

Appendix A-14.5 Sensitivity Analysis
 Table A-14.5.1 Cost Benefit Analysis of Section 1: Noi Bai - Bac Ninh

Case Design length: 4 Lane 31.3 km
 IERR: 10.94%
 Unit: 1 Million Dong

Year	Cost		Benefit				B/C Analysis		Discount Factor	Total	Benefit Present Value
	Capital	Maintenance	Normal Traffic	Diverted Traffic	Normal Traffic	Diverted Traffic	Cost Present Value	Benefit Present Value			
1	54,363	0	0	0	0	0	0	0.901	0	49,002	0
2	118,689	0	0	0	0	0	0	0.813	0	96,435	0
3	482,356	0	0	0	0	0	0	0.732	0	353,267	0
4	885,884	0	0	0	0	0	0	0.660	0	254,744	0
5	989	989	17,312	11,708	4,999	2,324	36,343	0.595	36,343	589	21,626
6	989	989	20,052	15,675	6,259	3,102	45,089	0.536	45,089	530	24,185
7	989	989	23,059	20,376	7,839	4,082	55,355	0.483	55,355	478	26,763
8	989	989	26,548	26,830	9,858	5,233	68,269	0.436	68,269	431	29,752
9	989	989	30,626	33,651	12,466	6,519	83,261	0.393	83,261	389	32,708
10	35,417	989	35,007	34,974	15,320	6,925	92,225	0.354	92,225	12,891	32,656
11	989	989	37,941	36,619	16,941	7,261	98,761	0.319	98,761	316	31,522
12	989	989	43,380	38,680	20,933	7,577	110,569	0.288	110,569	285	31,811
13	989	989	49,228	40,803	25,991	7,874	123,896	0.259	123,896	256	32,130
14	989	989	53,857	40,848	28,809	7,837	131,850	0.234	131,850	231	30,704
15	989	989	58,466	43,174	31,872	8,058	141,570	0.211	141,570	208	29,830
16	35,417	989	63,459	79,799	35,267	12,787	191,332	0.190	191,332	6,915	36,339
17	989	989	68,901	87,924	39,025	13,744	209,594	0.171	209,594	169	35,882
18	989	989	74,760	94,905	43,169	14,853	227,686	0.154	227,686	153	35,136
19	989	989	81,146	101,905	47,765	15,962	246,777	0.139	246,777	138	34,327
20	989	989	85,524	105,853	50,672	16,594	258,843	0.125	258,843	124	32,429
21	989	989	90,078	110,650	53,749	17,361	271,838	0.113	271,838	112	30,723
22	35,417	989	94,809	114,874	57,006	18,044	284,733	0.102	284,733	8,709	29,007
23	989	989	98,324	118,233	59,514	18,615	295,286	0.092	295,286	81	27,115
24	989	989	101,863	121,395	61,938	19,180	304,476	0.083	304,476	82	25,202
25	989	989	104,479	124,322	64,201	19,733	312,735	0.075	312,735	74	23,333
26	989	989	106,875	123,697	66,535	19,855	317,061	0.067	317,061	67	21,823
27	989	989	109,441	127,484	68,937	20,544	326,407	0.061	326,407	60	19,787
28	35,417	989	111,859	129,213	71,410	20,981	333,473	0.055	333,473	1,989	18,222
29	989	989	114,247	130,507	73,952	21,362	340,068	0.049	340,068	49	15,750
30	989	989	116,564	131,309	76,562	21,670	346,104	0.044	346,104	44	15,366
31	989	989	116,570	127,593	76,561	21,131	341,855	0.040	341,855	40	13,681
32	989	989	115,429	115,429	76,561	19,327	327,887	0.036	327,887	36	11,828
33	989	989	116,570	108,820	76,561	18,250	320,200	0.033	320,200	32	10,411
34	35,417	989	116,570	108,820	76,561	18,250	320,200	0.029	320,200	1,067	9,385
35	989	989	116,570	108,820	76,561	18,250	320,200	0.026	320,200	25	8,459
36	989	989	116,570	108,820	76,561	18,250	320,200	0.024	320,200	24	7,625
Total	1,218,377	31,648	2,518,042	2,723,506	1,510,953	451,542	7,203,443		7,203,443	785,050	786,017

