CHAPTER 8 CITY PARKING

8.1 Background

The problem of parking in the City Center has become worse due to increase in number of private cars and inadequate measures for traffic management. The increase in private cars in the City center was presumably due to increase in car ownership, incremental population, and urban development. The private cars disorderly parked on streets obstructed the vehicle traffic including public transportation.

In response to the worsened parking conditions, the government of Bishkek City acknowledged the necessity of proper measures to improve the parking conditions in the City center. In the Development Concept of Bishkek City for 2012 to 2015 formulated by the City Government, it highlighted the improvement of the parking as one of the key issues in the transportation sector. However, there were no available data that showed the current parking conditions in the City Center.

Hence, the JICA Study Team decided to conduct a parking survey to study the current parking condition and a future prospect of parking in the City center. This chapter describes the outcomes of the parking survey and issues identified after analyzing the parking survey results.

8.2 Responsible Organization for Parking

The Directorate of Municipal Market Parking Places and Lots is responsible for parking operation and management of municipal parking in Bishkek City. The Directorate of Municipal Market Parking Places and Lots manages two types of parking:

(i) The parking directly operated by Directorate of Municipal Market Parking Places and Lots

(ii) The parking lent to private company and operated by the private company

The Directorate of Municipal Market Parking Places and Lots makes a construction plan of new parking. Construction of the new parking starts only after Bishkek City office approval on the new parking plan proposed by Directorate of Municipal Market Parking Places and Lots.

8.3 Relevant Law for Parking

(a) Decree No.135: Regulation of procedures of calculating and payment fees for transport parking in the Bishkek City territory, Bishkek City Parliament, 29 December 2009

This decree prescribes parking fees. The parking fee rate is defined by the Bishkek City Council. Parking fee payers are parking users who are private persons and of juridical entity. Parking fee payers shall promptly and pay the fee on time. In case of violation he/she will be treated in accordance with the law of the Kyrgyz Republic.

(b) Decree No.777: Regulation of organization of Directorate of Municipal Market Parking Places

and Lots, Bishkek City Mayor, 12 January 2010

This decree prescribes organization structure, function, and work of Department of Municipal Parking. Functions of Directorate of Municipal Market Parking Places and Lots are:

(i) Coordination and approval of organization issues for markets, parking and parking lots

(ii) Construction of new municipal markets, parking and parking lots

(iii) Charging of fees from municipal markets, parking and parking lots

(iv) Rental contracts conclusion with economic entity for organization of wholesale and retail trade, as well as parking and parking lots

(v) Others

(c) Regulation No.136: Regulation of amendments of Regulation No.421, Regulation of approval of road regulations and basic regulations about transport access to operation and responsibility of authorities to organization of traffic safety, 4 August 1991 Government of the Kyrgyz Republic, 3 March 2009.

This regulation prescribes traffic rule which include parking prohibited area and parking allowable area.

8.4 Parking Survey in the City Center

8.4.1 Methodology

(1) Parking Survey Component

The parking survey consisted of three components. The first component was carried out as an inventory survey to identify the location of the facilitated and non-facilitated parking areas in the City center. The inventory survey included a work to count the number of parking lots in the facilitated parking areas. It also covered a measurement work for the length of a curb that is occupied by the non-facilitated parking.

The second component of the parking survey was carried out to count the number of parked cars by type of parking. The third component included a detailed parking survey in selected areas and an interview survey with the drivers. **Table 8.4-1** shows the contents of the parking survey.

Table 8.4-1 Contents of Parking Survey in the City Center

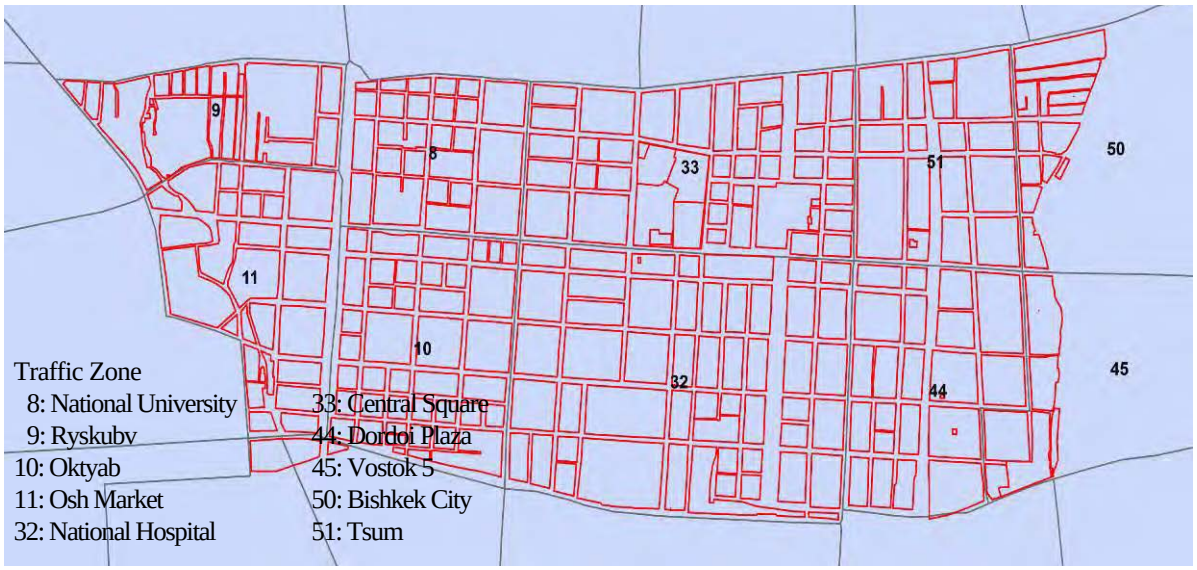
Component	Survey Item
Inventory Survey of Parked Area	1. Survey item including 1.1 Location of parking area consisting of 1) Municipal car park in Bishkek City, 2) Other facilitated parking area in the City Center, and 3) Non-facilitated parking area in the City Center. 1.2 Number of parking lots of facilitated parking areas 1.3 Length of curb allowable and non-allowable for on-street parking

Component	Survey Item
Parking Condition Survey	1. Number of parked cars by type of parking on weekdays and weekends 2. Video shooting of parking condition 3. Photo of surveyed parking area
Detailed Parking Condition in Selected Area	1. Target area: Three selected areas of large-scale commercial areas 2. Survey date and period: 12 hours on weekdays and weekends 3. Method: Record of number plate of parked car every 30 minutes
Interview Survey	1. Interview survey to drivers who parks a car in a car park

Source : JICA Study Team

(2) Survey Area

The survey targeted on the Central Business District (CBD) and municipal parking areas. The JICA Study Team defined the CBD as shown in **Figure 8.4-1**. The municipal parking areas consist of 55 locating in the CBD and 49 locating in other area.

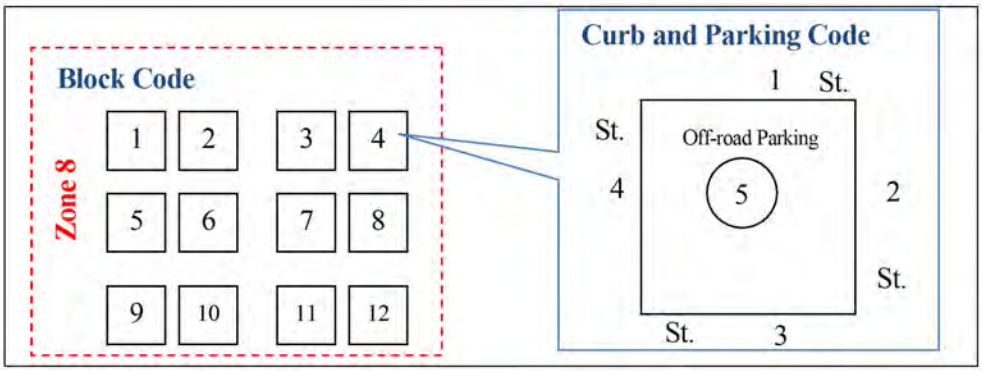


Source : JICA Study Team

Figure 8.4-1 Parking Survey Area in the City Center

(3) Coding of Parking Facility

The parking facility was identified by the face of the block or each individual off-road parking. Therefore, each block of traffic zone was coded and then faces and off-road parking areas were coded. The coding rule is shown in **Figure 8.4-2**.



Source : JICA Study Team

Figure 8.4-2 Coding Rule for Parking Survey

(4) Parking Classification

The parking was classified into four categories in the parking survey. The type of parking was firstly classified into the facilitated parking and the non-facilitated parking. The facilitated parking covered three categories as:

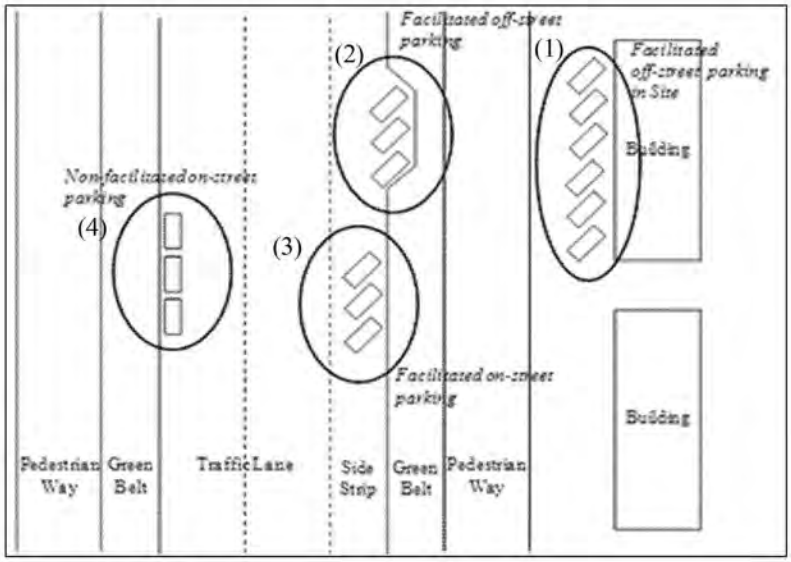
(a) Off-street parking on premises of a building (named facilitated off-street parking in site in the parking survey)

(b) Off-street parking at a buffer area between a traffic lane and premises of a building (Facilitated off-street parking)

(c) On-street parking on road shoulder beside the traffic lane (Facilitated on-street parking)

The non-facilitated parking was defined as on-street parking in a traffic lane (on-street parking).

Figure 8.4-3 illustrates the location of four types of parking.



Source : JICA Study Team

Figure 8.4-3 Type of Parking Defined in the Parking Survey

(5) Inventory and Parking Condition Survey

The inventory survey and parking condition survey are conducted on curb faces and individual parking areas. **Table 8.4-2** shows a survey form with sample data which identified the length of parking availability on each curb and the number of parking cars at the time survey conducted. This form is also used for non-facilitated parking.

Table 8.4-3 shows a survey form for facilitated parking with sample data. This form identifies characteristics of parking, capacity and usage.

