APPENDIX IV

ENVIRONMENTAL IMPACT STATEMENT AND ENVIRONMENTAL IMPACT ASSESSMENT DATA

Appendices IV Environmental Impact Statement and Environmental Impact Assessment Data

IV.1 Detailed Survey Items

Table IV-1 Detailed Survey Items

Items to be investigated	Detailed survey items
(1) Social environment	
Resettlement	- Distribution of houses and facilities - Distribution of grave yards - Existing land use condition - Compensation regulations - Hearing from relevant authorities and residents
Social and Economic activities	- Effect of traffic to residence and public facilities such as schools, mosques and hospitals - Industries and their scale to be influenced - Agricultural areas & productions to be influenced
Construction waste	- Volume and physical and chemical characteristics of waste - Location, scale and capacity of disposal sites - Waste regulations
Historical remains & cultural property (HP&CP)	- Kinds of HR&CP - Location of HR&CP - Characteristics & value of HR&CP - Relocation possibility of HR&CP
Disaster and Risk	-Wadi and flash flood
(2) Natural environment	
Trees, shrubs, vegetation	-Characteristics of trees, shrubs and vegetation - Ecological conditions of flora & fauna - Natural environment protection regulations
(3) Pollution	
Atmospheric quality	- Existing condition of air quality (SO_X, CO, SPM, NO_X, Pb) - Air quality protection regulations
Noise and vibration	- Existing condition of noise level (L_{eq}) - Noise/vibration restriction regulations
Water pollution	- Water use and pollution
Soil pollution	- Soil character and pollution

IV.2 Environmental Impact Statement

Following is the EIS application form submitted to the Department of Environment and Permission.

Table IV-2 EIS Application Form

SULTANATE OF OMAN
Ministry of Environment

سلطنة عمان
وزارة البيئة

ENVIRONMENTAL IMPACT
STATEMENT FORM L
INFRASTRUCTURE PROJECTS

بيان التأثير على البيئة
النموذج (ل) ـ مشروعات
البنية الأساسية

Refer to seperate notes for
Explanation of Questions

يرجى الرجوع الى نقاط الاسترشاد
الاسترشاد لمزيد من الاستيضاح

1. PROJECT ORGANISATION

١ ـ تنظيم المشروع :

A. PROJECT TITLE

أ ـ اسم المشروع :ـ

The detailed design study on road development project in Batinah Highway

B. BRIEF DESCRIPTION

ب ـ ملخص مختصر للمشروع :ـ

In response to the request of the Government of the Sultanate of Oman, the Government of Japan has decided to conduct this project. Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of technical cooperation programme of Japan, undertakes this study. The study is to prepare the detailed engineering design for the construction of eight (8) flyovers and twelve (12) pedestrian underpasses along the Batinah highway.

C. LOCATION

جـ ـ موقع المشروع :ـ

Flyover locations : 8 roundabouts and junction area a A' Naseem Garden R/A, Barka R/A, Al Muladdah Jn. Khaburah R/A, Saham R/A, Sohar R/A, Falaj Al Qabail R/A, Aqr R/A. Pedestrian underpass locations :12 site areas at Barka, Al Billah, A' Tareef, Al Qurat, A' Tharmd, A' Suweiq, Al Khadra, Qarih, Majaz A' Sughra, Khor A' Siyabi, Liwa, Asrar Bani Sa'd

D. OWNER

د ـ مالك المشروع :ـ

NAME Directorate General of Roads, Ministry of Communications

١ ـ الاسم :

ADDRESS P.O.Box 27 P.C 114

٢ ـ العنوان :

TELEPHONE NUMBER 702344

٣ ـ رقم التليفون :

E. CONTACT

ه ـ المسئول الذي يمكن الاتصال به :ـ

NAME Eng. Abdullah Suleiman Al-Sharji

١ ـ الاسم :

ADDRESS P.O.Box 27 P.C 114

٢ ـ العنوان :

TELEPHONE NUMBER 702344

٣ ـ رقم التليفون :

F. CONSULTANTS

و ـ الاستشاريون :ـ

NAME Pacific Consultants International (JICA study team)

١ ـ الاسم :

ADDRESS DGR P.O.Box 27 P.C 114

٢ ـ العنوان :

TELEPHONE NUMBER 785028

٣ ـ رقم التليفون :

NAME OF CONTACT

٤ ـ اسم الشخص الذي يمكن الاتصال به :

Yoshimi Takai (JICA study team leader)

G. PROPOSED STARTING DATE

ز ـ التاريخ المقترح للبدء :ـ

(i) CONSTRUCTION Earliest at May ,1998

١ ـ الانشاء :

(ii) OPERATION Earliest at 2000

٢ ـ التشغيل :