Appendix A - 14.5 Sensitivity Analysis

Table A-14.2 Cost Benefit Analysis of Section 2 : Bac Ninh - Chi Linh

Case : Overlay + Highway 36.4 km
 Design Length :
 IRR : 13.23%
 Unit : Million Dong

Year	Cost		Benefit				Ferry Cost Saving	Total	B/C Analysis	
	Capital	Maintenance	V.O.C Saving	Time Saving	Discout Factor	Cost Present Value			Benefit Present Value	
			Normal Traffic	Diverted Traffic	Normal Traffic	Diverted Traffic				
1 1997	0	0	0	0	0	0	0	0	0.8832	0
2 1998	154,572	0	0	0	0	0	0	0	0.7800	120,561
3 1999	154,572	0	0	0	0	0	0	0	0.6888	106,475
4 2000	38,700	288	0	0	0	0	0	0	0.6084	23,715
5 2001	128,030	288	7,004	18,101	1,363	338	15,184	36,990	0.5373	68,939
6 2002	488,156	288	8,769	18,898	1,862	513	5,470	85,512	0.4745	231,761
7 2003	390,524	288	9,983	27,054	2,301	769	5,836	45,942	0.4191	163,769
8 2004	0	1,283	21,350	51,988	3,869	1,987	11,402	90,597	0.3701	475
9 2005	30,192	1,283	24,523	72,499	4,753	2,795	10,214	114,784	0.3268	10,288
10 2006	0	1,283	28,285	81,916	5,785	3,201	14,826	134,013	0.2887	370
11 2007	0	1,283	32,663	90,773	7,060	3,332	16,232	150,259	0.2549	327
12 2008	0	1,283	37,687	100,377	8,630	3,884	11,598	162,175	0.2251	289
13 2009	0	1,283	43,462	117,794	10,573	4,746	12,684	189,259	0.1988	255
14 2010	0	1,283	50,122	137,978	12,987	5,810	18,296	225,193	0.1756	225
15 2011	30,192	1,283	57,747	155,076	15,994	6,662	16,982	252,462	0.1551	4,381
16 2012	0	1,283	63,758	167,508	17,949	7,198	16,788	273,201	0.1370	176
17 2013	90,368	1,283	70,431	180,861	20,143	7,750	26,000	305,185	0.1210	11,086
18 2014	0	1,283	77,841	195,271	22,606	8,366	21,732	325,817	0.1068	137
19 2015	0	1,283	86,074	210,714	25,371	9,013	22,824	353,996	0.0943	121
20 2016	0	1,283	92,493	222,122	27,553	9,513	27,716	379,397	0.0833	107
21 2017	30,192	1,283	99,278	234,049	29,895	10,003	25,328	398,554	0.0736	2,316
22 2018	0	1,283	106,568	246,631	32,437	10,550	28,260	424,446	0.0650	83
23 2019	0	1,283	115,574	259,770	35,195	11,084	35,712	457,336	0.0574	74
24 2020	0	1,283	122,815	273,551	38,189	11,639	31,084	477,277	0.0507	65
25 2021	0	1,283	131,393	287,891	41,376	12,218	31,550	504,429	0.0448	57
26 2022	0	1,283	140,524	302,869	44,826	12,817	32,024	533,059	0.0395	51
27 2023	120,560	1,283	150,237	318,491	48,559	13,434	32,504	563,225	0.0349	4,254
28 2024	0	1,283	160,564	334,772	52,598	14,068	32,991	594,994	0.0308	40
29 2025	0	1,283	171,538	351,725	56,967	14,719	33,486	628,435	0.0272	35
30 2026	0	1,283	111,583	369,360	56,796	15,386	33,989	587,114	0.0241	31
Total	1,656,058	30,641	2,022,267	4,823,042	625,637	201,994	570,712	8,243,652		750,964
										751,275

Appendix A-14.5 Sensitivity Analysis
 Table A-14.3 Cost Benefit Analysis of Section 4 : Cua Ong - Tien Yen

Case : 1 Stage Improvement
 Design Length : 43.5 km
 Discount Rate : 11.23%
 Unit : 1 Million Dong

