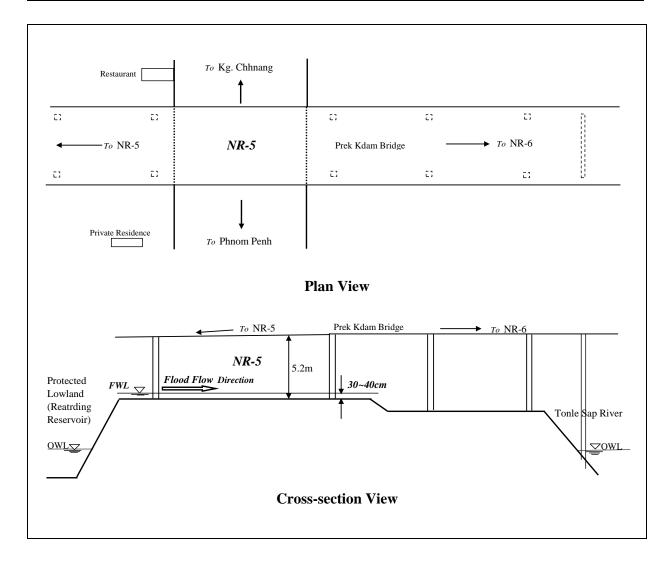
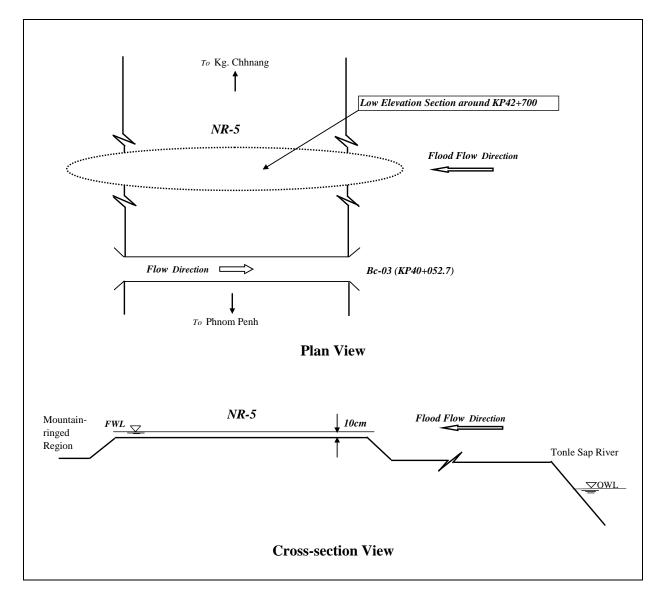
# **APPENDIX 7-2**

# INQUIRING SURVEY ON INFORMATION OF FLOOD CONDITIONS

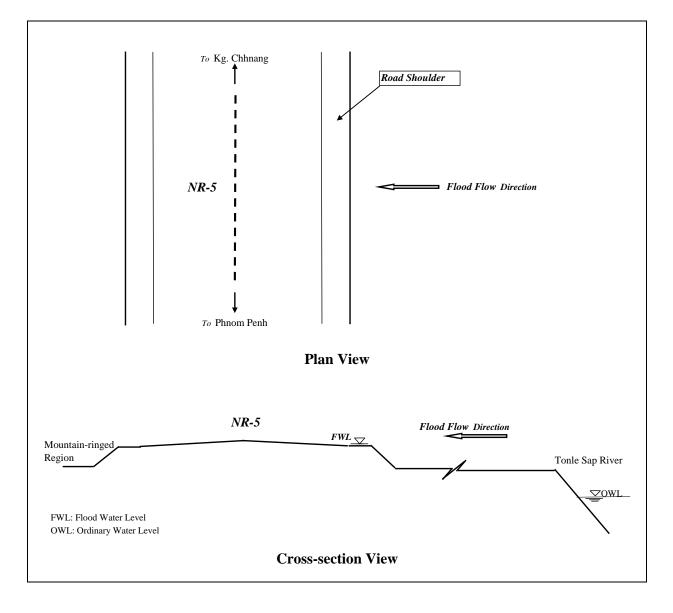
			No.:		1
Date	2 <sup>nd</sup> October 2012				
Interview with	Mr. Nhem Sorn (restauran	t's cook), 52-years-old			
	Ms. Chhourn Poev (street	vendor nearby her house	), 62-yea	rs-old	
PK (km)	31+000	Province	Kampo	ng Chh	nang
Circumstance	Hout Chan Restaurant clo	se to Preak Kdam Bridge			
	Commercial area and resid	lential area			
Drainage Facility	None				
Flood Level	30 ~ 40cm around piers	Flood Flow Direction	Protecte	ed	lowland
			(Retard	ing Res	servoir)
			→ Tonl	le Sap H	River
Frequency	Seldom				
Duration Per Flood	1 month	Occurrence Month	Octobe	r ~	November
			2011		



