

CHAPTER 7

ENVIRONMENTAL AND SOCIAL CONSIDERATION

CHAPTER 7 ENVIRONMENTAL AND SOCIAL CONSIDERATION

7.1 ENVIRONMENTAL AND SOCIAL CONSIDERATION

7.1.1 Overview of the Project Component that causes Environmental and Social Impacts

7.1.1.1 Project Location

The object of the Project is to expand transmission and distribution system in Phnom Penh City and Kandal Province. The location of the project area is shown in Fig. 7.1-1.

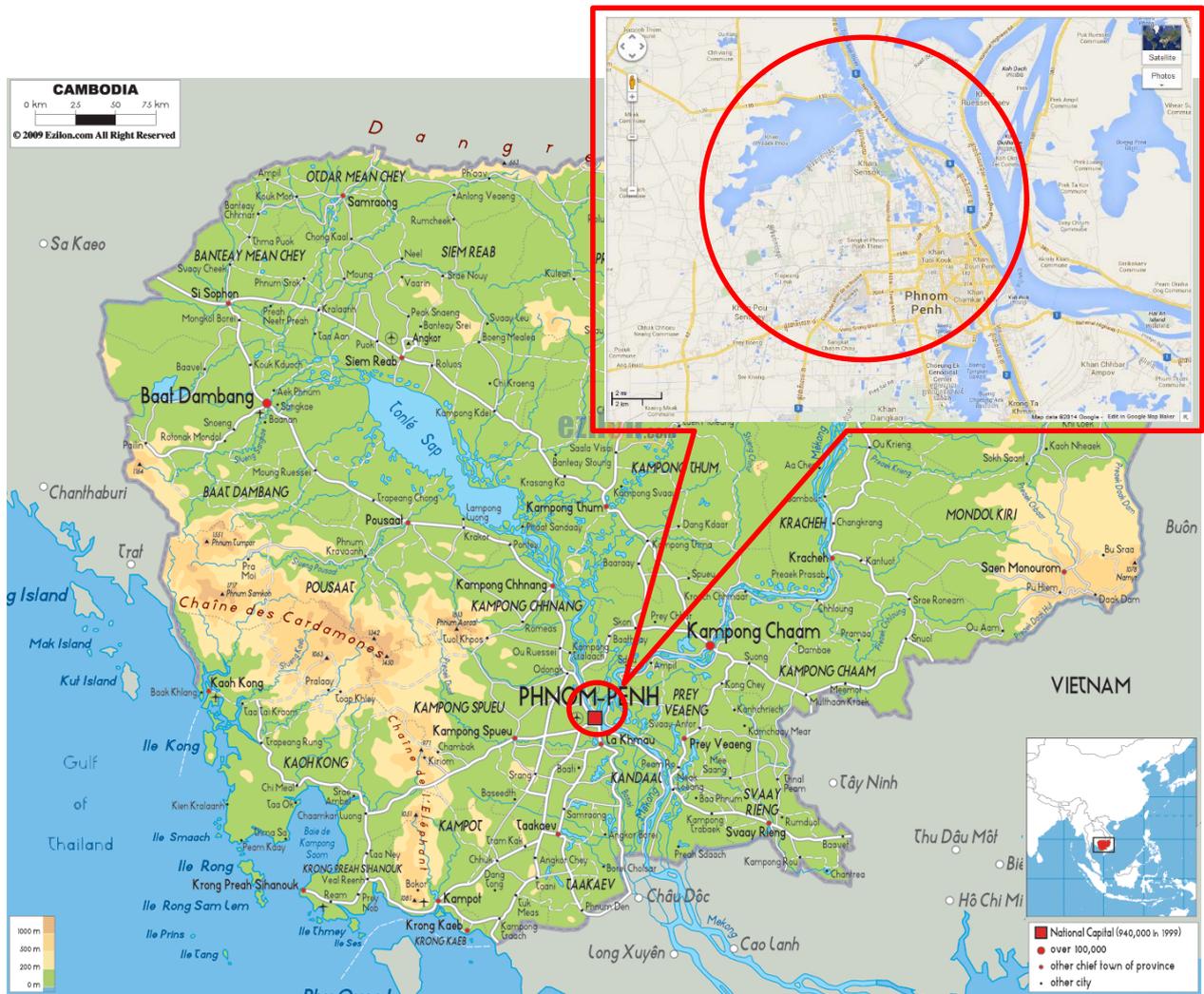


Fig. 7.1-1 Project Area Map

7.1.1.2 Overview

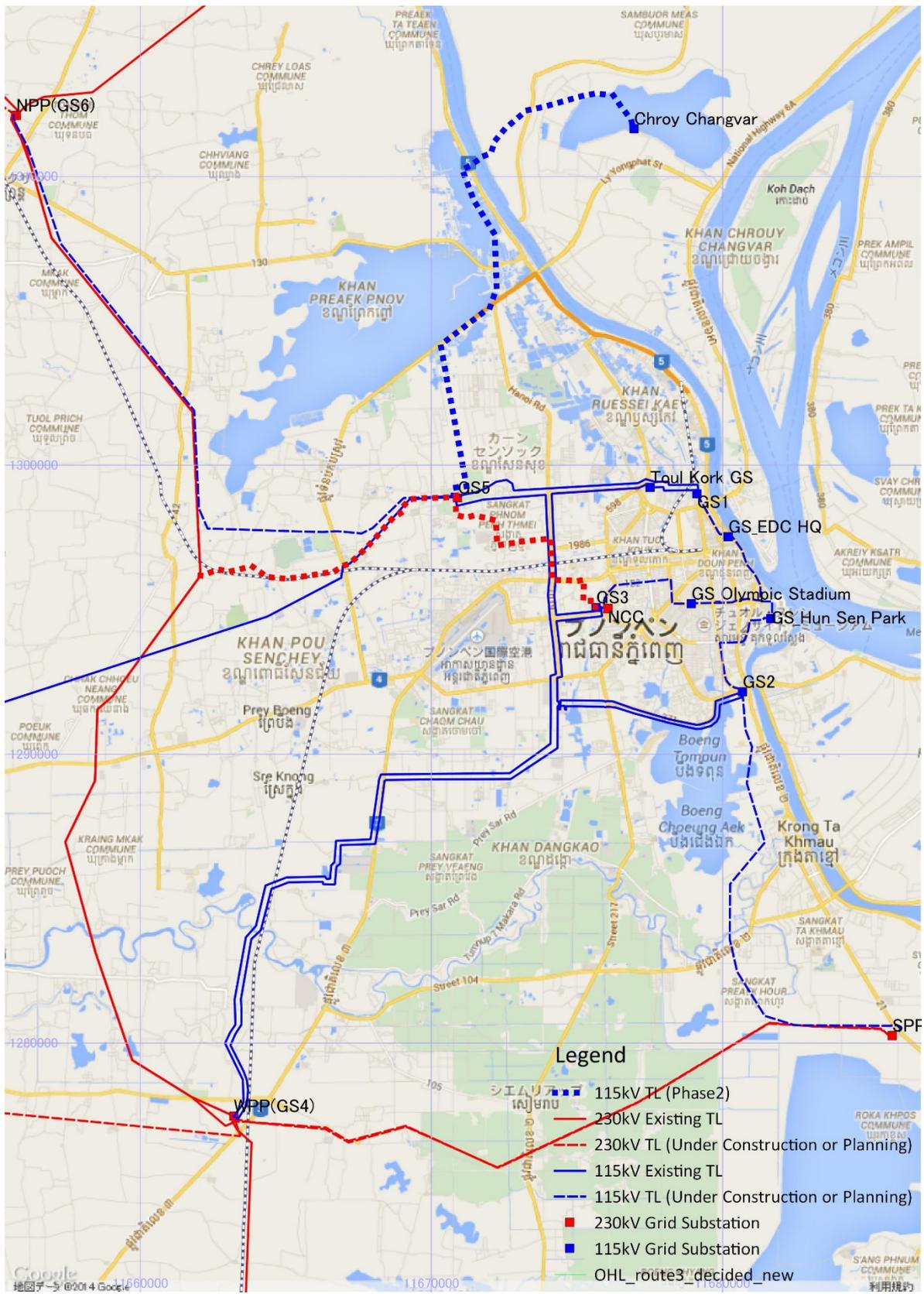
The Project will contribute to the construction of three new substations, expansion of two substations, development of 115kV and 230kV overhead transmission lines, 230kV underground transmission lines, and 22kV distribution lines. Table 7.1-1 shows the target construction work of the project scope. The location map is shown in Fig. 7.1-2.

Table 7.1-1 Project Scope

Item	Place / Route	Area / Distance	Location
Construction of new substations	NCC* substation	30m × 105m	Phnom Penh City
	Toul Kork substation	25m × 75m	Phnom Penh City
	Chroy Changvar substation	180m × 180m	Kandal Province
Expansion of existing substations	GS5	210m × 210m	Phnom Penh City
230kV overhead transmission lines	GS5 – Midpoint of NPP and WPP	10.2km	Phnom Penh City
230kV underground transmission lines	GS5 – NCC	9.28km	Phnom Penh City
115kV overhead transmission lines	GS5 – Chroy Changvar	20.2km	Phnom Penh City Kandal Province
	GS5 – Midpoint of NPP and WPP	0.7km	Phnom Penh City
22kV distribution lines	NCC, Toul Kork Chroy Changvar	66.7km	Phnom Penh City Kandal Province

* NCC : National Control Center

Source: JICA Study Team



©2014 Google

Source: JICA Study Team

Fig. 7.1-2 Location Map of the Project Scope

7.1.2 Environmental and Social Baseline

7.1.2.1 Physical Environment

(1) Air quality

Infrastructure development of the environmental aspect has not kept up with the progress of urbanization, in Phnom Penh City, therefore air pollution caused by private power generation and vehicle emissions is in progress.

Air pollution in Cambodia is caused by private owned generators and automobiles. A higher concentration of particles is observed in some areas near the unpaved roads.

As the result of air quality analysis of 3 points of roadside in Phnom Penh (Kbaltnal, Olympic, Toul Kork), CO, NO₂, and SO₂ concentrations were lower than the standard of Cambodia¹.

Table 7.1-2 Result of Air Quality Analysis in Phnom Penh City

Parameter	Environmental Standard of Cambodia	2001		2002		2003		2005	
		Mean	Max	Mean	Max	Mean	Max	Mean	Max
CO (mg/m ³)	40	3.94	6.25	3.06	3.5	4.37	5.25	4.32	5.62
NO ₂ (µg/m ³)	300	-	-	-	-	-	-	0.022	0.038
SO ₂ (µg/m ³)	500	-	-	-	-	-	-	106.6	215.8

*Mean = hourly average among 3 roadside air quality monitoring stations

Source: "Country Synthesis Report on Urban Air Quality Management" ADB, 2006

(2) Water quality

The result of water quality analysis of the Mekong River conducted in July 2013 is shown in Table 7.1-3 and Table 7.1-4².

Total coliform was slightly above the standard, the other hand fecal coliform bacteria were not detected. The main factor is assumed to be natural origin due to decomposition of organic matters.

The factor that turbidity is above the standard is also natural origin due to erosion of the upstream, because this phenomenon occurs commonly in the rainy season in Cambodia.

There is no item which exceeds the drinking water standard of MIME (Ministry of Industry, Mine and Energy) in the ground water quality. The ground water is available as drinking water.

It is assumed that the water of the river is little used as living water, because the water supply improvement almost is developed in Phnom Penh City. On the other hand, in the right side area of the Tonle Sap River near Chroy Changvar S/S, the water of canal and pond is used as living water.

1 Country Synthesis Report on Urban Air Quality Management, ADB, 2006

2 Preparatory Survey for Rural water supply Extension and Development Project Report, JICA, 2013

Table 7.1-3 Surface Water Quality in the Mekong River (July 2013)

No.	Analysis Item	unit	MIME DWQS*	Result
1	pH	-	6.5-8.5	7.6
2	Temperature	°C	-	30.2
3	Total Suspended Solid (TSS)	mg/l	25-100	64.00
4	Total Dissolved Solid (TDS)	mg/l	800	63.00
5	Dissolved Oxygen (DO)	mg/l	2.0-7.5	7.14
6	Turbidity	NTU	5	93.90
7	Alkalinity	mg/l	-	249.90
8	Total Hardness	mg/l	300**	28.39
9	Nitrite (NO ₂)	mg/l	3	ND<0.1
10	Nitrate (NO ₃)	mg/l	50	0.98
11	Sulphate (SO ₄)	mg/l	-	7.63
12	Fluoride (F)	mg/l	-	0.21
13	Chloride (Cl)	mg/l	250	4.14
14	Ammonium (NH ₄)	mg/l	-	ND<0.1
15	Sulphide (S)	mg/l	-	0.08
16	Color	TCU	5	5.00
17	Biochemical Oxygen Demand (BOD)	mg/l	1.0-10.0	0.85
18	Chemical Oxygen Demand (COD)	mg/l	-	2.13
19	Total Phosphorus (TP)	mg/l	-	0.15
20	Cyanide (CN)	mg/l	0.07	ND<0.04
21	Aluminum (Al)	mg/l	-	0.004
22	Arsenic (As)	mg/l	0.05	ND<0.0001
23	Cadmium (Cd)	mg/l	0.003	ND<0.0002
24	Chromium (Cr)	mg/l	0.05	ND<0.0005
25	Copper (Cu)	mg/l	1	0.22
26	Iron (Fe)	mg/l	0.3	0.04
27	Lead (Pb)	mg/l	0.01	ND<0.0002
28	Manganese (Mn)	mg/l	0.1	0.002
29	Mercury (Hg)	mg/l	0.001	0.0003
30	Selenium (Se)	mg/l	0.01	ND<0.0006
31	Zinc (Zn)	mg/l	3	0.04
32	Total Coliform	Count/100ml	0	2.4 × 10 ²
33	E-Coli	MPN/100ml	0	0

Note: * MIME DWQS-, the drinking water standard (2004)

** Hardness is calculated as mg/L CaCO₃

Source: JICA Study Team

Table 7.1-4 Groundwater Quality in the Mekong River (July 2013)

No.	Analysis Item	unit	MIME DWQS*	Result
1	pH	-	6.5-8.5	6.7
2	Temperature	°C	-	30.1
3	Total Suspended Solid (TSS)	mg/l	25-100	36.00
4	Total Dissolved Solid (TDS)	mg/l	800	306.00
5	Dissolved Oxygen (DO)	mg/l	-	3.45
6	Turbidity	NTU	5.0	0.00
7	Alkalinity	mg/l	-	1092.70
8	Total Hardness	mg/l	300	200.90
9	Nitrite (NO ₂)	mg/l	3.0	ND<0.1
10	Nitrate (NO ₃)	mg/l	50.0	21.97
11	Sulphate (SO ₄)	mg/l	250	12.42
12	Fluoride (F)	mg/l	1.5	0.20
13	Chloride (Cl)	mg/l	250.0	30.52
14	Ammonium (NH ₄)	mg/l	1.5	ND<0.1
15	Sulphide (S)	mg/l	-	0.14
16	Color	TCU	5.0	2.00
17	Biochemical Oxygen Demand (BOD)	mg/l	1.0-10	0.11
18	Chemical Oxygen Demand (COD)	mg/l	-	0.59
19	Total Phosphorus (TP)	mg/l	-	0.59
20	Cyanide (CN)	mg/l	0.07	ND<0.04
21	Aluminum (Al)	mg/l	0.2	0.003
22	Arsenic (As)	mg/l	0.05	ND<0.0001
23	Cadmium (Cd)	mg/l	0.003	ND<0.0002
24	Chromium (Cr)	mg/l	0.05	ND<0.0005
25	Copper (Cu)	mg/l	1	ND<0.0003
26	Iron (Fe)	mg/l	0.3	0.09
27	Lead (Pb)	mg/l	0.01	ND<0.0002
28	Manganese (Mn)	mg/l	0.1	0.005
29	Mercury (Hg)	mg/l	0.001	0.0001
30	Selenium (Se)	mg/l	0.01	0.001
31	Zinc (Zn)	mg/l	3.0	0.005
32	Total Coliform	MPN/100ml	0	0
33	E-Coli	MPN/100ml	0	0

Note : *MIME DWQS-, the drinking water standard (2004)

Source: JICA Study Team

(3) Waste management

The waste generated by construction are expected construction waste and soil and so on.

The waste in Phnom Penh City is mainly collected by a private company which is outsourced by the Municipality. Stung Mean Chey disposal site, the final landfill in Phnom Penh, takes the open dumping method and has filled up about 670 tons of municipal solid waste per day. Industrial waste have been brought in Stung Mean Chey disposal site or in the hazardous waste disposal site dedicated.

(4) Noise / vibration

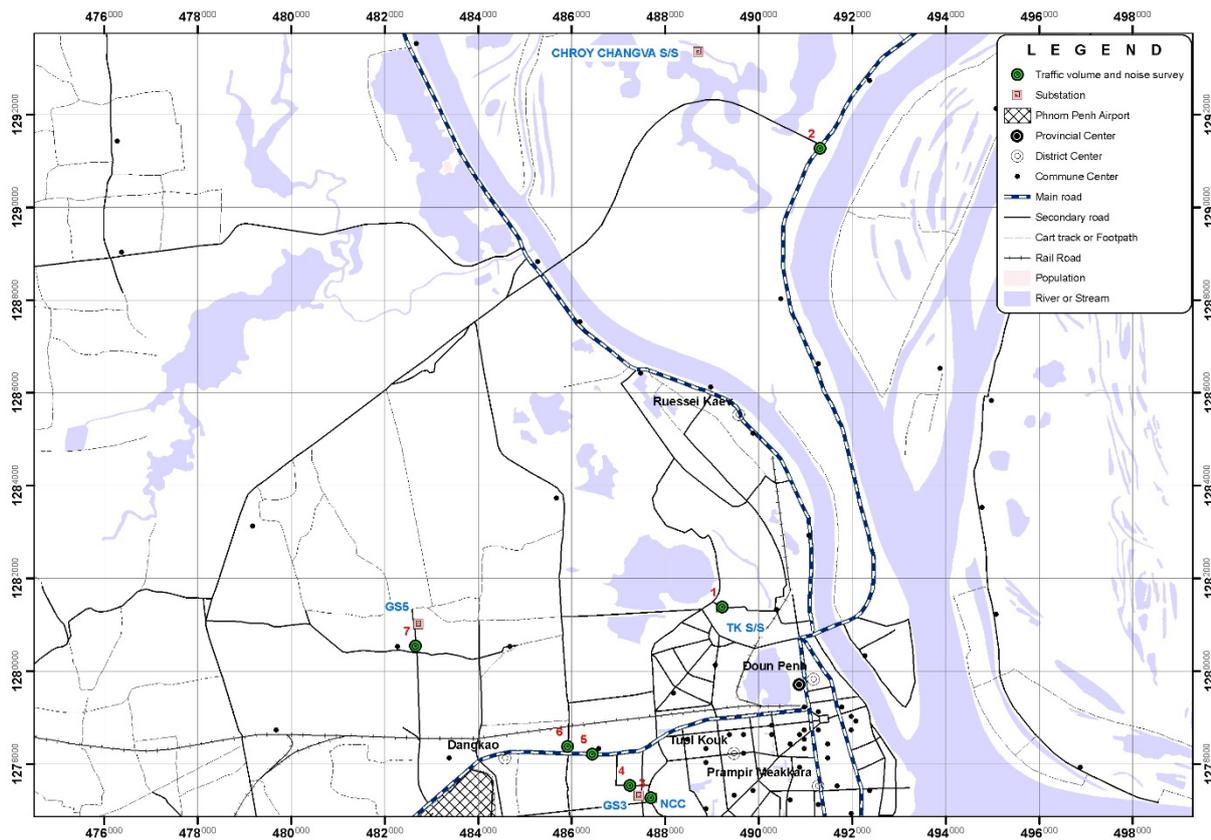
Major concept of the environment and social consideration in this project are traffic volume and noise survey. The survey was carried out to investigate the current situation of the newly constructed substations included NCC (National Control Center), Toul Kork S/S and Chroy Changvar S/S; and the underground 230kV transmission route line from NCC to GS5. The traffic volume and noise survey shown in this section were implemented at seven points closed to the site where the construction noise might arise or traffic noise caused by a construction vehicle might be increased. The survey points are shown in Table 7.1-5 and Fig. 7.1-3.

Table 7.1-5 Survey Points of Traffic Volume and Noise Survey

Survey Point		Site Description	Survey Date
Point 1	Tuol Kork S/S	The road in front of substation (Row*: 9m, 2 car lanes), 1.5m away from the road side.	June 04, 2014 to June 05, 2014
Point 2	Chroy Changvar S/S	The National Road No. 6A (Row: 27m, 4 car lanes), 3m away from the road side	August 13, 2014 to August 14, 2014
Point 3	NCC S/S	Yuthapol Khemarak Phoumin Blvd (Row: 17.4m, 4 car lanes), 3m away from the road side.	June 05, 2014 to June 06, 2014
Point 4	UG NCC – GS5	Road 2002 (Row: 9.3m, 2 car lanes), 4m away from the road side.	June 06, 2014 to June 07, 2014
Point 5	UG NCC – GS5	Russian Confederation Blvd (Row: 21m, 4 car lanes), 2.5m away from the road side.	June 09, 2014 to June 10, 2014
Point 6	UG NCC – GS5	Hanoi Highway (Row: 15.5m, 4 car lanes), 5m away from the road side.	June 10, 2014 to June 11, 2014
Point 7	UG NCC – GS5	The road in front of GS5 (Row: 8m, 2 car lanes), 3m away from the road side.	June 11, 2014 to June 12, 2014

* ROW : Right of Way

Source: JICA Study Team



Source: JICA Study Team

Fig. 7.1-3 Survey Location Map

a) Methodology

In this traffic volume survey, vehicles were classified into four types (Table 7.1-6). The record was ten minutes per each hours with the analogue counter. The team of traffic survey work needed two persons per each direction lane and each of them occupied two types of vehicles classification. The duration of count was determined prior to a whole day permanent traffic (24 hours), which started from 6:00AM to 6:00AM.

Table 7.1-6 Vehicle Classification for the Survey

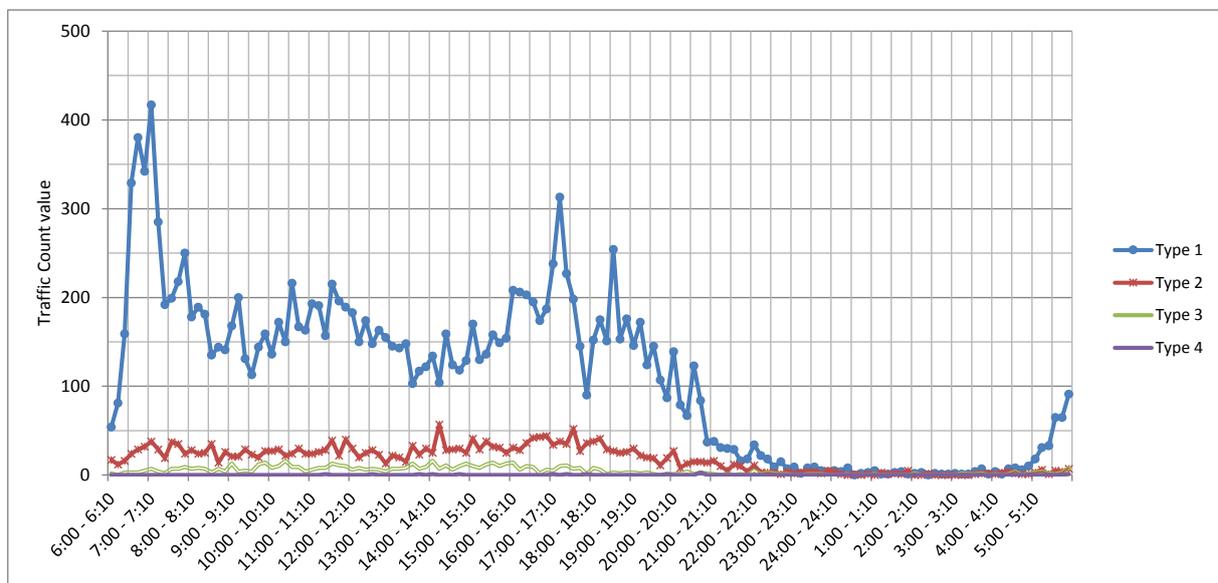
Classification	Vehicles
Type 1	Motorbike / Motor tricycle, Motorbike trailer
Type 2	Sedan, Wagon / Light van, Pickup, Jeep / Light truck
Type 3	Short and long body truck / Semi and full trailer truck
Type 4	Short and long body bus

Noise survey was undertaken at the same location as traffic survey do, at any side of traffic lane direction. In order to assess the overall noise level produced by traffic, the maximum and minimum of noise level was recorded in ten minutes per each hour. Noise monitoring was carried out using digital sound level meter MT-901A. The noise survey work needs only 1 person par team and per location.

b) Results

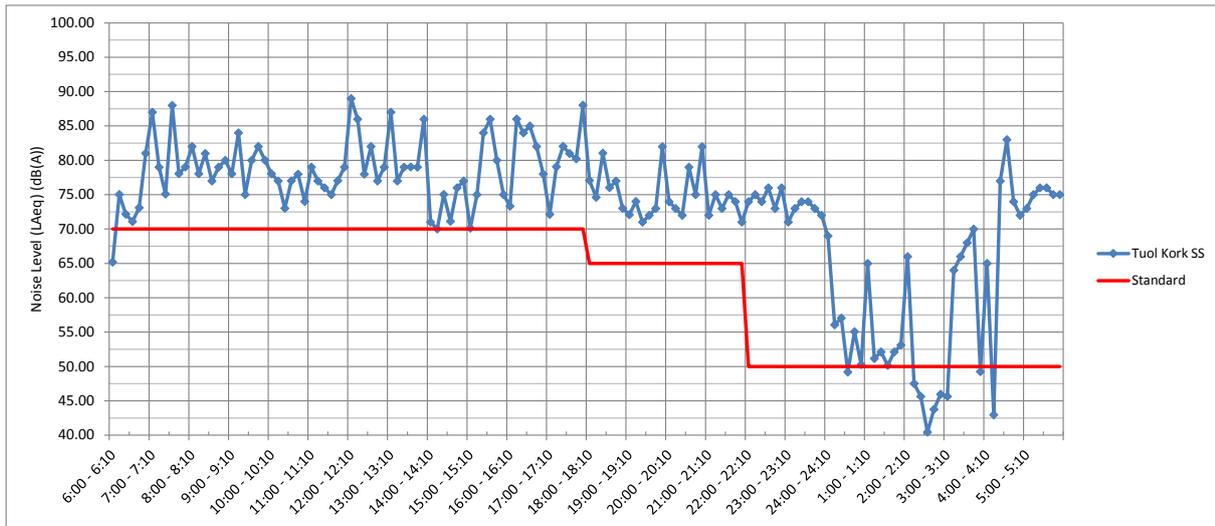
At most of locations, traffic peaks at the time period from 7:00 to 11:00 and 17:00, the commuter rush in the morning, rush hour during the lunch break and the commuter rush in the evening. Based on the vehicle category, the Type 1 (except Point 2) had the most traffic volume for all time periods. Survey result in each point is shown the following figures and Appendix 6. The maximum volume in each point is shown in Table 7.1-7.

