

# A Study on Suggestion of Criteria for Speed Change Lane Installation at Side Road

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Double lane road, connected two-lane, is traffic congestion occurs due to a right turn vehicle due to the connection, so securing a right lane for the smooth traffic flow is important. For this, the installation of the speed change lane is frequently used as a method for smooth flow of traffic. In the speed change lane, a right-turn vehicle can safely in and out without affecting the traffic flow. But there are no clear installation criteria for speed change lane and installation of speed change lane is only recommended by reviewing the deliberation committee of each local government considering the condition of road and traffic volume. This study is objective to suggest the judgment criterion for the installation of the speed change lane connected between road and road. As a result of the study, it is suggested that if the speed difference between the main road and the side road is less than 10km/h, the speed change lane is not in-stalled and that the speed change lane is necessarily installed when the speed difference is more than 20km/h. In case of less than 10km/h to less than 20km/h, the standard was set to decide whether to in-stall in consideration of the surrounding traffic environment. Criterion for the installation of the speed change lane that suggested to this study, it is considered appropriate to apply the installation standard only when the traffic volume of side road is less than 100vehicle/hour considering the characteristics of side road.

**Key Words :** *double lane road, speed change lane, installation criteria for speed change lane, VISSIM analysis, speed difference model*

## 1. INTRODUCTION

The traffic volume in the city is increasing due to the increase in the number of vehicle recently, and the traffic volume to the city is rapidly increasing due to the development of the area outside the city and the development of the new town. Therefore, expansion of existing roads and establishment of new roads for improve traffic flow are important tasks in transportation planning. Roads and roads are connected, intersections and simple inflow / outflows are installed for improve traffic flow.

Especially, when a double lane road(two-lane) is connected to another road, traffic congestion occurs due to a right turn vehicle<sup>(1)</sup> due to the connection, so securing a right lane for the smooth traffic flow is important. It is important to secure a right-of-way

lane for smooth traffic flow because right-turn vehicles cause traffic congestion. However, the installation of intersections or access roads on these roads is deteriorating the safety and function of roads. And expansion of existing roads and establishment of new roads requires the securing of road sites and business expenses. Therefore, the installation of the speed change lane<sup>(2)</sup> is frequently used as a method for smooth flow of traffic. When two roads with different design speeds are connected, the installation of the speed change lane serves as a road which can smoothly flow in and out, and can be added or subtracted at a speed suitable for the road. In the speed change lane, a right-turn vehicle can safely in and out without affecting the traffic flow. But there are no clear installation criteria for speed change lane and installation of speed change lane is only rec-

ommended by reviewing the deliberation committee of each local government considering the condition of road and traffic volume.

Therefore, the purpose of this study is to present the judgment criterion for the installation of the speed change lane when the road and the road are connected.

## 2. REVIEW OF RELATED RESEARCH

The researches related the speed change lane are as follows. J.B, Jeong(2008) presented the appropriate length of bus stop and speed change lane considering queue, gap acceptance, weaving of traffic, bus stop length and deceleration lane length. And he has studied on installation of bus stops and speed change lane by selecting efficient type from integration and separation type. Urunjargal(2010) investigated the forms of inefficient and complicated signalized intersections, signal operation, traffic, pedestrian volume, etc. in the Ulaanbaatar. After creating three alternatives for the signalized intersection, simulated VISSIM for a total of 28 scenarios by increasing traffic volumes of current intersection type and three alternative. Measure Of Effectiveness(MOE) used the vehicular delay time, the number of stop and Level of Service(LOS) at the approach road, and proposed a more efficient and safer intersection signal operation than the current intersection operation.

There is an existing study on the speed change lane, but there is no study on the criteria of installation.