Table 8.4-2 Inventory and Condition Survey Form for Curb and Non - facilitated Parking

Inventory/ Condition	Date	Time	Zone No.	Block No.	Parking Facility (curb face) No.	A. Total	B. No-parking zone						C. Facilitated Parking	D. Parking Available
							B-1. Near Pedestrian Crossing (within 5 meters)	B-2. Bus Stop (within 15 meters)	B-3. Road Marking	B-4. Narrow Road	B-5. Road Sign	B-6. Other		
Length of-parking available zone (m)	03/05/2012	10:13	8	1	1	122	10	-	112	-	-	-	-	0
	03/05/2012	10:15	8	1	2	40	10	-	-	-	-	-	-	30
	03/05/2012	10:17	8	1	3	118	10	-	-	-	-	-	-	108
	03/05/2012	10:19	8	1	4	22	10	-	-	-	-	-	-	12
Number of Parking Car (vehicle)	03/05/2012	10:13	8	1	1	2	-	-	2	-	-	-	-	
	03/05/2012	10:15	8	1	2	4	-	-	-	-	-	-	-	4
	03/05/2012	10:17	8	1	3	15	-	-	-	-	-	-	-	15
	03/05/2012	10:19	8	1	4	1	1	-	-	-	-	-	-	

Source : JICA Study Team

Table 8.4-3 Inventory and Condition Survey Form for Facilitated Parking

Date	Time	Zone No.	Block No.	Parking Facility No.	Number of parking spaces	Number of parking	Location of parking	Type of Parking	Operation hours	Parking fees	Method of fee collection	Type of ownership/ users
							1. Off-street 2. On-street 3. Others (with descriptions)	1. Parallel 2. Perpendicular 3. Diagonal 4. Other	1. 8 hours 2. 24 hours 3. Others (with descriptions)	1. 10 SOMS 2. 25 SOMS 3. Others (with descriptions)	1. by Collector 2. Others (with descriptions)	1. Municipal Parking 2. Private 3. Restricted to employees 4. Customers of a particular building / Shop 5. Garages 6. Others
03/05/2012	10:17	8	1	5	40	17	2	1	3	2	2	4
06/05/2012	10:37	8	1	5	40	3	2	1	3	2	2	4

Source : JICA Study Team

(6) Detailed Parking Condition Survey

The detailed parking condition survey was conducted at selected three areas. **Table 8.4-4** shows a survey form with sample data. As shown in the table, survey was conducted every 30 minutes and recorded the car numbers which park on each parking booth.

Table 8.4-4 Detailed Parking Condition Survey Form

Item		Vehicle Code	Vehicle Types
Zone No.:	44	1	private car / pick-up
Block No.:	1	2	taxi
Parking Facility No.:	5	3	minibus (Marshrutka)
Date/ Time :	2012/06/04	4	medium and Large Bus
Weather:	clear	5	small truck (2 axle)
Surveyor:	******	6	heavy truck(2 axle and more)

Time	Parking Booth Number	1	2	3	4	5	6
7:00	Plate Number	B6071X					
	Vehicle Type	2					
7:30	Plate Number						
	Vehicle Type						
8:00	Plate Number						
	Vehicle Type						
8:30	Plate Number						
	Vehicle Type						
9:00	Plate Number	B4464H					
	Vehicle Type	2					
9:30	Plate Number	B4464H					
	Vehicle Type	2					
10:00	Plate Number	E5113E	E0202C	E8380O	B2070C	B3541AI	B6173AF
	Vehicle Type	1	1	1	1	1	1
10:30	Plate Number	E5113E	E0202C	E8380O	B2070C	B3541AI	B6173AF
	Vehicle Type	1	1	1	1	1	1

Source : JICA Study Team

8.4.2 Results

(1) Location and Capacity of Parking Area in the City Center

The inventory survey identified 747 facilitated parking areas that include 55 municipal car parks and the other 692 facilitated parking areas in the City center as shown in **Table 8.4-5**. It should be noted that the number of parking areas did not cover a car park on premises of housings including detached housing and apartment, because the parking survey focused on a parking area used for the public such as visitors.

Table 8.4-5 Number of Facilitated Parking Area in the City Center

Traffic Zone	Municipal Car Park (location)					Other Facilitated Parking Area (location)					Total (parking lot)
	Off - street	On - street	Other	Off - street in Site	Total	Off - street	On - street	Other	Off - street in Site	Total	
8	0	0	0	0	0	11	36	0	13	60	60
9	0	0	0	0	0	6	10	2	1	19	19
10	0	2	0	1	3	31	53	0	12	96	99
11	0	26	0	0	26	6	25	0	17	48	74
32	0	7	0	1	8	26	148	0	43	217	225
33	0	0	0	0	0	33	40	2	10	85	85
44	0	10	0	0	10	5	36	0	6	47	57
45	0	0	0	0	0	4	11	0	3	18	18
50	0	2	0	0	2	2	10	0	2	14	16
51	0	6	0	0	6	12	43	0	33	88	94
Total	0	53	0	2	55	136	412	4	140	692	747
Suburb	0	39	0	10	49	0	0	0	0	0	49

Note : The number of parking areas in suburb covered the municipal car park outside the City center.
Source : JICA Study Team

The number of the parking lot of the facilitated parking area was estimated at 14,522 that include 2,232 parking lots of the municipal car park and 12,290 parking lots of the other facilitated parking areas in the City center as shown in **Table 8.4-6**.

Table 8.4-6 Number of Parking Lot of Facilitated Parking Area in the City Center

Zone	Municipal Car Park (parking lot)					Other Facilitated Parking Area (parking lot)					Total (parking lot)
	Off - street	On - street	Other	Off - street in Site	Total	Off - street	On - street	Other	Off - street in Site	Total	
8	0	0	0	0	0	115	582	0	430	1,127	1,127
9	0	0	0	0	0	75	141	18	10	244	244
10	0	60	0	30	90	515	545	0	374	1,434	1,524
11	0	1,058	0	0	1,058	118	362	0	585	1,065	2,123
32	0	272	0	50	322	211	1,928	0	966	3,105	3,427
33	0	0	0	0	0	360	745	17	191	1,313	1,313
44	0	460	0	0	460	62	662	0	555	1,279	1,739
45	0	0	0	0	0	58	117	0	500	675	675
50	0	112	0	0	112	18	113	0	68	199	311
51	0	190	0	0	190	96	935	0	818	1,849	2,039
Total	0	2,152	0	80	2,232	1,628	6,130	35	4,497	12,290	14,522
Suburb	0	3,172	0	900	4,072	0	0	0	0	0	4,072

Note : The number of parking lots in suburb covered the parking lots of the municipal car park outside the City Center.
Source : JICA Study Team

The length of a curb occupied by the non-facilitated parking was measured in the inventory survey. The total length was divided into two types as allowable and non-allowable for the on-street parking as shown in **Table 8.4-7**.

Table 8.4-7 Length of Curb by Occupied by On - Street Parking in the City Center

Traffic Zone	No-Parking Zone (m)	Allowable for Parking (m)	Total (m)
8	7,320	7,085	14,405
9	19,381	839	20,220
10	20,125	990	21,115
11	15,880	3,082	18,962
32	21,635	15,352	36,987
33	24,281	535	24,816
44	13,821	768	14,589
45	6,774	452	7,226
50	9,570	160	9,730
51	8,121	3,950	12,071
Total	146,908	33,213	180,121

Note : No - parking zone includes the length of the following part: i) within 5 m from a pedestrian crossing, ii) within 15 m from a bus stop, iii) road marking prohibited for parking, iv) narrow street, and v) road sign, and vi) other.
Note : The length of allowable for parking excludes the length of facilitated on-street parking.
Source : JICA Study Team

Figure 8.4-4 shows the location map of the facilitated and non-facilitated parking areas in and around the City center. **Figure 8.4-5** shows the location map of the parking areas in the City center.

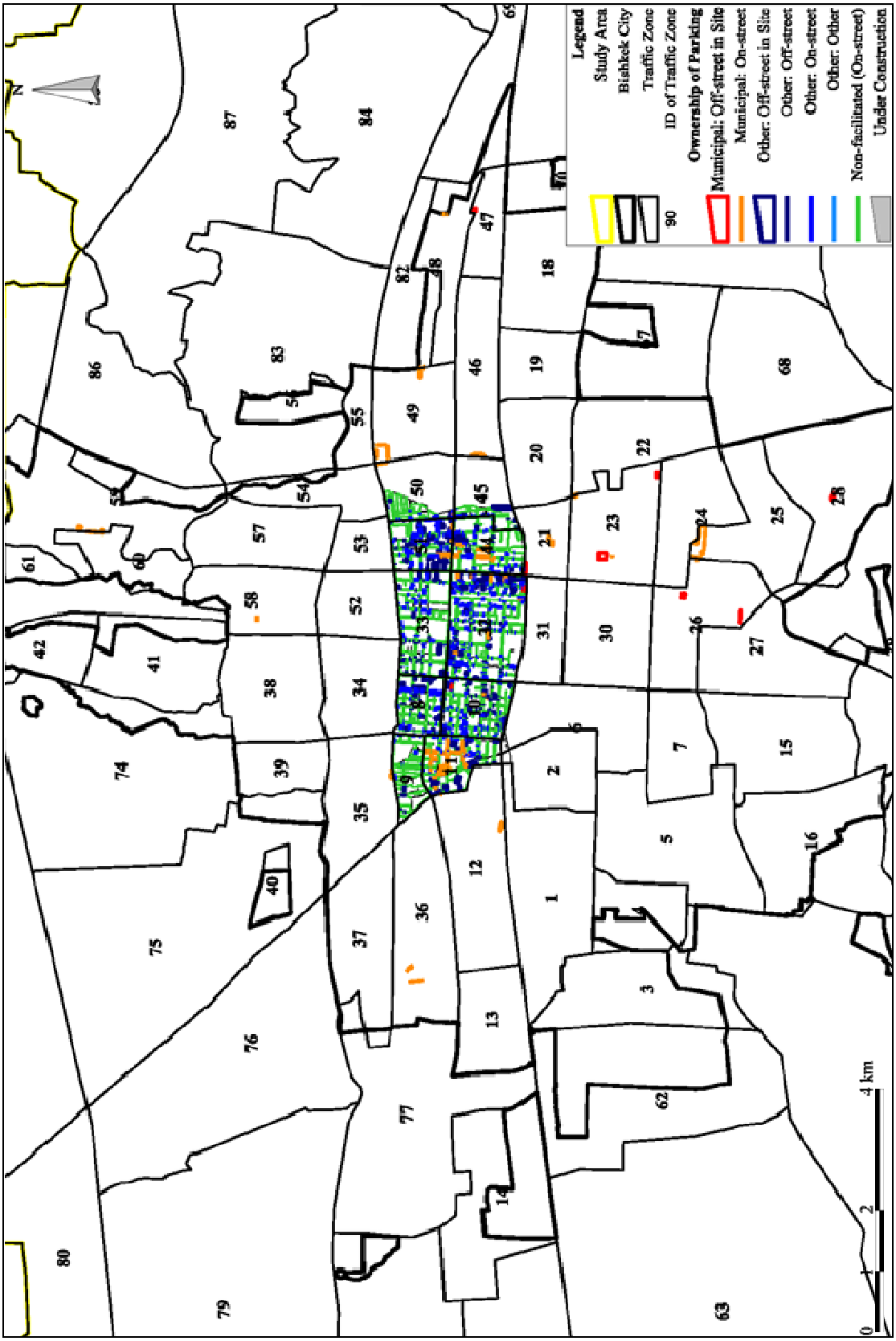


Figure 8.4-4 Location of Facilitated and Non - Facilitated Parking in and around the City Center