Most of noise was caused by the traffic noise such as the sound of engines roaring and fuming exhaust from motorbikes or other vehicles. The noise level of every survey points have exceeded the environmental standard during the day. On the other hand except point 7 (Road in front of GS5) every survey points have exceeded the environmental standard during the midnight. Noise levels of Point 3 (NCC S/S) and Point 5 (Russian Confederation Blvd.) are higher than the standard because there is much traffic throughout the day. Survey result in each point is shown the following figures with the result of the traffic survey. The equivalent steady sound level of noise energy-averaged over time (L_{Aeq}) comparing to noise standard was shown in Table 7.1-8.



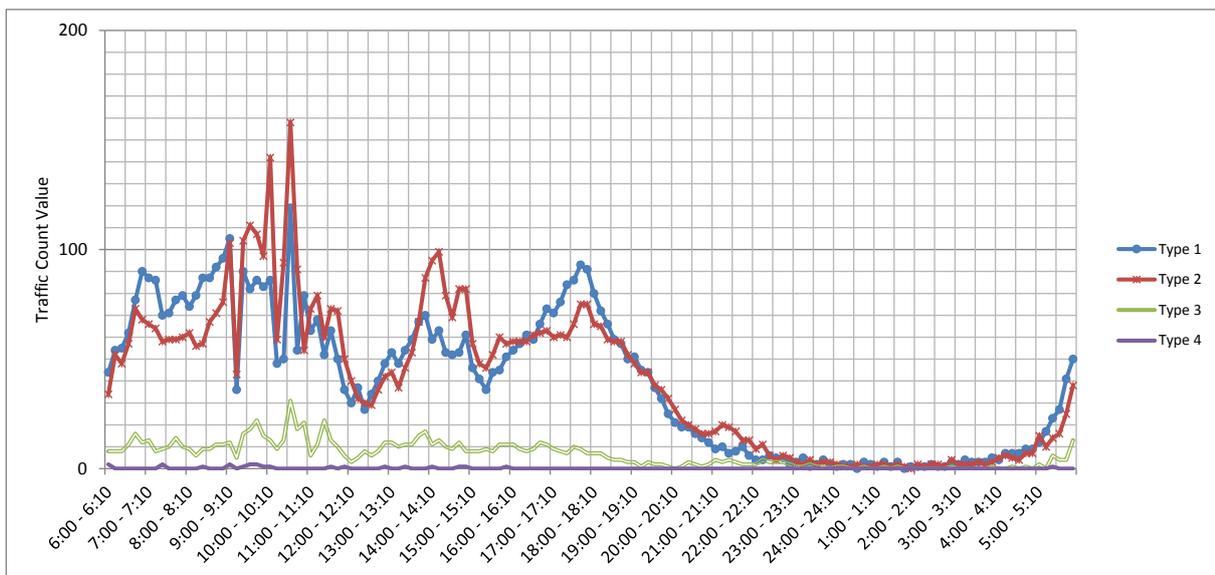
Source: JICA Study Team

Fig. 7.1-4 Traffic Volume at Point 1 (Tuol Kork S/S)



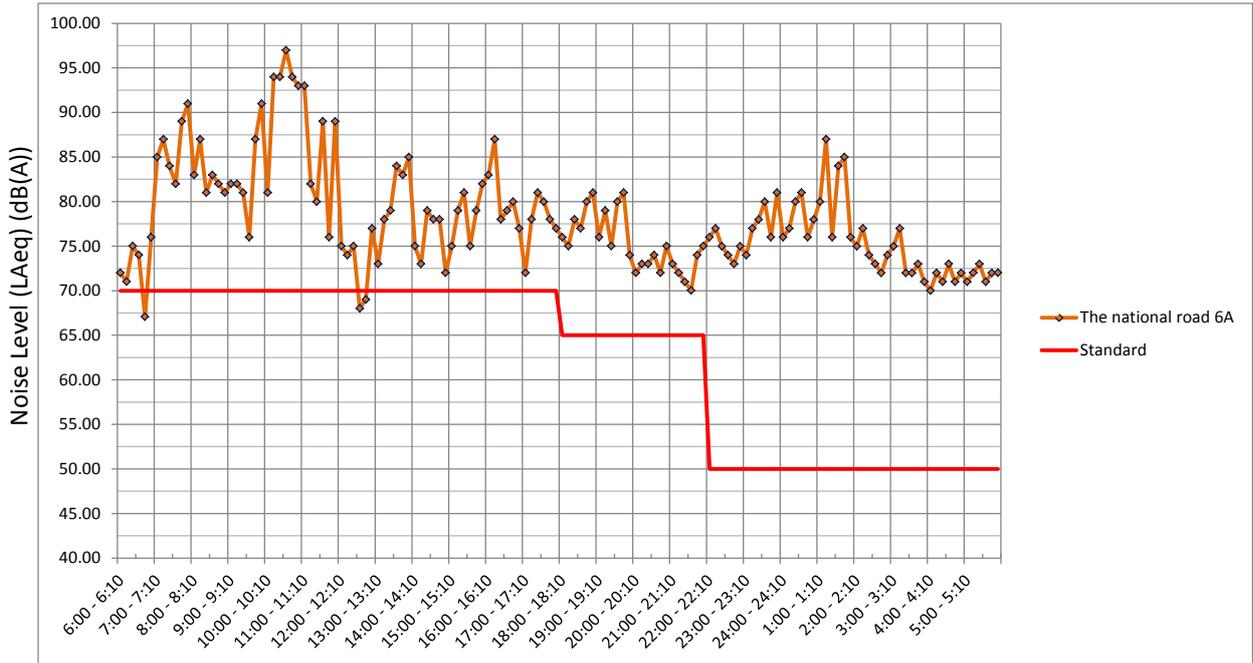
Source: JICA Study Team

Fig. 7.1-5 Noise Level at Point 1 (Tuol Kork S/S)



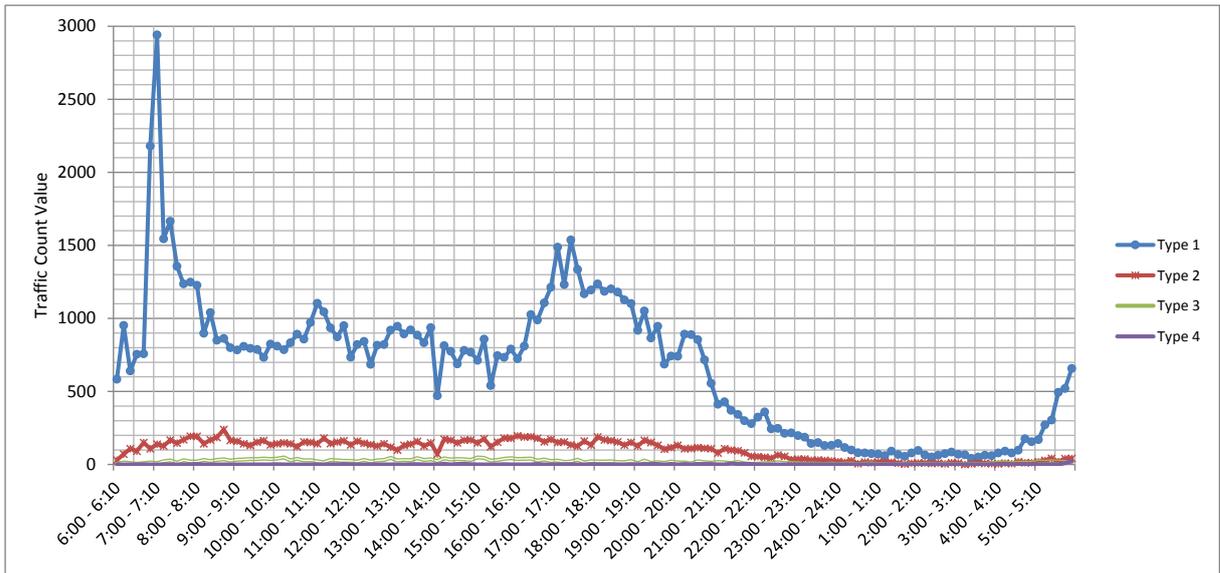
Source: JICA Study Team

Fig. 7.1-6 Traffic Volume at Point 2 (Chroy Changvar S/S)



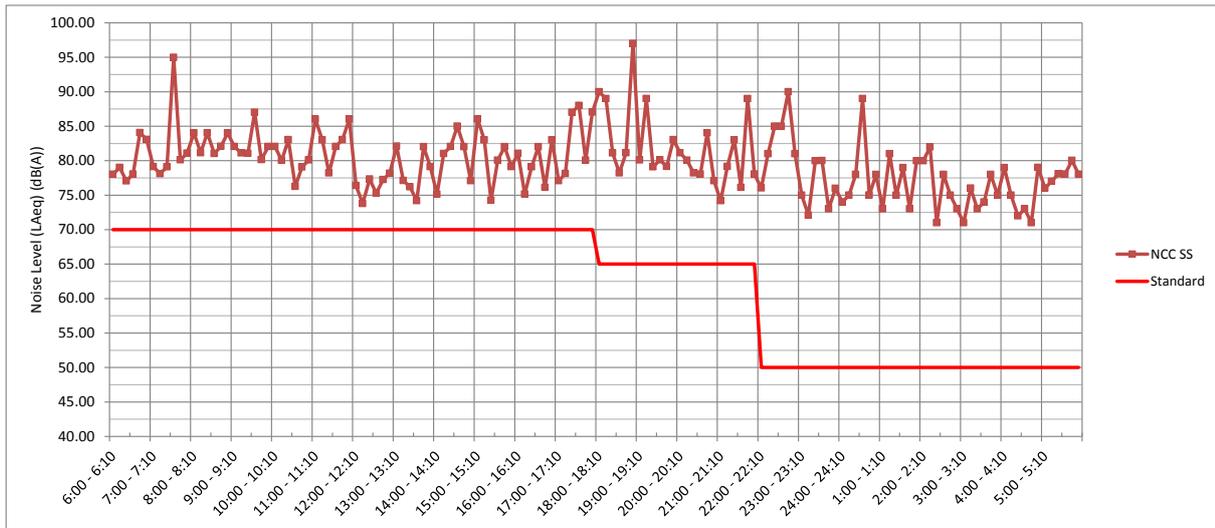
Source: JICA Study Team

Fig. 7.1-7 Noise Level at Point 2 (Chroy Changvar S/S)



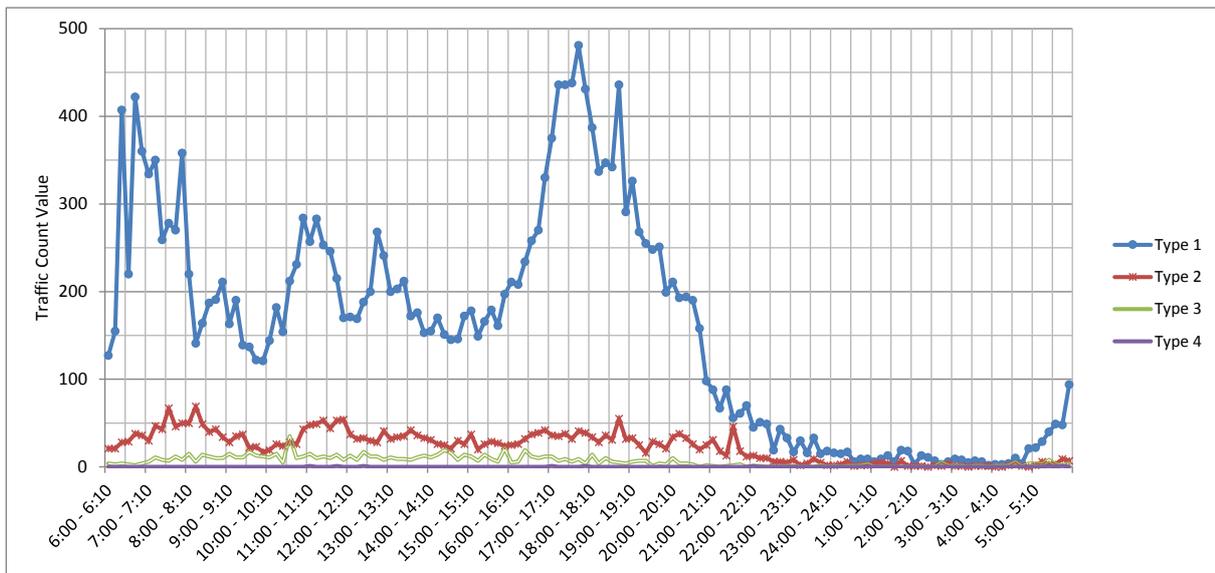
Source: JICA Study Team

Fig. 7.1-8 Traffic Volume at Point 3 (NCC S/S)



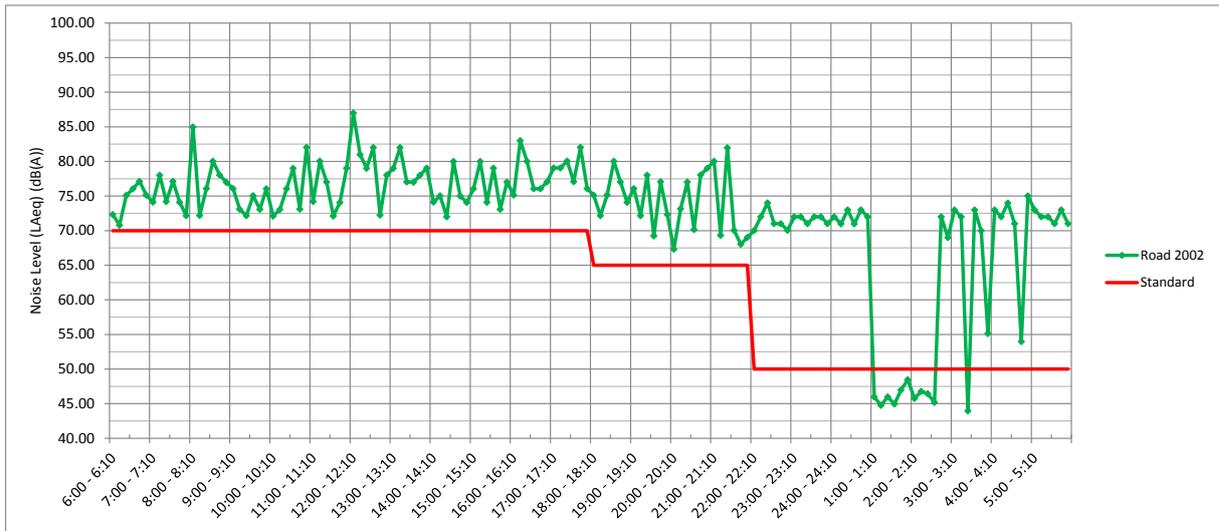
Source: JICA Study Team

Fig. 7.1-9 Noise Level at Point 3 (NCC S/S)



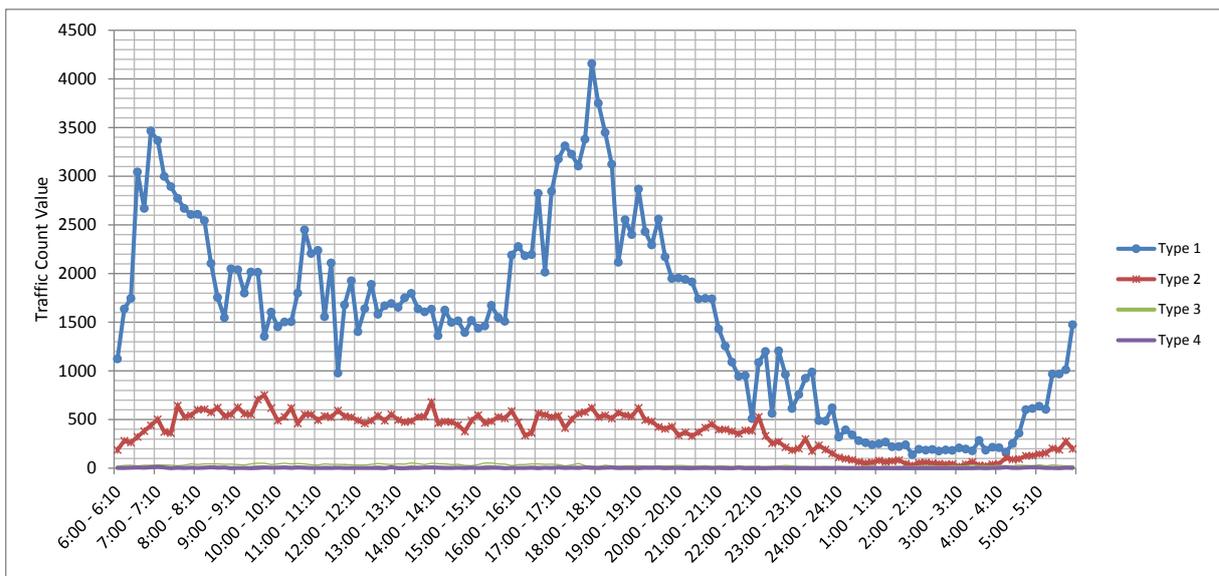
Source: JICA Study Team

Fig. 7.1-10 Traffic Volume at Point 4 (Road 2002)



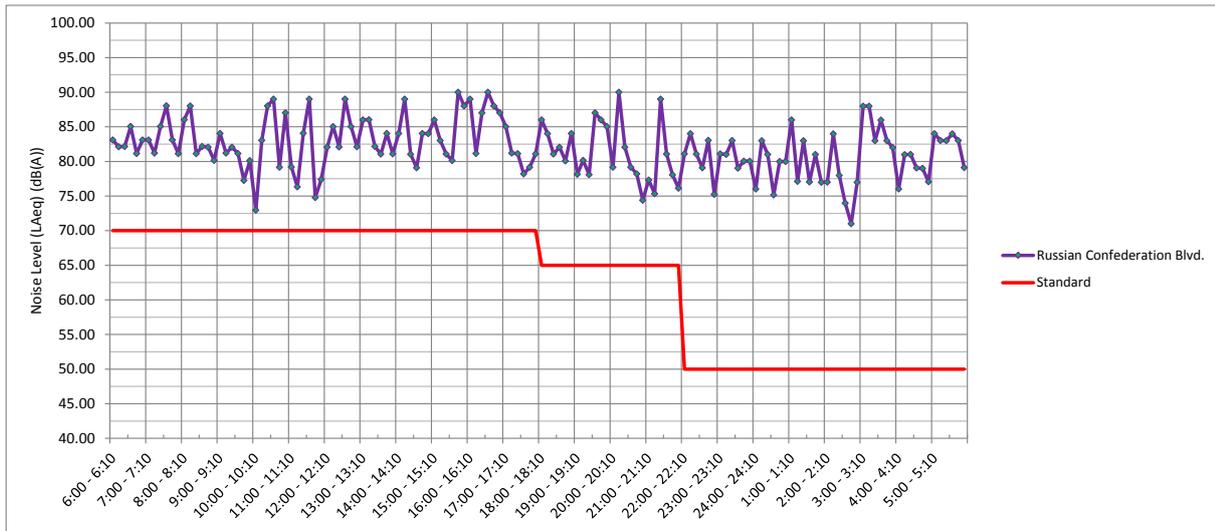
Source: JICA Study Team

Fig. 7.1-11 Noise Level at Point 4 (Road 2002)



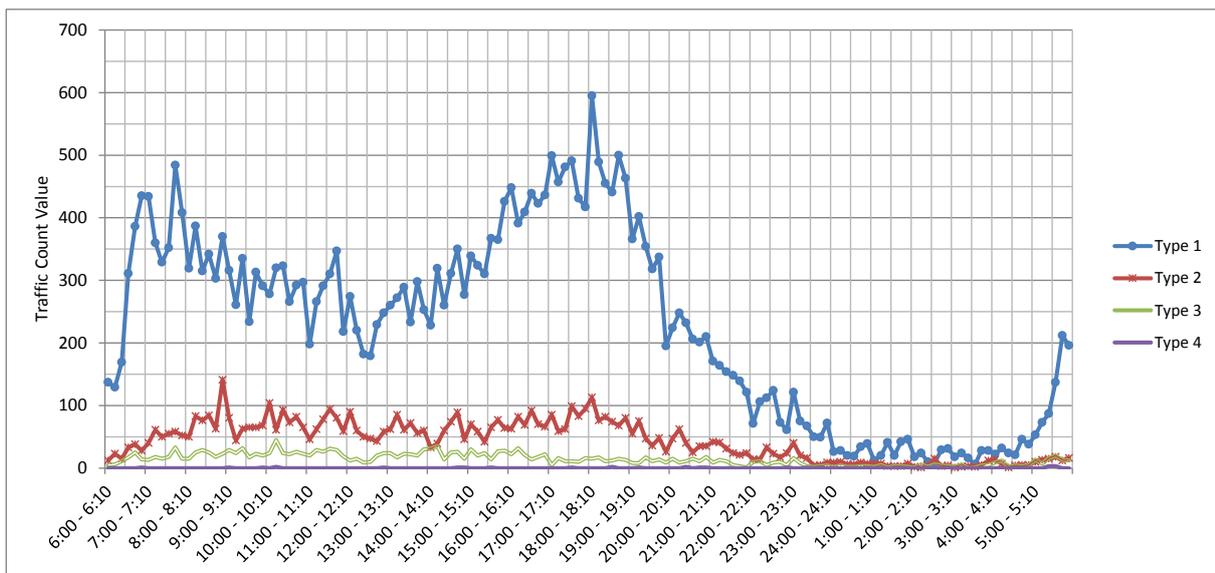
Source: JICA Study Team

Fig. 7.1-12 Traffic Volume at Point 5 (Russian Confederation Blvd.)



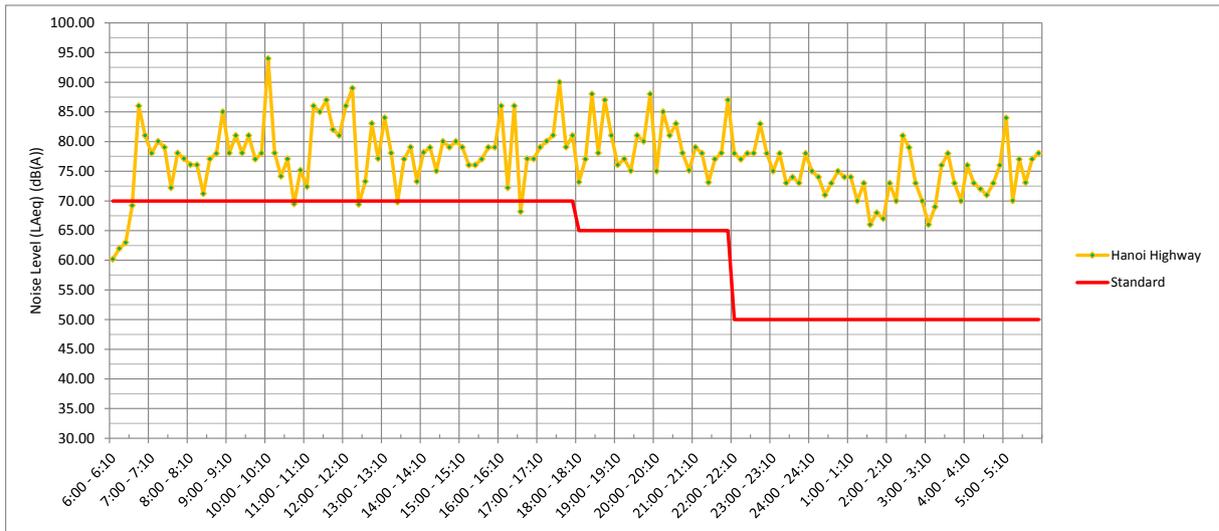
Source: JICA Study Team

Fig. 7.1-13 Noise Level at Point 5 (Russian Confederation Blvd.)



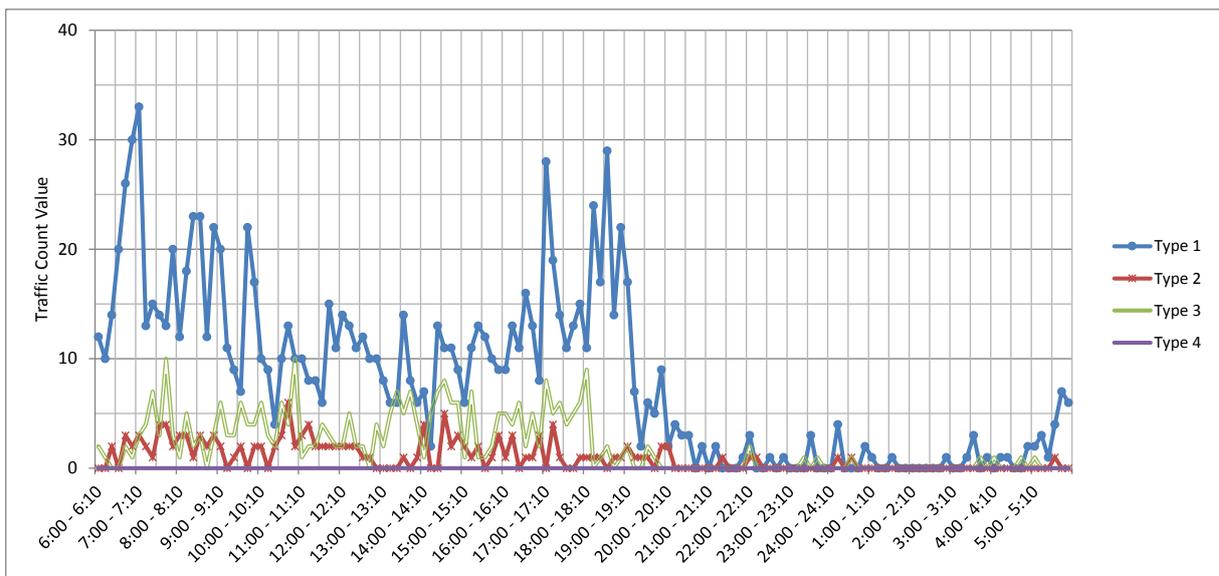
Source: JICA Study Team

Fig. 7.1-14 Traffic Volume at Point 6 (Hanoi Highway)



Source: JICA Study Team

Fig. 7.1-15 Noise Level at Point 6 (Hanoi Highway)



Source: JICA Study Team

Fig. 7.1-16 Traffic Volume at Point 7 (Road in front of GS5)



Source: JICA Study Team

Fig. 7.1-17 Traffic Volume at Point 7 (Road in front of GS5)

Table 7.1-7 Maximum Traffic Volume in Each Point

Location	Maximum Traffic Volume (per hour)	Time Zone	The Most Volume of Vehicle Category
Point 1	1,779	07:00 - 08:00	Type 1
Point 2	598	10:00 - 11:00	Type 2
Point 3	11,062	07:00 - 08:00	Type 1
Point 4	2,867	17:00 - 18:00	Type 1
Point 5	23,719	17:00 - 18:00	Type 1
Point 6	3,521	18:00 - 19:00	Type 1
Point 7	154	07:00 - 08:00	Type 1

Source: JICA Study Team

Table 7.1-8 Average Noise Level in Each Point

Location	Time Zone					
	6:00 to 18:00		18:00 to 22:00		22:00 to 6:00	
	L _{Aeq} (dB)	Standard in Cambodia (dB)	L _{Aeq} (dB)	Standard in Cambodia (dB)	L _{Aeq} (dB)	Standard in Cambodia (dB)
Point 1	81.21	70	76.33	65	72.36	50
Point 2	86.01	70	76.43	65	77.59	50
Point 3	82.86	70	86.35	65	80.01	50
Point 4	78.19	70	76.10	65	70.70	50
Point 5	84.61	70	83.43	65	81.88	50
Point 6	81.98	70	82.13	65	76.07	50
Point 7	81.57	70	74.72	65	65.15	50

Source: JICA Study Team

Location	Map	Situation
Point 1		
Point 2		
Point 3		
Point 4		

Location	Map	Situation
Point 5		
Point 6		
Point 7		

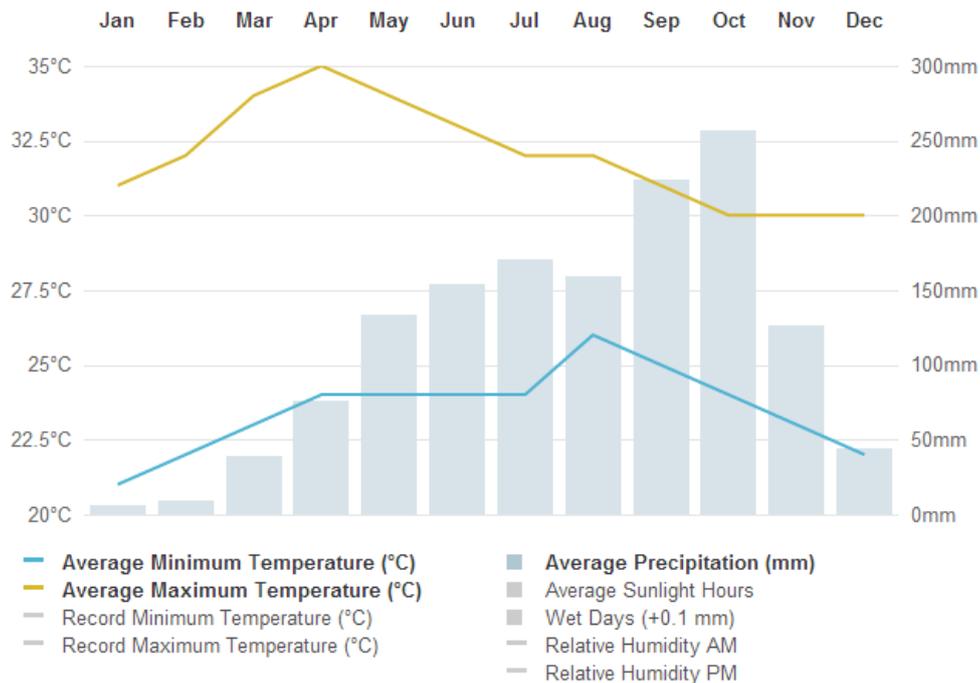
Source: JICA Study Team

Fig. 7.1-18 Detailed Survey Point and Situation

7.1.2.2 Natural Environment

(1) Climate

Phnom Penh city as capital of Cambodia belongs to a monsoon-dominant climate and has the dry season and the rainy season. The rainy season lasts from June to November. The humid southwest monsoon is blowing from the Gulf of Thailand and the Indian Ocean. The most rainfall is in September and October. The dry season lasts from December to May. Little rain is in January and February. April has the highest temperature just before the rainy season.