## 3. METHOD OF STUDY

In order to present the judgment criterion for the installation of the speed change lane, proceed as follows. 1)Plan access road with a virtual speed change lane and access road without a speed change lane using Auto CAD. 2)Set up the case with the variables of the travel speed and traffic volume of the planned main road and the side road, and set restrictions on the road management conditions and traffic management conditions. VISSIM is used to analyze the change in travel speed of each case, and Measure Of Effectiveness(MOE) uses the average travel speed. 3)Based on the results of VISSIM analysis, we conduct regression analysis with SPSS 21.0 to develop the speed difference model of the main road and the side road. 4)Based on the developed model, calculate the speed difference between

the main road and the side road by each case, and judge whether or not to install the speed change lane on the basis of the criteria shown in “Road Capacity Manual, 2013, Ministry of Land, Transport and Maritime Affairs”, “Guideline of Rescue Facility Standards on Roads, 2009, Ministry of Land, Transport and Maritime Affairs”.

## 4. ANALYSIS OF TRAVEL SPEED CHANGE DEPENDING ON THE INSTALLATION BY SPEED CHANGE LANE

### (1) Case settings

The travel speed according to installation of speed change lane depends on the road geometrical construction of the intersection, signal operating, and traffic volume. Therefore, we have limited the road geometrical condition and traffic conditions for an objective comparison of the installation effect by a simple access roads(side road).

The road management conditions were divided into two cases for two-lane uninterrupted traffic flow : a case in which a speed change lane was installed the point where a main road and side road were connected, and a case where the road was not installed. The criterion for the installation of the speed change lane were applied based on the minimum length of speed change lane on two-lane road proposed in “Guideline of Rescue Facility Standards on Roads, 2009, Ministry of Land, Transport and Maritime Affairs”. And the lane width, vehicle type, and shoulder width were applied based on the basic condition of two-lane road proposed in “Road Capacity Manual, 2013, Ministry of Land, Transport and Maritime Affairs”.

In order to analyze the change of travel speed according to the increase of traffic volume, the traffic

**Table 1** Road management conditions

		Installation	Uninstalled
The number of lane		2	2
Width of lane		3.5m	3.5m
Vehicle		Passenger car	Passenger car
Width Widening		1.5m	1.5m
Acceleration lane	Width	3.25m	-
	Length	Speed change lane	65
		taper	20
Deceleration lane	Width	3.25m	-
	Length	Speed change lane	30
		Taper	10
Geographical features		Level terrain	Level terrain

**Table 2** Traffic management conditions(unit: vehicle/h, km/h)

	Travel speed		Traffic volume									Speed change lane	
	Main road	Side road	Main road										
Case1	60	40	200	400	600	800	1000	1200	1400	1600	1800	30	Installation
			200	400	600	800	1000	1200	1400	1600	1800	50	
			200	400	600	800	1000	1200	1400	1600	1800	100	
			200	400	600	800	1000	1200	1400	1600	1800	30	uninstalled
			200	400	600	800	1000	1200	1400	1600	1800	50	
Case2	60	50	200	400	600	800	1000	1200	1400	1600	1800	30	Installation
			200	400	600	800	1000	1200	1400	1600	1800	50	
			200	400	600	800	1000	1200	1400	1600	1800	100	
			200	400	600	800	1000	1200	1400	1600	1800	30	uninstalled
			200	400	600	800	1000	1200	1400	1600	1800	50	
Case3	70	40	200	400	600	800	1000	1200	1400	1600	1800	30	Installation
			200	400	600	800	1000	1200	1400	1600	1800	50	
			200	400	600	800	1000	1200	1400	1600	1800	100	
			200	400	600	800	1000	1200	1400	1600	1800	30	uninstalled
			200	400	600	800	1000	1200	1400	1600	1800	50	
Case4	70	50	200	400	600	800	1000	1200	1400	1600	1800	30	Installation
			200	400	600	800	1000	1200	1400	1600	1800	50	
			200	400	600	800	1000	1200	1400	1600	1800	100	
			200	400	600	800	1000	1200	1400	1600	1800	30	uninstalled
			200	400	600	800	1000	1200	1400	1600	1800	50	

volume of main road was increased from 200 to 1,800 by 200 vehicle per hour in considering the capacity of the two-lane road, and the side roads were divided into 30, 50, and 100 vehicle per hour.