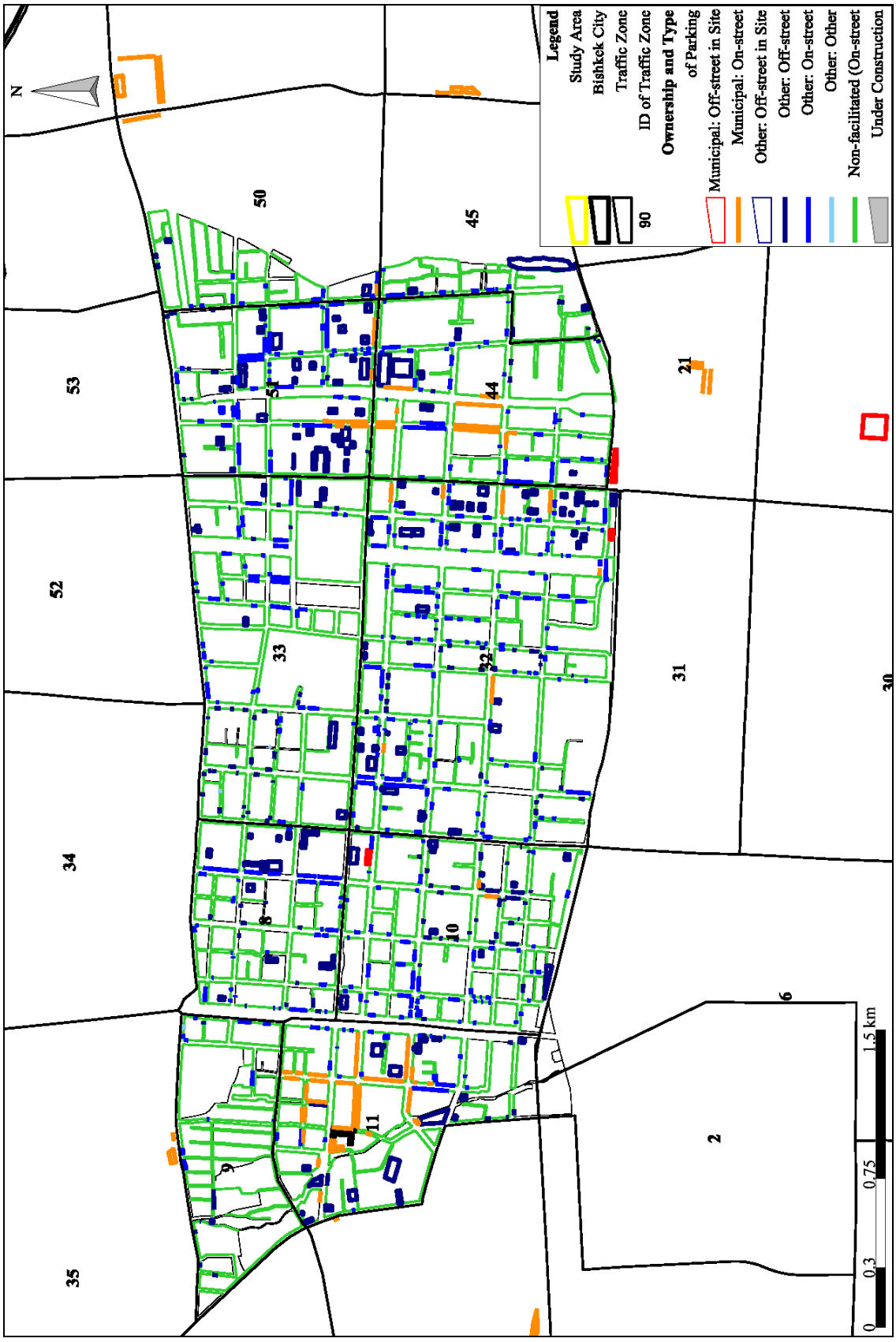


Figure 8.4-5 Location of Facility and Non - Facility Parking in the City Center

(2) Number of Parked Car in the City Center

The parking condition survey was conducted on weekdays and weekends in the period from 3 May 2012 to 20 May 2012. The municipal car park was used by 1,595 cars on weekdays, while 6,583 cars were parked in the other facilitated parking areas as shown in **Table 8.4-8**. The total number of parked cars on weekdays was 8,178 cars whereas the number of parked cars decreased to 5,107 parked cars on weekends as shown in **Table 8.4-9**.

Table 8.4-8 Number of Parked Car in Facilitated Parking Area on Weekdays

Zone	Municipal Car Park (car)					Other Facilitated Parking Area (car)					Total (car)
	Off - street	On - street	Other	Off - street in Site	Total	Off - street	On - street	Other	Off - street in Site	Total	
8	0	0	0	0	0	67	270	0	193	530	530
9	0	0	0	0	0	26	77	8	1	112	112
10	0	21	0	22	43	290	298	0	138	726	769
11	0	742	0	0	742	83	266	0	334	683	1,425
32	0	214	0	24	238	161	1,317	0	439	1,917	2,155
33	0	0	0	0	0	239	479	5	136	859	859
44	0	356	0	0	356	40	506	0	259	805	1,161
45	0	0	0	0	0	23	52	0	31	106	106
50	0	94	0	0	94	6	55	0	46	107	201
51	0	122	0	0	122	46	325	0	367	738	860
Total	0	1,549	0	46	1,595	981	3,645	13	1,944	6,583	8,178
Suburb	0	2,406	0	353	2,759	0	0	0	0	0	2,759

Note : The number of parked cars in suburb covered the parked car in the municipal car park outside the City center.
Source : JICA Study Team

Table 8.4-9 Number of Parked Car of Facilitated Parking Area on Weekends

Zone	Municipal Car Park (car)					Other Facilitated Parking Area (car)					Total (car)
	Off - street	On - street	Other	Off - street in Site	Total	Off - street	On - street	Other	Off - street in Site	Total	
8	0	0	0	0	0	10	59	0	43	112	112
9	0	0	0	0	0	18	72	4	2	96	96
10	0	11	0	16	27	211	204	0	39	454	481
11	0	695	0	0	695	82	199	0	236	517	1,212
32	0	86	0	37	123	54	425	0	357	836	959
33	0	0	0	0	0	36	115	3	82	236	236
44	0	378	0	0	378	33	380	0	144	557	935
45	0	0	0	0	0	26	39	0	48	113	113
50	0	88	0	0	88	6	30	0	34	70	158
51	0	166	0	0	166	39	254	0	346	639	805
Total	0	1,424	0	53	1,477	515	1,777	7	1,331	3,630	5,107
Suburb	0	2,304	0	331	2,635	0	0	0	0	0	2,635

Note : The number of parked cars in suburb covered the parked car in the municipal car park outside the City center.
Source : JICA Study Team

The number of non-facilitated on-street parking was 6,624 cars on weekdays and 3,641 cars on weekends as shown in **Table 8.4-10**.

Table 8.4-10 Number of Parked Car of Non - Facilitated Parking on Weekdays and Weekends

Zone	Parked Car on Weekdays (car)			Parked Car on Weekends (car)		
	No Parking Zone	Available for Parking	Total	No Parking Zone	Available for Parking	Total
8	260	228	488	140	67	207
9	230	31	261	200	23	223
10	541	48	589	368	35	403
11	833	158	991	704	114	818
32	988	970	1,958	186	288	474
33	969	27	996	438	0	438
44	766	95	861	583	43	626
45	123	14	137	192	7	199
50	104	4	108	101	9	110
51	148	87	235	76	67	143
Total	4,962	1,662	6,624	2,988	653	3,641

Source : JICA Study Team

The number of parked cars was estimated by block in the City center as shown in **Figure 8.4-6** for weekday and **Figure 8.4-7** for weekends. **Figure 8.4-8** and **Figure 8.4-9** illustrates the number of the non-facilitated on-street parking by block on weekdays and weekends.

These figures indicate that the number of parked cars in the central part of the City center consisting of four traffic zones (i.e. Traffic Zone 8, 10, 32, and 33) decreased on weekends in comparison with weekdays. In the parked cars might be of mainly visitors who came to the City center on weekdays in four traffic zones.

A significant difference of the number of the parked cars was not observed between weekdays and weekends in other four traffic zones (i.e. Traffic Zone 9, 11, 45, and 50). The parked cars might be of visitors to a large-scale shopping Centers such as Osh Market in Traffic Zone 11 and CUM in Traffic Zone 51. The parked cars were supposed to be of residents of apartments in Traffic Zone 44 and detached housing in Traffic Zone 9.

