Appendix 6 Intersection Analysis

APPENDIX 6 INTERSECTION ANALYSIS

Intersection analysis sheet are shown in the following pages as attached materials of Chapter 4 MID TERM SOLUTION.

I-1. Summary Table of Signalized Intersection Analyses

I-2. Intersection Analysis Sheet

1.1 Koteshwor Signalized Intersection (2030: Without case) Current Lane Arrangement

1.2 Tinkune Signalized Intersection (2030: Without case) Current Lane Arrangement

1.3 Koteshwor Signalized Intersection (2030: Option 4) Additional Lane Arrangement

1.4 Tinkune Signalized Intersection (2030: Option 4) Additional Lane Arrangement

1.5 Koteshwor Signalized Intersection (2030: Option 5) Additional Lane Arrangement

1.6 Tinkune Signalized Intersection (2030: Option 5) Additional Lane Arrangement

1.7 Koteshwor Signalized Intersection (2020: Without case) Current Lane Arrangement

1.8 Tinkune Signalized Intersection (2020: Without case) Current Lane Arrangement

2.1 Jadibuti Signalized Intersection (2030: With case) Current Lane Arrangement

2.2 Jadibuti Signalized Intersection (2030: With case) Additional Lane Arrangement

3.1 New Baneshwor Signalized Intersection (2030: Without case) Current Lane Arrangement

4.1 Maitighar (N) Signalized Intersection (2030: Without case) Current Lane Arrangement

4.2 Maitighar (N) Signalized Intersection (2030: Without case) Additional Lane Arrangement

5.1 Maitighar (S) Signalized Intersection (2030: Without case) Current Lane Arrangement

5.2 Maitighar (S) Signalized Intersection (2030: Without case) Additional Lane Arrangement

5.3 Maitighar (S) Roundabout Intersection (2030: Without case) Current Lane Arrangement

6.1 Thapathali Signalized Intersection (2030: Without case) Current Lane Arrangement

6.2 Thapathali Signalized Intersection (2030: Without case) Additional Lane Arrangement

7.1 Tripureshwor Signalized Intersection (2030: Without case) Current Lane Arrangement

7.2 Tripureshwor Signalized Intersection (2030: Without case) Additional Lane Arrangement

7.3 Tripureshwor Roundabout Intersection (2030: Without case) Current Lane Arrangement

I-1. Summary Table of Intersection Analyses

The result of intersection analyses (year-2030) summary are shown below.

Table 6.1 Summary Table of Signalized Intersection Analyses (1/8)

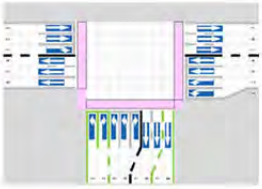
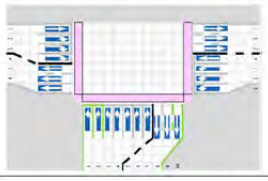
Name of Intersection	Name of Option	Type of Intersection	Lane Arrangement	Result/Evaluation of Signalized/Roundabout Intersection Analysis			Remarks Inflow lane arrangement	Lane arrangement of Intersection	Sheet No.
				Cycle Time	Saturation Degree	Evaluation			
Koteshwor	Without Case	Signalized 3 legs intersection	Current condition	180	2.14	NG (>0.90)	Cannot processing traffic volume of SB/NB/EB left turn lanes		1.1
Koteshwor	With Case Option 4	Signalized 3 legs intersection	Additional lane arrangement	120	0.91	Almost good	Slight traffic congestion will be occurred at the NB left turn lane.		1.3
				SB: 4 lns, NB: 6 lns and EB: 7 lns inflow lanes Total: 17 lns					
Koteshwor	With Case Option 5	Signalized 3 legs intersection	Additional lane arrangement	180	0.79	Excellent	Slight traffic congestion will be occurred at the NB/EB left turn lanes.		1.5
				SB: 4 lns, NB: 4 lns and EB: 7 lns inflow lanes Total: 15 lns					

Table 6.2 Summary Table of Signalized Intersection Analyses (2/8)

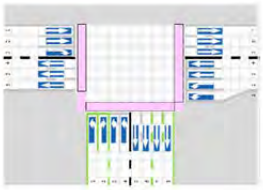
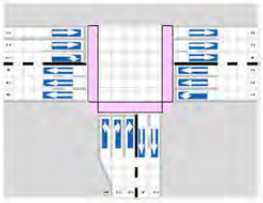
Name of Intersection	Name of Option	Type of Intersection	Lane Arrangement	Result/Evaluation of Signalized/Roundabout Intersection Analysis			Remarks Inflow lane arrangement	Lane arrangement of Intersection	Sheet No.
				Cycle Time	Saturation Degree	Evaluation			
Koteshwor	Without Case /2020	Signalized 3 legs intersection	Current condition	120	1.78	NG (>0.90)	During peak hour, a heavy congestion occurs at the NB left turn lanes		1.7
Tinkune	Without Case	Signalized 3 legs intersection	Current condition	120	1.15	NG (>0.90)	Traffic congestion will be occurred at the NB left turn lane.		1.2
Tinkune	With Case Option 4	Signalized 3 legs intersection	Additional lane arrangement	120	0.70	Excellent	Traffic volume can be processing at all inflows.		1.4
				SB: 3 lns, NB: 4 lns and EB: 3 lns inflow lanes Total: 10 lns					

Table 6.3 Summary Table of Signalized Intersection Analyses (3/8)

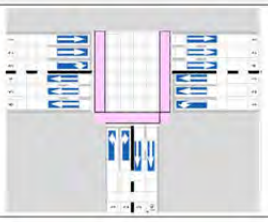
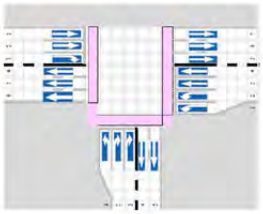
Name of Intersection	Name of Option	Type of Intersection	Lane Arrangement	Result/Evaluation of Signalized/Roundabout Intersection Analysis			Remarks Inflow lane arrangement	Lane arrangement of Intersection	Sheet No.
				Cycle Time	Saturation Degree	Evaluation			
Tinkune	With Case Option 5	Signalized 3 legs intersection	Additional lane arrangement	120	0.59	Excellent	Traffic volume can be processing at all inflows.		1.6
				SB: 3 lns, NB: 3 lns and EB: 2 lns inflow lanes Total: 8 lns					
Tinkune	Without Case /2020	Signalized 3 legs intersection	Current condition	100	0.72	Excellent	Traffic volume can be processing at all inflows.		1.8
Tinkune (year 2020) Existing condition of intersections	Tinkune North	Non signalized 3 legs intersection	Current condition	(60)	0.07	Good	Traffic volume can be processing at all inflows.		-
	Tinkune West			(60)	0.82				-
	Tinkune South			(60)	0.55				-

Table 6.4 Summary Table of Signalized Intersection Analyses (4/8)

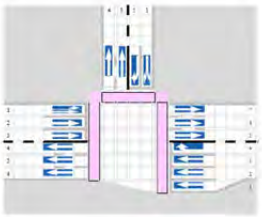
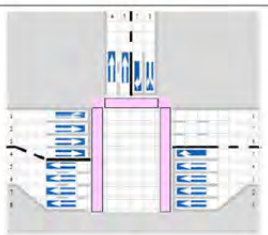
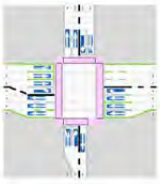
Name of Intersection	Name of Option	Type of Intersection	Lane Arrangement	Result/Evaluation of Signalized/Roundabout Intersection Analysis			Remarks Inflow lane arrangement	Lane arrangement of Intersection	Sheet No.
				Cycle Time	Saturation Degree	Evaluation			
Jadibuti	With case (Option 4/5)	Signalized 3 legs intersection	Current condition	70	1.13	NG (>0.90)	Cannot processing traffic volume of EB/WB through lanes.		2.1
				SB: 2 lns, EB: 3 lns and WB: 4 lns inflow lanes Total: 9 lns					
Jadibuti	With case (Option 4/5)	Signalized 3 legs intersection	Additional lane arrangement	70	0.92	Almost good	Slight traffic congestion will be occurred, but it can be processing.		2.2
				SB: 2 lns, EB: 4 lns and WB: 5 lns inflow lanes Total: 11 lns					
New Baneshwor	Without Case	Signalized 4 legs intersection	Current condition	70	0.81	Good	SB: 2 lns, EB: 4 lns, NB: 2 and WB: 4 lns inflow lanes Total: 10 lns		3.1

Table 6.5 Summary Table of Signalized Intersection Analyses (5/8)

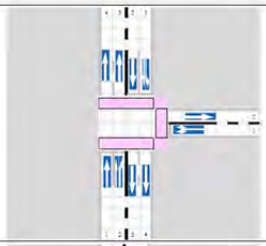
Name of Intersection	Name of Option	Type of Intersection	Lane Arrangement	Result/Evaluation of Signalized/Roundabout Intersection Analysis			Remarks Inflow lane arrangement	Lane arrangement of Intersection	Sheet No.
				Cycle Time	Saturation Degree	Evaluation			
Maitighar (North)	Without Case	Signalized 3 legs intersection	Current condition	120	1.04	NG (>0.90)	Cannot processing traffic volume of NB right turn lane		4.1
Maitighar (North)	Without Case	Signalized 3 legs intersection	Additional lane arrangement	120	0.62	Excellent	Can processing traffic volume of NB right turn lane		4.2
				Additional Lanes: SB: 1 ln. WB: 1 ln and NB: 1 ln					

Table 6.6 Summary Table of Signalized Intersection Analyses (6/8)

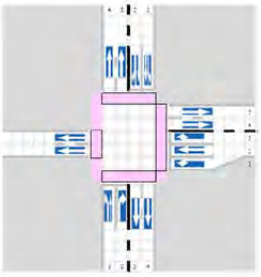
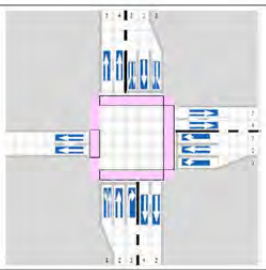
Name of Intersection	Name of Option	Type of Intersection	Lane Arrangement	Result/Evaluation of Signalized/Roundabout Intersection Analysis					Remarks Inflow lane arrangement	Lane arrangement of Intersection	Sheet No.
				Cycle Time	Saturation Degree	Evaluation					
Maitighar (South)	Without Case	Signalized 4 legs (WB: Outflow) intersection	Current condition	120	1.27	NG (>0.90)			Cannot processing traffic volume of inflow lanes		5.1
Maitighar (South)	Without Case	Signalized 4 legs (WB: Outflow) intersection	Additional lane arrangement	120	0.76	Excellent			Can processing entire traffic volume		5.2
				Additional Lanes: SB: 1 ln and NB: 1 ln							
Maitighar (South)	Without Case	Roundabout	Current condition		LOS F			No Good	Cannot processing traffic volume of inflow lanes	-	5.3
				WB	SB	EB	NB	$LOS_{intersection}$	Inflow section		
				505 F	103 F	-	735 F	532 F	Average Control Delay (second/veh.) and LOS		

Table 6.7 Summary Table of Signalized Intersection Analyses (7/8)

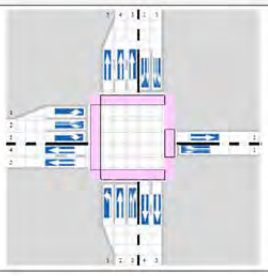
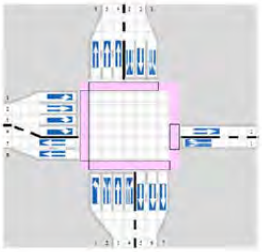
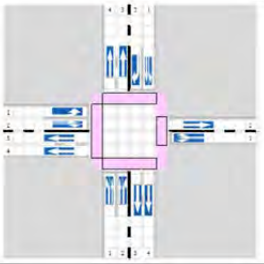
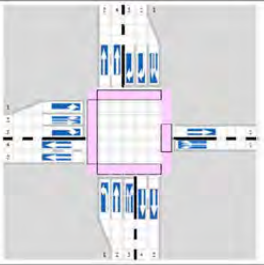
Name of Intersection	Name of Option	Type of Intersection	Lane Arrangement	Result/Evaluation of Signalized/Roundabout Intersection Analysis			Remarks Inflow lane arrangement	Lane arrangement of Intersection	Sheet No.
				Cycle Time	Saturation Degree	Evaluation			
Thapathali	Without Case	Signalized 4 legs intersection	Current condition	120	1.12	NG (>0.90)	Cannot processing traffic volume of NB left turn and EB right turn lanes		6.1
Thapathali	Without Case	Signalized 4 legs intersection	Additional lane arrangement	120	0.61	Excellent	Can processing entire traffic volume		6.2
				Additional Lanes: SB: 1 ln, NB: 1 ln and EB: 1 ln					

Table 6.8 Summary Table of Signalized Intersection Analyses (8/8)

Name of Intersection	Name of Option	Type of Intersection	Lane Arrangement	Result/Evaluation of Signalized/Roundabout Intersection Analysis					Remarks Inflow lane arrangement	Lane arrangement of Intersection	Sheet No.
				Cycle Time	Saturation Degree			Evaluation			
Tripureshwor	Without Case	Signalized 4 legs intersection	Current condition	120	1.32			NG (>0.90)	Cannot processing traffic volume of SB right turn lane		7.1
Tripureshwor	Without Case	Signalized 4 legs intersection	Additional lane arrangement	120	0.90			Good	Can processing traffic volume of SB right turn lane		7.2
				Additional Lanes: SB: 1 ln, NB: 1 ln and EB: 1 ln							
Tripureshwor	Without Case	Roundabout	Current condition		LOS F			No Good	Cannot processing traffic volume of inflow lanes	-	7.3
				WB	SB	EB	NB	$LOS_{intersection}$	Inflow section		
				33 D	656 F	84 F	311 F	427 F	Average Control Delay (second/veh.) and LOS		

I-2. Intersection Analysis Sheet

1.1 Koteshwor Signalized Intersection (2030: Without case) Current Lane Arrangement

Calculation result of Intersections (Koteshwor Intersection) *Current Lane Arrangement* xxx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Koteshwor Without case	C (Cycle time)	1 ϕ	2 ϕ	3 ϕ	4 ϕ	5 ϕ	6 ϕ
Target year	2030 peak hour	180	40	30	4	32	70	4
					Y&AR			Y&AR

Lane width	Heavy vehicle ratio (%)
3.50	11.6

Level crossing open ratio (%) = 100%

Approaches		A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane		Left Turn	Through	Right Turn	Through+Left	Through	Through+Left	Right Turn	Left Turn	Through		Left Turn	Right Turn	Left Turn	Right Turn
Number of lane			2	1					2	2		1	1	1	1
Basic value of saturation flow rate	S_B	1,900	2,000	1,900	2,000	2,000	2,000	1,900	1,900	2,000		1,900	1,900	1,900	1,900
Adjustment factor for lane width	α_W	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(lane width)	m	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50		3.50	3.50	3.50	3.50
Adjustment factor for approach grade	α_G	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(approach grade)	%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Adjustment factor for heavy vehicles	α_T	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		0.92	0.92	0.92	0.92
(ratio of hevy vehicles)	%	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60		11.60	11.60	11.60	11.60
Adjustment factor for bus-stop	α_{BS}	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Adjustment factor for lefft turn	$\alpha_{L(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.01	1.00	1.00	1.00
(ratio of left turn vehicles)	L %								100.0			1.00		1.00	
(decrease ratio of pedestrians)	f_p								0.15			0.00		0.00	
(effective green time)	G sec.								32			40		30	
(green time for pedestrians)	G_p sec.								27			35		25	
(though vehicle equivalent for left turn vehicles)	E_{LT}														
	S_L				Straight/Right				590			422		317	
Adjustment factor for right turn	$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(ratio of right turn vehicles)	R %			100.00											
(probability of right turn)	f			0.00											
(vehicle making turns at transitof phases)	K			3											
(volume of opposite through traffic)	q			> 1,000											
(saturaion flow rate of opposite approach)	S_R			799											
(though vehicle equivalent for right turn vehicles)	E_{RT}														
Saturation flow rate	S_A	0	3,680	1,748	0	0	0		3,496	3,680	0	1,766	1,748	1,748	1,748
Traffic volume : Right turn traffic volume				1,537									1,675		718
(heavy vehicle ratio)				11.60				11.60		11.60			11.60		11.60
Through traffic volume			2,116							2,846					
(heavy vehicle ratio)			11.60		11.60	11.60	11.60		11.60	11.60		11.60	11.60	11.60	
Left turn traffic volume									2,556			1,090		726	
(heavy vehicle ratio)		11.60	11.60		11.60		11.60		11.60			11.60		11.60	
Total traffic volume: q		0	2,116	1,537	0	0	0	0	2,556	2,846		1,090	1,675	726	718
(heavy vehicle ratio)		11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60		11.60	11.60	11.60	11.60
Traffic volume	q	0	2,116	1,537	0	0	0	0	2,556	2,846	0	1,090	1,675	726	718
Flow ratio	p		0.575	0.879					0.731	0.773		0.617	0.958	0.415	0.411
Necessary phase ratio	1 ϕ										1090>422 See below↓	0.958			
	2 ϕ										1 ϕ	422	1675>317 See below↓	0.411	
	3 ϕ												2 ϕ	317	
	4 ϕ		0.575					2556>590 See below↓		0.773					
	5 ϕ		1,537>799 See below↓					4 ϕ	590						
	6 ϕ														

Saturation degree of phase	Saturation degree of intersection
0.958	
0.406	
0.000	2.138
0.773	
0.000	

not Good

During the peak hours, a large traffic congestion occurs in the SB right turn lane at peak hours.

During the peak hours, a large traffic congestion occurs in the NB left turn lane at peak hours.

During the peak hours, a large traffic congestion occurs in the EB left turn lane at peak hours.

Right Turn Queues = 37 veh./cycle

Queues = pcu/cycle

Left Turn Queues = 98 pcu/cycle

Queues = 33 veh./cycle

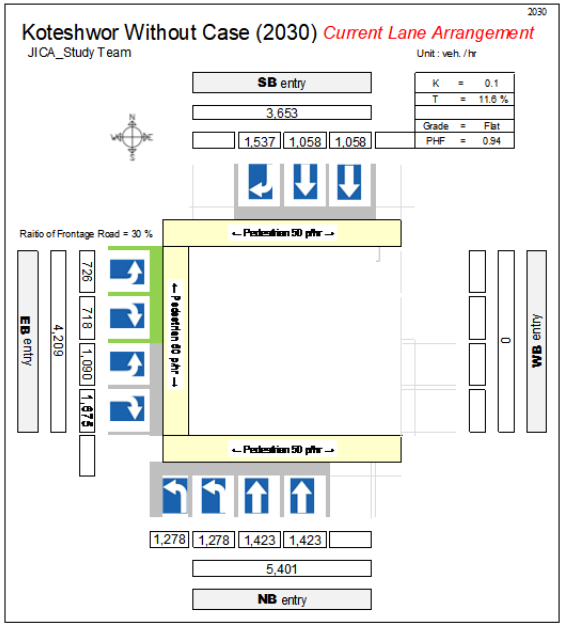
Left Turn

Queues = 20 veh./cycle

Left Turn

【Equations】

Lane Configuration and Turning movement



1.2 Tinkune Signalized Intersection (2030: Without case) Current Lane Arrangement

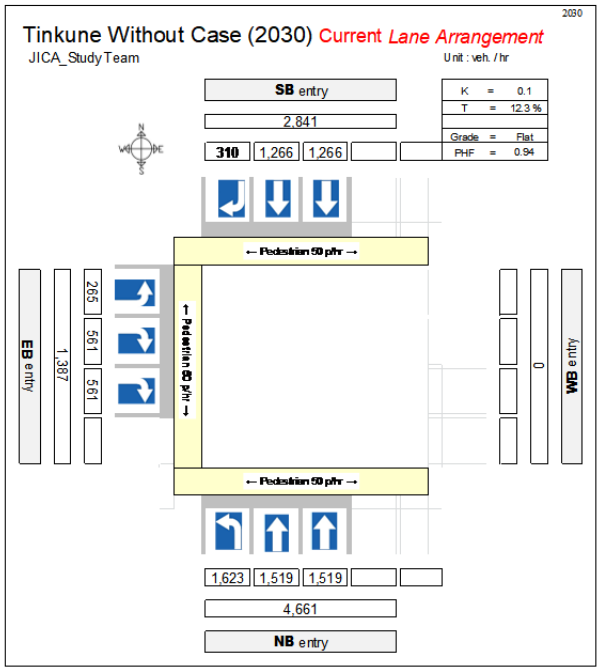
Calculation result of Intersections (Tinkune Intersection) Current Lane Arrangement x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Tinkune Without case	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	120	31	4	51	30	4	
				Y&AR			Y&AR	

Lane width	Heavy vehicle ratio (%)
3.50	12.3

Lane Configuration and Turning movement



Level crossing open ratio (%) = **100%**

Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left Turn	Through	Right Turn	Through+Left	Through	Through+Left	Right Turn	Left Turn	Through		Left Turn	Right Turn	Left+Through	Right Turn
Number of lane				2	1					1	2		1	2		
Basic value of saturation flow rate	:	S_B	1,900	2,000	1,900	2,000	2,000	2,000	1,900	1,900	2,000		1,900	1,900	1,900	1,900
Adjustment factor for lane width	:	α_W	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(lane width)		m	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50		3.50	3.50	3.50	3.50
Adjustment factor for approach grade	:	α_G	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(approach grade)		%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Adjustment factor for heavy vehicles	:	α_T	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		0.92	0.92	0.92	0.92
(ratio of hew vehicles)		%	12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30		12.30	12.30	12.30	12.30
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-	-	-	-	-	-	-	-	
Adjustment factor for **leftt** turn		$\alpha_{L(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.01	1.00	1.00	1.00
(ratio of left turn vehicles)		L %								100.0			1.00			
(decrease ratio of pedestrians)		f_p								0.15			0.15			
(effective green time)		G sec.								51			31			
(green time for pedestrians)		G_p sec.								46			26			
(though vehicle equivalent for left turn vehicles)		E_{LT}														
		S_L								698			429			
Adjustment factor for **right** turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %			100.00											
(probability of right turn)		f			0.00											
(vehicle making turns at transitof phases)		K			3											
(volume of opposite through traffic)		q			> 1,000											
(saturaion flow rate of opposite approach)		S_R			565											
(though vehicle equivalent for right turn vehicles)		E_{RT}														
Saturation flow rate	:	S_A	0	3,680	1,748	0	0	0		1,748	3,680	0	1,766	3,496	0	
Traffic volume	: Right turn traffic volume				310									1,122		356
	(heavy vehicle ratio)				12.30				12.30		12.30			12.30		12.30
	Through traffic volume			2,532							3,038					
	(heavy vehicle ratio)			12.30		12.30	12.30	12.30		12.30	12.30		12.30	12.30	12.30	
	Left turn traffic volume									1,623			265			
	(heavy vehicle ratio)		12.30	12.30		12.30		12.30		12.30			12.30		12.30	
	Total traffic volume : q		0	2,532	310	0	0	0	0	1,623	3,038		265	1,122	0	356
	(heavy vehicle ratio)		12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30		12.30	12.30	12.30	12.30
Traffic volume	:	q	0	2,532	310	0	0	0	0	1,623	3,038	0	265	1,122	0	356
Flow ratio	:	p		0.688	0.177					0.928	0.826		0.150	0.321		
Necessary phase ratio	:	1φ												0.321		
		2φ										265<429 OK				
		3φ		0.688					1623>698 See below ↓		0.826					
		4φ			310<565 OK				3φ	All Green						
		5φ														
		6φ														

Saturation degree of phase	Saturation degree of intersection
0.321	
0.000	
0.826	1.146
0.000	
0.000	

not Good

During the peak hours, a large traffic congestion occurs in the NB left turn lane at peak hours.