The cases were classified into four considering travel speed of the main road and the side road. The road geometrical construction was classified as with and without speed change lane. And a total of 216 cases reflecting the following traffic conditions and geometric conditions(with/without a speed change lane) were set up and analyzed using VISSIM.

**(2) Analysis of travel speed change by case**

The intersection was applied to the same condition as access roads(inflow / outflows) using AutoCAD. In the Road Capacity Manual, it is suggested to use the average travel speed and the total delay rate for the two-lane roads as Measure of Effectiveness(MOE) of the Level of Service(LOS) on road. And it is suggested to use the average travel speed and  $V / C$  for the multi-lane roads. Therefore, we analyzed through the travel speed obtained through VISSIM for a comprehensive analysis.

**a) The travel speed of case 1**

Assuming that the travel speed of main road is 60km/h and side road is 40km/h, the average travel speed of the main roads due to the change of the traffic volume is estimated as 53.0km/h to 66.0km/h when installed as a speed change lane, and 56.0km/h to 66.2km/h when not installed. It is analyzed that the difference in travel speed is -3.3km/h to 1.2km/h according to installation of speed change lane, and the travel speed of the main road is not influenced

**Table 3** Travel speed change in main road of case 1

Traffic	200	400	600	800	1000	1200	1400	1600	1800	Speed change lane
30	66.0	65.1	65.1	64.3	63.7	63.4	63.1	60.6	60.1	Installation
	66.2	65.1	64.3	64.3	63.9	63.9	63.1	60.1	60.4	Uninstalled
	-0.2	0.0	0.8	0.0	-0.2	-0.5	0.0	0.5	-0.3	Difference
50	66.0	65.1	64.5	63.9	63.4	62.6	61.6	59.4	57.1	Installation
	65.6	64.5	64.3	63.4	63.1	63.1	62.9	61.9	59.4	Uninstalled
	0.4	0.6	0.2	0.5	0.3	-0.5	-1.3	-2.5	-2.3	Difference
100	65.1	64.5	63.9	62.9	62.6	61.9	60.6	56.6	53.0	Installation
	63.9	63.7	63.7	63.1	62.6	61.6	60.8	56.0	56.3	Uninstalled
	1.2	0.8	0.2	-0.2	0.0	0.3	-0.2	0.6	-3.3	Difference

**Table 4** Travel speed change in side road of case 1

Traffic	200	400	600	800	1000	1200	1400	1600	1800	Speed change lane
30	42.2	42.2	41.9	42.0	41.8	41.1	39.2	37.5	38.8	Installation
	41.4	37.5	38.2	33.5	26.0	27.3	20.2	13.9	14.5	Uninstalled
	0.8	4.7	3.7	8.5	15.8	13.8	19.0	23.6	24.3	Difference
50	42.4	42.2	42.3	41.3	40.2	41.6	39.6	40.8	30.7	Installation
	40.3	38.8	34.1	28.9	27.7	25.4	24.5	17.0	15.7	Uninstalled
	2.1	3.4	8.2	12.4	12.5	16.2	15.1	23.8	15.0	Difference
100	42.3	42.3	42.3	42.2	40.8	41.9	38.7	35.4	36.1	Installation
	40.3	37.4	36.0	31.3	29.0	22.9	20.9	14.6	7.7	Uninstalled
	2.0	4.9	6.3	10.9	11.8	19.0	17.8	20.8	28.4	Difference

greatly by the speed change lane. The average travel speed of side road is analyzed to be influenced by the traffic volume of the main road. The results are as follows about the change of the travel speed to the side road when speed change lane was installed. When the traffic volume of side road is 30, the travel speed of the main road has increased more than 5km/h since 600vehicle. When the traffic volume of side road is 50, the travel speed of the main road has increased more than 5km/h since 400vehicle. When the traffic volume of side road is 100, the travel speed of the main road has increased more than 5km/h since 400vehicle.