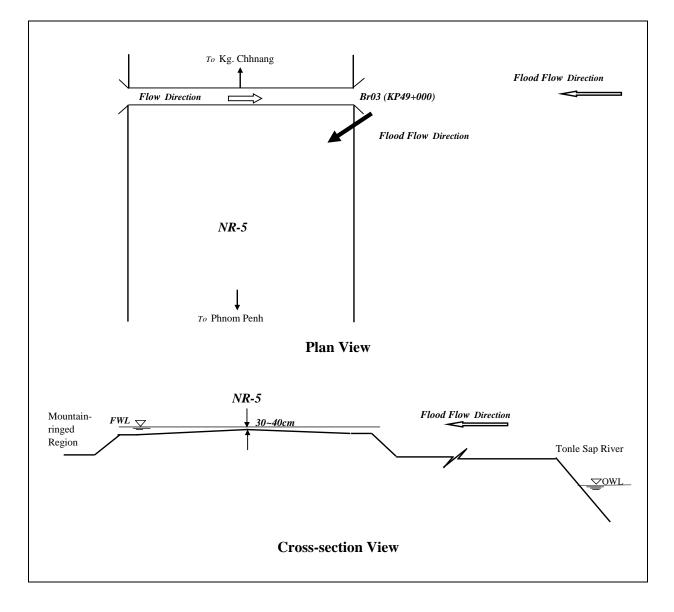
			No.:		2
Date	2 <sup>nd</sup> October 2012				
Interview with	Ms. Khim Sreytouch, 32	-years-old			
PK (km)	42+700	Province	Kampo	ong Chł	nnang
Circumstance	Lhsar Trach				
Drainage Facility	None				
Flood Level	10cm	Flood Flow Direction	Tonle S	Sap Riv	er →
			Mounta	ain-ring	ged Region
Frequency	1-yr (every year)				
<b>Duration Per Flood</b>	1 month	Occurrence Month	Octobe	er ~	November
			2011		



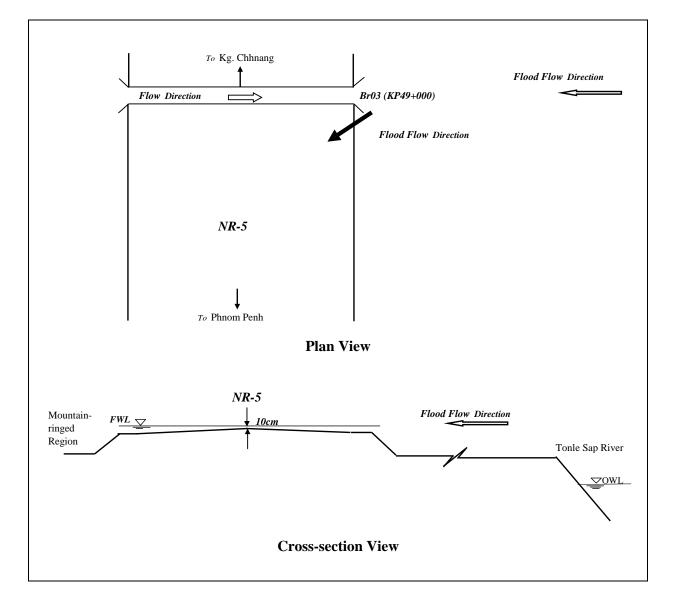
			No.:	3	
Date	2 <sup>nd</sup> October 2012				
Interview with	Ms. Nhem Sorn (Owner	of Grocery), 50-years-old			
PK (km)	45+400	Province	Kampong Chhnang		
Circumstance	Chamka Svay, Unlung T	hnout Village			
Drainage Facility	None				
Flood Level	Road shoulder flooded	Flood Flow Direction	Tonle	Sap River $\rightarrow$	
	only		Moun	tain-ringed Region	
Frequency	1-yr (every year)				
<b>Duration Per Flood</b>	3 ~ 4 days	Occurrence Month	Octob	er 2011	



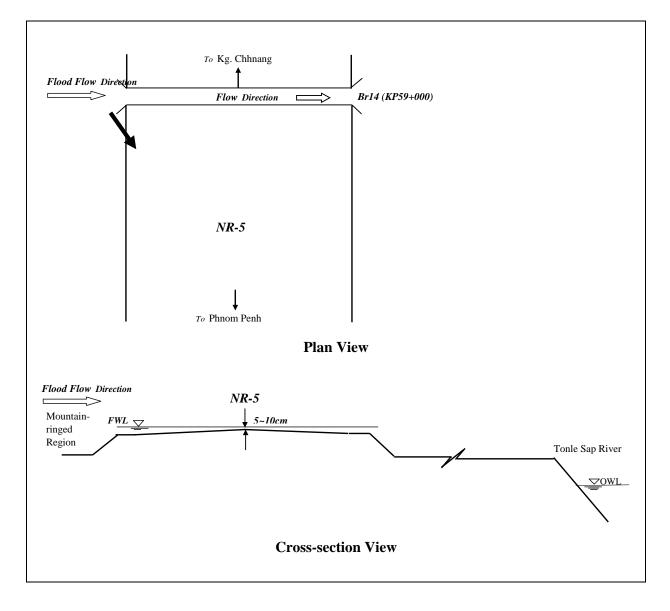
			No.:	4
Date	2 <sup>nd</sup> October 2012			
Interview with	Ms. Rich Samon, 48-yea	rs-old		
PK (km)	47+500	Province	Kamp	ong Chhnang
Circumstance	Spean Pour Village			
Drainage Facility	None			
Flood Level	30 ~ 40cm	Flood Flow Direction	Tonle	Sap River $\rightarrow$
			Moun	tain-ringed Region
Frequency	Seldom			
<b>Duration Per Flood</b>	3 ~ 4 days	Occurrence Month	Octob	er 2011