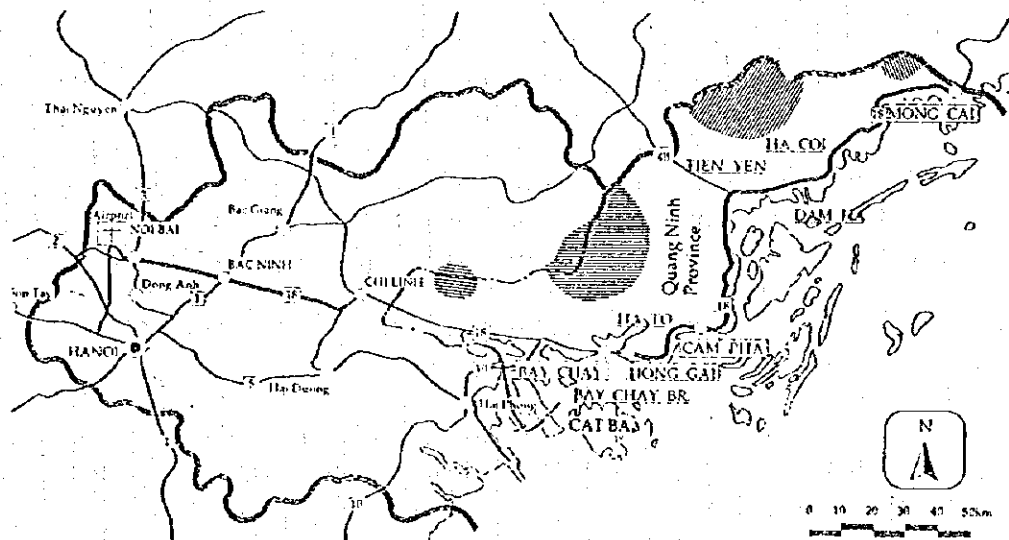
year	Cost		Benefit			E/C Analysis		Total	Discount Factor	Cost Present Value	Benefit Present Value
	Capital	Maintenance	Normal Traffic	VOC Generated Traffic	Time Saving Normal Traffic	Generated Traffic	Total				
1	18,156	0	0	0	0	0	0	0.8990	16,823	0	
2	88,823	0	0	0	0	0	0	0.8083	71,793	0	
3	126,716	0	0	0	0	0	0	0.7267	92,080	0	
4	225	225	4,258	4	416	4	4,677	0.6533	147	3,055	
5	225	225	5,262	8	519	8	5,789	0.5873	132	3,400	
6	225	225	6,545	8	614	8	7,168	0.5280	119	3,785	
7	225	225	8,154	12	728	12	8,895	0.4747	107	4,223	
8	225	225	10,176	17	866	17	11,060	0.4268	96	4,720	
9	18,600	225	12,720	18	1,033	18	13,772	0.3837	7,223	5,284	
10	225	225	14,806	28	1,408	28	16,048	0.3450	78	5,536	
11	225	225	17,226	35	1,676	35	18,671	0.3101	70	5,791	
12	225	225	20,019	36	1,996	36	21,734	0.2788	63	6,050	
13	225	225	23,221	42	2,625	42	25,261	0.2507	56	6,332	
14	225	225	29,196	48	3,135	48	31,872	0.2254	51	7,183	
15	18,600	225	33,761	61	3,749	61	36,961	0.2026	3,814	7,489	
16	225	225	39,023	64	4,486	64	42,841	0.1822	41	7,804	
17	225	225	45,027	77	5,778	77	49,599	0.1638	37	8,123	
18	225	225	53,502	89	6,965	89	59,379	0.1472	33	8,742	
19	225	225	61,598	100	8,062	100	68,673	0.1324	30	9,090	
20	225	225	67,794	110	9,358	110	75,977	0.1190	27	9,042	
21	18,600	225	74,559	121	10,895	121	84,051	0.1070	2,014	8,993	
22	225	225	81,944	132	12,727	132	92,987	0.0962	22	8,944	
23	225	225	90,002	145	14,732	145	102,893	0.0865	19	8,898	
24	225	225	97,153	157	17,124	157	112,064	0.0777	17	8,712	
25	225	225	104,815	169	19,997	169	122,133	0.0699	16	8,537	
26	225	225	113,023	182	19,557	182	133,231	0.0628	14	8,372	
27	18,600	225	110,109	208	19,557	208	129,913	0.0565	1,064	7,340	
28	225	225	110,101	214	19,557	214	129,913	0.0508	11	6,598	
29	225	225	110,101	214	19,557	214	129,913	0.0457	10	5,932	
30	225	225	110,101	214	19,557	214	129,913	0.0411	9	5,393	
31	225	225	110,101	214	19,557	214	129,913	0.0369	8	4,795	
32	225	225	110,101	214	19,557	214	129,913	0.0332	7	4,311	
33	18,600	225	110,101	214	19,557	214	129,913	0.0298	562	3,870	
Total	326,695	6,750	1,784,493	3,156	267,001	477	2,055,126		196,093	196,300	