Average Conditions data © Copyright RM, 2011. All rights reserved. [Helicon Publishing](http://www.heliconpublishing.com) is a division of RM.

Source: <http://www.bbc.com/weather/1821306>

Fig. 7.1-19 Temperature and Rainfall in Phnom Penh City

(2) Protected Area

There are 23 protected areas in Cambodia. Total area is 33 million ha, which corresponds to 18% of the country. They are classified into 8 categories below.

1. National park
2. Wildlife sanctuary
3. Protected landscape
4. Multiple use area
5. Ramsar site
6. Biosphere reserve
7. Natural heritage site
8. Marine park

Location of protected areas is shown in Fig. 7.1-20. The project area does not include the protected area and is not adjacent to any protected areas.

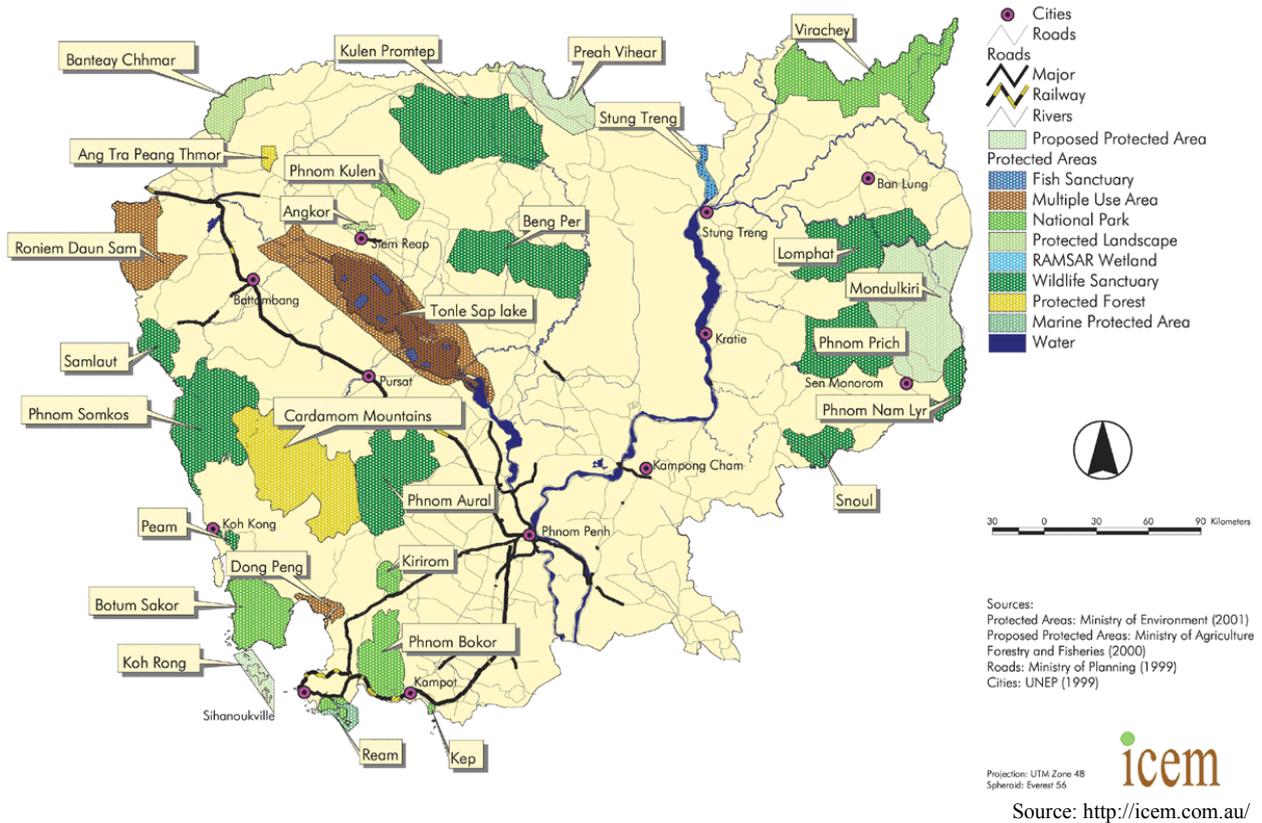


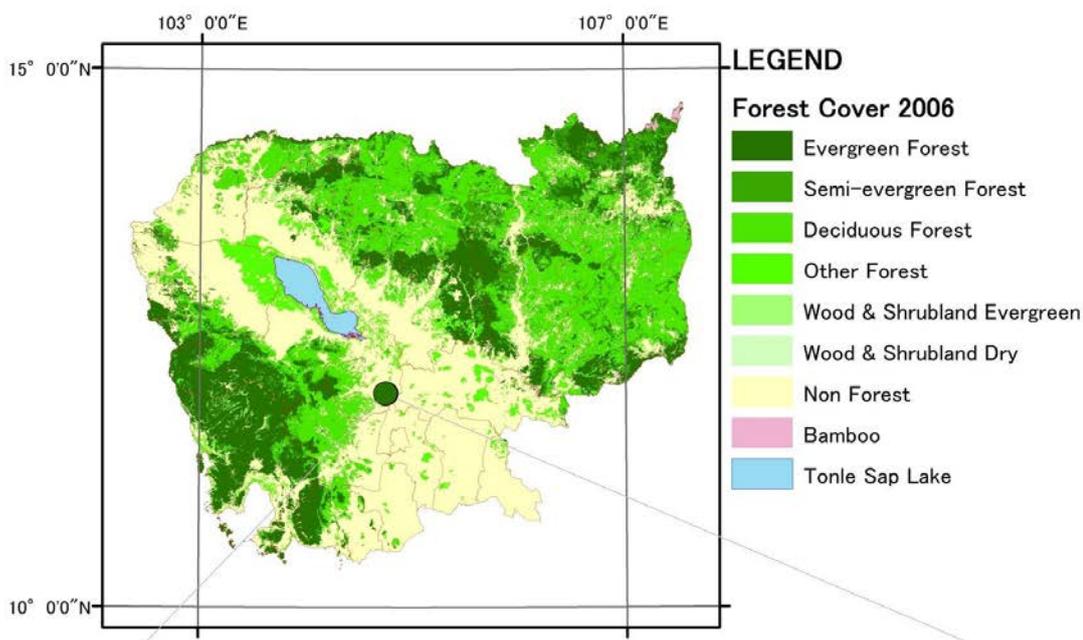
Fig. 7.1-20 Protected Area Map

(3) Ecosystem

Vegetation is covered with evergreen forest, semi-evergreen forest, deciduous forest, evergreen shrub land, dry shrub land and bamboo etc. (see Fig. 7.1-21). The project area are almost agricultural land and has little forest.

The Tonle Sap Lake is located at the upstream of The Tonle Sap River and is one of protected areas as a multiuse management area. The feature of this lake is to expand area because of the reverse flow of The Tonle Sap River, which allow inhabit of more than 600 freshwater fishes such as Mekong giant catfish (*Pangasius gigas*) and a variety of organisms. At the end of the rainy season fishes finish breeding and go down to downstream.

In addition to the Tonle Sap Lake, there are three wetlands listed in Statistical Yearbook of Cambodia 2011 in Phnom Penh City. They are located away from the project area.



Source: Center of Asian Conservation Ecology, Kyushu Univ.

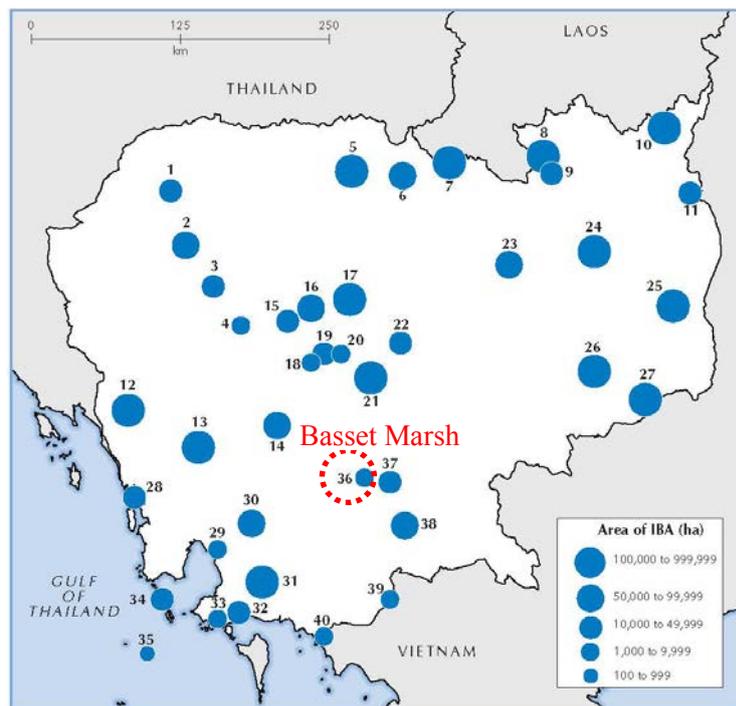
Fig. 7.1-21 Forest Map

Table 7.1-9 Wetlands in Phnom Penh City

Wetlands identified	Location	Province/ Municipality	Elevation AV (m) (max)	Area (ha)
Prasant Tuyoy Lake	About 57km East of Kampong Cham town	Phnom Penh	7	72,000
Boeung Veal Samnap	About 10m NE Phnom Penh	Phnom Penh	9	10,850
Boeung Prang	11m NE Phnom Penh	Phnom Penh	6	12,600

Source: Statistical Yearbook of Cambodia 2011

One of IBAs (Important Bird and Biodiversity Areas) is included in the project area. IBAs is set by Birdlife International, which is NGO (Non-Government Organization) of the world’s largest nature conservation partnership. The IBAs comprises of Basset Marsh, a permanent lake located along Road No. 5, about 12 km north of Phnom Penh. The 115kV OHL will pass along the east end of Basset Marsh. The areas surrounding the lake become inundated when the Tonle Sap River floods during the wet season, and thus support extensive marshes. These marshes are surrounded by agricultural land, mainly rice land, small numbers of Spot-billed Pelicans *Pelecanus philippensis* (NT) are regular in the wet season and Darters *Anhinga melanogaster* (NT) are also regular. The location is shown in Fig. 7.1-22.



Source: Birdlife International

Fig. 7.1-22 Location Map of IBAs in Cambodia

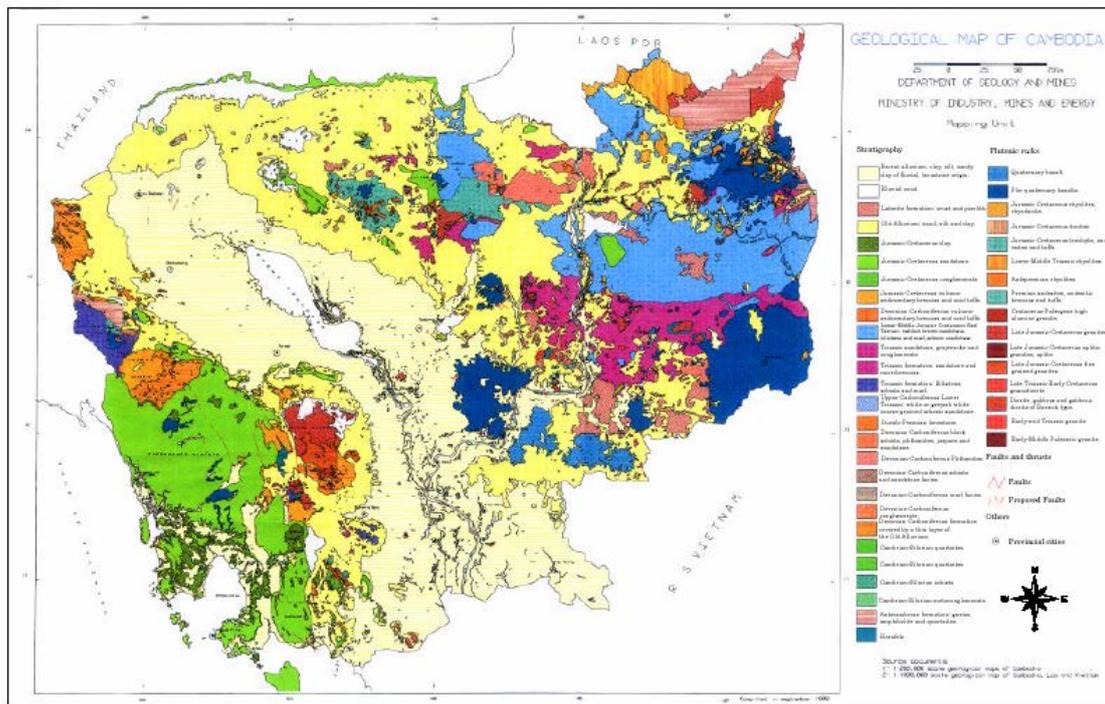
(4) Hydrology

The Tonle Sap River originating from the Tonle Sap Lake and the Mekong River meet each other at the east of Phnom Penh City and forks to the Mekong River and Bassac River downstream. The Mekong River causes flooding because of the heavy rain during the rainy season. The monitoring point in Phnom Penh is located at the river water level which is more than EL. +7m in the months from August to November and less than EL.+2m from March to July. There is a big difference in the river water level between the rainy season and the dry season. When the water level of the Mekong River exceeds the level of the Tonle Sap River, the river water flows upward.

(5) Topography / Geology

Most of the land in Cambodia is blanketed by alluvial plains for which the Mekong River brings, and the Dangrek Mountains stretch along the border of Thailand in the northeastern. On the other hand, a plateau expands adjacent to Vietnam in the southeastern. In the southwestern, the land fronts on the Gulf of Siam and the lake Tonle Sap which is the largest freshwater lake in Southeast Asia lies in the western. Phnom Penh City and Kandal Province in which this Project is planned sit on the alluvial plain.

The land of Cambodia is roughly divided into three geotectonic structures. Shallow sedimentary sequences which accumulated during the Triassic through the Jurassic Lias period comprise the basement broadly in the eastern, and the Jurassic-Cretaceous terrestrial sandstone comprises the highlands in the western. The Quaternary sediments are distributed on the alluvial plain in which the project site is located surrounded by these basement areas.



Source: MIME

Fig. 7.1-23 Geology Map

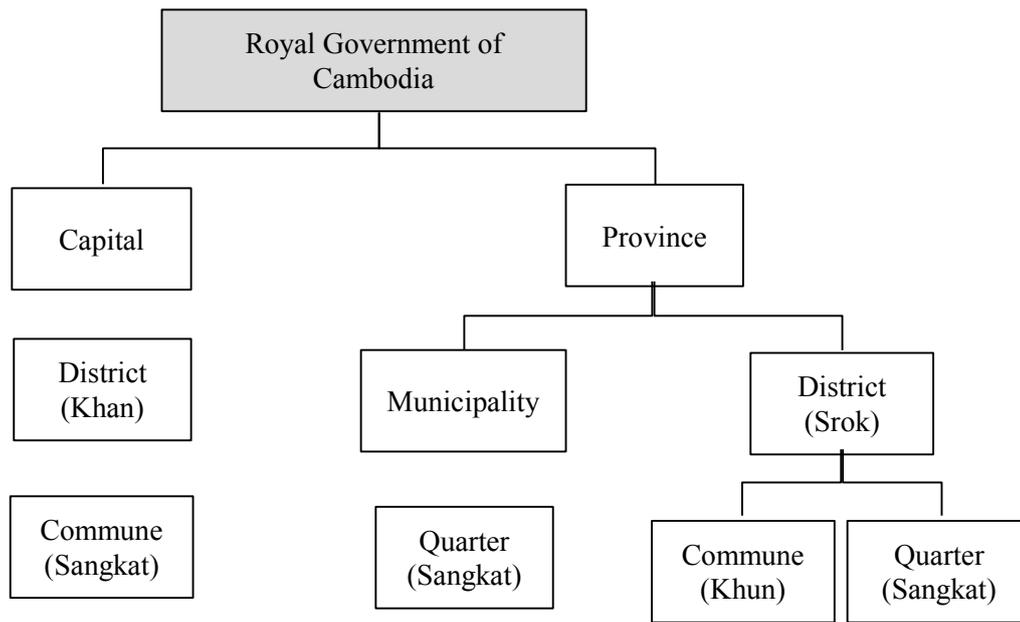
7.1.2.3 Social Environment

(1) Administrative Boundaries

Cambodia comprises Phnom Penh City and 23 provinces.

Phnom Penh City is divided into district (khan), then district is divided into quarter (sangkat).

Province comprises district (Srok) and municipality, then district is divided into commune (khum) and quarter (sangkat). Municipality (without Phnom Penh) is divided into quarter (sangkat). Then commune and quarter are further divided into village (phum). However village is not an administrative agency. Administrative system is shown in Fig. 7.1-24.



Source: Profile on Environmental and Social Considerations in Cambodia, JICA, 2013

Fig. 7.1-24 Administrative System in Cambodia

The project area is located in Phnom Penh City and Kandal Province. Phnom Penh City comprised of 9 districts shown in Fig. 7.1-25. In 2014, Russey Keo was divided to 3 districts such as Russey Keo, Chroy Changvar and Prek Pnao, Meanchey was divided to Meanchey and Chba Ampao. As a result, Phnom Penh City comprises of 12 districts at present. Kandal Province comprises 11 districts (see Fig. 7.1-26).



Fig. 7.1-25 Administrative Boundary in Phnom Penh City

Kandal province administrative map year 2000.
(Map KDL AD.00)



Source: http://www.foodsecurityatlas.org/khm/country/provincial-Profile/Kandal-files/KDL_Map_Admin.pdf
Fig. 7.1-26 Administrative Boundary in Kandal Province

(2) Land use

The project area and its surrounding are mostly covered with urban area of Phnom Penh and farm land such as rice land. In some space, shrub grassland and wetland are interspersed.

Most of the land under 230kV overhead transmission line is composed of farmland. It includes small shrub grassland. There is the wetland under 115kV overhead transmission line from Chroy Changvar S/S to GS5 .

There are housings and shops around Toul Kork S/S, NCC S/S, GS3, and underground transmission line route, which are located in the urban area of Phnom Penh City.

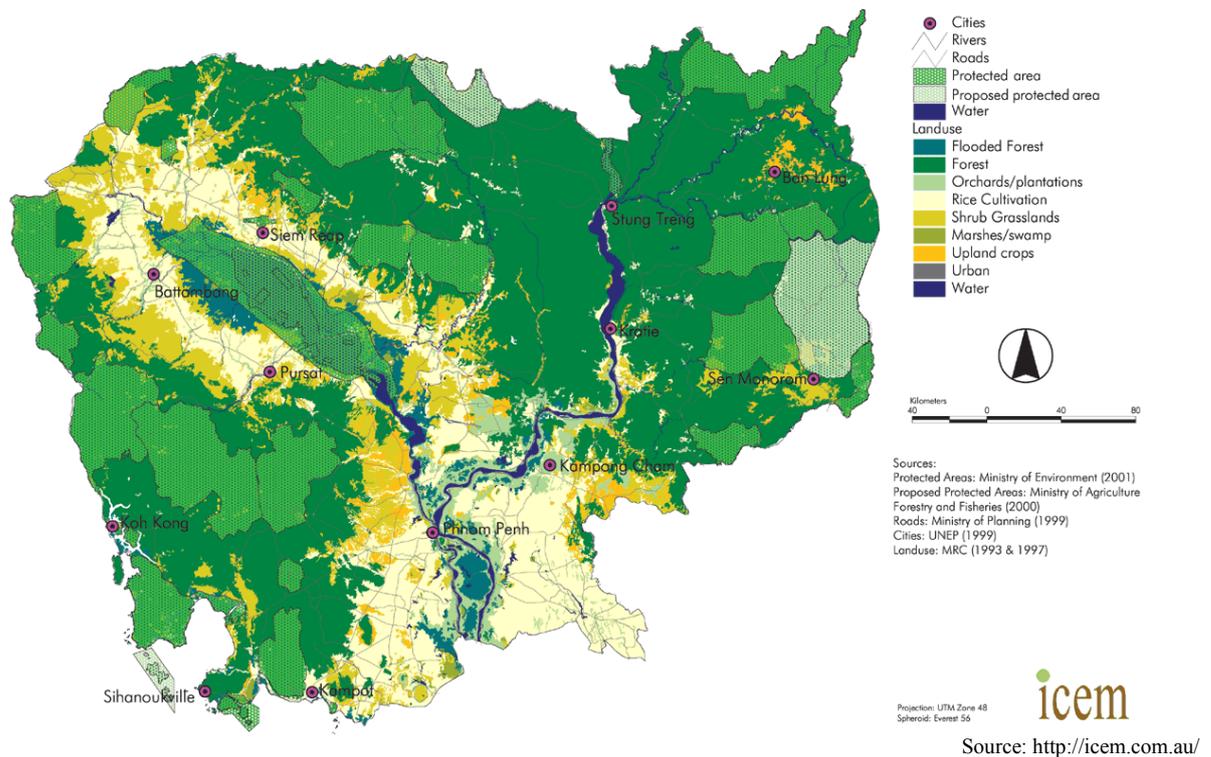
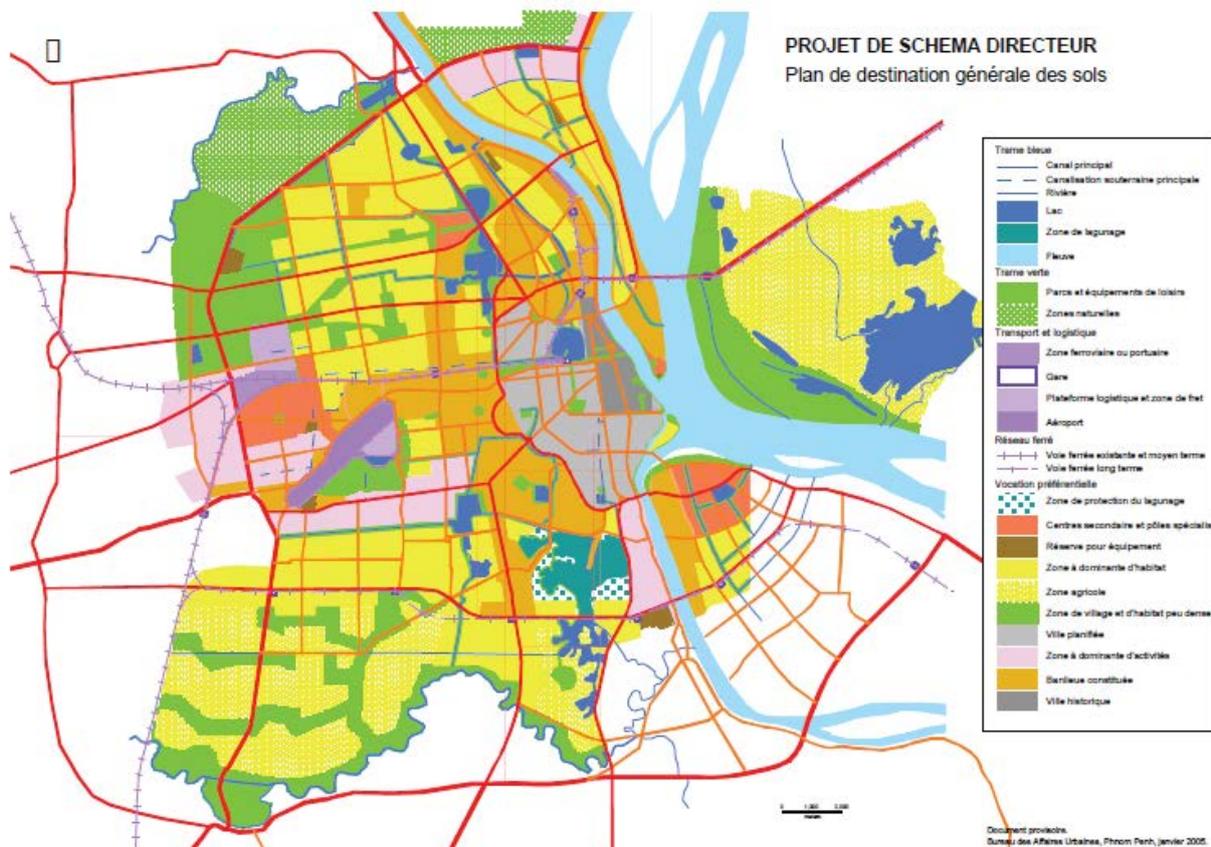


Fig. 7.1-27 Land Use Map



Source: Revised “Master Plan in Phnom Penh City, Office of Urban Affairs, Phnom Penh City, January 2005”

Fig. 7.1-28 Master Plan in Phnom Penh City

(3) Population

The population in both Phnom Penh City and Kandal Province are increasing. Table 7.1-10 shows the population trends in Phnom Penh City and Kandal Province.