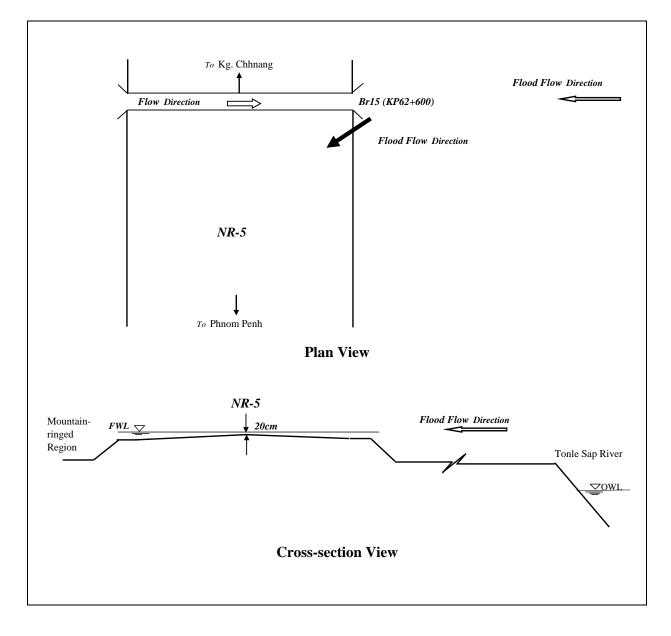
			No.:	5
Date	5 <sup>th</sup> October 2012			
Interview with	Ms. Jim Chenda, 52-year	rs-old		
PK (km)	48+800	Province	Kamp	ong Chhnang
Circumstance	Sethey commune			
Drainage Facility	None			
Flood Level	10cm	Flood Flow Direction	Tonle	Sap River $\rightarrow$
			Moun	tain-ringed Region
Frequency	Seldom			
<b>Duration Per Flood</b>	3 ~ 4 days	Occurrence Month	Nover	nber 2011



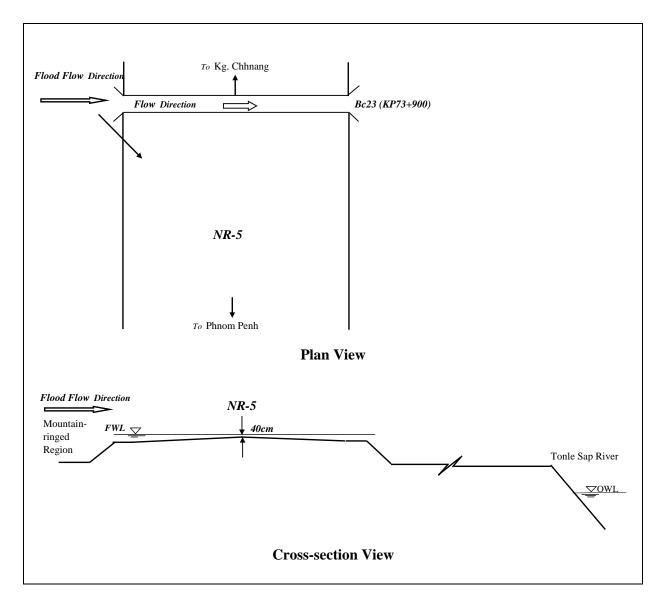
			No.:	6		
Date	5 <sup>th</sup> October 2012					
Interview with	Mr. Lee Sman (House O	Mr. Lee Sman (House Owner), 46-years-old				
PK (km)	57+500	57+500 <b>Province</b> Kampong Chhnang				
Circumstance	Prek Peas Village					
Drainage Facility	None					
Flood Level	5 ~ 10cm	Flood Flow Direction	Moun	tain-ringed Region		
			→ Tor	nle Sap River		
Frequency	1-yr (every year)					
Duration Per Flood	12 hours	Occurrence Month	Octob	er 2011		



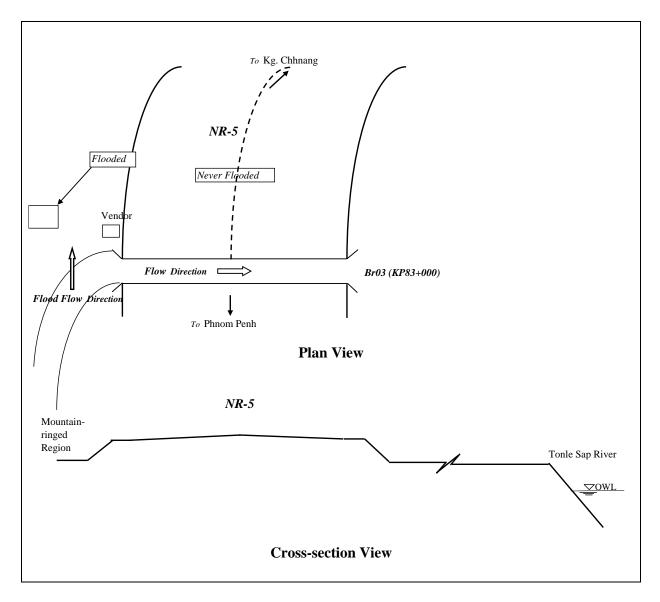
			No.:	7
Date	5 <sup>th</sup> October 2012			
Interview with	Mr. Math Min (House O	wner), 55-years-old		
PK (km)	60+000	Province	Kamp	ong Chhnang
Circumstance	Chouk Sor Commune			
Drainage Facility	Side Ditch (Both Sides)			
Flood Level	20cm	Flood Flow Direction	Tonle	Sap River $\rightarrow$
			Moun	tain-ringed Region
Frequency	1-yr (every year)			
<b>Duration Per Flood</b>	2 ~ 3 days	Occurrence Month	Octob	er 2011