Queues = pcu/cycle | Queues = pcu/cycle | Left Turn Queues = 31 pcu/cycle | Queues = pcu/cycle

1.3 Koteshwor Signalized Intersection (2030: Option 4) Additional Lane Arrangement

Calculation result of Intersections (Koteshwor Intersection) x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Koteshwor OPTION 4.0	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	120	30	10	4	52	20	4
					Y&AR			Y&AR

Lane width	Heavy vehicle ratio (%)
3.50	11.6

Level crossing open ratio (%) = 100%

Approaches		A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane		Left Turn	Through	Right Turn	Through+Left	Through	Through+Left	Right Turn	Left Turn	Through		Left Turn	Right Turn	Left Turn	Right Turn
Number of lane			3	1					2	4		1	3	1	2
Basic value of saturation flow rate	S_B	1,900	2,000	1,900	2,000	2,000	2,000	1,900	1,900	2,000		1,900	1,900	1,900	1,900
Adjustment factor for lane width	α_W	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(lane width)	m	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50		3.50	3.50	3.50	3.50
Adjustment factor for approach grade	α_G	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(approach grade)	%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Adjustment factor for heavy vehicles	α_T	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		0.92	0.92	0.92	0.92
(ratio of hew vehicles)	%	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60		11.60	11.60	11.60	11.60
Adjustment factor for bus-stop	α_{BS}	-	-	-	-	-	-		-	-	-	-	-	-	
Adjustment factor for **leftt** turn	$\alpha_{L(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.01	1.00	1.00	1.00
(ratio of left turn vehicles)	L %								100.0			1.00		1.00	
(decrease ratio of pedestrians)	f_p								0.15			0.00		0.00	
(effective green time)	G sec.								52			30		10	
(green time for pedestrians)	G_P sec.								47			25		5	
(though vehicle equivalent for left turn vehicles)	E_{LT}										4φ				
	S_L				Straight Flow				1,423		562	475		158	
Adjustment factor for **right** turn	$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(ratio of right turn vehicles)	R %			100.00											
(probability of right turn)	f			0.00											
(vehicle making turns at transitof phases)	K			3											
(volume of opposite through traffic)	q			> 1,000											
(saturaion flow rate of opposite approach)	S_R			407											
(though vehicle equivalent for right turn vehicles)	E_{RT}														
Saturation flow rate	S_A	0	5,520	1,748	0	0	0		3,496	7,360	0	1,766	5,244	1,748	3,496
Traffic volume : Right turn traffic volume				136									1,676		718
(heavy vehicle ratio)				11.60				11.60		11.60			11.60		11.60
Through traffic volume			2,115							2,844					
(heavy vehicle ratio)			11.60		11.60	11.60	11.60		11.60	11.60		11.60	11.60	11.60	
Left turn traffic volume									2,556			130		56	
(heavy vehicle ratio)		11.60	11.60		11.60		11.60		11.60			11.60		11.60	
Total traffic volume : q		0	2,115	136	0	0	0	0	2,556	2,844		130	1,676	56	718
(heavy vehicle ratio)		11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60		11.60	11.60	11.60	11.60
Traffic volume	q	0	2,115	136	0	0	0	0	2,556	2,844	0	130	1,676	56	718
Flow ratio	p		0.383	0.078					0.731	0.386		0.074	0.320	0.032	0.205
Necessary phase ratio	1φ											**0.074**	**0.320**		
	2φ										130<475 OK			0.032	**0.205**
	3φ												56<158 OK		**0.000**
	4φ		**0.383**				2556>1986	See below ↓		**0.386**					
	5φ		136<407 OK				4φ+5φ		1,986						**0.000**
	6φ														

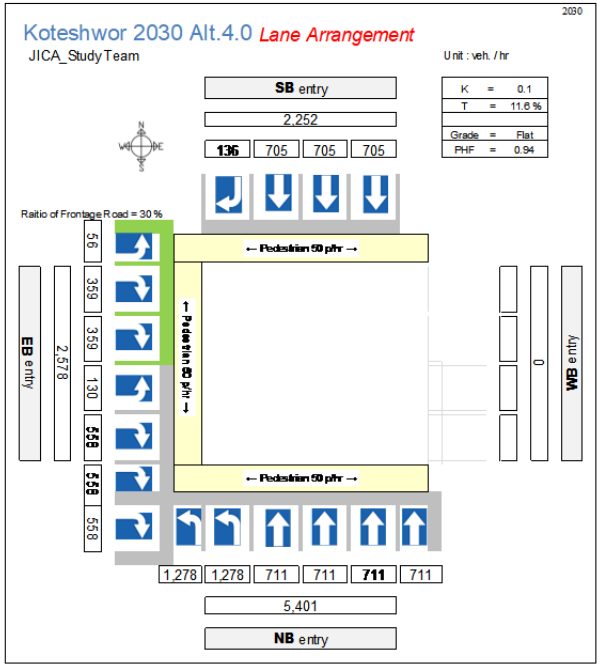
Saturation degree of phase	Saturation degree of intersection
0.320	
0.205	
0.000	0.911
0.386	
0.000	

almost Good

During the peak hours, a slight congestion occurs in the NB left turn lanes.

Queues = pcu/cycle | Queues = pcu/cycle | Left Turn Queues = 19 pcu/cycle | Queues = pcu/cycle

Lane Configuration and Turning movement



1.4 Tinkune Signalized Intersection (2030: Option 4) Additional Lane Arrangement

Calculation result of Intersections (Tinkune Intersection)

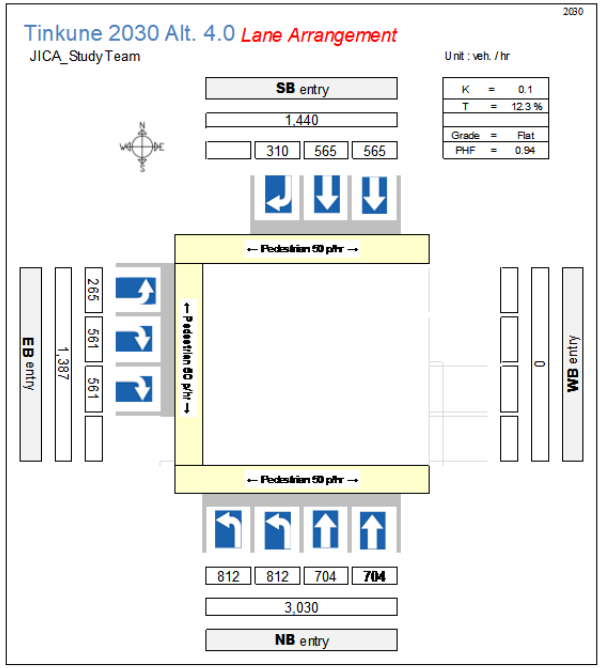
x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Tinkune OPTION 4.0	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	120	45	4	52	15	4	
				Y&AR			Y&AR	

Lane width	Heavy vehicle ratio (%)
3.50	12.3

Lane Configuration and Turning movement



Level crossing open ratio (%) = **100%**

Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left Turn	Through	Right Turn	Through+Left	Through	Through+Left	Right Turn	Left Turn	Through		Left Turn	Right Turn	Left+Through	Right Turn
Number of lane				2	1					2	2		1	2		
Basic value of saturation flow rate	:	S_B	1,900	2,000	1,900	2,000	2,000	2,000	1,900	1,900	2,000		1,900	1,900	1,900	1,900
Adjustment factor for lane width	:	α_W	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(lane width)		m	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50		3.50	3.50	3.50	3.50
Adjustment factor for approach grade	:	α_G	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(approach grade)		%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Adjustment factor for heavy vehicles	:	α_T	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		0.92	0.92	0.92	0.92
(ratio of hew vehicles)		%	12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30		12.30	12.30	12.30	12.30
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-	-	-	-	-	-	-	-	
Adjustment factor for **leftt** turn		$\alpha_{L(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.01	1.00	1.00	1.00
(ratio of left turn vehicles)		L %								100.0			1.00			
(decrease ratio of pedestrians)		f_p								0.15			0.15			
(effective green time)		G sec.								52			45			
(green time for pedestrians)		G_p sec.								47			40			
(though vehicle equivalent for left turn vehicles)		E_{LT}										4φ				
		S_L								1,423		428	618			
Adjustment factor for **right** turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %			100.00											
(probability of right turn)		f			0.00											
(vehicle making turns at transitof phases)		K			3											
(volume of opposite through traffic)		q			> 1,000											
(saturaion flow rate of opposite approach)		S_R			328											
(though vehicle equivalent for right turn vehicles)		E_{RT}														
Saturation flow rate	:	S_A	0	3,680	1,748	0	0	0		3,496	3,680	0	1,766	3,496	0	
Traffic volume	:	Right turn traffic volume			310									1,122		
		(heavy vehicle ratio)			12.30				12.30		12.30			12.30		12.30
		Through traffic volume		1,130							1,408					
		(heavy vehicle ratio)		12.30		12.30	12.30	12.30		12.30	12.30		12.30	12.30	12.30	
		Left turn traffic volume								1,624			265			
		(heavy vehicle ratio)	12.30	12.30		12.30		12.30		12.30			12.30		12.30	
		Total traffic volume : q	0	1,130	310	0	0	0	0	1,624	1,408		265	1,122	0	0
		(heavy vehicle ratio)	12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30		12.30	12.30	12.30	12.30
Traffic volume	:	q	0	1,130	310	0	0	0	0	1,624	1,408	0	265	1,122	0	0
Flow ratio	:	p		0.307	0.177						0.383		0.150	0.321		
Necessary phase ratio	:	1φ												0.321		
		2φ										265<618 OK				
		3φ		0.307					1624<1851 OK		0.383					
		4φ			310<328 OK				3φ+4φ	1,851						
		5φ														
		6φ														

Saturation degree of phase	Saturation degree of intersection
0.321	0.704
0.000	
0.383	
0.000	
0.000	

Excellent

Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle

1.5 Koteshwor Signalized Intersection (2030: Option 5) Additional Lane Arrangement

Calculation result of Intersections (Koteshwor Intersection) x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Koteshwor OPTION 5	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	180	60	30	4	32	50	4
					Y&AR			Y&AR

Lane width	Heavy vehicle ratio (%)
3.50	11.6

Level crossing open ratio (%) = **100%**

Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left Turn	Through	Right Turn	Through+Left	Through	Through+Left	Right Turn	Left Turn	Through		Left Turn	Right Turn	Left Turn	Right Turn
Number of lane				1	3					3	1		2	3	1	1
Basic value of saturation flow rate	:	S_B	1,900	2,000	1,900	2,000	2,000	2,000	1,900	1,900	2,000		1,900	1,900	1,900	1,900
Adjustment factor for lane width	:	α_W	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(lane width)		m	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50		3.50	3.50	3.50	3.50
Adjustment factor for approach grade	:	α_G	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(approach grade)		%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Adjustment factor for heavy vehicles	:	α_T	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		0.92	0.92	0.92	0.92
(ratio of hew vehicles)		%	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60		11.60	11.60	11.60	11.60
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Adjustment factor for **leftt** turn		$\alpha_{L(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.01	1.00	1.00	1.00
(ratio of left turn vehicles)		L %								100.0			1.00		1.00	
(decrease ratio of pedestrians)		f_p								0.15			0.00		0.00	
(effective green time)		G sec.								32			60		30	
(green time for pedestrians)		G_p sec.								27			55		25	
(though vehicle equivalent for left turn vehicles)		E_{LT}										5φ				
		S_L								885		1,370	1,267		317	
Adjustment factor for **right** turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %			100.00											
(probability of right turn)		f			0.00											
(vehicle making turns at transitof phases)		K			3											
(volume of opposite through traffic)		q			> 1,000											
(saturaion flow rate of opposite approach)		S_R			1,643											
(though vehicle equivalent for right turn vehicles)		E_{RT}														
Saturation flow rate	:	S_A	0	1,840	5,244	0	0	0		5,244	1,840	0	3,531	5,244	1,748	1,748
Traffic volume : Right turn traffic volume					1,536									1,676		718
(heavy vehicle ratio)					11.60				11.60		11.60			11.60		11.60
Through traffic volume				100							100					
(heavy vehicle ratio)				11.60		11.60	11.60	11.60		11.60	11.60		11.60	11.60	11.60	
Left turn traffic volume										2,556			1,271		545	
(heavy vehicle ratio)			11.60	11.60		11.60		11.60		11.60			11.60		11.60	
Total traffic volume :		q	0	100	1,536	0	0	0	0	2,556	100		1,271	1,676	545	718
(heavy vehicle ratio)			11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60		11.60	11.60	11.60	11.60
Traffic volume	:	q	0	100	1,536	0	0	0	0	2,556	100	0	1,271	1,676	545	718
Flow ratio	:	p		0.054	0.293					0.487	0.054		0.360	0.320	0.312	0.411
Necessary phase ratio	:	1φ												0.320		
		2φ										1271 >=1267 OK				0.411
		3φ												545>317 See below ↓		
		4φ		0.054				2556>2255 See below ↓		0.054						
		5φ		1,536>1,643 OK				4φ+5φ		2,255						
		6φ														

Saturation degree of phase	Saturation degree of intersection
0.320	0.785
0.411	
0.000	
0.054	
0.000	

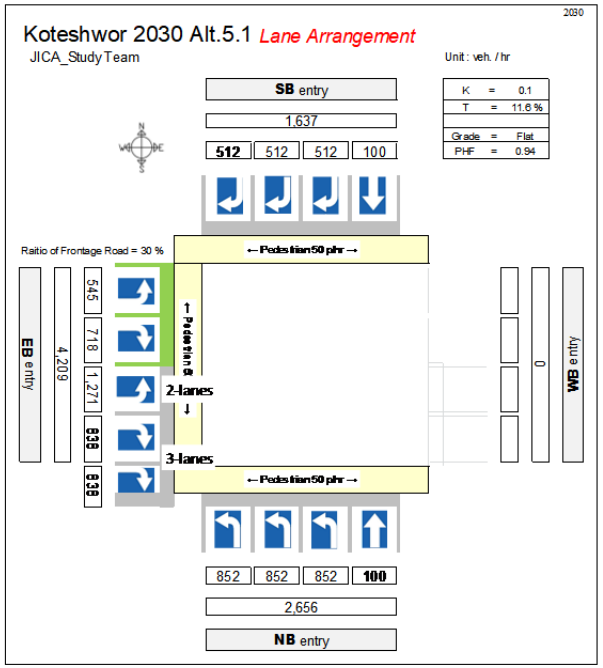
Excellent

During the peak hours, a slight congestion occurs in the NB left turn lanes.

During the peak hours, a slight congestion occurs in the EB (Frontage road) left turn lane.

Queues = pcu/cycle | Queues = pcu/cycle | Left Turn Queues = 15 pcu/cycle | Queues = 11 veh./cycle | Left Turn

Lane Configuration and Turning movement



1.6 Tinkune Signalized Intersection (2030: Option 5) Additional Lane Arrangement

Calculation result of Intersections (Tinkune Intersection)

x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Tinkune OPTION 5	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	120	45	4	52	15	4	
				Y&AR			Y&AR	

Lane width	Heavy vehicle ratio (%)
3.50	12.3

Level crossing open ratio (%) = **100%**

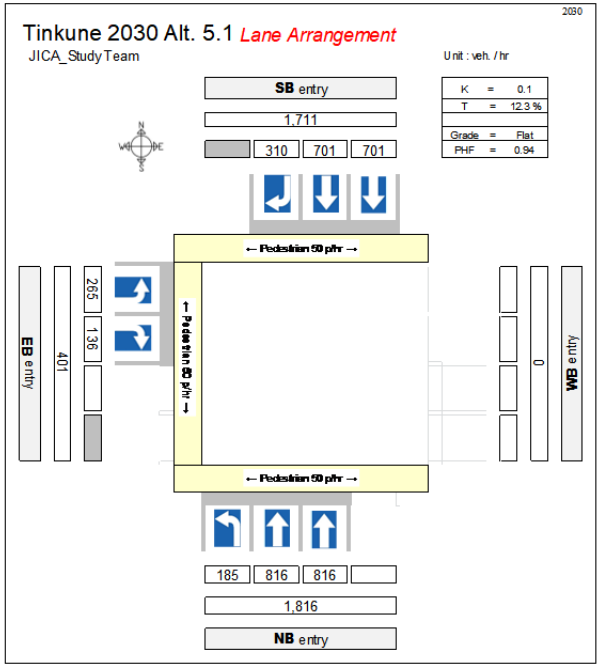
Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left Turn	Through	Right Turn	Through+Left	Through	Through+Left	Right Turn	Left Turn	Through		Left Turn	Right Turn	Left+Through	Right Turn
Number of lane				2	1					1	2		1	1		
Basic value of saturation flow rate	:	S_B	1,900	2,000	1,900	2,000	2,000	2,000	1,900	1,900	2,000		1,900	1,900	1,900	1,900
Adjustment factor for lane width	:	α_W	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(lane width)		m	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50		3.50	3.50	3.50	3.50
Adjustment factor for approach grade	:	α_G	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(approach grade)		%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Adjustment factor for heavy vehicles	:	α_T	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		0.92	0.92	0.92	0.92
(ratio of hew vehicles)		%	12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30		12.30	12.30	12.30	12.30
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-	-	-	-	-	-	-	-	
Adjustment factor for **leftt** turn		$\alpha_{L(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.01	1.00	1.00	1.00
(ratio of left turn vehicles)		L %								100.0			1.00			
(decrease ratio of pedestrians)		f_p								0.15			0.15			
(effective green time)		G sec.								52			45			
(green time for pedestrians)		G_p sec.								47			40			
(though vehicle equivalent for left turn vehicles)		E_{LT}										4φ				
		S_L				Straight Flow				712		214	618			
Adjustment factor for **right** turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %			100.00											
(probability of right turn)		f			0.00											
(vehicle making turns at transitof phases)		K			3											
(volume of opposite through traffic)		q			> 1,000											
(saturaion flow rate of opposite approach)		S_R			328											
(though vehicle equivalent for right turn vehicles)		E_{RT}														
Saturation flow rate	:	S_A	0	3,680	1,748	0	0	0		1,748	3,680	0	1,766	1,748	0	
Traffic volume	: Right turn traffic volume				310									136		
	(heavy vehicle ratio)				12.30				12.30		12.30			12.30		12.30
	Through traffic volume			1,402							1,632					
	(heavy vehicle ratio)			12.30		12.30	12.30	12.30		12.30	12.30		12.30	12.30	12.30	
	Left turn traffic volume									185			265			
	(heavy vehicle ratio)		12.30	12.30		12.30		12.30		12.30			12.30		12.30	
	Total traffic volume :	q	0	1,402	310	0	0	0	0	185	1,632		265	136	0	0
	(heavy vehicle ratio)		12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30	12.30		12.30	12.30	12.30	12.30
Traffic volume	:	q	0	1,402	310	0	0	0	0	185	1,632	0	265	136	0	0
Flow ratio	:	p		0.381	0.177					0.106	0.443		0.150	0.078		
Necessary phase ratio	:	1φ											**0.150**	**0.078**		
		2φ											265<618 OK			
		3φ		**0.381**						185<925 OK	**0.443**					
		4φ			310<328 OK				3φ+4φ	**925**						
		5φ														
		6φ														