H. FUTURE DEVELOPMENT

ح ـ التوسعات المستقبلية :ـ

None

2. PROJECT DETAILS ٢ ـ تفاصيل خاصة بالمشروع :ـ

A. CONSTRUCTION DETAILS ١ ـ التفاصيل الخاصة بالانشاءات :ـ

Flyover

Superstructure: Prestressed concrete box girder.Substructure: Abutment; Reinforced concrete inverted T-shaped abutment in Right of way area Pier; Rigid framed reinforced concrete pier in roundabout area Standard bridge span: 20 to 30m depending on roundabout sites. Bridge length: 300m, Total flyover length (include approach length) :800m. Foundation:Cast in-situ ϕ 60cm reinforced concrete piles, standard type: without pile.

Pedestrian Underpass

Main underpass structure: Reinforced concrete box culvert shape with 3.0 m x 3.0 m at cross section and approx. 50 m in length, stairs and canopy at both ends within the area of right of way

B. UTILITIES REQUIREMENTS ب ـ متطلبات التشغيل :ـ

(i) WATER ١ ـ المياه :

Temporary water tank installation on site, water supplied by tank lorry.

(ii) ELECTRICITY ٢ ـ الكهرباء :

Temporary electric generator installation on site for construction machinery

(iii) FUELS ٣ ـ الوقود :

Temporary fuel tank for construction machinery

C. OTHER LOCATIONS CONSIDERED ج ـ المواقع الاخرى التي تؤخذ في الاعتبار :ـ

Temporary concrete casting yard for precast concrete productions near the camp site. Borrow pits for enbankment materials and quarry sites for aggregate materials to be approved by the relevant authority.

D. FACTORS DETERMINING PROJECT LOCATION د ـ العوامل التي تحدد موقع المشروع :ـ

Traffic volume at roundabouts

E. DETAILS OF PRELIMINARY INVESTIGATIONS ALREADY CARRIED OUT هـ ـ بيانات تفصيلية عن الاختبارات الأولية التي تمت

This project is basically an amelioration project of existing highway, therefore it will not cause major impact on natural environment such as geophysical features , flora and fauna against peripheral area of the highway. This project is to improve a traffic condition and to contribute reduction of pollutant exhaust.

3. OFF SITE ANCILLARY DEVELOPMENTS : ٣ ـ العوامل المساعدة خارج الموقع

None

4. POLLUTION CONTROL : ٤ ـ مراقبة التلوث

A. WASTE WATER : أ ـ مخلفات المياه :ـ

(i) NATURE AND CHEMICAL COMPOSITION : ١ ـ طبيعة المخلفات ومكوناتها الكيمائية

Generally no waste water

(II) QUANTITIES : ٢ ـ الكميات

Generally no waste water

(iii) METHODS OF CONTROL : ٣ ـ طرق المراقبة

No need of control

(iv) POINTS OF DISPOSAL : ٤ ـ نقاط التصريف

None

(v) MONITORING PROPOSALS : ٥ ـ مقترحات الرصد

None

B. EMISSIONS TO ATMOSPHERE : ب ـ انبعاثات الغبار والأبخرة والدخان في الغلاف الجوي :ـ

(i) NATURE AND CEMICAL COMPOSITION : ١ ـ طبيعة هذه الأشياء ومكوناتها الكيمائية

None

(ii) QUANTITIES : ٢ ـ الكميات

None

(iii) METHODS OF CONTROL : ٣ ـ طرق المراقبة

None

(iv) POINTS OF DISPOSAL : ٤ ـ نقاط التصريف

None

(v) MONITORING PROPOSALS : ٥ ـ مقترحات الرصد

None

C. SOLID WASTES

(i) NATURE AND CHEMICAL COMPOSITION

Demolished asphaltic concrete and curb stones, these can be partially reused

(ii) QUANTITIES

Approximate 22,000 m^3

(iii) METHODS OF CONTROL

Crushing asphaltic concrete blocks into small segments and disposal or partially reused

(iv) POINTS OF DISPOSAL

Disposal pits shall be approved by the relevant authority.

(v) MONITORING PROPOSALS

Inspection system in construction supervision

D. POLLUTION CONTROL OFFICIAL

Inspectors of supervision consultants appointed by relevant authority

5. POLLUTION HAZARDS

A. TOXIC OR HAZARDOUS MATERIALS

(i) NATURE AND CHEMICAL COMPOSITION

None

(ii) QUANTITIES

None

(iii) ORIGINS

None

B. SPECIAL FACILITIES AND OPERATIONAL PROCEDURES

(i) SAFETY OFFICIAL

None

(ii) EXPLOSIVES

None

IMPACTS ON AMENITIES AND SERVICES

٦ ـ التاثير على وسائل الراحة والخدمات :

A. EFFECTS ON AMENITIES AND SERVICES

١ ـ التاثير على وسائل الراحة والخدمات :ـ

Undertaking safety and smooth traffic cross over at the roundabout section, and installation of underpass to avoid dangerous pedestrian's crossing the highway. So that the construction of flyovers and pedestrian underpasses along the Batinah highway is the urgent task for the state on pubic safety and smooth traffic flow. Resolving these problems introduces the improvement of important infrastructure element for conveyance and transport and for domestic economic growth.

