing number of tourists	- generation of construction waste - increase of tourist litres	construction operational	Short long	direct cumulative
Landscape	- construction of structure and road etc. - changes of socio-economic activities and landuse change	- deterioration of landscape	construction operational	Short long	Direct In-direct
Ecology	- earthwork and construction work - establishment of temporary facilities and road - wastewater from plant and temporary facilities - illegal hunting	- damage to vegetation around the proposed alignment - impacts on vegetation along wadis - impacts on the aquatic ecosystem in wadis - impacts on the animals especially endangered animals	construction operational	short	direct
Archaeological remains	- earthwork - place temporary road and facilities etc. - transport work	- damage to existing archaeological remains and newly discovered sites	construction	short	direct

Table 3.4.6 Proposed mitigation measures

	Impacts	Mitigation measures	Notes
Countermeasures should be clarified in the Tender Documents	Archaeological remains	- work plans including temporary facilities and road should be submitted to MPWH and DOA as normal construction works - observe in consultation with experts of DOA to avoid direct impact on potential archaeological remains	
	Waste pollution	- ensure disposal site for construction wastes	
	Water pollution	- avoid rainy season - avoid using water from wadis - avoid direct discharge of non-treated waste water	There is no legal requirement.
Others	Landscape	- careful attention to be paid to height, colour, and feature of construction to alleviate drastic landscape changes	
	Ecology	- use bridge/culvert for water courses - avoid rainy season as much as possible - provide passes for animal trails and Bedouin's stock routes, if any	
	Archaeological remains	- place signage and fences to protect important sites, if any	

Source: JICA Study Team

3.4.4. Construction method and schedule

The construction schedule should be prepared by taking into consideration the items mentioned above.

A construction schedule, including major work items, proposed by the Study Team as an option, is shown in Figure 4.1 in Chapter 4.

3.5. Dead Sea Panoramic Complex

3.5.1. Design Policy

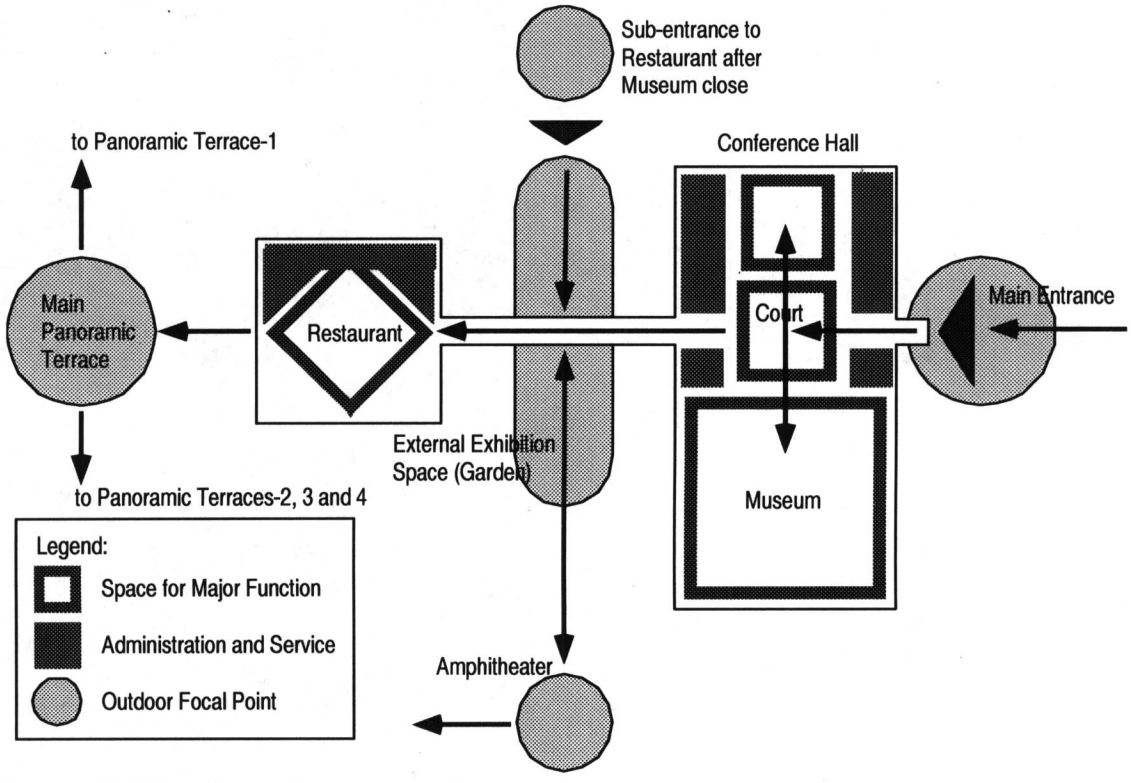
As the location of the Dead Sea Panoramic Complex overlooks the Dead Sea and provides a unique panoramic view to the area the site layout of our project aims to capitalise on this potential. The exhibition is focused on the Dead Sea; History, Culture, Science and Geology.