Appendix A-14.5 Sensitivity Analysis
 Table A-14.5.4 Cost Benefit Analysis of Section 5 : Ten Yen - Bac Luan

Year	Case : 1 Stage Improvement Design length : 86.9 km		Discount Rate 10.95% Unit: 1 Million Dong									
	Cost		Benefit					B/C Analysis				
	Capital	Maintenance	Vehicle Operating Saving	Time Saving	Total	Discount Factor	Present Value	Cost	Benefit	Present Value	Benefit	
		Normal Traffic	Generated Traffic	Normal Traffic	Generated Traffic							
1	35,009	0	0	0	0	0	0.901	31,554	0	0		
2	186,172	0	0	0	0	0	0.812	151,238	0	0		
3	279,257	0	0	0	0	0	0.732	204,466	0	0		
4	0	477	6,684	788	8	7,548	0.660	315	4,981	4,981		
5	0	477	8,706	982	10	9,787	0.595	284	5,821	5,821		
6	0	477	9,901	1,053	11	11,065	0.536	256	5,932	5,932		
7	0	477	12,466	1,261	13	13,867	0.483	230	6,700	6,700		
8	0	477	17,338	1,697	17	19,229	0.435	208	8,374	8,374		
9	34,385	477	22,880	2,131	22	25,266	0.393	18,684	9,917	9,917		
10	0	477	26,845	2,522	26	29,667	0.354	16,93	10,495	10,495		
11	0	477	32,657	3,081	31	36,102	0.319	152	11,512	11,512		
12	0	477	41,385	3,995	41	45,844	0.287	137	12,175	12,175		
13	0	477	49,889	4,841	49	55,288	0.259	124	14,321	14,321		
14	0	477	58,160	5,717	58	64,529	0.233	111	15,065	15,065		
15	34,385	477	72,694	7,364	75	80,874	0.210	7,336	17,018	17,018		
16	0	477	84,377	8,61	89	94,028	0.190	90	17,888	17,888		
17	0	477	97,817	9,98	105	109,200	0.171	82	18,666	18,666		
18	0	477	113,247	1,156	124	126,691	0.154	73	19,519	19,519		
19	0	477	138,859	1,681	161	157,463	0.139	66	21,866	21,866		
20	0	477	144,850	1,478	163	162,963	0.125	60	20,396	20,396		
21	34,385	477	149,642	1,527	175	168,498	0.113	3,933	19,007	19,007		
22	0	477	154,132	1,573	182	173,739	0.102	48	17,664	17,664		
23	0	477	170,181	1,737	209	192,560	0.092	44	17,646	17,646		
24	0	477	187,726	1,916	239	213,315	0.083	39	17,618	17,618		
25	0	477	192,591	1,965	249	219,169	0.074	36	16,315	16,315		
26	0	477	212,187	2,165	286	242,652	0.067	32	16,281	16,281		
27	34,385	477	233,587	2,384	329	268,589	0.060	2,108	16,242	16,242		
28	0	477	238,644	2,435	342	274,356	0.055	26	14,986	14,986		
29	0	477	262,433	2,678	396	304,284	0.049	23	14,948	14,948		
30	0	477	262,463	2,678	396	304,320	0.044	21	13,474	13,474		
31	0	477	262,463	2,678	396	304,320	0.040	19	12,145	12,145		
32	0	477	262,463	2,678	396	304,320	0.036	17	10,946	10,946		
33	34,385	477	262,463	2,678	396	304,320	0.032	1,130	9,866	9,866		
Total	672,363	14,310	3,790,743	38,935	489,778	4,324,453		418,111		418,781		