B. MEASURES TO ALLEVIATE HARMFUL EFFECTS

ب ـ الاجراءات التي اتخذت للحد من الآثار الضارة :ـ

During the construction phase, embankment earth works may cause dusty condition to atmosphere and may affect to the vicinity residents, periodical water spray measures may alleviate this condition.

SIGNATURE OF APPLICANT

توقيع مقدم الطلب :

JICA Study team leader: Yoshimi Takai

DATE February ,1996 STAMP

التاريخ / / ١٩ م .

NAME OF OWNER/COMPANY

اسم المالك/الشركة :

Directorate General of Roads
MINISTRY OF COMMUNICATIONS
SULTANATE OF OMAN

SIGNATURE OF OWNER

توقيع المالك :

DATE February , 1996 STAMP

الختم :

التاريخ / / ١٩ م

IV.3 Environmental Impact Assessment

1. Social Environment

(1) Grave yard

Table IV-3 Grave yard location

R/A	Location		Grave yard location
R/A-2	A'Naseem Garden	Sea side	1 km off
P/U 1	Barka	Mt.side	2 km off
R/A-3	Barka	Sea side	6 km off
P/U 2	Al Billah	Sea side	3 km off
P/U 3	A' Tareef	Sea side	2 km off
R/A-5	Al Muladdah	Mt. side	0.5 km off
P/U 4	Al Qarat	Mt.side	2 km off
P/U 5	A' Tharmad	Sea side	2 km off
P/U 6	A' Suweiq	Sea side	2 km off
P/U 7	Al Khadra	Sea side	2 km off

R/A	Location		Grave yard location
P/U 8	Qarih	Mt.side	2 km off
R/A-8	Khaburah	Sea side	2 km off
P/U 9	Majaz A' Sughra	Sea side	2 km off
P/U 10	Khor A' Siyabi	Mt.side	2 km off
R/A-10	Saham	Sea side	3 km off
R/A-12	Sohar	Mt. side	1 km off
P/U 11	Liwa	Sea side	1 km off
P/U 12	Asrar Bani Sa'd	Sea side	3 km off
R/A-14	Falaj Al Qabail	Mt. side	1 km off
R/A-18	Aqr	Sea side	1 km off

(2) Waste disposal site

Table IV-4 Waste disposal site

Location of the Project		Waste disposal management (Municipality)	Location of disposal yard managed by Municipality
			General waste & building rabble
A' Naseem Garden	R/A-2	Barka	3 km towards mounten side
Barka	P/U-1	Barka	10 km towards mounten side
	R/A-3	Barka	10 km towards mounten side
Al Billah	P/U-2	Barka	15 km towards mounten side
A' Tareef	P/U-3	Masan'ah	10 km towards mounten side
Al Muladdah	R/A-5	Masan'ah	9 km towards mounten side
Al Qarat	P/U-4	Masan'ah	10 km towards mounten side
A' Tharmad	P/U-5	Suweiq	5 km towards mounten side
A' Suweiq	P/U-6	Suweiq	5 km towards mounten side
Al Khaddra	P/U-7	Suweiq	15 km towards mounten side
Qarih	P/U-8	Suweiq	15 km towards mounten side
Al Khaburah	R/A-8	Khaburah	10 km towards mounten side
Saham	R/A-10	Saham	10 km towards mounten side
Majas A' Sughra	P/U-9	Saham	10 km towards mounten side
Khar A' Siyabi	P/U-10	Sohar	5 km towards mounten side
Sohar	R/A-12	Sohar	10 km towards mounten side
Falaj Al Qabail	R/A-14	Sohar	10 km towards mounten side
Liwa	P/U-11	Liwa	10 km towards mounten side
Asrar Bani Sa'd	P/U-12	Shinas	20 km towards mounten side
Aqr	R/A-18	Shinas	10 km towards mounten side