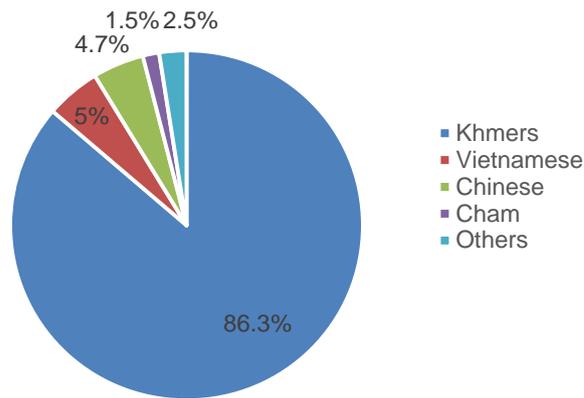
Table 7.1-10 Population Trends in Phnom Penh City and Kandal Province

Cambodia /Province	Population			Annual growth rate	
	1998	2008	2013	1998-2008	2008-2013
Cambodia	11,437,656	13,395,682	14,676,591	1.54	1.83
Kandal	1,075,125	1,091,170	1,115,965	1.62	0.45
Phnom Penh	999,804	1,501,725	1,688,044	2.83	2.34

Source: National Institution of Statistics

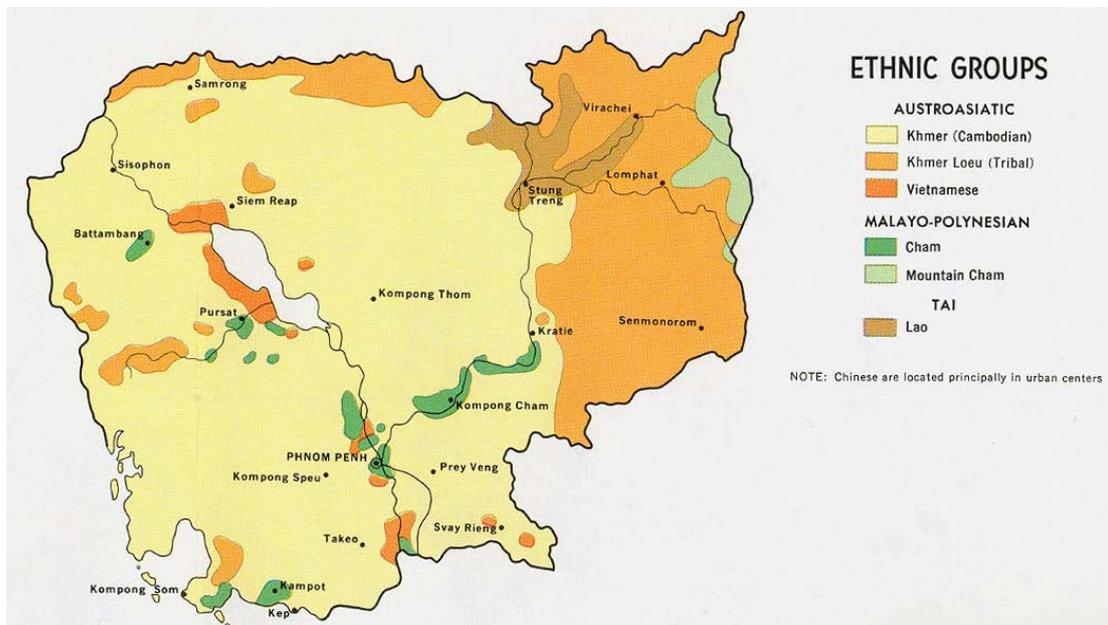
(4) Ethnic minority / indigenous people

The total population in Cambodia comprises Khmers (83%), Chinese (4.7%), Vietnamese (5%), and ethnic minority such as Cham (1.5%) (Central Intelligence Agency, 2013). Most of the ethnic minority live in the north of Cambodia such as Ratanakiri, Stung Treng, Mondolkiri, and Preah Vihear Province. Khmers occupy in the central of Cambodia. Khmers and Cham are mixed in many communities along the river. Population of urban area comprises Khmers and Vietnamese.



Source: Central Intelligence Agency

Fig. 7.1-29 Ethnic Group in Cambodia



Source: <http://www.lib.utexas.edu/maps/thematic.html>

Fig. 7.1-30 Ethnic Minority Distribution Map

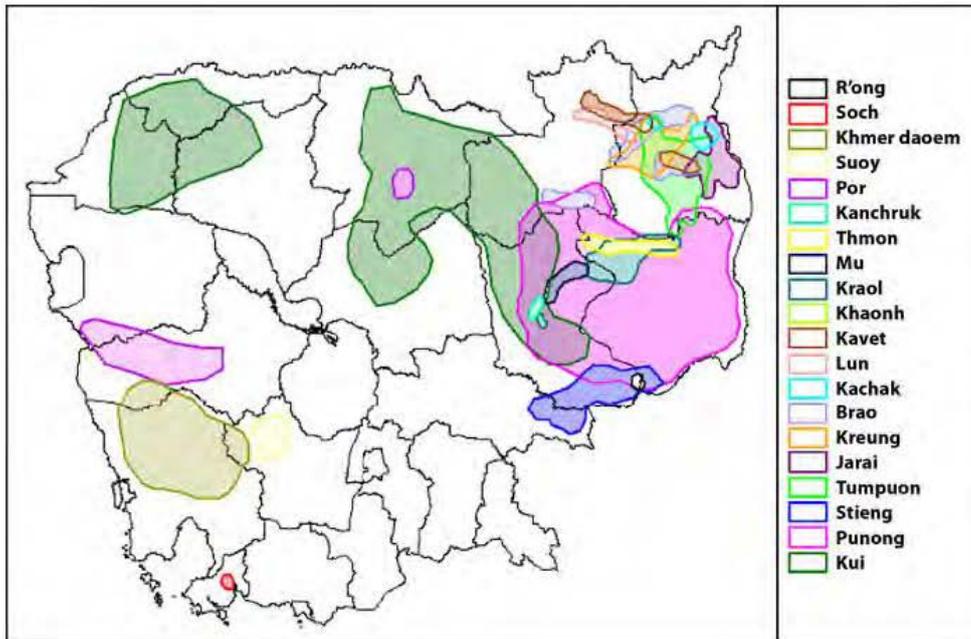
In 2011, the number of indigenous people was approximately 200,000. They accounted for 1.2% of the Cambodian population at that time (International Work Group for Indigenous Affairs, 2011). There are 24 indigenous groups on 15 of its 23 provinces (International Fund of Agricultural Development, 2012). Two-thirds of these groups are found in the Northeast of Cambodia, in the provinces of Ratanakiri and Mondolkiri (Camfrel 2012). These groups are shown in Table 7.1-11. Fig. 7.1-31 is a geographical distribution map of indigenous people.

As above indigenous people and ethnic minority don't live in and around the project area, this project has no impact on them.

Table 7.1-11 Indigenous Peoples and Ethnic Minority Groups in Cambodia

Indigenous peoples and ethnic minority groups					
Broa	Kavet	Kreung	Mil	Ro'Ang	Spong
Chhong	Kel	Krol	Phnong	Sa'Ouch	Stieng
Jarai	Koang	La'Eun	Por	Sam Rei	Thmoum
Kachak	Kouy	Lun	Radei	Souy	Tompoun

Source: JICA Study Team



Source: JICA Study Team

Fig. 7.1-31 Ethnic Minority Distribution Map

(5) Poverty

The poverty ratio is declining in the whole country recently. Population below the absolute poverty line fell to less than 1% in 2007.

People who flowed into the urban area from the rural area in search of work formed dramatically slums from the 1990's to the 2000's. In Basak slum which is one of the large-scale slums in Phnom Penh, residents were compulsorily relocated to suburb. In this way, resettlement issues occur frequently with urban development. The project area does not have any slum, the project is not expected to impact on the poverty.

(6) Tourism

Many tourists visit to Cambodia from all of the world every year. Siem Reap with Angkor Wat Ruins is the most popular tourist destination. Besides that, there are many tourism resources in Phnom Penh City and Kandal Province as follows. The project area is far from these tourism resources, the project is not expected to impact on them.

Table 7.1-12 Tourism Resources in Phnom Penh City and Kandal Province

Capital / Province	Tourism resource	Capital / Province	Tourism resource
Phnom Penh	National Museum	Kandal	Ang Kor Chey Pagoda
	Royal Palace		Handicraft Centre
	Silver Pagoda		Kean Svay Krau Pagoda
	Wat Phnom		Koh Dack
	National Monument		Phnom Edthares
	Toul Sleng Museum		Phnom Odong
	Killing Field		Phnom Prasith
	War Crimes Museum		Sa Ang Mountain
	Central Market		Tum Pek Pagoda
		Wat Phnom Thom Mond	

Source: JICA Study Team

(7) Transportation network

In Phnom Penh, there is Phnom Penh International Airport, the largest one in Cambodia, which has flights to the world. Railway was developed in French Indochina era, but was gone to ruin by Cambodian civil war. After the war, Cambodian railway operated only the line between Phnom Penh and Battambang, however, all lines are currently out of service. Operation of the local bus on Monivong Boulevard is started from 2014. Many long distance bus to Siem Reap and Sihanoukville, and international bus to Ho Chi Minh City and Bangkok frequency operate. In addition, there are shared-taxi, meter taxi, tuk-tuk, and motorcycle taxi.

In Phnom Penh City, traffic volume is increasing gradually along with increase in cars and motorcycles privately owned.

The underground transmission line will be constructed along the road in urban area, it may cause traffic congestion.

(8) Heritage

There are two world cultural heritages in Cambodia, Angkor Wat Ruin and Preah Vihear Temple. They are far away from the projected area. On the other hand, there are famous cultural heritage such as Palace and Wat Phnom in Phnom Penh. Since these are far from the project area, the Project has no physical impact on these heritages.

(9) Landscape

The project area and its surrounding area do not include the aesthetic landscape specified by law. However, Phnom Penh Municipality takes into consideration the landscape along the Tonle Sap River side area because it is a tourist spot. The OHL will pass the Tonle Sap River in the distance of the tourist spot, the project is not expected to impact on the landscape of the Tonle Sap River.

7.1.2.4 Environmental State in the Project Area

Table 7.1-13 to Table 7.1-15 show the state of the proposed site of substations and transmission lines.

Involuntary resettlement by development of substations and the underground transmission line is not assumed. Though the overhead transmission line may pass over houses.

The following proposed areas need to acquire the private land.

- The proposed site for new construction of Toul Kork S/S (already acquired)
- The proposed site for new construction of Chroy Changvar S/S
- The proposed site for expansion of GS5
- The proposed route of 230kV OHL : Midpoint of NPP and WPP – GS5
- The proposed route of 115kV OHL : GS5 – Chroy Changvar

Table 7.1-13 State of the Proposed Site of S/S

Site	NCC	Toul Kork	Chroy Changvar	GS5
New construction/ Expansion	New construction	New construction	New construction	Expansion
Installed/Expanded Facilities	230/115/22kV, GIS*1	115/22kV, GIS	115/22kV, AIS*2	Under Construction (Installation of 230kV Feeder bays for OHL) (Installation of 230kV Feeder bays for UG) Installation of 115kV Feeder bays for OHL
Land Scale	30m x 105m	21m x 75m	180m x 180m	210m x210m
Land Owner	EDC	Already acquired by EDC	Private land	Private land
Background of Land Acquisition	Site for NCC	Vacant land	Wetland	Fallow field
Necessity of Land Acquisition for the Development	N/A	Necessary	Necessary	Necessary
Natural Environment	Gravel, Grassland, Concrete	Gravel, Grassland	Wetland	Gravel, Grassland, Concrete, Rice land
Social Condition	The proposed site is adjacent to EDC Sales office and the diesel power plant and is located in the city. There are shops and houses in the surrounding.	The proposed site is located in the city. There are shops and houses in the surrounding.	There are wetland and natural lake around the proposed site.	The only staff involved in EDC is able to enter. There are rice land, houses, buildings under construction, and vacant land in the surrounding.

*1 GIS : Gas Insulated Switchgear

*2 AIS : Air Insulated Switchgear

Source: JICA Study Team

Table 7.1-14 State of the Proposed Route of OHL

Section	Midpoint of NPP and WPP to GS5	GS5 – Chroy Changvar S/S	Toul Kork S/S to Midpoint of GS5 and GS1
New construction/ Expansion	New construction	New construction	New construction
Voltage (kV)	230	115	115
Number of Circuit	2	2	2
Length (km)	10.2	20.2	0.1
Road Administrator	MPWT*1, DPWT*2 *Tomnoph Kop Srov Road	MPWT, DPWT *Tomnoph Kop Srov Road *National highway 5	MPWT, DPWT
Land Owner	Private land, MPWT	MPWT,DPWT, Private land	EDC
Necessity of Land Acquisition for the Development	Necessary	Necessary	Necessary (already acquired)
Surrounding Condition	- Cross over houses - Cross over farmland and railway line	- Cross over houses, farmland, fish pond, lake and railway line	The site for Toul Kork

*1 MPWT : Ministry of Public Works and Transmission Line

*2 DPWT : Department of Public Works and Transport

Source: JICA Study Team

Table 7.1-15 State of the Proposed Route of UG

Section	GS5 to NCC S/S
New construction/ Expansion	New construction
Voltage (kV)	230
Number of Circuit	1
Length (km)	9.1
Road Administrator	Confederation de la Russie, St 105K, Oknha Try Heng 2011, 2002Rd, Hanoi, No.271, Yothapol Khemarak Phoumin Blvd, City road: PPM
Land Owner	MPWT, DPWT, PPM
Necessity of Land Acquisition for the Development	N/A
Surrounding Condition	Confederation de la Russie is a three-lane boulevard on one side. Yothapol Khemarak Phoumin Blvd (Photo 7.1-1) has also a great traffic volume.

Source: JICA Study Team



Photo 7.1-1 (1) Situation around the Proposed Site for S/S



Photo 7.1-1 (2) Situation around the Proposed Site for S/S



There are riceland and communities on the west side.



Railway (currently out of service)



Those are many communities on the south side

Photo 7.1-2 Situation around the Proposed Route of 230kV OHL



There are some houses along the route



IBS (Basset Marsh) along the route



Floating people around the route



Wetland on the route.



Farming land on the route



Lake on the route

Photo 7.1-3 Situation around the Proposed Route of 115kV OHL

7.1.3 Comparative Study on Alternatives

This Project includes the construction works of the overhead/underground transmission line at the suburbs /suburban of the Phnom Penh City. It is anticipated that there might be some possibilities of an impact to the surrounding social environment during the construction work. In this Survey, the JICA Study Team raised some plans after conducting review of the existing data and information, interview with the related authorities and concerned personnel and site reconnaissance, considering the impact on the neighborhood residents and surrounding environment. Then, the Survey Team proposed the optimal plan to EDC.

7.1.3.1 Alternative Plans of the Project

The total of four project alternatives was proposed as shown in Table 7.1-16. In the Zero option, no construction work is planned. For Alternative 1, it is planned that 230kV overhead and underground transmission lines are connected directly to NCC, the center of the city from the circumferential 230kV backbone system. Besides, for Alternative 2, it is designed that 230kV overhead transmission line is connected to GS5, located near the city load, and further 230kV transmission line is connected to NCC which is the load center.

In case the Project was not implemented, there is no adverse impact on natural and social environment and no construction cost is required. However, this plan cannot cope with the increasing future power demand. Accordingly, the duration of blackout will be longer and a sufficient volume of power cannot be supplied to the city. As a result, the Zero option would not be realistic because it interferes with the development of Phnom Penh City.

Plans of Alternative 1-A, 2-A, 1-B and 2-B may possibly have a temporary and limited impact of the noise due to the construction work or impact to the neighboring traffic conditions, but those plans provide sufficient power to meet the requirements of current and future power demand. The Project area has already been developed. Therefore, it is anticipated that there will be a little impact on the natural environment if the protected area was not selected as the substation sites. Regarding the resettlement, Alternative 1-A, 2-A, 1-B and 2-B can select the transmission line route to avoid those issues for the most part. But some of resettlement is required. Regarding the land acquisition, all of the plans of 230kV overhead transmission line cannot avoid those issues.

In the comparative study of the alternatives, first of all, Alternative 1-A and Alternative 2-A were compared. For the environmental and social considerations aspect, Alternative 2-A does not have negative impact than Alternative 1-A. On the technical aspect, the construction cost of Alternative 2-A is the lowest, and there is no anxiety on the reliability.

Therefore, Alternative 2-A is recommended since it will largely contribute to the improvement of quality of life of the resident and the development of Phnom Penh City through the stable power supply.

Compared to Alternative 2-B, Alternative 2-A has the shorter transmission line than Alternative 2-B, and the construction period of transmission line is also shorter. However, there is no significant difference of impact on noise and traffic between these two alternatives. If the construction cost was compared, Alternative 2-A is more economical.

Table 7.1-16 Comparison of Alternative Plans of the Project

Item		Zero Option	Alternatives			
			1-A	2-A	1-B	2-B
Project Summary	Feature	No construction 230kV / 115kV Toul Kork (115kV)	230kV OHL/UG cable line (2 cct) is installed to the center of the city and connected to NCC. Power demand in the Phnom Penh City is supplied by these systems together with the 115kV line.	230kV OHL cable line (2 cct) is installed to GS5. Power demand in the Phnom Penh City is supplied by these systems together with the 115kV line.	230kV OHL/UG cable line (2 cct) is installed to the center of the city and connected to NCC. Power demand in the Phnom Penh City is supplied by these systems together with the 115kV line.	230kV OHL cable line (2 cct) is installed to GS5. Power demand in the Phnom Penh City is supplied by these systems together with the 115kV line.
			New Toul Kork substation is connected to the system in the form of π connection from the nearby existing 115kV transmission line.		New Toul Kork substation is connected by a single circuit of the new 115kV transmission line from GS5 and NCC, respectively.	
	New/ Expansion of Substation	N/A	GIS S/S : 2 AIS S/S : 1	GIS S/S : 2 AIS S/S : 2	GIS S/S : 2 AIS S/S : 1	GIS S/S : 2 AIS S/S : 2
	Total length of Overhead T/L	0km	230kV : 7.7km 115kV : 20.3km	230kV : 10.2km 115kV : 20.3km	230kV : 7.7km 115kV : 27.2km	230kV : 10.2km 115kV : 27.2km
	Total length of Overhead T/L	0km	230kV:10.0km 115kV:0.4km	230kV:9.28km 115kV:0.4km	230kV:10.0km 115kV:5.8km	230kV:9.28km 115kV:5.8km
	Technical aspect	Power supply	- High risk of blackout - The supply capacity cannot satisfy the increasing demand.	- The power supply capacity meets the power demand in the City.	- The power supply capacity meets the power demand in the City.	- The power supply capacity meets the power demand in the City.
Main Spec.		N/A	230kV OHL/UG cable line (2 cct) is installed to the center of the city and connected to NCC.	230kV OHL (2 cct) is installed to GS5, then 230kV UG (1 cct) is installed to NCC.	In addition to the alternatives 1 and 2, the new Toul Kork substation is connected to the system in the form of π connection from the nearby existing 115kV transmission line.	
Construction Cost		N/A	Base	High	Very high.	
Consistency with the urban development plan		Insufficient power supply would prevent the urban development.	This plan contributes to the urban development of Phnom Penh City.	This plan contributes to the urban development of Phnom Penh City.	This plan contributes to the urban development of Phnom Penh City.	This plan contributes to the urban development of Phnom Penh City.
Environmental and Social Considerations	Pollution control	No impact on environmental pollution.	Impact of noise and vibration to the neighborhood are anticipated during the construction work.	Impact of noise and vibration to the neighborhood are anticipated during the construction work.	Impact of noise and vibration to the neighborhood are anticipated during the construction work.	Impact of noise and vibration to the neighborhood are anticipated during the construction work.
	Natural environment	No impact to the natural environment	The construction work of 230kV/115kV OHL is mostly implemented outside of the metropolitan area, therefore, some impacts to the natural environment might occur depending on the selected tower location of the 230kV OHL.	The construction work of 230kV/115kV OHL is mostly implemented outside of the metropolitan area, therefore, some impacts to the natural environment might occur depending on the selected tower location of the 230kV OHL.	The construction work of 230kV/115kV OHL is mostly implemented outside of the metropolitan area, therefore, some impacts to the natural environment might occur depending on the selected tower location of the 230kV OHL.	The construction work of 230kV/115kV OHL is mostly implemented outside of the metropolitan area, therefore, some impacts to the natural environment might occur depending on the selected tower location of the 230kV OHL.
	Social environment	-No impact on the social environment due to the construction work. - This plan cannot satisfy with the increasing power demand in the future. - Minus this project, an insufficient amount of power will cause an incalculable loss of life and business activity to the people living in the area.	- This plan might require the land acquisition for S/S (CK). - The resettlement can be avoided at the selection process of T/L route and S/S site. - This plan could have a temporary and limited impact on neighboring traffic conditions. - In operation phase, enough capacity for power demand is supplied, but the reliability is much lower.	- This plan might require the land acquisition for S/S (CK, GS5). - The resettlement can be avoided at the selection process of T/L route and S/S site. - This plan could have a temporary and limited impact on neighboring traffic conditions. - In operation phase, enough capacity for power demand is supplied, but the reliability is much lower.	- This plan might require the land acquisition for S/S (CK, GS5). - The resettlement can be avoided at the selection process of T/L route and S/S site. - This plan could have a temporary and limited impact on neighboring traffic conditions. - In operation phase, enough capacity for power demand is supplied, but the reliability is much lower.	- This plan might require the land acquisition for S/S (CK, GS5). - The resettlement can be avoided at the selection process of T/L route and S/S site. - This plan could have a temporary and limited impact on neighboring traffic conditions. - In operation phase, enough capacity for power demand is supplied, but the reliability is much lower.
	Proposed optimum plan and reason	- This plan is not recommended - The power supply is not enough for now and future demand. It would interfere with the development of Phnom Penh City.	- This plan is not recommended. - The power supply is unstable, so it has few advantages. - The overload in SPP in the future was pointed out as the result of system analysis.	- This plan is strongly recommended.	- This plan is not recommendable. - Compared with [1-A, 2-A], construction cost is very high. - The overload in SPP in the future was pointed out as the result of system analysis of [1-B].	

Source: JICA Study Team

7.1.3.2 Alternative of Overhead Transmission Line Route

(1) Temporary routes considered before field survey

JICA Study Team examined three routes before field survey. 230kV_Route1 is overhead transmission line which branches at the midpoint of NPP and WPP and goes to GS5. 115V_Route2 is overhead transmission line which connects from GS5 to Chroy Changvar S/S. 115V_Route3 is overhead transmission line which branches at the midpoint of GS5 and GS1 and goes to Toul Kork S/S. The Location map of the temporary route of the transmission line before field survey is shown in Fig. 7.1-32.

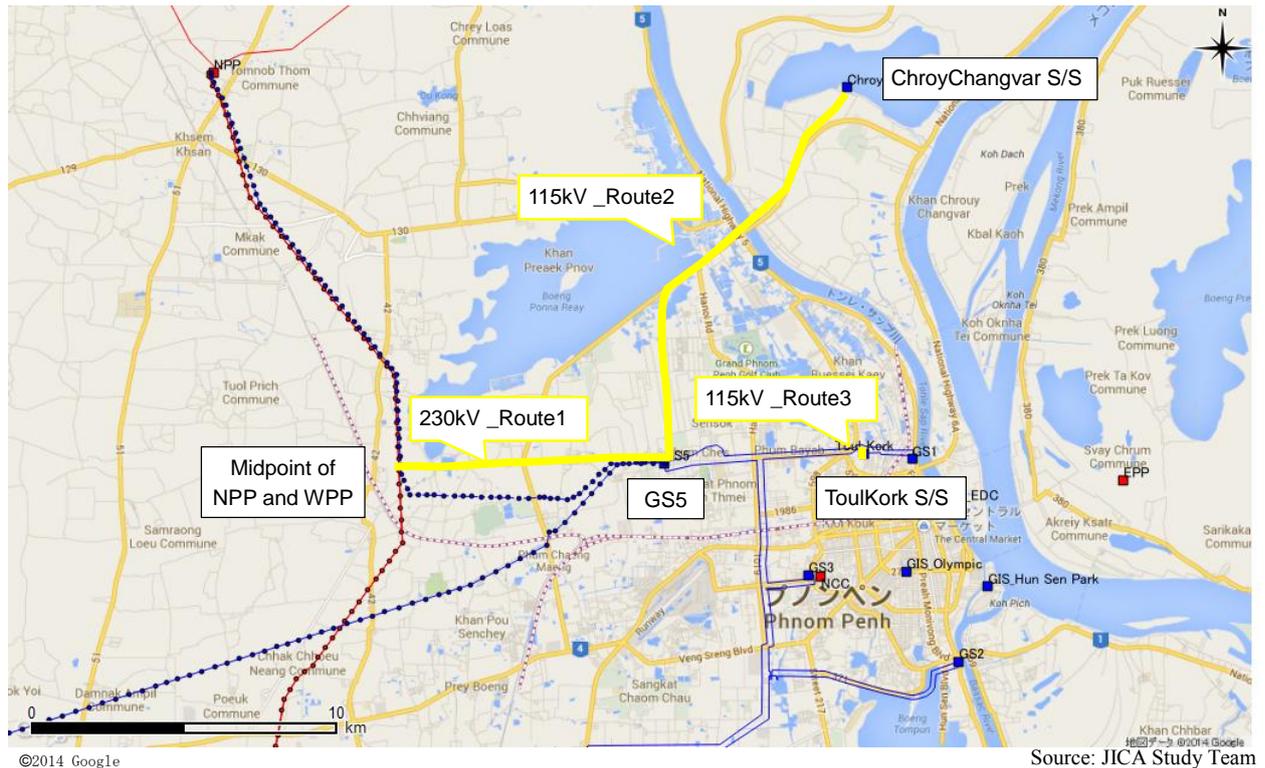


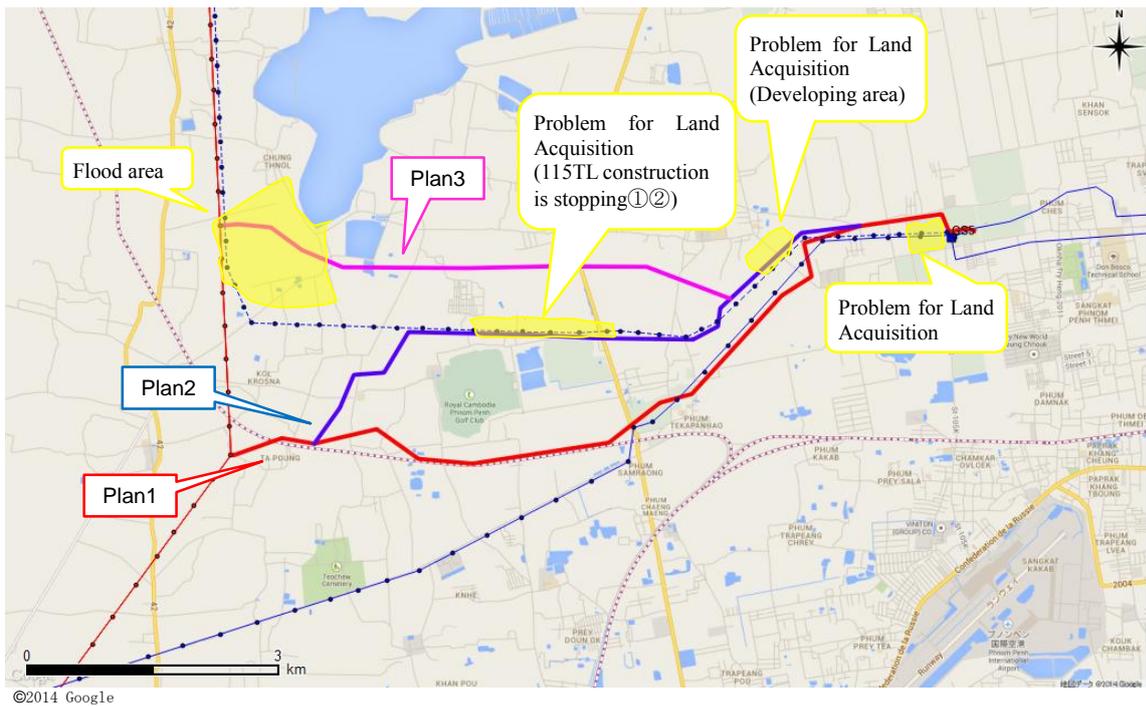
Fig. 7.1-32 Location Map of Temporary Route of Transmission Line before Field Survey

Factors considered for selection of tentative routes are as follows.