(1) Site Plan

The following planning policies are applied to the planning and design study of the Dead Sea Panoramic Complex:

- To construct the Complex as a natural and scenic park with high ecological value
- To maximise the most significant asset of this area: panoramic view as the attraction of the facility
- To emphasise the rocky conditions as an authentic attraction of the landscaping of the Complex
- To produce local/Arabic ambience for the international tourists through use of the Arabic design pattern
- To provide dual functions in the Complex; the Museum and Restaurant together with various external facilities.

Figure 3.5.1 Diagrammatic Site/Building Layout



Source: JICA Study Team

(2) Building Layout and Design

Layout

- To take two building components for the Complex; Museum Building as the main building and Restaurant building as a sub-building.
- To simplify the building layout and make circulation clear by applying a building layout axis from the entrance approach to the Dead Sea.
- To match the topographic conditions in the building layout in order to reduce the grading works as much as possible, since the earth work will be costly in the rocky soil conditions.
- In order to provide enough stability to the project components against landslides, buildings are located no less than 35m from the cliff and to provide enough space outdoor for the layout of the tourist trails and panoramic terraces.

Design

- Although the buildings are treated as modern architecture, the simple and compact geometrical forms of the buildings are based on the design concept of the regional architecture.
- The Arabic design pattern and/or traditional architectural typology are reflected throughout the entire building. A courtyard type building is adopted for the Main Building, in the arch style typical in the Arabic world.
- The courtyard is culturally characterised as the smooth transition from the harsh and dry outside environment to the secure and quiet internal environment
- Sandstone, a local material, will be used as the main construction material. Effort will be made to use complementary material for finishing some indoor spaces as well. The material is to harmonise with the circumstances and contribute to less maintenance.

(3) Exhibition

The concept of the planning of exhibitions for the Complex is as follows;

- To serve as a tourism attraction but also an educational asset, especially for school students
- To utilise various exhibitions technologies to promote exhibits, and
- To provide exhibition that will allow tourists to have the opportunity to learn in a short time about the Dead Sea area: the origin, nature, history and culture of the Dead Sea.

(4) Other facilities

Panoramic Terraces

- To provide more than one terrace
- To locate close to the edge of the cliff as much as possible to get good panoramic views
- To provide safety measures for the visitors
- To match the topographic conditions to reduce the earthworks
- To provide a network of Tourist Trails to connect the Panoramic View Terraces

Outdoor exhibition area

The basic concept of the landscaping in the Complex is to introduce the dry landscape concept; local rocks and native plants of the area.

- To present and capitalise on the natural flora of the project vicinity
- To utilise indigenous plants to sustain the ecosystem in the area
- To minimise the intervention to the ecological site environment
- To utilise the unique subtle beauty of the arid landscape

3.5.2. Design Solutions

(1) Site Layout

The building layout is aligned with an axis to simplify and make circulation clear. The Museum is located in the main building in front of the entrance-courtyard and the restaurant building is located almost facing the cliff edge.

In between the main and restaurant buildings a garden is located as an external exhibition space in which species of plants and rocks in this area are collected and presented.

To allow visitors to enjoy the most predominant attractions of the location 5 panoramic terraces are provided along the cliff edge.

The parking area for the visitors and staff are located at the northern side of the buildings and on both sides of the service road to the restaurant. For big events only, a temporary parking area is designated at the northern side of the approach road.

(2) Architectural design

Dead Sea Museum/Main Building

The main entrance is emphasised by the axis of the approach road. Going through the entrance of the main building, a graceful courtyard appears, which has an Arabic traditional ornament and ambience, but the courtyard is surrounded by glassed colonnade in order to separate it from the harsh courtyard environment. The Museum/main building is divided into two areas by the courtyard. One area on the north side consists of the conference hall, administration office and services, and the other area on the opposite side is the exhibition hall.

Restaurant

A corridor links the main building and the restaurant through the external exhibition terrace (garden), in which a sub-access is used for direct access to the restaurant for evening time operation after the Museum closes.

A stair is provided from the corner of the dining terrace to the main panoramic terrace along the axis.