**b) The travel speed of case 2**

Assuming that the travel speed of main road is 60km/h and side road is 50km/h, the average travel speed of the main roads due to the change of the traffic volume is estimated as 60.1km/h to 66.5km/h when installed as a speed change lane, and 56.5km/h to 66.2km/h when not installed. It is analyzed that the difference in travel speed is -0.9km/h to 0.4km/h according to installation of speed change lane, and the travel speed of the main road is not influenced greatly by the speed change lane. The average travel speed of side road is analyzed to be influenced by the traffic volume of the main road. The results are as follows about the change of the travel speed to the side road when speed change lane was installed. When the traffic volume of side road is 30, the travel speed of the main road has increased more than 5km/h since 600vehicle. When the traffic volume of side road is 50, the travel speed of the main road has increased more than 5km/h since 400vehicle. When the traffic volume of side road is 100, the travel speed of the main road has increased more than 5 km/h since 200vehicle.

#### c) The travel speed of case 3

Assuming that the travel speed of main road is 70km/h and side road is 40km/h, the average travel speed of the main roads due to the change of the traffic volume is estimated as 54.6km/h to 76.4km/h when installed as a speed change lane, and 56.3km/h to 76.4km/h when not installed. It is analyzed that the difference in travel speed is -4.1km/h to 4.9km/h according to installation of speed change lane, and the travel speed of the main road is not influenced greatly by the speed change lane. The average travel speed of side road is analyzed to be influenced by the traffic volume of the main road. The results are as follows about the change of the travel speed to the side road when speed change lane was installed. When the traffic volume of side road is 30, the travel speed of the main road has increased more than 5km/h since 400vehicle. When the traffic volume of side road is 50, the travel speed of the main road has increased more than 5km/h since 400vehicle. When the traffic volume of side road is 100, the travel speed of the main road has increased more than 5 km/h since 400vehicle.

#### d) The travel speed of case 4

Assuming that the travel speed of main road is 70km/h and side road is 50km/h, the average travel speed of the main roads due to the change of the traffic volume is estimated as 66.9km/h to 76.8km/h when installed as a speed change lane, and 68.1km/h to 76.4km/h when not installed. It is analyzed that the difference in travel speed is -2.3km/h to 1.5km/h according to installation of speed change lane, and

**Table 5** Travel speed change in main road of case 2

Traffic	200	400	600	800	1000	1200	1400	1600	1800	Speed change lane
30	66.0	65.6	65.4	64.8	64.5	63.7	63.7	63.1	62.6	Installation
	66.2	65.1	64.5	64.5	64.3	63.9	63.4	62.9	62.9	Uninstalled
	0.0	0.4	0.2	0.2	0.0	0.0	0.0	-0.2	-0.2	Difference
50	66.5	65.6	65.4	64.5	64.5	63.7	63.1	62.3	61.6	Installation
	66.2	65.1	64.5	64.3	64.3	63.4	63.4	62.9	62.6	Uninstalled
	0.3	0.2	0.2	0.3	0.0	0.0	-0.2	-0.5	-0.9	Difference
100	66.0	65.6	64.8	63.9	63.4	63.4	62.3	62.1	60.1	Installation
	65.6	64.8	64.8	64.3	63.9	63.1	62.6	61.9	56.5	Uninstalled
	0.0	0.0	0.0	0.3	0.3	-0.2	-0.3	-0.2	-0.8	Difference