- To apply the straight line route as much as possible
- The transmission line will require an ROW width of 30m
- To avoid residential areas
- To minimize impacts on undisturbed forest areas
- To avoid flood areas as much as possible

(2) The results of field survey

JICA Study Team in April - June 2014 did the field survey. The field survey of each route proposal and the photograph of a spot are shown in Fig. 7.1-33 to Fig. 7.1-38.



Source: JICA Study Team

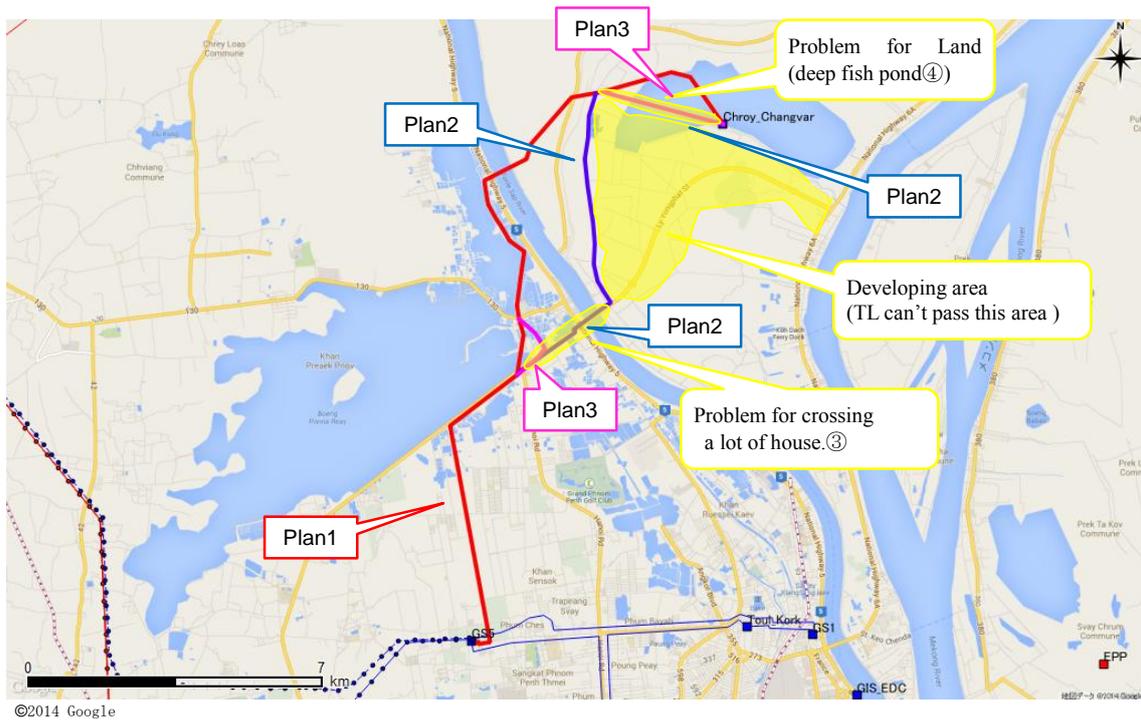
Fig. 7.1-33 Field Survey Route Location Map of 230kV_Route1



① [115kV TL construction is stopping]

② [115kV TL construction is stopping]

Fig. 7.1-34 Field Survey Route Photograph of 230kV_Route1



Source: JICA Study Team

Fig. 7.1-35 Field Survey Route Location Map of 115kV_Route2

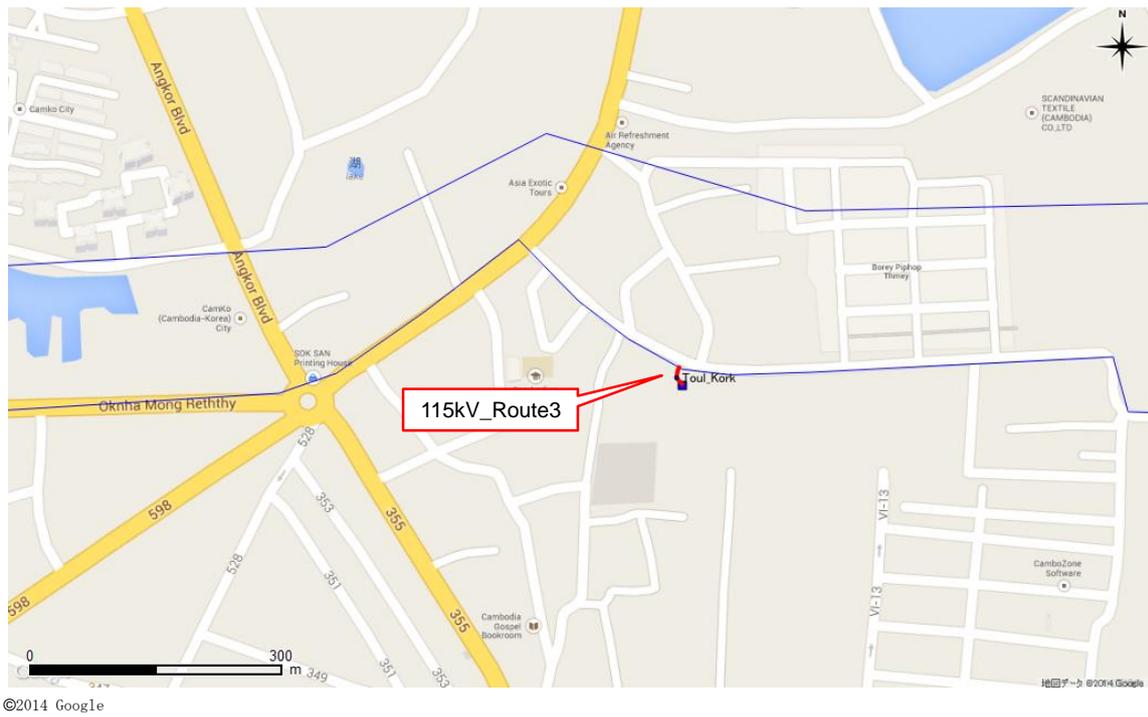


③ [Problem for crossing a lot of house]



④ [Problem for Land (deep fish pond)]

Fig. 7.1-36 Field Survey Route Photograph of 115kV_Route2



Source: JICA Study Team

Fig. 7.1-37 Field Survey Route Location Map of 115kV_Route3



Fig. 7.1-38 Field Survey Route Photograph of 115kV_Route3

(3) Key issues on each route and selection route**a) 230kV_Route1**

JICA Study Team examined three tentative routes shown in Fig. 7.1-33.

- Plan3 is flood area in the rainy season
- Plan2 is difficult to build steel towers newly, because the construction of 115kV TL has been interrupting now.
- Plan2 and Plan3 pass along the area where the present development is furthered.

Plan1 which makes environmental influence smallest was chosen from the above-mentioned result. The progress situation of Plan1 is shown in Fig. 7.1-39.

b) 115kV_Route2

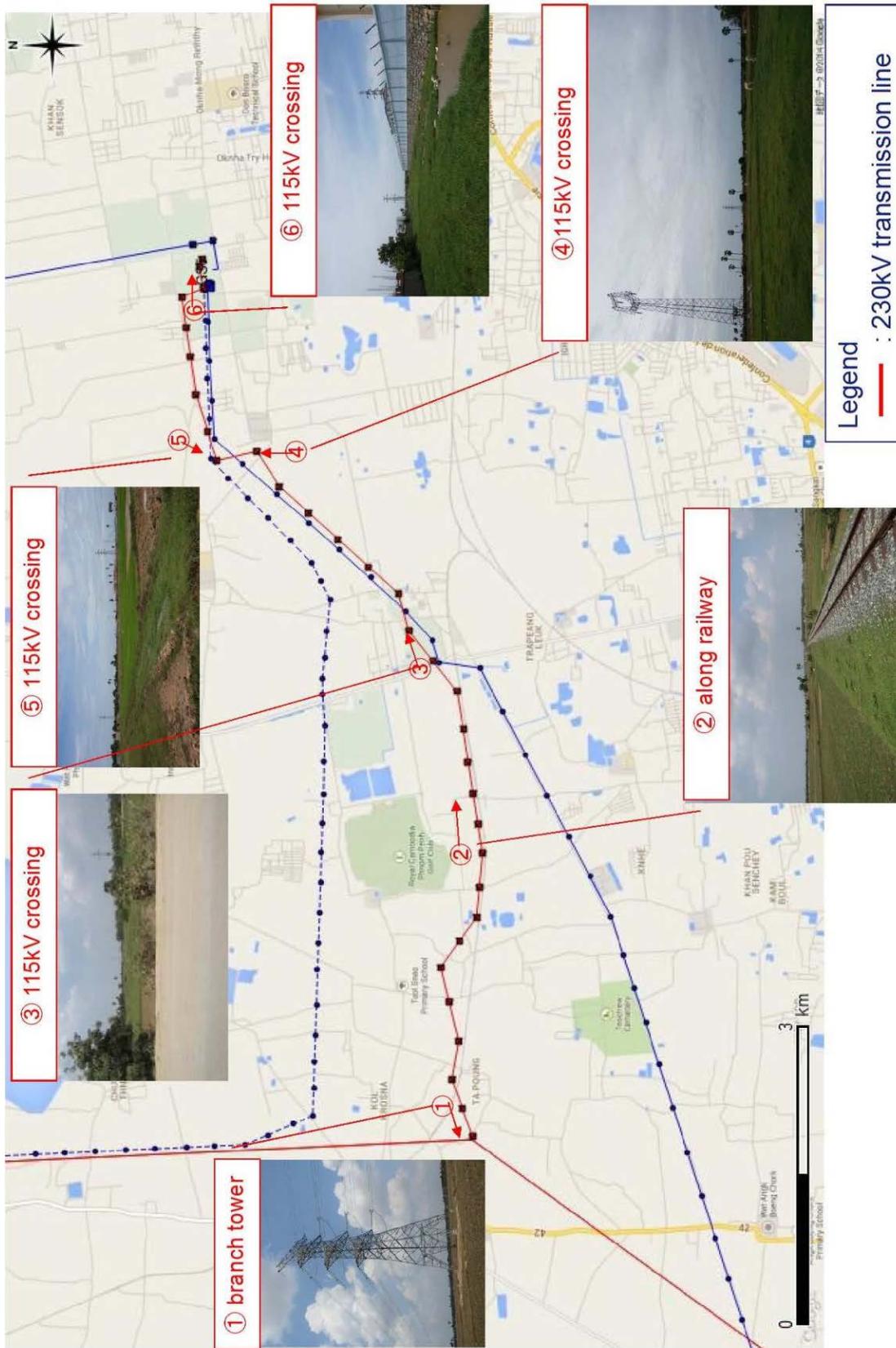
JICA Study Team examined three tentative routes shown in Fig. 7.1-35.

- Plan2 cross the high density housing area where crossing the river.
- Plan2 and Plan3 cross the housing area along the road.
- Plan3 are assumed that the pond of near Chroy Changvar S/S is deep. It should be assumed that a considerable quantity of reclamation is required at the time of steel tower construction.
- Plan1 and Plan3 can cross the river without crossing the residence.

Plan1 which makes environmental influence smallest was chosen from the above-mentioned result. The progress situation of Plan1 is shown in Fig. 7.1-40. By the result of additional researches, such as the depth of a pond, Plan3 is taken as the proposal which can turn into alternatives.

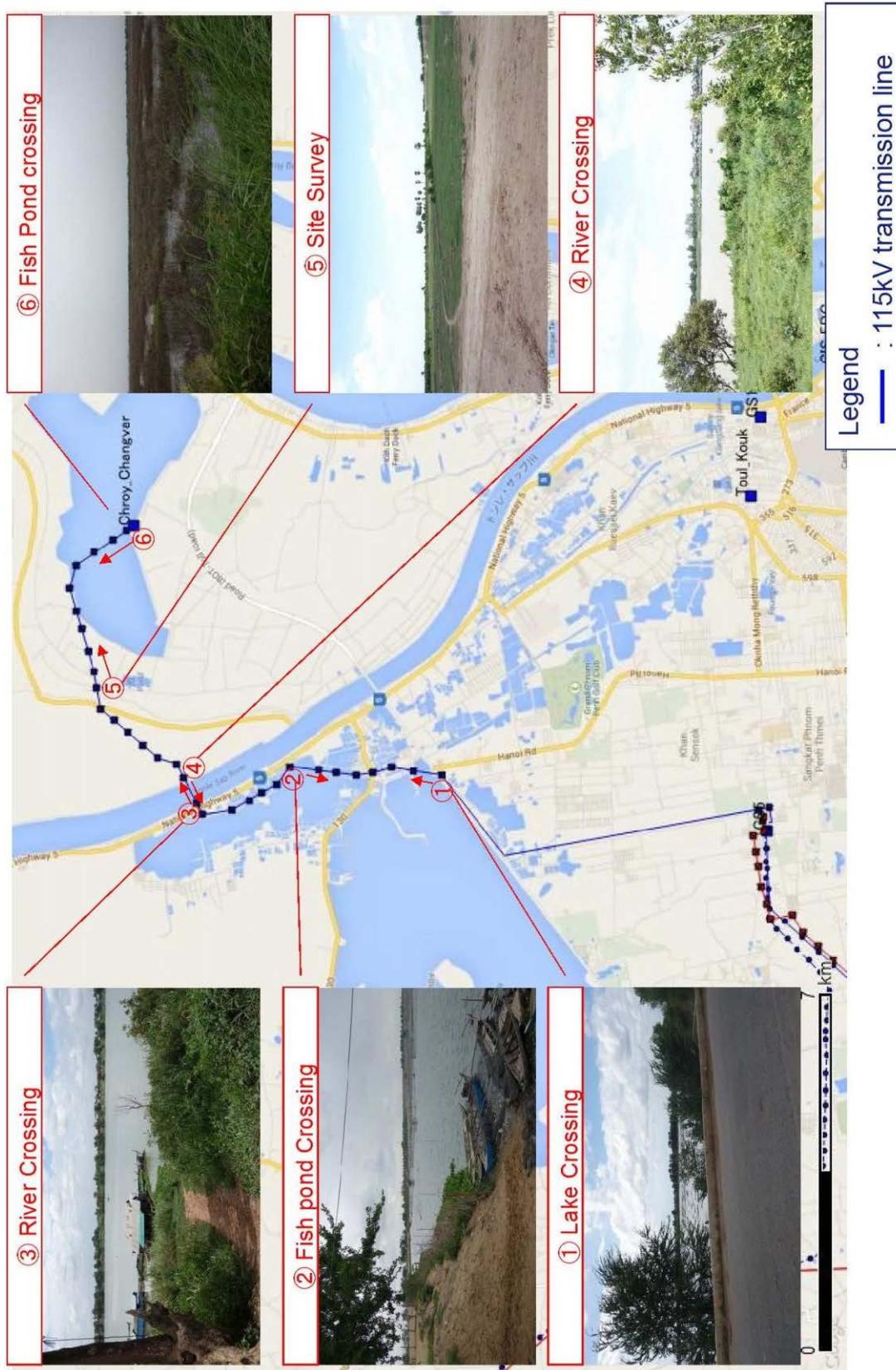
c) 115kV_Route3

115 kV_Route3 is shown in Fig. 7.1-37. 115V_Route3 is overhead transmission line which branches at the midpoint of GS5 and GS1 and goes to Toul Kork S/S. Length is less than 0.1km. The environmental influence is slight, because steel pipe pole can construct in a substation site.



©2014 Google
Source: JICA Study Team

Fig. 7.1-39 Location Map of 230kV_Route1



©2014 Google
Source: JICA Study Team

Fig. 7.1-40 Location Map of 115kV_Route2

7.1.4 System and Organization related to Environmental and Social Consideration

7.1.4.1 Legal Framework related to Environmental and Social Consideration

(1) Laws and regulations

The Law on Environmental Protection and Natural Resource Management enacted in 1996 is the fundamental environmental law in Cambodia. Article 6 in Chapter 3 specified that Environmental Impact Assessment (EIA) should be conducted for every public and private project and submitted to the Cambodian Government after approval by MOE (Ministry of Environment). The Sub-Decree on the EIA Process defines EIA and the target project of Initial Environmental Impact Assessment (IEIA) / EIA whose Annex shows the list of categories and the scale of the project which needs to implement IEIA/EIA. The procedures of the preparation and the approval of IEIA/EIA follow “Prakas (Declaration) on the General Guideline for Conducting Initial and Full Environmental Impact Assessment Reports”. The other related laws and their summary are shown in Table 7.1-17.

Table 7.1-17 Related Laws, Sub-Decrees and Regulations

No.	Title	Enacted Year	Summary
Basic law			
1	Law on Environmental Protection and Natural Resource Management (LEPNRM)	1996	It is Environmental Basic Law in Cambodia in which chapter III stipulates EIA shall be conducted on every private or public project and activity, and shall be approved by the MOE before being submitted to the Royal Government of Cambodia for decision. Article 7 provides the operative provision of IEIA. This law includes the other provisions about the natural resource management, environmental protection, monitoring, inspection, public participation, access to information. Environmental fund and penalties.
EIA			
2	Sub-Decree on Environmental Impact Assessment Process	1999	This Sub-Decree specifies the definition of “EIA”, target project types, public participation and others. In case that project has an adverse effect on the socio-environment, the project owner is required to submit an EIA report to MOE, and MOE reviews the EIA report and monitors the project. The Annex stipulates the criterion of the necessity of EIA in Cambodia as a type of project and their size and capacity.
3	Prakas (Declaration) on Guideline for Conducting Environmental Impact Assessment Reports	2000	This Declaration stipulated first that the Department of Environmental Impact Assessment (DEIA) in MOE is the unit in charge of EIA.
4	Prakas (Declaration) on General Guideline for Conducting Initial and Full Environmental Impact Assessment Reports	2009	This Declaration stipulates the approval procedures of IEIA/EIA of the project each on a national level and the municipality/provincial level and DMS instructions of the application form and documents which should be attached. Also the Declaration allows the project owner to hire a consultant company, which must be registered in the MOC (Ministry of Commerce) and be recognized by MOE beforehand, to prepare an IEIA/EIA report.
5	United Declaration for Public Service Contribution of MOE, No.999	2012	This declaration defines the necessity of IEIA for 115kV Transmission Line Development.
Natural Environment			
6	Royal Decree on Creation and Designation of Protected Areas	1993	National protected areas, which are managed and supervised for the development and protection of natural areas by the Secretariat of Environment, are classified into four categories; (1) National parks, (2) Wildlife sanctuaries, (3) Protected landscapes, and (4) Multiple use areas.
Pollution Control/Urban Environment			
7	Sub-Decree on Water Pollution Control	1999	This Sub-Decree stipulates the water quality standard of discharged water. MOE is responsible for the monitoring of the pollution source and pollution situation.
8	Sub-Decree on Air Pollution and Noise Disturbance	2000	The standard of the maximum allowable level of noise and the maximum quality of hazardous substances permitted in the air are specified in this Sub-Decree.
9	Sub-Decree on Solid Waste Management	1999	This Sub-Decree specified the concrete regulations and procedures for the management of general waste and hazardous waste.
Others			
10	Electricity Law of The Kingdom of Cambodia	2001	Each power company must comply with all conditions set forth in its License, the rules and regulations adopted by the Authority, and the laws of the Kingdom of Cambodia, including laws regarding environmental protection, safety, health, taxes, and electric system performance, protection and standards.
11	Labor Law	1997	This law states the basic provisions related to the wage, working hours, overtime working, paid holidays, health care, labor health service and accident, etc.

Source: JICA Study Team

(2) Environmental Standard**a) Air quality**

The Air Quality Standard specified by the “Sub Decree on Air and Noise Pollution Control” (1999) is shown in Table 7.1-18 and Table 7.1-19.

Table 7.1-18 Air Quality Standard

No.	Parameter	(unit: mg/m ³)			
		Hourly Average mg/m ³	Eight hourly Average mg/m ³	Daily Average mg/m ³	Yearly Average mg/m ³
1	Carbon monoxide (CO)	40	20	-	-
2	Nitrogen dioxide (NO ₂)	0.3	-	0.1	-
3	Sulfur dioxide (SO ₂)	0.5	-	0.3	0.1
4	Ozone (O ₃)	0.2	-	-	-
5	Lead (Pb)	-	-	0.005	-
6	Total Suspended Particulate (TSP)	-	-	0.33	0.1

Source: Sub Decree on Air and Noise Pollution Control (1999), Annex 1

Table 7.1-19 Maximum Allowance Concentration of Hazardous Substance in Ambient Air

No.	Parameter	Formula	Maximum Allowance Level (mg/m ³)
1	Aniline	C ₆ H ₅ NH ₂	0.03
2	Ammonia	NH ₃	0.2
3	Acetic Acid	CH ₃ COOH	0.2
4	Sulfuric Acid	H ₂ SO ₄	0.3
5	Nitric Acid	HNO ₃	0.4
6	Ben Zene	C ₆ H ₆	1
7	Ben Zidine	NH ₂ C ₆ H ₄ C ₆ H ₄ NH ₂	
8	Carbondisulfide	CS ₂	0.02
9	Chloroform	CH ₃ Cl ₃	0.01
10	Carbontetracjloride	CCl ₄	3
11	Particle containing Asbestos	-	
12	DDT	C ₈ H ₁₁ Cl ₄	0.5
13	Formaldehyde	HCOH	0.012
14	Hydrogen Arsenic	AsH ₃	0.002
15	Hydrogen Cyanide	HCN	0.01
16	Hydrogen Fluoride	HF	0.002
17	Hydrogen Sulfide	H ₂ S	0.001
18	Phenol	C ₆ H ₅ OH	0.01
19	Styrene	C ₆ H ₅ CHCH ₂	0.003
20	Tetra Chloroethylene	C ₂ Cl ₄	0.1
21	Tetraethyle Lead	Pb(C ₂ H ₅) ₄	0.005
22	Tri Chloroethylene	C ₁ CHCCl ₂	0.2
23	Toluene	C ₆ H ₅ CH ₃	0.4
24	Vinyl Chloride	C ₁ CHCH ₂	0.05
25	Arsenic (Compound organic)	As	0.00001
26	Cadmium (Compound & Oxide)	Cd	0.003
27	Chromium (Compound & Metal)	Cr	0.0015
28	Nickel (Compound & Metal)	Ni	0.0002
29	Mercury (Compound & Metal)	Hg	0.0001
30	Petrol		5

Source: Sub Decree on Air and Noise Pollution Control (1999), Annex 1

b) Noise

Noise standard is specified in the “Sub Decree on Air and Noise Pollution Control” (1999).

Table 7.1-20 Maximum Permitted Noise Level in Public and Residential Area

Unit : dB(A)

No.	Area	Time Zone		
		6:00 - 18:00	18:00- 22:00	22:00 - 6:00
1	Quiet areas - Hospitals - Libraries - School - Kindergarten	45	40	35
2	Residential area: - Hotels - Administration offices - House	60	50	45
3	Commercial and service area and mix	70	65	50
4	Small industrial factories intermingling in residential areas	75	70	50

Remark: This standard is applied to control of noise level of any source of activity that emitted noise into the public and residential area.

Source: Sub Decree on Air and Noise Pollution Control (1999), Annex 13

c) Water quality

Water Quality Standard is specified in “Sub-Decree on Water Pollution Control” (1999).

Table 7.1-21 Water Quality Standard

No.	Parameter	Unit	Water Quality Standard of MOE		
			River ^(*)	lake and reservoir ^(*)	Allowable limits for pollutant substance discharging to public water areas or sewer ^(**)
1	Temperature	°C	-	-	<45
2	pH	-	6.5 – 8.5	6.5 – 8.5	5-9
3	Total Suspended Solid (TSS)	mg/l	25-100	1-15	<120
4	Dissolved Oxygen (DO)	mg/l	2.0-7.5	2.0-7.5	>1
5	Biological Oxygen Demand (BOD5)	mg/l	1-10	-	<80
6	Chemical Oxygen Demand (COD)	mg/l	-	1-8	<100
7	Total Nitrogen	mg/l	-	0.1-0.6	-
8	Total Phosphorus	mg/l	-	0.005-0.05	-
9	Total Coliform	MPN/100ml	< 5000	< 1000	-

Source: ^(*) Extraction from Annex 4 of the Sub-Decree on Water Pollution Control

^(**) Extraction from Annex 2 of the Sub-Decree on Water Pollution Control

(3) ROW (Right-of-Way)**a) Road/ Railway**

The ROW of the National, Provincial and Communal Road and Railway is specified in “Prakas No.961 Regarding the Implementation of Right of Way Policy on National Roads, Provincial Roads, Communal Roads, and Railway in Cambodia” (2000), which MPWT issued to Provincial Agencies. After Prakas No.961 is amended, the ROW of the national road with one digit and two digits supervised by MPWT is specified by the “Sub-Decree on the Right of way of the National Road and Railways of the Kingdom of Cambodia” (2009). In cases where the road passes the capital city, provincial city or a crowded city area, however, this Sub-Decree does not apply. Table 7.1-22 shows the ROW dimensions of the Road and the Railway.

Table 7.1-22 ROW Dimensions

Road Category	ROW Dimensions
National Road with one digit	30 m from the centerline
National roads with two digit	25 m from the centerline
Provincial/city roads with three digits	20 m from the centerline
Commune/village roads	15 m from the centerline
Railway outside city, province and crowned place	30 m from the centerline
Railways in forest area	100 m from the centerline

Source: Sub-Decree on Right of way of National road and Railroads of the Kingdom of Cambodia, 2009
Sechkdey Prakas No.6: Measures to Crack Down on Anarchic Land Grabbing and Encroachment, 1999

b) Overhead Transmission Line

The standards of the clearance of OHL is set up on Electric Power Technical Standards of the Kingdom of Cambodia, Electricity Authority of Cambodia, 2007.

EDC set up ROW based on Electric Power Technical Standards in consideration of the safely. The transmission line of 230kV and 115kV incorporates a 30m ROW, covering 15 m either side of the centerline, where settlement and structures will not be permitted and 3m vegetation height restrictions will apply. However, in urban area the 115kV transmission line incorporates 15m ROW for settlement and structures, covering 7.5m either side of the centerline.

