

F. ENVIRONMENT

F-1. List of Data

Table F-1 Beginning, end and continue days of all seasons in Erdene - Undurkhaan

Undurkhaan	Winter	Spring	Summer	Autumn
Begin	9.XI	14.III	14.V	15.IX
End	14.III	14.V	15.IX	9.XI
Day	125	61	124	55
Erdene	Winter	Spring	Summer	Autumn
Begin	27.X	27.III	18.V	6.IX
End	27.III	18.V	6.IX	27.X
Day	151	52	111	51
Kherlen	Winter	Spring	Summer	Autumn
Begin	1.XI	28.III	15.V	17.IX
End	28.III	15.V	17.IX	1.XI
Day	147	48	125	45

Table F-2 Sun illumination and time of the month and year

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Sum
Ulaanbaatar	172	202	268	276	300	277	261	246	251	223	175	146	2797
Undurkhaan	203	205	267	269	309	295	277	268	256	235	197	175	2960
Choibalsan	196	213	272	273	305	308	299	283	259	240	202	179	3029

Table F-3 Sun illumination and time of the twenty four hours

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average
Ulaanbaatar	5.5	7.2	8.6	9.2	9.7	9.2	8.4	7.9	8.4	7.2	5.8	4.7	7.7
Undurkhaan	6.5	7.3	8.6	9.0	10.0	9.8	8.9	8.6	8.5	7.8	6.6	5.6	8.1
Choibalsan	6.3	7.6	8.8	9.1	9.8	10.2	9.6	9.1	8.6	7.7	6.7	5.8	8.4

Table F-4 Sun ray sum in horizontal surface , mJ/m²

Latitude	Month												Year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
43°	228.5	332.6	495.0	591.7	694.8	681.6	587.2	575.0	514.0	401.2	261.4	191.4	5554.4
44°	224.4	324.1	487.2	587.5	685.8	670.8	599.7	554.1	504.2	386.1	253.7	204.8	5482.4
45°	216.8	305.8	484.2	571.3	685.6	617.9	567.0	547.7	488.4	371.9	234.6	185.5	5276.7
46°	197.7	272.0	437.6	519.0	682.1	621.8	548.6	501.9	434.1	339.7	224.1	171.5	4950.1
47°	176.4	263.6	426.6	505.2	647.4	620.9	547.2	507.3	431.2	313.4	184.3	138.2	4761.7
48°	162.7	268.8	428.8	500.5	631.6	620.3	547.0	505.3	409.1	312.6	187.3	137.3	4711.3
49°	151.8	241.5	403.8	494.8	600.4	601.4	540.7	504.9	397.6	288.8	174.0	138.3	4538.0
50°	144.1	234.7	394.6	493.3	582.6	589.3	536.1	458.6	358.2	265.4	160.3	110.3	4327.5

Table F-5 Sun straight ray in horizontal surface, mJ/m²

Latitude	Month												Year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
43 ⁰	156.0	213.0	314.1	371.5	463.5	410.6	372.8	371.5	354.2	281.3	173.7	130.3	3612.5
44 ⁰	161.5	215.1	308.7	356.1	423.4	425.3	369.1	356.0	361.0	283.8	167.0	126.6	3553.6
45 ⁰	145.8	207.7	308.4	373.5	424.6	434.9	400.1	378.0	369.7	261.5	158.8	119.7	3582.7
46 ⁰	111.3	162.0	261.1	363.1	424.0	428.1	397.8	367.2	312.1	212.2	128.3	96.7	3263.9
47 ⁰	88.0	157.0	247.0	308.7	400.3	362.7	309.1	305.1	300.4	190.0	97.3	64.8	2830.4
48 ⁰	87.0	156.5	257.2	294.7	366.6	358.3	304.7	290.3	256.4	190.2	92.7	64.4	2719.0
49 ⁰	73.1	135.0	236.1	275.4	322.5	356.6	293.0	248.0	225.4	158.7	83.4	52.8	2460.0
50 ⁰	64.8	155.5	183.3	187.5	263.0	230.9	212.9	207.5	173.4	136.9	80.0	51.3	1947.0

Table F-6 Sun dispersion ray, mJ/m²

Latitude	Month												Year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
43 ⁰	72.8	96.5	152.1	192.5	212.0	221.2	212.5	178.8	130.6	97.3	70.4	64.0	1700.7
44 ⁰	89.2	113.7	186.5	238.2	275.4	257.8	237.4	205.7	155.8	121.6	95.8	79.5	2056.6
45 ⁰	86.1	106.6	186.4	238.1	272.8	251.6	263.3	214.8	157.9	118.7	82.8	72.1	2051.2
46 ⁰	86.0	111.0	176.7	221.8	279.5	272.7	252.8	214.7	163.3	126.5	106.8	74.8	2086.6
47 ⁰	88.4	115.9	179.6	224.8	247.1	253.5	250.1	202.2	150.7	113.5	87.0	73.4	1986.2
48 ⁰	80.4	104.2	174.9	228.4	268.2	255.6	253.7	216.0	154.5	119.2	85.5	72.8	2013.4
49 ⁰	79.2	107.2	167.4	217.0	268.0	250.9	237.1	209.7	159.8	128.7	90.6	79.2	1994.8
50 ⁰	79.2	106.3	167.0	214.0	254.0	223.7	227.3	197.6	148.4	113.2	77.4	64.2	1872.3

Table F-7 Sun reflection ray, mJ/m²

Latitude	Month												Year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
43 ⁰	61.7	68.9	100.1	101.1	114.3	110.8	99.1	97.8	83.6	74.6	56.9	50.3	1019.2
44 ⁰	102.9	105.1	130.4	132.7	147.8	132.7	119.6	111.2	104.1	98.0	91.0	81.8	1357.3
45 ⁰	106.0	127.1	168.8	175.1	205.2	192.8	179.4	162.9	151.2	124.3	101.0	96.0	1789.8
46 ⁰	89.3	107.7	137.1	139.0	145.9	135.3	119.3	117.9	102.5	94.7	89.8	79.9	1358.4
47 ⁰	89.6	110.2	134.2	140.0	131.7	104.5	97.1	93.0	78.2	72.1	65.4	63.4	1179.4
48 ⁰	85.5	99.6	110.1	114.3	127.5	120.4	109.6	101.3	85.9	81.2	74.0	71.5	1180.9
49 ⁰	75.5	96.8	188.8	106.8	119.8	105.2	95.7	89.2	75.2	81.0	67.1	57.4	1158.5
50 ⁰	67.1	74.9	94.4	110.6	132.8	113.2	101.6	93.3	80.1	67.9	51.2	44.4	1031.5

Table F-8 Sun absorbed ray, mJ/m²

Latitude	Month												Year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
43 ⁰	167.7	231.3	362.0	469.4	574.2	538.2	496.6	456.8	405.1	306.5	187.3	144.6	4339.7
44 ⁰	148.0	221.5	360.4	462.4	549.3	544.9	490.1	449.2	402.8	304.4	167.9	121.7	4222.6
45 ⁰	138.0	178.7	319.0	414.8	494.2	485.5	466.7	417.5	354.5	284.3	137.0	89.2	3779.4
46 ⁰	113.7	169.4	295.6	375.6	467.1	471.9	437.1	389.3	335.7	244.7	131.3	90.6	3522.0
47 ⁰	106.8	151.4	305.3	371.5	431.3	452.1	417.0	395.9	285.9	227.0	118.9	73.9	3337.0
48 ⁰	95.3	159.8	330.3	404.2	512.8	485.7	462.0	395.8	325.6	231.8	113.8	65.2	3582.3
49 ⁰	91.4	155.0	307.3	392.5	472.9	490.7	459.8	412.2	319.7	221.0	115.8	83.8	3522.1
50 ⁰	81.6	125.7	238.8	300.7	390.3	376.8	348.3	318.8	259.9	191.9	99.9	70.2	2802.9

Table F-9 Reflection of sun ray, %

Latitude	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
44 ⁰	41	32	26	22	21	19	19	19	20	24	36	39
45 ⁰	50	42	35	30	30	28	28	28	29	33	43	52
46 ⁰	42	37	30	25	23	21	21	22	22	27	40	44
47 ⁰	38	38	31	25	21	19	19	20	21	30	39	42
48 ⁰	51	38	26	22	20	19	19	20	21	26	39	52
49 ⁰	47	43	34	25	23	21	21	21	22	29	41	44
50 ⁰	37	33	23	22	20	19	18	18	19	23	30	36

Table F-10 Balance of sun ray, mJ/m²

Latitude	Month												Year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
43 ⁰	-4.0	67.2	150.2	263.6	315.7	344.8	330.3	285.6	214.2	110.6	14.3	-8.7	2083.8
44 ⁰	-39.8	27.4	111.4	210.9	273.7	305.2	281.1	242.8	172.1	61.7	-31.7	-53.2	1561.6
45 ⁰	-27.4	33.2	96.3	184.0	247.9	269.5	274.5	219.7	150.3	58.1	-21.9	-41.5	1442.7
46 ⁰	-36.4	17.0	110.7	191.6	253.3	287.3	270.3	221.5	148.2	66.2	-11.5	-42.4	1475.8
47 ⁰	-3.9	45.1	156.7	205.2	275.0	311.9	295.4	266.9	172.4	99.7	5.8	-1.8	1828.4
48 ⁰	-29.7	33.4	134.6	217.3	295.9	311.7	302.5	255.9	163.1	64.3	-17.6	-40.7	1690.7
49 ⁰	-49.5	24.5	99.0	184.2	260.9	300.5	297.2	255.2	150.5	48.7	-22.6	-62.7	1485.9
50 ⁰	-26.8	3.7	67.8	141.9	209.6	230.6	215.4	181.7	119.1	34.0	-42.1	-41.1	1093.8

Table F-11 Plant Diversity list (Erdene –Undurkhaan)

Name of plant	Region Mongol-Daguur	Region medium Khalkh	Rare plants	Endemic plants
1.LYCOPODIOPHYTA				
1.Selaginellaceae Mett.				
Selaginella boealis (Kaulf.) Rupr.	+	+		
S.sanguinolenta (L.) Spring.	+	+		
2.EQUISETOPHYTA				
2.Equisetaceae Rich.				
Equisetum arvense L.	+	+		
E.fluviatile L.	+			
E.hyemale L.	+			
E.palustre L.	+			
E.pratense L.	+			
E.sylvaticum L.	+			
3.PTERIDOPHYTA				
3.Sinopteridaceae Koidz.				
Aleuritopteris argentea (S.G.Gmel.) Fee.	+	+		
4.Polypodiaceae Bercht. Et Presl.				
Polypodium sibiricum Sipl.	+	+		
5.Aspidiaceae Mett. ex Frank.	+			
Dryopteris fragrans (L.) Schott.				
6.Athyriaceae Alst.				
Athyrium filix-femina (L.) Roth.	+			
Cystopteris fragilis(L.)Bernh.	+	+		
7.Woodsiaceae (Diels.) Herter.				
Woodsia acuminata (Fomin) Sipl.	+	+		
W.ilvensis (L.) R.Br.	+	+		
8.Thelipteridaceae Pichii-Sermolii				
Phegopteris connectilis (Michx.) Watt.	+			
4.PINOPHYTA				
9.Pinaceae Lindl.				
Larix dahurica x L.sibirica	+			
L.sibirica Ledeb.	+	+		
10.Cupressaceae Bartl.				
Juniperus pseudosabina Fisch. et Mey.	+	+		
J.sabina L.	+	+		
11.Ephedraceae Dumort.				
Ephedra equisetina Bunge		+		
E.Fedtschenkoeae Pauls.	+			
E.monosperma C.A.Mey.	+	+		
E.sinica Starf.	+	+		
5.MAGNOLIOPHYTA				
12.Typhaceae Juss.				
Typha Laxmannii Lepech.	+	+		
13.Sparganiaceae Rrudolfii Sparganium stloniferum	+			
Bush-Ham ex Juz.				
14.Potamogetonaceae Dumort.				
Potamogeton gramieus L.	+	+		
P.pectinatus L.	+	+		
P.perfoliatus L.	+	+		
P.praelongus Wulf.	+	+		
P.pusillus L.	+	+		
P.vaginatus Turcz.	+	+		
15.Zannichelliaceae Dumort.				
Zannichellia pedunculata Reich.	+	+		
16.Juncaginaceae Rich.				
Triglochin maritimum L.	+	+		
T.palustre L.	+	+		
17.Poaceae Barnh.				
Spodoipogon sibiricus Trin.	+			
Panicum miliaceumL.	+			
Setaria viridis (L.) P. B.	+	+		

Phalaroides arundinacea L.	+			
Hierochloa glabra Trin.	+			
H.odorata (L.) P. B.	+			
Achnatherum splendens (Trin.) Nevski	+	+		
Stipa baicalensis Roshev.	+	+		
S.brevifolia Griseb.		+		
S.glareosa P.Smirn.		+		
S.gobica Roshev.	+	+		+
S.grandis P.Smirn.	+	+		
S.Klemenzi Roshev.	+	+		+
S.Krylovii Roshev.	+	+		
S.sibirica (L.) Lam.	+	+		
Phleum phleoides (L.) Karst.	+	+		
Alopecurus aequalis Sobol.	+	+		
A.arundinaceus Poir.	+	+		
A.brachystachyus Bieb.	+	+		
A.pratensis L.	+	+		
Agrostis gigantea Roth.	+			
A.mongolica Roshev.	+	+		
A.stolonifera L.	+	+		
A.trinii Turcz.	+	+		
Calamagrostis epigeios (L.) Roth.	+	+		
C.macrolepis Litv.	+	+		
C.macilentia (Griseb.) Litv.	+			
C.neglecta (Ehrh.) Gaerth., Mey et Schrenb.	+	+		
C.purpurea (Trin.) Trin.	+			
C.sajanensis Malyshev.	+			
Deschampsia caespitosa (L.) Beauv.	+			
D. Sukatschewii (Popl.) Roshev.	+			
Trisetum sibiricum Rupr.	+	+		
Helictotrichon dahuricum (Kom.) Kitag.	+			
H.pubescens (Huds.) Pilg.	+			
H.Schellianum (Hack.) Kitag.	+	+		
Avena fatua L.	+			
A.sativa L.	+			
Chloris virgata Sw.		+		
Tripogon chinensis (Franch.) Hack.	+	+		
Beckmannia syzigachne (Steud.) Fern.	+	+		
Enneapogon borealis (Griseb.) Honda.		+		
Phragmites communis Trin.	+	+		
Cleistogenes kitagawae Honda.	+	+		
C.songarica (Roshev.) Ohwi		+		
C.squarrosa (Trin.) keng.	+	+		
Eragrostis minor Host.	+	+		
E.pilosa (L.) Beauv.	+	+		
Koeleria altaica (Domin.) Kryl.	+	+		
K.cristata (L.) Pers.	+	+		
K.mukdenensis domin.	+	+		
Catabrosa aquatica (L.) P.B.	+	+		
Melica virgata Turcz. ex Trin	+	+		
Poa argunensis Roshev.	+	+		
P.attenuata Trin.	+	+		
P.botryoides Trin.	+	+		
P.nemoralis L.	+	+		
P.ochotensis Trin.	+			
P.palustris Trin.	+			
P.pratensis L.	+	+		
P.sibirica Roshev.	+			
P.subfastigiata Trin.	+	+		
Scolochloa festuacea (Willd.) Link.	+			
Glyceria triflora (Korsh.) Kom.	+	+		
Puccinellia macranthera (Krecz.) Norlindh.	+	+		
P.tenuiflora (Griseb.) Scribn. Et Merr.	+	+		
Festuca dahurica (St.-Yves.) Krecz. Et Bobr.	+	+		
F.lenensis Drob.	+	+		
F.ovina l.	+			