2. Natural Environment

(1) Vegitation at R/A and P/U area

Table IV-5 Planted major trees at R/A, P/U area and road side

Location of the Project		Road side	Inside R/A	Tree species	Size	Planting condition
A' Naseem Garden	R/A-2	x		Pithecellobium Dulce	H=2 - 3 m	12 m pich :
Barka	P/U-1	x		Zizyphus Spina-Christi	H=2 - 3 m	15 m pich :
		x		Ficus Benjamina	H=2 - 3 m	
	R/A-3	x		Zizyphus Spina-Christi	H=2 - 3 m	15 m pich :
		x		Ficus Benjamina	H=2 - 3 m	
			x	Pongamia Glabra	H=2 - 3 m	
			x	Phoenix Dactylifera	H=5 - 7 m	
			x	Azadirachta Indica	H=4 - 6 m	
Al Billah	P/U-2	x		Zizyphus Spina-Christi	H=2 - 3 m	15 m pich :
A' Tareef	P/U-3	x		Ficus Benjamina	H=2 - 3 m	15 m pich :
Al Muladdah	R/A-5	x		Pongamia Glabra	H=2 - 3 m	15 m pich :
		x		Prosopis Cineraria	H=2 - 3 m	
Al Qarat	P/U-4	x		Azadirachta Indica	H= 6 m	15 m pich :
A' Thamad	P/U-5	x		Zizyphus Spina-Christi	H=2-3 m	15 m pich :
A' Suweiq	P/U-6	x		Carissa Grandiflora	H=2-3 m	15 m pich :
Al Khaddra	P/U-7	x		Pongamia Glabra	H=2 - 3 m	15 m pich :
Qarih	P/U-8	x		Pongamia Glabra	H=2 - 3 m	15 m pich :
Al Khaburah	R/A-8	x		Azadirachta Indica	H=2 - 3 m	15 m pich :
			x	Tecoma Stan	H=5 - 7 m	
Saham	R/A-10	x		Pithecellobium Dulce	H=2 - 3 m	20 m pich :
		x		Zizyphus Spina-Christi	H=2 - 3 m	
			x	Pongamia Glabra	H=2 - 3 m	
			x	Ficus religiosa	H=5 - 6 m	
			x	Casuarina Equisentifolia	H=5 - 7 m	

Majas A' Sughra	P/U-9	x		Pongamia Glabra	H=2 - 3 m	15 m pich :
Khar A' Siyabi	P/U-10	x		Phoenix Dactylifera	H=6 m	15 m pich :
		x		Azadirachta Indica	H=6 m	
		x		Delonix Elata	H=6 m	
Sohar	R/A-12	x		Carissa Grandiflora	H=6 m	15 m pich :
		x		Azadirachta Indica	H=6 m	
		x		Bougainvillae sp.	H=1 - 2 m	
		x		Phoenix Dactylifera	H=6 m	
			x	Pithecellobium Dulce	H=2 - 3 m	
			x	Ficus Rerogiosa	H=5 - 7 m	
			x	Hibiscus Rosa-Sinensis	H=1 - 2 m	
Falaj Al Qabail	R/A-14	x		Pongamia Glabra	H=2 - 3 m	15 m pich :
			x	Tecoma Stans	H=5 - 7 m	
			x	Peltophorum Inerme	H=5 - 7 m	
Liwa	P/U-11	x		Zizyphus Spina-Christi	H=2 - 3 m	20 m pich :
Asrar Bani Sa'd	P/U-12	x		Pongamia Glabra	H=2 - 3 m	15 m pich :
Aqr	R/A-18	x		Pithecellobium Dulce	H=2 - 3 m	15 m pich :

3. Pollution

(1) Air Quality and noise level: Monitoring results

Table IV- 6 Hourly average values of measured parameters

R/A 3 Barka (Sat) 25 May 1996

Time	Leq	NOx ppbV	CO ppmV	SO2 ppbV	SPM mg/m3
0600-0700	67.8	27	0.1	8	259
0700-0800	66.8	70	1	4	187
0800-0900	66.4	46	0.5	8	220
0900-1000	66.8	21	0.4	10	353
1000-1100	67.4	16	0.3	8	522
1100-1200	67.3	14	0.2	7	665
1200-1300	67.6	12	0.4	6	1226
1300-1400	67.2	13	0.1	6	890
1400-1500	66.9	6	0	6	2442
1500-1600	67.1	7	0	4	1160
1600-1700	67.2	9	0.3	2	787
1700-1800	67.1	7	0.2	3	626
1800-1900	66.2	19	0.4	4	522
1900-2000	65.8	59	0.8	6	606
2000-2100	64.5	77	1.7	7	960
2100-2200	58.2	66	1.8	5	321
Daily Average		29	0.5	6	734

Hourly average values for chemical pollutants recalculated to mass concentrations