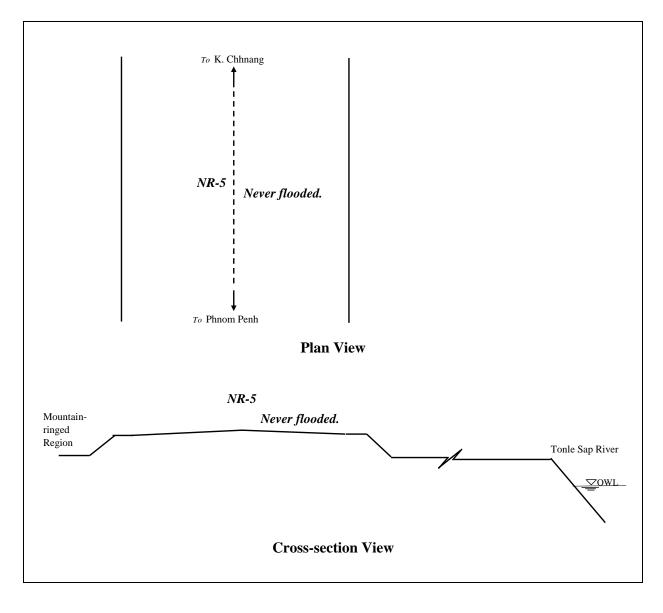
			No.:	8	
Date	5 <sup>th</sup> October 2012				
Interview with	Ms. Sok Chantha, 25-year	s-old			
PK (km)	73+000	Province	Kamp	ong Chhnang	g
Circumstance	Teok Hot Commune				
Drainage Facility	Side Ditch (Both Sides)				
Flood Level	40cm	Flood Flow Direction	Moun	tain-ringed	Region
			→ Tot	nle Sap Rive	er
Frequency	Seldom				
<b>Duration Per Flood</b>	1 week	Occurrence Month	Septer	mber ~	October
			2010	& 2011	



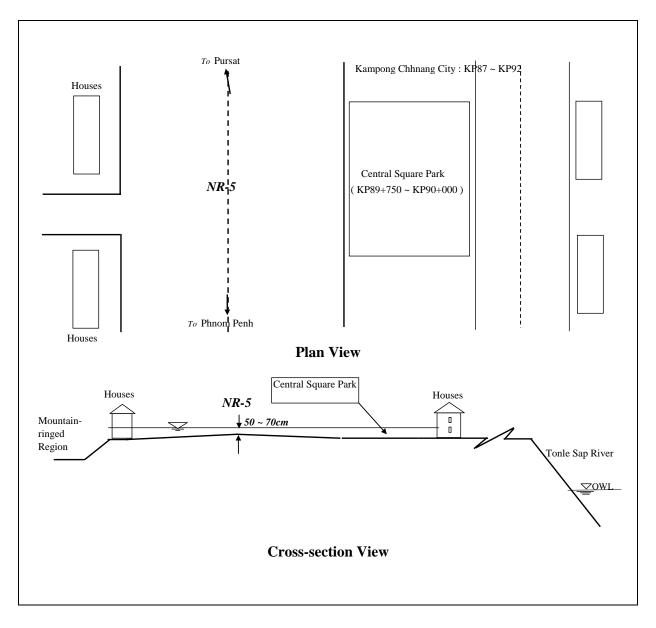
			No.:	9
Date	5 <sup>th</sup> October 2012			
Interview with	Mrs. Qa Navy (House Ow	mer), 19-years-old		
PK (km)	83+000	83+000 <b>Province</b> Kampong Chhnang		
Circumstance	Jrey Bak Commune			
Drainage Facility	Drainage Canal (Both Sid	es)		
Flood Level	Never flooded	Flood Flow Direction	Moun	tain-ringed Region
	(30~40cm around		→ Tot	nle Sap River
	house)			
Frequency	Seldom			
<b>Duration Per Flood</b>	2 weeks	Occurrence Month	Augus	st – September 2011



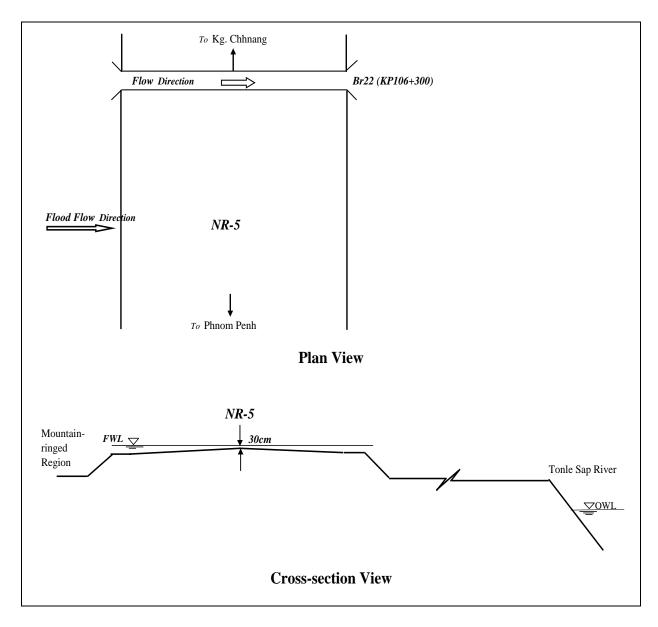
			No.:	10		
Date	5 <sup>th</sup> October 2012	<sup>th</sup> October 2012				
Interview with	Ms. Nhean Soth (House Ov	Ms. Nhean Soth (House Owner), 42-years-old				
PK (km)	55+000	Province	Kamp	ong Chhnang		
Circumstance	Sala Lekj Pram Commune	Sala Lekj Pram Commune				
Drainage Facility	None					
Flood Level	Never flooded	Flow Direction	Never	flooded		
Frequency	Never flooded					
Duration Per Flood	Never flooded	Occurrence Month	Never	flooded		