F.rubra L.	+	+		
F.sibirica Hack. ex Boiss.	+	+		
F.valesiaca Gaud.	+			
F.valesiaca ssp. hypophylla (St.-Yves.) Tzvel.	+			
Bromus inermis Leyss.	+	+		
B.Korotkyi Drob.	+	+		
B.pumpellianus Scribn.	+	+		
Agropyron cristatum (L.) Beauv.	+	+		
A.desertorum (Fisch. ex Link.) Schult		+		
A.fragile (Roth.) Candargy		+		
A.krylovianum Schischk.	+			
A.michnoi Roshev.	+	+		
A.pectinatum (Bieb.) Beauv.	+	+		
Hordeum Roshevitzii Bowden.	+	+		
H.brevisubulatum (Trin.) Link.	+	+		
H.turkestanicum Nevskii		+		
Leymus chinensis (Trin.) Tzvel.	+	+		
L.poboanus (Claus.) Pilg.		+		
L.racemosus (Lam.) Tzvel.		+		
L.secalinus (Georgi.)Tzvel.	+	+		
Elymus aegopodoides (Drob.) Worosch.	+			
E.brachypodioides(Nevski) Peschkova	+			
Elymus confusus (Roshev.)Tzvel.	+	+		
E.dahuricus Turcz. ex Griseb.	+	+		
E.excelus Turcz. ex Griseb.	+			
E.gmelinii (Ledeb.) Tzvel.	+	+		
E.transbaicalensis (Nevski) Tzvel.	+			
E.sibiricus L.	+	+		
18.Cyperaceae Juss.				
Cyperus fuscus L.		+		
Eriophorum polystachyon L.	+			
E. polystachyon ssp. komarovii (V.Vassil) Novosellova.	+	+		
Baeothryon pumilum (Vahl.) A. et D.Love	+	+		
Scirpus Hippoliti V.Krecz.	+	+		
S.orientalis Ohwi	+			
S.radicans Schruhr.	+			
Bolboschoenus planiculmis (Fr. Schmidt.) Egor.	+	+		
Blysmus rufus (Huds.) Link.	+	+		
B.sinocompressus Tang. Et Wang.	+	+		
Dichstylis micheliana (L.) Ness.	+			
Eleocharis acicularis (L.) Roem. et Schult.	+			
E. acicularis ssp. yokoscens (Franch. Et Savat.) Egor.	+			
E.meridionalis Steud.	+	+		
E.palustris (L.) Roem et Schult.	+	+		
Kobresia filifolia (Turcz.) Clarke.	+	+		
Carex appendiculata (Trautv. et Mey.) Kuk	+	+		
C. argunensis Turcz. ex Trev.	+			
C. aspratillis V.Krecz.	+			
C. atherodes Spreng.	+	+		
C. coriophora Fisch. et Mey.	+	+		
C. delicata Clarke	+	+		
C. dichroa (Frey.) V.Krecz.	+			
C. duriuscula C.A.Mey.	+	+		
C. enervis C.A.Mey.	+	+		
C. Korshinskyi Kom.	+	+		
C. lithophila Turcz.	+			
C. media R.Br.	+			
C. microglochin Wahlenb.	+	+		
C. orbicularis Boott.	+	+		
C. pediformis C.A.Mey	+	+		
C. relaxa V.Krecz.	+	+		
C. reptabunda (Trautv.) V.Krecz.	+	+		
C. rhynchophysa C.A.Mey	+			
C. rostrata Stokes		+		

C. sabulosa Turcz. ex Kunth.	+	+		
C. sajanensis V.Krecz.	+	+		
C. schmidtii Meinsh.	+			
C. Sedakovii C.A.Mey. ex Meinsh.	+			
C. Gotoi Ohwi	+			
C. selengensis Ivanova	+			
C. stenophylloides V.Krecz.		+		
C. supermascula V.Krecz.	+			
C. tomentosa L.	+	+		
C. vesicata Meinsh.	+	+		
19.Araceae Juss.				
Acorus calamus L.	+			
20.Lemnaceae S.F.Gray.				
Lemna minor L.	+	+		
21.Juncaceae Juss.				
Juncus alpino-articulatus Chaix.	+	+		
J. bufonius L.	+	+		
J. bufonius ssp. ambiguus (Guss.) Schinz. Et Thell.	+			
J. bufonius ssp. turkestanicus (V.Krecz. et Gontsch.) V.Novikov	+			
J. compressus Jacq.	+	+		
J. Gerardii Loiss.	+	+		
J. leucochlamys Zing. Ex V.Krecz	+			
J. orchonicus V.Novikov	+	+		
J. salsuginosus Turcz. ex E.Mey.	+	+		
22.Melanthiaceae				
Veratrum lobelianum Bernh.	+			
V. nigrum L.	+			
23.Hemerocallidaceae				
Hemerocallis minor Mill.	+	+		
H. lilio-asphodelus L.	+			
24.Alliaceae J.Agardh. Allium altaicum Pall.		+		
A. anisopodium Ledeb.	+	+		
A. bidentatum Fisch. ex Prokh.	+	+		
A. buriaticum Frisen.	+	+		
A. dauricum Frisen.	+			
A. eduardii Stearm.	+	+		
A. leucocephalum Turcz. ex Ledeb.	+	+		
A. lineare L.	+			
A. maximowiczii Regel	+			
A. mongolicum Turcz. ex Regel.	+	+		+
A. polyrhizum Turcz ex Regel.	+	+		
A. prostratum Trev.	+	+		
A. ramosum L.	+	+		
A. senescens L.	+	+		
A. splendens Willd. Ex Schult. Et Schult. Fil.	+	+		
A. stellerianum Willd.	+			
A. strictum Schrad.	+	+		
A. tenuissimum L.	+	+		
A. vodopjanovae Frisen.	+	+		
Calloscordum nerinifolium Herb.	+			
25.Liliaceae Juss.				
Gagea pauciflora Turcz. ex Ledeb.	+			
Lilium dauricum Ker-Gawl.	+			
L. martagon L.	+			
L. pumilum Delite	+	+		
26.Asparagaceae				
Asparagus dahuricus Fisch	+	+		
27.Convallariaceae				
Polygonatum sibiricum Delaroche	+	+		
28.Iridaceae Juss.				
Iris Bungei Maxim.		+		+
Idichotoma Pall.	+	+		
I. humilis Georgi	+	+		
I. lavtea Pall.	+	+		
I. Potaninii Maxim.	+	+		

Ltenuifolia Pall.		+		
L.tigridia Bge.	+	+		
29.Orchdaceae Juss.				
Herminium monorchis (L.) R.Br.	+	+		
Coeloglossum viride (L.) C.Hartm.	+			
Orchis salina Turcz. ex Lindl.= Dactylorhiza salina (Turcz. ex Lindl.) Soo	+	+		
30.Salicaceae Mirb.				
Salix ledebouriana Trautv.	+			
S.microstachya Turcz. ex Trautv.	+	+		
S.pseudopentandra (B.Flod.) B.Flod.	+	+		
S.rosmarinifolia L.	+			
S.taraikensis Kimura	+			
31.Betulaceae S.F.Gray				
Betula microphylla Bge.	+	+		
32.Ulmaceae Mirb.				
Ulmus pumila L.	+	+		
U.japonica (Rehd.) Sarg.		+		
33.Cannabaceae Endl.				
Cannabis ruderalis Janisch.	+	+		
34.Urticaceae Juss.				
Urtica angustifolia Fisch. ex Hornem.	+			
U.cannabina L.	+	+		
35.Santalaceae R.Br.				
Thesium longifolium Turcz. ex Ledeb.	+			
Th. refractum C.A.Mey.	+	+		
Th. repens Ledeb.	+			
Th. saxatile Turcz. ex A.DC.	+	+		
36.Polygonaceae Juss.				
Rheum undulatum L.	+			
Rumex acetosella L.	+	+		
R.aquaticus L.	+	+		
R.Gmelinii Turcz. ex Ledeb.	+	+		
R.Marschallianus Reich.		+		
R.stenophyllus Ledeb.	+			
R.thyrsoflorus Fingerh.	+	+		
Atraphaxis pungens (M.B.) Jaub. Et Spach.	+	+		
Polygonum aviculare L.	+	+		
P.cognatum Meissn.	+	+		
P.neglectum Bess.	+			
Fagopyrum esculentum Moench.	+	+		
F. tataricum (L.) Gaertn.	+			
Fallopia convolvulus (L.) A.Love	+	+		
Knorringia sibirica (Laxm.) Tzvel.	+	+		
Persicaria Amphibia (L.) S.F.Gray.	+	+		
P.Hydropiper (L.) Spach.	+	+		
P.lapathifolia (L.) S.F.Gray.	+	+		
P.sungarensis Kitag.	+	+		
Aconogon alpinum (L.) Schur.	+	+		
A.angustifolium (L.) Hara	+	+		
A.chaneyi (B.Fedtsch. ex Schward.) Hara		+		
A.divaricatum (L.) Nakai ex Mori.	+	+		
A. seriseum (Pall. Ex Georgii) Hara		+		
A.valerii (A.Skvorts.) Sojak.	+	+		
Bistorta alopecuroides (Turcz. ex Meissn.) Kom.	+	+		
Bistorta vivipara (L.) S.F.Gray.	+	+		
37.Chenopodiaceae Vent.				
Chenopodium acuminatum Willd.	+	+		
Ch. album L.	+	+		
Ch. aristatum L.	+	+		
Ch. glaucum L.	+	+		
Ch. hybridum L.	+	+		
Ch. prostratum Bunge	+	+		
Atriplex fera (L.) Bunge	+	+		
A. laevis C.A.Mey.	+	+		
A. sibirica L.	+	+		

Kraschennikovia ceratoides (L.) Guildenst.	+	+		
Axyris prostrata L.	+	+		
A. amaranthoides L.	+	+		
A. hybrida L.	+	+		
Bassia dasyphylla (Fisch. et Mey.) Ktze.	+	+		
Kochia densiflora Turcz. ex Moq.				
K. prostrata (L.) Schrad.	+	+		
K. scoparia (L.) Schrad.	+	+		
Corispermum chinganicum Iljin.	+	+		
C. declinatum Steph.	+	+		
C. mongolicum Iljin.		+		
Suaeda corniculata (C.A.Mey.) Bunge	+	+		
Salsola collina Pall.	+	+		
S. tragus L.	+	+		
Micropeplis arachnoides (Moq.) Bunge	+	+		
38. Caryophyllaceae Juss.				
Stellaria cherleriae (Fisch. ex Ser.) Williams.	+	+		
S. crassifolia Fhrh.	+	+		
S. dahurica Willd.	+			
S. dichotoma L.	+	+		
S. irrigua Bunge	+			
S. media (L.) Cyr.	+			
S. petraea Bunge	+			
Cerastium arvense L.	+	+		
C. davuricum Fisch. ex Spreng.	+			
Minuartia arctica (Siev. Ex Ser.) Aschers et Graebn.	+			
M. laricina (L.) Mattf.	+			
M. regeliana (Trautv.) Mattf.		+		
Arenaria capillaris Poir.	+	+		
A. juncea M.B.	+			
A. meyeri Fenzl.	+			
Moehringia lateriflora (L.) Fenzl.	+			
Silene jenseensis Willd.	+	+		
S. repens Patr.	+	+		
Lychnis sibirica L.	+			
Melandrium apricum (Turcz.)	+	+		
M. mongolicum (Maxim.) Grub.	+		+	
Gypsophila davurica Turcz.	+	+		
G. desertorum (Bge.) Fenzl.	+	+		+
G. paniculata L.	+			
G. Patrini Ser.	+			
Dianthus superbus L.	+	+		
D. versicolor Fisch ex Link.	+	+		
39. Ranunculaceae Juss.				
Caltha membranacea (Turcz.) Schipz.	+			
C. natans Pall. Ex Georgi	+			
C. palustris L.	+			
Trollius asiaticus L.	+			
T. ledebouri Reichb.	+			
Leptopyrum fumarioides (L.) Reichb.	+	+		
Aquilegia viridiflora Pall.	+	+		
Delphinium triste Fisch.	+			
D. cheilanthum Fisch.	+	+		
D. dissectum Huth.	+	+		
D. grandiflorum L.	+			
Aconitum ambiguum Reich.	+			
A. baicalense Turcz. ex Rapaics.	+			
A. barbatum Pers.	+			
A. glandulosum Rapaics.	+			
A. septentrionale Koelle	+	+		
A. turczaninowii Worosch.	+			
Anemone crinita Juz.	+			
Pulsatilla ambigua (Turcz.) Juz.	+			
P. bungeana C.A.Mey.	+	+		
P. flavescens (Zucc.) Juz.	+			

P. multifida (G.Pritz.) Juz.	+			
P. Turczaninowii Kryl. Et Serg.	+	+		
Halerpester salsuginosa (Pall. Ex Serg.) Greene	+	+		
H. sarmentosa (Adans.) Kom.	+	+		
Ranunculus Gmelinii DC.	+			
R. ajponicus Thunb.	+			
R. longicaulis var. pulchellus (C.A.Mey.) Gubanov	+	+		
R. natans C.A.Mey.	+	+		
R. pedatifidus Smith.	+			
R. propinquus C.A.Mey.	+	+		
R. repens L.	+	+		
R. scleratus L.	+	+		
Thalictrum petaloideum L.	+			
Th. simplex L.	+	+		
Th. squarrosum Steph. Ex Willd.	+	+		
40. Menispermaceae Juss.				
Menispermum dauricum DC.	+			
41. Papaveraceae Juss.				
Papaver nudicaule L.	+	+		
P. rubro-aurantiacum (DC.) Fisch ex Steud.	+	+		
Chiazospermum erectum L.	+	+		
Ch. lactiflorum Kar. et Kir.	+	+		
42. Cruciferae Juss.				
Brassica campestris L.	+			
B. juncea (L.) Czern.	+			
Lepidium amplexicaule Willd.		+		
L. cordatum Willd.		+		
L. densiflorum Schrad.	+	+		
L. latifolium L.	+	+		
Isatis costata C.A.Mey.	+	+		
I. oblongata DC.	+	+		
Thlaspi arvense L.	+			
Alyssum lenense Adans.	+	+		
A. obovatum (C.A.Mey.) Turcz.	+	+		
Ptilotrichum canescens C.A.Mey.	+	+		
P. tenuifolium (Steph.) C.A.Mey.	+	+		
Draba nemorosa L.	+	+		
Cardamine pratensis L.	+			
Arabis hirsuta (L.) Scop.	+			
A. pendula L.	+			
Rorippa islandica (Oed.) Borb.	+			
Dontostemon integrifolius (L.) C.A.Mey	+	+		
Dimorphostemon pectinatus (DC.) V. Golubk.	+	+		
Clausia aprica (Steph.) Korn.-Tr.	+			
Erysimum flavum (Georgi) Bobr.	+	+		
E. canescens Roth.	+	+		
E. cheiranthoides L.	+	+		
Sisimbrium polymorphum (Murr.) Roth.	+	+		
S. heteromallum C.A.Mey.	+	+		
Thellungiella salsuginea (Pall.) O.E. Schulz.		+		
Camelina sativa (L.) Crantz.	+			
43. Crassulaceae DC.				
Orostachis fimbriata (Turcz.) Berger.	+	+		
O. malocophylla (Pall.) Fisch.	+	+		
O. spinosa (L.) C.A.Mey.	+	+		
O. thyrsiflora Fisch.	+	+		
44. Parnassiaceae				
Parnassia palustris L.	+	+		
45. Grossulariaceae				
Ribes diacantha Pall.	+			
46. Rosaceae Juss.				
Spiraea aquilegifolia Pall.	+	+		
S. pubescens Turcz.	+			
S. flexuosa Fisch. ex Camb.	+	+		
S. hypericifolia L.	+			
S. media Franz. Schmidt.	+			

S. sericea Turcz.	+	+		
Cotoneaster melanocarpus Fisch. ex Blytt.	+	+		
C. mongolicus Pojark.	+	+		+
Dasiphora fruticosa (L.) Rydb.	+	+		
D. parvifolia (Fisch.) Juz.	+	+		
Comarum palustre L.	+			
Potentilla acaulis L.	+	+		
P. acervata Sojak.	+	+		
P. anserina L.	+	+		
P. bifurca L.	+	+		
P. conferta Bunge	+	+		
P. leucophylla Pall.	+	+		
P. longifolia Willd. Ex Schlecht.	+	+		
P. multifida L.	+	+		
P. norvegica L.	+			
P. pensylvanica L.	+	+		
P. sericea L.	+	+		
P. supina L.	+	+		
P. tanacetifolia Willd. Ex Schlecht.	+	+		
P. verticillaris Steph.	+	+		
P. virgata Lehm.	+	+		
Sibbaldianthe adpressa (Bunge) Juz.	+	+		
Chamaerhodes altaica Pall.	+	+		
Ch. erecta (L.) Bunge	+	+		
Agrimonia pilosa Ledeb.	+			
Sanguisorba officinalis L.	+	+		
Rosa acicularis Lindl.	+	+		
Amygdalus pedunculata Pall	+	+		
47. Leguminosae Juss.				
Thermopsis dahurica Czeffr.	+	+		
Trigonella coerulea (Desr.) Ser.	+			
Medicago falcata L.	+	+		
M. lupulina L.	+	+		
M. ruthenica (L.) Trautv.	+	+		
M. sativa L.	+			
Melilotus albus Medic.	+	+		
M. dentatus (Waldst. Et Kit.) Pers.	+	+		
M. suaveolens Ledeb.	+	+		
Trifolium eximium Steph. Ex DC.	+	+		
T. lupinester L.	+	+		
Caragana leucophloea Pojark.	+	+		
C. microphylla (Pall.) Lam.	+	+		
C. pygmaea (L.) DC.	+	+		
Gueldenstaedtia verna (Georgi) boriss.	+			
Astragalus adsurgens Pall.	+	+		
A. brevifolius Ledeb.	+	+		+
A. galactites Pall.	+	+		+
A. inopinatus Boriss.	+	+		
A. laguroides Pall.	+	+		
A. emililoides Pall	+	+		
A. miniatus Bge.	+	+		
A. mongolicus Bunge	+	+		
A. pseudochorinensis Ulzji.	+		+	
A. puberulus Ledeb.	+			
A. rytidocarpus ledeb.	+			
A. scaberrimus Bunge	+	+		
A. suffruticosus DC.	+	+		
A. tenuis Turcz.	+	+		
A. uliginosus L.	+	+		
A. versicolor Pall.	+	+		
A. viridiflavus Ulzji.	+		+	
Oxytropis ambigua (Pall.) DC.	+			
O. ampullata (Pall.) Pers.		+		
O. baicalia (Pall.) Pers.	+			
O. caespitosa (Pall.) Pers.	+	+		+
O. coerulea (Pall.) DC.	+			