Saturation degree of phase	Saturation degree of intersection
0.150	0.594
0.000	
0.443	
0.000	
0.000	

Excellent

Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle

Lane Configuration and Turning movement



1.7 Koteshwor Signalized Intersection (2020: Without case) Current Lane Arrangement

Calculation result of Intersections (Koteshwor Intersection) x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Koteshwor Current Lane Arrangement	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2020 peak hour	120	40	27	4	40	5	4
					Y&AR			Y&AR

Lane width	Heavy vehicle ratio (%)
3.50	8.0

Level crossing open ratio (%) = **100%**

Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left Turn	Through	Right Turn	Through+Left	Through	Through+Left	Right Turn	Left Turn	Through		Left Turn	Right Turn	Left Turn	Right Turn
Number of lane				2	1					2	2		0	2	1	1
Basic value of saturation flow rate	:	S_B	1,900	2,000	1,900	2,000	2,000	2,000	1,900	1,900	2,000		1,900	1,900	1,900	1,900
Adjustment factor for lane width	:	α_W	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(lane width)		m	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50		3.50	3.50	3.50	3.50
Adjustment factor for approach grade	:	α_G	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(approach grade)		%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Adjustment factor for heavy vehicles	:	α_T	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95		0.95	0.95	0.95	0.95
(ratio of hew vehicles)		%	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00		8.00	8.00	8.00	8.00
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-		-	-	-	-	-	-	
Adjustment factor for **leftt** turn		$\alpha_{L(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.01	1.00	1.00	1.00
(ratio of left turn vehicles)		L %								100.0			1.00		1.00	
(decrease ratio of pedestrians)		f_p								0.15			0.00		0.00	
(effective green time)		G sec.								40			40		27	
(green time for pedestrians)		G_p sec.								35			35		22	
(though vehicle equivalent for left turn vehicles)		E_{LT}														
		S_L								1,100			0		428	
Adjustment factor for **right** turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %			100.00											
(probability of right turn)		f			0.00											
(vehicle making turns at transitof phases)		K			3											
(volume of opposite through traffic)		q			> 1,000											
(saturaion flow rate of opposite approach)		S_R			169											
(though vehicle equivalent for right turn vehicles)		E_{RT}														
Saturation flow rate	:	S_A	0	3,800	1,805	0	0	0		3,610	3,800	0	0	3,610	1,805	1,805
Traffic volume : Right turn traffic volume					3									1,736		868
(heavy vehicle ratio)					8.00				8.00		8.00			8.00		8.00
Through traffic volume				1,884							3,092					
(heavy vehicle ratio)				8.00		8.00	8.00	8.00		8.00	8.00		8.00	8.00	8.00	
Left turn traffic volume										4,092			0		5	
(heavy vehicle ratio)			8.00	8.00		8.00		8.00		8.00			8.00		8.00	
Total traffic volume :		q	0	1,884	3	0	0	0	0	4,092	3,092		0	1,736	5	868
(heavy vehicle ratio)			8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00		8.00	8.00	8.00	8.00
Traffic volume	:	q	0	1,884	3	0	0	0	0	4,092	3,092	0	0	1,736	5	868
Flow ratio	:	p		0.496	0.002					1.134	0.814			0.481	0.003	0.481
Necessary phase ratio	:	1φ												**0.481**		
		2φ													**0.003**	**0.481**
		3φ													5<428 OK	
		4φ		**0.496**					4φ	**1,100**	**0.814**					
		5φ			3<169 OK			4092>1100 See below ↓								
		6φ														

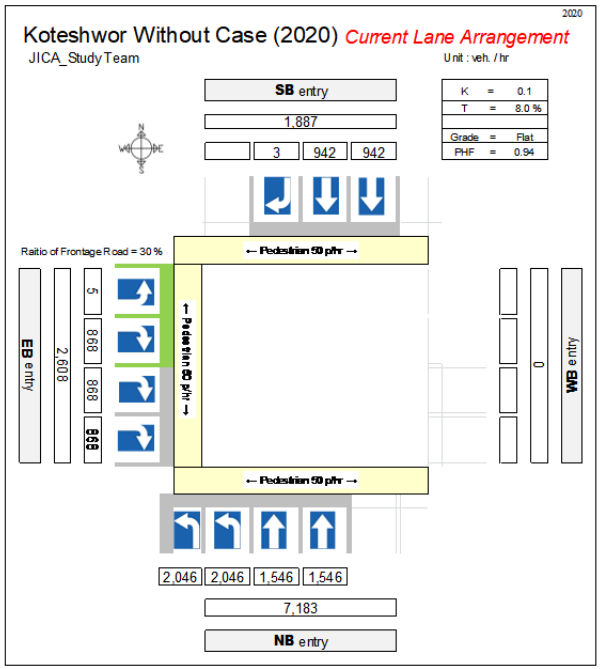
Saturation degree of phase	Saturation degree of intersection
0.481	
0.481	
0.000	
0.814	1.775
0.000	

not Good

During the peak hours, a heavy congestion occurs in the NB left turn lanes.

Queues = pcu/cycle | Queues = pcu/cycle | Left Turn Queues = 100 pcu/cycle | Queues = pcu/cycle

Lane Configuration and Turning movement



1.8 Tinkune Signalized Intersection (2020: Without case) Current Lane Arrangement

Calculation result of Intersections (Tinkune Intersection)

x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Tinkune	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2020 peak hour	100	32	4	30	30	4	
				Y&AR			Y&AR	

Lane width	Heavy vehicle ratio (%)
3.50	10.2

Level crossing open ratio (%) = **100%**

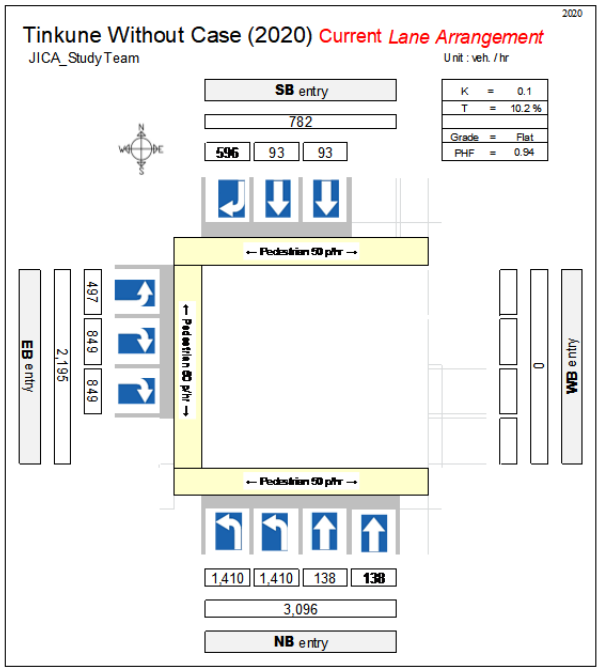
Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left Turn	Through	Right Turn	Through+Left	Through	Through+Left	Right Turn	Left Turn	Through		Left Turn	Right Turn	Left+Through	Right Turn
Number of lane				2	1					2	2		1	2		
Basic value of saturation flow rate	:	S_B	1,900	2,000	1,900	2,000	2,000	2,000	1,900	1,900	2,000		1,900	1,900	1,900	1,900
Adjustment factor for lane width	:	α_W	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(lane width)		m	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50		3.50	3.50	3.50	3.50
Adjustment factor for approach grade	:	α_G	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(approach grade)		%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Adjustment factor for heavy vehicles	:	α_T	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93		0.93	0.93	0.93	0.93
(ratio of hew vehicles)		%	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20		10.20	10.20	10.20	10.20
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-	-	-	-	-	-	-	-	
Adjustment factor for **leftt** turn		$\alpha_{L(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.01	1.00	1.00	1.00
(ratio of left turn vehicles)		L %								100.0		100.0	1.00			
(decrease ratio of pedestrians)		f_p								0.15		0.15	0.15			
(effective green time)		G sec.								30	3φ+4φ	60	32			
(green time for pedestrians)		G_p sec.								25		25	27			
(though vehicle equivalent for left turn vehicles)		E_{LT}														
		S_L						3φ		998	4φ	1,967	531			
Adjustment factor for **right** turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %			100.00											
(probability of right turn)		f			0.00											
(vehicle making turns at transitof phases)		K			3											
(volume of opposite through traffic)		q			> 1,000											
(saturaion flow rate of opposite approach)		S_R			678											
(though vehicle equivalent for right turn vehicles)		E_{RT}														
Saturation flow rate	:	S_A	0	3,720	1,767	0	0	0		3,534	3,720	0	1,785	3,534	0	
Traffic volume	:	Right turn traffic volume			596									1,698		
		(heavy vehicle ratio)			10.20				10.20		10.20			10.20		10.20
		Through traffic volume		186							276					
		(heavy vehicle ratio)		10.20		10.20	10.20	10.20		10.20	10.20		10.20	10.20	10.20	
		Left turn traffic volume								854			497			
		(heavy vehicle ratio)	10.20	10.20		10.20		10.20		10.20			10.20		10.20	
		Total traffic volume : q	0	186	596	0	0	0	0	854	276		497	1,698	0	0
		(heavy vehicle ratio)	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20		10.20	10.20	10.20	10.20
Traffic volume	:	q	0	186	596	0	0	0	0	854	276	0.000	497	1,698	0	0
Flow ratio	:	p		0.050	0.337					0.242	0.074		0.278	0.480		
Necessary phase ratio	:	1φ											**0.278**	**0.480**		
		2φ											497<531 OK			
		3φ		**0.050**						0.242	**0.074**					
		4φ			596<678 OK											
		5φ														
		6φ														

Saturation degree of phase	Saturation degree of intersection
0.480	
0.000	
0.242	0.722
0.000	
0.000	

Excellent

Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle

Lane Configuration and Turning movement



2.1 Jadibuti Signalized Intersection (2030: With case) Current Lane Arrangement

Calculation result of Intersections (Jadibuti Intersection)

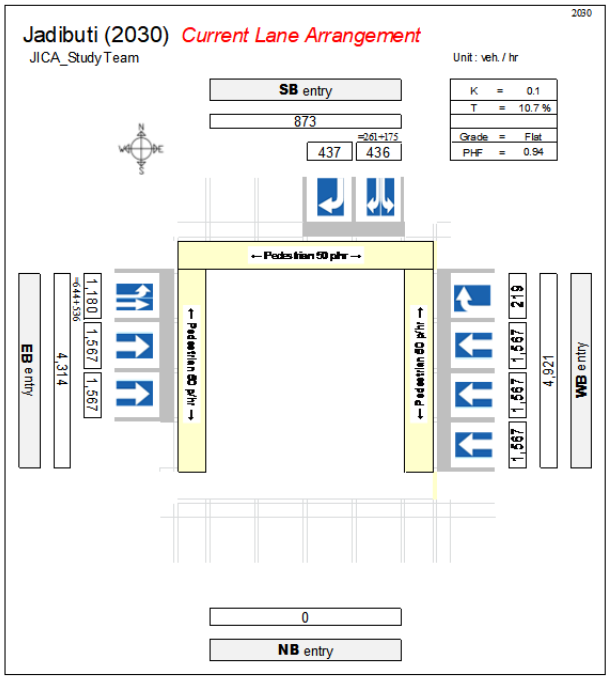
x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Jadibuti Current Lane	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	70	32	10	4	20	4	
					Y&AR		Y&AR	

Lane width	Heavy vehicle ratio (%)
3.50	10.7

Lane Configuration and Turning movement



Level crossing open ratio (%) = **100%**

Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left+Right	Right Turn		Through	Right Turn						Left+ Through	Through		
Number of lane			1	1		3	1						1	2		
Basic value of saturation flow rate	:	S_B	1,900	1,900		2,000	1,900						2,000	2,000		
Adjustment factor for lane width	:	α_W	1.00	1.00		1.00	1.00						1.00	1.00		
(lane width)		m	3.50	3.50		3.50	3.50						3.50	3.50		
Adjustment factor for approach grade	:	α_G	1.00	1.00		1.00	1.00						1.00	1.00		
(approach grade)		%	0.00	0.00		0.00	0.00						0.00	0.00		
Adjustment factor for heavy vehicles	:	α_T	0.93	0.93		0.93	0.93						0.93	0.93		
(ratio of hew vehicles)		%	10.70	10.70		10.70	10.70						10.70	10.70		
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-		-	-	-	-	-	-	
Adjustment factor for **leftt** turn		$\alpha_{L(T)}$	0.87	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	1.00	1.00
(ratio of left turn vehicles)		L %	40.1										54.6			
(decrease ratio of pedestrians)		f_p	0.15										0.15			
(effective green time)		G sec.	20										32			
(green time for pedestrians)		G_p sec.	27										27			
(though vehicle equivalent for left turn vehicles)		E_{LT}	1.38										1.26			
		S_L				Straight Flow										
Adjustment factor for **right** turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %		100.0			100.0									
(probability of right turn)		f					0.00									
(vehicle making turns at transitof phases)		K					3									
(volume of opposite through traffic)		q					> 1,000									
(saturaion flow rate of opposite approach)		S_R					426									
(though vehicle equivalent for right turn vehicles)		E_{RT}														
Saturation flow rate	:	S_A	1,534	1,767	0	5,580	1,767	0		0	0	0	1,629	3,720	0	
Traffic volume	:	Right turn traffic volume		437			219									
		(heavy vehicle ratio)		10.70			10.70									
		Through traffic volume	261			4,701							536	3,134		
		(heavy vehicle ratio)	10.70			10.70							10.70	10.70		
		Left turn traffic volume	175										644			
		(heavy vehicle ratio)	10.70										10.70			
		Total traffic volume : q	436	437	0	4,701	219	0	0	0	0		1,180	3,134	0	0
		(heavy vehicle ratio)	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70
Traffic volume	:	q	436	437	0	4,701	219	0	0	0	0	0	1,180	3,134	0	0
Flow ratio	:	p	0.284	0.247		0.842							0.724	0.842		
Necessary phase ratio	:	1φ				0.842							0.724	0.842		
		2φ					219<426 OK									
		3φ														
		4φ	0.284	0.247												
		5φ														
		6φ														

Saturation degree of phase	Saturation degree of intersection
0.842	
0.000	
0.000	
0.284	1.127
0.000	

Lack of The number of through lanes in WB and EB.

No good

Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle

2.2 Jadibuti Signalized Intersection (2030: With case) Additional Lane Arrangement

Calculation result of Intersections (Jadibuti Intersection)

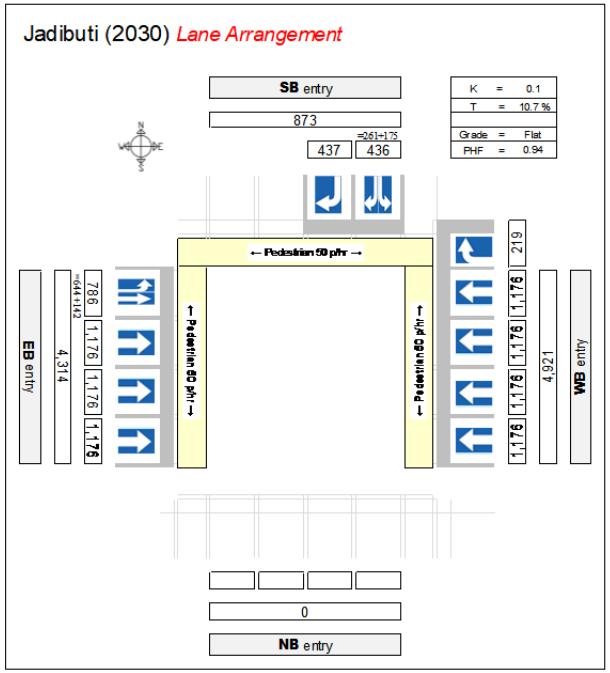
x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Jadibuti Add-Lane	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	70	32	10	4	20	4	
					Y&AR		Y&AR	

Lane width	Heavy vehicle ratio (%)
3.50	10.7

Lane Configuration and Turning movement



Level crossing open ratio (%) = **100%**

Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left+Right	Right Turn		Through	Right Turn						Left+ Through	Through		
Number of lane			1	1		4	1						1	3		
Basic value of saturation flow rate	:	S_B	1,900	1,900		2,000	1,900						2,000	2,000		
Adjustment factor for lane width	:	α_W	1.00	1.00		1.00	1.00						1.00	1.00		
(lane width)		m	3.50	3.50		3.50	3.50						3.50	3.50		
Adjustment factor for approach grade	:	α_G	1.00	1.00		1.00	1.00						1.00	1.00		
(approach grade)		%	0.00	0.00		0.00	0.00						0.00	0.00		
Adjustment factor for heavy vehicles	:	α_T	0.93	0.93		0.93	0.93						0.93	0.93		
(ratio of hew vehicles)		%	10.70	10.70		10.70	10.70						10.70	10.70		
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-		-	-	-	-	-	-	
Adjustment factor for **leftt** turn		$\alpha_{L(T)}$	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.82	1.00	1.00	1.00
(ratio of left turn vehicles)		L %	40.1										81.9			
(decrease ratio of pedestrians)		f_p	0.15										0.15			
(effective green time)		G sec.	20										32			
(green time for pedestrians)		G_p sec.	27										27			
(though vehicle equivalent for left turn vehicles)		E_{LT}	1.38										1.26			
		S_L				Straight Flow										
Adjustment factor for **right** turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %		100.0			100.0									
(probability of right turn)		f					0.00									
(vehicle making turns at transitof phases)		K					3									
(volume of opposite through traffic)		q					> 1,000									
(saturaion flow rate of opposite approach)		S_R					426									
(though vehicle equivalent for right turn vehicles)		E_{RT}														
Saturation flow rate	:	S_A	1,534	1,767	0	7,440	1,767	0		0	0	0	1,534	5,580	0	
Traffic volume	:	Right turn traffic volume		437			219									
		(heavy vehicle ratio)		10.70			10.70									
		Through traffic volume	261			4,704							142	3,528		
		(heavy vehicle ratio)	10.70			10.70							10.70	10.70		
		Left turn traffic volume	175										644			
		(heavy vehicle ratio)	10.70										10.70			
		Total traffic volume : q	436	437	0	4,704	219	0	0	0	0		786	3,528	0	0
		(heavy vehicle ratio)	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70
Traffic volume	:	q	436	437	0	4,704	219	0	0	0	0	0	786	3,528	0	0
Flow ratio	:	p	0.284	0.247		0.632							0.512	0.632		
Necessary phase ratio	:	1φ				**0.632**							**0.512**	**0.632**		
		2φ				219<426 OK										
		3φ														
		4φ	**0.284**	0.247												
		5φ														
		6φ														

Saturation degree of phase	Saturation degree of intersection
0.632	0.917
0.000	
0.000	
0.284	
0.000	

Almost good

Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle

3.1 New Baneshwor Signalized Intersection (2030: Without case) Current Lane Arrangement

Calculation result of Intersections (New Baneshwor Intersection) x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	New Baneshwor Current Lane	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	70	37	5	4	15	5	4
					Y&AR			Y&AR