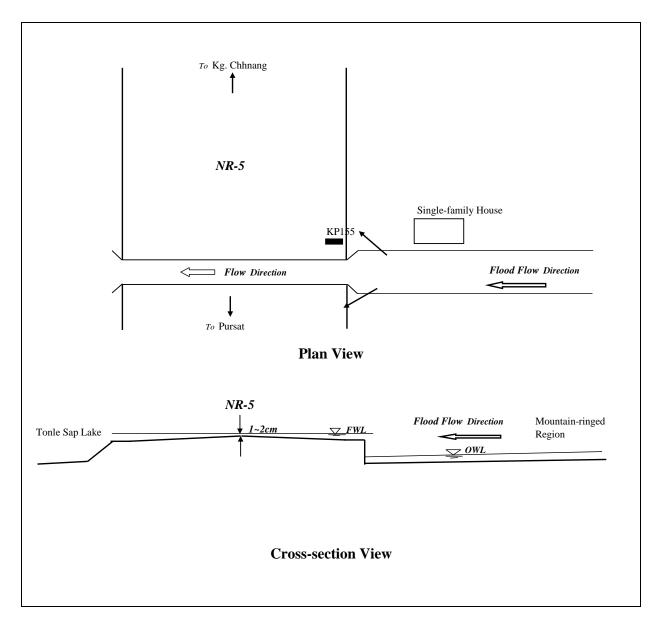
			No.:	11		
Date	10 <sup>th</sup> October 2012					
Interview with	Ms. Eung Sreng (Owner of	Ms. Eung Sreng (Owner of Photoshop), 39-year-old				
PK (km)	90+000	Province	Kamp	ong Chhnang		
Circumstance	City Square Park					
Drainage Facility	None					
Flood Level	5 – 10 cm	Flow Direction	From	Tonle Sap River		
Frequency	Seldom					
<b>Duration Per Flood</b>	15 days	Occurrence Month	Septer	mber 2011		



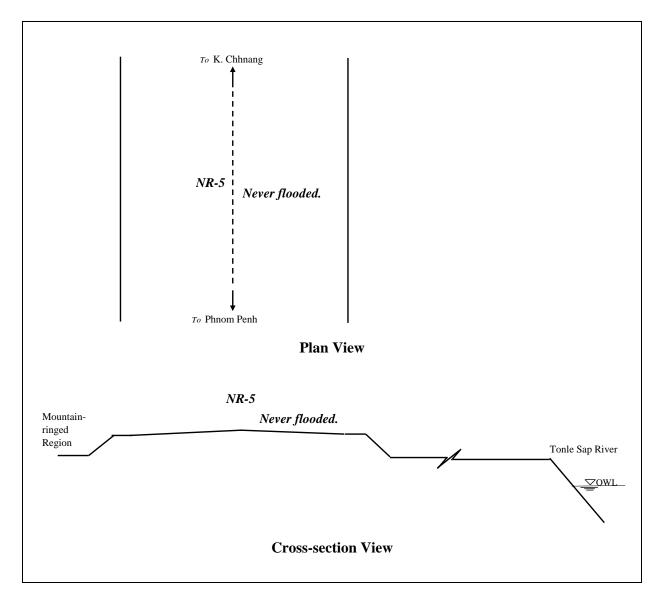
			No.:	12	
Date	10 <sup>th</sup> October 2012				
Interview with	Mr. Norg Phekday (Owner	of Street Vender), 58-ye	ears-old		
PK (km)	106+100	Province	Kampong Chhnang		
Circumstance	Rural area				
Drainage Facility	None				
Flood Level	30 cm	Flow Direction	Mount	ain-ringed Region	
			$\rightarrow$ Tor	nle Sap River	
Frequency	Seldom				
<b>Duration Per Flood</b>	14 days	Occurrence Month	Septer	nber 2000	



			No.:	13		
Date	10 <sup>th</sup> October 2012					
Interview with	Mr. Nel Manrth (Teacher), 43-years-old					
PK (km)	155+000	Province	Pursat			
Circumstance	Krakor District (Suburban Area)					
Drainage Facility	Two pipe culverts					
Flood Level	1 -2 cm Flow Direction Mountain-rin					
	(10 cm in 2000) $\rightarrow$ Tor		nle Sap Lake			
Frequency	N/A					
Duration Per Flood	2 – 3 days Occurrence Month October 2010			er 2010		
	(1 month in 2000)		(Septe	ember 2000)		



			No.:	14		
Date	10 <sup>th</sup> October 2012					
Interview with	Ms. Sorthey (Owner of Street Vendor), 55-years-old					
PK (km)	58+800 <b>Province</b> Kampong Chnnang					
Circumstance	Odongk, Chhnk Sor					
Drainage Facility	None					
Flood Level	Never flooded Flow Direction		Never flooded			
Frequency	Never flooded					
<b>Duration Per Flood</b>	Never flooded	Occurrence Month	Never	flooded		



# **APPENDIX 8-1**

# **POSSIBLE ROUTE OF ODONGK BYPASS**

(This document was prepared for discussion on Odongk Bypass between MPWT, MEF and JICA Survey Team)

#### 1 Introduction

Widening of Odongk Section of NR 5 requires relocation of considerable number of houses/shops/buildings. Possibility of bypass construction was studied to avoid such relocation. In addition to reduction of relocation, construction of bypass gives the following benefits:

- (i) Smooth traffic: Vehicles can travel faster and smoother by not passing through the urbanized area of Odongk.
- (ii) Economic benefit: Smooth traffic yields economic benefits such as reduction of travel time and vehicle operation cost (fuel consumption etc).
- (iii) Reduction of traffic accidents, noise and air pollution: Through traffic will detour to the bypass resulting in reduction of traffic accident, noise and air pollution in the urbanized area.
- (iv) Sound development of the town: Smooth traffic allows sound economic growth of the town without problems which would be caused traffic congestion if through traffic would pass the urbanized area.

Because of these reasons, possibility of bypass construction around the urbanized area of Odongk was studied.

#### 2 Initial Examination of Alternatives

Initially, several alternative routes as shown in the attached aerial photo (Figure-1) were examined. Advantages and disadvantages of these alternatives are compared in Table-1. Main points of consideration are explained below:

(i) Historical heritage

One of the main concerns at this stage was historical heritage. Since the alternative routes traversing the southern side of the existing urbanized area pass near Phnom Odongk, old capital of Cambodia before Phnom Penh, high possibility of encountering historical heritage is considered to be high, compared to the alternatives traversing the northern side of the urbanized area.