O. deflexa (Pall.) DC.	+			
O. filiformis DC.	+	+		+
O. glabra (Lam.) DC.	+	+		
O. gracillima Bunge	+	+		+
O. grandiflora (Pall.) DC.	+			
O. klementzii Ulzji.	+	+	+	
O. kossinskyi B.Fedtsch. et Basil.	+	+		+
O. lanata (Pall.) DC.	+	+		+
O. lasiopoda Bunge	+	+		+
O. leptophylla (Pall.) DC.	+	+		
O. mixotriche Bunge	+	+		
O. myriophylla (Pall.)DC.	+	+		
O. nitens Turcz.	+	+		+
O. oxycephala (Pall.)DC.	+	+		
O. prostrata (Pall.)DC.	+	+		+
O. pseudoglandulosa Gontsch. Ex Grub.	+	+	+	
O. reverdattoi Jurtz.	+			+
O. salina Vass.	+	+		+
O. selengensis Bunge	+	+		+
O. squamulosa DC.	+	+		
O. strobilacea Bunge	+			
O. turczaninovii Jurtz.	+			+
O. viridiflava Kom.	+	+	+	
Hedysarum fruticosum Pall.	+	+		
H. dahuricum Turcz.	+	+		
H. ferganense Korsh.	+	+		
Onobrychis sibirica Sirj.	+	+		
Lespedeza dahurica (Laxm.) Schindl.	+	+		
L. juncea (L.fil.) Pers.	+	+		
Vicia amoena Fisch.	+	+		
Vicia costata Ledeb	+	+		
V. cracca L.	+	+		
V. megalotropis Ledeb	+	+		
V. multicaulis Ledeb.	+	+		
V. unijuga A.Br.	+	+		
V. Venosa (Willd. Ex Link.) Maxim.	+	+		
V. geminiflora Trautv.	+			
Lathyrus humilis (Ser.) Spreng.	+	+		
L. palustris L. ssp. pilosus (Cham.) Hulten.	+	+		
L. pratensis L.	+			
48.Geraniaceae Juss.				
Geranium pratense L.	+			
Geranium pratense ssp. transbaicalicum (Serg.) Gubanov	+			
G. pseudosibiricum J.Mayer	+			
G. sibiricum L.	+	+		
G. wlsowianum Fisch. ex Link.	+			
Erodium stephanianum Willd.	+	+		
49.Linaceae S.F.Gray				
Linum sibiricum DC.	+	+		
50.Rutaceae Juss.	+	+		
Haplophyllum dauricum (L.) G.Don				
51. Polygalaceae R.Br.				
Polygala hybrida DC.	+			
P. tenuifolia Willd.	+	+		
52.Euphorbiaceae Juss.				
Euphorbia discolor Ledeb.	+	+		
E. esula L.	+			
E. fischeriana Steud.	+			
E. humifusa Willd.	+	+		
53.Rhamnaceae R.Br.				
Rhamnus erythroxylonPall.		+		
54.Malvaceae Juss				
Malva neglecta Wallr.	+			
M. verticillata L.	+	+		

55.Tamaricaceae Link. <i>Myricaria longifolia</i> (Willd.) Ehrenb.	+			
56.Violaceae Batsch. <i>Viola dissecta</i> Ledeb.	+			
57.Thymeliaceae Juss. <i>Diartron linifolium</i> Turcz.	+			
<i>Stellera chamaejasme</i> L.	+			
58.Onagraceae Juss. <i>Epilobium palustre</i> L.	+	+		
<i>Chamenerion angustifolium</i> (L.) Scop.	+	+		
59.Haloragaceae R.Br. <i>Myriophyllum spicatum</i> L.	+	+		
<i>M. verticillatum</i> L.	+	+		
60.Hippuridaceae Link. <i>Hippuris vulgaris</i> L.	+	+		
61.Umbelliferae Juss. <i>Sphallerocarpus gracilis</i> (Bess. Ex Trev.) K.-Pol.	+	+		
<i>Pleurospermum uralense</i> Hoffm.	+	+		
<i>Bupleurum bicaule</i> Helm.	+	+		
<i>B. scorzonrifolium</i> Willd.	+	+		
<i>Cicuta virosa</i> L.	+	+		
<i>Carum buriaticum</i> Turcz.	+	+		
<i>C. carvi</i> L.	+	+		
<i>Sium suave</i> Walt.	+			
<i>Cnidium dahuricum</i> (Jacq.) Turcz. ex Fisch. et Mey.	+	+		
<i>Conioselinum tataricum</i> Hoffm.	+			
<i>Angelica dahurica</i> (Fisch. ex Hoffm.) Benth. Et Hook. Fil. Ex Franch. Et Savat	+			
<i>A. tenuifolia</i> (Pall. Ex Spreng.) Pimenov	+	+		
<i>Phlojodicarpus sibiricus</i> (Steph.) K.-Pol.	+	+		
<i>Saposhnikovia divaricata</i> (Turcz.) Schischk.	+			
<i>Peucedanum vaginatum</i> Ledeb	+			
<i>P. salinum</i> Pall. Ex Spreng.	+			
<i>P. hystrix</i> Bunge	+	+		
<i>Heracleum dissectum</i> Ldb.	+			
<i>Kadenia salina</i> (Turcz.) Lavrova et V.Tichomirov	+	+		
<i>Kitagawia baicalensis</i> (Redow. Ex Willd.) Pimenov	+	+		
62.Primulaceae Vent. <i>Primula farinosa</i> L.	+			
<i>P. nutans</i> Georgi	+			
<i>Androsace incana</i> Lam.	+	+		
<i>A. lactiflora</i> Pall.	+			
<i>A. maxima</i> L. ssp. <i>Turczaninowii</i> (Freyn.) Fed.	+	+		
<i>A. septentrionalis</i> L.	+	+		
<i>Trientalis europaea</i> L.	+			
<i>Glaux maritima</i> L.	+	+		
63.Plumbaginaceae Juss. <i>Goniolimon speciosum</i> (L.) Boiss.	+	+		
<i>Limonium aureum</i> (L.) Hill.	+	+		
<i>L. flexuosum</i> (L.) O.Kuntze	+	+		
64.Gentianaceae Juss. <i>Gentiana dahurica</i> Fisch.	+			
<i>G. decumbens</i> L.fil.	+	+		
<i>G. leucomelaena</i>	+	+		
<i>G. macrophylla</i> Pall.	+			
<i>G. nutans</i> Bunge	+			
<i>G. squarrosa</i> Ledeb.	+	+		
<i>Lomatogonium rotatum</i> (L.) Fries.	+			
<i>Anagellidium dichtomum</i> (L.) Griseb.	+			
65.Menyanthaceae Dum. <i>Nymphoides peltatum</i> (S.G.Gmel.) Ktze.	+	+		
66.Asclepiadaceae R.Br. <i>Vinceoxicum sibiricum</i> (L.) Desne	+	+		
67.Convulvulaceae Juss. <i>Convolvulus ammannii</i> Desr.	+	+		
<i>C. chinensis</i> Ker.-Gawl.	+	+		

68.Cuscutaceae Dum.				
Cuscuta chinensis Lam.	+			
C. europaea L.	+			
C. monogyna Vahl.	+	+		
69.Polemoniaceae Juss.				
Polemonium racemosum (Rgl.) Kitam.	+			
70.Boraginaceae Juss.				
Myosotis caespitosa S.F.Schult.	+			
M. sylvatica (Ehrh.) Hoffm.	+			
Lappula consanguinea (fisch. et Mey.) Curke.	+			
L. intermedia (Ldb.) M.Pop.	+	+		
L. myosotis Moench.	+	+		
Amblynotus rupestris (Pall.) M.Pop. ex Serg.	+	+		
Anoplocoryum compressum (Turcz.) Ldb.	+			
71.Berbenaceae Jaume.				
Caryopteris mongolica Bge.	+	+		+
72.Labiatae Juss.				
Amethystea coerulea L.	+	+		
Scutellaria baicalensis Georgi	+	+		
S. galericulata L.	+			
S. grandiflora Sims.	+			
S. scordifolia Fisch. ex Schrank.	+	+		
Lagopsis supina (Steph.) Ik.-Gal.	+			
Lophanthus chinensis (Raf.) Benth.	+	+		
Schizonepeta multifida (L.) Briq.	+	+		
Dracocephalum foetidum Bge	+	+		
D. fruticosum Steph. Ex Willd.	+	+		+
D. junatovii A.Budantz.	+		+	
D. nutans L.	+			
D. origanoides Steph. Ex Willd.	+	+		
D. Ruyschiana L.	+			
Phlomis tuberosa L.	+	+		
Galeopsis bifida Boenn.	+			
Lamium album L.	+			
Leonurus deminutus V.Krecz.	+	+		
L. mongolicus V.Krecz. et Kuprain	+	+	+	
L. sibiricus L.	+	+		
Panzeria lanata (L.) Bge.	+	+		
Thymus baicalensis Serg.	+			
Th. dahuricus Serg.	+			
Th. gobicus Tscherneva	+	+	+	
Th. michaelis R.Kam. et A.Budantz.	+	+		
Mentha arvensis L.	+	+		
73.Solanaceae Juss.				
Physochlaina physaloides (L.) G.Don.	+	+		
Hyoscyamus niger L.	+	+		
74.Scrophulariaceae Juss.				
Linaria buriatica Turcz.	+	+		
L. acutiloba Fisch. ex Reichb.	+	+		
Scrophularia incisa Weinm.	+	+		
Veronica anagallis-aquatica	+	+		
V. daurica Stev.	+	+		
V. incana L.	+	+		
V. linarifolia Pall. Ex Link.	+	+		
V. longifolia L.	+			
V. pinnata L.	+			
V. spuria L.	+			
Veronicastrum sibiricum (L.) Pennel.	+			
Castilleja pallida (L.) Spreng.	+	+		
Euphrasia tatarica fisch. ex Spreng.	+	+		
Odontites rubra (Baumb.) Pers.	+	+		
Pedicularis achilleifolia Steph.		+		
P. flava Pall.	+	+		+
P. karoï Freyn.	+	+		
P. labrodorica Wirsing	+			
P. myriophylla Pall.	+	+		
P. resupinata L.	+	+		
P. rubens Steph.	+			

P. sceptrum-carolinum L.	+			
P. spicata Pall.	+			
P. striata Pall.	+	+		
P. uliginosa Bunge	+			
P. venusta Schang. Ex Bge.	+	+		
P. verticillata L.	+			
Cymbaria dagurica L.	+	+		
75.Orobanchaceae Vent.				
Orobanche coerulescens Steph.	+	+		
76.Lentibulariaceae Rich.				
Utricularia vulgaris L.	+	+		
77.Plantaginaceae Juss.				
Plantago depressa Schiecht.	+	+		
P. major L.	+	+		
P. salsa Pall.	+	+		
78.Rubiaceae Juss. Galium boreale L.	+			
G. verum L.	+	+		
79.Valerianaceae batsch.				
Patrinia rupestris (Pall.) Dufr.	+			
P. scabiosifolia Fisch. ex Link	+			
P. sibirica (L.) Juss.	+			
V. alternifolia Ledeb.	+			
80.Dipsacaceae Juss.				
Scabiosa comosa Fisch. ex Roem. Et Schult.	+	+		
81.Campanulaceae Juss.				
Campanula glomerata L.	+			
Adenophora coronifolia Fisch.	+			
A. crispata (Korsh.) Kitag.	+			
Adenophora Gmelinii (Spreng.) Fisch.	+			
Adenophora stenanthina (Ledeb.) Kitag.	+	+		
82. Asteraceae Dumort. Solidago dahurica Kitag.	+			
Heteropappus altaicus (Willd.) Novopokr.	+	+		
H. biennis (Ledeb.) Tamamsch. Ex Grub.	+	+		
H. hispidus (Thunb.) Less.	+	+		
Aster alpinus L.	+	+		
Arctogeron gramineum (L.) DC.	+	+		
Galatella dahurica DC.	+			
Erigeron lonchophyllus Hook	+			
Leontopodium conglobatum (Turcz.) Hand.-Mazz.	+	+		
L. leontopodioides (Willd.) Beauverd.	+	+		
Inula britannica L.	+	+		
Bidens tripartita L.	+			
Achillea alpina L.	+	+		
A. acuminata (Ldb.) Sch.Bip.	+			
A. asiatica Serg.	+			
Chrysanthemum Zawadskii Herb.	+			
Filifolium sibiricum (L.) Kitam.	+	+		
Artemisia Adamsii Bess.	+	+		
A. anethifolia Web. Ex Stechm.	+	+		
A. annua L.	+	+		
A. argyi Levl. Et Vaniot.	+	+		
A. ayrata Kom.	+	+		
A. bargusinesis Spreng.	+			
A. borealis Pall.	+			
A. brachyloba Franch.	+	+		
A. caespitosa Ledeb.	+	+		+
A. capillaris Thunb.	+	+		
A. commutata Bess.	+	+		
A. depauperata Krasch.	+	+		
A. desertorum Spreng.	+			
A. dolosa Krasch.	+	+		
A. dracunculus L.	+	+		
A. Freyniana (Pamp.)Krasch	+	+		
A. frigida Willd.	+	+		
A. glauca Pall. Ex Willd.	+			
A. gmelinii Web. Ex Stechm.	+	+		
A. halodendron Turcz.	+	+		
A. integrifolia L.	+	+		

A. klementzae Krasch. Ex Leonova	+	+		
A. laciniata Willd.	+	+		
A. latifolia Ledeb.	+			
A. leucophylla (Bess.) Turcz. ex Clarke.	+	+		
A. macilenta (Maxim.) Krasch	+			
A. macrocephala Jacq. Ex Bess.	+	+		
A. mandschurica (Kom.) Kom	+	+		
A. mongolica (Bess.) Fisch. ex Nakai	+	+		
A. mongolorum ssp. gobica Krasch.	+	+	+	
A. monostachya Bunge ex Maxim.	+	+		
A. oxycephala Kitag.	+	+		
A. palustris L.	+	+		
A. phaeolepis Krasch.	+	+		
A. pycnorhiza Ledeb.	+	+		
A. rupripes Nakai	+	+		
A. rupestris L.	+	+		
A. rutifolia Steph. Ex Spreng	+	+		
A. scoparia Waldst. Et Kit.	+	+		
A. sericea Web. Ex Stechm.	+	+		
A. sieversiana Willd.	+	+		
A. stolonifera (Maxim.) Kom.	+			
A. sylvatica L.	+			
A. tanacetifolia L.	+	+		
A. xanthochroa Krasch.	+	+		+
A. xylophiza Krasch. Ex Filatova	+	+	+	
Cacalia hastata L.	+			
Senecio ambraceus Turcz.	+	+		
S. arcticus Rupr.	+			
S. erucifolius L.	+			
S. integrifolius (L.) Clairv.	+	+		
S. jacobaea L.	+	+		
Ligularia fischeri (Ledeb.) Turcz.	+			
L. sagitta (Maxim.) Mattf.	+			
L. sibirica (L.) Cass.	+			
Echinops latifolius Tausch.	+	+		
Saussurea alata DC.	+			
S. amara (L.) DC.	+	+		
S. elongata DC.	+			
S. laciniata Ledeb.	+	+		
S. parviflora (Poir.) DC.	+			
S. runcinata DC.	+	+		
S. salicifolia (L.) DC.	+	+		
Cardus crispus L.	+			
Serratula centauroides L.	+	+		
S. marginata Tausch.	+	+		
Synurus deltoides (Ait.) Nakai	+			
Rhaphonticum uniflorum (L.) DC.	+	+		
Scorsonera austriaca Willd.	+	+		
S. radiata Fisch.	+			
Tragopogon trachycarpus S.Nikit.	+	+		
Picris hieracioides L.	+			
P. japonica Thunb.	+			
Sonchus arvensis L.	+	+		
Youngia tenuifolia (Willd.) Bab. Et Stebbins	+	+		
Ixeridium gramineum (Fisch.) Tzvel.	+	+		
Taraxacum asiaticum Dahlst.	+	+		
T. ceratophorum (Ledeb.) DC.	+			
T. collinum DC.	+	+		
T. commixtiforme Soest.	+			
T. dealbatum Hand.-Mazz.	+	+		
T. dissectum (Ledeb.) Ledeb.	+			
T. leucanthum (Ledeb.) Ledeb.	+	+		
T. mongoliforme Doll.	+			+
T. sinicum Kitag.	+			
Crepis Bungei Ledeb.	+			
Crepis tectorum L.	+			
Hieracleum umbellatum L.	+			