There are 53 different ethnic minorities within the territory of Vietnam, and their population makes up about 10% of the total national population. These minority groups are distributed mainly in the mountain and highland areas from the central to northern part of Vietnam. In the northern to northeastern highland areas of the northern part of Vietnam, there are minorities which make up more than 10% of the population in the northern part of Vietnam. Various policies to protect their existence have been taken by the government. Most of these minority's life cycle is based on slash-and-burn agriculture system, rotating crops on mountain hillsides.

Project area of Highway No.18 is situated in the Red River delta area and also in the coastal plain to coastal hilly areas. In this project area Kinh (Viet) people as known majority of Vietnamese has inhabited Vietnam historically for a long time and they have civilized these region. In the northern mountain area of Quang Ninh province, there are ethnic minorities settled in the mountain ranges where natural vegetation remains rich. The population is minimal; estimated to be about 1% of the provincial population. The approximate locations of the minorities are shown in Figure A - 15.1. These areas are more than 10km apart from Highway No.18. The areas adjacent to the highway are low hills of about 100m high. These areas are covered by grass and low shrubs due to the woods cut by the people in the past.




 Estimated location of Minorities

Figure A - 15.1 Approximate Locations of Minorities in Quang Ninh Province

Appendix A - 15.2 Flora and Fauna

The northern part of Vietnam is generally rich in natural environmental resources. Flora and fauna species are rich in their diversity, especially in the mountain areas and basins in the north to northeast areas of the region. Many valuable fauna species inhabit the subtropical monsoon forests. Certain distinctive rare and endangered fauna species identified by the government generally inhabit these natural forest areas in mountains.

The Red River and its tributaries are widely distributed in the northern part of Vietnam, distributing water to large lakes, ponds and also irrigation channels along the paddy fields. Therefore, fish species are also rich in diversity in the wider range of the aquatic river system, and the main fish are carp and catfish.

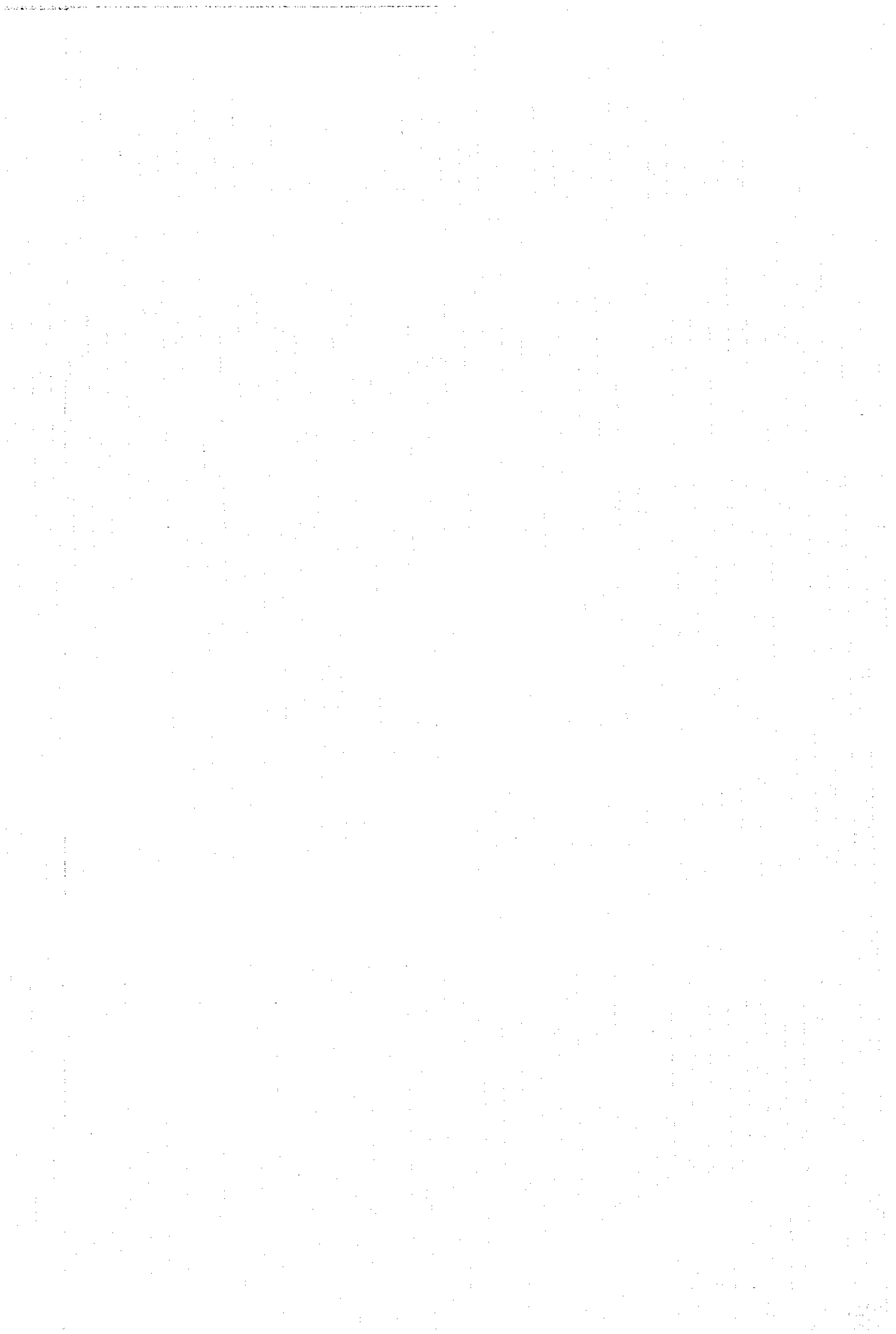
Life style of most minority groups is based on slash-and-burn agriculture system, so that some of mountain hillsides have become barren land. This is one of today's environmental problems to the natural forest areas. The government has taken measures to for reforestation of these slash-and-burn hillside areas.