**Table 6** Travel speed change in side road of case 2

Traffic	200	400	600	800	1000	1200	1400	1600	1800	Speed change lane
30	42.2	42.2	41.9	42.0	41.8	41.1	39.2	37.5	38.8	Installation
	41.4	37.5	38.2	33.5	26.0	27.3	20.2	13.9	14.5	Uninstalled
	0.8	4.7	3.7	8.5	15.8	13.8	19.0	23.6	24.3	Difference
50	42.4	42.2	42.3	41.3	40.2	41.6	39.6	40.8	30.7	Installation
	40.3	38.8	34.1	28.9	27.7	25.4	24.5	17.0	15.7	Uninstalled
	2.1	3.4	8.2	12.4	12.5	16.2	15.1	23.8	15.0	Difference
100	42.3	42.3	42.3	42.2	40.8	41.9	38.7	35.4	36.1	Installation
	40.3	37.4	36.0	31.3	29.0	22.9	20.9	14.6	7.7	Uninstalled
	2.0	4.9	6.3	10.9	11.8	19.0	17.8	20.8	28.4	Difference

**Table 7** Travel speed change in main road of case 3

Traffic	200	400	600	800	1000	1200	1400	1600	1800	Speed change lane
30	76.4	74.9	74.5	74.5	73.8	73.4	72.3	70.0	70.3	Installation
	76.4	75.3	74.9	74.5	73.8	73.4	73.1	70.0	69.3	Uninstalled
	0.0	-0.4	-0.4	0.0	0.0	0.0	-0.8	0.0	1.0	Difference
50	75.3	74.5	73.8	73.4	72.3	72.7	70.0	67.4	61.3	Installation
	75.6	74.1	73.8	73.1	73.1	72.7	72.0	69.7	65.4	Uninstalled
	-0.3	0.4	0.0	0.3	-0.8	0.0	-2.0	-2.3	-4.1	Difference
100	74.5	73.1	72.7	71.3	70.0	69.0	67.4	66.0	54.6	Installation
	72.3	72.3	71.3	72.0	71.3	70.0	68.7	61.1	56.3	Uninstalled
	2.2	0.8	1.4	-0.7	-1.3	-1.0	-1.3	4.9	-1.7	Difference

**Table 8** Travel speed change in side road of case 3

Traffic	200	400	600	800	1000	1200	1400	1600	1800	Speed change lane
30	42.0	42.2	41.7	40.1	40.6	40.6	41.7	25.4	32.6	Installation
	40.7	40.8	32.9	30.4	29.1	29.7	23.8	13.4	17.7	Uninstalled
	1.3	1.4	8.8	9.7	11.5	10.9	17.9	12.0	14.9	Difference
50	42.4	42.4	42.2	41.7	36.8	36.2	33.5	33.2	32.2	Installation
	39.8	38.3	35.0	32.9	32.3	26.2	25.8	19.4	17.9	Uninstalled
	2.6	4.1	7.2	8.8	4.5	10.0	7.7	13.8	14.3	Difference
100	42.3	42.3	41.1	42.0	40.5	40.6	35.2	28.0	25.6	Installation
	40.0	37.3	34.6	32.7	29.0	23.0	23.6	16.8	9.4	Uninstalled
	2.3	5.0	6.5	9.3	11.5	17.6	11.6	11.2	16.2	Difference

**Table 9** Travel speed change in main road of case 4

Traffic	200	400	600	800	1000	1200	1400	1600	1800	Speed change lane
30	76.8	76.1	75.3	75.3	74.5	73.8	73.4	72.0	72.7	Installation
	76.4	76.1	74.9	74.9	74.5	74.5	73.8	73.4	73.1	Uninstalled
	0.4	0.0	0.4	0.4	0.0	-0.7	-0.4	-1.4	-0.4	Difference
50	76.4	75.6	75.3	74.5	74.1	73.4	72.0	71.0	70.0	Installation
	76.4	74.1	74.9	74.5	74.5	74.1	73.4	73.1	72.3	Uninstalled
	0.0	1.5	0.4	0.0	-0.4	-0.7	-1.4	-2.1	-2.3	Difference
100	76.4	75.3	74.9	73.4	72.7	71.7	70.3	70.0	66.9	Installation
	74.9	74.5	74.1	74.1	73.4	73.1	72.0	69.7	68.1	Uninstalled
	1.5	0.8	0.8	-0.7	-0.7	-1.4	-1.7	0.3	-1.2	Difference