NOx mg/m3	CO mg/m3	SO2 mg/m3
51.6	0.1	21.3
133.7	1.2	10.6
87.9	0.6	21.3
40.1	0.5	26.6
30.6	0.3	21.3
26.7	0.2	18.6
22.9	0.5	16
24.8	0.1	16
11.5	0	16
13.4	0	10.6
17.2	0.3	5.3
13.4	0.2	8
36.3	0.5	10.6
112.7	0.9	16
147.1	2	18.6
126.1	2.1	13.3
56	0.6	15.6

Table IV-7 Hourly average values of measured parameters

Hourly average values for chemical pollutants recalculated to mass concentrations

P/U 3 A'Tareef, (Sun) 26 May 1996

Time	Leq	NOx ppbV	CO ppmV	SO2 ppbV	SPM	NOx mg/m3	CO mg/m3	SO2 mg/m3
0600-0700	68.2	59	0.3	4	238	112.7	0.3	10.6
0700-0800	66.1	33	0.5	6	471	63	0.6	16
0800-0900	66.3	11	0.5	4	424	21	0.6	10.6
0900-1000	66.5	12	1	3	427	22.9	1.2	8
1000-1100	66.3	12	0.5	3	479	22.9	0.6	8
1100-1200	65.9	12	0.5	3	582	22.9	0.6	8
1200-1300	66.2	9	0.3	3	617	17.2	0.3	8
1300-1400	66.3	3	0.3	3	961	5.7	0.3	8
1400-1500	67.5	3	0.8	3	221	5.7	0.9	8
1500-1600	66.4	6	0.1	6	234	11.5	0.1	16
1600-1700	65.8	17	0.1	7	1174	32.5	0.1	18.6
1700-1800	68.6	6	1.3	3	491	11.5	1.5	8
1800-1900	66.8	8	0.3	2	573	15.3	0.3	5.3
1900-2000	66.3	14	0.7	2	654	26.7	0.8	5.3
2000-2100	65.2	20	1.5	6	789	38.2	1.7	16
2100-2200	66.6	34	1	4	823	64.9	1.2	10.6
Daily Average		15	0.6	4	572	30.9	0.7	10.3

Table IV-8 Hourly average values of measured : parameters

Hourly average values for chemical pollutants recalculated to mass concentrations

R/A 8 Al Khaburah, (Mon) 27May 1996

Time	Leq	NOx ppbV	CO ppmV	SO2 ppbV	SPM	NOx mg/m3	CO mg/m3	SO2 mg/m3
0600-0700	65.5	32	0.5	4	565	61.1	0.6	10.6
0700-0800	65.4	34	1.1	8	1137	64.9	1.3	21.3
0800-0900	65.3	7	0.6	8	1170	13.4	0.7	21.3
0900-1000	66.6	11	0.4	8	1208	21	0.5	21.3
1000-1100	65.6	13	0.9	8	1126	24.8	1	21.3
1100-1200	65.1	7	0.5	9	970	13.4	0.6	23.9
1200-1300	63.8	8	0.7	7	825	15.3	0.8	18.6
1300-1400	64.1	4	0.2	6	671	7.6	0.2	16
1400-1500	64.2	1	0.1	6	394	1.9	0.1	16
1500-1600	66.5	3	0.2	6	439	5.7	0.2	16
1600-1700	64.8	6	0.2	7	614	11.5	0.2	18.6
1700-1800	65.7	7	0.8	7	805	13.4	0.9	18.6
1800-1900	64.7	34	1.1	8	938	64.9	1.3	21.3
1900-2000	65.1	41	2	7	1341	78.3	2.3	18.6
2000-2100	64.4	14	1.3	4	1174	26.7	1.5	10.6
2100-2200	61.7	18	1.9	5	1145	34.4	2.2	13.3
Daily Average		15	0.8	7	907.6	28.7	0.9	18

Table IV- 9 Hourly average values of measured parameters

Hourly average values for chemical pollutants recalculated to mass concentrations

P/U 9 A'Sughra, (Tue) 28May 1996

Time	Leq	NOx ppbV	CO ppmV	SO2 ppbV	SPM	NOx mg/m3	CO mg/m3	SO2 mg/m3
0600-0700	75.1	55	0.5	4	1196	105.1	0.6	10.6
0700-0800	72.8	53	0.8	5	1126	101.2	0.9	13.3
0800-0900	71.3	90	0.7	6	898	171.9	0.8	16
0900-1000	70.4	63	0.7	6	664	120.3	0.8	16
1000-1100	69.7	6	0	2	1303	11.5	0	5.3
1100-1200	69.6	2	0.1	6	1313	3.8	0.1	16
1200-1300	69.5	0	0	3	1074	0	0	8
1300-1400	68.8	0	0	4	688	0	0	10.6
1400-1500	70.2	0	0.1	4	1167	0	0.1	10.6
1500-1600	70.4	0	0	3	921	0	0	8
1600-1700	70	1	0	3	1146	1.9	0	8
1700-1800	69.8	0	0	3	1106	0	0	8
1800-1900	68.7	4	0.6	9	932	7.6	0.7	23.9
1900-2000	69.4	25	0.5	20	714	47.8	0.6	53.2
2000-2100	68.4	40	0.6	11	741	76.4	0.7	29.3
2100-2200	67.8	47	1.2	8	728	89.8	1.4	21.3
Daily Average		24	0.4	6	982.3	46.1	0.4	16.1