Elevation design and Building Form

Basically the traditional architectural typology and/or the Arabic design vocabulary are reflected throughout the entire building. The Museum/main building, coming from the approach road, is visualised first with a horizontal stonewall and an entrance gate between small twin towers. The elevation of the building in this context is simple and powerful as a silhouette; however, the texture of the wall is adapted to the context with the rough finish of local sandstone from the local region.

Another typical example is rotated squares as seen in the Arabesque design patterns with mosaic tiles, lattice windows, carpets, etc. This geometric image is developed in three dimension as an Arabic design vocabulary and created the rotated stepping squares which emphasis the monumentality not only outside but also inside on major spaces such as exhibition hall, conference hall and restaurant. These three rotated stepping squares unify this complex and give a strong character of Regional Architecture in this part of the world.

The geometrical forms of these rotated stepping squares are structurally integrated and honestly reflected in the interior spaces. As a space concept, all the exhibition areas are represented as spaces under the concrete waffle slab ceiling, which gives a delicate texture and enriches the spaces. The combination between the rotated stepping square form and the ceiling pattern of the concrete waffle slab makes the dynamic spaces more sensitive.

(3) Exhibition plan

Exhibition hall

The exhibition hall consists of a core zone for the main feature of the exhibition, and four exhibition spaces for the specific subjects. These exhibitions include the geological, ecological, historical, religious and cultural significance of the Dead Sea area, and aim to emphasise the importance of the informative and educational role of the area.

1) Central exhibition space

The space shows information of the geological features of the Dead Sea; the lowest sea level (-395m) in the world, which was forward by the diastrophism. Topographic model and audiovisual information will be presented in this space in order to introduce the topography and geology of the Dead Sea in panoramic view.

2) Corner exhibition spaces

The spaces exhibit detailed information regarding the specific themes shown below linking the central space exhibition.

- "Origin of the Dead Sea", which includes about 50 pieces of the geological cut stone samples from the Dead Sea area and panels of detailed geological and scientific information in addition to the topographic model in the core zone.
- "Ecological System", which includes the nature of the Dead Sea as one of the most important and peculiar ecological zones in the world, including plants and animals with audio-visual explanation, and expands to the outdoor exhibition area with the native plants.
- "Man and the Dead Sea", which includes findings and discoveries such as the Dead Sea Scrolls, the scull from the Baptism site, the historical and archaeological information relating to distinguished sites including the harbour in Zara, Roman Road, the life of Jesus Christ, Mount Nebo, etc.
- "Will the Dead Sea Really Die?", which includes the environmental issues about the decrease of water level and the pollution of the Dead Sea with its scientific data and information provided by the computer reference system, the audio-visual explanation and panels.

Outdoor Exhibition Area

The outdoor exhibition area is considered as an expansion of the exhibition hall inside, and linked with the connecting corridor between the museum and restaurant. This area is comprised of natural rock formations and native plants, surrounded by the pedestrian

pathways from the parking lots to the Amphitheater.

(4) Perspective View and List of Sub-project

As for the results of the design developed according to the planning and design policy and design concept, perspective view and/or sketches are shown in Figure 3.5.2, and a list of the project outlines is shown in Table 3.5.1 (1) (2).

Figure 3.5.2 Perspective view, sketches (outside view)

Source: JICA Study Team

Table 3.5.1(1) Area List (1): Building Floor Area

Section	Room Name	Internal area (m^2)	Covered external area (m^2)	Remarks
Main Building	Exhibition Hall	714		
	Conference Hall	191		138 seats w/connecting rooms
	Museum Shop	28		
	Foyer	28		
	Ticketing Office	19		
	Administration Office	44		
	Security Room	19		
	Preparation	28		
	Storage	55		
	Toilets	44		
	Circulation	218	45	Corridor, etc.
	(sub-total)	**(1,388)**	**(45)**	
Restaurant GF	Dining	245	130	152 seats internal, 112 outdoors
	Kitchen	154		
	Cash and cloak room	8		
	Toilets	43		
	(sub-total)	**(450)**	**(130)**	
Basement Fl.	Stores	37		
	Offices	12		
	Changing Room	13		
	Guard Room	7		
	Rest Area	20		W/Kitchen
	Toilets	13		
	Circulation	74		Corridor Elec. Etc
	(sub-total)	**(176)**		
Mechanical Bldg. (underneath the parking area)	Water Tanks	156		W/Pump Room
	Generator	54	12	
	Transformer	86		
	(sub-total)	**(296)**	**(12)**	
Total Floor Area		**(2,310)**	**(187)**	