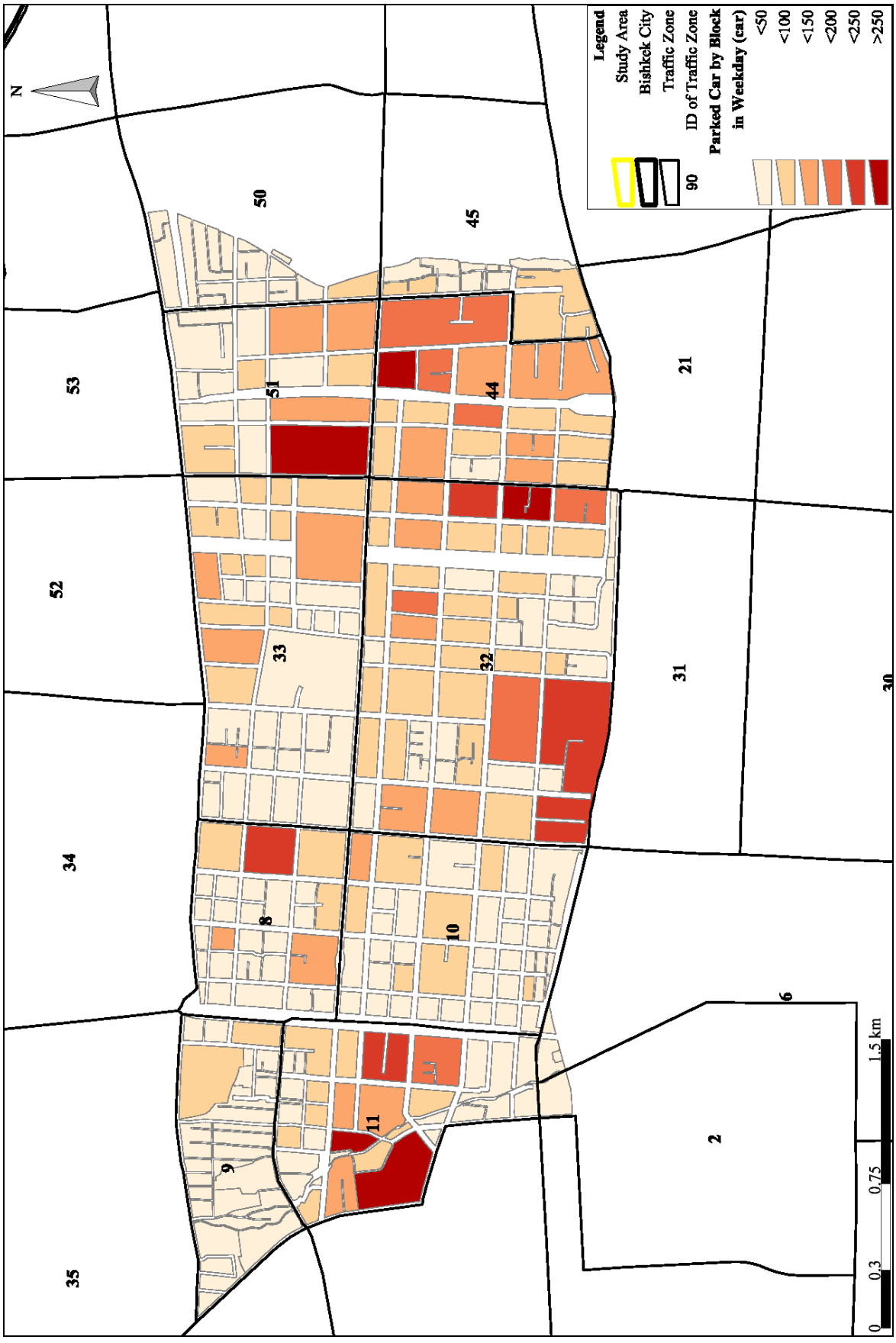


Figure 8.4-6 Number of Parked Car by Block in the City Center on Weekdays

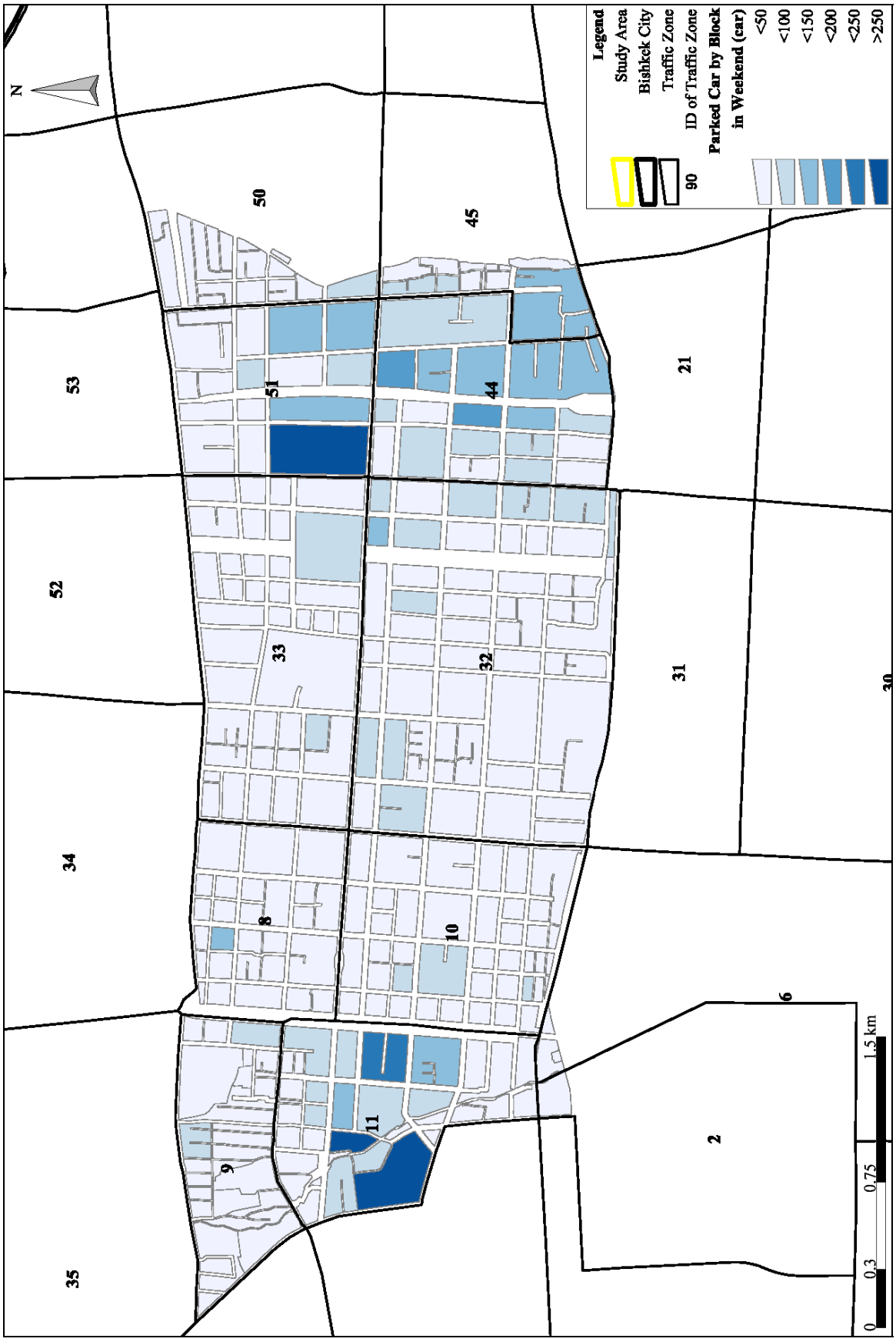


Figure 8.4-7 Number of Parked Car by Block in the City Center on Weekends

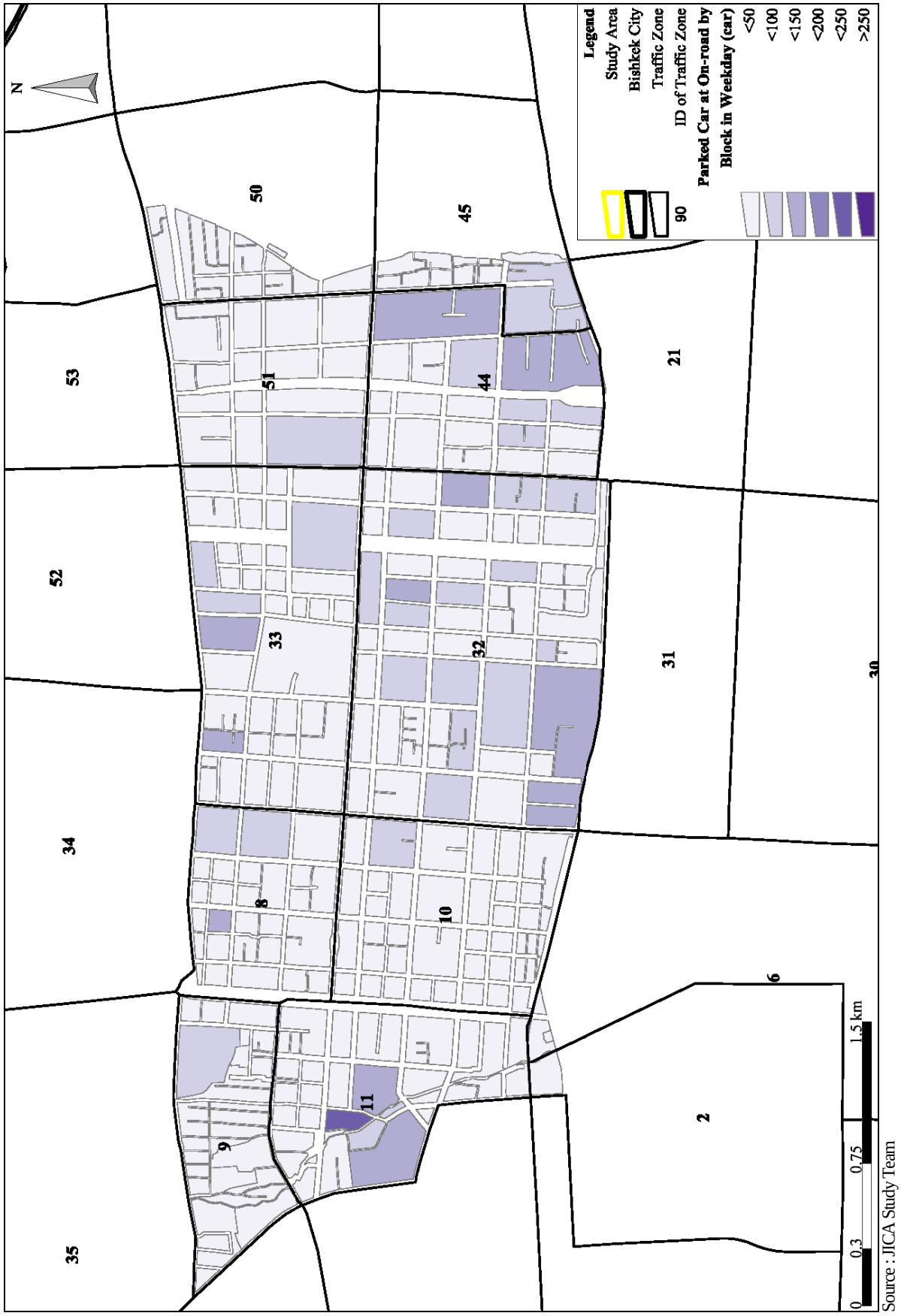


Figure 8.4-8 Number of Non - Facilitated Parking by Block in the City Center on Weekdays

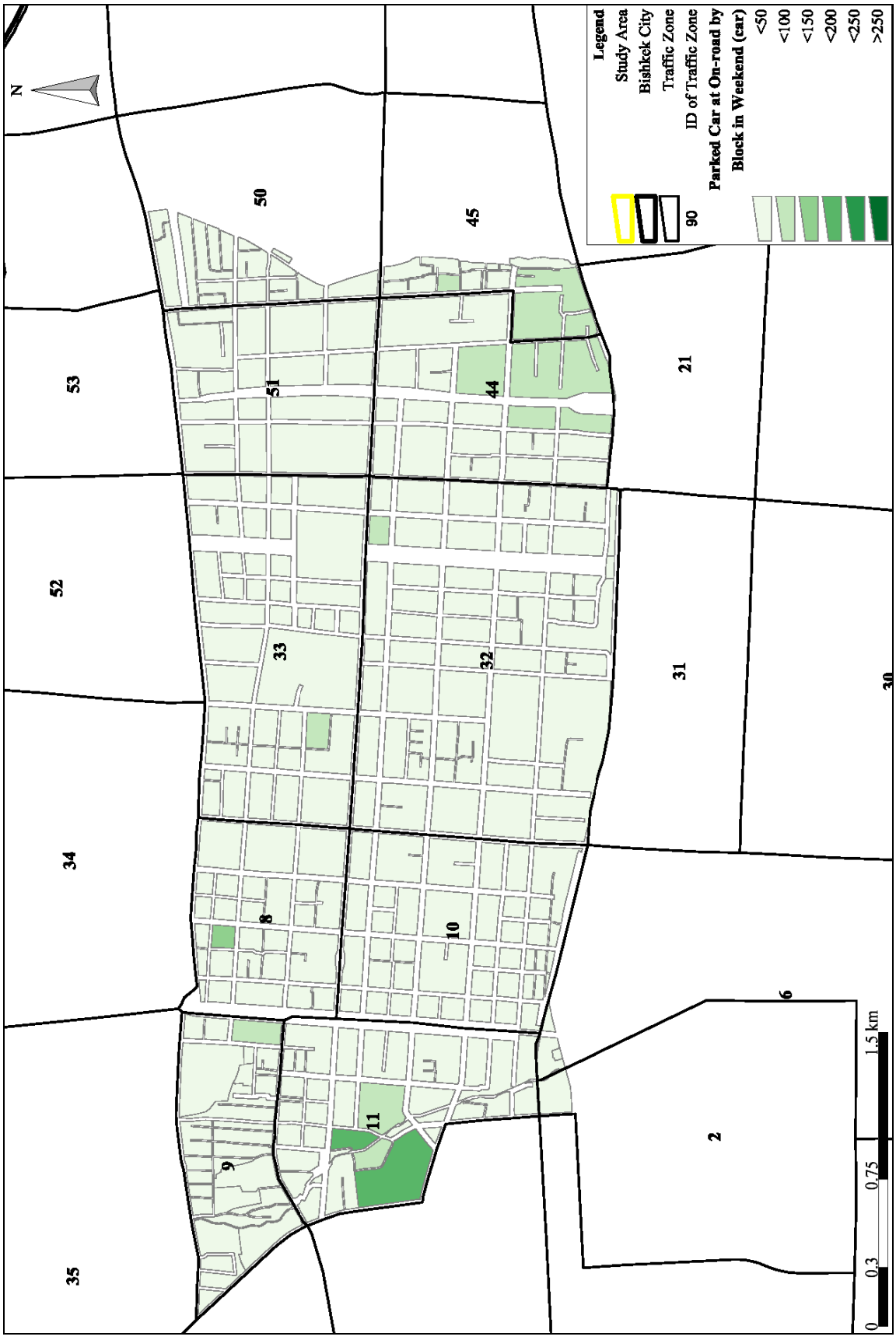


Figure 8.4-9 Number of Non - Facilitated Parking by Block in the City Center on Weekends

(3) Remaining Capacity of Parking Lot in the City Center

The remaining capacity of facilitated parking was 6,344 parking lots that includes 637 remaining parking lots of the municipal car park on weekdays as shown in **Table 8.4-11**. The remaining capacity was increased to 9,415 parking lots on weekends as shown in **Table 8.4-12**. Although the facilitated parking still have the remaining capacity of 6,344 parking lots, 6,624 cars were parked on street as non-facilitated parking on weekdays as shown in **Table 8.4-10** in the previous page without utilizing the available parking lots.