Table IV-10 Hourly average values of measured parameters

Hourly average values for chemical pollutants recalculated to mass concentrations

R/A 12 Sohar, (Wed) 29 May 1996

Time	Leq	NOx ppbV	CO ppmV	SO2 ppbV	SPM	NOx mg/m3	CO mg/m3	SO2 mg/m3
0600-0700	65.4	55	0.6	7	694	105.1	0.7	18.6
0700-0800	62.7	67	0.7	10	835	128	0.8	26.6
0800-0900	60.7	15	0	4	264	28.7	0	10.6
0900-1000	61.1	4	0	2	259	7.6	0	5.3
1000-1100	60.4	5	0	1	312	9.6	0	2.7
1100-1200	60	2	0	1	294	3.8	0	2.7
1200-1300	59.4	1	0	0	284	1.9	0	0
1300-1400	59.9	2	0	0	264	3.8	0	0
1400-1500	60.6	3	0	0	229	5.7	0	0
1500-1600	60.3	2	1	0	179	3.8	1.2	0
1600-1700	61.1	4	0	0	222	7.6	0	0
1700-1800	61.3	8	1	0	280	15.3	1.2	0
1800-1900	60.3	16	1.6	1	816	30.6	1.9	2.7
1900-2000	59.7	118	2.4	6	648	225.4	2.8	16
2000-2100	59.5	73	1.1	3	485	139.4	1.3	8
2100-2200	66.7	50	0.7	2	394	95.5	0.8	5.3
Daily Average		27	0.5	2	403.7	50.7	0.7	6.2

(2) Noise: Monitoring results

Noise measurements data are reported for the following parameters: time at end of monitoring interval (TIM); monitoring interval duration (ELT); Leq average sound pressure level during the monitoring interval; sound exposure level (SEL); minimum recorded level during interval (MINL); maximum recorded level (MAXL); maximum peak (MAXP); percentage overload (OVL); percentage overrange (OVL); percentage underrange (UNR);

Table IV-11 R/A 3 Barka, Noise monitoring result

Time	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
End time	5:59	6:59	7:59	8:59	9:59	10:59	11:59	12:59	13:59	14:59	15:59	16:59	17:59	18:59	19:59	20:59
Leq	67.8	66.8	66.4	66.8	67.4	67.3	67.6	67.2	66.9	67.1	67.2	67.1	66.2	65.8	64.5	58.2
SEL	103.2	102.3	101.9	102.2	102.3	102.7	103.0	102.5	101.8	102.8	102.6	102.6	101.6	101.3	100.0	99.0
UNR	0	0.35	7.95	10.5	9.48	4.87	6.51	5	3.82	6.9	0	0	0	0	0	0
OVR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OVL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MINL	61.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.0	57.4	56.1	55.2	52.7	52.2
MAXL	85.6	83.4	87.0	88.0	94.0	84.1	87.7	83.7	85.1	84.2	88.7	95.8	90.7	91.6	87.8	92.5
MAXP	97.6	95.6	97.7	102.1	102.1	99.3	101.4	99.5	100.2	98.2	99.6	105.9	99.8	101.7	98.2	115.5

Table IV- 12 P/U3 A' Tareef, Noise monitoring result

Time	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
End time	5:59	6:59	7:59	8:59	9:59	10:59	11:59	12:59	13:59	14:59	15:59	16:59	17:59	18:59	19:59	20:59
Leq	68.2	66.1	66.3	66.5	66.3	65.9	66.2	66.3	67.5	66.4	65.8	68.7	66.8	66.3	65.2	66.6
SEL	103.7	101.6	101.7	101.9	101.8	101.4	101.7	101.5	103.3	101.8	101.3	104.1	102.2	101.7	100.6	102.1
UNR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OVR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OVL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MINL	58.3	55.7	55.5	55.8	54.1	55.8	55.0	56.0	56.8	56.5	57.1	57.9	57.0	57.0	56.2	0
MAXL	88.1	82.6	85.9	91.5	87.9	87.5	86.0	85.0	86.7	84.3	85.2	90.7	85.7	88.1	85.7	95.7
MAXP	100.3	94.6	99.5	101.5	101.2	99.1	99.5	99.0	100.2	96.4	97.6	104.3	97.5	101.7	98.6	123.6