Lane width	Heavy vehicle ratio (%)
3.50	10.4

Level crossing open ratio (%) = **100%**

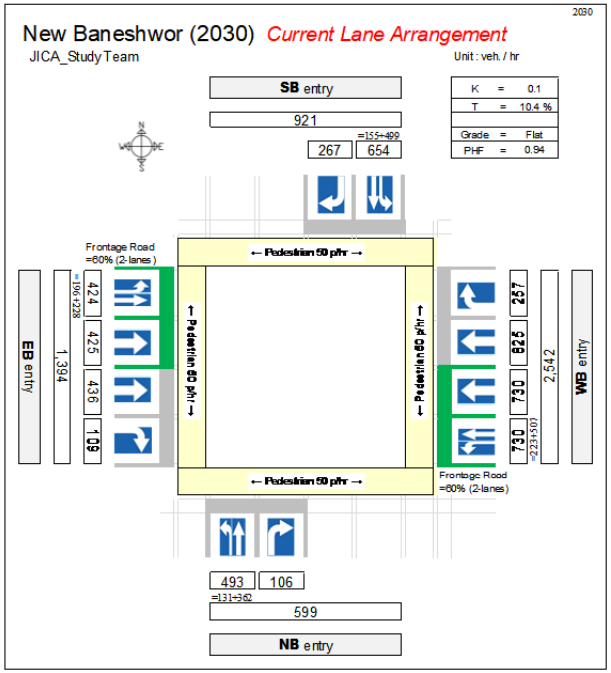
Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left+Through	Right Turn		Left+Through	Through	Through	Right Turn	Left+Through	Right Turn		Left+ Through	Through	Through	Right Turn
Number of lane			1	1		1	1	1	1	1	1		1	1	1	1
Basic value of saturation flow rate	:	S_B	2,000	1,900		2,000	2,000	2,000	1,900	2,000	1,900		2,000	2,000	2,000	1,900
Adjustment factor for lane width	:	α_W	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(lane width)		m	3.50	3.50		3.50	3.50	3.50	3.50	3.50	3.50		3.50	3.50	3.50	3.50
Adjustment factor for approach grade	:	α_G	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
(approach grade)		%	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Adjustment factor for heavy vehicles	:	α_T	0.93	0.93		0.93	0.93	0.93	0.93	0.93	0.93		0.93	0.93	0.93	0.93
(ratio of hew vehicles)		%	10.40	10.40		10.40	10.40	10.40	10.40	10.40	10.40		10.40	10.40	10.40	10.40
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-	-	-	-	-	-	-	-	
Adjustment factor for **leftt** turn		$\alpha_{L(T)}$	0.95	1.00	1.00	0.93	1.00	1.00	1.00	0.94	1.00	1.00	0.89	1.00	1.00	1.00
(ratio of left turn vehicles)		L %	23.7			30.5				26.6			46.2			
(decrease ratio of pedestrians)		f_p	0.15			0.15				0.15			0.15			
(effective green time)		G sec.	15			37				15			37			
(green time for pedestrians)		G_p sec.	10			32				10			32			
(though vehicle equivalent for left turn vehicles)		E_{LT}	1.22			1.26				1.22			1.26			
		S_L														
Adjustment factor for **right** turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %		100.0					100.0		0.0					100.00
(probability of right turn)		f		0.68					0.00		0.60					0.00
(vehicle making turns at transitof phases)		K		3					3		3					3
(volume of opposite through traffic)		q		362					> 1,000		499					> 1,000
(saturaion flow rate of opposite approach)		S_R		53	290				290		53	290				290
(though vehicle equivalent for right turn vehicles)		E_{RT}		4φ	5φ				2φ		4φ	5φ				2φ
Saturation flow rate	:	S_A	1,767	1,767	0	1,721	1,860	1,860		1,756	1,767	0	1,658	1,860	1,860	1,767
Traffic volume	:	Right turn traffic volume		53	214				257		53	53				109
		(heavy vehicle ratio)		10.40	10.40				10.40		10.40	10.40				10.40
		Through traffic volume	499			507	730	825		362			228	425	436	
		(heavy vehicle ratio)	10.40			10.40	10.40	10.40		10.40			10.40	10.40	10.40	
		Left turn traffic volume	155			223				131			196			
		(heavy vehicle ratio)	10.40			10.40				10.40			10.40			
		Total traffic volume : q	654	53	214	730	730	825	257	493	53	53	424	425	436	109
		(heavy vehicle ratio)	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40
Traffic volume	:	q	654	53	214	730	730	825	257	493	53	53	424	425	436	109
Flow ratio	:	p	0.370			0.424	0.392	0.444		0.281			0.256	0.228	0.234	
Necessary phase ratio	:	1φ				**0.424**	0.392	**0.444**					**0.256**	**0.228**	**0.234**	
		2φ							257<290 OK							109<290 OK
		3φ														
		4φ	**0.370**	4φ+5φ=	267					**0.281**	4φ+5φ=	106				
		5φ			214<290 OK							53<290 OK				
		6φ														

Saturation degree of phase	Saturation degree of intersection
0.444	0.814
0.000	
0.000	
0.370	
0.000	

Good

Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle

Lane Configuration and Turning movement



4.1 Maitighar (N) Signalized Intersection (2030: Without case) Current Lane Arrangement

Calculation result of Intersections (Maitighar(N) Intersection) x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Maitighar(N) Current Lane	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	120	47	35	4	30	4	
					Y&AR		Y&AR	

Lane width	Heavy vehicle ratio (%)
3.50	6.5

Level crossing open ratio (%) = 100%

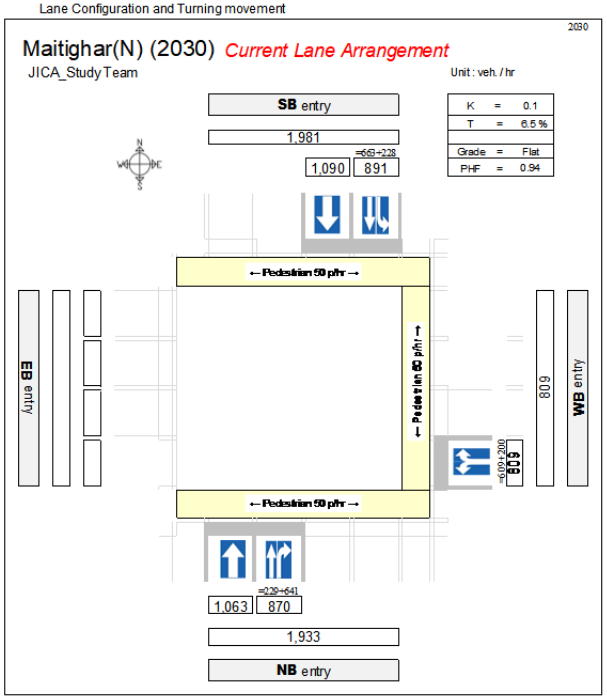
Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left+Through	Through	Right Turn	Left+Right	Through	Through+Left	Right Turn	Through	Right+Through		Left Turn	Right Turn	Left+Through	Right Turn
Number of lane			1	1		1				1	1					
Basic value of saturation flow rate	:	S_B	2,000	2,000		1,900				2,000	2,000					
Adjustment factor for lane width	:	α_W	1.00	1.00		1.00				1.00	1.00					
(lane width)		m	3.50	3.50		3.50				3.50	3.50					
Adjustment factor for approach grade	:	α_G	1.00	1.00		1.00				1.00	1.00					
(approach grade)		%	0.00	0.00		0.00				0.00	0.00					
Adjustment factor for heavy vehicles	:	α_T	0.96	0.96		0.96				0.96	0.96					
(ratio of hew vehicles)		%	6.50	6.50		6.50				6.50	6.50					
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-		-	-	-	-	-	-	
Adjustment factor for leftt turn		$\alpha_{L(T)}$	0.94	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of left turn vehicles)		L %	25.6			75.3										
(decrease ratio of pedestrians)		f_p	0.15			0.15										
(effective green time)		G sec.	47			30										
(green time for pedestrians)		G_P sec.	42			25										
(though vehicle equivalent for left turn vehicles)		E_{LT}	1.27			1.07										
		S_L				[illegible]										
Adjustment factor for right turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %				24.7					73.7					
(probability of right turn)		f									0.00					
(vehicle making turns at transitof phases)		K									3					
(volume of opposite through traffic)		q				q=0					> 1,000					
(saturaion flow rate of opposite approach)		S_R									673					
(though vehicle equivalent for right turn vehicles)		E_{RT}														
Saturation flow rate	:	S_A	1,796	1,920	0	1,733	0	0		1,920	1,920	0	0	0	0	
Traffic volume	:	Right turn traffic volume				200										
		(heavy vehicle ratio)				6.50										
		Through traffic volume	663	1,090						1,063	641					
		(heavy vehicle ratio)	6.50	6.50						6.50	6.50					
		Left turn traffic volume	228			609										
		(heavy vehicle ratio)	6.50			6.50										
		Total traffic volume : q	891	1,090	0	809	0	0	0	1,063	641		0	0	0	0
		(heavy vehicle ratio)	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
Traffic volume	:	q	891	1,090	0	809	0	0	0	1,063	641	0	0	0	0	0
Flow ratio	:	p	0.496	0.568		0.467				0.554						
Necessary phase ratio	:	1φ	0.496	0.568						0.554	641<673 OK					
		2φ														
		3φ														
		4φ				0.467										
		5φ														
		6φ														

Saturation degree of phase	Saturation degree of intersection
0.568	1.035
0.000	
0.000	
0.467	
0.000	

Almost Good

Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle

Lane Configuration and Turning movement



4.2 Maitighar (N) Signalized Intersection (2030: Without case) Additional Lane Arrangement

Calculation result of Intersections (Maitighar(N) Intersection)

x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Maitighar(N) Add-Lane	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	120	47	35	4	30	4	
					Y&AR		Y&AR	

Lane width	Heavy vehicle ratio (%)
3.50	6.5

Level crossing open ratio (%) = **100%**

Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left+Through	Through		Left Turn	Left+Right			Through	Right+Through					
Number of lane			1	2		1	1			2	1					
Basic value of saturation flow rate	:	S_B	1,900	2,000		1,900	1,900			2,000	1,900					
Adjustment factor for lane width	:	α_W	1.00	1.00		1.00	1.00			1.00	1.00					
(lane width)		m	3.50	3.50		3.50	3.50			3.50	3.50					
Adjustment factor for approach grade	:	α_G	1.00	1.00		1.00	1.00			1.00	1.00					
(approach grade)		%	0.00	0.00		0.00	0.00			0.00	0.00					
Adjustment factor for heavy vehicles	:	α_T	0.96	0.96		0.96	0.96			0.96	0.96					
(ratio of hew vehicles)		%	6.50	6.50		6.50	6.50			6.50	6.50					
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-		-	-	-	-	-	-	
Adjustment factor for leftt turn		$\alpha_{L(T)}$	0.90	1.00	1.00	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of left turn vehicles)		L %	39.7			100.0										
(decrease ratio of pedestrians)		f_p	0.15			0.15										
(effective green time)		G sec.	47			30										
(green time for pedestrians)		G_p sec.	42			25										
(though vehicle equivalent for left turn vehicles)		E_{LT}	1.27													
		S_L				1,000										
Adjustment factor for right turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %					49.5				100.0					
(probability of right turn)		f									0.00					
(vehicle making turns at transitof phases)		K									3					
(volume of opposite through traffic)		q					q=0				> 1,000					
(saturaion flow rate of opposite approach)		S_R									644					
(though vehicle equivalent for right turn vehicles)		E_{RT}														
Saturation flow rate	:	S_A	1,647	3,840	0	1,596	1,824	0		3,840	1,824	0	0	0	0	
Traffic volume	:	Right turn traffic volume					200									
		(heavy vehicle ratio)					6.50									6.50
		Through traffic volume	347	1,406						1,063	641					
		(heavy vehicle ratio)	6.50	6.50						6.50	6.50					
		Left turn traffic volume	228			405	204									
		(heavy vehicle ratio)	6.50			6.50	6.50									
		Total traffic volume : q	575	1,406	0	405	404	0	0	1,063	641	0	0	0	0	0
		(heavy vehicle ratio)	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
Traffic volume	:	q	575	1,406	0	405	404	0	0	1,063	641	0	0	0	0	0
Flow ratio	:	p	0.349	0.366		0.254	0.221			0.277						
Necessary phase ratio	:	1φ	0.349	0.366						0.277	641<644 OK					
		2φ														
		3φ														
		4φ				0.254	0.221									
		5φ														
		6φ														

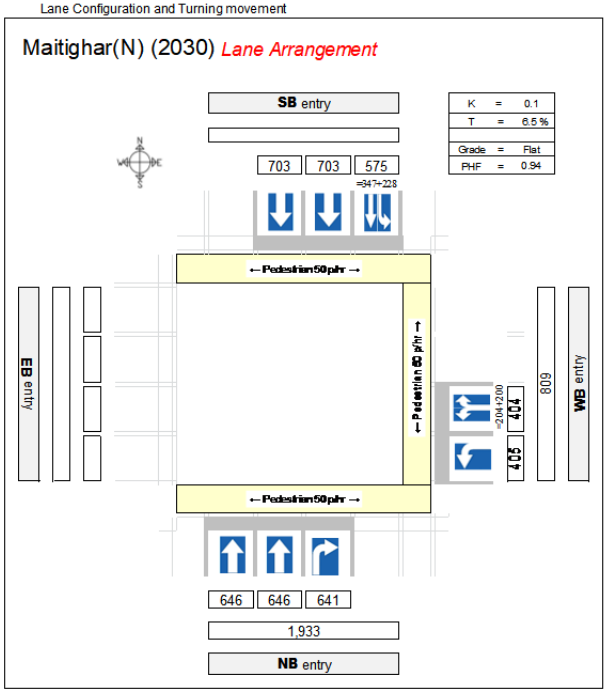
Saturation degree of phase	Saturation degree of intersection
0.366	0.620
0.000	
0.000	
0.254	
0.000	

Excellent

Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle

Lane Configuration and Turning movement

Maitighar(N) (2030) *Lane Arrangement*



5.1 Maitighar (S) Signalized Intersection (2030: Without case) Current Lane Arrangement

Calculation result of Intersections (Maitighar(S) Intersection)

x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Maitighar(S) Current Lane	C (Cycle time)	1ϕ	2ϕ	3ϕ	4ϕ	5ϕ	6ϕ
Target year	2030 peak hour	120	67	15	4	30	4	
					Y&AR		Y&AR	

Lane width	Heavy vehicle ratio (%)
3.50	6.5

Level crossing open ratio (%) = **100%**

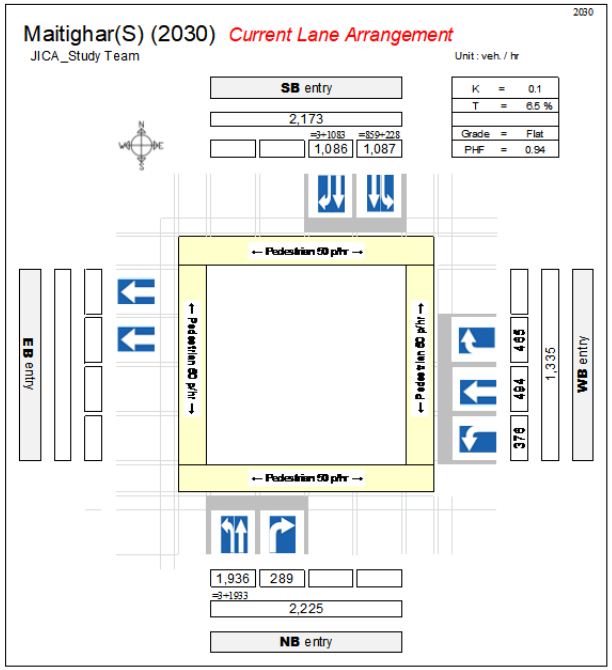
Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left+Through	Through+Right		Left Turn	Through	Right Turn		Left+Through	Right Turn					
Number of lane			1	1		1	1	1		1	1					
Basic value of saturation flow rate	:	S_B	2,000	2,000		1,900	2,000	1,900		2,000	1,900					
Adjustment factor for lane width	:	α_W	1.00	1.00		1.00	1.00	1.00		1.00	1.00					
(lane width)		m	3.50	3.50		3.50	3.50	3.50		3.50	3.50					
Adjustment factor for approach grade	:	α_G	1.00	1.00		1.00	1.00	1.00		1.00	1.00					
(approach grade)		%	0.00	0.00		0.00	0.00	0.00		0.00	0.00					
Adjustment factor for heavy vehicles	:	α_T	0.96	0.96		0.96	0.96	0.96		0.96	0.96					
(ratio of hew vehicles)		%	6.50	6.50		6.50	6.50	6.50		6.50	6.50					
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-		-	-	-	-	-	-	
Adjustment factor for **leftt** turn		$\alpha_{L(T)}$	0.95	1.00	1.00	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of left turn vehicles)		L %	21.0			100.0				0.2						
(decrease ratio of pedestrians)		f_p	0.15			0.15				0.15						
(effective green time)		G sec.	67			30				67						
(green time for pedestrians)		G_p sec.	62			25				62						
(though vehicle equivalent for left turn vehicles)		E_{LT}	1.28							1.28						
		S_L				415.63										
Adjustment factor for **right** turn		$\alpha_{R(T)}$	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %		0.28							100.0					
(probability of right turn)		f		0				1.00			0.00					
(vehicle making turns at transitof phases)		K		3							3					
(volume of opposite through traffic)		q		>1,000							> 1,000					
(saturaion flow rate of opposite approach)		S_R									328					
(though vehicle equivalent for right turn vehicles)		E_{RT}		12.28												
Saturation flow rate	:	S_A	1,814	1,862	0	1,596	1,920	1,824		1,919	1,824	0	0	0	0	
Traffic volume : Right turn traffic volume				3				465			289					
(heavy vehicle ratio)				6.50				6.50			6.50					
Through traffic volume			859	1,083			494			1,933						
(heavy vehicle ratio)			6.50	6.50			6.50			6.50						
Left turn traffic volume			228			376				3						
(heavy vehicle ratio)			6.50			6.50				6.50						
Total traffic volume : q			1,087	1,086	0	376	494	465	0	1,936	289	0	0	0	0	0
(heavy vehicle ratio)			6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
Traffic volume	:	q	1,087	1,086	0	376	494	465	0	1,936	289	0	0	0	0	0
Flow ratio	:	p	0.599	0.583		0.236	0.257	0.255		1.009	0.158					
Necessary phase ratio	:	1ϕ	0.599	0.583						1.009						
		2ϕ														
		3ϕ									289<328 OK					
		4ϕ				0.236	0.257	0.255								
		5ϕ														
		6ϕ														

Saturation degree of phase	Saturation degree of intersection
1.009	1.266
0.000	
0.000	
0.257	
0.000	

No good

Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle

Lane Configuration and Turning movement



5.2 Maitighar (S) Signalized Intersection (2030: Without case) Additional Lane Arrangement

Calculation result of Intersections (Maitighar(S) Intersection)

x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Maitighar(S) Add-Lane	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	120	47	35	4	30	4	
					Y&AR		Y&AR	

Lane width	Heavy vehicle ratio (%)
3.50	6.5

Level crossing open ratio (%) = **100%**

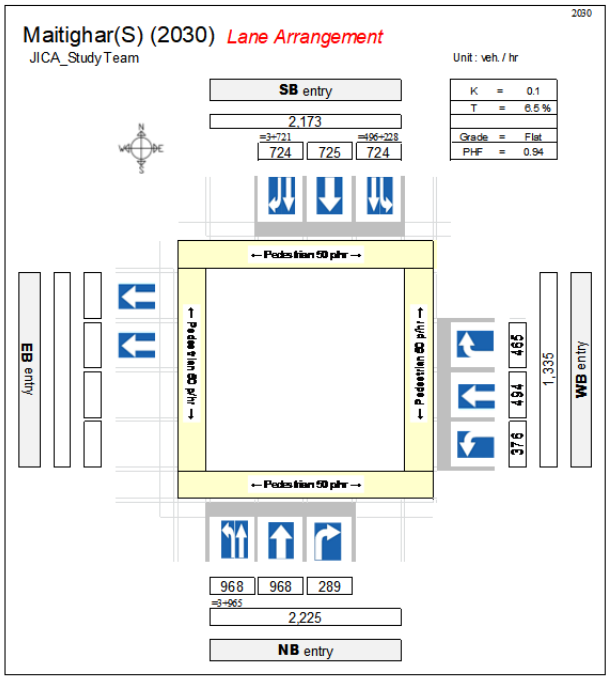
Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left+Through	Through	Through+Right	Left Turn	Through	Right Turn		Left+Through	Through	Right Turn				
Number of lane			1	1	1	1	1	1		1	1	1				
Basic value of saturation flow rate	:	S_B	2,000	2,000	2,000	1,900	2,000	1,900		2,000	2,000	1,900				
Adjustment factor for lane width	:	α_W	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00				
(lane width)		m	3.50	3.50	3.50	3.50	3.50	3.50		3.50	3.50	6.50				
Adjustment factor for approach grade	:	α_G	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00				
(approach grade)		%	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00				
Adjustment factor for heavy vehicles	:	α_T	0.96	0.96	0.96	0.96	0.96	0.96		0.96	0.96	0.96				
(ratio of hew vehicles)		%	6.50	6.50	6.50	6.50	6.50	6.50		6.50	6.50	6.50				
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-		-	-	-	-	-	-	
Adjustment factor for **leftt** turn		$\alpha_{L(T)}$	0.92	1.00	1.00	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of left turn vehicles)		L %	31.5			100.0				0.3						
(decrease ratio of pedestrians)		f_p	0.15			0.15				0.15						
(effective green time)		G sec.	47			30				47						
(green time for pedestrians)		G_p sec.	42			25				42						
(though vehicle equivalent for left turn vehicles)		E_{LT}	1.27							1.27						
		S_L				415.63										
Adjustment factor for **right** turn		$\alpha_{R(T)}$	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %			0.41							100.0				
(probability of right turn)		f			0.00			1.00				0.00				
(vehicle making turns at transitof phases)		K			3							3				
(volume of opposite through traffic)		q			> 1,000							> 1,000				
(saturaion flow rate of opposite approach)		S_R										644				
(though vehicle equivalent for right turn vehicles)		E_{RT}			6.42											
Saturation flow rate	:	S_A	1,769	1,920	1,878	1,596	1,920	1,824		1,918	1,920	1,824	0	0	0	
Traffic volume : Right turn traffic volume					3			465								
(heavy vehicle ratio)					6.50			6.50								
Through traffic volume			496	725	721		494			965	968					
(heavy vehicle ratio)			6.50	6.50	6.50		6.50			6.50	6.50					
Left turn traffic volume			228			376				3						
(heavy vehicle ratio)			6.50			6.50				6.50						
Total traffic volume :		q	724	725	724	376	494	465	0	968	968	0	0	0	0	0
(heavy vehicle ratio)			6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
Traffic volume	:	q	724	725	724	376	494	465	0	968	968	0	0	0	0	0
Flow ratio	:	p	0.409	0.378	0.386	0.236	0.257	0.255		0.505	0.504					
Necessary phase ratio	:	1φ	0.409	0.378	0.386					0.505	0.504					
		2φ										289<644 OK				
		3φ														
		4φ				0.236	0.257	0.255								
		5φ														
		6φ														