Alternative-8 was planned to pass the southern area of Phnom Odongk to reduce the possibility of encountering historical heritage related to Phnom Odongk.

(ii) Connection to NR 51

The alternative routes passing the southern side of Odongk Town are directly connected to NR 51 which extends to NR 4 in the west of Phnom Penh. Thus these alternatives will contribute to smooth transportation route of Thai border – Battambang - NR 51 - NR 4 – Sihanouk Ville without passing through congested Phnom Penh and its suburbs. Thus, these alternatives are very preferable from view point of nation-wide transport.

#### (iii) Flood

During the flood season, the area surrounding Odongk Town is flooded. Construction of highway embankment in flooded area need certain consideration in highway design, such as slope protection and soft ground treatment, some additional construction cost and adjustment of execution schedule of civil works. Thus, the length of section to be constructed in the flooded area should be as short as possible.

#### (iv) Initial Screening

After the above evaluation and comparison, Alt-1, Alt-2 and Alt-8 were discarded for the following reasons:

- Alt-1 and Alt-2 were evaluated to be less attractive than other alternative routes (have no particular advantages) and were discarded.
- Further examination of Alt-4 was temporarily haltered because it is too close to the existing urbanized area. Thus the road side of this route will be urbanized soon and the function as a bypass will be substantially lost.
- > Alt-8 was found to have the following serious disadvantages and discarded:
  - · Length of the bypass becomes excessively long (13.9km).
  - Location of southern connection point with the existing NR 5 becomes south of Prek Kdam Bridge where the NR 5 is being widened under Chinese financial assistance.
- 3 Further Examination of Alternatives
  - (i) Modification of Alternatives

As the result of the initial examination and screening as stated above, three alternatives (Alt-3, Alt-5 and Alt-6) remained. The Survey Team had discussion with MPWT in early January 2013 on these possible routes after preliminary observation of site conditions. MPWT's comments on these routes are as follows:

- Alt-3: Large-scale development is on-going at the west connection point of the bypass and the existing NR 5. Thus, the connection point needs to be shifted to south by about 1km.
- Large-scale development is to be started in the area around the east connection points of Alt-7 with NR 5. Thus, land acquisition is very difficult.

Based on the discussion with MPWT and further observation of the site conditions, three alternatives were modified as shown in Figure-2:

> Alt-3a: The west connection point of Alt-3 is shifted to south by about 1km to avoid

the development project site.

- Alt-7a: This alternative is planned as the reserve route to be considered if existence of historical heritage is suspected on the route of Alt-7.
- Alt-7b: This alternative is planned to avoid crossing with the road going to Phnom Odongk where high possibility of encountering historical heritage is anticipated.
- (ii) Survey on Site Conditions

The Survey Team surveyed the site conditions in January – February 2013 mainly focusing on the route of Alt-3a and found the following problems:

- There are many concrete piles in the area around the east connection point of the bypass and NR 5, indicating a development project has started and land acquisition is difficult.
- Land fill (embankment) has been done in the vicinity of the west connection point indicating land acquisition may be difficult.
- (iii) Consultation with Ministry of Culture and Fine Art and

Since the bypass is to traverse the area where existence of historical heritage is highly possible, the Survey Team visited the Ministry of Culture and Fine Art (MCFA) on 24 January 2013 to consult on survey on historical heritage.

MCFA's comments were basically as follows:

- Staff of MCFA will join MPWT staff in the survey for identifying existence of historical heritage.
- If historical heritage is found on the route of bypass (or NR 5), survey is conducted and conditions of the heritage site is recorded. The cultural remains (such as ceramics) are stored or displayed in museum. After survey, road can be constructed.
- In the north of Odongk Town, a historical site of Longvaek exists. Experts of Nara National Research Institute for Cultural Properties (of Japan) are cooperating with MCFA in survey and restoration of historic sites in Cambodia, including Angkor Watt. They are now surveying the site of Longvaek.

Based on the above comments of MCFA, the Survey Team contacted the experts of Nara National Research Institute for Cultural Properties and asked their opinion on the bypass routes. They explained that the survey on Longvaek has just started and very little is known at present. Based on the results of the survey so far done, their comments are as summarized below:

• While there is high possibility of existence of historical heritage in the south of Odongk Town, there are also historical heritage sites in the north of the town,

between Longvaek and the town.

- Three old roads used during the period of Longvaek Capital are still remaining (Figure-3). These old roads need to be maintained.
- However, the bypass can be constructed on the north side of Odongk Town if diligent consideration is given to maintain the historical heritage and survey is conducted before construction of the bypass.
- (iv) Evaluation of Alternative Routes

Based on the information described above, the each alternative route is evaluated as summarized below:

- Alt-3a (Alt-3): Private development projects are going on around or near the connection points to NR 5. Thus, the locations of both connection points need to be changed.
- Alt-7 and Alt-7a: Large-scale private development project has started around the east connection point with NR 5, according to MPWT, and acquisition here is difficult. Thus, these alternatives are not recommended.
- Alt-5 and Alt-7b: Length of bypass is considerably longer than the length of the existing NR 5r corresponding to the bypass, and traffic is not expected to divert to bypass. Thus, these alternatives are not recommended.

As a conclusion, only Alt-3a can be recommended but needs substantial modification of alignment to move both of the connection points with the existing NR 5.

- 4 Modification of Alt-3a Route and Proposed Bypass Route
- (i) Proposed Route

Survey Team surveyed the site condition again to identify the possible connection points of bypass with existing NR 5. The route of Alt-3a is largely modified so that the bypass can be connected to NR 5 without difficulty of land acquisition. Two routes as shown in Figure-3 are proposed.