Table IV-13 R/A8 Al Khaburah, Noise monitoring result

Time	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
End time	5:59	6:59	7:59	8:59	9:59	10:59	11:59	12:59	13:59	14:59	15:59	16:59	17:59	18:59	19:59	20:59
Leq	65.5	65.4	65.3	66.6	65.6	65.1	63.8	64.1	64.2	66.5	64.8	65.7	64.7	65.1	64.4	61.7
SEL	101.1	100.9	100.8	102.1	101.1	100.6	99.3	99.5	99.7	101.9	100.3	101.2	100.1	100.5	99.8	97.1
UNR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38.4
OVR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OVL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
MINL	56.3	56.2	57.5	57.9	56.6	55.2	55.8	55	56.5	56.9	58.1	56.9	57.3	56.8	55.9	0
MAXL	92.4	87.5	90.4	87.7	87	90.3	83.6	85.4	83	97.3	83.8	81.7	81.1	85.6	85.1	93
MAXP	99.5	109	103	98.6	100.1	100.7	95.1	96.6	95	107.9	95.5	101	96.3	96.8	98.8	112

Table IV-14 P/U 9 A' Sughra, Noise monitoring result

Time	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
End time	5:59	6:59	7:59	8:59	9:59	10:59	11:59	12:59	13:59	14:59	15:59	16:59	17:59	18:59	19:59	20:59
Leq	75.1	72.8	71.3	70.4	69.7	69.6	69.5	68.8	70.2	70.4	70.3	69.8	68.7	69.4	68.4	67.8
SEL	111	108	107	106	105.2	105	105	104	106	105.9	105.5	105	104	105	104	103
UNR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OVR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OVL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MINL	69.4	65.4	63.5	60.7	60.8	60.7	62.6	61.2	61.1	60..1	61.1	57.2	52	52.4	51.2	0
MAXL	94.7	88.0	97.4	90.0	90.0	90.4	87.4	89.6	90.5	89.7	88.3	91.7	91.7	97.3	88.9	93.0
MAXP	102.8	98.9	99.4	99.1	101.1	103.3	99.8	101.5	101.1	101.5	101.1	116.8	121.3	109.0	100.9	113.1

Table IV-15 R/A 12 Sohar, Noise monitoring result

Time	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00
End time	5:59	6:59	7:59	8:59	9:59	10:59	11:59	12:59	13:59	14:59	15:59	16:59	17:59	18:59	19:59	20:59
Leq	65.4	62.7	60.7	61.1	60.4	60	59.4	59.9	60.6	60.3	61.1	61.3	60.3	59.7	59.5	66.7
SEL	100.9	98.2	96.2	96.5	95.8	95.5	94.9	95.3	96.0	95.7	96.5	96.3	95.7	95.2	94.9	102.1
UNR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OVR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OVL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MINL	60.8	56.3	55.1	55.6	53.5	52.6	53.5	53.8	53.6	54.5	54.1	54.3	51.5	51.3	51.2	51.8
MAXL	80.0	77.1	75.9	77.8	76.9	80.2	78.8	74.2	88.9	74.9	84.7	79.8	79.8	77.1	80.2	96.2
MAXP	89.1	88.3	89.7	89.3	90.0	92.9	90.5	88.8	98.7	89.4	106.1	98.0	98.0	91.4	96.1	114.8

(3) Noise level of construction machines

Table IV-16 Noise level of construction machine

Type of machine	Capacity	Noise power level dB(A)	(with noise controled) dB(A)
Buldozer	3 ton	104 - 108	
	15 ton	11 - 115	98 - 103
	21 ton	112 - 116	
Tractor shovel	0.8 m3	105 - 109	
	1.2 m3	106 - 110	100 104
	1.5 m3	108 - 112	
Back hoe	0.35 m3	105 - 109	99 - 103
	0.6 m3	107 - 111	101 - 105
Track	10-11 ton	107 - 113	
Tipper track	10 ton	107 - 113	
Craweler crane	80 - 100 ton	99 - 103	
Track crane	40 - 50 ton	102 - 104	
Concrete Breaker	20 kg	114 - 118	108 - 112
	30 kg	120 - 124	111 - 115
Tire roller	8 -20 ton	102 - 106	
Macadam roller	10 - 12 ton	102 - 106	
Vibrator roller	1 ton	101 - 106	
	2.5 ton	106 - 111	
	3 - 4 ton	107 - 112	
Tamer	100 kg	103 - 108	
Transit mixer	4.4 m3	109 - 113	
Asphalt finisher	2.4 - 4 m	105 - 109	
Air compressor	10.5 m3/min	108 - 112	99 - 103
	17m3/min	109 - 113	100 - 106
Generator	75 k VA	102 - 106	90 - 94
	175kVA	109 - 113	93 - 97
	300 - 400kVA		94 - 98