Saturation degree of phase	Saturation degree of intersection
0.505	0.762
0.000	
0.000	
0.257	
0.000	

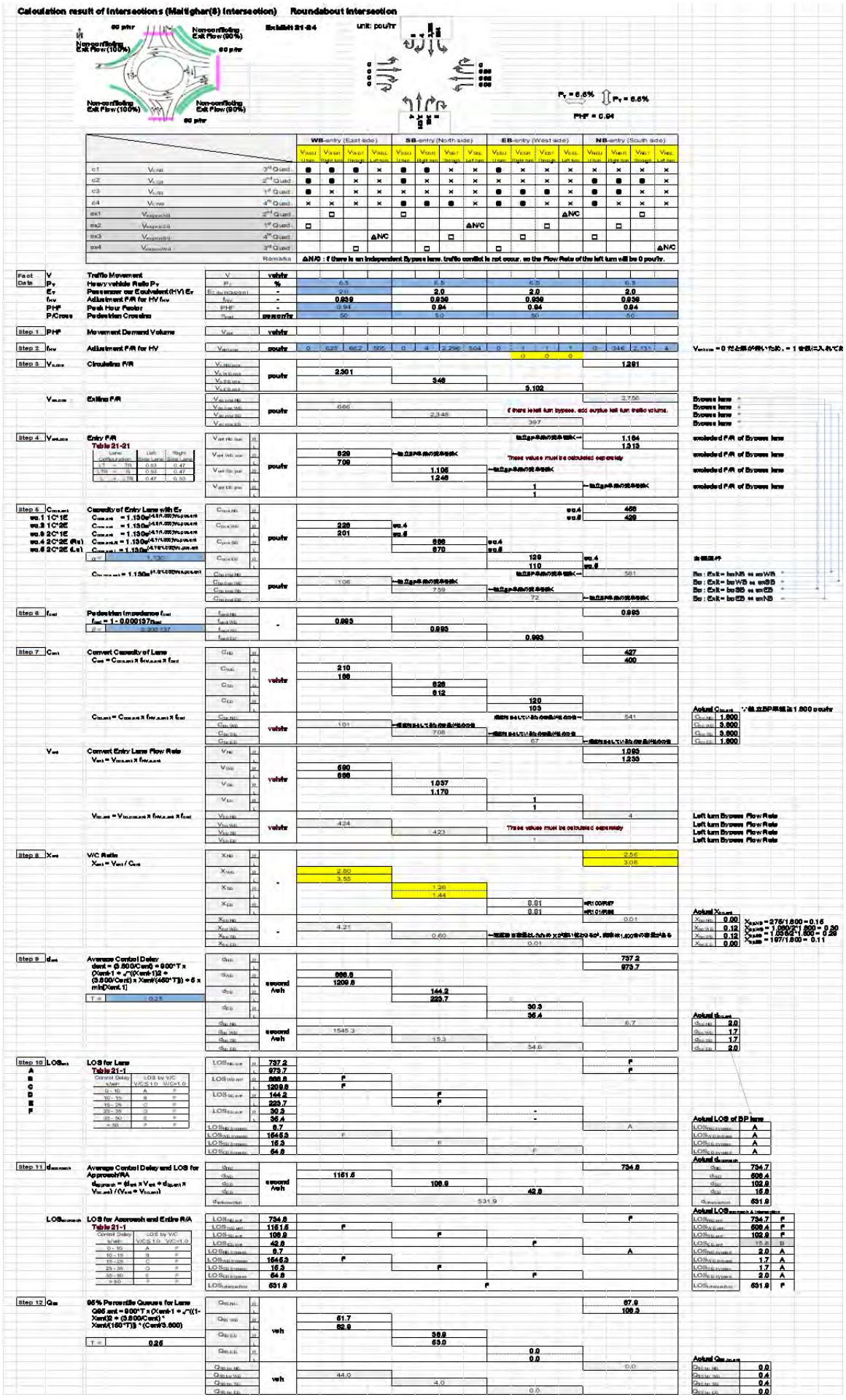
Excellent

Queues = pcu/cycle	Queues = pcu/cycle	Queues = pcu/cycle	Queues = pcu/cycle

Lane Configuration and Turning movement



5.3 Maitighar (S) Roundabout Intersection (2030: Without case) Current Lane Arrangement



6.1 Thapathali Signalized Intersection (2030: Without case) Current Lane Arrangement

Calculation result of Intersections (Thapathali Intersection)

x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Thapathali Current Lane	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	120	30	35	4	27	20	4
					Y&AR			Y&AR

Lane width	Heavy vehicle ratio (%)
3.50	5.4

Level crossing open ratio (%) = 100%

Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left+Through	Through+Right	Right Turn	L+T+R				Left Turn	Through	Through+Right	Left Turn	Through+Right	Right Turn	
Number of lane			1	1	1	1				1	1	1	1	1	1	
Basic value of saturation flow rate	:	S_B	2,000	2,000		2,000				1,900	2,000	2,000	1,900	2,000	1,900	
Adjustment factor for lane width	:	α_W	1.00	1.00		1.00				1.00	1.00	1.00	1.00	1.00	1.00	
(lane width)		m	3.50	3.50		3.50				3.50	3.50	3.50	3.50	3.50	3.50	
Adjustment factor for approach grade	:	α_G	1.00	1.00		1.00				1.00	1.00	1.00	1.00	1.00	1.00	
(approach grade)		%	0.00	0.00		0.00				0.00	0.00	0.00	0.00	0.00	0.00	
Adjustment factor for heavy vehicles	:	α_T	0.96	0.96		0.96				0.96	0.96	0.96	0.96	0.96	0.96	
(ratio of hew vehicles)		%	5.40	5.40		5.40				5.40	5.40	5.40	5.40	5.40	5.40	
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-		-	-	-	-	-	-	
Adjustment factor for leftt turn		$\alpha_{L(T)}$	1.00	1.00	1.00	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of left turn vehicles)		L %	0.9			1.0				100.0			100.00			
(decrease ratio of pedestrians)		f_p	0.15			0.15				0.15			0.15			
(effective green time)		G sec.	30			27				30			27			
(green time for pedestrians)		G_p sec.	25			22				25			22			
(though vehicle equivalent for left turn vehicles)		E_{LT}	1.26						2φ	1φ			4φ			
		S_L			Right Turn	395			554	416			375			Right Turn
Adjustment factor for right turn		$\alpha_{R(T)}$	1.00	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.67	1.00	1.00
(ratio of right turn vehicles)		R %		0.00		2.0						0.3		45.3	100.0	100.0
(probability of right turn)		f		0		0.68		1.00				0.00		0.74		0.74
(vehicle making turns at transitof phases)		K		3	3	3						3		3	3	3
(volume of opposite through traffic)		q		>1,000		363						> 1,000		292		292
(saturaion flow rate of opposite approach)		S_R			644										407	208
(though vehicle equivalent for right turn vehicles)		E_{RT}		5.50	2φ混合	2.87						5.50		2.09	5φ	4φ
Saturation flow rate	:	S_A	1,916	1,920	0	1,625	0	0		1,824	1,920	1,892	1,824	1,285	1,900	
Traffic volume : Right turn traffic volume				0		6						3		301	664	
(heavy vehicle ratio)				5.40		5.40						5.40		5.40	5.40	
Through traffic volume			1,151	678		292					912	909		363		
(heavy vehicle ratio)			5.40	5.40		5.40					5.40	5.40		5.40		
Left turn traffic volume			10			3				1,229			395			
(heavy vehicle ratio)			5.40			5.40				5.40			5.40			
Total traffic volume :		q	1,161	678	0	301	0	0	0	1,229	912	912	395	664	664	0
(heavy vehicle ratio)			5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40
Traffic volume	:	q	1,161	678	0	301	0	0	0	1,229	912	912	395	664	664	0
Flow ratio	:	p	0.606	0.353		0.185					0.475	0.482		0.517		
Necessary phase ratio	:	1φ	0.606	0.353												
		2φ							1229>970 See below ↓							
		3φ							1φ+2φ	970		395>375 See below ↓	664>615 See below ↓			
		4φ				0.185							375	0.517	615	
		5φ														
		6φ														

Saturation degree of phase	Saturation degree of intersection
0.606	1.123
0.000	
0.000	
0.517	
0.000	

No good

During the peak hours, a slight congestion occurs in the NB left turn lane.

During the peak hours, a slight congestion occurs in the EB left turn and right turn lanes.

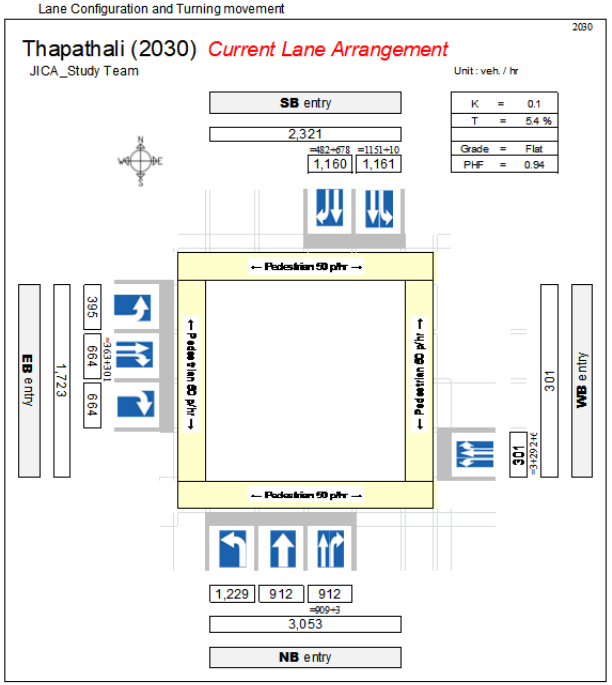
Queues = pcu/cyde

Queues = pcu/cycle

Left Turn Queues = 9 veh./cycle

Right Turn Queues = 2 veh/cycle

Lane Configuration and Turning movement



6.2 Thapathali Signalized Intersection (2030: Without case) Additional Lane Arrangement

Calculation result of Intersections (Thapathali Intersection)

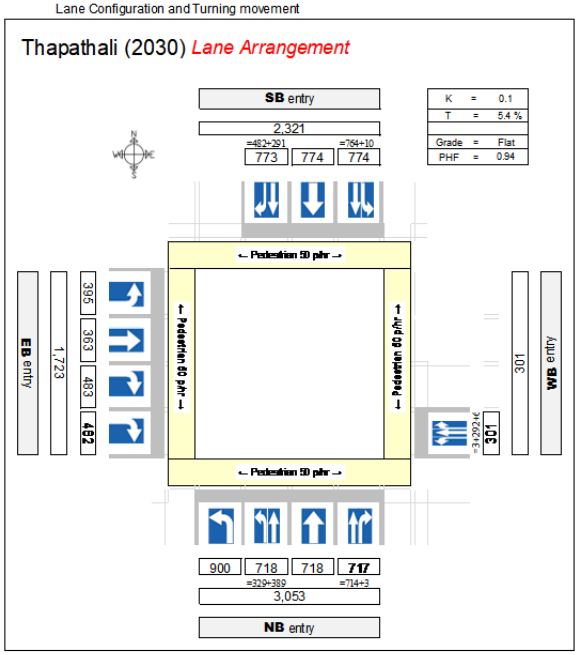
x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Thapathali Add-Lane	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	120	30	35	4	27	20	4
					Y&AR			Y&AR

Lane width	Heavy vehicle ratio (%)
3.50	5.4

Lane Configuration and Turning movement



Level crossing open ratio (%) = 100%

Approaches		A. SB entry			B. WB entry				C. NB entry				D. EB entry			
Lane		Left+Through	Through	Through+Right	L+T+R				Left Turn	Left+Through	Through	Trough+Right	Left Turn	Through	Right Turn	
Number of lane		1	1	1	1				1	1	1	1	1	1	2	
Basic value ofsaturationflow rate	S_B	2,000	2,000	2,000	2,000				1,900	2,000	2,000	2,000	1,900	2,000	1,900	
Adjustment factor for lane width	α_W	1.00	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00	1.00	
(lane width)	m	3.50	3.50	3.50	3.50				3.50	3.50	3.50	5.40	3.50	3.50	3.50	
Adjustment factor for approach grade	α_G	1.00	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00	1.00	
(approach grade)	%	0.00	0.00	0.00	0.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Adjustment factor for heavy vehicles	α_T	0.96	0.96	0.96	0.96				0.96	0.96	0.96	0.96	0.96	0.96	0.96	
(ratio of hevy vehicles)	%	5.40	5.40	5.40	5.40				5.40	5.40	5.40	5.40	5.40	5.40	5.40	
Adjustment factor for bus-stop	α_{BS}	-	-	-	-	-	-		-	-	-		-	-	-	
Adjustment factor for **leftt** turn	$\alpha_{L(T)}$	0.997	1.00	1.00	0.88	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of left turn vehicles)	L %	1.3			1.0				100.0	45.8			100.00			
(decrease ratio of pedestrians)	f_p	0.15			0.15				0.15	0.15			0.15			
(effective green time)	G sec.	30			27				30	30			27			
(green time for pedestrians)	G_P sec.	25			22				25	25			22			
(though vehicle equivalent for left turn vehicles)	E_{LT}	1.26						2φ	1φ	1.26			5φ			
	S_L				395			554	416				317			Right Turn
Adjustment factor for **right** turn	$\alpha_{R(T)}$	1.00	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of right turn vehicles)	R %			0.0	2.0							0.0			100.0	100.0
(probability of right turn)	f			0.00	0.68							0.00				0.74
(vehicle making turns at transitof phases)	K			3	3							3			3	3
(volume of opposite through traffic)	q			> 1,000	363							> 1,000				292
(saturaion flow rate of opposite approach)	S_R		2φ	554							2φ	644			723	327
(though vehicle equivalent for right turn vehicles)	E_{RT}			5.50	2.87										5φ	4φ
Saturation flow rate	S_A	1,914	1,920	1,920	1,625	0	0		1,824	1,718	1,920	1,920	1,824	1,920	3,800	
Traffic volume : Right turn traffic volume				0	6							0			664	
(heavy vehicle ratio)				5.40	5.40							5.40			5.40	
Through traffic volume		764	774	291	292					389	718	714		363		
(heavy vehicle ratio)		5.40	5.40	5.40	5.40					5.40	5.40	5.40		5.40		
Left turn traffic volume		10			3				900	329			78			
(heavy vehicle ratio)		5.40			5.40				5.40	5.40			5.40			
Total traffic volume : q		774	774	291	301	0	0	0	900	718	718	714	78	363	664	0
(heavy vehicle ratio)		5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40
Traffic volume	q	774	774	291	301	0	0	0	900	718	718	714	78	363	664	0
Flow ratio	ρ	0.404	0.403	0.152	0.185					0.418	0.374	0.372	0.043	0.189		
Necessary phase ratio	1φ	0.404	0.403	0.152						0.418	0.374	0.372				
	2φ							1φ+2φ	970							
	3φ								900<970 OK							
	4φ				0.185								0.043	0.189		
	5φ														1,050	
	6φ														664<1050 OK	

Saturation degree of phase	Saturation degree of intersection
0.418	0.607
0.000	
0.000	
0.189	
0.000	

Excellent

Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle

7.1 Tripureshwor Signalized Intersection (2030: Without case) Current Lane Arrangement

Calculation result of Intersections (Tripureshwor Intersection) x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Tripureshwor Current Lane	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	120	20	50	4	20	22	4
					Y&AR			Y&AR

Lane width	Heavy vehicle ratio (%)
3.50	6.6

Level crossing open ratio (%) = 100%

Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left+Through	Right Turn		L+T+R				Left+through	Right+Through		Left Turn	Through+Right		
Number of lane			1	1	1	1				1	1		1	1		
Basic value of saturation flow rate	:	S_B	2,000	1,900		2,000				2,000	2,000		1,900	2,000		
Adjustment factor for lane width	:	α_W	1.00	1.00		1.00				1.00	1.00		1.00	1.00		
(lane width)		m	3.50	3.50		3.50				3.50	3.50		3.50	3.50		
Adjustment factor for approach grade	:	α_G	1.00	1.00		1.00				1.00	1.00		1.00	1.00		
(approach grade)		%	0.00	0.00		0.00				0.00	0.00		0.00	0.00		
Adjustment factor for heavy vehicles	:	α_T	0.96	0.96		0.96				0.96	0.96		0.96	0.96		
(ratio of hew vehicles)		%	6.60	6.60		6.60				6.60	6.60		6.60	6.60		
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-		-	-	-	-	-	-	
Adjustment factor for leftt turn		$\alpha_{L(T)}$	0.999	1.00	1.00	0.89	1.00	1.00	1.00	0.85	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of left turn vehicles)		L %	0.3			33.3				71.9			100.00			
(decrease ratio of pedestrians)		f_p	0.15			0.15				0.15			0.15			
(effective green time)		G sec.	20			20				20			20			
(green time for pedestrians)		G_P sec.	15			15				15			15			
(though vehicle equivalent for left turn vehicles)		E_{LT}	1.24							1.24						
		S_L			Right Turn	296			2φ	833		5φ	348			
Adjustment factor for right turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %		100.0		33.3					0.3			99.6		
(probability of right turn)		f		0		0.99					0.00			0.99		
(vehicle making turns at transitof phases)		K		3	3	3					3			3		
(volume of opposite through traffic)		q		>1,000		3					>1,000			3		
(saturaion flow rate of opposite approach)		S_R		90	822											
(though vehicle equivalent for right turn vehicles)		E_{RT}		1φ	2φ	0.86					3.67			0.86		
Saturation flow rate	:	S_A	1,919	1,824	0	1,704	0	0		1,638	1,905	0	1,824	1,920	0	0
Traffic volume : Right turn traffic volume				1,572		3					3			669		
(heavy vehicle ratio)				6.60		6.60					6.60			6.60		
Through traffic volume			1,054			3				283	1,002			3		
(heavy vehicle ratio)			6.60			6.60				6.60	6.60			6.60		
Left turn traffic volume			3			3				0			1,399			
(heavy vehicle ratio)			6.60			6.60				6.60			6.60			
Total traffic volume :		q	1,057	1,572	0	9	0	0	0	283	1,005	0	1,399	672	0	0
(heavy vehicle ratio)			6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60
Traffic volume	:	q	1,057	1,572	0	9	0	0	0	283	1,005	0	1,399	672	0	0
Flow ratio	:	ρ	0.551			0.005				0.173	0.528		0.767	0.350		
Necessary phase ratio	:	1φ	0.551							0.173	0.528					
		2φ		912												
		3φ	1572>912 See below ↓													
		4φ				0.005							0.767	0.350		
		5φ														
		6φ														

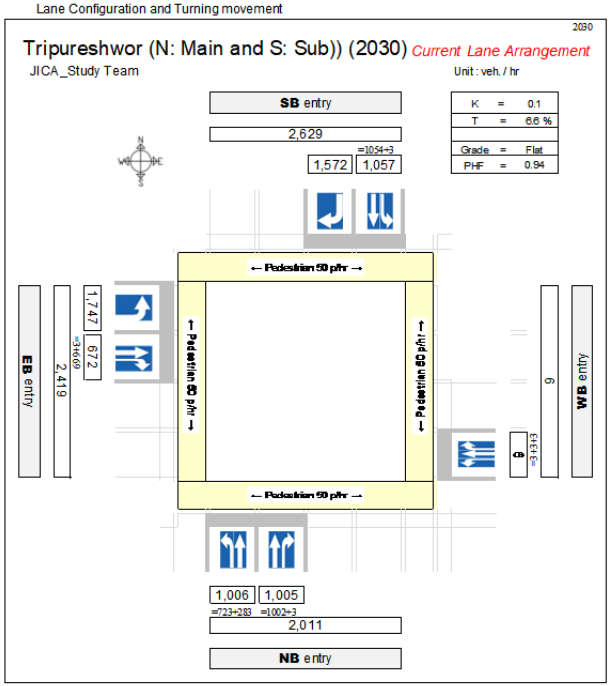
Saturation degree of phase	Saturation degree of intersection
0.551	
0.000	
0.000	
0.767	1.318
0.000	

No Good

During the peak hours, a slight congestion occurs in the SB right turn lane.