Table F-12 Mammals of Mongolia listed (Erdene Sum to Undurkhaan)

Names of species			Assertion of rareness		
Latin	mongolian	English	Red book of Mongolia 1997	List of rare species of Mongolia, 1995	Appendix I; II of CITES, 2000
Canis lupus	Саарал чоно	Grey wolf	-	-	II
Felis manul	Мануул	Pallas Cat Manul	-	-	II
Ovis ammon	Аргаль	Argali	+	+	II

Table F-13 Main parameters of Hydrometric Sections form (Erdene-Undurkhaan)

A (km)-square of watershed area (River bed,dry bed,ravin and channel)

L (km)- Long of erosion line in watershed area,

B max (km) – Maximum width of watershed area

D km/km² – average density of river net of watershed area

D km/km ² - average density of river net of watershed area							
1	Coordination		A km ²	L km.	Bmax km.	B m km	D km/km ²
	E	N					
Main route subway No-1							
1	107° 51' 40 "	47° 41' 15 "	2,56	2,05	1,3	1,24	0,80
2	107° 52' 00 "	47° 41' 12 "	1,68	2,25	0,6	0,74	1,34
3	107° 52' 07 "	47° 41' 16 "	0,80	1,05	0,5	0,76	1,31
4	107° 54' 27 "	47° 41' 39 "	11,9	4,45	3,3	2,67	0,37
5	107° 52' 24 "	47° 41' 45 "	4,5	3,4	2,0	1,32	0,75
6	107° 56' 09 "	47° 42' 21 "	12.8	8.9	2.7	1,43	0,67
7	107° 59' 47 "	47° 43' 29 "	119.2	67.8	15.9	1,77	0,57
8	108° 06' 17 "	47° 42' 12 "	34,5	11,7	3,2	2,95	0,34
9	108° 25' 45 "	47° 46' 48 "	56.7	12.1	4.2	4,68	0,21
10	108° 29' 47 "	47° 43' 08 "	1,6	1,8	0,8	0,89	1,12
11	108° 29' 50 "	47° 43' 12 "	0,95	1,8	0,6	0,53	1,89
12	108° 30' 00 "	47° 44' 00 "	7,8	2,0	1,3	3,90	0,26
13	108° 31' 29 "	47° 46' 00 "	2,2	2,0	1,3	1,10	0,91
14	108° 34' 12 "	47° 41' 12 "	9,9	8,3	2,6	1,19	0,84
15	108° 35' 00 "	47° 47' 26 "	1,4	1,95	0,7	0,72	11,39
16	108° 37' 00 "	47° 48' 37 "	1,5	1,3	0,7	1,15	0,87
17	108° 40' 94 "	47° 50' 43 "	1.1	1.3	0.8	0,85	1,18
18	108° 38' 35 "	47° 41' 12 "	48.6	13.7	5.2	3,55	0,28
19	108° 39' 51 "	47° 55' 41 "	12.9	13.0	3.5	0,99	1,01
20	108° 50' 18 "	47° 47' 04 "	1.40	2.1	1.2	0,67	1,50
21	108° 54' 23 "	47° 45' 52 "	5.6	5.2	1.9	1,07	0,93
22	108° 58' 50 "	47° 44' 10 "	0.7	1.3	0.6	0,54	1,86
23	109° 01' 57 "	47° 43' 15 "	0.8	0.7	0.4	1,14	0,87
24	109° 07' 02 "	47° 40' 43 "	1.2	1.0	0.6	1,20	0,83
25	109° 07' 15 "	47° 40' 37 "	172.9	54.0	17.4	3,20	0,11
26	109° 08' 57 "	47° 39' 32 "	1.08	0.7	0.5	1,59	0,65
27	109° 09' 00 "	47° 38' 45 "	73.4	27.3	8.9	2,69	0,37
28	109° 10' 38 "	47° 37' 09 "	6.8	6.1	2.6	1,12	0,90
29	109° 13' 26 "	47° 36' 09 "	36.7	16.0	5.9	2,29	0,43
30	109° 15' 00 "	47° 35' 43 "	13.1	10.8	3.4	1,21	0,82
31	109° 18' 19 "	47° 34' 08 "	1.3	1.4	1.0	0,93	1,07
32	109° 24' 34 "	47° 32' 10 "	107.6	55.2	8.8	1,94	0,51
33	109° 49' 21 "	47° 27' 22 "	56.9	18.2	7.5	3,12	0,32
34	110° 20' 10 "	47° 22' 57 "	214.9	108.3	Ç0.6	1,98	0,50

35	-	-	1.9	1.9	1.2	1,00	1,00
36	-	-	4.2	3.8	1.7	1,10	0,90
Subway No-2							
37	110° 16' 41"	47° 23' 52"	1.2	1.5	0.8	0,80	1,25
38	110° 14' 19"	47° 24' 13"	22.3	14.5	5.4	1,54	0,65
39	110° 24' 44"	47° 41' 15"	3.2	6.8	2.7	0,47	2,12
Subway No-3							
40	108° 41' 12"	47° 47' 39"	23.9	9.0	3.05	2,65	0,38
41	108° 40' 43"	47° 47' 25"	1.3	1.5	0.9	0,87	1,15
42	108° 39' 21"	47° 46' 28"	11.9	6.4	2.3	5,17	0,53
43	108° 37' 53"	47° 45' 30"	12.4	8.6	2.8	1,44	0,69
44	108° 36' 03"	47° 44' 23"	4.8	4.3	1.6	1,12	0,89
45	108° 33' 45"	47° 43' 12"	6.0	7.4	1.9	0,81	0,23
46	108° 33' 08"	47° 42' 31"	7.3	6.1	2.4	1,20	0,83
47	108° 31' 48"	47° 41' 37"	3.5	5.5	1.7	0,64	1,57
48	108° 28' 34"	47° 41' 23"	4.7	7.2	2.3	0,65	1,53
49	108° 26' 30"	47° 41' 31"	-	-	-	-	-
Subway No-4							
50	108° 10' 56"	47° 39' 24"	95.6	12.8	10.7	7,46	0,13
51	108° 05' 00"	47° 37' 25"	3.9	4.05	1.8	0,96	1,04
52	108° 01' 55"	47° 37' 00"	10.7	8.30	2.60	1,29	0,77
53	107° 59' 09"	47° 38' 17"	3.8	4.70	1.36	0,80	1,24
54	107° 57' 22"	47° 38' 31"	5.5	4.5	1.65	1,22	0,81
55	107° 56' 10"	47° 38' 09"	2.65	2.75	1.5	0,96	1,04
56	107° 54' 51"	47° 30' 37"	4.75	3.80	1.45	1,25	0,80
57	107° 54' 10"	47° 40' 00"	3.25	3.05	1.9	1,06	0,94
58	107° 52' 45"	47° 40' 37"	1.08	1.15	0.7	0,94	1,06
59	107° 54' 05"	47° 40' 50"	0.4	0.6	0.6	0,67	1,50

Table F-14 Ordinates need to calculate average intensity of precipitation in various term (by N.Dashdeleg, Ts.Sugar.1971)

Ordination	Term / minut /											
	5	10	20	40	60	90	150	300	720	1440	2880	
$\Psi_{1\%}(\tau)$	0.150	0.232	0.320	0.450	0.478	0.570	0.736	0.936	1.050	1.230	1.480	
$\Psi_{25\%}(\tau)$	0.030	0.025	0.016	0.010	0.008	0.006	0.004	0.002	0.001	0.002	0.001	

Table F-15 1% fidelity maximum precipitation per day (by Bayandelger Sum)

Year	Term / minute /											
	5	10	20	40	60	90	150	300	720	1440	2880	Å
1971	4,8	9,7	17,0	23,6	27,0	28,8	29,9	32,9	33,4	33,4	33,8	33,2
1972	3,8	6,2	10,2	11,0	11,0	11,0	11,0	12,4	20,1	21,8	22,0	20,8
1973	4,4	7,2	12,4	20,2	20,6	21,0	23,4	35,3	37,9	38,4	38,4	38,4
1975	1,4	3,1	5,7	6,5	6,9	7,2	13,9	17,1	17,1	25,4	29,3	25,4
1976	3,5	4,8	1,8	6,9	9,8	13,1	16,1	18,4	18,4	20,2	20,2	20,2
1977	3,5	4,9	6,0	6,2	6,4	7,6	13,6	39,8	49,0	52,2	53,6	47,7
1978	1,7	2,5	3,2	6,0	6,9	7,3	7,4	14,2	14,2	17,0	17,0	17,0

Table F-16 Maximum discharge on hydrometric sections of eastern arterial road (m3/sec)

	A km ²	L km.	D km/km ²	16.670Ψ(τ)H _{1%}	Q _{1%}
Main route No-1					
1	2,56	2,05	0,80	3,38	7,09
2	1,68	2,25	1,34	2,2	4,62
3	0,80	1,05	1,31	1,05	2,20
4	11,9	4,45	0,37	15,59	28,06
5	4,5	3,4	0,75	5,9	12,39
6	12,8	8,9	0,67	16,77	30,18
7	119,2	67,8	0,57	156,17	187,4
8	34,5	11,7	0,34	45,2	81,36
9	56,7	12,1	0,21	74,29	133,72
10	1,6	1,8	1,12	2,09	4,39
11	0,95	1,8	1,89	1,24	2,6
12	7,8	2,0	0,26	10,22	18,39
13	2,2	2,0	0,91	2,88	6,04
14	9,9	8,3	0,84	12,97	23,34
15	1,4	1,95	1,39	1,83	3,84
16	1,5	1,3	0,87	1,96	4,12
17	1,1	1,3	1,18	1,44	2,31
18	48,6	13,7	0,28	63,67	114,6
19	12,9	13,0	1,01	16,9	30,42
20	1,40	2,1	1,50	1,83	3,84
21	5,6	5,2	0,93	7,33	15,39
22	0,7	1,3	1,86	0,92	1,93
23	0,8	0,7	0,87	1,05	2,2
24	1,2	1,0	0,83	1,57	3,29
25	172,9	54,0	0,11	226,53	271,84
26	1,08	0,7	0,65	1,41	2,96
27	73,4	27,3	0,37	96,17	173,1
28	6,8	6,1	0,90	8,91	18,71
29	36,7	16,0	0,43	48,08	86,54
30	13,1	10,8	0,82	17,16	30,88
31	1,3	1,4	1,07	1,7	3,57
32	107,6	55,2	0,51	140,98	169,17
33	56,9	18,2	0,32	74,55	134,19
34	214,9	108,3	0,50	281,56	337,87
35	1,9	1,9	1,00	2,49	5,23
36	4,2	3,8	0,90	5,5	11,55
Subway No-2					
37	1,2	1,5	1,25	1,57	3,29
38	22,3	14,5	0,65	29,21	52,58
39	3,2	6,8	2,12	4,19	8,79
Subway No-3					
40	23,9	9,0	0,38	31,31	56,39
41	1,3	1,5	1,15	1,7	3,57
42	11,9	6,4	0,53	15,59	28,06
43	12,4	8,6	0,69	16,24	29,23
44	4,8	4,3	0,89	6,29	13,21
45	6,0	7,4	0,23	7,86	16,51
46	7,3	6,1	0,83	9,56	20,07
47	3,5	5,5	1,57	4,58	9,62
48	4,7	7,2	1,53	6,16	12,94
49	-	-	-	-	-
Subway No-4					

50	95.6	12.8	0,13	125,25	150,3
51	3.9	4.05	1,04	5,11	10,73
52	10.7	8.30	0,77	14,02	25,24
53	3.8	4.70	1,24	4,98	10,46
54	5.5	4.5	0,81	7,2	15,12
55	2.65	2.75	1,04	3,47	7,29
56	4.75	3.80	0,80	6,22	13,06
57	3.25	3.05	0,94	4,26	8,95
58	1.08	1.15	1,06	1,41	2,96
59	0.4	0.6	1,50	0,52	1,09

Table F-17 Soil analyses

No.	Analysis	Method	Number of sample
1	Humus	I.V.Turin	11
2	Potassium, Phosphorus from one extract	B.P.Machigin	11
3	Soil reaction, PH	Potentiometer	16
4	Carbonate CO ₂	Calcimeter	5
5	Texture	N.A.Kachinskii	16

Table F-18 Main soils properties of area along the main eastern roads

Profile ¹	Horizon	Depth of soil sample sm.	Humus %	Soil reaction, PH of soil	Carbonate %	Mobile, In the 100 g. of soil		Texture, %		Soil index
						P ₂ O ₅	KgO	<0.001	<0.01	
DKsp /Tsagaan hutul/										
23	A	2-12	2.23	6.8	-	2.42	18.23	4.3	12.4	1 ýě
DKcp /12 km east from Erdene /										
3	A	2-12	2.63	6.8	-	2.33	21.7	8.4	24.6	1 õø
DKc										
6	A	3-16	3.89	7.2	-	2.64	22.4	8.6	22.4	2 õø
DKs /15 km north-west from Tsenkhermandal/										
10	A	0-10	3.91	7.6	-	2.2	23.0	4.8	13.7	2 ýě
	A	10-20	3.84	7.6	-	1.9	18.9	4.9	16.8	
	BK	20-30	-	7.4	-	0.96	21.1	7.8	18.3	
Mc /Halzan valley/										
25	A	0-20	5.98	6.8	-	2.8	31.0	10.1	26.3	3 õø
Kss /Ikh Khar lake valley of Jargalthaan/										
27	A	0-18	3.21	7.6	-	1.98	19.7	8.3	24.3	4 õø
DKs /North-east from engine well/										
31	A	0-10	3.26	7.2	-	1.95	18.61	10.8	27.8	5 õø
	A	10-23	1.97	7.4	-	0.98	20.0	9.80	22.6	
	AB	23-28	0.68	7.4	0.5	-	-	10.8	27.3	
DKtc /North from ground road, nearby crop field/										
220õ	A	0-20	2.30	7.2	-	0.96	15.2	4.9	15.2	5 ýě
	AB	20-39	1.10	6.4	-	0.48	5.6	8.9	14.8	
DKs /Ust valley/										
34	A	0-29	3.96	7.6	-	1.88	20.4	10.8	28.8	6 õø
	B	30-40	1.68	7.4	-	1.06	17.8	9.8	24.0	
	C	40-60	-	6.4	1.33	-	-	7.8	20.1	
Ac /Togos river/										
4	A	0-10	3.88	7.8	-	0.96	17.0	11.0	26.8	7 õø
	B	20-30	1.61	7.9	1.4	0.86	20.7	9.8	24.9	
	C	40-50	-	7.9	4.9	-	-	4.80	11.6	
Amc /Kherlen Ireland/										
69*	A	0-10	2.86	6.8	-	0.96	19.7	7.80	15.10	8 ýě
	AB	10-18	0.88	7.16	-	2.0	17.0	9.70	18.10	
Ass /2 km east from Kherlen r./										
63*	A	0-10	3.24	6.8	-	0.45	14.0	5.80	17.80	9 ýě
Amc /1 km north from Ajgan lake/										
9	A	0-30	4.28	7.8	-	1.96	15.0	12.50	40.0	10 äø

220*, 69*, 63* -- From other sources

F-2. Law Amendment

November 22, 2001

Ulaanbaatar

AMENDMENT TO THE ENVIRONMENT IMPACT ASSESSMENT LAW

Article 1. The statements and sentences of the following articles and paragraphs of the Environment Impact Assessment Law shall be amended:

1) Statement of 3.1.5, 3.1.6, 3.1.7, 3.1.8:

3.1.5. "Assessment Examination" is conclusion made on project EIA report by independent party expert assigned by party, who conducted IEE.

3.1.6. "Expert" is person authorized to assess project environment impact and make conclusion.

3.1.7. "Assessment Specialist" is person authorized to participate in EIA activity in certain field and carry out study and assessment.

3.1.8. "Project Client" is citizen or juridical person financing certain project.

2) Statement of 4.6.4:

"4.6.4 Projects not according to the related legislation, with technique and technology having negative affect to the nature and/or environment and not mentioned in land use plan shall be rejected".