Table 8.4-11 Remaining Capacity of Facilitated Parking Area on Weekdays

Zone	Municipal Car Park (parking lot)					Other Facilitated Parking Area (parking lot)					Total (parking lot)
	Off - street	On - street	Other	Off - street in Site	Total	Off - street	On - street	Other	Off - street in Site	Total	
8	0	0	0	0	0	48	312	0	237	597	597
9	0	0	0	0	0	49	64	10	9	132	132
10	0	39	0	8	47	225	247	0	236	708	755
11	0	316	0	0	316	35	96	0	251	382	698
32	0	58	0	26	84	50	611	0	527	1,188	1,272
33	0	0	0	0	0	121	266	12	55	454	454
44	0	104	0	0	104	22	256	0	296	474	578
45	0	0	0	0	0	35	65	0	469	569	569
50	0	18	0	0	18	12	58	0	22	92	110
51	0	68	0	0	68	50	610	0	451	1,111	1,179
Total	0	603	0	34	637	647	2,485	22	2,553	5,707	6,344
Suburb	0	766	0	547	1,313	0	0	0	0	0	1,313

Note : The number of remaining capacity in suburb focused on a municipal car park outside the City center.
Source : JICA Study Team

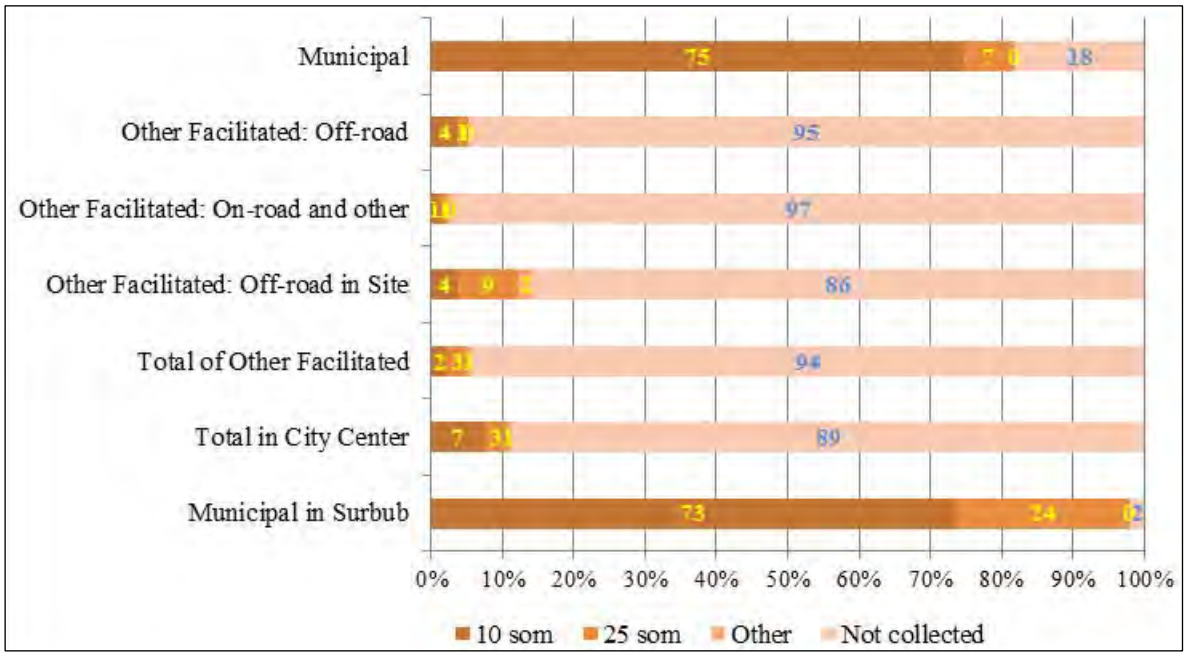
Table 8.4-12 Remaining Capacity of Facilitated Parking Area on Weekends

Zone	Municipal Car Park (parking lot)					Other Facilitated Parking Area (parking lot)					Total (parking lot)
	Off - street	On - street	Other	Off - street in Site	Total	Off - street	On - street	Other	Off - street in Site	Total	
8	0	0	0	0	0	105	523	0	387	1,015	1,015
9	0	0	0	0	0	57	69	14	8	148	148
10	0	49	0	14	63	304	341	0	335	980	1,043
11	0	363	0	0	363	36	163	0	349	548	911
32	0	186	0	13	199	157	1,503	0	609	2,269	2,468
33	0	0	0	0	0	324	630	14	109	1,077	1,077
44	0	82	0	0	82	29	282	0	411	722	804
45	0	0	0	0	0	32	78	0	452	562	562
50	0	24	0	0	24	12	83	0	34	129	153
51	0	24	0	0	24	57	681	0	472	1,210	1,234
Total	0	728	0	27	755	1,113	4,353	28	3,166	8,660	9,415
Suburb	0	868	0	569	1,437	0	0	0	0	0	1,437

Note : The number of remaining capacity in suburb focused on a municipal car park outside the City center.
Source : JICA Study Team

(4) Parking Fee in the City Center

The fees in the facilitated parking were confirmed during the parking condition survey. It reveals that 72 percent of the parking fee was collected from the municipal car park and five percent from the other facilitated parking areas as shown in **Figure 8.4-10**. In general, the parking fee is a fixed rate at 10 SOMS per parking without any extra charge.

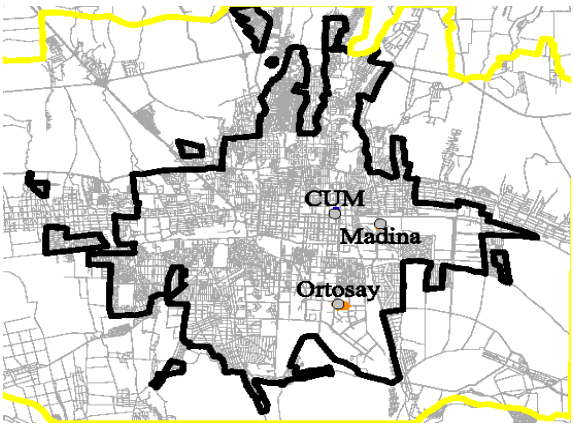


Source : JICA Study Team

Figure 8.4-10 Parking Fee by Type of Parking in the City Center

(5) Result of Detailed Parking Survey

A detailed parking survey was carried out in three major commercial areas, namely CUM, Ortosayskiy rinok (hereinafter Ortosay), and Madina on weekdays and weekends during the periods from 4 June 2012 to 16 June 2012. The number of parked cars was counted at every 30 minutes interval from 7:00 to 19:00. **Figure 8.4-11** shows the location of the surveyed commercial areas.



Location of Selected Commercial Areas

Surveyed Parking Area at CUM (1/10,000)

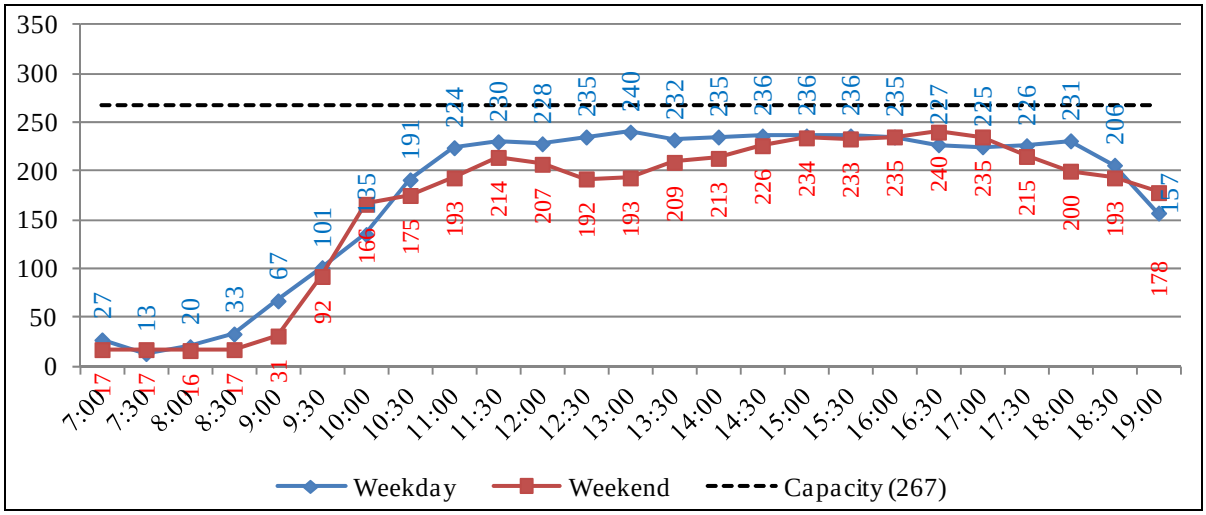
Surveyed Parking Area at Madina (1/10,000) Surveyed Parking Area at Ortosay (1/10,000)

Note : Location map of surveyed parking area indicates municipal car park in orange and the other facilitated parking area in blue respectively.
Note : An off-site parking on premises of CUM was not allowed to conduct a survey. Its location is shown in hatched lines in red in the figure above.
Source: JICA Study Team

Figure 8.4-11 Location of Selected Commercial Area and Surveyed Parking Area

The number of parked cars every 30 minutes interval was shown in **Figure 8.4-12** for CUM, **Figure 8.4-13** for Madina, and **Figure 8.4-14** for Ortosay. There were no significant difference in the maximum number of the parked cars between weekdays and weekends, though the number of parked cars changed by time. These commercial areas attracted the visitors, regardless of weekdays and weekends.