Right Turn Queues = 22 veh/cycle | Queues = pcu/cycle | Queues = pcu/cycle | Queues = pcu/cycle

Lane Configuration and Turning movement



7.2 Tripureshwor Signalized Intersection (2030: Without case) Additional Lane Arrangement

Calculation result of Intersections (Tripureshwor Intersection) x/xx

Calculation Form of Japan Society of Traffic Engineers (JSTE) 1977

Name of Intersection	Tripureshwor Add-Lane	C (Cycle time)	1φ	2φ	3φ	4φ	5φ	6φ
Target year	2030 peak hour	120	20	50	4	20	22	4
					Y&AR			Y&AR

Lane width	Heavy vehicle ratio (%)
3.50	6.6

Level crossing open ratio (%) = 100%

Approaches			A. SB entry			B. WB entry				C. NB entry			D. EB entry			
Lane			Left+Through	Right Turn		L+T+R				Left Turn	Through	Right+Through	Left Turn	Left+Through	Right Turn	
Number of lane			1	2	1	1				1	1	1	1	1	1	
Basic value of saturation flow rate	:	S_B	2,000	1,900		2,000				1,900	2,000	2,000	1,900	2,000	1,900	
Adjustment factor for lane width	:	α_W	1.00	1.00		1.00				1.00	1.00	1.00	1.00	1.00	1.00	
(lane width)		m	3.50	3.50		3.50				3.50	3.50	6.60	3.50	3.50	6.60	
Adjustment factor for approach grade	:	α_G	1.00	1.00		1.00				1.00	1.00	1.00	1.00	1.00	1.00	
(approach grade)		%	0.00	0.00		0.00				0.00	0.00	0.00	0.00	0.00	0.00	
Adjustment factor for heavy vehicles	:	α_T	0.96	0.96		0.96				0.96	0.96	0.96	0.96	0.96	0.96	
(ratio of hew vehicles)		%	6.60	6.60		6.60				6.60	6.60	6.60	6.60	6.60	6.60	
Adjustment factor for bus-stop	:	α_{BS}	-	-	-	-	-	-		-	-	-	-	-	-	
Adjustment factor for leftt turn		$\alpha_{L(T)}$	0.999	1.00	1.00	0.89	1.00	1.00	1.00	0.89	1.00	1.00	0.89	0.81	1.00	1.00
(ratio of left turn vehicles)		L %	0.3			33.3				100.0			100.00	99.7		
(decrease ratio of pedestrians)		f_p	0.15			0.15				0.15			0.15	0.15		
(effective green time)		G sec.	20			20				20			20	20		
(green time for pedestrians)		G_P sec.	15			15				15			15	15		
(though vehicle equivalent for left turn vehicles)		E_{LT}	1.24											1.24		
		S_L			Right Turn	296			2φ	792		5φ	348			
Adjustment factor for right turn		$\alpha_{R(T)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
(ratio of right turn vehicles)		R %		100.0		33.3						0.5				
(probability of right turn)		f		0		0.99						0				
(vehicle making turns at transitof phases)		K		3	3	3						3				
(volume of opposite through traffic)		q		>1,000		3						>1,000				
(saturaion flow rate of opposite approach)		S_R		90	1,613											
(though vehicle equivalent for right turn vehicles)		E_{RT}		1φ	2φ	0.86										
Saturation flow rate	:	S_A	1,919	3,648	0	1,704	0	0		1,619	1,920	1,920	1,619	1,550	1,900	0
Traffic volume : Right turn traffic volume				1,572		3						3			669	
(heavy vehicle ratio)				6.60		6.60						6.60			6.60	
Through traffic volume			1,054			3					644	641		3		
(heavy vehicle ratio)			6.60			6.60					6.60	6.60		6.60		
Left turn traffic volume			3			3				723			527	524		
(heavy vehicle ratio)			6.60			6.60				6.60			6.60	6.60		
Total traffic volume :		q	1,057	1,572	0	9	0	0	0	723	644	644	527	527	669	0
(heavy vehicle ratio)			6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60
Traffic volume	:	q	1,057	1,572	0	9	0	0	0	723	644	644	527	527	669	0
Flow ratio	:	p	0.551	0.431		0.005				0.447	0.335	0.335	0.325	0.340	0.352	
Necessary phase ratio	:	1φ	0.551							723<792 OK	0.335	0.335				
		2φ		1,703												
		3φ	1572<1703 OK													
		4φ				0.005							0.325	0.340	0.352	
		5φ														
		6φ														

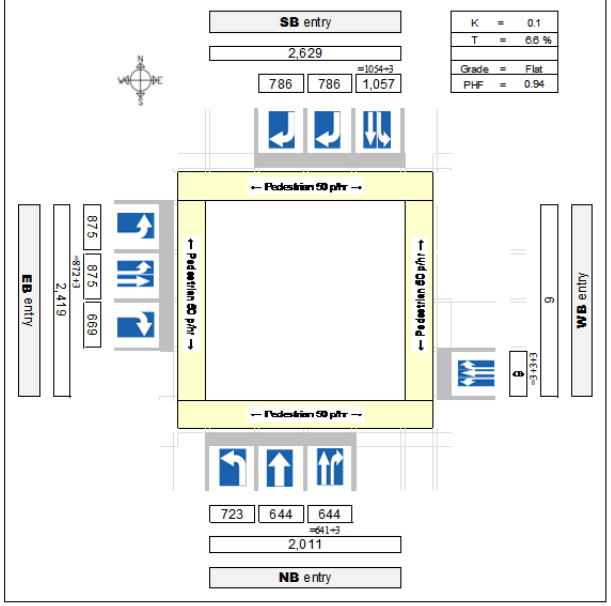
Saturation degree of phase	Saturation degree of intersection
0.551	0.903
0.000	
0.000	
0.352	
0.000	

Good

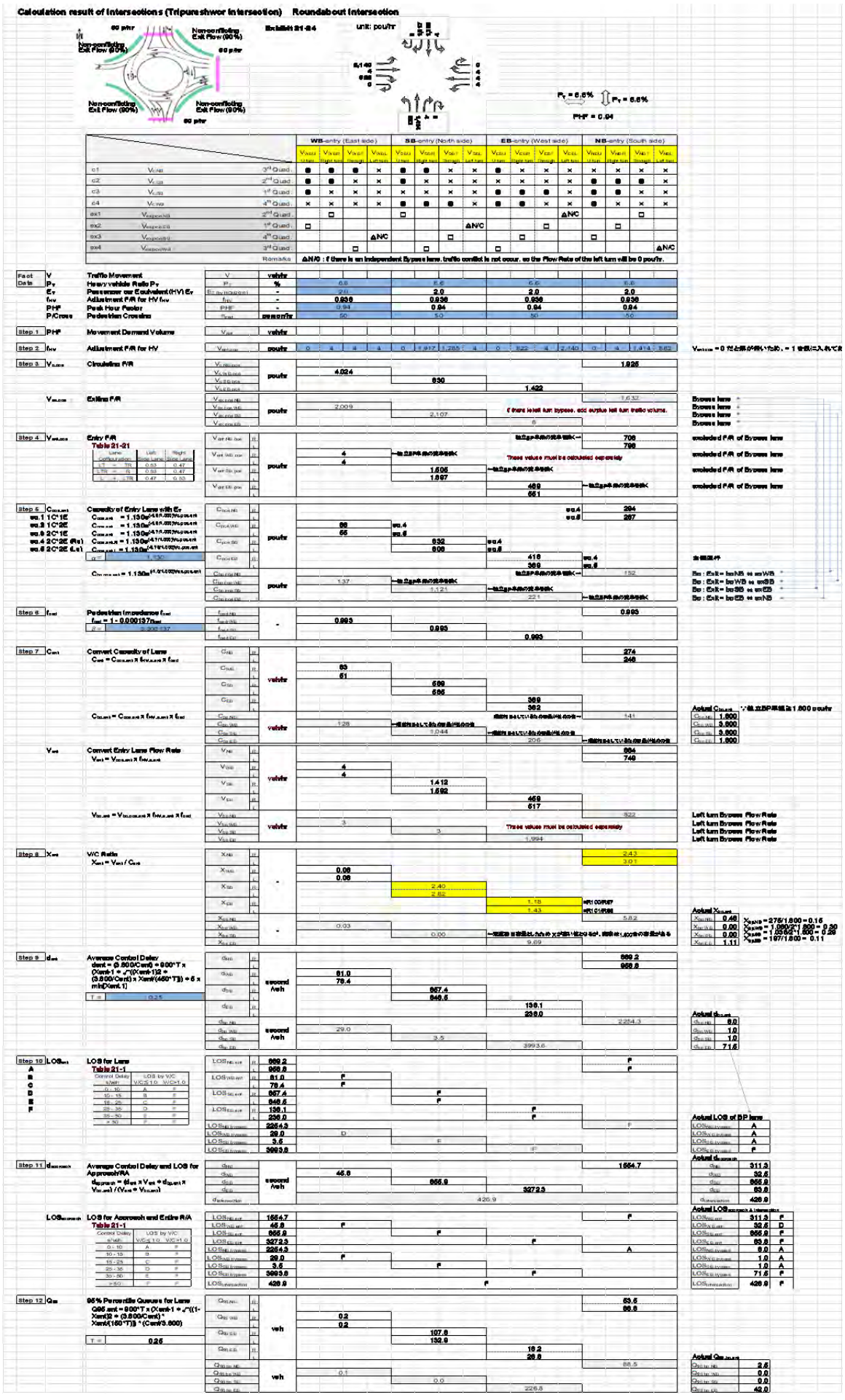
Queues = pcu/cyde | Queues = pcu/cyde | Queues = pcu/cyde | Queues = pcu/cyde

Lane Configuration and Turning movement

Tripureshwor (N: Main and S: Sub)) (2030) *Lane Arrangement*



7.3 Tripureshwor Roundabout Intersection (2030: Without case) Current Lane Arrangement

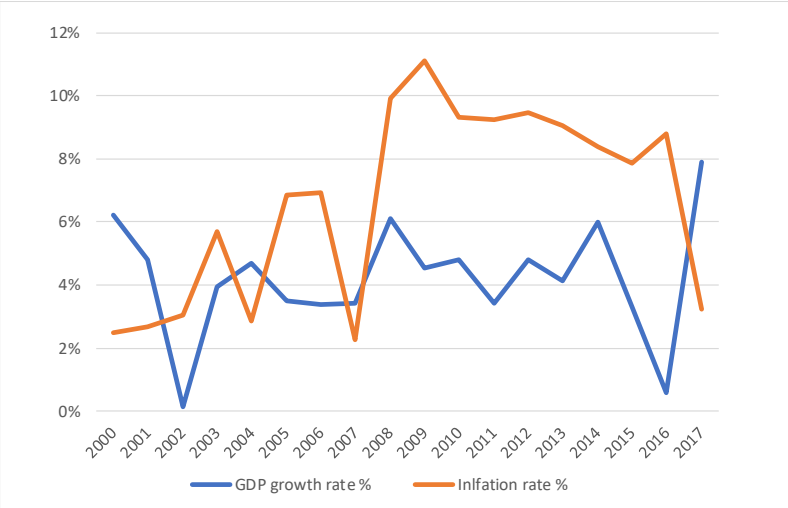


Appendix 7 Financial Capacity

APPENDIX 7 FINANCIAL CAPACITY

7.1 Economic Background

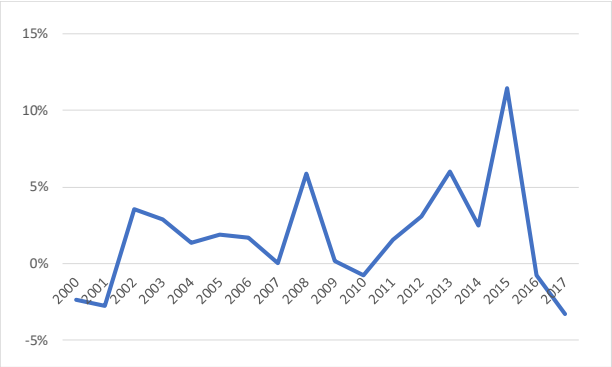
Nepal has shown continued economic growth over the past ten years, with an average GDP growth rate of 4.6% (2008-2017), supported by the strong manufacturing and tourism-related sectors. As shown in Figure 7.1, in 2017, the GDP reached US$24.88 billion, with a growth rate of 7.9%, GDP per capita at US$849, and inflation rate of 3.2%. According to IMF, the near-term outlook for economic growth is favorable, although macroeconomic and financial vulnerabilities need to be monitored continuously. GDP growth is expected at 6.5% in FY2018 (mid-July 2018 to mid-July 2019), supported by ongoing reconstruction works after the 2015 earthquake, investment in hydro-power projects, and strong tourism-related activities.



Source: The World Bank

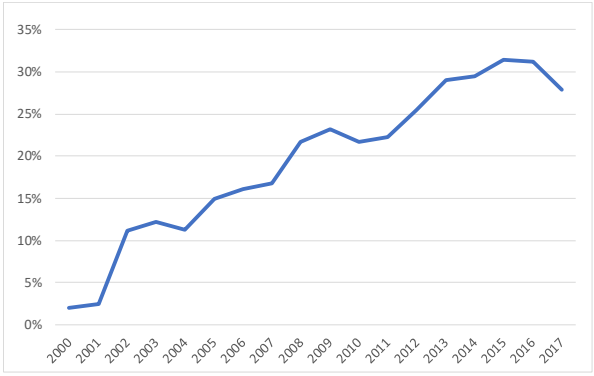
Figure 7.1 GDP Growth and Inflation Rate

The current account balance as % of GDP is shown in Figure 7.2. In the past ten years, the current account balance has been in surplus in the majority of the years, reaching an all-time high in the first quarter of 2015 at 86.6 billion NPR supported by the large remittance inflows. However, recently it has shown a sharp fall and recorded a deficit of -74.8 billion NPR, led by an increasing trade deficit, from large imports. As shown in Figure 7.3, Nepal's remittance inflows have grown 10.2% in FY2017, the amount equivalent to 27.9% of Nepal's GDP, boosting the consumption and imports to the country.



Source: The World Bank

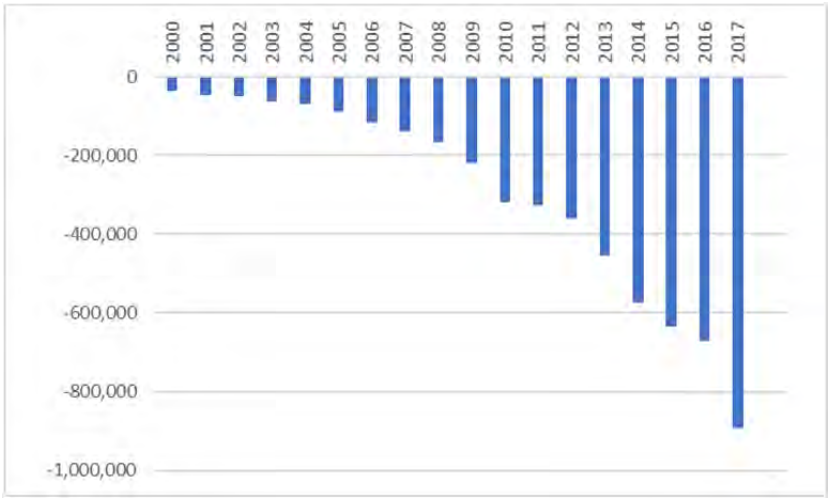
Figure 7.2 Current Account Balance (% of GDP)



Source: The World Bank

Figure 7.3 Remittance Inflows (% of GDP)

The trade deficit (export minus import), as shown in Figure 7.4, has been expanding year by year, due to the increase in imports from the expansion of consumption supported by the buoyant remittance inflows. Nepal's major export partner is India, with a share of more 57%, followed by the United States with 11%, and Turkey with 6% (2017 figures). Its major import partner is also India, with a 64% share, followed by China at 12% (2017 figures). Major exported products include textiles and clothing (44%), vegetables (14%), and food products (12%) and major imported products include machines and electronics, (15%), fuel (15%), metals (12%) and vegetables (12%). It could be said that the Nepalese economy is in the stage of structural transformation as the share of service sector is increasing, while that of agriculture sector is decreasing. The share of agriculture and non-agriculture sectors to GDP has been at 29% and 70% respectively in FY2016.



Source: The World Bank

Figure 7.4 Import and Export Balance (million NPR)

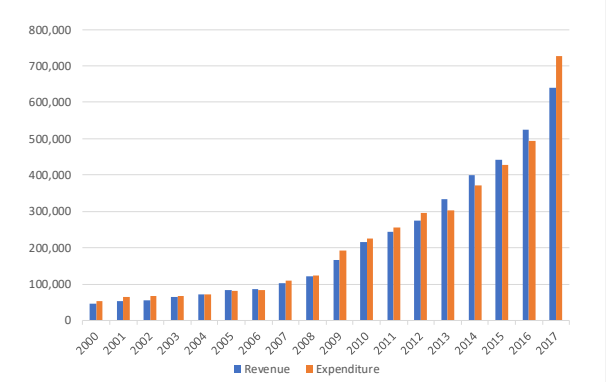
7.2 Financial Situation of the Government of Nepal

7.2.1 Government Revenue and Expenditure

Overall, Nepal's finances have been relatively sound. As shown in Figure 7.5 and Figure 7.6, the fiscal balance in Nepal was in deficit (expenditure larger than revenue) from year FY2000 to FY2012, but with increase in revenue largely due to increase in remittances. The fiscal balance became a surplus from FY2013 to FY2016, until a sharp drop in FY2017 due to a significant increase in government expenditure.

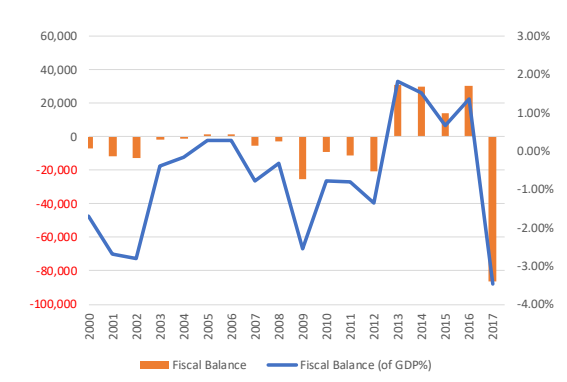
Government expenditure has been increasing over the years, from around 13% of GDP in the early 2000s to more than 20% of GDP since FY2015. In FY2017, the expenditure increased by 32.4% year-on-year to NPR 727,280 million, propelled by Nepal's transition to fiscal federalism and ongoing reconstruction spending. As in previous years, spending was concentrated in the last quarter of the fiscal year.

Government revenue has also been increasing to more than 20% of GDP since FY 2014. Growth in tax revenues has been steady in terms of revenue, this is due to the increase in import-related tax revenues, from increased remittances after the end of the civil war in 2006, along with the government's plans and tax reforms, strengthening of customs control by the fiscal authorities and the Internal Revenue Service.



Source: IMF – Government Finance Statistics (GFS) Data

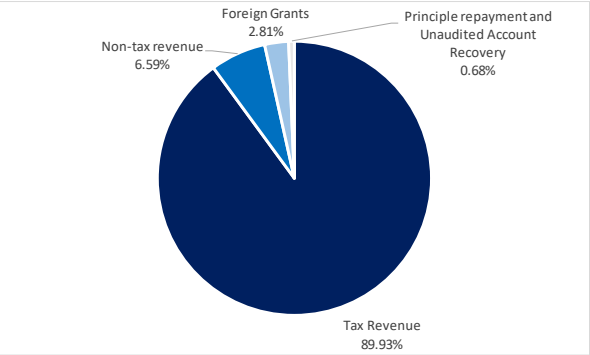
Figure 7.5 Revenue and Expenditure (million NPR)



Source: IMF – Government Finance Statistics (GFS) Data

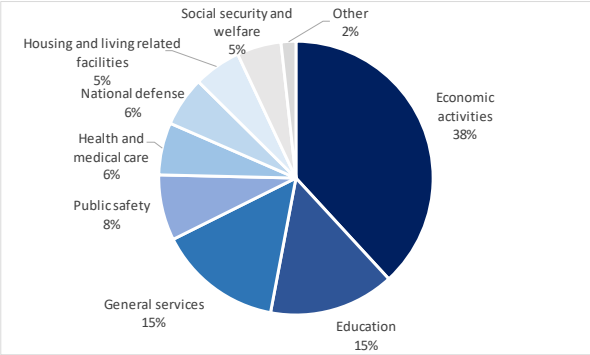
Figure 7.6 Fiscal Balance (million NPR)

Furthermore, Figure 7.7 and Figure 7.8 show the breakdown of the government revenues and expenditures, respectively. It shows that the government revenue is supported by tax and non-tax revenue (97%), as well as foreign grants and repayments (3%). However, the contribution of foreign grants to the government's total income has been gradually declining since FY2012. Majority of expenditures are utilized for economic activities (38%), education (15%) and general services (15%).



Source: IMF – Government Finance Statistics (GFS) Data

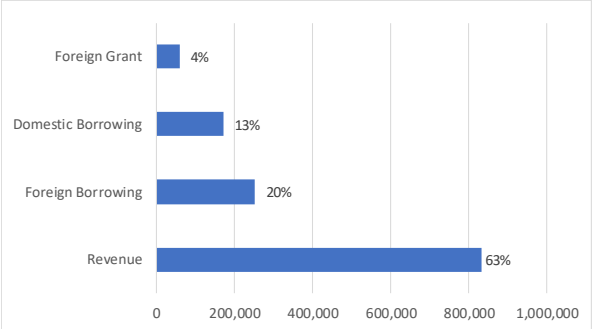
Figure 7.7 Revenue Breakdown FY2016



Source: IMF – Government Finance Statistics (GFS) Data, Economic Survey by Ministry of Finance

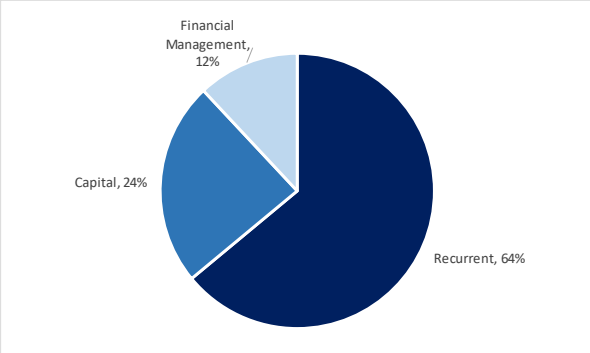
Figure 7.8 Expenditure Breakdown FY2017

The government's FY2018 budget of NPR 1.31 trillion has been set, with a target of 8% economic growth and 29.8% revenue growth. The federal budget allocated NPR 113.43 billion to seven provinces and NPR 195.05 billion to 753 local bodies and under the revenue-sharing scheme, the provinces and local bodies have received NPR 60.42 billion and NPR 53.82 billion, respectively, from the divisible fund. In terms of the sources of budget, foreign borrowing and foreign grant for FY2018 account for 24% of the total budget, as shown in Figure 7.9. It also should be noted that the recurrent expenditure in Nepal makes up more than 60% of total government spending. In contrast, capital expenditure remains below 20%, as shown in Figure 7.10.