**Table 10** Travel speed change in side road of case 4

Traffic	200	400	600	800	1000	1200	1400	1600	1800	Speed change lane
30	51.9	51.9	51.7	51.9	51.7	50.1	45.9	36.3	36.1	Installation
	51.6	43.3	42.3	39.1	30.2	32.2	24.3	18.7	18.2	Uninstalled
	0.3	8.6	9.4	12.8	21.5	17.9	21.6	17.6	17.9	Difference
50	52.5	52.1	52.1	50.8	47.7	50.0	50.3	49.3	45.3	Installation
	49.8	45.7	40.7	33.8	40.5	29.9	28.4	22.4	20.0	Uninstalled
	2.7	6.4	11.4	17.0	7.2	20.1	21.9	26.9	25.3	Difference
100	52.1	52.1	52.3	50.3	51.6	51.4	48.2	45.5	44.5	Installation
	50.7	45.3	43.7	39.1	31.9	27.7	24.7	23.9	14.8	Uninstalled
	1.4	6.8	8.6	11.2	19.7	23.7	23.5	21.6	29.7	Difference

**Table 11** Model summary : case 1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.945(a)	.892	.883	2.65807

a. Predictors: (Constant), Traffic volume of side road, Traffic volume of main road

**Table 12** Coefficients : case 1

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	-2.088	1.526	-	-1.368	0.184
	Traffic volume of main road	0.014	0.001	0.943	14.060	0.000
	Traffic volume of side road	0.016	0.017	0.060	0.893	0.381

a. Dependent Variable: the speed difference between the main road and the side road

$$y = -2.088 + 0.014x_1 + 0.016x_2 \quad (1a)$$

**Table 13** Model summary : case 2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.848(a)	.718	.695	5.49878

a. Predictors: (Constant), Traffic volume of side road, Traffic volume of main road

**Table 14** Coefficients : case 2

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	-5.134	3.158	-	-1.626	0.117
	Traffic volume of main road	0.015	0.002	0.804	7.427	0.000
	Traffic volume of side road	0.089	0.036	0.267	2.466	0.021

a. Dependent Variable: the speed difference between the main road and the side road

$$y = -5.134 + 0.015x_1 + 0.089x_2 \quad (1b)$$

**Table 15** Model summary : case 3

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.844(a)	.712	.688	2.68325

a. Predictors: (Constant), Traffic volume of side road, Traffic volume of main road

**Table 16** Coefficients : case 3

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	0.996	1.541	-	0.646	0.524
	Traffic volume of main road	0.008	0.001	0.841	7.678	0.000
	Traffic volume of side road	0.011	0.018	0.071	0.648	0.523

a. Dependent Variable: the speed difference between the main road and the side road

$$y = 0.996 + 0.008x_1 + 0.011x_2 \quad (1c)$$

**Table 17** Model summary : case 4

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.898(a)	.807	.791	3.76713

a. Predictors: (Constant), Traffic volume of side road, Traffic volume of main road

**Table 18** Coefficients : case 4

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	-0.299	2.163	-	-0.138	0.891
	Traffic volume of main road	0.014	0.001	0.893	9.948	0.000
	Traffic volume of side road	0.027	0.025	0.098	1.095	0.284

a. Dependent Variable: the speed difference between the main road and the side road

$$y = -0.299 + 0.014x_1 + 0.027x_2 \quad (1d)$$

the travel speed of the main road is not influenced greatly by the speed change lane. The average travel speed of side road is analyzed to be influenced by the traffic volume of the main road. The results are as follows about the change of the travel speed to the side road when speed change lane was installed. When the traffic volume of side road is 30, the travel speed of the main road has increased more than 5km/h since 200vehicle. When the traffic volume of side road is 50, the travel speed of the main road has increased more than 5km/h since 200vehicle. When the traffic volume of side road is 100, the travel speed of the main road has increased more than 5 km/h since 200vehicle.