3) 2nd sentence of 4.7:

"If required, related specialists may be involved into assessment works".

4) Paragraph 4.8:

"4.8. If required, state central organization responsible for nature and environment aspects may prolong period mentioned in paragraph 4.6 of this Law".

5) Statement of 5.4.10:

"5.4.10. Rehabilitation project."

6) Paragraph 6.5, 6.6:

"6.5. Organization conducted IEE shall make decision in accordance with related procedure on release of Project Client's bond amount based on report on execution of nature and environment protection plan and results of inspection stated in 6.4.

6.6. Procedures and methodologies for formulation of nature and environment protection plan, environment monitoring program and rehabilitation shall be approved by the state central organization responsible for nature and environment aspects. Rehabilitation standards shall be approved by the related organization in accordance with the legislation."

7) Paragraph 7.4, 7.5, 7.6:

“7.4. Procedure for assessment examination and methodology of assessment shall be approved by the state central organization responsible for nature and environment aspects.

7.5. Organization received EIA report shall take measures for introducing this report to the public.

7.6. Relations, appeared in relation with the creation of the environment assessment database, shall be coordinated by the Law on Protection of Nature and Environment.”

8) Paragraph 9.12:

“9.12. State central organization responsible for nature and environment aspects shall issue authorization to or cancel such authorization of assessment specialists.”

9) Statement of 11.1.3:

“11.1.3. Permanently control execution of plans and programs mentioned in EIA and, if required, submit conclusion on continuation or cancellation of the project to the related state central organization.”

10) Statement of 12.2.4:

“12.2.4. If the examination proves that EIA is conducted not correct, then organization carried out EIA shall pay penalty in the amount of 150,000 – 200,000 togrog.”

Article 2. The following parts and statements of the Environment Impact Assessment Law shall be changed as mentioned below:

1) Paragraph 4.2:

“4.2. IEE shall be conducted prior mining minerals and issuance of a right to own and use land and project implementation.”

2) Paragraph 6.2, 6.3:

“6.2. Nature and environment protection plan for current year, environment monitoring program and amount of budget and expenditures required for their implementation shall be approved by the organization conducted IEE.

6.3. Project implementation organizations except projects related to mining of minerals, shall transfer to the environment protection accounts of sums and districts the amount not less than 50% of expenditures required for execution of their duties regarding to protection of nature and environment as a guarantee of their execution and shall report execution every year. Guarantee for execution of duties regarding protection of nature and environment for projects related to mining of minerals shall be coordinated by the Law on Mineral Resources.”

3) Paragraph 7.2, 7.3:

“7.2. Expert who received EIA report, shall examine it within 18 working days. If required, state central organization responsible for nature and environment aspects may prolong this period.

If required for assessment examination, laboratory verified for monitoring of nature and environment may issue a conclusion.

7.3. State central organization responsible for nature and environment aspects, shall make decision on project implementation or cancellation based on expert’s conclusion on EIA report and considering opinion of inhabitants of project implementation area.”

4) Statement of 9.2.2:

“9.2.2. Definition by the assessment specialist.”

5) Paragraph 9.11:

“9.11. If the examination proves that authorized organizations conducted EIA not correct, then administrative measures shall be taken or state central organization responsible for nature and environment aspects shall cancel their assessment license. If the examination proves that assessment specialist conducted assessment improperly, then state central organization responsible for nature and environment aspects may suspend him during the period up to 2 years.”

Article 3. The words “citizen” before “juridical person” in Paragraph 3.1.3, “technological decision” after “technical and economical basis” in Paragraph 4.4, “and technological” after “project” in Paragraph 5.4.2, “cultural layer of the project implementation area” before “project” in Paragraph 5.4.9, “required budget and expenditures” after “form” in Paragraph 6.1.2, “causing and” after “negative affect to the nature and environment” in Paragraph 8.1 and “client” to the title of Article 10 and after “project” in Paragraph 10.1 shall be amended to the Environment Assessment Law.

Article 4. The words “conduct” in Paragraph 4.1, “ opinion of citizens” in Paragraph 5.4.8, “concluded by two parties” in Paragraph 5.6, “specialists participated in assessment work” in Paragraph 5.7, “assessment conclusion” in title of Article 7 shall replaced respectively with words “conduct, preliminary define affect of the project to the nature and environment within this assessment and make conclusion”, “opinion of citizens and presidiums of sum and district citizens’ assemblies”, “project client concluded with authorized entity”, “assessment specialists” and ”assessment examination” in the Environment Assessment Law.

Vice Chairman of the Parliament of Mongolia

J. BYAMBADORJ

F-3. Letter of Approval for EIA

Батлав: Байгаль Орчны Дэд Сайд <i>Шүүмж хийсэн:</i> Байгаль орчны яамны мэргэжилтэн др. В. Баясгалан	<i>Болат</i> А. Болат <i>Төмөр Б.</i>
 Байгаль орчинд нөлөөлөх байдлын нарийвчилсан үнэлгээний тайлан	
Төслийн нэр: ЗҮҮН ГОЛ ЗАМ	
Тосол хэрэгжүүлэгч: Засгийн Газрын Хэрэгжүүлэгч Агентлаг Авто Замын газар, Японы Олон Улсын Хамтын Ажиллагааны Агентлаг (JICA), Номхон Далайн Олон Улсын Зөвлөхүүд (PCF) компани	
Нарийвчилсан үнэлгээ гүйцэтгэсэн: ЭКО-Трейд "Эко Трейд" ХХК-ийн захирал <i>Д. ДОРЖСҮРЭН</i>	
Тайланг зөвлөхөөрч хүлээн авсан: Засгийн Газрын Хэрэгжүүлэгч Агентлаг Авто Замын Газар Дарга-аа <i>Б. БУД</i> Р. БУД	
Тайлангтай таарч байсан: Төв аймгийн Засаг Дарга <i>М. МЭНДБИЛЭГ</i> М. МЭНДБИЛЭГ	
Хянгын аймгийн Засаг Дарга: <i>Орхон</i> Орхон	
Ч.ЭРДЭНЭБААТАР	
Б. ЛХАГВА	
Улаанбаатар хот 2002 он	

Approved by Vice Minister of Nature and
Environment, Mongolia

Borbat

A. Bolat

Reviewed by Chief Specialist of Ministry of
Nature and Environment, Mongolia

D. Bayasgalan

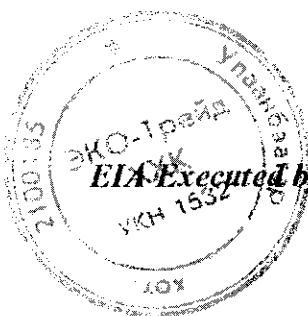
Bayasgalan B.



Report of
Environmental Impact
Assessment

Name of project: **EASTERN ARTERIAL ROAD**

Implementer of project: Department of Road, Mongolia
Japan International Cooperation Agency (JICA)
Pacific Consultants International (PCI)



EIA Executed by: ECO-TRADE Co., Ltd Environmental Consultants
Director **D. DORJSUREN**

Dorjsuren

Recognized and Received: Department of Road, Mongolia
Director **R. BUD**

Reviewed by Governor of Tuv aimag

M. Mendbileg

M. MENDBILEG

Governor of Khentii aimag

Shereev

Ch. ERDENEBAATAR

Governor of Baganuur District

B. LKHAGVA

Ulaanbaatar, 2002



Г АВТОЗАМЫН ГАЗРЫН ДАРГА Г
Р.БУД ТАНАА

**МОНГОЛ УЛСЫН
БАЙГАЛЬ ОРЧНЫ ЯАМ**

210620а Улаанбаатар хот, Сүхбаатар дүүрэг, Бага тойруу 44,
Засгийн газрын III байр, Утас: 32-32-73, Факс: 32-14-01
E-mail: monenv@mail.mn

2002.09.26 № 4/323
танай _____-ны № _____-т

Г Байгаль орчны үнэлгээний Г
дүгнэлт хүргүүлэх тухай

Төв аймгийн Эрдэнэ сумаас Хэнтий аймгийн Өндөрхаан хот хүртэл тавих Зүүн гол замыг байгуулах төслийн байгаль орчинд нөлөөлөх байдлын нарийвчилсан үнэлгээний ажлын үр дүнд хийсэн шүүмжийн дүгнэлтийг үндэслэн уг төслийг хэрэгжүүлэх нь зүйтэй гэж үзэв.

Төслийг хэрэгжүүлэх явцад сөрөг нөлөөллийг бууруулахаар заасан арга хэмжээ, Байгаль орчны төлөвлөгөө, хяналт-шинжилгээний хөтөлбөрт заагдсан ажил бүрийг бүрэн биелүүлэх шаардлагатай.

Цаашид манай байгууллагаас хэрэгжүүлэх аливаа төсөл нь Улсын Их Хурлын 2001 оны 11 дүгээр сарын 22-ны өдрийн хуралдаанаар баталсан Байгаль орчинд нөлөөлөх байдлын нарийвчилсан үнэлгээний тухай хуульд нэмэлт, өөрчлөлт оруулах тухай хуульд заагдсан шаардлагуудыг хангасан байхыг сануулж байна.

Зүүн гол замын төслийн байгаль орчны урьдчилсан судалгаа, байгаль орчинд нөлөөлөх байдлын нарийвчилсан үнэлгээний ажлын агуулга, хэлбэр, гүйцэтгэсэн дараалал нь энэ бүхэнд жишиг загвар болж болох юм гэж үзэж байна.

МЭДЭЭЛЭЛ, ХЯНАЛТ-ШИНЖИЛГЭЭ, ҮНЭЛГЭЭНИЙ
ГАЗРЫН ДАРГА

Д.ЭНХБАЯР

08 0618

MINISTRY OF NATURE AND ENVIRONMENT

To Mr. R. Bud, General Director of the Department of Roads

Date: Feb. 26, 2002

Subject: Conclusion on the EIA

Based on the conclusion of the examination of the EIA for the Feasibility Study for Construction of Eastern Arterial Road between Erdene sum of Tuv aimag and Undurhaan of Hentii aimag, it is considered that this project shall be implemented.

During the project it is necessary to execute all required measures for implementation of the nature and environment protection plan and monitoring program in order to mitigate negative impact to the nature and environment.

We would like to remind you that any project to be assessed by our organization in future, shall meet with the statements of the Amendment to the Environment Impact Assessment Law adopted by the Parliament on 22nd of November, 2001.

Content, form and execution order of the IEE and EIA studies conducted for the Feasibility Study for Construction of Eastern Arterial Road can be a model for the matter mentioned above.

Director of the Information, Monitoring and Assessment Department

D. ENKHBAYAR

G. COST ESTIMATE

G. Cost Estimate

G-1. Cost Estimation for ALT-1

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS BY PORTION

■ Case - 1 : Asphalt Concrete Pavement at All Sections

■ Route Length : 221.822 km

ITEM No.	Description	Unit	Unit Cost Foreign (US\$)	Unit Cost Domestic (Tg)	Quantity	Foreign Portion (US\$)	Domestic Portion (1,000 Tg)	Total (US\$)
1	Clearing and Surface Stripping	m2	0.300	100.1	2,744,194	823,258	274,694	1,072,980
2	Excavation	m3	1.796	605.0	503,502	904,290	304,619	1,181,216
3	Embankment	m3	2.470	1,023.0	3,482,394	8,601,513	3,562,489	11,840,140
4	Earth work for raising	m	40.947	18,389.1	445	18,221	8,183	25,660
5	Maintaining hauling route	m2	0.088	31.9	1,015,900	89,399	32,407	118,860
6	Subbase	m3	-	-	501,008	275,048	1,123,139	3,771,518
7	Graded Base Course	m3	-	-	213,192	2,738,015	973,303	3,622,836
8	Bituminous Surface Treatment	m2	1.632	724.8	0	0	0	0
9	Asphalt Concrete Surface	m2	3.364	1,789.7	1,544,182	5,194,628	2,763,623	7,707,013
10	Asphalt Concrete Overlay for Ac surface	m2	3.266	1,777.6	112,742	368,215	200,410	550,406
11	Asphalt Concrete Overlay for BST surface	m2	3.729	2,028.4	14,637	54,581	29,690	81,572
12	Granular Shoulder	m2	2.021	517.0	487,988	986,224	252,290	1,215,578
13	Shoulder modification	m2	0.537	100.1	54,591	29,315	5,465	34,283
14	Kilometer marker posts	No.	14	61,600	221	3,094	13,614	15,470
15	Guard post	No.	8,000	35,200.0	6,671	53,368	234,819	266,840
16	Pavement markings	km	900,000	330,000.0	531	477,900	175,230	637,200
17	Signs	No.	210,000	77,000.0	115	24,150	8,855	32,200
18	Road Station	No.	17,106,019	8,239,330.7	5	85,530	41,197	122,982
19	Observation Platform	No.	17,106,019	8,239,330.7	2	34,212	16,479	49,193
20	Lined Drain	m	1.6	7040	35,965	57,544	253,194	287,720
21	Culvert Type A (1 @ 1.0m dia)	No.	770,000	5,110,000.0	122	93,940	623,420	660,686
22	Culvert Type B (1 @ 1.5m dia)	No.	1,370	7,810,000.0	57	78,090	445,170	482,790
23	Culvert Type C (2 @ 1.5m dia)	No.	1,970	11,370,000.0	18	35,460	204,660	221,515
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	3,170	16,020,000.0	12	38,040	192,240	212,804
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	4,970	22,710,000.0	12	59,640	272,520	307,385
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	6,580	28,540,000.0	5	32,900	142,700	162,627
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	8,770	36,970,000.0	0	0	0	0
28	Bridge Type 1 (l = 15.0m)	No.	38,050	59,350,000	2	76,100	118,700	184,009
29	Bridge Type 2 (l = 17.5m)	No.	43,030	65,840,000.0	1	43,030	65,840	102,885
30	Bridge Type 3 (l = 35.0m)	No.	86,070	131,690,000.0	0	0	0	0
31	Bridge Type 4 (l = 52.5m)	No.	129,100	197,530,000.0	2	258,200	395,060	617,345
32	Bridge Type 5 (l = 70.0m)	No.	172,140	263,370,000.0	0	0	0	0
33	Bridge Type 6 (l = 268.8m)	No.	655,890	1,234,560,000.0	1	655,890	1,234,560	1,778,217
34	Environmental countermeasure for borrow pit	m2	0.574	215.6	76,880	44,129	16,575	59,198
35	Environmental countermeasure for quarry	m2	0.574	215.6	44,640	25,623	9,624	34,373
36	Slope for domestic animal crossing	No.	603,733	468,949.0	23	13,886	10,786	23,691
37	Planting tree	No.	0.000	4,000.0	590	0	2,360	2,145
38	Reinstate of hauling road	km	440,000	159,509.9	203	89,320	32,381	118,755
39	Total	-	-	-	-	24,838,188	14,040,296	37,602,092
40	General	-	-	-	5% of 39	1,241,909	702,015	1,880,105
	Construction Cost	-	-	-	39+40	26,080,097	14,742,311	39,482,197

Note : 1 US\$ = 1,100 Tg

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 1-3)

■ Case - 1 : Asphalt Concrete Pavement at All Sections

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 1		Section 2		Section 3	
				STA. 112 + 127 ~ 121 + 448		STA. 121 + 448 ~ 130 + 769		STA. 130 + 769 ~ 142 + 700	
				9.321 km		9.321 km		11.931 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km		9.321		9.321		11.645	
1	Clearing and Surface Stripping	m2	0.391	0	0	0	0	186,913	73,083
2	Excavation	m3	2.346	0	0	0	0	2,783	6,529
3	Embankment	m3	3.400	0	0	0	0	265,894	904,040
4	Earth work for raising	m	57.664	445	25,660	0	0	0	0
5	Maintaining hauling route	m2	0.117	0	0	0	0	59,655	6,980
6	Subbase	m3	-	1,044	8,323	0	0	32,273	216,657
7	Graded Base Course	m3	-	312	7,308	0	0	13,274	211,583
8	Bituminous Surface Treatment	m2	2.291	0	0	0	0	0	0
9	Asphalt Concrete Surface	m2	4.991	3,115	15,547	0	0	88,494	441,676
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	62,132	303,328	50,610	247,078	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	14,637	81,572	0	0
12	Granular Shoulder	m2	2.491	1,335	3,325	0	0	27,946	69,612
13	Shoulder modification	m2	0.628	26,628	16,722	27,963	17,561	0	0
14	Kilometer marker posts	No.	70.000	9	630	9	630	12	840
15	Guard post	No.	40.000	52	2,080	0	0	865	34,600
16	Pavement markings	km	1,200.000	22	26,400	22	26,400	29	34,800
17	Signs	No.	280.000	7	1,960	13	3,640	12	3,360
18	Road Station	No.	24,596.320	0	0	0	0	1	24,596
19	Observation Platform	No.	24,596.320	0	0	0	0	0	0
20	Lined Drain	m	8.000	0	0	0	0	2,850	22,800
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	0	0	0	0	7	37,908
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	0	0	0	0	2	16,940
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	0	0	0	0	1	12,306
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	0	0	0	0	0	0
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	0	0	0	0	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	0	0	0	0	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (l = 15.0m)	l	92,004.545	1	92,005	0	0	0	0
29	Bridge Type 2 (l = 17.5m)	l	102,884.545	0	0	0	0	1	102,885
30	Bridge Type 3 (l = 35.0m)	l	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (l = 52.5m)	l	308,672.727	0	0	0	0	0	0
32	Bridge Type 5 (l = 70.0m)	l	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (l = 268.8m)	l	1,778,217.273	0	0	0	0	1	1,778,217
34	Environmental countermeasure for borrow pit	m2	0.770	0	0	0	0	6,930	5,336
35	Environmental countermeasure for quarry	m2	0.770	0	0	0	0	4,080	3,142
36	Slope for domestic animal crossing	No.	1,030.050	2	2,060	1	1,030	0	0
37	Planting tree	No.	3.636	0	0	0	0	0	0
38	Reinstate of hauling road	km	585.009	0	0	0	0	12	7,020
	Sub - Total	-	-	-	505,349	-	377,911	-	4,014,910