Source: Nepal Economic Forum

Figure 7.9 Source of Budget Financing FY2018

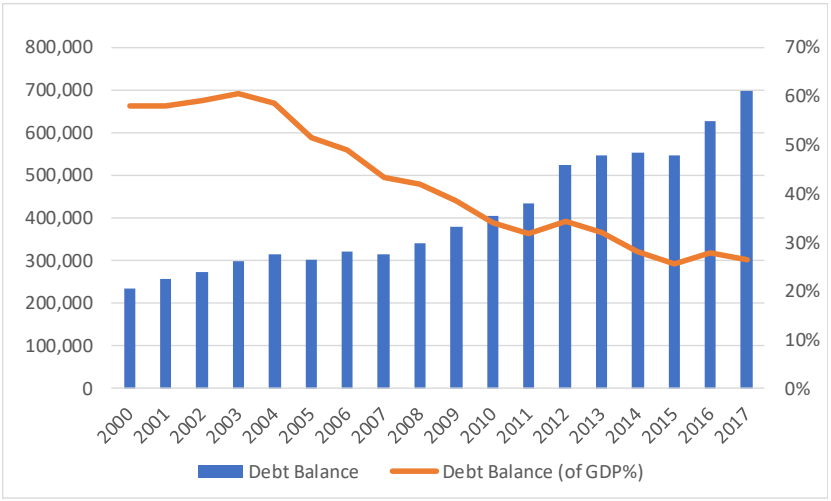


Source: Nepal Economic Forum

Figure 7.10 Allocation of Budget FY2018

7.2.2 Debt Balance

In Nepal, public debt grew rapidly since the 1980s and reached 50-60% of GDP in the 1990s and early 2000s. However, as shown in Figure 7.11, with the recovery of the fiscal deficit trend (excluding the case of recent years) and the government policy on promoting public debt repayment, the debt balance has improved significantly, to 26.4% of GDP in 2017.



Source: IMF – Government Finance Statistics (GFS) Data

Figure 7.11 Debt Balance (million NPR)

According to IMF's Article IV consultation (debt sustainability analysis), shown in Table 7.1, Nepal's risk of external debt distress remains low and under the IMF/World Bank Debt Sustainability Analysis Framework for Low Income Countries (LIC-DSF), all debt and debt service ratios are projected to remain below relevant indicative threshold values. However, following a prolonged decline, a rise in total public debt is projected, to about 35% of GDP in the medium term and about 42% of GDP in the long term, owing to continuing fiscal and current account deficits, as the authorities implement fiscal federalism and aim to put the economy on a higher growth path.

Table 7.1 IMF – Debt Sustainability Analysis 2018

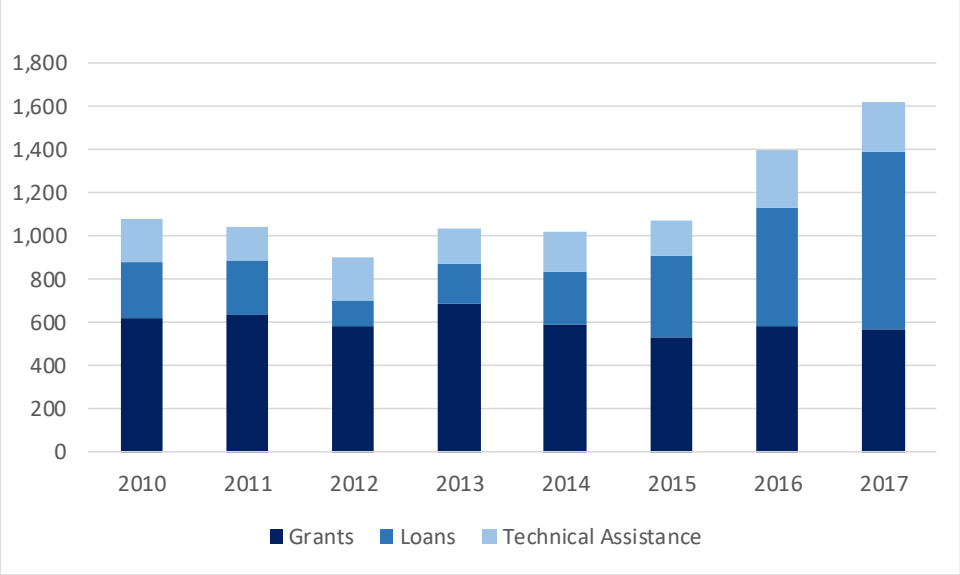
Risk of External Debt Distress	Low
Overall Risk of Debt Distress	Low

7.2.3 Donor Assistance

The Ministry of Finance recognizes that international finance among the public finance, including foreign direct investment, remittance and official development assistance (ODA), plays a key role in socioeconomic development. There are four types of classifications of foreign aid related to the national budget, as follows[1]:

- On-Budget: Funds that are reflected in the Government's annual budget book
- Off-Budget: Funds are not reflected in the Government's annual budget book
- On-Treasury: Funds channeled through the Government's treasury system
- Off-Treasury: Funds not channeled through the Government's treasury system

In the past, major source of development expenditure used to be foreign aid. Currently, it is around 20% of the national budget. Figure 7.12 shows the ODA disbursement situation from FY2010 to FY2018. Of the total ODA in FY2017, the shares of grants, loan and technical assistance accounted for 35%, 50%, 14% respectively.

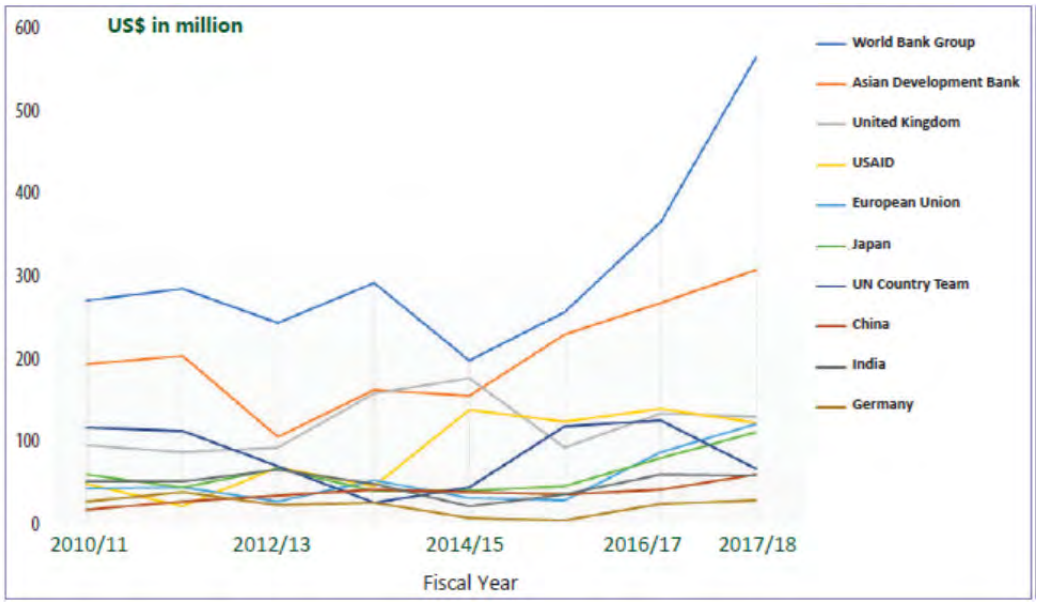


Source: Development Cooperation Report, FY2017/2018, Ministry of Finance

Figure 7.12 ODA Disbursement (million US$)

The trends of ODA disbursements by the 10 highest-disbursing donors over the last eight years is shown in Figure 7.13. It shows that the disbursement in FY 2017 by most of the 10 DPs increased compared to FY 2016. There was a noticeable decline in disbursement by the UN Country Team, and a slight decline in that of the United Kingdom, USAID and India in FY 2017 compared to 2016.

[1] In FY2017, the On-Budget accounted for 22%, and Off-Budget at 78%, and On-treasury at 66% and Off-Treasury at 34% of ODA disbursement.



Source: Development Cooperation Report, FY2017/2018, Ministry of Finance

Figure 7.13 10 Highest-Disbursing donors to Nepal (million US$)

In terms of ODA loan amount, it has been increasing versus the total ODA disbursement amount in the recent years, as shown in Figure 7.12. Table 7.2 shows the commitment of loans by the World Bank and ADB, the major donors, and Japan, in the past ten years. Although there are fluctuations depending on the year, can be seen that an average of 29,000 million NPR or around US$ 260 million and 26,000 million NPR or around US$ 230 million have been committed by the World Bank and ADB, respectively, in the past ten years.

Table 7.2 Loan Commitments by the WB, ADB, and Governemnt of Japan

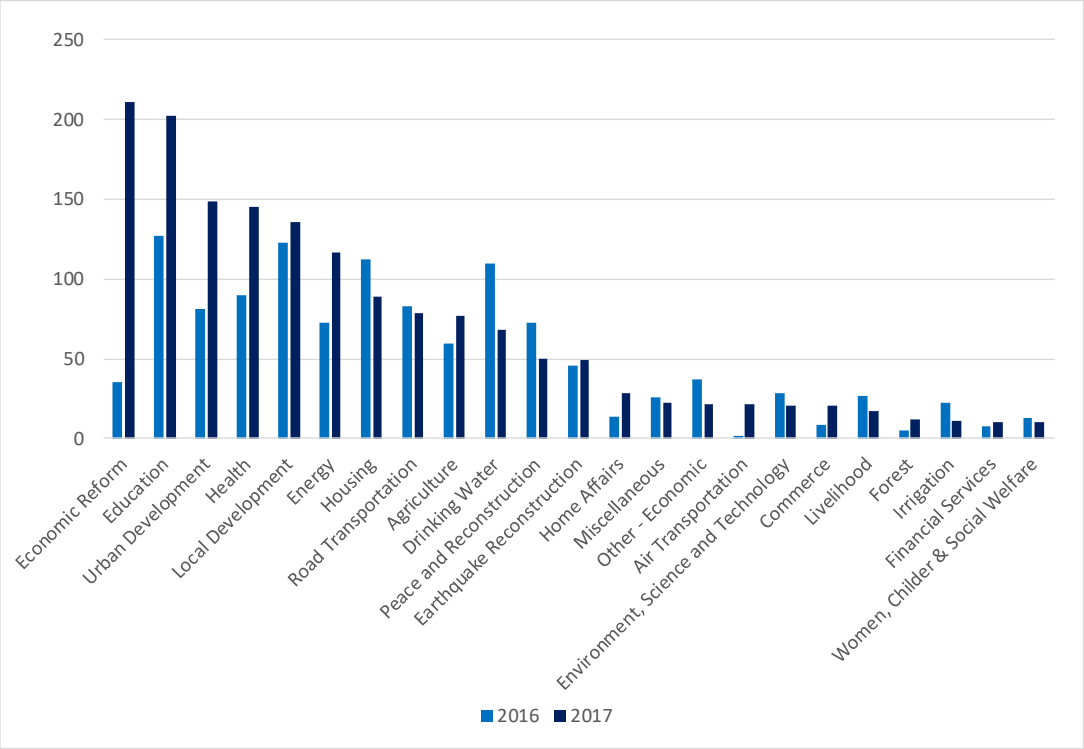
(in million US$)

	The World Bank	ADB	Government of Japan
2009	173	172	-
2010	168	278	-
2011	206	105	-
2012	104	119	-
2013	276	305	155
2014	220	351	-
2015	385	290	215
2016	205	120	153
2017	435	509	-
2018	440	100	-

Note: 2018 figures are up to July

Source: JICA

Figure 7.14 shows the sector-wise ODA disbursement to Nepal in FY2016 and FY2017. The top five sectors, economic reform, education, urban development, health and local development account for around 52.1% of the total. The road transport sector has received US$ 83.3 million and US$ 78.3 million in FY2016 and FY2017, respectively.



Source: Development Cooperation Report, FY2017/2018, Ministry of Finance

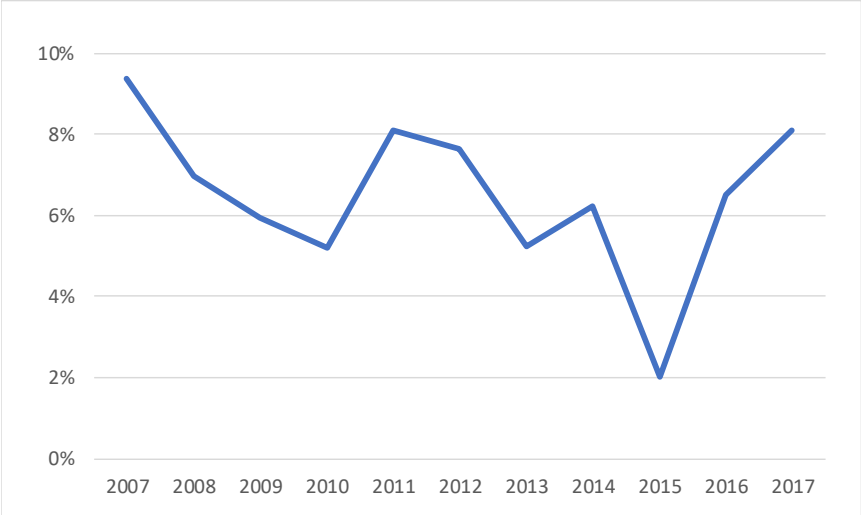
Figure 7.14 Sector-Wise ODA Disbursement, FY2016 and FY2017

7.3 Financing of Transport Projects

7.3.1 Transport sector in Nepal

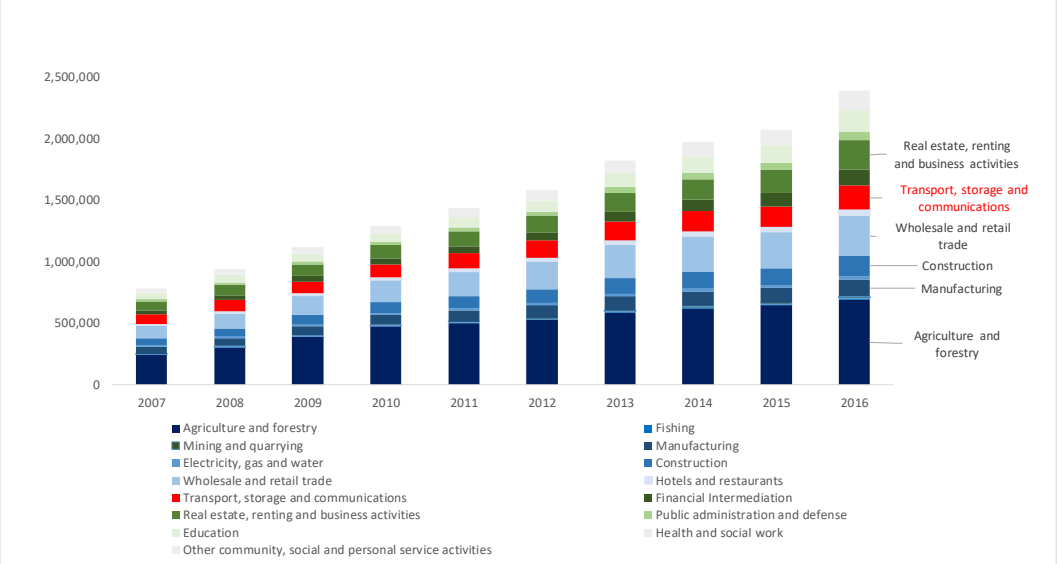
In Nepal, there is a total road network of 80,078 km. Out of a total of 75, only 67 district head quarter's roads are linked with all-weather roads. Most of these roads are basic road connectors and require regular maintenance, upgrading, and further road connection to other districts. The other means of transportation include Nepal's railway line, with a total length of 57 km out of which only 5 km is currently operating. Also, the country operates 1 international airport and 56 domestic airports.

As shown in Figure 7.15, the transport sector accounted for 8.11% of GDP and grew 6.8% in FY2016. Although there have been fluctuations over the years, the average growth rate from FY2013 to FY2016 has been 6.32%. Moreover, the Gross Value Added of the transport, communication and warehousing sector reached 193 billion NPR in FY2016, as shown in Figure 7.16. Over the next five years, the government is targeting to mobilize US$ 8.2 billion for road infrastructure, rail connectivity and transport sector management.



Source: Ministry of Finance

Figure 7.15 Annual Growth Rate to GDP of the Transport, Storage and Communication Sector (at current price)



Source: Central Bureau of Statistics

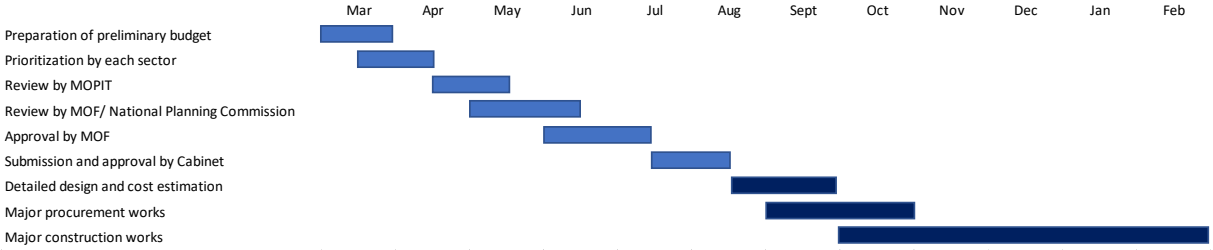
Figure 7.16 Gross Value Added by Industrial Division (at current price, million NPR)

7.3.2 Budgeting Procedure

The basic budgeting procedure is shown in Figure 7.17. From around March of each year, preliminary budget information from relevant offices, projects, units and branches are collected by each sector, which then is prioritized and submitted to the Ministry of Physical Infrastructure and Transport (MOPIT). After review and further prioritization by MOPIT, it is then submitted to the Ministry of Finance (MOF), which scrutinizes the proposed budget by each ministry along with the National Planning Commission (NPC). At this time, series of meetings will be held with each sector offices and MOF. Once MOF completes the review of all budgets from all ministries, it is submitted to the NPC for final approval. Once approved, it is submitted to the Cabinet for approval by Parliament, which is held from around July to August.

Post-budget approval, each ministry receives the confirmed budget from MOF, and each sector performs the detailed design and cost estimation according to the approved budget, and procurement is conducted.

For the road sector, usually the procurement is held from July-September for major works, to be completed by the end of the monsoon season so that the major construction works can start from October.



Source: JICA Study Team, based on interview with MOF, DOR, and local consultant

Figure 7.17 Budgeting Timeline Sample

7.3.3 Budget and Expenditure of the Transport Sector Projects

Table 7.3 shows the annual budget and actual expenses of the Department of Roads (DOR). The budget allocated to DOR has seen a constant rise every year, which is evident that infrastructure development is given more attention than before. Among the total budget of MOPIT in the fiscal year 2013, 88% was allocated to the DOR, and 12% to the other sectors, namely railway and airport sectors.

Table 7.3 Annual Budget and Expenditure of DOR

(in million NPR)

FY	Allocated Budget	Actual Expenses				
		Construction	Upgrading	Maintenance	Miscellaneous	Total
2010	23,609	13,244	2,827	917	3,458	20,446
2011	23,542	8,709	8,261	1,460	862	19,292
2012	28,568	10,151	8,036	2,073	1,572	21,832
2013	34,518	8,497	5,025	5,921	8,518	27,961

Source: Department of Roads

For the road sector, the Road Board Nepal (RBN), an agency which controls the road fund, was established under MOPIT to manage the road fund. The funds of the RBN are specifically utilized for the maintenance of roads, and shared between the central government as well as the municipalities. Although the legislation states that collected resources of the fund shall be received directly by DOR, according to DOR, at this moment, it is first received by MOF and then allocated to DOR, since currently, tax and fees are collected by MOF. As shown in Table 7.4, the funding sources of RBN include fuel levies and vehicle registration fees, and a small share of toll.