(4) Water and soil

Table IV-17 Ground water and soil condition

Location of the Project		Water		Soil
		Water obtaining resource	Ground water	Soil Type
A' Naseem Garden	R/A-2	Open well and Tanker delivered	Brackish water at 20 m depth	Silty sand
Barka	P/U-1	Open well and Tanker delivered	Fresh water at 25 m depth	Sandy gravel
	R/A-3	Open well and Tanker delivered	Fresh water at 25 m depth	Sandy gravel
Al Billah	P/U-2	Open well and Tanker delivered	Brackish water at 25 m depth	Silty sand
A' Tareef	P/U-3	Open well and Tanker delivered	Fresh water at 25 m depth	Sandy gravel
Al Muladdah	R/A-5	Open well and Tanker delivered	Fresh water at 25 m depth	Silty sand
Al Qarat	P/U-4	Open well and Tanker delivered	Fresh water at 25 m depth	Silty sand
A' Tharmad	P/U-5	Open well and Tanker delivered	Fresh water at 25 m depth	Sandy gravel
A' Suweiq	P/U-6	Open well and Tanker delivered	Fresh water at 25 m depth	Silty sand
Al Khaddra	P/U-7	Open well and Tanker delivered	Fresh water at 25 m depth	Silty sand
Qarih	P/U-8	Open well and Tanker delivered	Fresh water at 25 m depth	Silty sand
Al Khaburah	R/A-8	Open well and Tanker delivered	Fresh water at 25 m depth	Sandy gravel
Saham	R/A-10	Open well and Tanker delivered	Fresh water at 25 m depth	Sandy gravel
Khar A' Siyabi	P/U-10	Open well and Tanker delivered	Fresh water at 25 m depth	Sandy gravel
Sohar	R/A-12	Open well and Tanker delivered	Fresh water at 15 m depth	Sandy silt
Falaj Al Qabail	R/A-14	Open well and Tanker delivered	Fresh water at 15 m depth	Sandy gravel
Liwa	P/U-11	Open well and Tanker delivered	Fresh water at 25 m depth	Sandy gravel
Asrar Bani Sa'd	P/U-12	Open well and Tanker delivered	Fresh water at 25 m depth	Silty sand
Aqr	R/A-18	Open well and Tanker delivered	Fresh water at 25 m depth	Sandy gravel

Table IV-18 Chemical character of soil

Location	Soil type	Average value of chemical analysis			
		Moisture content	pH	SO3 (mg/l)	Cl (%)
R/A2 Naseem	Gravelly soil	11.9	8.09	152	0.04
	Sandy soil	-	8.12	168	0.04
R/A3 Barka	Cohesive soil	27.2 (Individual)	-	-	-
	Gravelly soil	-	8.18	55	0.03
	Sandy soil	10.2	8.21	137	0
R/A5 Muladdah	Cohesive soil	21.4	8.38	135	0.16
R/A8 Al Khadra	Cohesive soil	20	8.58	130	0.02
	Sandy soil	-	7.81	198	0.25
R/A10 Saham	Cohesive soil	18.8	8.82	276	0.13
	Sandy soil	-	-	-	-
R/A12 Sohar	Cohesive soil	19.9	8.5	55	0.02
R/A14 Falaj Al Qabail	Gravelly soil	22.8	9.07	106	0.01
R/A18 Aqr	Gravelly soil	-	9.11	118	0

Table IV-19 Chemical character of water at near project areas

Location	Value of chemical analysis		
	pH	SO3 (g/l)	Cl (mg/l)
A'Tareef-1	7.14	-	238.6
Wusdam As Sahil	7.78	0.05	65.2
Al Hijari	8.25	0.151	53.9
Ohi	8.22	0.096	70.5
Al Aqr	8.09	0.109	119.1

(5) Specialists participated the study work for Environmental survey and the Environmental Impact Assessment

Table IV-20, Major specialists participated the EIA study

Consultant firm: Swissboring Corp., P.O.Box 2694 Ruwi, Postal code 112 Muscat, Sultanate of Oman	
Personnel	Fields of Specialty
Mr. Guy. Salerno	Geotechnical and Soil mechanics engineer, Project manager
Mr. T.Sivalumaran	Public relation, Supervisor
Mr. Omer Hamood Ali Al Hasni	Public relation
Mr. Charels Outschorn	Foreman for Ambient air and noise monitoring
Dr. Ian Evans	EIA specialist, Persons Engineering Science, Lincoln, UK
Mr. Richard Russel	EIA assistant, Persons Engineering Science, Oman

JICA