The main points of planning of these routes are summarized below:

Location of East Connection Point	Outside of densely populated section				
Location of East Connection Point	Place where no development project started at present				
Alignment	Minimize impact to cultural heritages in the north of				
	Odongk Town				

#### Table-3 Main Points of Planning of Route

Route-1 is recommended as the first priority because of its smoother horizontal alignment and shortening of travel distance, although only 0.2km (bypass=4.9km; NR 5=5.1km). Route-2 is proposed as the reserve plan because there are grave yards

(tombs) close to the east connection point of Rout-1. If it will be found that relocation of tombs be necessary and such relocation be difficult, Rout-2 shall be adopted.

(ii) Preliminary Estimation of Construction Cost

Very preliminary estimation of construction const is summarized below:

Table-4 Preliminary Cost Estimation

(US\$ million)

Route	Bypass Construction	Widening of NR 5	Difference
Route-1	5.77	5.43	+0.34
Route-2	5.47	4.86	+0.61

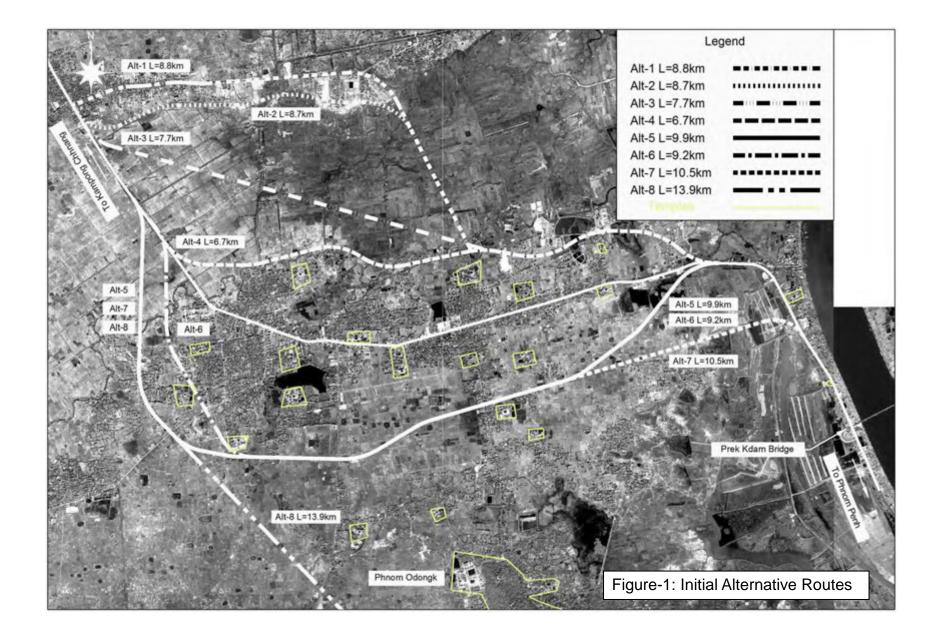
Increase of construction cost for bypass, compared to widening of the existing NR 5 is larger in Route-2 because Route-2 is longer than corresponding section of the existing NR 5 while Route-1 is shorter than the existing NR 5.

The main reason of small differences is that if the existing NR 5 is to be widened, 2.5m-side parking spaces are needed on the both sides while such parking spaces are not necessary in bypass. A large portion of the construction cost is the cost for pavement. Thus, seining of existing NR 5 in urbanized area needs large cost and pavement cost of bypass is smaller than pavement cost of widening of existing NR 5.

Please note that the above construction costs do not include the cost for land acquisition/relocation.

#### 5 Conclusion

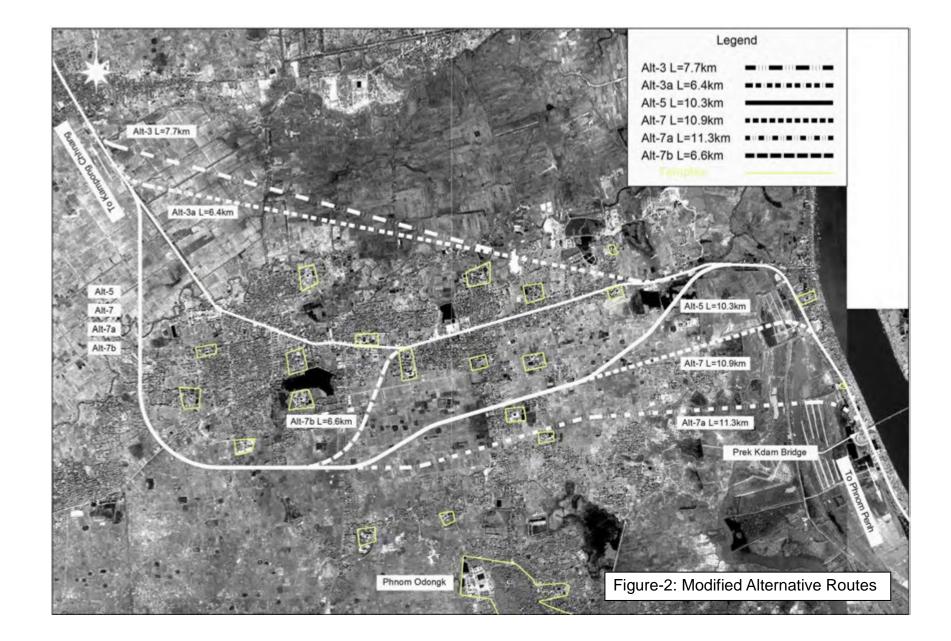
Route-1 as shown in Figure-3 is recommended as the optimum route of Odngk Bypass.