The project area from Noi Bai to Chi Linh through Bac Ninh where Highway No.18 passes is located in the Red River delta. This delta area has been cultivated and civilized for thousands of years. Natural environmental conditions have been changed to the paddy-based agro-ecosystem environment, where no valuable flora or fauna species exist anymore. However, there are a number of common species. Hong Gai to Mong Cai through Cua Ong and Tien Yen where the highway passes is located on the coastal plain and among coastal hilly areas. These areas also have been civilized for many centuries due to the roads as a transportation access as well as marine ports. Since the 19th century Hong Gai and its vicinity areas have been developed as coal mining industry zones. Therefore, today natural ecological situation has been largely changed to an urban-type ecosystem. Lesser natural resources of flora and fauna exist. Since the hillside forest has been also affected by the people who cut woods and clear the land, trees and shrubs have been used and the rich natural vegetation of the past has been mostly destroyed, therefore secondary vegetation now grows. Such poor natural vegetation on the hillsides can be observed. The Vietnamese government has made efforts to afforest with pine and eucalyptus trees starting 20 years ago to rehabilitate the forest area. However, only a small amount has been accomplished.

Mangrove vegetation is widely distributed along the coastal zone. More than 15 km. to the south from Bai Chay, at the estuary of Bach Dang river well grown mangrove colonies of about 15m high are distributed. The mangrove in this area is quite significant and protected by the government. But the area is very far from the project site. From Bai Chay bay to Mong Cai there are dwarf type mangrove vegetation zones along the shallow coastal area (see Figure A - 15.2). In this coastal area the mangrove trees of about 20m high had

flourished, but these have been cut down for charcoal and other uses. Today there are only dwarf-type mangrove species of about 1m high. These are strong and survive under the worst environmental conditions.

The fauna composition to be found along the study route could be obtained from data of the fauna present in the adjacent protected areas. According to studied data, there were 18 species of wild mammals, 60 species of birds, and 20 species of reptiles. But because of development of an agricultural ecosystem, industry, and roads; natural primary forest vegetation as well as wildlife has disappeared from the study route area. These were either killed off or have migrated to deeper places inland. (see Figure A - 15.2. Locations of mangrove vegetation zone and estimated area of important wildlife in Quang Ninh province)



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