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 4-6)

■ Case - 1 : Asphalt Concrete Pavement at All Sections

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 4		Section 5		Section 6	
				STA. 142 + 700 ~ 152 + 700		STA. 152 + 700 ~ 162 + 700		STA. 162 + 700 ~ 172 + 700	
				10.000 km		10.000 km		10.000 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	= 1,100 Tug	10.000	-	10.000	-	10.000	-
1	Clearing and Surface Stripping	m2	0.391	133,209	52,085	142,272	55,628	149,420	58,423
2	Excavation	m3	2.346	28,995	68,022	14,294	33,534	62,195	145,909
3	Embankment	m3	3.400	158,813	539,964	219,493	746,276	305,440	1,038,496
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	50,000	5,850	50,000	5,850	50,000	5,850
6	Subbase	m3	-	27,716	186,066	27,716	179,282	27,716	179,282
7	Graded Base Course	m3	-	11,400	176,182	19,760	178,946	19,760	184,473
8	Bituminous Surface Treatment	m2	2.291	0	0	0	0	0	0
9	Asphalt Concrete Surface	m2	4.991	76,000	379,316	76,000	379,316	76,000	379,316
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	24,000	59,784	24,000	59,784	24,000	59,784
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	10	700	10	700	10	700
15	Guard post	No.	40.000	605	24,200	661	26,440	1,150	46,000
16	Pavement markings	km	1,200.000	24	28,800	24	28,800	24	28,800
17	Signs	No.	280.000	11	3,080	4	1,120	0	0
18	Road Station	No.	24,596.320	0	0	0	0	0	0
19	Observation Platform	No.	24,596.320	1	24,596	0	0	0	0
20	Lined Drain	m	8.000	1120	8,960	470	3,760	4,345	34,760
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	7	37,908	9	48,739	14	75,816
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	4	33,880	3	25,410	4	33,880
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	1	12,306	2	24,613	0	0
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	2	35,467	1	17,734	2	35,467
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	0	0	1	25,615	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	0	0	1	32,525	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (l = 15.0m)	1	92,004.545	0	0	0	0	0	0
29	Bridge Type 2 (l = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (l = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (l = 52.5m)	1	308,672.727	0	0	0	0	0	0
32	Bridge Type 5 (l = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (l = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	5,568	4,287	5,364	4,130	12,896	9,930
35	Environmental countermeasure for quarry	m2	0.770	3,720	2,864	7,080	5,452	0	0
36	Slope for domestic animal crossing	No.	1,030.050	2	2,060	2	2,060	0	0
37	Planting tree	No.	3.636	0	0	0	0	0	0
38	Reinstate of hauling road	km	585.009	10	5,850	10	5,850	10	5,850
Sub - Total				-	-	-	-	-	-
				-	1,692,229	-	1,891,565	-	2,322,737

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 7-9)

■ Case - 1 : Asphalt Concrete Pavement at All Sections

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 7		Section 8		Section 9	
				STA. 172 + 700 ~ 182 + 700		STA. 182 + 700 ~ 192 + 400		STA. 192 + 400 ~ 203 + 400	
				10.000 km		9.700 km		11.000 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	= 1,100 Tug	10.000	-	9.700	-	11.000	-
1	Clearing and Surface Stripping	m2	0.391	150,330	58,779	132,180	51,682	173,071	67,671
2	Excavation	m3	2.346	25,119	58,929	22,876	53,667	3,557	8,345
3	Embankment	m3	3.400	253,910	863,294	192,415	654,211	254,781	866,255
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	50,000	5,850	48,500	5,675	55,000	6,435
6	Subbase	m3	-	23,860	177,250	25,642	159,969	23,944	193,242
7	Graded Base Course	m3	-	8,626	174,870	10,181	198,441	11,328	200,564
8	Bituminous Surface Treatment	m2	2.291	0	0	0	0	0	0
9	Asphalt Concrete Surface	m2	4.991	76,000	379,316	73,720	367,937	83,600	417,248
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	24,000	59,784	23,280	57,990	26,400	65,762
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	10	700	10	700	11	770
15	Guard post	No.	40.000	754	30,160	132	5,280	541	21,640
16	Pavement markings	km	1,200.000	24	28,800	23	27,600	26	31,200
17	Signs	No.	280.000	8	2,240	0	0	12	3,360
18	Road Station	No.	24,596.320	0	0	0	0	1	24,596
19	Observation Platform	No.	24,596.320	0	0	0	0	0	0
20	Lined Drain	m	8.000	3680	29,440	4,030	32,240	0	0
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	8	43,324	4	21,662	9	48,739
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	3	25,410	2	16,940	4	33,880
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	1	12,306	1	12,306	0	0
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	1	17,734	0	0	2	35,467
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	1	25,615	3	76,846	1	25,615
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	0	0	0	0	1	32,525
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (1 = 15.0m)	1	92,004.545	0	0	0	0	0	0
29	Bridge Type 2 (1 = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (1 = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (1 = 52.5m)	1	308,672.727	0	0	0	0	0	0
32	Bridge Type 5 (1 = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (1 = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	9,492	7,309	6,304	4,854	7,232	5,569
35	Environmental countermeasure for quarry	m2	0.770	0	0	0	0	0	0
36	Slope for domestic animal crossing	No.	1,030.050	2	2,060	0	0	2	2,060
37	Planting tree	No.	3.636	0	0	0	0	100	364
38	Reinstate of hauling road	km	585.009	10	5,850	10	5,850	11	6,435
Sub - Total				-	-	-	-	-	-
				-	2,009,020	-	1,753,851	-	2,097,743

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 10-12)

■ Case - 1 : Asphalt Concrete Pavement at All Sections

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 10		Section 11		Section 12	
				STA. 203 + 400 ~ 214 + 400		STA. 214 + 400 ~ 225 + 400		STA. 225 + 400 ~ 237 + 100	
				11.000 km		11.000 km		11.700 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	= 1,100 Tug	10.947	-	11.000	-	11.685	-
1	Clearing and Surface Stripping	m2	0.391	157,414	61,549	141,490	55,323	170,980	66,853
2	Excavation	m3	2.346	1,337	3,137	63,805	149,687	740	1,736
3	Embankment	m3	3.400	160,638	546,169	237,968	809,091	172,522	586,575
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	55,000	6,435	55,000	6,435	58,500	6,845
6	Subbase	m3	-	25,089	259,971	28,908	207,080	30,909	220,532
7	Graded Base Course	m3	-	12,480	172,446	11,244	180,880	12,104	208,452
8	Bituminous Surface Treatment	m2	2.291	0	0	0	0	0	0
9	Asphalt Concrete Surface	m2	4.991	83,197	415,237	83,600	417,248	88,806	443,231
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	26,273	65,446	26,400	65,762	28,044	69,858
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	11	770	11	770	12	840
15	Guard post	No.	40.000	143	5,720	631	25,240	52	2,080
16	Pavement markings	km	1,200.000	26	31,200	26	31,200	28	33,600
17	Signs	No.	280.000	15	4,200	4	1,120	8	2,240
18	Road Station	No.	24,596.320	1	24,596	0	0	0	0
19	Observation Platform	No.	24,596.320	0	0	0	0	0	0
20	Lined Drain	m	8.000	2760	22,080	7,130	57,040	960	7,680
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	6	32,493	2	10,831	6	32,493
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	2	16,940	3	25,410	5	42,350
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	0	0	4	49,225	1	12,306
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	0	0	1	17,734	0	0
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	1	25,615	1	25,615	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	1	32,525	1	32,525	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (l = 15.0m)	1	92,004.545	0	0	0	0	1	92,005
29	Bridge Type 2 (l = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (l = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (l = 52.5m)	1	308,672.727	1	308,673	0	0	0	0
32	Bridge Type 5 (l = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (l = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	0	0	7,358	5,666	372	286
35	Environmental countermeasure for quarry	m2	0.770	5,040	3,881	6,780	5,221	0	0
36	Slope for domestic animal crossing	No.	1,030.050	5	5,150	2	2,060	2	2,060
37	Planting tree	No.	3.636	50	182	0	0	0	0
38	Reinstate of hauling road	km	585.009	11	6,435	11	6,435	12	7,020
Sub - Total				-	-	-	-	-	-
				-	2,050,850	-	2,187,598	-	1,839,041

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 13-15)

■ Case - 1 : Asphalt Concrete Pavement at All Sections

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 13		Section 14		Section 15	
				STA. 237 + 100 ~ 247 + 100		STA. 247 + 100 ~ 257 + 100		STA. 257 + 100 ~ 267 + 100	
				10.000 km		10.000 km		10.000 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	= 1,100 Tug	10.000	-	10.000	-	10.000	-
1	Clearing and Surface Stripping	m2	0.391	128,896	50,398	124,824	48,806	134,147	52,451
2	Excavation	m3	2.346	19,920	46,732	8,801	20,647	163,662	383,951
3	Embankment	m3	3.400	168,461	572,767	139,793	475,296	224,564	763,518
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	50,000	5,850	50,000	5,850	50,000	5,850
6	Subbase	m3	-	22,884	178,633	23,778	175,688	24,449	220,331
7	Graded Base Course	m3	-	9,690	211,764	10,678	222,197	11,400	241,819
8	Bituminous Surface Treatment	m2	2.291	0	0	0	0	0	0
9	Asphalt Concrete Surface	m2	4.991	76,000	379,316	76,000	379,316	76,000	379,316
10	Asphalt Concrete Overlay for Ae surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	24,000	59,784	24,000	59,784	24,000	59,784
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	10	700	10	700	10	700
15	Guard post	No.	40.000	0	0	44	1,760	600	24,000
16	Pavement markings	km	1,200.000	24	28,800	24	28,800	24	28,800
17	Signs	No.	280.000	4	1,120	4	1,120	2	560
18	Road Station	No.	24,596.320	1	24,596	0	0	0	0
19	Observation Platform	No.	24,596.320	0	0	0	0	1	24,596
20	Lined Drain	m	8.000	1620	12,960	400	3,200	4,600	36,800
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	8	43,324	6	32,493	2	10,831
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	2	16,940	3	25,410	2	16,940
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	1	12,306	1	12,306	3	36,919
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	0	0	0	0	1	17,734
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	0	0	1	25,615	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	0	0	0	0	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (l = 15.0m)	1	92,004.545	0	0	0	0	0	0
29	Bridge Type 2 (l = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (l = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (l = 52.5m)	1	308,672.727	0	0	0	0	0	0
32	Bridge Type 5 (l = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (l = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	4,416	3,400	8,100	6,237	0	0
35	Environmental countermeasure for quarry	m2	0.770	0	0	0	0	0	0
36	Slope for domestic animal crossing	No.	1,030.050	1	1,030	2	2,060	0	0
37	Planting tree	No.	3.636	200	727	0	0	0	0
38	Reinstate of hauling road	km	585.009	10	5,850	10	5,850	10	5,850
Sub - Total				-	1,656,999	-	1,533,136	-	2,310,750

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 16-18)

■ Case - 1 : Asphalt Concrete Pavement at All Sections

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 16		Section 17		Section 18	
				STA. 267 + 100 ~ 277 + 100		STA. 277 + 100 ~ 287 + 100		STA. 287 + 100 ~ 297 + 100	
				10.000 km		10.000 km		10.000 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	= 1,100 Tug	10.000	-	10.000	-	10.000	-
1	Clearing and Surface Stripping	m2	0.391	139,931	54,713	131,952	51,593	129,538	50,649
2	Excavation	m3	2.346	4,710	11,050	0	0	492	1,154
3	Embankment	m3	3.400	156,742	532,923	87,777	298,442	87,114	296,188
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	50,000	5,850	50,000	5,850	50,000	5,850
6	Subbase	m3	-	23,439	177,586	21,000	172,773	21,000	172,773
7	Graded Base Course	m3	-	7,790	176,182	7,600	160,291	7,600	153,382
8	Bituminous Surface Treatment	m2	2.291	0	0	0	0	0	0
9	Asphalt Concrete Surface	m2	4.991	76,000	379,316	76,000	379,316	76,000	379,316
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	24,000	59,784	24,000	59,784	24,000	59,784
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	10	700	10	700	10	700
15	Guard post	No.	40.000	221	8,840	0	0	0	0
16	Pavement markings	km	1,200.000	24	28,800	24	28,800	24	28,800
17	Signs	No.	280.000	0	0	0	0	3	840
18	Road Station	No.	24,596.320	0	0	0	0	0	0
19	Observation Platform	No.	24,596.320	0	0	0	0	0	0
20	Lined Drain	m	8.000	0	0	0	0	0	0
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	6	32,493	3	16,246	10	54,155
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	3	25,410	3	25,410	2	16,940
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	1	12,306	0	0	0	0
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	0	0	0	0	0	0
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	1	25,615	0	0	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	1	32,525	0	0	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (1 = 15.0m)	1	92,004.545	0	0	0	0	0	0
29	Bridge Type 2 (1 = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (1 = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (1 = 52.5m)	1	308,672.727	0	0	0	0	0	0
32	Bridge Type 5 (1 = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (1 = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	2,136	1,645	0	0	0	0
35	Environmental countermeasure for quarry	m2	0.770	0	0	0	0	6,480	4,990
36	Slope for domestic animal crossing	No.	1,030.050	0	0	0	0	0	0
37	Planting tree	No.	3.636	0	0	0	0	0	0
38	Reinstate of hauling road	km	585.009	10	5,850	10	5,850	10	5,850
Sub - Total				-	-	-	-	-	-
				-	1,571,588	-	1,205,055	-	1,231,370

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 19-21)

■ Case - 1 : Asphalt Concrete Pavement at All Sections

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 19		Section 20		Section 21	
				STA. 297 + 100 ~ 307 + 400		STA. 307 + 400 ~ 320 + 600		STA. 320 + 600 ~ 333 + 949	
				10.300 km		13.200 km		13.349 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	= 1,100 Tug	10.300	-	13.147	-	13.349	-
1	Clearing and Surface Stripping	m2	0.391	120,574	47,144	152,625	59,676	144,428	56,471
2	Excavation	m3	2.346	37,530	88,045	28,279	66,343	14,407	33,799
3	Embankment	m3	3.400	127,675	434,095	157,212	534,521	111,182	378,019
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	51,500	6,026	66,000	7,722	66,745	7,809
6	Subbase	m3	-	22,616	175,623	33,257	243,128	33,768	267,329
7	Graded Base Course	m3	-	7,828	150,156	9,992	198,927	10,145	213,973
8	Bituminous Surface Treatment	m2	2.291	0	0	0	0	0	0
9	Asphalt Concrete Surface	m2	4.991	78,280	390,695	99,917	498,687	101,452	506,349
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	24,720	61,578	31,553	78,598	32,038	79,806
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	10	700	13	910	13	910
15	Guard post	No.	40.000	84	3,360	136	5,440	0	0
16	Pavement markings	km	1,200.000	25	30,000	32	38,400	32	38,400
17	Signs	No.	280.000	2	560	3	840	3	840
18	Road Station	No.	24,596.320	1	24,596	0	0	0	0
19	Observation Platform	No.	24,596.320	0	0	0	0	0	0
20	Lined Drain	m	8.000	2000	16,000	0	0	0	0
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	2	10,831	6	32,493	7	37,908
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	3	25,410	4	33,880	3	25,410
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	0	0	0	0	1	12,306
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	1	17,734	1	17,734	0	0
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	1	25,615	1	25,615	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	0	0	0	0	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (1 = 15.0m)	1	92,004.545	0	0	0	0	0	0
29	Bridge Type 2 (1 = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (1 = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (1 = 52.5m)	1	308,672.727	0	0	1	308,673	0	0
32	Bridge Type 5 (1 = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (1 = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	0	0	712	548	0	0
35	Environmental countermeasure for quarry	m2	0.770	4,440	3,419	3,480	2,680	3,540	2,726
36	Slope for domestic animal crossing	No.	1,030.050	0	0	0	0	0	0
37	Planting tree	No.	3.636	20	73	20	73	200	727
38	Reinstate of hauling road	km	585.009	10	5,850	13	7,605	13	7,605
Sub - Total				-	1,517,510	-	2,162,492	-	1,670,387