(4) IEIA/EIA procedure in Cambodia

a) Criteria required IEIA/EIA

The Annex of the “Sub-Decree on Environmental Impact Assessment Process” (No.72 ANRK.BK, 1999)” shows the projects which require an IEIA/EIA.

Though the list of the Annex in this Sub-Decree does not include the transmission line project, but the new Declaration (United Declaration for public service contribution of MOE, No. 999, 28 December 2012) issued on the 28th, specifies that the transmission line whose scale is 115 kV and more requires IEIA approval.

Table 7.1-23 Electric Development Project Required IEIA/EIA

IX		Other Industries
1.	Waste processing, burning	All sizes
2.	Waste water treatment plants	All sizes
3.	Power plants	≥ 5 MW
4.	Hydropower	≥ 1 MW
5.	Cotton manufacturing	≥ 15 Tones/month
6.	Animal's food processing	≥ 10,000 Tones/year

Source: “Sub-Decree on Environmental Impact Assessment Process” (No.72 ANRK.BK, 1999), Annex

b) IEIA/EIA procedure

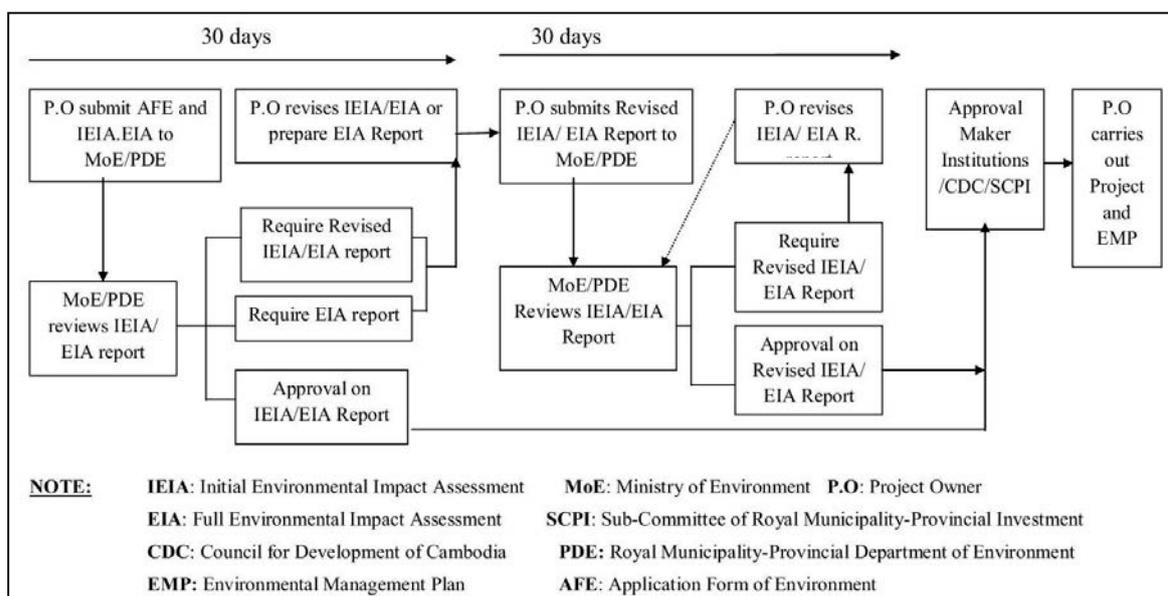
The approval procedure is shown Fig. 7.1-41.

The DEIA in MOE is in charge of reviewing IEIA/EIA reports for projects on a national level, while Municipal/Provincial Environment Departments are responsible for evaluating projects on a regional level. However, in actual, since the environmental department of local government does not have a large authority, IEIA/EIA report of the regional level project has been also submitted to DEIA.

Based on Prakas (Declaration) on General Guideline for Conducting Initial and Full Environmental Impact Assessment Reports, 2009, the project owner either, as private or ministries/government agencies must prepare an IEIA or EIA report for the projects and submit it to MOE. In the reviewing and providing comment on IEIA or EIA report shall be 30 working days counting from the date of official receipt of the report by DEIA. At the national level project, the date for reviewing and providing comments are as follows;

- DEIA has 10 working days;
- The inter-concerned department of MOE has 5 working days;
- The senior official of MOE has 5 working days;
- The inter ministries has 5 working days.

According to MOE, because currently reviewing of IEIA/EIA is organized within MOE, the 4th stage is carried out as needed. In addition, the project owner shall submit TOR (Terms of Reference) to DEIA and obtain the approval of TOR before preparing IEIA/EIA.



Source: PRAKAS on General Guideline for Conducting Initial and Full Environmental Impact Assessment Report, 02 September, 2009

Fig. 7.1-41 EIA/IEIA Approval Procedure

c) Contents of EIA/IEIA Report

The contents of an EIA/IEIA report is defined in Prakas (Declaration) on General Guideline for Conducting Initial and Full Environmental Impact Assessment Reports, (2000) as follows.

- Chapter 1 : Introduction
- Chapter 2 : Legal frameworks
- Chapter 3 : Project Description
- Chapter 4 : Description of Environmental Resources
 - 4.1 Natural Environmental Resources
 - 4.1.1 Physical Resources
 - 4.1.2 Biological Resources
 - 4.2 Socio-economic Resources
- Chapter 5 : Public participation
- Chapter 6 : Environmental Impacts and Mitigation Measures
- Chapter 7 : Environmental Management Plan
- Chapter 8 : Economic Analysis and Environmental Value
- Chapter 9 : Conclusion and Recommendations
- References
- Annexes

d) Public consultation

Public consultation will be done through community leaders in the commune and village. The participants are the village chief/vice chief, commune council members or policemen, and people from the village. The public consultation is held during the IEIA study period.

e) Resettlement and land acquisition

The policy framework of the resettlement has not been systematized yet in Cambodia. A practical and political measure of resettlement follows the Cambodian Constitution (1993),

Land Law (2001) and Expropriation Law (2010). The RD (Resettlement Department) of MEF (Ministry of Economy and Finance) is in charge of the political measures of the resettlement for public works managed by the national government. The policy of resettlement and land expropriation for each project are discussed in the IRC (Inter-ministerial Resettlement Committee) whom RD serves as a secretariat. IRC is composed of MEF, MPWT, MLMUPC (Ministry of Land Management, Urban Planning and Construction) and related province/city organizations. MEF heads up IRC.

On the other hand, the government document issued on December 28, 2012 stipulates that EDC is responsible for the resettlement and land expropriation for projects that EDC is involved in. In the case of this Project, therefore, EDC will take care of those issues coordinated with DPWT, MLMUPC and other related organizations if this project requires land expropriation and resettlement. In the event that any project requires them, EDC shall implement a survey on a social economic reconnaissance and estimation of the land acquisition. Based on the survey result, EDC negotiates a compensation or resettlement action plan with the affected people or land owner, consulting with other related organizations as needed.

(5) Categorization

The project area is not located in a sensitive area, and has none of the sensitive characteristics under the JICA Guideline, it is not likely to have significant adverse impact on the environment. Therefore this project is classified as Category B.

This Project is categorized as B in Cambodia according to MOE, and must conduct IEIA.

7.1.4.2 Organization in charge of Environmental and Social Considerations

(1) EDC

The Social, Environmental & Public Relations Office under the Corporate Planning & Project Department in EDC was founded on July 7, 2003 and began to operate practically from May 9, 2004 because no staff was assigned at first. They are in charge of Environmental and Social Considerations including IEIA/EIA, land acquisition, resettlement and waste management etc. regarding the EDC project. One of their outputs is the IEIA report for the Kampot - Sihanoukville Transmission Line (December 2005) funded by ADB (Asian Development Bank).

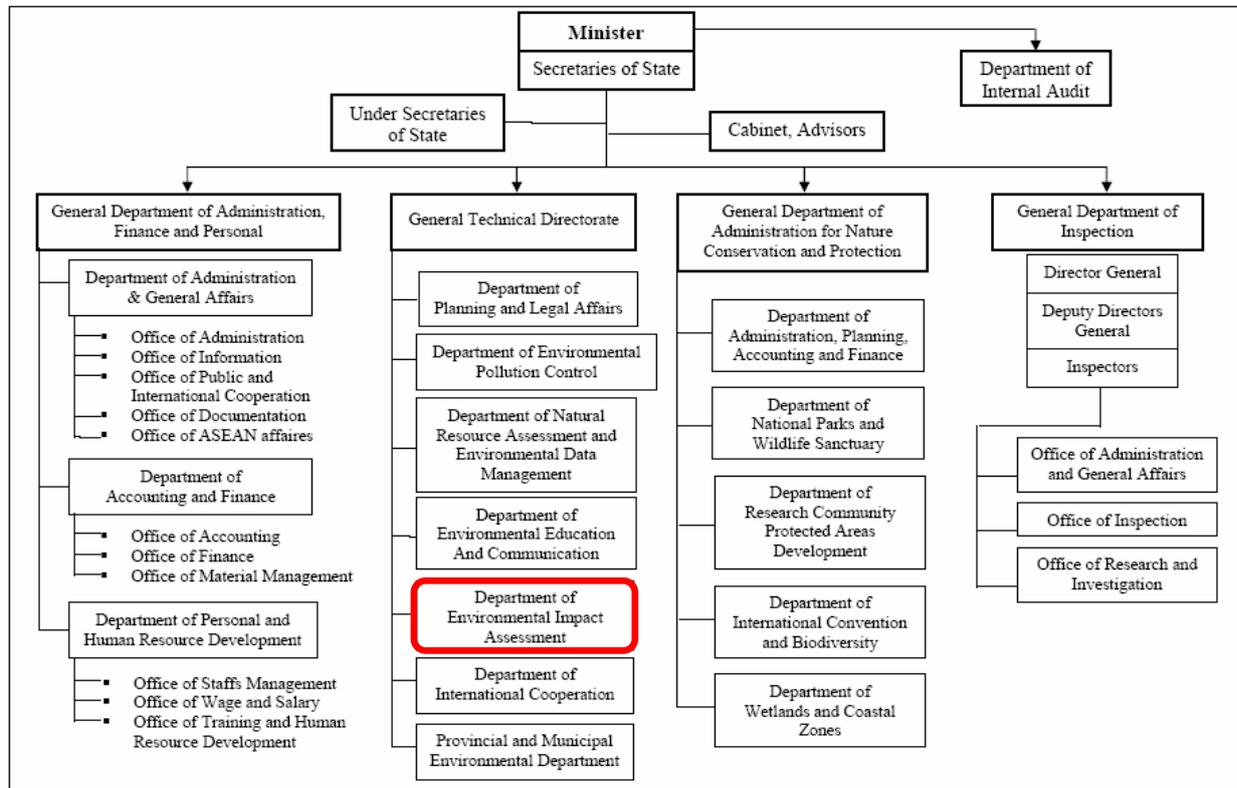
The Social, Environmental & Public Relations Office will cooperate with the Procurement Office of EDC, DPWT and DLMUPC (Department of Land Management, Urban Planning and Construction), etc. of the Phnom Penh Municipality when the project faces the issue of resettlement or land acquisition.

This office had eight staff in total as of September, 2014.

(2) MOE

MOE is empowered by law to protect and enhance the nation's environmental resources and implement sub-decrees related to EIA, air and water pollution control, and solid waste management that aim to mitigate environmentally damaging activities. The Sub-decree on the EIA Process in article 3 stated that MOE has the duties to examine and evaluate the EIA report in collaboration with other line-ministries, and to conduct monitoring during the project construction, operations, and closure for assuring that the project activities are in compliance with the guideline/standards of Cambodia and EMP (Environmental Management Plan) in the approved IEIA/EIA report.

The DEIA is funded under the General Technical Department of MOE in 1994 and in charge of checking IEIA /EIA and the monitoring of the EMP for the public and private project. An organizational chart is shown in Fig. 7.1-42.



Source: DEIA, MOE

Fig. 7.1-42 Organization Chart of MOE

(3) Related organization in the National Government

a) MPWT

The MPWT has three general directorates (General Directorate of Administrative Service, General Directorate of Transports and General Directorate of Public Works), Department of General Inspection, and Department of Finance Audit Control as the government ministry and twenty four Public Work Divisions per region. The MPWT is involved in the preparation of the Sub-Decree regarding the national roads and the railway road and supervises the national road with one digit and two digits and the provincial road.

b) DPWT

The DPWT is the outpost agency of MPWT in the provinces. DPWT in Phnom Penh Municipality is responsible for the construction and maintenance of transportation infrastructures such as roads or bridges in Phnom Penh City.

c) Ministry of Mines and Energy (MME)

MME controls the administration of law and regulation, planning of strategy and technical standards in the power sector.

b) Police and transport police in the Phnom Penh Municipality

The Phnom Penh Municipality Police and the Office of Traffic Police are responsible for traffic control, nabbing traffic offenders and investigating traffic accidents, etc. in accordance with the Law on Land Traffic.

7.1.5 Scoping and TOR of Environmental and Social Consideration Study**(1) Scoping**

The draft scoping is shown in Table 7.1-24.

Table 7.1-24 Scoping

	No.	Impact Item	Evaluation		Evaluation Reason
			Construction	Operation	
Pollution Control	1	Air Pollution	B-	D	Under Construction: Impact on air quality is expected by dust and emission due to operation of construction vehicles. But the scale of the work is small and affected area is limited. Operation: Works which cause air pollution are not expected.
	2	Water Quality	B-	C-	Under Construction: The water quality of the lake may be degraded due to landfill for towers and temporary road. There is a possibility of water pollution by waste water from construction site, heavy equipment, construction vehicles and construction quarters. Operation: There is a possibility of water pollution by contamination of insulating oil for transformer.
	3	Wastes	B-	D	Under Construction: Occurrence of construction waste and waste soil is expected. Operation: Occurrence of waste which affects to the surrounding environment is not expected.
	4	Soil	C-	C-	Under Construction: There is a possibility of the soil pollution by outflow of construction oil. Operation: There is a possibility of soil pollution by contamination of insulating oil for transformer.
	5	Noise/Vibration	B-	B-	Under Construction: Noise from construction equipment and vehicles is expected. Operation: Impact of noise and vibration on residents by operation of substations is expected.
	6	Ground Subsidence	D	D	Works which cause ground subsidence are not expected.
	7	Odor	D	D	Works which cause water odor are not expected.
	8	Bottom Sediment	D	D	Works which cause bottom sediment are not expected.
Natural Environment	9	Protected Area	D	D	There is no protected area in the project area and its surrounding.
	10	Ecosystem	B-	C-	Under Construction: The habitat of aquatic biota may be disturbed due to landfill for towers and temporary road. There is a possibility that loss and divide habitat of flora and fauna, but the affected area is limited. Operation: There is a possibility which impact on fly of bird by development of transmission lines.
	11	Hydrology	D	D	Works which impact on hydrology are not expected.
	12	Topography / Geography	B-	D	Under Construction: It is expected the impact on Topography and Geology is limited, because any cut is not planned and fill is not large scale on Chroy Changvar. Operation: Works which affect topography and geology are not expected.
Social Environment	13	Land Acquisition / Resettlement	B-	D	Under Planning: Land acquisition is necessary for development of substations and OHL. There is a possibility that resettlement occur for development of OHL. Operation: Works which cause land acquisition and resettlement are not expected.
	14	Poverty Group	C-	D	Before Construction: There is a possibility that affected people as a target of compensation for resettlement and land acquisition include poverty. Operation: Works which impact on poverty are not expected.
	15	Ethnic Minority / Indigenous People	D	D	There is no ethnic minority and indigenous people in the project area and its surrounding.

	No.	Impact Item	Evaluation		Evaluation Reason
			Construction	Operation	
Social Environment	16	Local Economy (Employment and Livelihood, etc.)	B±	B±	Under Construction: Employment of local people due to the construction work is expected. On the other hand, while it is limited, reduction of cropland due to land acquisition for tower sites is expected. The fishery may be affected due to landfill for towers and temporary road. Operation: Livelihood can lead to be diverse due to a stable power supply. On the other hand, while it is limited, the reduction of crop yields is expected due to loss of cropland. Fish catches may reduce.
	17	Land Use / Use of Regional Resource (including Traffic)	B-	B-	Under Construction/Operation: The restriction of land use under OHL is expected.
	18	Water Use	C-	D	Under Construction: There is a possibility that turbid water under construction cause the impact if local people use the water of the river around the project area. Operation: Works which impact on water use are not expected.
	19	Existing Social Infrastructure, Social Service	B-	B+	Under Construction: The traffic jam is expected due to the roadblock by the construction of UG. Operation: The stable power supply can lead to improve the social service such as school and hospital.
	20	Social Capital / Local Social Organization of Decision-making	C-	D	Under Construction: There is a possibility that consultation and assessment of compensation for land acquisition impact on social capital and organization. Operation: The impact on social capital and local social organization of decision-making is not expected.
	21	Uneven distribution of benefits and damage	B-	B-	Under Construction/Operation: The restriction of land use under OHL for land owners is expected.
	22	Conflict of Interest in the Region	B-	D	Under Construction: There is a possibility that consultation and assessment of compensation for land acquisition cause a conflict of interest. Operation: Regional conflict of interest is not expected.
	23	Cultural Heritage	D	D	There is no cultural heritage in the project area and its surrounding.
	24	Landscape	B-	B-	There is no landscape resource in the project area and its surrounding, but loss of local landscape by construction of OHL is expected.
	25	Gender	C-	C-	The negative impact on gender is not expected. However it should be conducted a field survey of interview to implementation organization and assessed the impact on gender.
	26	Children's Rights	C-	C-	The negative impact on children's rights is not expected. However it should be conducted a field survey of interview to implementation organization and assessed the impact on children's rights.
	27	Infections (HIV/AIDS, etc.)	B-	D	Under Construction: Extent of infections due to the inflow of construction workers is expected. Operation: Impact of infection is not expected.
	28	Working Condition	B-	D	Under Construction: It is necessary to consider working condition of construction workers. Operation: Works which impact on working condition are not expected.
	Others	29	Accidents	B-	D
30		Impact across the Border, Climate Change	D	D	The project is development of substations and transmission lines, and the scale of construction is small. Therefore it causes little impact across the border and climate change.

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected.

Source: JICA Study Team

(2) TOR of environmental and social consideration study

Survey according to Table 7.1-25 is carried out on items assumed negative impact in the draft scoping.

Table 7.1-25 TOR

Classification	Impact Item	Survey Item	Method
Alternative	Examination of alternatives	① Zero option ② Construction method ③ Transmission lone route	① Examination to minimize the number of resettlement household and land acquisition, to maximize the benefits of the project ② Examination of construction method to reduce the environmental impact and the traffic jam ③ Examination of the route of transmission lines to minimize the environmental impact
Physical Environment	Air Quality	① Confirmation of environmental standards ② Understanding of current state of air quality ③ Assessment of impact under construction	① Existing document research ② Existing document research, collection of information in related organizations ③ Confirmation of contents of construction, construction method, duration, location, range, type of construction equipment, operation location, operation period, number of running construction vehicle, running period, driving route, etc.
	Water Quality	① Confirmation of environmental standards ② Water quality of the river and the lake ③ Use situation of the river water ④ Assessment of impact under construction	① Existing document research ② Existing document research, collection of information in related organizations, water quality analysis of the lake ③ Existing document research, interview in and around the project area ④ Confirmation of contents of construction, construction method, duration, location, range, type of construction equipment, operation location, operation period, number of running construction vehicle, running period, driving route, etc.
	Waste	① Treatment method of construction waste	① Interview to related organizations, similar case study
	Soil Pollution	① Prevention measure of oil leakage under construction ② Prevention measure of oil leakage of transformer	① Confirmation of contents of construction, construction method, duration, location, range, type, operation period, and storage position of construction equipment, etc. ② Existing document research
	Noise / Vibration	① Confirmation of environmental standard ② Confirmation of the distance between residential area (including schools, hospitals) and the source ③ Assessment of impact under construction	① Existing document research ② Interview and site survey ③ Noise survey before construction ④ Confirmation of contents of construction, construction method, duration, location, range, type of construction equipment, operation location, operation period, number of running construction vehicle, running period, driving route, etc.
Natural Environment	Ecosystem	① Assessment of impact on organisms in and around the project area. ② Assessment of impact on the ecosystem	① Existing document research, interview to related organizations and local residents ② Bird survey, fish and fishery survey
	Topography / Geography	① Assessment of impact under construction	① Existing document research
Social Environment	Land acquisition / Resettlement	① Confirmation of the scale of land acquisition and resettlement ② Preparation of resettlement action plan if land acquisition and resettlement occur	① Existing document research (related legal system and existing case, etc.) ② Confirmation of land use situation of the project area with satellite photo, land use map and site survey ③ Confirmation of presence and type (house, school, hospital, etc.) of buildings with satellite photo and site survey ④ Socio economic survey for affected people and residents in affected villages ⑤ Preparation of resettlement action plan based on Lands Act in Cambodia, JICA guideline, and Operational Policy 4.12 of WB
	Poverty	① Confirmation of possibility that affected people include poverty	① Interview to related organization and local residents ② Socio economic survey for affected people and residents in affected villages
	Existing Social Infrastructure and Social Service (including Traffic)	① Confirmation of impact of traffic jam	① Traffic volume survey before construction
	Infections (HIV/AIDS, etc.)	① HIV/AIDS prevalence around the project area ② Organization engaging in related activities	① Existing document research, interview to related organizations, ② Interview to related organizations
	Working Condition (including Working Safety)	① Measure for working safety	① Similar case survey
	Accident	① Increase of traffic accident during operation period (distribution situation of houses and various facilities, distance and positional relationship between the movement of people and the transportation facilities)	① Existing document research, site reconnaissance
	Stakeholder Consultation (SHM)	① Collecting opinions from relevant organizations ② Collecting opinions from affected people and Affected communities	① Organization of the stakeholder consultation ② Organization of the public consultation

Source: JICA Study Team

7.1.6 Result of Environmental and Social Consideration Survey

The outline of result of the environmental and social consideration survey conducted according to the scoping is shown in Table 7.1-26.

Table 7.1-26 Result of the Survey

Items	Survey result																																																															
Air quality	<p>➤ The environmental standard of Cambodia is shown below;</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Parameter</th> <th>Hourly Average</th> </tr> </thead> <tbody> <tr> <td>CO (mg/m³)</td> <td>40</td> </tr> <tr> <td>NO₂ (µg/m³)</td> <td>300</td> </tr> <tr> <td>SO₂ (µg/m³)</td> <td>500</td> </tr> </tbody> </table> <p>➤ The previous survey result is shown below. In 2005, the CO, NO₂ and SO₂ concentrations are lower than the environmental standard.</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th rowspan="2">Parameter</th> <th colspan="2">2001</th> <th colspan="2">2002</th> <th colspan="2">2003</th> <th colspan="2">2005</th> </tr> <tr> <th>Mean</th> <th>Max</th> <th>Mean</th> <th>Max</th> <th>Mean</th> <th>Max</th> <th>Mean</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>CO(mg/m³)</td> <td>3.94</td> <td>6.25</td> <td>3.06</td> <td>3.5</td> <td>4.37</td> <td>5.25</td> <td>4.32</td> <td>5.62</td> </tr> <tr> <td>NO₂(µg/m³)</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>0.022</td> <td>0.038</td> </tr> <tr> <td>SO₂(µg/m³)</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>106.6</td> <td>215.8</td> </tr> </tbody> </table>	Parameter	Hourly Average	CO (mg/m ³)	40	NO ₂ (µg/m ³)	300	SO ₂ (µg/m ³)	500	Parameter	2001		2002		2003		2005		Mean	Max	Mean	Max	Mean	Max	Mean	Max	CO(mg/m ³)	3.94	6.25	3.06	3.5	4.37	5.25	4.32	5.62	NO ₂ (µg/m ³)	-	-	-	-	-	-	0.022	0.038	SO ₂ (µg/m ³)	-	-	-	-	-	-	106.6	215.8											
Parameter	Hourly Average																																																															
CO (mg/m ³)	40																																																															
NO ₂ (µg/m ³)	300																																																															
SO ₂ (µg/m ³)	500																																																															
Parameter	2001		2002		2003		2005																																																									
	Mean	Max	Mean	Max	Mean	Max	Mean	Max																																																								
CO(mg/m ³)	3.94	6.25	3.06	3.5	4.37	5.25	4.32	5.62																																																								
NO ₂ (µg/m ³)	-	-	-	-	-	-	0.022	0.038																																																								
SO ₂ (µg/m ³)	-	-	-	-	-	-	106.6	215.8																																																								
Water quality	<p>➤ The environmental standard of Cambodia is shown below;</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th rowspan="2">No.</th> <th rowspan="2">Parameter</th> <th rowspan="2">Unit</th> <th colspan="3">Water Quality Standard of MOE</th> </tr> <tr> <th>River^(*)</th> <th>lake and reservoir</th> <th>Allowable limits for pollutant substance discharging to public water areas or sewer</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Temperature</td> <td>°C</td> <td>-</td> <td>-</td> <td><45</td> </tr> <tr> <td>2</td> <td>pH</td> <td>-</td> <td>6.5 – 8.5</td> <td>6.5 – 8.5</td> <td>5-9</td> </tr> <tr> <td>3</td> <td>TSS</td> <td>mg/l</td> <td>25-100</td> <td>1-15</td> <td><120</td> </tr> <tr> <td>4</td> <td>DO</td> <td>mg/l</td> <td>2.0-7.5</td> <td>2.0-7.5</td> <td>>1</td> </tr> <tr> <td>5</td> <td>BOD</td> <td>mg/l</td> <td>1-10</td> <td>-</td> <td><80</td> </tr> <tr> <td>6</td> <td>COD</td> <td>mg/l</td> <td>-</td> <td>1-8</td> <td><100</td> </tr> <tr> <td>7</td> <td>Total Nitrogen</td> <td>mg/l</td> <td>-</td> <td>0.1-0.6</td> <td>-</td> </tr> <tr> <td>8</td> <td>Total Phosphorus</td> <td>mg/l</td> <td>-</td> <td>0.005-0.05</td> <td>-</td> </tr> <tr> <td>9</td> <td>Total Coliform</td> <td>MPN/100ml</td> <td>< 5000</td> <td>< 1000</td> <td>-</td> </tr> </tbody> </table> <p>➤ In the result of the Mekong River in July 2013, the turbidity is above the standard, however this phenomenon occurs commonly in the rainy season in Cambodia.</p> <p>➤ The water supply improvement almost is developed in Phnom Penh City. On the other hand, in the right side area of the Tonle Sap River near Chroy Changvar S/S, the water of canal and pond is used as living water.</p>	No.	Parameter	Unit	Water Quality Standard of MOE			River ^(*)	lake and reservoir	Allowable limits for pollutant substance discharging to public water areas or sewer	1	Temperature	°C	-	-	<45	2	pH	-	6.5 – 8.5	6.5 – 8.5	5-9	3	TSS	mg/l	25-100	1-15	<120	4	DO	mg/l	2.0-7.5	2.0-7.5	>1	5	BOD	mg/l	1-10	-	<80	6	COD	mg/l	-	1-8	<100	7	Total Nitrogen	mg/l	-	0.1-0.6	-	8	Total Phosphorus	mg/l	-	0.005-0.05	-	9	Total Coliform	MPN/100ml	< 5000	< 1000	-
No.	Parameter				Unit	Water Quality Standard of MOE																																																										
		River ^(*)	lake and reservoir	Allowable limits for pollutant substance discharging to public water areas or sewer																																																												
1	Temperature	°C	-	-	<45																																																											
2	pH	-	6.5 – 8.5	6.5 – 8.5	5-9																																																											
3	TSS	mg/l	25-100	1-15	<120																																																											
4	DO	mg/l	2.0-7.5	2.0-7.5	>1																																																											
5	BOD	mg/l	1-10	-	<80																																																											
6	COD	mg/l	-	1-8	<100																																																											
7	Total Nitrogen	mg/l	-	0.1-0.6	-																																																											
8	Total Phosphorus	mg/l	-	0.005-0.05	-																																																											
9	Total Coliform	MPN/100ml	< 5000	< 1000	-																																																											
Waste	<p>➤ The waste generated by construction are expected construction waste and soil and so on.</p> <p>➤ Industrial waste have been brought in Stung Mean Chey disposal site or in the hazardous waste disposal site dedicated.</p>																																																															
Soil pollution	<p>➤ There is a possibility of the soil pollution by outflow of construction oil under construction.</p> <p>➤ There is a possibility of the soil pollution by contamination of insulating oil for transformer under operation.</p>																																																															
Noise/ vibration	<p>➤ The environmental standard of Cambodia is shown below;</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th rowspan="2">Area</th> <th colspan="3">Time Zone</th> </tr> <tr> <th>6:00 - 18:00</th> <th>18:00- 22:00</th> <th>22:00 - 6:00</th> </tr> </thead> <tbody> <tr> <td>Commercial and service area and mix</td> <td>70 dB(A)</td> <td>65 dB(A)</td> <td>50 dB(A)</td> </tr> </tbody> </table> <p>➤ The result of noise survey in Phnom Penh was above the environmental standard throughout the day because of the great deal traffic.</p> <p>➤ There are little residences around the site for new construction of substations, the noise from the traffic impacted in residential areas.</p>	Area	Time Zone			6:00 - 18:00	18:00- 22:00	22:00 - 6:00	Commercial and service area and mix	70 dB(A)	65 dB(A)	50 dB(A)																																																				
Area	Time Zone																																																															
	6:00 - 18:00	18:00- 22:00	22:00 - 6:00																																																													
Commercial and service area and mix	70 dB(A)	65 dB(A)	50 dB(A)																																																													