Table 7.4 Resources of Road Board Nepal

(in million NPR)

FY	Allocated by MOF		Collected by RBN	Total Maintenance	Allocated Budget to RBN by MOF
	Fuel Levy	Vehicle Registration	Toll		
2004	199	150	N/A	349	220
2005	226	152	41	419	363
2006	228	168	39	435	330
2007	247	251	47	545	390
2008	500	444	40	984	760
2009	741	688	50	1,479	665
2010	927	1,459	65	2,451	1,315
2011	1,759	1,598	65	3,422	2,518
2012	2,080	1,440	73	3,593	2,768
2013	2,333	2,297	58	4,688	2,574
2014	2,473	2,615	67	5,155	4,000

Source: Road Board Nepal

It should be noted that currently, Nepal is under the process of decentralization. For the transport sector, it is undergoing a gradual transformation process, but still is at the initial stage and will take more time to create the structure and framework for adequate budgeting and financing. For the road sector, for provincial roads, some of the budget has been directly provided to the provincial government, but due to inexperience, support from DOR is often necessary. Moreover, according to DOR, there were cases where DOR handed the provincial government to manage certain roads, but the provincial government couldn't complete the works, so the works were returned to DOR.

7.4 Summary

The summary of the financial situation of the Government of Nepal are as follows:

- At macro level, overall, with a GDP growth rate at 7.9% in FY2017, positive economic growth and sound government finances are seen. With the government going through fiscal reforms, negative current account balance from trade deficit and fiscal deficit, with continued high remittance inflows, which has reached 27.9% of GDP in 2017, need to be monitored. However, with the government's efforts in fiscal reform, the debt balance to GDP has decreased to 26.4% in 2017 from 60% in 2003.
- IMF's near-term outlook for economic growth of Nepal is favorable, although macroeconomic and financial vulnerabilities need to be monitored. Furthermore, IMF Article IV consultation (debt sustainability analysis) in 2018 has stated that Nepal's risk of external debt distress and overall debt distress remain low.
- The transport sector account for around 8.11% of the GDP and has shown a positive growth rate for the past ten years, which shows the importance of the sector to the overall development of the country.
- Within the transport sector, the road sector utilizes majority of the budget of MOPIT. Obtaining maintenance budget for sustainability of roads has been a challenge for the country, though use of the funds of the Road Board Nepal has supported the situation. Direct sourcing of the funds shall be implemented in the near future.
- In terms of ODA loan disbursement, the amount has been increasing in the recent years. The major donors are the World Bank and ADB, an average of around US$ 260 million and around US$ 230 million have been committed by the World Bank and ADB, respectively, in the past ten years.

Appendix 8 Draft Project Design Matrix (PDM) for TA

APPENDIX 8 DRAFT PROJECT DESIGN MATRIX (PDM) FOR TA

The draft project design matrix (PDM) for TA is described from the following page.

Project Design Matrix (PDM) (Draft_20190404)

Project Title: The Project for Introduction of the Urban Traffic Management Guidelines in Kathmandu Valley

Implementing Agency: Department of Roads (DoR), Department of Traffic Management (DoTM), Kathmandu Metropolitan City (KMC), Kathmandu Metropolitan Police Division (KMPD)

Period of Project: 3 years **Project Site**: Kathmandu Valley

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
Overall Goal			
Safe and smooth traffic flow on major urban roads in Kathmandu Valley is achieved**. **This achievement is expected 3 years after the TA completion.	• Traffic volume throughput capacity of the urban main roads is increased at least by ##%. • Number of traffic accident caused by human errors factors and involving pedestrian on urban roads in the valley is reduced by ##%.	• Control delay at intersection by periodic traffic survey or GPS probe data from buses • Statistics/Database of road accident and victims information	
Project Purpose			
The capacity to implement intersection improvement, traffic safety education, and traffic regulation in Kathmandu Valley by counterpart (C/P) agencies is enhanced.	• Traffic volume throughput capacity of the intersections under pilot project(s) is increased by ##% compared to that of baseline survey.	• Control delay at intersection (by traffic survey or GPS probe data)	• Traffic volume does not grow drastically during the project period.
	• Intersection improvement activities are implemented in accordance with the schedule proposed in UTMP**. **UTMP: Urban Traffic Management Plan	• Project reports	
	• Traffic rules and manners awareness campaigns are continuously conducted and public awareness level on traffic rules and manners becomes level "3" or more in a five "5" point scale by Month/Year.	• Number of media coverage / Interview (questionnaire) to the citizens in KV	
Outputs			
1. Urban traffic management policy is strengthened. **[UTMP, with government officers]** - Set vision, strategy, and plan the followings: o Intersection improvement plan (physical/ geometric improvement, signal installation) o Traffic safety education plan o Traffic enforcement strengthening plan o Sustainable funding/financial plan - Set monitoring plan/tool (GPS probe data, etc.) - Further TA/Grant Aid scheme	1.1 UTMP is approved by the GON by Month/Year.	• UTMP	
	1.2 Percentage of correct answers of endline survey on urban transport management policy from concerned officers increases by ##% compared to that of the baseline survey.	• Examination/ Questionnaire to concerned officers who attend the training/seminar	
2. Urban intersection improvement capacity is enhanced. **[Urban Traffic Management Guidelines (UTMG)]** - A series of technical manuals/guidelines pertaining to: o Physical (geometric) improvement of urban road intersection (e.g. lane width) o Traffic signal operation and installation **[Pilot project on intersection improvement]** - To be conducted at selected intersection to demonstrate the introduction of the guideline which may includes o Physical/ geometric improvement project o Traffic signal installation project	2.1 A series of technical guidelines on traffic management as parts of UTMG are developed by Month/Year.	• Draft technical manuals/ guidelines	
	2.2 Level of skills and knowledge on technical guidelines of the UTMG of ## key officers from C/P agencies are improved to trainer level by Month/Year.	• Training evaluation report	
	2.3 ## of key officers participate in the preparation and the implementation of the pilot project(s) to test the applicability of proposed manuals/guidelines.	• Pilot project report	
	2.4 ## of key officers are able to develop similar improvement plan at other intersections following technical guidance from JICA experts by Month/Year.	• Improvement plans/ proposals from the key officer	
	2.5 UTMG is developed and approved by the C/P agencies by Month/Year	• UTMG	
3. Traffic signal operation and maintenance capacity is improved. **[Principle and practices in traffic signal operation and maintenance]**	3.1 Traffic signal maintenance manuals is developed by Month/Year as part of UTMG.	• Manual(s) as part of UTMG	• Budgets for the project are secured by C/P agencies
	3.2 ## of key officers successfully complete the training on traffic signal operation design and maintenance.	• Training evaluation report	
	3.3 Traffic signal maintenance is conducted routinely in accordance with the manual and number of breakdown is negligible.	• Maintenance record	
4. Capacity for implementing road safety education and awareness program is	4.1 Guidelines for safe road user behavior is developed by Month/Year.	• Guidelines	

enhanced. **[Road safety management]** - Awareness campaign for vulnerable road users (pedestrians, motorcyclists, etc.) **[Safe road user behavior]** - Education and awareness strategy on traffic rules and manners; - Action plan on road safety education - Pedestrian crossing facilities improvement plan in urban area			
	4.2 Road safety education materials for vulnerable target groups are prepared by Month/Year.	• Booklet / Leaflet/ Toolkit	
	4.3 Percentage of correct answers of endline survey on traffic rules and manners from participants of awareness campaign increases by ##% compared to that of baseline survey.	• Questionnaire to participants	
	4.4 At least ## driver trainer(s) of driving schools, ## representatives of bus entrepreneur/route associations, and ## operation manager(s) of prominent transport companies servicing in Kathmandu Valley participate in the road safety seminar organized by C/P agencies.	• Seminar reports	
5. Traffic enforcement capacity is improved. **[Safe and smooth traffic flow with proper enforcement by traffic police]** - Traffic rules enforcement program (violation and penalty) - Enforcement supporting devices/ technologies (camera, etc.) in view of effectiveness, efficiency, and safety.	5.1 Traffic rule enforcement program is developed by Month/Year.	• Draft UTMG • Training evaluation report	
	5.2 Road accident database system is developed by Month/Year.	• Road accident database system	
	5.3 Operation manual of traffic enforcement devices is developed.	• Manual	
	5.4 At least ## traffic police officers attended training and able to demonstrate good enforcement practice.	• Training evaluation report	

Activities	Inputs		Pre-conditions
	Japanese Side	Nepalese Side	
[1. Policy Making] 1.1 To review the current policy and legal framework pertaining to traffic management Kathmandu Valley; 1.2 To review the conditions of urban traffic; 1.3 To prepare the UTMP with concerned government officers; 1.4 To conduct seminars on urban traffic management policy for C/P agencies.	**1. Experts** 1) Team Leader / Urban Transport Policy 2) Intersection Design Engineer 3) Traffic Signal Plan/ Operation Engineer 4) Road Safety Expert 5) Technical Training/ Public Relation 6) Traffic Database/ Traffic Survey Engineer/ Monitoring Planner About 80.0 Man-Months **2. Pilot Projects** • Construction works/materials (with Japanese technologies) • Equipment and accessory • System Development (i.e. vehicle tracking, video-monitoring, with Japanese technologies) **3. Training Two Times in Japan and Two Times in 3rd Countries** **4. Seminars' Venue and Materials**	**1. Counterpart Personnel** • Sufficient number shall be assigned from DOR, DOTM, KMC, KMPD **2. Provision of Office Space** **3. Detail Design, Civil Works and Installation Cost for Pilot Projects Equipment** **4. O&M Cost for the Equipment or Device Provided by Japanese Side**	
[2. Main Intersection Improvement] (Engineering) 2.1 To develop technical guidelines pertaining to physical (geometric) improvement of urban road intersection and traffic signal installation; 2.2 To conduct training on technical guidelines including on-the-job training; 2.3 To review the conditions of urban traffic; 2.4 To select target intersection(s); 2.5 To examine improvement measures (geometric improvement, signal control, etc.); 2.6 To implement pilot project(s) taking into consideration of improvement measures; 2.7 To make develop improvement plan for other intersection(s). 2.8 To finalize the UTMG			
[3. Traffic Signal Operation & Management] (Engineering) 3.1 To review the traffic signal controlling system in overseas. 3.2 To review basic policy for the traffic signal specification and the controlling system and to draft their standards 3.3 To prepare manual on operation & maintenance of traffic signal; 3.4 To conduct trainings based on the above and to conduct training including OJT.			
[4. Road Safety Awareness] (Education) 4.1 To examine the traffic awareness condition; 4.2 To develop guidelines for safe road user behavior; 4.3 To prepare road safety education materials; 4.4 To conduct awareness campaigns for target groups (vulnerable road users such as pedestrians, motorcyclists); 4.5 To give lecture on traffic safety program to driver trainers from driving schools, bus entrepreneur/route			

associations, and operation managers of transport companies in Kathmandu Valley.			
[5. Traffic enforcement capacity] (Enforcement) 5.1 To examine traffic violation characteristics; 5.2 To develop traffic rule enforcement program; 5.3 To develop traffic accident database management system; 5.4 To provide support on introduction of traffic enforcement devices; 5.5 To conduct training for traffic police officers on implementation of effective, efficient, and safe enforcement of traffic regulation.			

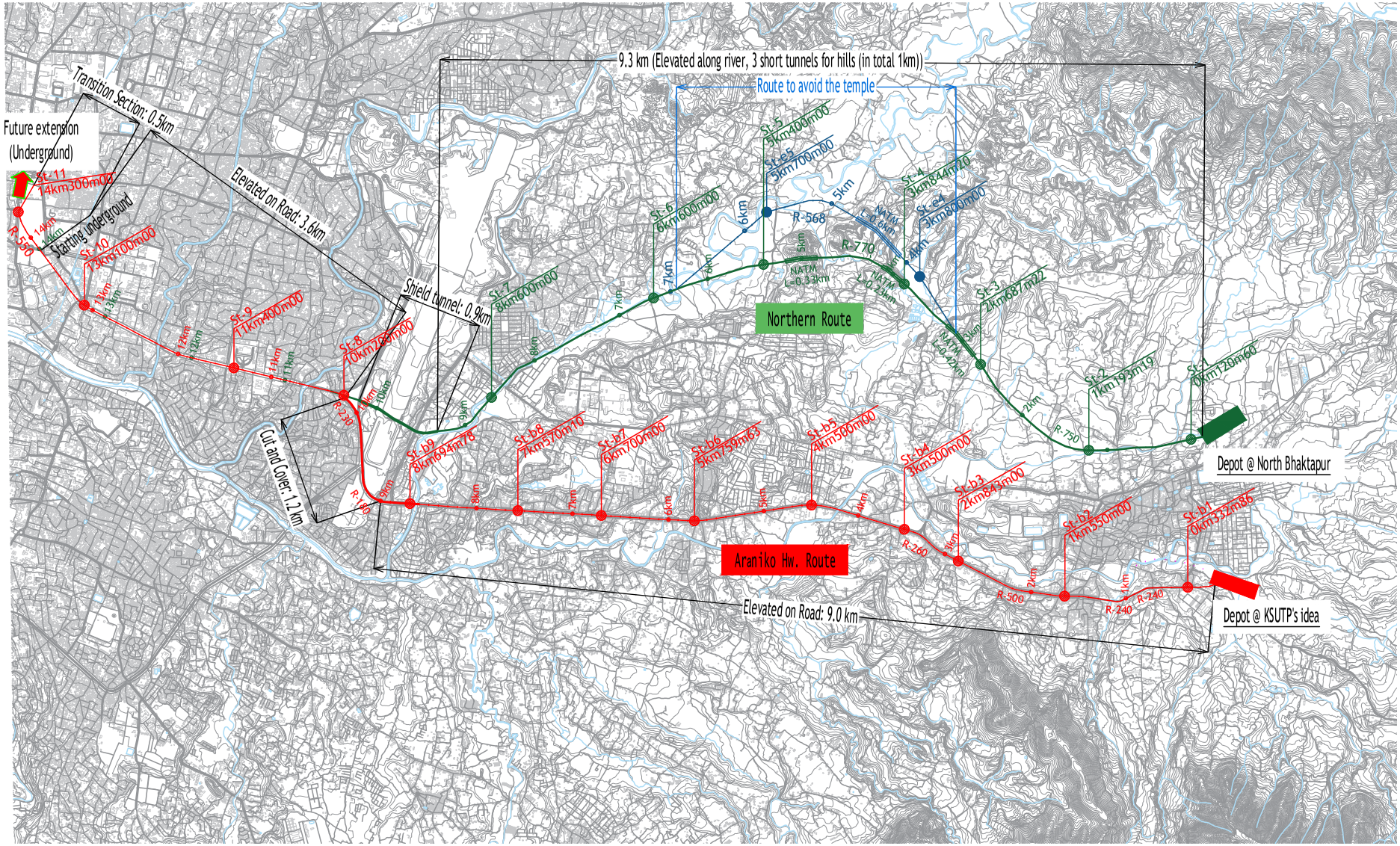
Appendix 9 Detailed Railway Route Plan

APPENDIX 9 DETAILED RAILWAY ROUTE PLAN

The detailed railway route plan is described from the following page.

Detailed Railway Route Plan

SCALE 1:20000 (1:40000)



DATA COLLECTION SURVEY ON URBAN TRANSPORT IN KATHMANDU VALLEY IN FEDERAL DEMOCRATIC REPUBLIC OF NEPAL	MOPIT Ministry of Pysial Infrastruture and Transport刀 晦図 KVDA Katmandu Valley Development Autority図尉	JICA / Oriental Consultants Global / PADECO	SUB PROJECT:	SCALE: AS SHOW / JUNE 2019	Detailed Railway Route Plan	DWG. NO: 01

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Appendix 10 Review of Macroscopic Transport Demand Analysis Model

APPENDIX 10 REVIEW OF MACROSCOPIC TRANSPORT DEMAND ANALYSIS MODEL

The JICA Masterplan has initiated the transport demand analysis model development which was completed in 2017. It is designed with the ordinary 4-step methodology and substantiated with numerous household and roadside interview surveys and roadside traffic counting in 2012. It is designed for strategic analysis of future road traffic demand for the master plan objectives. It consists of traffic generation/attraction model, distribution model, mode-choice model, and network assignment model. The network assignment was handled by the JICA STRADA package software. The set of models had been completed in 2016 and utilized for the 2017 Master Plan analysis. Hereafter, this is called the JICA MP Model.

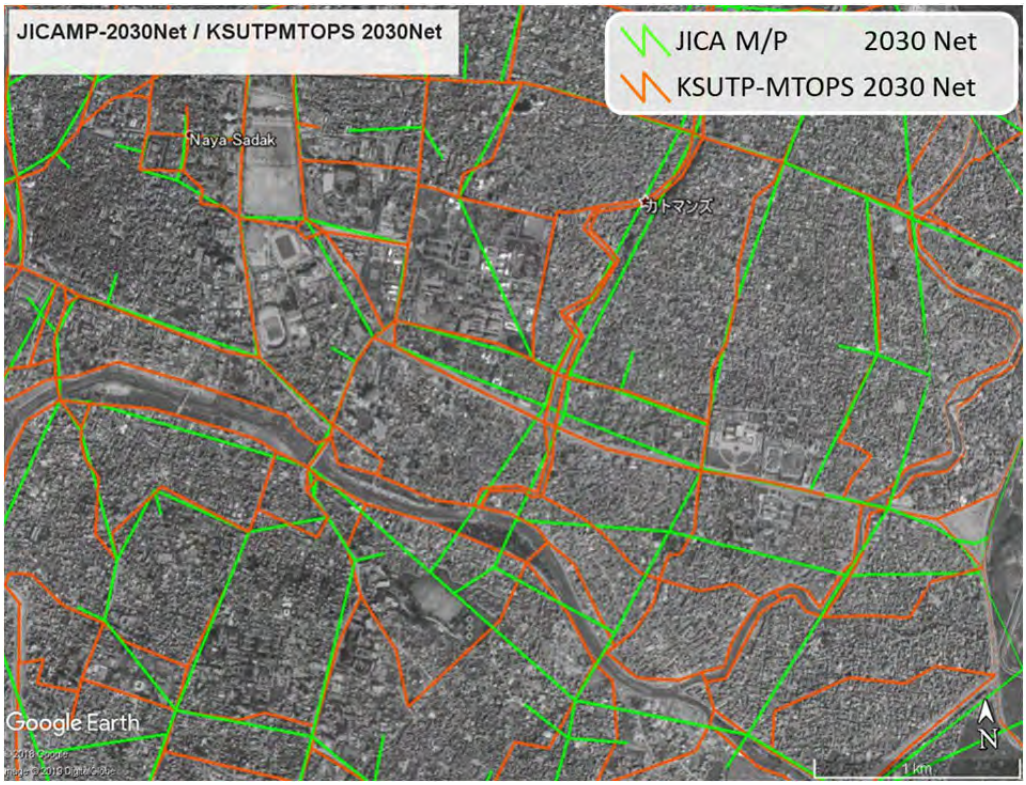
KSUTP-MTOPS, which was implemented during 2017-18 by ADB, was handed over the resources of the JICA MP Model, and modified the model for the Mass Transit Feasibility assessment. The modification has contributed to the improvement of model quality in the following three aspects:

Network setting quality: The KSUTP-MTOPS team conducted a set of road assets surveys, prepared the proper alignment of existing road network in GIS, and incorporated it into the network model. Additionally, the KSUTP-MTOPS team reviewed the latest road development plan and idea for the year 2030 and 2040 scenario with DOR, and improved the road development scenario with qualified alignment. Figure 10.1 shows that the accuracy of road alignment were improved by the KSUTP-MTOPS model. This JICA survey (Data Collection Survey) aims to assess the intersection improvement by the network assignment model, and the quality of network setting is essential to the study. It is advantageous to use the KSUTP-MTOPS network setting.

Traffic Analysis Zone (TAZ) setting: The JICA study team developed origin-destination (OD) matrices for each trip purpose and for each transport mode within the 93 traffic analysis zones (TAZs) system. To evaluate the traffic demand on mass transit options, KSUTP-MTOPS disaggregated the 93 TAZs-based OD matrices into 171 TAZs for each scenario. The refined zone plan enabled for a more detailed modeling of the proposed mass transit systems, as well as intersection improvement assessment for the JICA data collection survey.

Population Scenarios Setting: The KSUTP team has incorporated the latest KVDA new city development scenario in 2018 after a long consultation with KVDA. Table 10.1 shows the difference between the JICA MP and KSUTP-MTOPS population setting for Kathmandu Valley. The population scenario settings of the KSUTP-MTOPS are 1.3-1.5 times larger than that of the JICA MP. However, the KSUTP-MTOPS adopted this scenario as per the request of the KVDA new city development trend.

The survey team has consulted with KVDA and other stakeholders in the interim WG (11 February) and the participants agreed on the scenario.



Source: JICA Study Team

Figure 10.1 Quality Difference of the Network Setting between JICAMP/KSUTP

Table 10.1 Population Scenario Difference

MTOPS – Scenario	2016	2020	2030	2040
Population (A)	3,740,432	4,169,643	4,924,467	5,728,718
Generated Traffic (C)	4,123,713	5,972,482	7,200,132	8,755,482
Generated Traffic per Person	1.10	1.43	1.46	1.53
Vehicle Ownership per Household	69.43%	73.30%	83.35%	92.05%
JICA Master Plan Scenario	2011	2020	2030	
Population (B)	2,439,760	3,120,000	3,724,000	
Generated Traffic (D)	3,438,393	4,418,205	5,324,470	
Generated Traffic per Person	1.41	1.42	1.43	
Vehicle Ownership per Household	62.79%	74.51%	79.47%	
Population Comparison (A)/(B)	1.533	1.336	1.322	--
Generated Traffic Comparison (C/D)	1.199	1.352	1.352	

Source: JICA Study Team