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS BY PORTION

■ Case - 2 : Both Asphalt Concrete Pavement and Bituminous Surface Treatment

■ Route Length : 221.822 km

ITEM No.	Description	Unit	Unit Cost Foreign (US\$)	Unit Cost Domestic (Tg)	Quantity	Foreign Portion (US\$)	Domestic Portion (1,000 Tg)	Total (US\$)
1	Clearing and Surface Stripping	m2	0.300	100.1	2,744,194	823,258	274,694	1,072,980
2	Excavation	m3	1.796	605.0	503,502	904,290	304,619	1,181,216
3	Embankment	m3	2.470	1,023.0	3,482,394	8,601,513	3,562,489	11,840,140
4	Earth work for raising	m	40.947	18,389.1	445	18,221	8,183	25,660
5	Maintaining hauling route	m2	0.088	31.9	1,015,900	89,399	32,407	118,860
6	Subbase	m3	-	-	501,008	275,048.3	1,123,139	3,771,518
7	Graded Base Course	m3	-	-	213,192	2,738,015	973,303	3,622,836
8	Bituminous Surface Treatment	m2	1.632	724.9	735,650	1,200,581	533,273	1,685,373
9	Asphalt Concrete Surface	m2	3.364	1,789.7	808,533	2,719,905	1,447,032	4,035,386
10	Asphalt Concrete Overlay for Ac surface	m2	3.266	1,777.6	112,742	368,215	200,410	550,406
11	Asphalt Concrete Overlay for BST surface	m2	3.729	2,028.4	14,637	54,581	29,690	81,572
12	Granular Shoulder	m2	2.021	517.0	487,988	986,224	252,290	1,215,578
13	Shoulder modification	m2	0.537	100.1	54,591	29,315	5,465	34,283
14	Kilometer marker posts	No.	14	61600	221	3094	13614	15470
15	Guard post	No.	8,000	35,200.0	6,671	53,368	234,819	266,840
16	Pavement markings	km	900,000	330,000.0	531	477,900	175,230	637,200
17	Signs	No.	210,000	77,000.0	115	24,150	8,855	32,200
18	Road Station	No.	17,106,019	8,239,330.7	5	85,530	41,197	122,982
19	Observation Platform	No.	17,106,019	8,239,330.7	2	34,212	16,479	49,193
20	Lined Drain	m	1.6	7040	35965	57544	253194	287720
21	Culvert Type A (1 @ 1.0m dia)	No.	770,000	5,110,000.0	122	93,940	623,420	660,686
22	Culvert Type B (1 @ 1.5m dia)	No.	1,370	7,810,000.0	57	78,090	445,170	482,790
23	Culvert Type C (2 @ 1.5m dia)	No.	1,970	11,370,000.0	18	35,460	204,660	221,515
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	3,170	16,020,000.0	12	38,040	192,240	212,804
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	4,970	22,710,000.0	12	59,640	272,520	307,385
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	6,580	28,540,000.0	5	32,900	142,700	162,627
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	8,770	36,970,000.0	0	0	0	0
28	Bridge Type 1 (1 = 15.0m)	No.	38,050	59,350,000	2	76,100	118,700	154,800
29	Bridge Type 2 (1 = 17.5m)	No.	43,030	65,840,000.0	1	43,030	65,840	102,885
30	Bridge Type 3 (1 = 35.0m)	No.	86,070	131,690,000.0	0	0	0	0
31	Bridge Type 4 (1 = 52.5m)	No.	129,100	197,530,000.0	2	0	395,060	617,345
32	Bridge Type 5 (1 = 70.0m)	No.	172,140	263,370,000.0	0	0	0	0
33	Bridge Type 6 (1 = 268.8m)	No.	655,890	1,234,560,000.0	1	655,890	1,234,560	1,778,217
34	Environmental countermeasure for borrow pit	m2	0.574	215.6	76880	44129	16575	59198
35	Environmental countermeasure for quarry	m2	0.574	215.6	44,640	25,623	9,624	34,373
36	Slope for domestic animal crossing	No.	603,733	468,949.0	23	13,886	10,786	23,691
37	Planting tree	No.	0.000	4,000.0	590	0	2,360	2,145
38	Reinstate of hauling road	km	440,000	159,509.9	203	89,320	32,381	118,755
39	Total	-	-	-	-	23,564,046	13,256,978	35,615,838
40	General	-	-	-	5% of 39	1,178,202	662,849	1,780,792
	Construction Cost	-	-	-	39+40	24,742,248	13,919,827	37,396,630

Note : 1 US\$ = 1,100 Tg

G-2. Cost Estimation for ALT-2

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 1-3)

■ Case - 2 : Both Asphalt Concrete Pavement and Bituminous Surface Treatment

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 1		Section 2		Section 3	
				STA. 112 + 127 ~ 121 + 448		STA. 121 + 448 ~ 130 + 769		STA. 130 + 769 ~ 142 + 700	
				9.321 km		9.321 km		11.931 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km		9.321		9.321		11.645	
1	Clearing and Surface Stripping	m2	0.391	0	0	0	0	186,913	73,083
2	Excavation	m3	2.346	0	0	0	0	2,783	6,529
3	Embankment	m3	3.400	0	0	0	0	265,894	904,040
4	Earth work for raising	m	57.664	445	25,660	0	0	0	0
5	Maintaining hauling route	m2	0.117	0	0	0	0	59655	6,980
6	Subbase	m3		1,044	8,323	0	0	32,273	216,657
7	Graded Base Course	m3		312	7,308	0	0	13,274	211,583
8	Bituminous Surface Treatment	m2	2.291	0	0	0	0	0	0
9	Asphalt Concrete Surface	m2	4.991	3,115	15,547	0	0	88,494	441,676
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	62,132	303,328	50,610	247,078	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	14,637	81,572	0	0
12	Granular Shoulder	m2	2.491	1,335	3,325	0	0	27,946	69,612
13	Shoulder modification	m2	0.628	26,628	16,722	27,963	17,561	0	0
14	Kilometer marker posts	No.	70.000	9	630	9	630	12	840
15	Guard post	No.	40.000	52	2,080	0	0	865	34,600
16	Pavement markings	km	1,200.000	22	26,400	22	26,400	29	34,800
17	Signs	No.	280.000	7	1,960	13	3,640	12	3,360
18	Road Station	No.	24,596.320	0	0	0	0	1	24,596
19	Observation Platform	No.	24,596.320	0	0	0	0	0	0
20	Lined Drain	m	8.000	0	0	0	0	2,850	22,800
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	0	0	0	0	7	37,908
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	0	0	0	0	2	16,940
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	0	0	0	0	1	12,306
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	0	0	0	0	0	0
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	0	0	0	0	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	0	0	0	0	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (1 = 15.0m)	1	92,004.545	1	92,005	0	0	0	0
29	Bridge Type 2 (1 = 17.5m)	1	102,884.545	0	0	0	0	1	102,885
30	Bridge Type 3 (1 = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (1 = 52.5m)	1	308,672.727	0	0	0	0	0	0
32	Bridge Type 5 (1 = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (1 = 268.8m)	1	1,778,217.273	0	0	0	0	1	1,778,217
34	Environmental countermeasure for borrow pit	m2	0.770	0	0	0	0	6,930	5,336
35	Environmental countermeasure for quarry	m2	0.770	0	0	0	0	4,080	3,142
36	Slope for domestic animal crossing	No.	1,030.050	2	2,060	1	1,030	0	0
37	Planting tree	No.	3.636	0	0	0	0	0	0
38	Reinstate of hauling road	km	585.009	0	0	0	0	12	7,020
	Sub - Total	-	-	-	505,349	-	377,911	-	4,014,910

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 4-6)

■ Case - 2 : Both Asphalt Concrete Pavement and Bituminous Surface Treatment

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 4		Section 5		Section 6	
				STA. 142 + 700 ~ 152 + 700		STA. 152 + 700 ~ 162 + 700		STA. 162 + 700 ~ 172 + 700	
				10.000 km		10.000 km		10.000 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	= 1,100 Tug	10.000	-	10.000	-	10.000	-
1	Clearing and Surface Stripping	m2	0.391	133,209	52,085	142,272	55,628	149,420	58,423
2	Excavation	m3	2.346	28,995	68,022	14,294	33,534	62,195	145,909
3	Embankment	m3	3.400	158,813	539,964	219,493	746,276	305,440	1,038,496
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	50,000	5,850	50,000	5,850	50,000	5,850
6	Subbase	m3	-	27,716	186,066	27,716	179,282	27,716	179,282
7	Graded Base Course	m3	-	11,400	176,182	19,760	178,946	19,760	184,473
8	Bituminous Surface Treatment	m2	2.291	0	0	0	0	0	0
9	Asphalt Concrete Surface	m2	4.991	76,000	379,316	76,000	379,316	76,000	379,316
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	24,000	59,784	24,000	59,784	24,000	59,784
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	10	700	10	700	10	700
15	Guard post	No.	40.000	605	24,200	661	26,440	1,150	46,000
16	Pavement markings	km	1,200.000	24	28,800	24	28,800	24	28,800
17	Signs	No.	280.000	11	3,080	4	1,120	0	0
18	Road Station	No.	24,596.320	0	0	0	0	0	0
19	Observation Platform	No.	24,596.320	1	24,596	0	0	0	0
20	Lined Drain	m	8.000	1120	8,960	470	3,760	4,345	34,760
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	7	37,908	9	48,739	14	75,816
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	4	33,880	3	25,410	4	33,880
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	1	12,306	2	24,613	0	0
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	2	35,467	1	17,734	2	35,467
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	0	0	1	25,615	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	0	0	1	32,525	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (l = 15.0m)	1	92,004.545	0	0	0	0	0	0
29	Bridge Type 2 (l = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (l = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (l = 52.5m)	1	308,672.727	0	0	0	0	0	0
32	Bridge Type 5 (l = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (l = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	5,568	4,287	5,364	4,130	12,896	9,930
35	Environmental countermeasure for quarry	m2	0.770	3,720	2,864	7,080	5,452	0	0
36	Slope for domestic animal crossing	No.	1,030.050	2	2,060	2	2,060	0	0
37	Planting tree	No.	3.636	0	0	0	0	0	0
38	Reinstate of hauling road	km	585.009	10	5,850	10	5,850	10	5,850
Sub - Total				-	1,692,229	-	1,891,565	-	2,322,737

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 7-9)

■ Case - 2 : Both Asphalt Concrete Pavement and Bituminous Surface Treatment

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 7		Section 8		Section 9	
				STA. 172 + 700 ~ 182 + 700		STA. 182 + 700 ~ 192 + 400		STA. 192 + 400 ~ 203 + 400	
				10.000 km		9.700 km		11.000 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	≈ 1,100 Tug	10.000	-	9.700	-	11.000	-
1	Clearing and Surface Stripping	m2	0.391	150,330	58,779	132,180	51,682	173,071	67,671
2	Excavation	m3	2.346	25,119	58,929	22,876	53,667	3,557	8,345
3	Embankment	m3	3.400	253,910	863,294	192,415	654,211	254,781	866,255
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	50,000	5,850	48,500	5,675	55,000	6,435
6	Subbase	m3	-	23,860	177,250	25,642	159,969	23,944	193,242
7	Graded Base Course	m3	-	8,626	174,870	10,181	198,441	11,328	200,564
8	Bituminous Surface Treatment	m2	2.291	0	0	0	0	0	0
9	Asphalt Concrete Surface	m2	4.991	76,000	379,316	73,720	367,937	83,600	417,248
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	24,000	59,784	23,280	57,990	26,400	65,762
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	10	700	10	700	11	770
15	Guard post	No.	40.000	754	30,160	132	5,280	541	21,640
16	Pavement markings	km	1,200.000	24	28,800	23	27,600	26	31,200
17	Signs	No.	280.000	8	2,240	0	0	12	3,360
18	Road Station	No.	24,596.320	0	0	0	0	1	24,596
19	Observation Platform	No.	24,596.320	0	0	0	0	0	0
20	Lined Drain	m	8.000	3680	29,440	4,030	32,240	0	0
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	8	43,324	4	21,662	9	48,739
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	3	25,410	2	16,940	4	33,880
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	1	12,306	1	12,306	0	0
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	1	17,734	0	0	2	35,467
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	1	25,615	3	76,846	1	25,615
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	0	0	0	0	1	32,525
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (l = 15.0m)	1	92,004.545	0	0	0	0	0	0
29	Bridge Type 2 (l = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (l = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (l = 52.5m)	1	308,672.727	0	0	0	0	0	0
32	Bridge Type 5 (l = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (l = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	9,492	7,309	6,304	4,854	7,232	5,569
35	Environmental countermeasure for quarry	m2	0.770	0	0	0	0	0	0
36	Slope for domestic animal crossing	No.	1,030.050	2	2,060	0	0	2	2,060
37	Planting tree	No.	3.636	0	0	0	0	100	364
38	Reinstate of hauling road	km	585.009	10	5,850	10	5,850	11	6,435
Sub - Total				-	2,009,020	-	1,753,851	-	2,097,743

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 10-12)

■ Case - 2 : Both Asphalt Concrete Pavement and Bituminous Surface Treatment

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 10		Section 11		Section 12	
				STA. 203 + 400 ~ 214 + 400		STA. 214 + 400 ~ 225 + 400		STA. 225 + 400 ~ 237 + 100	
				11.000 km		11.000 km		11.700 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	= 1,100 Tug	10.947	-	11.000	-	11.685	-
1	Clearing and Surface Stripping	m2	0.391	157,414	61,549	141,490	55,323	170,980	66,853
2	Excavation	m3	2.346	1,337	3,137	63,805	149,687	740	1,736
3	Embankment	m3	3.400	160,638	546,169	237,968	809,091	172,522	586,575
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	55,000	6,435	55,000	6,435	58,500	6,845
6	Subbase	m3	-	25,089	259,971	28,908	207,080	30,909	220,532
7	Graded Base Course	m3	-	12,480	172,446	11,244	180,880	12,104	208,452
8	Bituminous Surface Treatment	m2	2.291	0	0	0	0	0	0
9	Asphalt Concrete Surface	m2	4.991	83,197	415,237	83,600	417,248	88,806	443,231
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	26,273	65,446	26,400	65,762	28,044	69,858
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	11	770	11	770	12	840
15	Guard post	No.	40.000	143	5,720	631	25,240	52	2,080
16	Pavement markings	km	1,200.000	26	31,200	26	31,200	28	33,600
17	Signs	No.	280.000	15	4,200	4	1,120	8	2,240
18	Road Station	No.	24,596.320	1	24,596	0	0	0	0
19	Observation Platform	No.	24,596.320	0	0	0	0	0	0
20	Lined Drain	m	8.000	2760	22,080	7,130	57,040	960	7,680
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	6	32,493	2	10,831	6	32,493
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	2	16,940	3	25,410	5	42,350
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	0	0	4	49,225	1	12,306
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	0	0	1	17,734	0	0
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	1	25,615	1	25,615	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	1	32,525	1	32,525	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (1 = 15.0m)	1	92,004.545	0	0	0	0	1	92,005
29	Bridge Type 2 (1 = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (1 = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (1 = 52.5m)	1	308,672.727	1	308,673	0	0	0	0
32	Bridge Type 5 (1 = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (1 = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	0	0	7,358	5,666	372	286
35	Environmental countermeasure for quarry	m2	0.770	5,040	3,881	6,780	5,221	0	0
36	Slope for domestic animal crossing	No.	1,030.050	5	5,150	2	2,060	2	2,060
37	Planting tree	No.	3.636	50	182	0	0	0	0
38	Reinstate of hauling road	km	585.009	11	6,435	11	6,435	12	7,020
Sub - Total				-	2,050,850	-	2,187,598	-	1,839,041

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 13-15)