Alt	ternative	Traffic/Road Function	Length (km)	Land Acquisition/Relocation	Historical Heritage	Others
	Alt-1	<ul> <li>North end section passes through town of Phsar Trach. Thus function as bypass is reduced. (D)</li> </ul>	8.8	<ul> <li>Considerable number of houses need to be relocated.</li> <li>(D)</li> </ul>	<ul> <li>Away from Phnom</li> <li>Odongk (A)</li> </ul>	<ul> <li>Considerable section needs to be constructed in flooded area (D)</li> </ul>
North of Odongk Town	Alt-2	<ul> <li>Does not pass urbanized area. (A)</li> <li>Horizontal alignment is not smooth.</li> </ul>	8.7	<ul> <li>Large scale relocation is not required.</li> </ul>		
	Alt-3	<ul> <li>Does not pass urbanized area. (A)</li> <li>Travel distance becomes shorter compared with the existing NR 5. (A)</li> </ul>	7.7			<ul> <li>Almost entire section needs to be constructed in flooded area (D)</li> </ul>
	Alt-4	<ul> <li>Pass hemisphere of urbanized area.</li> <li>Road side area will be urbanized &amp; function of bypass will be reduced in near future.</li> <li>Horizontal alignment is not smooth.</li> </ul>	6.7			
South of Odongk T.	Alt-6	<ul> <li>Direct connection to NR 51 (A)</li> <li>Passes west hemisphere of urbanized area. Road side area will be urbanized &amp; function of bypass will be reduced in near future.</li> <li>Travel distance becomes longer than existing NR 5. (D)</li> </ul>	9.2	<ul> <li>Large scale relocation is not required.</li> </ul>	<ul> <li>High possibility of encountering historical heritage due to closeness to Phnom Odongk. (D)</li> </ul>	
	Alt-7	Direct connection to NR 51 (A)	10.5			<ul> <li>About 2km-long section is constructed in flooded area (D)</li> </ul>
	Alt-8	Direct connection to NR 51 (A)	13.9		<ul> <li>Lower possibility of encountering historical heritage</li> </ul>	

#### Table-1: Comparison of Alternative Routes in Initial Examination

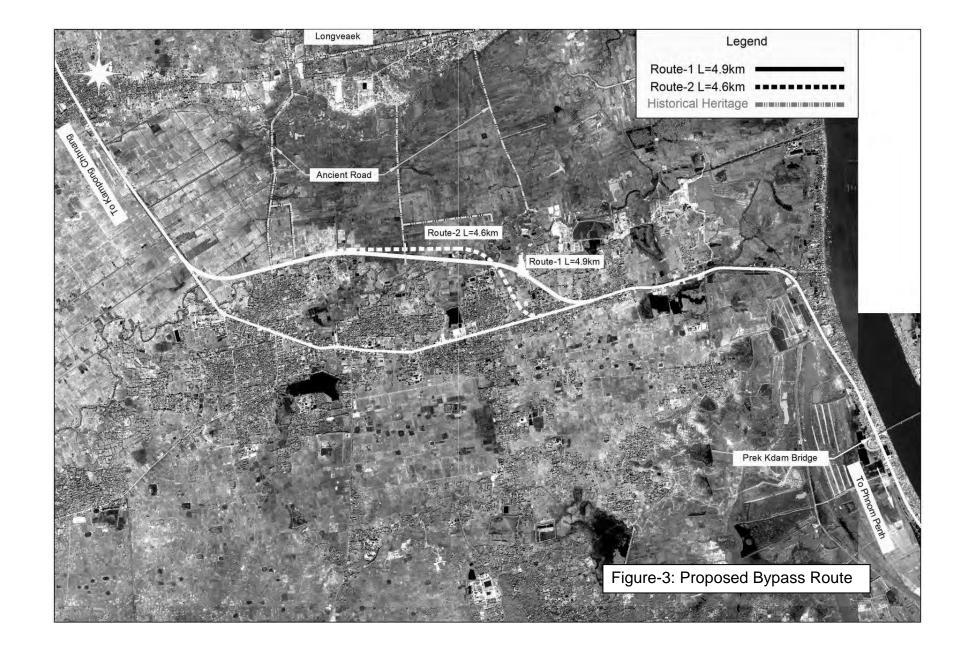
D: Disadvantage (substantial) A: Advantage (substantial)



Alternative		Traffic/Road Function	Length (km)	Land Acquisition	Historical Heritage	Others
North	Alt-3 Alt-3a	<ul> <li>Changed to Alt-3a considering</li> <li>Does not pass urbanized area. (A)</li> <li>Travel distance becomes shorter compared with the existing NR 5. (A)</li> </ul>	g private c 6.4	<ul> <li>Large scale relocation is not required.</li> </ul>	<ul> <li>est connection point with NR 5.</li> <li>Crosses 2 ancient roads</li> </ul>	<ul> <li>Large portion of the entire section needs to be constructed in flooded area.</li> </ul>
South	Alt-5 Alt-7 Alt-7a	Direct connection to NR 51 (A) Travel distance becomes longer: Alt-5: 2.5km Alt-7: 1.7km	10.3 10.9 11.3	<ul> <li>Large scale relocation is not required.</li> <li>Private development project has started at the east end. (D)</li> </ul>	<ul> <li>High possibility of encountering historical heritage but no concrete data/information at present.</li> <li>(D)</li> </ul>	<ul> <li>About 2km-long section needs to be constructed in flooded area.</li> <li>Substantial section needs to be constructed in flooded area (D)</li> </ul>
	Alt-7b	Alt-7a: 0.9km Alt-7b: 2.6km (D)	6.6	Large scale relocation is not required.	Possibility of encountering historical heritage is low compared with Alt-5, Alt-7, Alt-7a and Alt-7b.	

#### Table-2 Further Examination of Alternative Route

D: Disadvantage (substantial) A: Advantage (substantial)



# **APPENDIX 9-1**

# **KEY PLAN OF NATIONAL ROAD NO.5 IN THE SOUTH SECTION**