Source: JICA Study Team

Table 3.5.1(2) Area List (2): Development Site Area

Area	Location	Area (m2)	Remarks
Building Area		**2,506**	
Landscaped Area	Entrance Plaza	452	
	Courtyard	106	
	Central Gardens	675	External exhibition space
	Terrace	205	Dining Terrace
	Panoramic Terrace	790	5 Places
	Amphi-theater	254	
	Car Parking	253	37 passenger cars and 3 large tourist buses
	Temporary Parking	2,000	
	Access Road	5,494	620m
	(sub-total)	**(10,229)**	
Others		**47,289**	
Total Development Site Area		**(60,024)**	

Source: JICA Study Team

3.5.3. Construction Plan

Since the site of the sub-project is remote from Amman and in an environmentally sensitive area, the construction plan should be carefully established by the contractor, and accepted by PMU and agencies concerned. The following are major points to be taken into consideration in the construction plan. The site for the temporary facilities can be located in the sub-project site but necessary utilities such as electricity, water supply and telephone are difficult to obtain in this area.

(1) Utilities for construction

Water supply

Since there is no existing water supply system to the location, the contractor should obtain water under his own responsibility. As an option, water can be brought from the Madaba Municipality by tank lorry, but the contractor should provide a water reservoir.

Electrical supply

Electrical supply is also not available in the location at this moment. However, it is planned to obtain power with a new cable installation from the transmission line along the section of Madaba-Ma'in road. The cable can be utilised for the temporary power supply if the construction sequence is well managed.

Telecommunications

For the telephone, it may be practical to utilise mobile telephones. However, for the facsimile line and also internet/e-mail lines a cable line may be required so far. Permanent telephone lines for the Panoramic Complex are to be installed being branched from the Main line along the Madaba-Ma'in Spa road. If the construction sequence permits it, this telephone line could be utilised.

Toilet and Sewerage

The sewage should be carefully treated in the location, since it is an environmentally sensitive area. There are two alternative solutions: 1) to be shipped out with a vacuume car of Madaba Municipality from a cesspool to be constructed, or 2) to provide a sewerage treatment plant to meet the Jordanian standards and regulations. The discharge point of the treated water to a wadi should be coordinated with Jordan Valley Authority. A plan of total sewage treatment system should be submitted to and approved by the agencies prior to the construction on site.

Disposal of excess soil and debris

The excess soil and debris should be properly disposed to an area(s), which should be designated under the coordination with the relevant agencies. The necessary measures to mitigate environmental impacts should be taken under the contractor's responsibility.

(2) Specific Note

The location of the sub-project is in a remote area and in the same location where the Dead Sea Parkway is to be constructed as a component of this Project. It is essential that the two contractors of the Panoramic Complex and the Parkway cooperate in the operation of some plant, such as concrete mixing plant and asphalt plant, etc. and large size/capacity equipment, in order to reduce the costs of the temporary works.

Furthermore, it is recommended that the two sub-projects should be combined into one package for the implementation in order to more effectively reduce costs of the temporary

works. This may be possible, as the tender management and construction supervision are conducted by MPWH.

(3) Environmental considerations

Environmental factors should be taken into considerations in preparing the construction plan. Table 3.5.2 shows the results of the environmental study made on the sub-project.

Table 3.5.2 Potential Impacts and Proposed Mitigation Measures

Predicted Impacts	Caused by	Mitigation measures
Archaeological remains: - damage to the existing archaeological remains and newly discovered sites	- cut and embankment - establishment of temporary facilities and road etc. - transportation	- construction work plans including temporary facilities and road should be approved by DOA - observe in consultation with experts of DOA to avoid direct impacts on potential archaeological remains
Waste pollution: - generate huge amount of construction wastes	**[construction stage]** - construction work and earthwork	- ensure disposal site for construction wastes near the project site
Water pollution: - degrade water quality in the wadis by wastewater and suspended particles	**[construction stage]** - discharge of wastewater from plant, temporary facilities and accommodation into wadis	- avoid rainy season - avoid using water supply from wadis - avoid direct discharge of waste water
Landscape: - deteriorate landscape	**[construction stage]** - construction of structure and road etc.	- careful attention to be paid to height, color, and feature of construction to alleviate drastic landscape changes
Ecology: - affect the existing vegetation along wadis and aquatic habitats	**[construction stage]** - wastewater from plant and temporary facilities into wadis - water extraction from wadis	- provide bridge and culvert for water courses - avoid rainy season as much as possible

Source: JICA Study Team

(4) Construction method and schedule

The construction schedule should be prepared taking into consideration the items above mentioned.

A construction schedule, including major work items, proposed by the Study Team as an option, is shown in Figure 4.1 in Chapter 4.