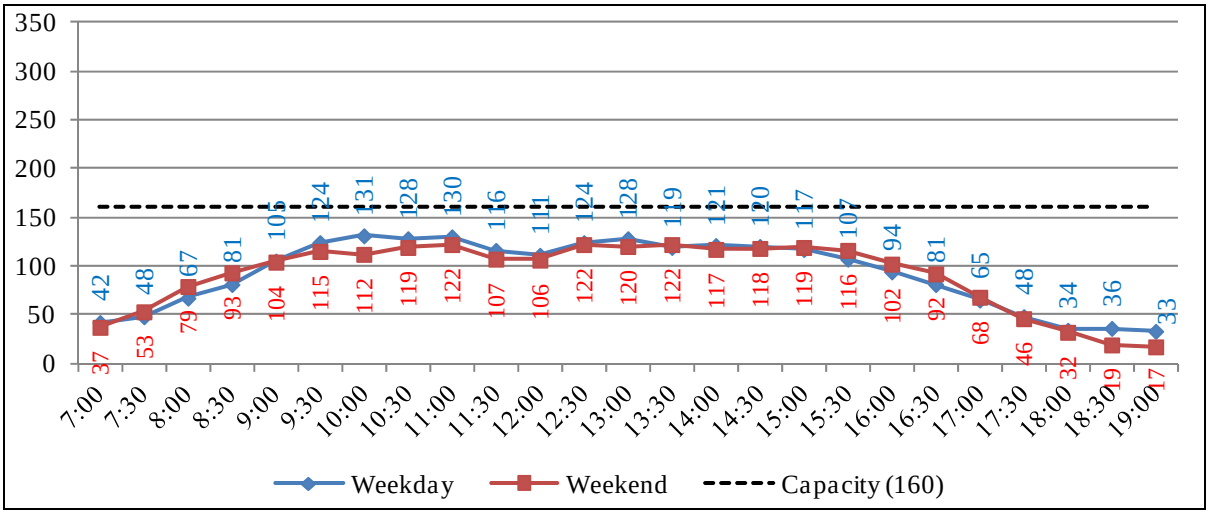
Unit: Vehicle



Source : JICA Study Team

Figure 8.4-12 Number of Parked by Time Car at CUM on and Weekend

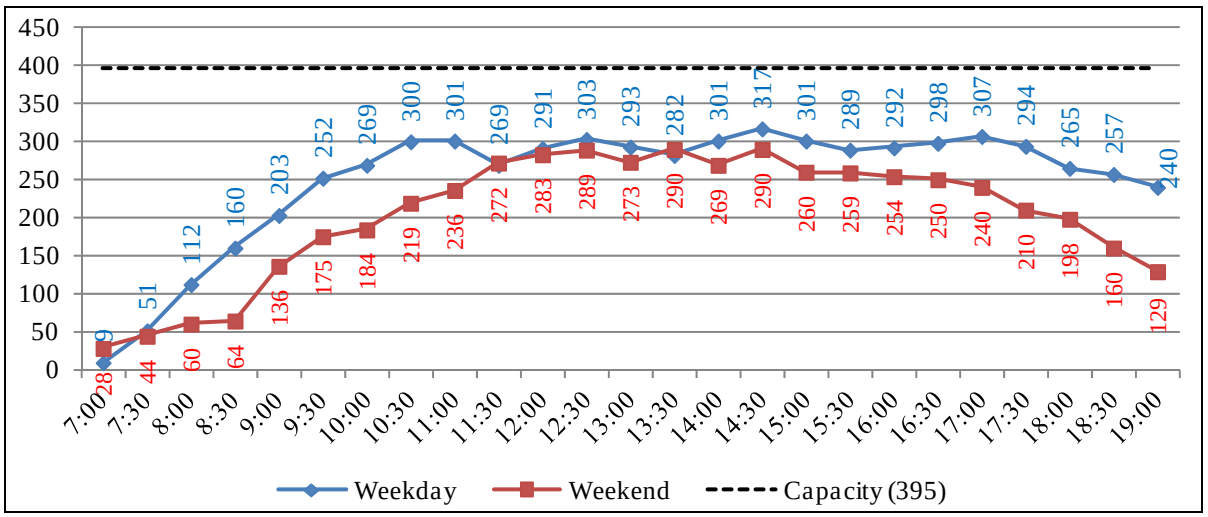
Unit : Vehicle



Source : JICA Study Team

Figure 8.4-13 Number of Parked by Time Car at Madina on Weekday and Weekends

Unit : Vehicle



Source : JICA Study Team

Figure 8.4-14 Number of Parked by Time Car at Ortosay on Weekdays and Weekends

(6) Result of Interview Survey

An interview survey was conducted simultaneously in the same areas where the detailed parking survey was carried out. The interview was carried out for 400 drivers at each survey area.

The most frequent purpose of visit was shopping (44%), followed by business (23%) as shown in **Figure 8.4-15**.

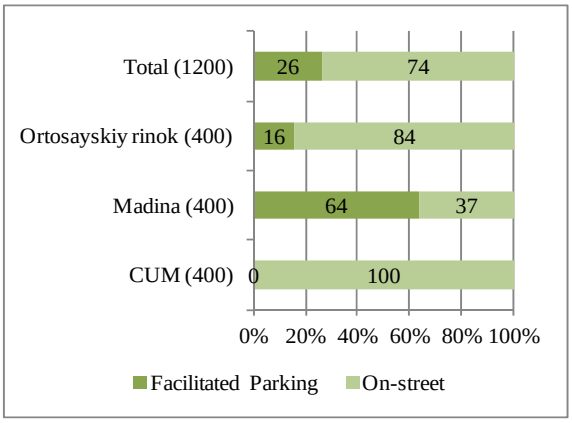
In the interview survey, three types of questions were asked as to:

(i) The acceptable walking distance from the parking place to the final destination

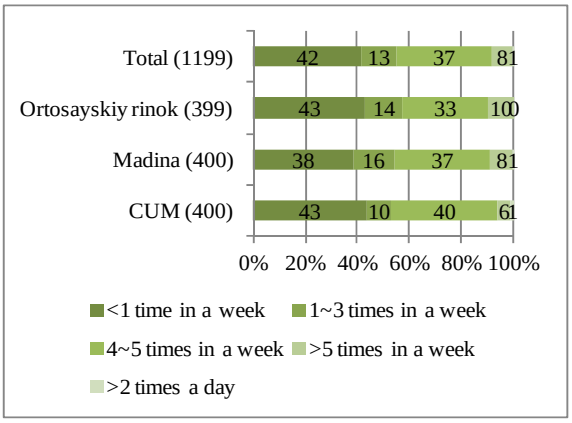
(ii) The duration of parking

(iii) The affordable amount of parking fee

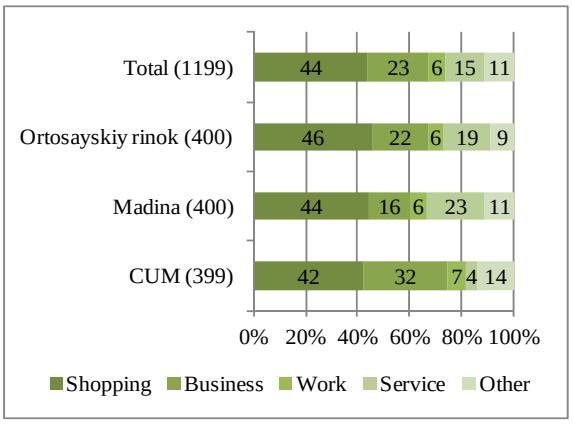
The responses of these questions were described as the material for the recommendations in **Sub-chapter 21.1**.



Q1 Where do you park your car?



Q2 How often do you use this parking space?



Q3 What is your purpose of visit?

Note : Numerical number in parentheses indicates the number of samples.
Source : JICA Study Team

Figure 8.4-15 Results of Interview Survey

8.5 Issues

Based on the parking survey, the following were identified as the issues for the improvement of the parking conditions.

(a) Remaining capacity of facilitated parking: Although the facilitated parking areas still have remaining capacity of 6,344 parking lots on weekdays, the large number of cars (i.e. 6,624 cars) was parked on street. Steps should be taken to encourage drivers to park their cars in the facilitated parking areas.

(b) Unclear definition of allowable space for parking: In some places, private entity installed a sign that declared part of public land and road as a parking space without any official authorization has been granted for the parking place as the parking space. It should be required to designate the place that can be used for the public parking.

(c) Parking in public land by resident: As a large number of parked cars were observed on-street on weekends, these parked cars were supposed to be of residents. A proper place to park cars by residents needs to be designated.

(d) Fixed rate of parking fee: The parking fee was set up as a fixed rate at a low rate. Consequently, the drivers parked their cars at any place based on their intention without any consideration about the parking fee.

In addition, the officials for management of parking areas pointed out needs for improvement of the ban on the illegal parking and the modification of the technical standard as follows:

(i) Strict enforcement of penalty for illegal parking: A fine for the illegal parking was set at the relatively low level of 300 SOMS in comparison with the practice in foreign countries. This low rate of the fine is insufficient to discourage the drivers to park their cars in an illegal place.

(ii) Collection of parking fee from all users: An existing collection system for the parking fee allows exemption for, but not limited to, officials and military services. This exemption resulted in reducing the amount of the collected parking fee by 40 percent. The collection system needs to be reviewed for collecting the parking fee from all users of the parking area.

(iii) Outdated technical standard for mandatory parking by type of building: An existing technical standard specifies the minimum number of mandatory parking lots by type of building. Since the technical standard was prepared in the Soviet era, the level of the mandatory parking lots became outdated to meet the current demand. The minimum number of the mandatory parking lots in the technical standard should be modified to comply with the current demand.

(e) The current mechanism needs to be modified to discourage the drivers to park their cars in an illegal parking place with the enforcement of the strict penalty. The ban on the illegal parking will lead the drivers to park their cars in the designated parking places.

CHAPTER 9 TRAFFIC CONTROL

9.1 Present Traffic Signal System

9.1.1 Traffic Signal Facility and Guideline

(1) Signals in Bishkek City

As of August 2012, there were a total of 203 traffic signals operating in Bishkek City. The location of existing signals is shown in **Figure 9.1-1**. The year of installation of the signals is summarized in **Table 9.1-1**. Although new signals were installed in recent years, 80.3 percent of the signals are 20 years old or older as shown in the table. This is due to the fact that restoration or change of signals has not been carried out.

Source : JICA Study Team

Figure 9.1-1 Location of Signalized Intersection

Table 9.1-1 Number of Signals Installed

Year of Installation	Quantity	%
1970	74	36.4
1980	79	39.0
1990	10	5.0
2000 and after	40	19.6
Total	203	100.0

Note : The numbers was confirmed as in December 2010.
Source : CMOD

Out of 203 signals, 93 signals are supposed to be centrally-controlled signals that are connected with the Traffic Control Center located at Construction, Mounting and Operation Department (CMOD) of Traffic Police at 20 Gorky Street. The remaining 110 units are isolated signals. Due to deterioration of the equipment and loss of communication lines, not all of the centrally-controlled signals are connected with the Control Center at present. The exact number of on-line signals must be updated. **Picture 9.1-1** shows the defunct local controller.

There is no local manufacturer or supplier of signal controllers and signal lanterns (traffic lights) in the Kyrgyz Republic. All of the existing signal controllers and signal lanterns were imported from Russia.

Picture 9.1-1 Defunct Local Controller Retrieved from Intersection

(2) Design Guidelines

According to CMOD, a signal design is made in accordance with the following Kyrgyz standards, which are same as those used in Russia:

Standard P 52282 - 2004 : Traffic Lights

Standard P 52289 - 2004 : Standards for Traffic Signals, Traffic Sign and Pavement Markings

(3) Lantern

A standard three-aspect lantern type is used at all intersections except those where protected left turn is provided. Left turn green arrow aspects are added at these intersections. Right-Turn-On-Red

(RTOR) is allowed at some T-shaped intersections with a right turn green arrow, which is lit during red indication for other movements from the same approach. Pedestrian signals are provided to 69 signals but many of them are not working due to busted bulb. A vehicular lantern is arranged vertically and mounted on a mast arm. A pedestrian lantern is mounted on a straight pole.

Both incandescent lamps and LEDs are used for lanterns. The LED type lanterns are used at 55 signals installed during the last 10 years. Conventional incandescent lamps are used at the remaining 148 signals. Some of the LED lanterns have a countdown timer to indicate the remaining time of green and red signals. Yellow aspect is used for this purpose and remaining time is indicated when yellow aspect is off.

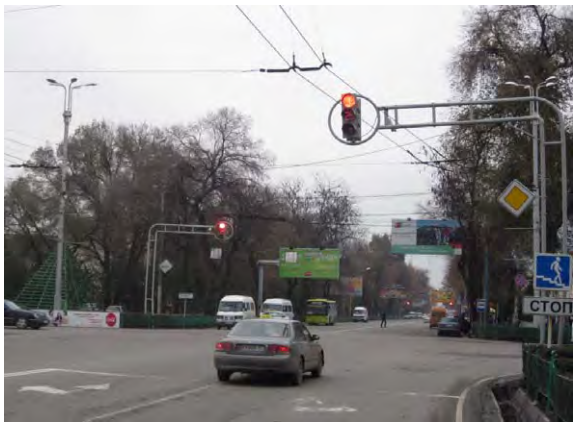
Signal lanterns used to be Russian-made but Chinese-made lanterns are becoming popular in recent years.

(4) Signal Layout

Basically, two sets of the vehicular lanterns are installed on a mast arm for each approach. One is on the near side and another at far and opposite side of an intersection. Hence, the vehicular lanterns are installed on a mast arm in back-to-back configuration and a total of four (4) mast arms are provided to a standard 4-leg intersection. At the intersections with median, signal layout is different and more poles are used.

(5) Pole

A signal lantern is mounted on a pole which was manufactured locally. A mast arm type pole is used for vehicular lanterns and a straight pole is used for pedestrian lanterns. There are several different designs of the mast arms for vehicular lanterns. According to the Standard P 52289, clearance of 5.0 - 6.0 meters is required for the vehicular lantern installed over the carriageway. However, most of the existing vehicular lanterns do not satisfy the requirement. The length of arm that extends over the carriageway is also too short. An example of a traffic signal on Chui Avenue is shown in **Picture 9.1-2**.



Picture 9.1-2 Traffic Signal on Chuy Ave.