### e) Summary of analysis results

As a result of the traffic volume on main road, the travel speed of the main roads showed little change from -4.1km/h to 4.9km/h. But the travel speed of side road was sensitive and it was analyzed that the deviation increases as traffic volume increases.

## 5. SUGGEST OF JUDGMENT CRITERION FOR THE INSTALLATION OF THE SPEED CHANGE LANE

### (1) Model of speed difference between the main road and the side road

In order to develop the model for predicting the speed difference between the main road and the side road, the dependent variable was set as the speed difference between the main road and the side road, and the independent variables were set as the design speed and traffic volume of the main road and the side road. Model development was regression analyzed using SPSS 21.0. The following the result of regression analysis for each case.

### (2) Suggest of judgment criterion for the instal-

### lation by speed change lane according to speed difference

In order to judgment installation of speed change lane, the Level of Service(LOS) of two-lane road proposed by “Road Capacity Manual, 2013, Ministry of Land, Transport and Maritime Affairs” and the guideline presented by “Guideline of Rescue Facility Standards on Roads, 2009, Ministry of Land, Transport and Maritime Affairs” were utilized. The two-lane road of Level of Service(LOS) proposed by “Road Capacity Manual, 2013, Ministry of Land, Transport and Maritime Affairs” is 5km/h to 10km/h as the standard of the speed difference for each grade. And “Guideline of Rescue Facility Standards on Roads, 2009, Ministry of Land, Transport and Maritime Affairs” suggests that the design speed difference should be limited to within 20km/h considering the safety when planning intersection. Based on these, suggest that a speed change lane is not installed when the speed difference between the main road and the side road is less than 10km/h and that the speed change lane must be installed when the speed difference is more than 20km/h. In case of more than 10km/h and less than 20km/h, the standard was set to decide whether to install in consideration of the surrounding traffic environment. The installation was decided considering the surrounding traffic environment when the speed difference between the main road and the side road is 10km/h or more and less than 20km/h.

**Table 19** Suggest of judgment criterion for the installation

	Less than 10km/h	Less than 10km/h and more than 20km/h	More than 20km/h
Installed	Uninstalled	Consideration	Installation

## 6. Conclusion

In this study, the purpose was to analyze the installation effect of the speed change lane based on the change of the traffic volume of the main road and

the side road in which connecting to the main road, and to present the criteria to judge the installation.

As a result of the study, it is suggested that if the speed difference between the main road and the side road is less than 10km/h, the speed change lane is not installed and that the speed change lane is necessarily installed when the speed difference is more than 20km/h. In case of less than 10km/h to less than 20km/h, the standard was set to decide whether to install in consideration of the surrounding traffic environment. Criterion for the installation of the speed change lane that suggested to this study, it is considered appropriate to apply the installation standard only when the traffic volume of side road is less than 100vehicle/hour considering the characteristics of side road.

## APPENDIX A APPENDIX

- (1) Securing Exclusive Right-turn Lanes
- (2) In the Article 2 of the Road Law, the term "speed change lane" means "When a high speed car decelerates and flows into another road, or when a low speed car enters a high speed car group (an automobile group), It is a lane that is set up to safely decelerate or accelerate without disturbing the driving of other high-speed cars on the main road. Generally, the former is called the deceleration lane, and the latter is called the acceleration lane."

## REFERENCES

- 1) Jeong, J.B. : Study on Design Method of Bus Bay and Auxiliary Lanes at Signalized Intersection, 2008.
- 2) Urunjargal. : A Study on Improvement of Crossing Operation of the City of Ulaanbaatar using Micro Simulation, 2010.
- 3) Ministry of Land, Transport and Maritime Affairs. :Road Capacity Manual, 2013.
- 4) Ministry of Land, Transport and Maritime Affairs : Guideline of Rescue Facility Standards on Roads, 2009.

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