■ Case - 2 : Both Asphalt Concrete Pavement and Bituminous Surface Treatment

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 13		Section 14		Section 15	
				STA. 237 + 100 ~ 247 + 100		STA. 247 + 100 ~ 257 + 100		STA. 257 + 100 ~ 267 + 100	
				10.000 km		10.000 km		10.000 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	= 1,100 Tug	10.000	-	10.000	-	10.000	-
1	Clearing and Surface Stripping	m2	0.391	128,896	50,398	124,824	48,806	134,147	52,451
2	Excavation	m3	2.346	19,920	46,732	8,801	20,647	163,662	383,951
3	Embankment	m3	3.400	168,461	572,767	139,793	475,296	224,564	763,518
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	50,000	5,850	50,000	5,850	50,000	5,850
6	Subbase	m3	-	22,884	178,633	23,778	175,688	24,449	220,331
7	Graded Base Course	m3	-	9,690	211,764	10,678	222,197	11,400	241,819
8	Bituminous Surface Treatment	m2	2.291	76,000	174,116	76,000	174,116	76,000	174,116
9	Asphalt Concrete Surface	m2	4.991	0	0	0	0	0	0
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	24,000	59,784	24,000	59,784	24,000	59,784
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	10	700	10	700	10	700
15	Guard post	No.	40.000	0	0	44	1,760	600	24,000
16	Pavement markings	km	1,200.000	24	28,800	24	28,800	24	28,800
17	Signs	No.	280.000	4	1,120	4	1,120	2	560
18	Road Station	No.	24,596.320	1	24,596	0	0	0	0
19	Observation Platform	No.	24,596.320	0	0	0	0	1	24,596
20	Lined Drain	m	8.000	1620	12,960	400	3,200	4,600	36,800
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	8	43,324	6	32,493	2	10,831
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	2	16,940	3	25,410	2	16,940
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	1	12,306	1	12,306	3	36,919
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	0	0	0	0	1	17,734
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	0	0	1	25,615	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	0	0	0	0	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (l = 15.0m)	1	92,004.545	0	0	0	0	0	0
29	Bridge Type 2 (l = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (l = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (l = 52.5m)	1	308,672.727	0	0	0	0	0	0
32	Bridge Type 5 (l = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (l = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	4,416	3,400	8,100	6,237	0	0
35	Environmental countermeasure for quarry	m2	0.770	0	0	0	0	0	0
36	Slope for domestic animal crossing	No.	1,030.050	1	1,030	2	2,060	0	0
37	Planting tree	No.	3.636	200	727	0	0	0	0
38	Reinstate of hauling road	km	585.009	10	5,850	10	5,850	10	5,850
Sub - Total				-	1,451,799	-	1,327,936	-	2,105,550

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 16-18)

■ Case - 2 : Both Asphalt Concrete Pavement and Bituminous Surface Treatment

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 16		Section 17		Section 18	
				STA. 267 + 100 ~ 277 + 100		STA. 277 + 100 ~ 287 + 100		STA. 287 + 100 ~ 297 + 100	
				10.000 km		10.000 km		10.000 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	= 1,100 Tug	10.000	-	10.000	-	10.000	-
1	Clearing and Surface Stripping	m2	0.391	139,931	54,713	131,952	51,593	129,538	50,649
2	Excavation	m3	2.346	4,710	11,050	0	0	492	1,154
3	Embankment	m3	3.400	156,742	532,923	87,777	298,442	87,114	296,188
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	50,000	5,850	50,000	5,850	50,000	5,850
6	Subbase	m3	-	23,439	177,586	21,000	172,773	21,000	172,773
7	Graded Base Course	m3	-	7,790	176,182	7,600	160,291	7,600	153,382
8	Bituminous Surface Treatment	m2	2.291	76,000	174,116	76,000	174,116	76,000	174,116
9	Asphalt Concrete Surface	m2	4.991	0	0	0	0	0	0
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	24,000	59,784	24,000	59,784	24,000	59,784
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	10	700	10	700	10	700
15	Guard post	No.	40.000	221	8,840	0	0	0	0
16	Pavement markings	km	1,200.000	24	28,800	24	28,800	24	28,800
17	Signs	No.	280.000	0	0	0	0	3	840
18	Road Station	No.	24,596.320	0	0	0	0	0	0
19	Observation Platform	No.	24,596.320	0	0	0	0	0	0
20	Lined Drain	m	8.000	0	0	0	0	0	0
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	6	32,493	3	16,246	10	54,155
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	3	25,410	3	25,410	2	16,940
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	1	12,306	0	0	0	0
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	0	0	0	0	0	0
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	1	25,615	0	0	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	1	32,525	0	0	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (1 = 15.0m)	1	92,004.545	0	0	0	0	0	0
29	Bridge Type 2 (1 = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (1 = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (1 = 52.5m)	1	308,672.727	0	0	0	0	0	0
32	Bridge Type 5 (1 = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (1 = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	2,136	1,645	0	0	0	0
35	Environmental countermeasure for quarry	m2	0.770	0	0	0	0	6,480	4,990
36	Slope for domestic animal crossing	No.	1,030.050	0	0	0	0	0	0
37	Planting tree	No.	3.636	0	0	0	0	0	0
38	Reinstate of hauling road	km	585.009	10	5,850	10	5,850	10	5,850
Sub - Total				-	1,366,388	-	999,855	-	1,026,170

CONSTRUCTION OF EASTERN ARTERIAL ROAD : QUANTITIES AND COSTS (Section 19-21)

■ Case - 2 : Both Asphalt Concrete Pavement and Bituminous Surface Treatment

ITEM No.	Description	Unit	Unit Cost Total (US\$)	Section 19		Section 20		Section 21	
				STA. 297 + 100 ~ 307 + 400		STA. 307 + 400 ~ 320 + 600		STA. 320 + 600 ~ 333 + 949	
				10.300 km		13.200 km		13.349 km	
				Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)	Quantity	Item wise Cost (US\$)
	Road length	km	= 1,100 Tug	10.300	-	13.147	-	13.349	-
1	Clearing and Surface Stripping	m2	0.391	120,574	47,144	152,625	59,676	144,428	56,471
2	Excavation	m3	2.346	37,530	88,045	28,279	66,343	14,407	33,799
3	Embankment	m3	3.400	127,675	434,095	157,212	534,521	111,182	378,019
4	Earth work for raising	m	57.664	0	0	0	0	0	0
5	Maintaining hauling route	m2	0.117	51,500	6,026	66,000	7,722	66,745	7,809
6	Subbase	m3	-	22,616	175,623	33,257	243,128	33,768	267,329
7	Graded Base Course	m3	-	7,828	150,156	9,992	198,927	10,145	213,973
8	Bituminous Surface Treatment	m2	2.291	78,280	179,339	99,917	228,910	101,452	232,427
9	Asphalt Concrete Surface	m2	4.991	0	0	0	0	0	0
10	Asphalt Concrete Overlay for Ac surface	m2	4.882	0	0	0	0	0	0
11	Asphalt Concrete Overlay for BST surface	m2	5.573	0	0	0	0	0	0
12	Granular Shoulder	m2	2.491	24,720	61,578	31,553	78,598	32,038	79,806
13	Shoulder modification	m2	0.628	0	0	0	0	0	0
14	Kilometer marker posts	No.	70.000	10	700	13	910	13	910
15	Guard post	No.	40.000	84	3,360	136	5,440	0	0
16	Pavement markings	km	1,200.000	25	30,000	32	38,400	32	38,400
17	Signs	No.	280.000	2	560	3	840	3	840
18	Road Station	No.	24,596.320	1	24,596	0	0	0	0
19	Observation Platform	No.	24,596.320	0	0	0	0	0	0
20	Lined Drain	m	8.000	2000	16,000	0	0	0	0
21	Culvert Type A (1 @ 1.0m dia)	No.	5,415.455	2	10,831	6	32,493	7	37,908
22	Culvert Type B (1 @ 1.5m dia)	No.	8,470.000	3	25,410	4	33,880	3	25,410
23	Culvert Type C (2 @ 1.5m dia)	No.	12,306.364	0	0	0	0	1	12,306
24	Culvert Type D (1 @ 2.5m x 2.5m)	No.	17,733.636	1	17,734	1	17,734	0	0
25	Culvert Type E (2 @ 2.5m x 2.5m)	No.	25,615.455	1	25,615	1	25,615	0	0
26	Culvert Type F (3 @ 2.5m x 2.5m)	No.	32,525.455	0	0	0	0	0	0
27	Culvert Type G (3 @ 3.0m x 3.0m)	No.	42,379.091	0	0	0	0	0	0
28	Bridge Type 1 (l = 15.0m)	1	92,004.545	0	0	0	0	0	0
29	Bridge Type 2 (l = 17.5m)	1	102,884.545	0	0	0	0	0	0
30	Bridge Type 3 (l = 35.0m)	1	205,788.182	0	0	0	0	0	0
31	Bridge Type 4 (l = 52.5m)	1	308,672.727	0	0	1	308,673	0	0
32	Bridge Type 5 (l = 70.0m)	1	411,567.273	0	0	0	0	0	0
33	Bridge Type 6 (l = 268.8m)	1	1,778,217.273	0	0	0	0	0	0
34	Environmental countermeasure for borrow pit	m2	0.770	0	0	712	548	0	0
35	Environmental countermeasure for quarry	m2	0.770	4,440	3,419	3,480	2,680	3,540	2,726
36	Slope for domestic animal crossing	No.	1,030.050	0	0	0	0	0	0
37	Planting tree	No.	3.636	20	73	20	73	200	727
38	Reinstate of hauling road	km	585.009	10	5,850	13	7,605	13	7,605
Sub - Total				-	1,306,154	-	1,892,715	-	1,396,466

G-3. Equipment Required for Road Rehabilitation/Maintenance Center

Targeted Road Length: 144.4km

Section III, IV and V (49.7 + 44.7 + 50.0)

Construction Period: 3 years

Type of Pavement: Asphalt Concrete Pavement

1. Earthwork

Excavation	Bulldozer
Excavation & Loading	Excavator
Loading	Wheel Loader
Hauling	Dump Truck
Leveling	Motor Grader, Bulldozer
Compaction	Vibration Roller, Water Tanker

2. Base & Sub-base Course

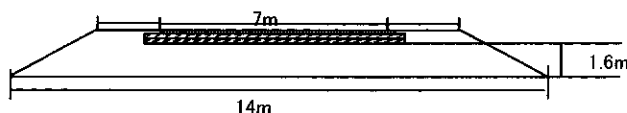
Crushing	Jaw Crusher (Primary), Cone Crusher (Secondary), Vibration Scree
	Belt Conveyer, Generator, Bulldozer, Backhoe, Wheel Loader
Loading	Wheel Loader
Hauling	Dump Truck
Leveling	Motor Grader
Compaction	Vibration Roller, Water Tanker

3. Surface Course

Hot-mixing	Asphalt Plant
Loading	Wheel Loader
Hauling	Dump Truck
Leveling	Chip Spreader
Distribution	Asphalt Sprayer
Placing	Asphalt Finisher
Initial Compaction	Vibration Roller
Final Compaction	Tire Roller

Earthwork Volume

Lane Width	7.00	m
Average Embankment Height	1.60	m
Shoulder Width	1.50	m
Sub-base Course	0.2-0.26	m
Base Course	0.1-0.15	m
Surface Course	0.05	m



	Total Work Volume	Work Volume per Km
Earthwork	2,733,317 M3	18,929 M3/Km
Base & Sub-base Course		
Base Course	164,035 M3	1,136 M3/Km
Sub-base Course	357,050 M3	2,473 M3/Km
Total		3,609 M3/Km
Surface Course		
7.6 x 0.05 x 144,400 m	54,872 M3	380 M3/Km

Targeted Road Length

Annual Average Progress
Annual Working Hours

48.1 km
1500 h

Type of Work	Equipment Type	Excavation	Excavation	Loading	Hauling	Leveling	Compaction	Final Compaction	Placing	Hot-mixing
	Specification									
	Conditions									
Earthwork		Bulldozer	Excavator	W. Loader	D. Truck	M Grader	V Roller	Tire Roller	Asphalt Finisher	Asphalt Plant
		28 ton	0.7 m3	2.1 m3	11ton, 7 m3	3.7 m	10 ton	10 ton	4 m	60 ton/h
	Hourly Productivity	157 m3/hr	135 m3/hr	109 m3/hr	18.17 m3/hr	64.6 m3/hr	108 m3/hr			
	Annual Productivity	235,500 m3	202,500 m3	163,500 m3	27,260 m3	96,900 m3	162,000 m3			
Base & Subbase Course	Annual Work Volume	911,106 m3	911,106 m3	911,106 m3	911,106 m3	911,106 m3	911,106 m3			
	Required Number	3.9 Veh.	4.50 Veh.	5.57 Veh.	33.42 Veh.	9.40 Veh.	5.62 Veh.			
	Conditions									
Surface Course	Hourly Productivity									
	Annual Productivity									
	Annual Work Volume									
	Required Number									
	Conditions									
Required Number										

Targeted Road Length

Annual Average Progress
Annual Working Hours

48.1 km
1500 h

Type of Work	Equipment Type	Initial Crushing	Final Crushing	Hauling	Loading	Power Supply
	Specification	Jaw Crusher	Cone Crusher	Bulldozer	W. Loader	Generator
	Conditions	60 t	40 t	7 ton	1.3 m3	220 kVA
		Efficiency: 0.65	Efficiency: 0.65	Hauling Distance: 20m Efficiency: 1.0	Cycle Time: 60sec Efficiency: 0.7	
Crushed Stone Production	Hourly Productivity	15 m3/hr	10 m3/hr	40 m3/hr	44 m3/hr	
	Annual Productivity	22 500 m3	15 000 m3	60 000 m3	66 000 m3	
	Annual Work Volume	48 246 m3	33 772 m3	48 246 m3	48 246 m3	
	Required Number	2.14 veh.	2.25 veh.	0.8 veh.	0.73 veh.	
	Conditions					
Base & Subbase Course	Hourly Productivity					
	Annual Productivity					
	Annual Work Volume					
	Required Number					
	Conditions					
Surface Course	Hourly Productivity					
	Annual Productivity					
	Annual Work Volume					
	Required Number					
Required Number		2.24 veh.	2.02 veh.	Two locations	Two locations	Two locations
		2 veh.	2 veh.	2 veh.	2 veh.	2 veh.

Equipment List and Estimated Cost

Item	Description	Specification	Q'ty	Unit Price	Amount	Remark
					(J.Yen)	
1	Bulldozer	28 ton	3 units	33,800,000	101,400,000	Construction
2	Bulldozer	7 ton	2 units	8,200,000	16,400,000	"
3	Hydraulic Excavator	0.7 m3	4 units	21,500,000	86,000,000	"
4	Wheel Loader	2.1 m3	5 units	14,500,000	72,500,000	"
5	Wheel Loader	1.3 m3	2 units	7,400,000	14,800,000	"
6	Dump Truck	11 ton	33 units	9,400,000	310,200,000	"
7	Motor Grader	3.7 m	9 units	16,800,000	151,200,000	"
8	Vibration Roller	10 ton	5 units	11,300,000	56,500,000	"
9	Tire Roller	10 ton	1 units	9,800,000	9,800,000	"
10	Asphalt Finisher	4 m	1 unit	17,000,000	17,000,000	"
11	Asphalt Plant	60 ton	1 unit	93,800,000	93,800,000	"
12	Water Tanker	8000 liter	1 units	7,100,000	7,100,000	"
13	Asphalt Sprayer	1500 liter	1 units	2,000,000	2,000,000	"
14	Chip Spreader	Vessel mount type	2 units	2,500,000	5,000,000	"
15	Tractor Head with Trailer	35 ton	1 unit	16,500,000	16,500,000	"
16	Crusher Plant	Jaw 60t & Cone 49t	2 units	35,000,000	70,000,000	"
17	Asphalt Cutter		2 units	500,000	1,000,000	Maintenace
18	Air Compressor	180 PSI	2 units	1,500,000	3,000,000	"
19	Plate Compactor	60 kg	8 units	300,000	2,400,000	"
20	Pnuematic Breaker	30 kg	8 units	150,000	1,200,000	"
21	Dump Truck	4 ton, 4 x 4	4 units	6,500,000	26,000,000	"
22	Truck with 3 ton Crane	5 ton	1 unit	9,500,000	9,500,000	"
23	Road Patrol Car	4 x 4	1 unit	4,500,000	4,500,000	"
24	Double Cab Pick-up	4 x 4	2 units	3,500,000	7,000,000	"
25	Line Marker Truck		1 unit	11,000,000	11,000,000	Others
26	Mobile Workshop	GVW 13 ton, 4 x 4	2 units	15,000,000	30,000,000	"
27	Rotary Snow Remover	Unimog type	2 units	25,000,000	50,000,000	"
28	Asphalt Testing Equipment		1 lot	5,000,000	5,000,000	"
29	Radio Communication	Base / Mobile	1 lot	3,000,000	3,000,000	"
30	Road Measure (wheel type)	5 digits	1 set	200,000	200,000	"
	TOTAL:				¥1,184,000,000	