(6) Intersection Design Document

CMOD prepares a set of intersection design documents for each intersection before installing a signal. The document contains the following information:

(i) Lantern layout drawing

(ii) Cabling layout drawing

(iii) Power supply diagram

(iv) Timing plan table

(v) Bill of quantity

9.1.2 Signal Control

(1) Signal Phase Sequence

As the road network of Bishkek City was developed in a grid configuration, almost all intersections are standard four-leg intersections. Thus, a standard two-phase signal sequence is adopted at all intersections and left turn is made by filtering. At 15 intersections, however, an additional left turn aspect is provided for protected left turn phase.

According to CMOD, there is no systematic procedure to design and calculate timing plans. The signal phase and timing plan are prepared in a exploratory way. No signal design softwares and microscopic simulation models are used in the signal design. Due to simple intersection layouts and relatively low traffic volume, such approach is effective at present. As the number of vehicles is increasing, however, signal timing will become more critical in managing traffic and preventing congestion.

Flashing green is shown for three (3) seconds at the end of green before turning to yellow. All red indication is not used for controlling the conflicting movements.

(2) Signal Timing Plan

Regardless of the type of signal (centrally controlled or isolated), all signals in Bishkek City operate in fixed time mode and same timing plan for 24 hours regardless of time of day and day of the week. No periodical review and updating of the timing plans are made and the same timing plan has been used at least for the last two years.

(3) Vehicle Detector

According to CMOD, vehicle detectors were used in the past and a traffic responsive control was adopted in which a signal timing plan was selected among the predefined plans according to the time-of-day with traffic flow conditions including vehicle counts, vehicle speeds or congestion levels (occupancy rates). No vehicle detectors exist at present, however, due to deterioration of the device. As there is no vehicle detector, actuation control, which extends green signal if there is arriving vehicle, is not used.

(4) Signal Monitoring at Control Center

As presented above, some of the centrally-controlled signals are still connected with the Traffic Control Center through communication cable installed and owned by Traffic Police. A wall map display showing the schematic map of the control areas and locations of the centrally-controlled signals is installed at the Control Center. Each signal on the wall map has two lamps, green and red. The green lamp indicates that the signal is operating normally. Red signal indicates that the signal is operating in yellow flashing mode. If both lamps are off, it indicates signal is not working or communication line is cut. The wall map display is shown in **Picture 9.1-3**.

Three sets of control desks are provided in front of the wall map as the entire control area is divided into three sub-areas. The control desk has many push buttons and selectors for expecting two functions:

(i) Signal control mode, which can control traffic signals in normal sequential operation or flashing yellow operation

(ii) Signal timing, which can modify signal timing of specified intersection

Currently, only the former function is available. The main computers that control the signals were already removed so that no control functions except the control mode change is possible in the existing system.

Picture 9.1-3 Wall Map Display

(5) CCTV Camera System

Traffic Police does not have its own traffic surveillance camera system. CCTV cameras were installed at 20 intersections in Bishkek City by an internet provider Aknet. Key intersections were recommended by CMOD to the City government. A total of 15 units of monitor are provided to the monitoring room of the Traffic Police, although the Traffic Police cannot control over the cameras.

9.1.3 Summary

All of the existing 203 units of signals in Bishkek City operate in an isolated mode with a fixed pattern regardless of time of day and traffic condition. Vehicles are required to stop almost every signal along the

major road as no coordination between signals is implemented.

As the current traffic flow is low at the intersections in the City, except some critical intersections at peak hours, the present signal operation and timing plan seem not to cause serious traffic congestions, although still need to improve efficiency and appropriateness. However, not a small amount of loss in terms of time and fuel must be incurred by road users. Such loss can be reduced greatly if an advanced signal system is introduced. 75 percent of the existing signals are more than 20 years old. They may become faulty any time and repairing of the obsolete signal would not be feasible. Introduction of a new signal system seems urgent.

9.2 Proposal for New Automated Traffic Control System

CMOD has prepared a proposal for an automated traffic control system. The outline of the proposal is summarized below.

1.	Project Title	"Upgrade of Automated Traffic Control System and traffic lights facilities (equipping with LED traffic lights, environmental sensors, vehicle detector, countdown light panel for permissive/restrictive signal, additional sound associated devices), modern software and technical reequipping of control centers of ATCS with communication channels, hardware for communication with peripheral facilities, setting up radio channel in Bishkek City".
2.	System Components	30 − 50 traffic lights (first stage), 150 traffic lights (final stage) Vehicle detector (video camera type) Control panel (wall map and control console) Communication cable or wireless
3.	Type of Signal Control	Adaptive
4.	Funding Requirements	12.0 million USD
5.	Feasibility Study/Detailed Design	(To be required)

The information provided by CMOD with regard to the proposed Automated Traffic Control System (ATCS) is summarized below.

(i) The estimated project cost of 12 million USD was indicated by the City Government but the detailed breakdown of the total cost is required.

(ii) Availability of the fund from the City Government, Central Government or combination of both governments for the project should be clarified.

(iii) As the proposal mentions that the first stage will cover 30 to 50 intersections, detailed list of candidate intersections for new ATCS is prepared by the further survey.

(iv) Details of the system such as use of cable or wireless for data communication, type of vehicle detector, and method of signal control are yet to be decided.

(v) CMOD applied to the City Government for a feasibility study and detailed design of ATCS to be undertaken by a team of Russian and Kazakhstan experts with the estimated cost of 1 million USD.

CHAPTER 10 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

10.1 Framework and Approach of Environmental and Social Considerations

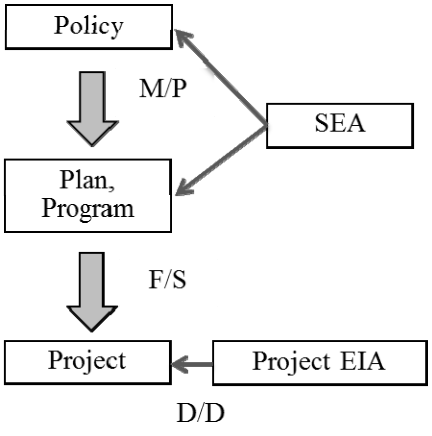
Based on the analysis of the current condition of traffic infrastructure in Bishkek City, the JICA Study Team formulated the Urban Transportation Improvement Plan which includes Improvement of Transportation Operation and Management System, and Strengthening of Institutional Capacity. However, the implementation of these plans does not go with considerable construction work and involuntary settlements with expropriations. It is presumed that it has a little impact on the environment.

In the Study, improvement approaches for the environment were derived from the results of the survey which were conducted under the framework of the Study. These approaches were collected and taken in the Recommendations for the Environment of Bishkek City.

The measures and approaches for environmental improvements were introduced by studying the current conditions of the environment and relating facts. The JICA Study Team conducted the following surveys:

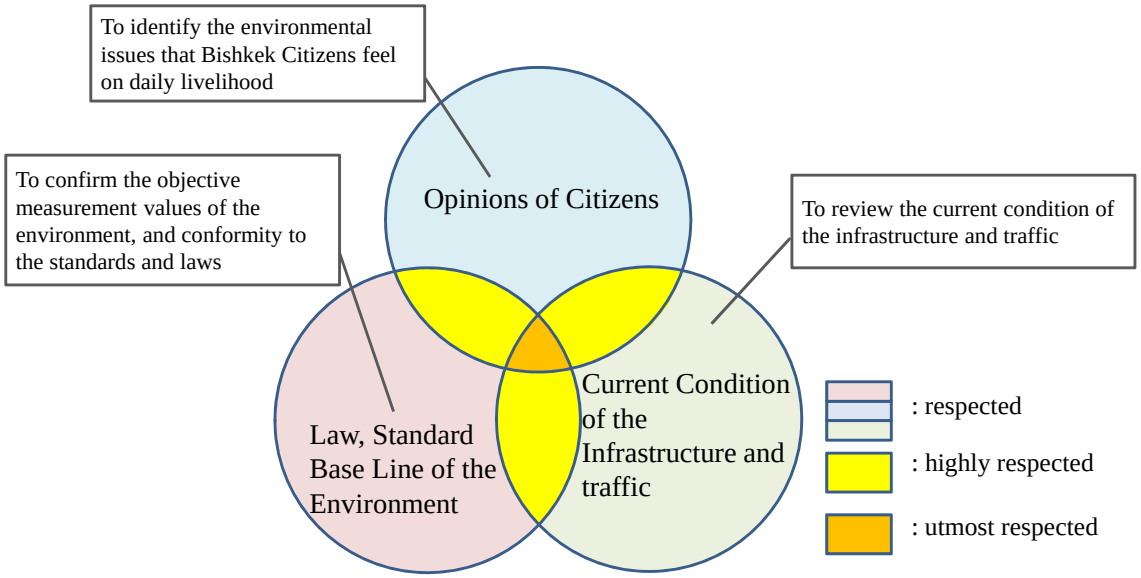
- ✓ Standards on the environment in the Kyrgyz Republic
- ✓ Baseline data in Bishkek City (including air pollution and water quality)
- ✓ Opinions of citizens
- ✓ Current condition of the infrastructure and traffic

The JICA Study Team conducted a questionnaire survey with Bishkek citizens. In the Master Plan Study, the Strategic Environmental Assessment (SEA) was conducted as environmental assessment because the study is a plan, program and policy which adopt the opinions of the citizens on environmental and social considerations that connect with the concept of the SEA. (See **Figure 10.1-1**)



Source : JICA Study Team

Figure 10.1-1 Positioning of SEA on Project Stage



Source : JICA Study Team

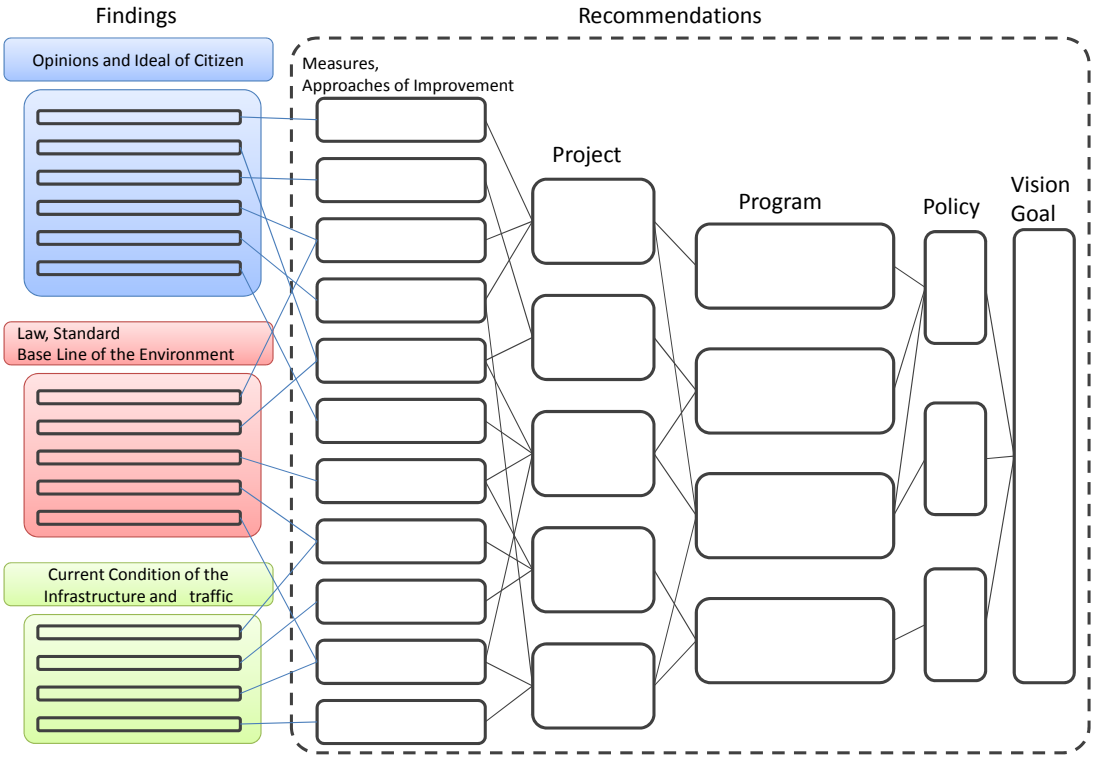
Figure 10.1-2 Three Aspects of the Environment and Social Consideration in the Study

As shown in **Figure 10.1-2**, the JICA Study Team surveyed three aspects:

(a) Laws, regulations and standards on the environment in the Kyrgyz, and baseline data in Bishkek City (air pollution and water quality)

(b) Opinions of the citizens (interviews)

(c) Current condition of the infrastructure, traffic and the environmental situation



Source : JICA Study Team

Figure 10.1-3 Approach Introducing Projects, Programs, Policies and Vision

The findings of the survey were arranged, classified and analyzed. Based on the analysis, the JICA Study Team introduced projects, programs, policies and vision from the standpoint of the environmental and social consideration as illustrated in **Figure 10.1-3**.