Items	Survey result
Land acquisition/ resettlement	<ul style="list-style-type: none"> ➤ The acquired land scale for construction of Chroy Changvar substation is 32,400m² and one of GS5 is 44,100m², total of those is 76,500 m². The land for Toul Kork has already been acquired by EDC. The land use of Toul Kork is vacant land, Chroy Changvar is wetland, GS5 is fallow field. The owner of the land for Toul Kork is a private person, Chroy Changvar is a private company (Lyongphat), GS5 is a village community. ➤ The acquired land scale to construct towers and poles is 2,025m² in 230kV and 8,445 m² in 115kV. They have been used as rice land, residential area and commercial area, and so on. These owners acquired compensation are 10 private persons and 1 company in 230kV, 21 persons and 3 companies in 115kV. ➤ In ROW of 230kV, 3 structures and 128 trees were found. In ROW of 115kV, 17 structures and 780 trees were found. The scale for compensation lands in ROW is 31,830 m² in 230kV and 32,867 m² in 115kV.
Existing Social Infrastructure and Social Service (including Traffic)	<ul style="list-style-type: none"> ➤ The traffic volume per hour in front of NCC was around 1000, it was around 3000 during rush hour in the morning. The traffic volume at Russian Confederation Blvd. per hour was above 1500 during the daytime, it was from 3500 to 4000 during rush hour in the morning and evening. ➤ It is assumed that there are many existing buried objects in the area of development for UGL such as water pipes, telephone lines and drainage pipes, etc.
Infections (HIV/AIDS, etc.)	<ul style="list-style-type: none"> ➤ In Cambodia, preparation and publication of the guideline regarding HIV/AIDS by National AIDS Authority is obligated by AIDS diffusion prevention act. Construction workers belong to the high risk group in this guideline. National AIDS Authority conduct the diffusion prevention measure for these groups by provision of information.
Working Condition (including working safety)	<ul style="list-style-type: none"> ➤ In Cambodia, the labor law (2002) defines the obligation to prepare the working provision and to ensure the safety of workers if the company has more than 8 workers.
Accident	<ul style="list-style-type: none"> ➤ In Cambodia, the land traffic law (2006) defines ensuring safe and orderly traffic, protection of life, mitigation for the impact on human health and for odor. On the other hand, installation of traffic sign under construction is not defined.
Stakeholder Consultation (SHM)	<ul style="list-style-type: none"> ➤ In EDC, the stakeholder meetings were organized on 29th April, 2014 of 1st SHM and on 10th September, 2014 of 2nd SHM. ➤ Local governments required the appropriate compensation by EDC. ➤ MOE advised about the procedure of approval of IEE and assessment of the impact. ➤ DPWT required early submission of the detailed design.
Public Consultation Meeting (PCM)	<ul style="list-style-type: none"> ➤ In affected villages, the public consultation meetings were organized on 30th August, 2014 of 1st PCM and on 18th October, 2014 of 2nd PCM in 230kV, and on 6th August, 2014 in 115kV. ➤ In 230 kV, there are a lot of objection for the Project. Therefore, the route of OHL was examined again. The new route was accepted by many affected villagers. ➤ The appropriate compensation was required.

Source: JICA Study Team

7.1.7 Impact Assessment

The impact by the project was assessed based on the result of the environmental and social consideration survey (Table 7.1-27). Environmental checklist is attached in Appendix 8.

Table 7.1-27 Impact Assessment

	No.	Impact Item	Scoping		Evaluation		Evaluation Reason
			Construction	Operation	Construction	Operation	
Pollution Control	1	Air Pollution	B-	D	B-	D	Under Construction: Impact on air quality is expected by dust and emission due to operation of construction vehicles. But the scale of the work is small and affected area is limited. Operation: Works which cause air pollution are not expected.
	2	Water Quality	B-	C-	B-	C-	Under Construction: The water quality of the lake may be degraded due to landfill for towers and temporary road. There is a possibility of water pollution by waste water from construction site, heavy equipment, construction vehicle and construction quarters. Operation: There is a possibility of water pollution by contamination of insulating oil for transformer.
	3	Wastes	B-	D	B-	D	Under Construction: Occurrence of construction waste and waste soil is expected. Operation: Occurrence of waste which affects to the surrounding environment is not expected.
Pollution Control	4	Soil	C-	C-	C-	C-	Under Construction: There is a possibility of the soil pollution by outflow of construction oil. Operation: There is a possibility of soil pollution by contamination of insulating oil for transformer.
	5	Noise/Vibration	B-	B-	B-	D	Under Construction: Noise from construction equipment and vehicles is expected. Operation: Impact of noise and vibration under operation of substations on the surrounding is not almost assumed.
	6	Ground Subsidence	D	D	D	D	Works which cause ground subsidence are not expected.
	7	Odor	D	D	D	D	Works which cause water odor are not expected.
	8	Bottom Sediment	D	D	D	D	Works which cause bottom sediment are not expected.
Natural Environment	9	Protected Area	D	D	D	D	There is no protected area in the project area and its surrounding.
	10	Ecosystem	B-	C-	B-	C-	Under Construction: The habitat of aquatic biota may be disturbed due to landfill for towers and temporary road. There is a possibility that loss and divide habitat of flora and fauna, but the affected area is limited. Operation: There is a possibility which impact on fly of bird by development of transmission lines.
	11	Hydrology	D	D	D	D	Works which impact on hydrology are not expected.
	12	Topography / Geography	B-	D	B-	D	Under Construction: It is expected the impact on Topography and Geology is limited, because any cut is not planned and fill is not large scale on Chroy Changvar. Operation: Works which affect topography and geology are not expected.
Social Environment	13	Land Acquisition / Resettlement	B-	D	B-	D	Under Planning: Land acquisition is necessary for development of substations and OHL. Resettlement will occur by development of OHL. Operation: Works which cause resettlement are not expected.
	14	Poverty Group	C-	D	D	D	Works which impact on poverty are not expected.
	15	Ethnic Minority / Indigenous People	D	D	D	D	There is no ethnic minority and indigenous people in the project area and its surrounding.
	16	Local Economy (Employment and Livelihood, etc.)	B±	B±	B±	B±	Under Construction: Employment of local people due to the construction work is expected. On the other hand, while it is limited, reduction of cropland due to land acquisition for tower sites is expected. The fishery may be affected due to landfill for towers and temporary road. Operation: Livelihood can lead to be diverse due to a stable power supply. On the other hand, while it is limited, the reduction of crop yields is expected due to loss of cropland. Fish catches may reduce.

	No.	Impact Item	Scoping		Evaluation		Evaluation Reason
			Construction	Operation	Construction	Operation	
Social Environment	17	Land Use / Use of Regional Resource	B-	B-	B-	B-	Under Construction/Operation: The restriction of land use under OHL is expected.
	18	Water Use	C-	D	B-	D	Under Construction: There is a possibility that turbid water under construction cause the impact on local people who use the water of the channel around the project area. Operation: Works which impact on water use are not expected.
	19	Existing Social Infrastructure, Social Service (including Traffic)	B-	B+	B-	B+	Under Construction: The traffic jam is expected due to the roadblock by the construction of UG. Operation: The stable power supply can lead to improve the social service such as school and hospital.
	20	Social Capital / Local Social Organization of Decision-making	C-	D	C-	D	Under Construction: There is a possibility that consultation and assessment of compensation for land acquisition impact on social capital and organization. Operation: The impact on social capital and local social organization of decision-making is not expected.
	21	Uneven distribution of benefits and damage	B-	B-	B-	B-	Under Construction/Operation: The restriction of land use under OHL for land owners is expected.
	22	Conflict of Interest in the Region	B-	D	B-	D	Under Construction: There is a possibility that consultation and assessment of compensation for land acquisition cause a conflict of interest. Operation: Regional conflict of interest is not expected.
	23	Cultural Heritage	D	D	D	D	There is no cultural heritage in the project area and its surrounding.
	24	Landscape	B-	B-	D	D	Since there is no landscape resource in the project area and its surrounding, and OHL has been already existing around the project area, the impact on regional landscape is not expected.
	25	Gender	C-	C-	D	D	The negative impact on gender is not expected.
	26	Children's Rights	C-	C-	B-	D	Under Construction: There is a possibility that children are employed as a worker. Operation: There is no element that infringes on children's rights.
Others	27	Infections (HIV/AIDS, etc.)	B-	D	B-	D	Under Construction: Extent of infections due to the inflow of construction workers is expected. Operation: Impact of infection is not expected.
	28	Working Condition	B-	D	B-	D	Under Construction: It is necessary to consider working condition of construction workers. Operation: Works which impact on working condition are not expected.
	29	Accidents	B-	D	B-	D	Under Construction: It is necessary to consider accidents and traffic accidents. Operation: The possibility of an accident occurring is low.
	30	Impact across the Border, Climate Change	D	D	D	D	This project is development of substations and transmission lines, and the scale of construction is small. Therefore it causes little impact across the border and climate change.

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected.

Source: JICA Study Team

7.1.8 Mitigation Measures

The mitigation measures were examined about the negative impact items assumed in the impact assessment.

Table 7.1-28 Mitigation measures

No.	Items	Mitigation measure	Implementation organization	Responsible organization
1	Air pollution	<ul style="list-style-type: none"> ➢ Use of low emission machines and vehicles, appropriate maintenance of them ➢ Preventing diffusion of dust by water spray 	DCC	EDC
2	Water pollution	<ul style="list-style-type: none"> ➢ Prevention measure of suspended solid and turbidity such as the excavated sediment trap ➢ Rapid compaction of the construction surface ➢ Installation of the oil trap to prevent the insulating oil of transformer from flowing out and separation of the position of the device with the drainage system 	DCC	EDC
3	Waste	<ul style="list-style-type: none"> ➢ Appropriate treatment of waste 	DCC	EDC
4	Soil pollution	<ul style="list-style-type: none"> ➢ Appropriate maintenance of construction vehicles and machines ➢ Installation of the oil trap to prevent the insulating oil of transformer from flowing out and separation of the position of the device with the drainage system 	DCC	EDC
5	Noise/ vibration	<ul style="list-style-type: none"> ➢ Use of low emission machines and vehicles ➢ Explanation of the work schedule to local people ➢ Restrictions of the construction time 	DCC	EDC
10	Ecosystem	<ul style="list-style-type: none"> ➢ Minimization of deforestation and disturbance of habitats ➢ Appropriate measure if the vast dead of fish occurs ➢ Prevention Measures to catch by OHL such as Bird Fly Diverter 	DCC EDC	EDC
12	Topography / Geography	<ul style="list-style-type: none"> ➢ Minimization of disturbance of area 	DCC EDC	EDC
13	Land acquisition/ resettlement	<ul style="list-style-type: none"> ➢ Implementation of appropriate compensation and resettlement 	EDC	EDC
16	Local Economy (Employment and Livelihood, etc.)	<ul style="list-style-type: none"> ➢ Setting of the start of construction to avoid the harvest season ➢ Appropriate compensation for land acquisition ➢ Appropriate measures if fish catch greatly reduces 	DCC EDC	EDC
17	Land use and Use of Regional Resource	<ul style="list-style-type: none"> ➢ Appropriate compensation 	EDC	EDC
18	Water use	<ul style="list-style-type: none"> ➢ Prevention measure of suspended solid and turbidity such as the excavated sediment trap 	DCC	EDC
19	Existing Social Infrastructure, Social Service (including Traffic)	<ul style="list-style-type: none"> ➢ Installation of traffic induction staffs during construction ➢ Implementation of pipe jacking methods at the place that a heavy traffic jams occurs ➢ Implementation of temporary excavation and underground buried object investigation in the drilling range before construction 	DCC EDC PIC	EDC
20	Social Capital / Local Social Organization of Decision-making	<ul style="list-style-type: none"> ➢ Organization of appropriate public consultation meetings and stakeholder meetings 	EDC	EDC
21	Uneven distribution of benefits and damage	<ul style="list-style-type: none"> ➢ Appropriate compensation 	EDC	EDC
22	Conflict of Interest in the Region	<ul style="list-style-type: none"> ➢ Organization of appropriate public consultation meetings and stakeholder meetings 	EDC	EDC
26	Children's rights	<ul style="list-style-type: none"> ➢ Compliance with the laws 	DCC	EDC
27	Infections (HIV/AIDS, etc.)	<ul style="list-style-type: none"> ➢ Education and awareness program to workers 	DCC	EDC
28	Working condition	<ul style="list-style-type: none"> ➢ Preparation and compliance of Safety Management Plan 	DCC	EDC
29	Accident	<ul style="list-style-type: none"> ➢ Wearing of basic safety equipment such as safety shoes, gloves and helmet ➢ Wearing safety best at high place ➢ Installation of warning signs 	DCC	EDC

DCC: Design and construct contractor

Source: JICA Study Team

7.1.9 Monitoring Plan

7.1.9.1 EMP and Implementation System

The implementation system of EMP is shown in Table 7.1-29. EDC is responsible for entire implementation of the project. DCC prepares the enforcement plan including the safety and EMP and implements it. PIC (Project Implementation Consultant) reviews the plan and requires the appropriate measure to DCC in the case that any problem occur in the construction phase.

In the case that residents in the project area have grievance or any environmental and social problems occurs, PMO (Project Management Office) which is charge of technical operations is responsible for them. Social, Environmental & Public Relations Office of EDC takes care the problems in cooperation with PMO if necessary. In addition, in the case that the related districts and Phnom Penh Municipality receive the grievances from the public, they are also informed to EDC and EDC will attempt to solve them.

Table 7.1-29 Environmental Management Responsibilities

Organization	Responsibilities
EDC	<ul style="list-style-type: none"> ➤ EDC is directly responsible for the implementation, management and supervision of the project, including IEIA and EMP requirement. ➤ The monitoring is implemented by DCC, supervised by PIC, and approved by EDC. ➤ PMO of EDC will be in charge of the overall management of the project design and construction, including implementation and internal monitoring of the EMP. ➤ A site engineer is the construction manager and performs the regular monitoring if there are any environmental and safety concerns at the construction site. ➤ Social, Environmental and Public Relations Office under the Corporate Planning and Project Department of EDC cooperates with PMO and go to check the construction sites if an environmental and social consideration occurs. ➤ PMO receives all complains and grievances which arise in the course of the implementation of project, if any.
DCC	<ul style="list-style-type: none"> ➤ DCC prepares the final project design according EMP. ➤ DCC prepares the enforcement plan including the safety and EMP and implements it.
PIC	<ul style="list-style-type: none"> ➤ PIC manages the overall project along EMP. ➤ PIC reviews the safety and EMP prepared by DCC.
MOE Environmental Impact Inspection office of Phnom Penh Municipality and Kandal Province	<ul style="list-style-type: none"> ➤ They are in charge of the monitoring of IEIA and EMP requirement. ➤ Phnom Penh Municipality and Kandal Province receive the grievances from the public, they are also informed to EDC.

Source: JICA Study Team

7.1.9.2 Monitoring Plan

The monitoring plan was prepared according to the mitigation measures (see Table 7.1-30). Monitoring form and monitoring cost are attached in Appendix-8.

Table 7.1-30 Monitoring Plan

Item	Parameters to be Monitored	Location	Frequency	Implementing /Responsible Organization
Pre- construction phase				
All items	Checking the final engineering design and layout of the substations	-	Once for detailed design and one time for final design	EDC, PIC
Construction phase				
Air Quality, noise and vibration	Checking dust, noise, the construction site, construction activities and transportation and storage of construction materials.	in construction sites and storage places	Weekly	DCC
			Monthly	EDC, DCC, PIC
Water pollution	Checking the turbidity and soil sediment visually	Surface water near the construction sites	Every week, during the cutting construction period	DCC
			Every month, during the cutting construction period	EDC, DCC, PIC
Waste management	Check waste management status	in construction sites and field office	Weekly	DCC
			Monthly	EDC, DCC, PIC
Destruction of living condition of residents	Check the construction site, construction activities	in construction sites	Weekly	DCC
			Monthly	EDC, DCC, PIC
Public Health, workers safety, Children's right	Worker's condition	in construction sites	Twice in construction period	EDC, DCC, PIC
Traffic	Patrol	Around the construction site	Weekly in construction crossing active road	EDC, DCC, PIC
			Monthly	EDC, DCC
Resettlement	Check the progress of compensation	Affected villages	Quarter	EDC
Operation phase				
Safety Management	Checking the warning sign	Substation	Every year	EDC
Soil and water pollution	Checking the leakage of insulating oil from transformer	Substation	Every year	EDC

Source: JICA Study Team

7.1.10 Stakeholder Consultation

7.1.10.1 1st Stakeholder Consultation

1st stakeholder consultation was conducted on April 29th, 2014.

Overview of the project and impact assumed at this time were explained to stakeholders.

Main opinion of stakeholders and reply of EDC at the meeting is shown below and the Minute is attached in Appendix-3.

[Main opinion of related organization]

- Noted the problem that the difference between the market price at the time of negotiation and of payment done in the existing transmission line project. Therefore, it is necessary to show the stakeholders a distinct affected area.
- It is necessary to show the stakeholders the affected area and compensation procedure.
- The approval procedure of EIA has become faster because a review of EIA report is carried out only by MOE.
- It is necessary to submit TOR before commencement of the environmental study.
- International consultants should carry out IEIA / EIA with the local consultant registered in MOE.
- The Project is categorized as B, therefore it is necessary to carry out IEIA according to the guideline of EIA, Prakas No. 376.

[Reply of EDC]

- EDC make an effort to reduce the affected area as much as possible not to occur the same problem.
- EDC is not able to show a distinct affected area because detailed contents of the project are under consideration at present. EDC should inform to the related organizations after completion of the Study.
- The study team for land acquisition will be soon formed.



Photo 7.1-4 1st Stakeholder Consultation

7.1.102 2nd Stakeholder Consultation

2nd stakeholder consultation was conducted on September 10th, 2014.

After explanation of the outline of the project, the result of the survey, EIA, mitigation measures and environmental monitoring plan, the participants asked and answered questions.

Main opinion of stakeholders and reply of EDC at the meeting is shown below and the Minute is attached in Appendix-3.

[Main opinion and statement of related organization]

MOE:

- Registrations Consultant Company for study and prepare a report evaluating the environmental and social impacts, MOE was enacted on May 19th, 2014. It requires that IEIA/ EIA should be conducted by the local consultant registered by MOE.
- In the procedure of approval EIA, ministerial level of MOE will review and provide some comments after reviewing by Department of EIA, MOE.
- Since the project area is a developing area, the project is expected not to impact on wetland and pond. Therefore the description regarding water quality, fishes, birds and fishery may be removed from the environmental monitoring plan.
- The duration to obtain approval of TOR is around from 1 to 2 weeks.

DPWT:

- Since road and railway have restriction regarding ROW, the detailed drawing is necessary.
- ROW for railway is 30m from centerline. ROW to be used for public facilities is the last outer 2 meter (i.e. between 28th – 30th meters).

EDC:

- Since the 115kV transmission line from GS5 to Midpoint of NPP and WPP was conducted in 1990's, the land of towers was compensated but no compensation for ROW.



Photo 7.1-5 2nd Stakeholder Consultation

7.2 INITIAL RESETTLEMENT ACTION PLAN

7.2.1 Necessity of Land Acquisition and Resettlement

The scope of the project is new construction of 3 substations, expansion of 2 substations, development of 230kV and 115kV OHL, development of 230kV UGL, and development of 22kV distribution line (see Table 7.1-1).

Components which do not need land acquisition and resettlement in the scope and its reasons are shown below;

- NCC S/S : new construction in the site of NCC
- GS3 : expansion in the site of GS3
- UGL : development in the public lands
- Distribution line : development in the public lands

It is assumed that land acquisition and compensation are necessary for the following components.

- Toul Kork S/S (already acquired by EDC)
- Chroy Changvar S/S
- GS5
- 230kV OHL : Midpoint of NPP and WPP - GS5
- 115kV OHL : GS5 – Chroy Changvar

The proposed site of Toul Kork S/S has been already acquired by EDC.

7.2.2 Legal Framework regarding Land Acquisition and Resettlement

7.2.2.1 Law and Regulation regarding Land Acquisition and Resettlement in Cambodia

The system of land management, land expropriation and resettlement in Cambodia is based on the Cambodian Constitution (1993), Land Law (2001) and Expropriation Law (2010). The right to own land property is stipulated in the Cambodian Constitution. On the other hand, newly de facto land ownership provided by continuous use is not allowed after the Land Law enacted in 2001.

Regarding the expropriation of private property, the Cambodian Constitution and Land law allows the government to expropriate the land for only the purpose of public benefit via appropriate procedures provided by the law and after just and fair compensation which should be fair and just in advance. The Expropriation Law prescribes the principals and procedures for the legal expropriation of property including land. The ROW are stipulated by “Sechkdey Prakas No.6: Measures to Crack Down on Anarchic Land Grabbing and Encroachment” (1999) and “Regarding the Implementation of Right of way policy on National Roads, Provincial Roads, Railways in Cambodia”(2000) which mentions that any private properties existing in the ROW are not officially compensated. Nonetheless, the handling of private property in the ROW should be sensitive because the application of those regulations is on a case-by-case basis and complicated.

The policy of resettlement in Cambodia is applied only by “expropriation for the public interest” and the Expropriation Law and has not been systematized. The key laws and regulations related to land acquisition and resettlement are shown in Table 7.2-1.

Table 7.2-1 Laws and Regulations Related to Land Acquisition and Resettlement

Category	Title	Enacted Year	Summary
Basic Law	Cambodian Constitution	1993	Constitution stipulates the property of land for Cambodian, expropriation of land for public benefit and state property.
Land	Land Law	2001	The Land Law is applied with the fair and equitable compensation in advance based on the law.
Land Expropriation	Expropriation Law	2010	This Law prescribes the principals, mechanisms and procedures etc. of expropriation, including fair and equitable expropriation, compensation in advance, expropriation for the public project of infrastructure construction This law is applied to the legal expropriation of lands from owners.
Land Concession	Sub-Decree on Social Land Concessions	2003	This is the Sub-Decree enacted by the management of MLMUPC. The procedures and mechanisms for land concessions for poverty-stricken groups or individuals who have to resettle due to infrastructure development construction etc.
	Sub-Decree on Economic Land Concessions	2003	This Sub-Decree is prepared by the Ministry of Agriculture, Forestry and Fisheries and provides the article of concession for the purpose of economic development.
Illegal Occupation	Sechkdey Prakas No.6: Measures to Crack Down on Anarchic Land Grabbing and Encroachment	1999	This Prakas stipulates an ROW for the illegal occupation of roads and railway roads, though it was updated by the other Sub-Decree in 2009. Nonetheless this ROW is not applied to densely-populated areas.
	Circular on Settlement of the illegal construction on the state land in cities and urban areas	2010	This Circular describes the investigation of the illegal occupation of property, its countermeasures, and stakeholder participation etc. in order to resolve illegal occupations in urban areas.

Source: JICA Study Team

7.2.2.2 JICA's Policy on Involuntary Resettlement

The key principle of JICA policies on involuntary resettlement is summarized below.

- I. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.
- II. When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.
- III. People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.
- IV. Compensation must be based on the full replacement cost as much as possible.
- V. Compensation and other kinds of assistance must be provided prior to displacement.
- VI. For projects that entail large-scale involuntary resettlement, resettlement action plans must be

prepared and made available to the public. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.

- VII. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.
- VIII. Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.
- IX. Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

Above principles are complemented by World Bank OP 4.12, since it is stated in JICA Guideline that “JICA confirms that projects do not deviate significantly from the World Bank’s Safeguard Policies”. Additional key principle based on World Bank OP 4.12 is as follows.

- X. Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.
- XI. Eligibility of Benefits include, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.
- XII. Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based
- XIII. Provide support for the transition period (between displacement and livelihood restoration.
- XIV. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.
- XV. For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.

In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation

7.2.2.3 Gap between Cambodian System and JICA Guideline

There is a slight gap between the theory of Cambodian regulations and JICA guidelines (2010) with regards to the resettlement, land expropriation and compensation. The Land Law (2001) does not allow those who occupy ROW or common land to have the right to receive compensation or social support even though they are the vulnerable groups. In addition, Cambodian regulations do not provide political measures and the means for the people who suffer an adverse impact to recover their lost livelihood. On the other hand, JICA Guidelines (2010) initially require a project

proponent etc. to take effective consensual measures to avoid involuntary resettlement and loss of livelihood, and to minimize the adverse impact and compensate the lost in cases where the impact is inescapable. Furthermore, JICA Guidelines requires support and compensation by the project proponents etc. for the people to improve or at least restore their living standard, income opportunities and production levels to a level comparable to their pre-project level. The comparison between Cambodian regulations and JICA Guidelines is shown in Table 7.2-2.

Table 7.2-2 Comparison between Cambodian System and JICA Guidelines

	Item	New JICA Guidelines Policy	Regulation in Cambodia (officially promulgated)	Dissipating the dissociation between the Cambodian System and JICA guidelines
1	Establishment of support system for socially vulnerable groups	Socially vulnerable groups tend to be exposed to environmental and social impacts. In addition, they have limited access to the decision making process. Thus, it is necessary to give appropriate consideration to them.	The Constitution (1993) and the Land Law (2001) do not address socially vulnerable groups.	The project will comply with JICA guidelines policy. Socially vulnerable groups will be paid appropriate compensation by the Project.
2	Provide assistance to restore and improve living standards	Living standards and income opportunities, and production levels of project affected people should be improved or at least restored to their pre-project levels.	The government has no clear policy or procedure to restore the livelihood of affected people.	This Project will propose assistance to restore and improve living standard of affected peoples, if necessary.
3	Enhancement of public participation in planning and implementation of resettlement action plan	Appropriate participation by the affected people and their communities should be promoted in the planning, implementation and monitoring of involuntary resettlement plans and measures taken against the loss of their means of livelihood.	It is clearly declared in the Sub-decree on the Social Land Concession that there shall be participation from the area residents and others in initiating a national social land concession plan.	To follow both the Policy and the Regulation
4	Compensation for land acquisition with replacement costs	Prior compensation, at full replacement cost, must be provided as much as possible.	Compensation should be fair and just in advance. For legal ownership, However, “No person shall be deprived of their ownership unless this action is for the public interest consistent with formalities and procedures provided by the law and after just and fair compensation”. Therefore, compensation is not provided for other types of losses.	The project will comply with JICA guidelines policy if there is any need for compensation or land acquisition.
5	Providing support for illegal occupants	People to be resettled involuntarily and people whose means of livelihood will be hindered or lost should be sufficiently compensated and supported by project proponents at the appropriate time.	Those who have occupied the ROW or public properties are not entitled to any compensation or social support, regardless of them being an affected people or coming from a vulnerable group.	The project will comply with JICA guidelines policy.
6	Grievance redress system	A grievance redress system must be formulated and it should function appropriately.	The grievance redress system is stipulated in the Law on Expropriation (2011).	To follow both the Policy and the Regulation

Source: Final Report on Preparatory Survey for Phnom Penh Transmission Line and Distribution System Construction Project (Tokyo Electric Power Co., Ltd. etc., May 2013)

7.2.2.4 Policy on Involuntary Resettlement of the Project

The project will cooperate to JICA guideline in the point that have the gap between Cambodian system and JICA guideline.

7.2.3 Scope of Land Acquisition and Resettlement

7.2.3.1 Affected Area

(1) Chroy Changvar S/S

The land required to construct Chroy Changvar S/S is 180m × 180m including the surrounding of it. The planning area is a wetland, it is owned by Lyongphat, a developer.

(2) GS5

The land required to construct GS5 is 210m × 210m including the surrounding of it. The planning area is a fallow field, it is owned by a village community (information from EDC).

(3) 230kV OHL

230 kV OHL is total length of 10.2km and it is planned to construct 31 towers. The required land which is assumed at present is shown in Table 7.2-3.

EDC is defined that ROW of 230KV is total width of 30m, 15m from the center line. There are basically no structures in ROW, and the height of vegetation as trees is restricted within 3m.

Table 7.2-3 Land Required for Towers (230kV)

Site area (m ²)	Towers (tower)	Total site area (m ²)
15m×15m	31	6,975
Total	31	6,975

Source: JICA Study Team

(4) 115kV OHL

115kV OHL is total length of 20.2km and it is planned to construct 33 towers and 145 concrete poles. The required land which is assumed at present is shown in Table 7.2-4.

EDC is defined that ROW of 230KV is total width of 30m, 15m from the center line. There are basically no structures in ROW, and the height of vegetation as trees is restricted within 3m. The restriction for structure and residence in urban area is different, the ROW is total width of 15m, 7.5m from the center line.

Table 7.2-4 Land Required for Towers and Poles (115kV)

	Site area (m ²)	Towers (tower) / poles (pole)	Total site area (m ²)
Tower	15m × 15m	24	5,400
	20m × 20m	7	2,800
	25m × 25m	2	1,250
	Sub-total	33	9450
Pole	2m × 2m	145	580
Total		—	10,030

Source: JICA Study Team

(5) Affected Villages

The planned route of 230kV OHL is located in 15 villages of Phnom Penh City. The one of 115kV OHL is located in 10 villages of Phnom Penh City and Kandal Province.

Table 7.2-5 Affected Villages

	Village	Commune	District	Province	
230kV	Sak Prayuth	Snoar	Po Sen Chey	Phnom Penh	
	Ta Poug				
	Kol Krasnar				
	Ta En				
	Pongror				
	Veal	Traoing Krasaing			
	Ak Sar	Samoang Krom			
	Samroang				
	Chamkar Sbaeng				
	Kouk Prich				
	Thlork	Kouk Rokar	Prek Phnov		
	Trapeing Cheung Srok	Kraing Angkrorng	Sen Sok		
	Prey Kla	Kraing Thnung			
	Cheang Tornng				
	Kraing Angkrorng II				
Total	15 villages	6 communes	3 districts	1 province	
115kV	Kraing Angkrorng II	Kraing Thnung	Sen Sok	Phnom Penh	
	Prey Moul				
	Samroang Teav				
	Toul Sampov	Kouk Rokar	Prek Pnov		
	Trapeing Raing Chass	Khmuonh			
	Prek Pnov	Prek Pnov			
	Doung				
	Chrey Andet	Kampong Os	Ponhea Lueu		Kandal
	Prek Reus	Sambuor Meas	Mukh Kampoul		
Krol Ko					
Total	10 villages	6 communes	4 districts	2 provinces	

Source: JICA Study Team

7.2.3.2 Population Census

(1) Affected Units and Persons

The land by towers of 230kV OHL is private, public and EDC's. The owners required compensation are 10 private owners and 1 company. The land for expansion of GS5 is owned by the community.

The land by towers and poles of 115kV OHL is private, public and EDC's. The owners required

compensation are 21 private owners and 3 company. The land for expansion of Chroy Changvar S/S is owned by the company.

Resettlement will occur because of existing of structures such as house and warehouse in ROW of OHL. 3 households and 15 persons will be affected by ROW of 230kV OHL. 13 households and 59 persons will be affected by the ROW of 115kV OHL (see Table 7.2-7).

Table 7.2-6 Number of Affected Units (for towers and poles)

	Type of owner	Individual	Company	Community	Total
230kV	OHL	10	1		
	GS5 S/S			1	
	Total	10	1	1	12
115kV	OHL	21	3		
	Chroy Changvar S/S		1		
	Total	21	3*	-	24

There is the case that same company have the lands for a substation and towers.

Source: JICA Study Team

Table 7.2-7 Number of Affected Units and Persons

Type of loss	230kV				115kV			
	No. of PAUs		No. of affected peoples		No. of PAUs		No. of affected peoples	
	Legal	Illegal	Legal	Illegal	Legal	Illegal	Legal	Illegal
Required of displacement								
Household (structure owner on gov.land)								
Household (structure on private land)	3		15		13		59	
Household (Tenants)								
Community owned structures including physical cultural resources								
Not required for displacement								
Land owners								
Wage earners								
Total	3		15		13		59	

Source: JICA Study Team

(2) Cut-off-Date

The cut-off-date will coincide with the first day of the affected peoples and the inventory of loss survey at the detailed design. All structure after the cut-off-date will not be entitled for any compensation from the project. The cut-off-date will be informed to affected peoples to prevent further population influx to the project area prior to commencement of the inventory of loss survey.

7.2.3.3 Assets and Land Survey

(1) Land

The required land for towers and substations are used as rice land, residential area, commercial area, and fish pond, and so on. The area of land acquisition for OHL and substations is shown in Table 7.2-8.

Table 7.2-8 Area of Land Acquisition

unit (m²)

	No.	Village	Residential land	Commercial land	Rice land	Aquaculture pond	Natural lake	Vacant land	Total
230kV	1	Sak Prayuth			225				225
	2	Ta Poug			225				225
	3	Kol Krasnar			225				225
	4	Ta En			900				900
	5	Thlork			225				225
	6	Cheang Torng			225				225
GS5	7	Kraing Angkrorng II						44,100	44,100
Total			0	0	2,025	0	0	44,100	46,125
115kV	1	Kraing Angkrorng II		225	20				245
	2	Prey Moul		225					225
	3	Prek Phnov	625			850			1,475
	4	Duong		625		1,475			2,100
	5	Chrey Andet	625		1,525				2,150
	6	Prek Reus			225				225
	7	Krol Ko			1,125		900		34,425
Chroy Changvar							32,400		
Total			1,250	1,075	2,895	2,325	33,300	0	40,845

Source: JICA Study Team

The property right of land except foundations of towers is not transferred to EDC from landowners. Since the cultivation less than 3m high is possible under the ROW, the rice land is not subject to compensation. The area which is subject to compensation for land use restriction is shown in Table 7.2-9.

Table 7.2-9 Area of Compensation for ROW

					unit (m ²)
	No.	Village	Residential land	Commercial land	Total
230kV	1	Samroang	6,780		6,780
	2	Kouk Prich	6,000		6,000
	3	Trapeing Cheung Srok		10,275	10,275
	4	Cheang Torng,	2,775	6,000	8,775
Total			15,555	16,275	31,830
115kV	1	Kraing Angkrorng II		2,971	2,971
	2	Prey Moul		3,177	3,177
	3	Samroang Teav	4,570		4,570
	4	Toul Sampov	7,324		7,324
	6	Prek Pnov	2,375		2,375
	7	Doung	2,100	8,075	10,175
	8	Chrey Andel	275		275
	Total			16,644	14,223

Source: JICA Study Team

(2) Structure

The structures have been not found in the land for substations, towers and poles. However, there are 3 structures in ROW of 230kv OHL, and 17 structures in 115kV.

Table 7.2-10 Structures in ROW

	No.	Location	Type of building	Subtotal of number	Total of number	Area (m ²)	Total Area (m ²)
230kV	Residential Building						
	1	Samroang	Zinc house	1	1	136	136
	2	Cheang Torng,	Zinc house	1	1	128	128
115kV	Residential Building						
	1	Toul Sampov	Zinc house	1	3	12	203
			Briched house	2		191	
	2	Trapeing Raing Chass	Zinc house/Wooden house	5	5	154	154
	3	Prek Pnov	Zinc house/Wooden house	4	4	202	202
	4	Doung	Zinc house	3	3	148	148
	Public institution						
	1	Samroang Teav	Police station	1	1	54	54
2	Trapeing Raing Chass	Water supply house	1	1	48	48	

Source: JICA Study Team

(3) Tree

There are 128 trees of in 230kV and 730 trees in 115kV, which are more than 3m subject to compensation.

Table 7.2-11 Trees in ROW

No.	Location	Type of plants	Subtotal of number	Total of number	
230kV	1	Ak Sar	Pring tree	1	9
		Sugar palm	6		
		Krasang	1		
		Other tree	1		
	2	Pongnor	Sugar palm	1	5
			Other tree	2	
			Mango	1	
			Coconut	1	
	3	Ta En	Bamboo	2	4
			Sugar palm	1	
			Ampil Teuk	1	
	4	Ta Poug	Sugar palm	8	38
			Bamboo	17	
			Mango	3	
			Krasang	8	
			Cashew	1	
			Other tree	1	
	5	Cheang Torng	Kro Khub	6	11
			Chartt	2	
			Ampil Teuk	1	
			Coconut	1	
			Krasang	1	
	6	Prey Kla	Mango	11	17
			Bamboo	2	
			Other tree	4	
	7	Thlork	Sugar palm	2	2
	8	Kouk Prich	Bamboo	3	42
			Mango	35	
Pring			1		
Coconut			1		
Other tree			2		
Total				128	
115kV	1	Prey Moul	Sugar palm	4	4
	2	Toul Sampov	Acacia	39	107
			Pine tree	5	
			Pring tree	1	
			Ampil Teuk	5	
			Cashew	9	
			Mango	5	
			Krasang	1	
			Coconut	8	
			Other tree	34	
	3	Trapeing Raing Chass	Ampil Teuk	15	370
			Acacia	349	
			Other tree	6	
	4	Prek Pnov	Coconut	145	164
			Other tree	6	
			Ampil Teuk	10	
			Krakop	3	
	5	Doung	Eucalyptus	30	43
			Ampil Teuk	13	
	6	Chrey Andet	Sugar palm	1	42
			Ampil Teuk	2	
			Other tree	2	
	7	Prek Reus	Sugar palm	25	
			Other tree	12	
	Total				730

Source: JICA Study Team

7.2.3.4 Family Budget and Livelihood

The features of affected households such as family composition, profession, and income are shown in Table 7.2-12.

Table 7.2-12 Features of Affected Households

	Household	Family composition (persons)	Age of household head	Profession of household head	Income family/year (US\$)
230kV	2	4	37-58	Farmer	1,440 – 2,640
	1	7	35	Fisherman	2,160
115kV	4	4-6	42-52	Farmer	800-1,800
	2	6-7	43-45	Fisherman	3,600-4,800
	5	3-5	36-51	Seller	1,200-3,600
	2	5-7	47-51	Businessman	4,200-6,000

7.2.3.5 Vulnerable People

The affected households by the Project is not under the poverty line and does not include vulnerable people who require the special assistance. There are some females who are a head of household, their income is as well as the one of male's head.

7.2.4 Compensation and Support Measures

7.2.4.1 Compensation Policy

Compensation policy of land acquisition, resettlement and use restriction in ROW in Table 7.2-13.

Table 7.2-13 Compensation Policy

	Object	Compensation policy
Tower and Pole	All affected objects	Replacement land is priority or cash compensation at replacement cost
ROW	Residential and commercial land (Entirely affected, or partially affected but the remaining portion is not viable for use)	Replacement land is priority or cash compensation at replacement cost
	Residential and commercial land (Partially affected)	Cash compensation is provided around 30% of the replacement cost of the affected land, called easement fee. Structures and trees with higher than 3m are compensated at replacement fee. Trees are compensated per unit of tree.
	Orchard land and forest (grown higher than 3m)	Cash compensation is provided in equivalent to 30% of the replacement cost of the affected land, called easement fee. Trees with higher than 3m are compensated at replacement fee. Trees are compensated per unit of ha.
	Orchard land (less than 3m)	No compensation is made as there is no impact on harvest or cultivation.
	Rice land, seasonal crops	No compensation is made as there is no impact on harvest or cultivation.

Source: JICA Study Team

7.2.5 Grievance Redress Mechanism

Affected peoples have right to ask question, raise concern or suggestion and lodge complaint at any time during resettlement planning and implementation. A Grievance Redress Committee will be established in Phnom Penh city and Kandal province and members are representatives of the following:

- Member of Resettlement Sub Committees
- Commune Committee Member(s)
- Local Consultant
- Local leader in each village/ local area
- NGO representatives, if any

The committee will be responsible for responding to all questions or complaint raised by affected peoples. The committee shall document all suggestion or complaint and the responses in writing.

If affected peoples disagree with compensation and relocation options, they may present their questions or complaints to the local administrative officials or grievance redress committees either in person or in writing. A grievance process shall have four stages:

- **First Stage**

Affected peoples present complaint or grievance to the Village or Commune Resettlement Sub-committee. The Sub-Committee will be obliged to provide immediate written confirmation of receiving the complaint. If after 15 days affected peoples do not hear from the committee, or if affected peoples is not satisfied with the decision taken by the first stage, affected peoples may bring the complaint to the District Office.

- **Second Stage**

The District office has 15 days within which to resolve the complaint to the satisfaction of all concerned. If the complaints cannot be solved in this stage, the District office will bring the case to the Provincial Grievance Committee.

- **Third Stage**

The Provincial Grievance Redress Committee meets with affected peoples and tries to resolve the situation. The Committee may ask the EMO (Environmental Monitoring Organization) to review the DMS. Within 30 days of affected people's grievance submission the Committee must make a written decision and submit copies to EDC, the EMO, and to affected people.

- **Final Stage**

If affected people do not hear from the Grievance Committee or if affected people are not satisfied, affected people can bring the case to Provincial Court. This is final stage for judging the complaint. If affected people is still not satisfied with the provincial court judgment, affected people can bring the case to higher levels of the court. On the other hand EDC, representing the project authority, also has right to submit complaint to the court if affected people does not act. At this stage, if affected people still disagree to sign the contract and accept the compensation as per approved compensation rates and if this action may cause significant delay to civil work, EDC may request affected people to remove the affected assets away from the project area with assurance that the project will pay in full amount as per court decision.

The project will reimburse any administrative fees during the legal complaint process if affected

people wins the case.

7.2.6 Institutional Framework

The key agencies related to implementation of the Resettlement Action Plan are shown as follows.

7.2.6.1 EDC

The EDC has established a dedicated working group (EDC-WG) for the project. It has the responsibility of EDC to update, implement, and monitor the resettlement action plan activities. The EDC-WG works closely with PRSC (Provincial Sub-Committee) in each province for all field activities in connection with the implementation of the updated resettlement action plan.

7.2.6.2 PRSC

The Provincial Resettlement Sub-Committee, headed by the Provincial Deputy Governor, plays an important role in resettlement implementation. Members of the PRSC include provincial department directors of relevant line ministries, and also District Governors and Chiefs of communes and villages from the project area. Each PRSC has a working group (PRSC-WG) dedicated to the implementation of resettlement for the project in the province. Chiefs of affected communes and villages sit in the PRSC-WG in matters concerning their respective areas of jurisdiction. Representatives of affected peoples will be co-opted in the PRSC-WG prior to implementation work. The PRSC, through the PRSC-WG, is responsible to carry out the following tasks:

- i. Facilitate a sustained public information campaign, ensuring that the public, especially the affected households, are updated on any developments regarding the project and resettlement activities.
- ii. Assist EDC-WG in the confirmation of identities of affected households, in the validation of impacts, DMS surveys and computation of compensation and other entitlements of affected households.
- iii. Assist EDC in the purchase of land for landless affected households
- iv. Assist EDC-WG in the delivery of compensation and other entitlements
- v. Resolve grievance cases in accordance
- vi. Maintain records of all public/consultation meetings, grievances and actions taken to address complaints and grievances.

7.2.7 Implementation Schedule

The implementation schedule of the Resettlement Action Plan are shown as follows.

7.2.8 Cost and Finances

7.2.8.1 Compensation Unit Cost

Compensation cost is calculated based of the result of interview for chiefs of affected villages and precious cases. The compensation rates of land, structure and tree are shown in Table 7.2-15 to Table 7.2-17.

Table 7.2-15 Compensation Unit Cost of Lands

Land Type	Price in Average (US\$/m ²)
Aquaculture pond	0.5
Commercial land	100
Natural lake	100
Residential land	75
Rice land	50

Source: JICA Study Team

Table 7.2-16 Compensation Rate of Structures

House Type	Tentative Applied Rate (US\$/ m ²)
Zinc/Wooden house	34.00-87.5
Bricked house	110.00-239.50

Source: "Draft Final Resettlement Planning of Road No.5 Improvement Project/Middle Section, JICA, 2014"

Table 7.2-17 Compensation Rate of Trees

Affected trees	Unit	Unit price (US\$/tree)
Acacia	Tree	5.5
Ampil Teuk	Tree	17
Bamboo	Tree	25
Cashew	Tree	35
Chartt	Tree	8
Coconut	Tree	35
Eucalyptus	Tree	5.5
Krasang	Tree	21
Krakop	Tree	8
Kro Khub	Tree	8
Mango	Tree	35
Pine tree	Tree	10
Pring tree	Tree	25
Sugar palm	Tree	55
Other tree	Tree	12

Source: "Short Resettlement Plan for 115kV Transmission Line from Stung Substation to Sihanouk Ville Substation, EDC, 2012"

7.2.8.2 Compensation Cost

(1) Cost for Land Acquisition and Resettlement

The cost for land acquisition and resettlement is shown in Table 7.2-18.

Table 7.2-18 Cost for Land Acquisition and Resettlement

No.	Compensation Items	Unit	Unit Price (US\$)	230kV OHL	115kV OHL	230kV Cost (US\$)	115kV Cost (US\$)	Total Cost (US\$)
I Compensation for Land								
1	Rice Land	m ²	50.0	2,025.0	2,895.0	101,250.0	144,750.0	246,000.0
2	Residential Land	m ²	75.0		1,250.0		93,750.0	93,750.0
3	Commercial land	m ²	100.0		1,075.0		107,500.0	107,500.0
4	Aquaculture pond	m ²	0.5		2,325.0		1,162.5	1,162.5
5	Natural lake	m ²	100.0		900.0		90,000.0	90,000.0
6	GS5 S/S	m ²	125.0	44,100.0		5,512,500.0		5,512,500.0
7	Chroy Changvar S/S	m ²	100.0		32,400.0		3,240,000.0	3,240,000.0
Sub-total (I)				46,125.0	40,845.0	5,613,750.0	3,677,162.5	9,290,912.5
II Compensation for Structure								
1	Zinc/Wooden house	m ²	34.000		160.0	0.0	5,440.0	5,440.0
2		m ²	72.500	200.0	314.0	14,500.0	22,765.0	37,265.0
3		m ²	84.500		24.0	0.0	2,028.0	2,028.0
4		m ²	87.500		72.0	0.0	6,300.0	6,300.0
5	Bricked house	m ²	110.000		63.0	0.0	6,930.0	6,930.0
6		m ²	130.000		176.0	0.0	22,880.0	22,880.0
7		m ²	239.500	64.0		15,328.0	0.0	15,328.0
Sub-total (II)				264.0	809.0	29,828.0	66,343.0	96,171.0
III Affected Trees								
1	Acacia	Tree	5.5		388	0.0	2,134.0	2,134.0
2	Ampil Teuk	Tree	17.5	2	45	35.0	787.5	822.5
3	Bamboo	Tree	28.0	24		672.0	0.0	672.0
4	Cashew	Tree	9.0	1	9	9.0	81.0	90.0
5	Chartt	Tree	8.0	2		16.0	0.0	16.0
6	Coconut	Tree	35.0	3	153	105.0	5,355.0	5,460.0
7	Eucalyptus	Tree	5.5		30	0.0	165.0	165.0
8	Krasang	Tree	21.0		3	0.0	63.0	63.0
9	Krakop	Tree	8.0	10	1	80.0	8.0	88.0
10	Kro Khub	Tree	8.0	6		48.0	0.0	48.0
11	Mango	Tree	45.0	50	5	2,250.0	225.0	2,475.0
12	Pine	Tree	10.0		5	0.0	50.0	50.0
13	Pring	Tree	25.0	2	1	50.0	25.0	75.0
14	Sugar palm	Tree	55.0	18	30	990.0	1,650.0	2,640.0
15	Other tree	Tree	5.0	10	60	50.0	300.0	350.0
Sub-total (III)				128	730	4,305.0	10,843.5	15,148.5
IV	Transportation allowance	Structure	70.0	3	17	210.0	1,190.0	1,400.0
Sub-total (IV)				3	17	210.0	1,190.0	1,400.0
Total (I+II+III+IV)						5,648,093.0	3,755,539.0	9,403,632.0

Source: JICA Study Team

(2) Cost of compensation for Land Use Restriction in ROW

The cost of compensation for land use restriction in ROW is shown in Table 7.2-19.

Table 7.2-19 Cost of Compensation for Land Use Restriction in ROW

V	Land along the overhead transmission route (calculated with 30% of price)		Unit	Unit Price (US\$)	230kV OHL	115kV OHL	230kV Cost (US\$)	115kV Cost (US\$)	Cost US\$
	1	Residential Land	m ²	75.0	15,555.0	16,644.0	349,987.5	374,490.0	724,477.5
	2	Commercial land	m ²	100.0	16,275.0	14,223.0	488,250.0	426,690.0	914,940.0
Sub-total (V)					31,830.0	30,867.0	838,237.5	801,180.0	1,639,417.5

Source: JICA Study Team

(3) Compensation Cost

The total amount of compensation cost is calculated as around 13,000,000 US\$. This cost includes the cost for land acquisition and resettlement, compensation for land use restriction in ROW, management cost and contingency.

Table 7.2-20 Total Cost of Land Acquisition and Compensation

Total (I+II+III+IV+V)			230kV Cost (US\$)	115kV Cost (US\$)	Cost US\$
			6,486,330.500	4,556,719.000	11,043,049.500
VI	Management Cost	Total (I+II+III+IV+V) *0.15	972,949.575	683,507.850	1,656,457.425
VII	Contingency	VI*0.1	97,294.958	68,350.785	165,645.743
Grand Total			7,556,575.033	5,308,577.635	12,865,152.668

Source: JICA Study Team

7.2.8.3 Finances

EDC are responsible to the cost of compensation for land acquisition and resettlement.

7.2.9 Monitoring

Monitoring regarding land acquisition and resettlement will be conducted by EDC. The following items will be monitored, the progress of preparation, approval and update of resettlement action plan, payment of compensation, land acquisition, resettlement. The monitoring will be commenced at the detailed design. Monitoring form and monitoring cost are attached in Appendix 8. The main monitoring parameters are shown below.

- The affected people's entitlements are in line with the approved policy.
- The assessment of compensation is carried out in line with agreed procedures.
- Payment of compensation and delivery of other entitlements to the affected peoples in the various categories (see Entitlement Matrix, Annex 1) according to the approved rates and entitlements as described in the resettlement action plan.
- Information disclosure and public consultation and grievance procedures are followed as described in the resettlement action plan.

- Payment of transportation allowance and other compensation are made before physical relocation.
- Compensation and resettlement and clearance of all encumbrances and income restoration measures complete prior to commencement of civil works.

Monitoring is divided into internal and external monitoring. Internal monitoring of the overall process of the Project is conducted by the implementing agency, including regular monitoring and evaluation of implementation of resettlement action plan. External monitoring is conducted by an external monitoring organization, an independent institution or a group hired by the IRC to carry out external monitoring and post-evaluation study.

7.2.10 Public Consultation Meeting

PCM (Public Consultation Meetings) for affected peoples were organized on the following date.

Table 7.2-21 State of Implementation of PCM

	Date	Location	Number of Participants
230kV			
1st	August 30th, 2014	Pong Ro village, Snoar Sagkat, Por Sen Chey Khan	17
2nd	October 18th, 2014	Prey Muol village, Kraing Thnung Sagnat Sagkat, Sen Sok Khan	21
150kV			
1st	August 6th, 2014	Doung primary school in Doung village, Preak Phnao, Sagnat Por Sen Sok Khan	36

There were a lot of objections from villagers at the first PCM of 230kV OHL area. In response to the opinion, the route was reviewed to minimize the impact. At the second PCM, many villagers expressed their sympathy for the new route. The main points of changing the route are shown as follows.

- The land of the existing towers is used for the new line as far as possible.
- The points of towers are moved into the ROW of the railway as far as possible

The main statements are shown in Table 7.2-22. Minutes of meeting is attached in Appendix-3.

Table 7.2-22 Statements of PCM

	Content	Statement of Aps	Response	Remarks
230kV				
1st	- Outline of the project - Compensation policy	a. Suggestion to minimization of the impact on the villages b. Concern to the safety of transmission line of high voltage c. Suggestion to adequate compensation based on a market price	Compensation will be conducted on a replacement price.	There are a lot of objection from villagers for the construction of this high voltage transmission line.
2nd	- The changed points of the route - Compensation policy	a. Agreement with the new route b. Question about compensation procedure	EDC and PRSC will negotiate with affected peoples about the compensation cost after the detailed design.	Many villagers expressed their sympathy for the new route.
150kV				
1st	- Outline of the project - Compensation policy	a. Agreement from villages that are expected little impact b. Suggestion to continue aqua farming c. Suggestion to adequate compensation based on a market price	Compensation will be conducted on a replacement price.	Many villagers agreed with the project assuring the adequate compensation.



Photo 7.2-1 Public Consultation Meetings