Environmentally Sustainable Transportation (EST)

Environmentally Sustainable Transportation (EST) is a new policy vision proposed by the Organization for Economic Cooperation and Development (OECD) and its commitment is to plan and implement policies on transportation and environment based on a long-term perspective.

Based on the EST concept, EST Guideline was developed by the OECD's Work Group and endorsed by OECD Conference on Sustainable Transportation held in 1996.

The EST Guidelines

Guideline 1: **Develop a long-term vision of a desirable transportation future** that is sustainable for environment and health and provides the benefits of mobility and access.

Guideline 2: **Assess long-term transportation trends, considering all aspects of transport,** their health and environmental impacts, and the economic and social implications of continuing with "business as usual".

Guideline 3: **Define health and environmental quality objectives** based on health and environmental criteria, standards, and sustainability requirements.

Guideline 4: **Set quantified, sector-specific targets** derived from the environmental and health quality objectives, and set target dates and milestones.

Guideline 5: **Identify strategies to achieve EST** and combinations of measures to ensure technological enhancement and changes in transportation activity.

Guideline 6: **Assess the social and economic implications of the vision,** and ensure that they are consistent with social and economic sustainability.

Guideline 7: **Construct packages of measures and instruments** for reaching the milestones and targets of EST. Highlight 'win-win' strategies incorporating, in particular, technology policy, infrastructure investment, pricing, transportation demand and traffic management, improvement of public transport, and encouragement of walking and cycling; capture synergies (e.g., those contributing to improved road safety) and avoid counteracting effects among instruments.

Guideline 8: **Develop an implementation plan** that involves the well-phased application of packages of instruments capable of achieving EST taking into account local, regional, and national circumstances. Set a clear timetable and assign responsibilities for implementation. Assess whether proposed policies, plans, and programs contribute to or counteract EST in transportation and associated sectors using tools such as Strategic Environmental Assessment (SEA).

Guideline 9: **Set provisions for monitoring implementation and for public reporting on the EST strategy;** use consistent, well-defined sustainable transportation indicators to communicate the results; ensure follow-up action to adapt the strategy according to inputs received and new scientific evidence.

Guideline 10: **Build broad support and co-operation for implementing EST;** involve concerned parties, ensure their active support and commitment, and enable broad public participation; raise public awareness and provide education programs. Ensure that all actions are consistent with global

Source : Environmentally sustainable transportation GUIDELINES (OECD)

So far, numerous efforts have reduced the negative environmental and health impacts of transportations such as carbon monoxide and lead. However, those measures still lack effective implementation, particularly those targeting structural changes in transportation activity, reductions in carbon dioxide emissions and noise.

Moreover, the Regional EST Forum in Asia held in Bangkok, Thailand, issued the Bangkok Declaration for 2020, which includes ten EST goals for the target year 2020.

Bangkok Declaration for 2020 - Sustainable Transportation Goals for 2010-2020

I. Strategies to Avoid unnecessary travel and reduce trip distances

Goal 1: Formally integrate **land-use and transportation planning** processes and related institutional arrangements at the local, regional, and national levels

Goal 2: Achieve **mixed-use development** and medium-to-high densities along key corridors within cities through appropriate land-use policies and provide people-oriented local access, and actively promote transit-oriented development (TOD) when introducing new public transportation infrastructure

Goal 3: Institute policies, programmes, and projects supporting **Information and Communications Technologies** (ICT), such as internet access, teleconferencing, and telecommuting, as a means to reduce unneeded travel

II. Strategies to Shift towards more sustainable modes

Goal 4: Require **Non-Motorized Transportation** (NMT) components in transportation master plans in all major cities and prioritize transportation infrastructure investments to NMT, including wide-scale improvements to pedestrian and bicycle facilities, development of facilities for intermodal connectivity, and adoption of complete street design standards, wherever feasible

Goal 5: Improve **public transportation** services including high quality and affordable services on dedicated infrastructure along major arterial corridors in the city and connect with feeder services into residential communities

Goal 6: Reduce the urban transportation mode share of private motorized vehicles through **Transportation Demand Management** (TDM) measures, including pricing measures that integrate congestion, safety, and pollution costs, aimed at gradually reducing price distortions that directly or indirectly encourage driving, motorization, and sprawl

Goal 7: Achieve significant shifts to more sustainable modes of **inter-city passenger and goods transportation**, including priority for high-quality long distance bus, inland water transportation, high-speed rail over car and air passenger travel, and priority for train and barge freight over truck and air freight by building supporting infrastructure such as dry inland ports

III. Strategies to Improve transportation practices and technologies

Goal 8: Diversify towards more sustainable **transportation fuels and technologies**, including greater market penetration of options such as vehicles operating on electricity generated from renewable sources, hybrid technology, and natural gas

Goal 9: Set progressive, appropriate, and affordable **standards** for fuel quality, fuel efficiency, and tailpipe emissions for all vehicle types, including new and in-use vehicles

Goal 10: Establish effective vehicle testing and compliance regimes, including formal vehicle registration systems and appropriate periodic vehicle **inspection and maintenance** (I/M) requirements, with particular emphasis on commercial vehicles, to enforce progressive emission and safety standards,

resulting in older polluting commercial vehicles being gradually phased-out from the vehicle fleet, as well as testing and compliance regimes for vessels

Goal 11: Adopt **Intelligent Transportation Systems** (ITS), such as electronic fare and road user charging systems, transportation control centers, and real-time user information, when applicable

Goal 12: Achieve improved **freight transportation** efficiency, including road, rail, air, and water, through policies, programmes, and projects that modernize the freight vehicle technology, implement fleet control and management systems, and support better logistics and supply chain management

IV. Cross-cutting strategies

Goal 13: Adopt a zero-fatality policy with respect to road, rail, and waterway **safety** and implement appropriate speed control, traffic calming strategies, strict driver licensing, motor vehicle registration, insurance requirements, and better post-accident care oriented to significant reductions in accidents and injuries

Goal 14: Promote monitoring of the **health** impacts from transportation emissions and noise, especially with regard to incidences of asthma, other pulmonary diseases, and heart disease in major cities, assess the economic impacts of air pollution and noise, and devise mitigation strategies, especially aiding sensitive populations near high traffic concentrations

Goal 15: Establish country-specific, progressive, health-based, cost-effective, and enforceable **air quality and noise** standards, also taking into account the WHO guidelines, and mandate monitoring and reporting in order to reduce the occurrence of days in which pollutant levels of particulate matter, nitrogen oxides, sulphur oxides, carbon monoxide, and ground-level ozone exceed the national standards or zones where noise levels exceed the national standards, especially with regard to environments near high traffic concentrations

Goal 16: Implement sustainable low-carbon transportation initiatives to mitigate the causes of **global climate change** and to fortify national **energy security**, and to report the inventory of all greenhouse gases emitted from the transportation sector in the National Communication to the UNFCCC

Goal 17: Adopt **social equity** as a planning and design criteria in the development and implementation of transportation initiatives, leading to improved quality, safety and security for all and especially for women, universal accessibility of streets and public transportation systems for persons with disabilities and elderly, affordability of transportation systems for low-income groups, and up-gradation, modernization and integration of intermediate public transport

Goal 18: Encourage innovative **financing** mechanisms for sustainable transportation infrastructure and operations through measures, such as parking levies, fuel pricing, time-of-day automated road user charging, and public-private partnerships such as land value capture, including consideration of carbon markets, wherever feasible

Goal 19: Encourage widespread distribution of **information and awareness** on sustainable transportation to all levels of government and to the public through outreach, promotional campaigns, timely reporting of monitored indicators, and participatory processes

Goal 20: Develop dedicated and funded **institutions** that address sustainable transport-land use policies and implementation, including research and development on environmentally sustainable transport, and promote good **governance** through implementation of environmental impact assessments for major transportation projects

Source : Fifth Regional EST Forum, 20-25 August 2010, Bangkok, Thailand

The EST guidelines and the goals of Bangkok Declaration for 2010 are significant in examining the project or plan plans for transportation. These concepts should be applied to formulate the plans that satisfy both transportation and the environmental sectors. The JICA Study Team considers the guidelines to introduce the recommendations on the environment of Bishkek City.

10.2 Law and Standard

10.2.1 Laws and Legislations on the Environment

The major environmental laws and legislations of the Kyrgyz Republic are shown in **Table 10.2-1**.

Table 10.2-1 Major Legislations for the Environmental Protection

Legislation	Year Passed	Purpose / Content
Constitution of Kyrgyz Republic	2010	Land, subsoil, air waters, forest, wildlife and other natural resources shall be utilized and, at same time, protection shall be given.
Law on Environmental Protection	1999 (2002, 2003, 2004, 2005, 2009)	The general legal framework for environmental protection and for the use of them. This law regulates the relations between rights and responsibilities of public organizations and various agencies of the state.
Law on Specially Protected Area and Biosphere Territory	1999	To regulate relations in the organization, protection and use of protected areas
Law on the Protection of Ambient Air	1999 (2003, 2005)	Ambient air standard and air quality management
Law on waters	1994 (1995)	To regulate the use and protection of waters, and preventing environmentally harmful effect
Forest Code	1999	Legal basis for the rational use, protection and reproduction of forests
Law on the Radioactive Safety of the Population	1999	Legal relationship in the field of radiation safety and protection of the environment from the harmful effects of radiation sources
Law on Ecological Expertise	1999 (2003, 2007)	About the legal relations in the field of environmental impact assessment
Law on Wildlife	2002 (2003)	About protection of wildlife habitats
Law on Fisheries	1997	To regulate legal, economic and organizational bases of fisheries
Law on Subsoil	1997	To regulate relations arising from the use of mineral resources
Law on Protection and Use of Flora	2001 (2003, 2007)	About protection, use, and reproduction of flora
Law on Mountain Areas in Kyrgyz Republic	2002 (2003)	To create socio-economic and legal framework for the sustainable development of mountain areas
Law on Waste of Production and Consumption	2001	About waste management

Source : Web Site of State Agency on Environment Protection and Forestry (http://www.nature.kg/)

10.2.2 Environmental Standard

The environmental standards of the Kyrgyz Republic relating to traffic environment are described below.

(1) Air Pollution

Ambient air quality standards are summarized in **Table 10.2-2**.

Table 10.2-2 Ambient Air Quality Standards (in mg/m^3 except as noted)

Pollutant	Maximum Permissible Concentration	Average Daily Concentration	Hazard Class
Total suspended particulate (TSP)	0.15	0.05	3
Sulfur dioxide (SO_2)	0.5	0.05	3
Carbon monoxide (CO)	5	3	4
Nitric dioxide (NO_2)	0.085	0.04	2
Nitrogen Oxide (NO)	0.40	0.06	3
Tetraethyl Lead	0.0001	0.00004	1

Source : Health Standard GN 2.1.6.1338-03

Currently, measurements of air pollution are being conducted in four cites of the country: Bishkek (7 locations), Kara-Balta (2 locations), Tokmok (2 locations), Cholpon-Ata (2 locations), and Osh (1 location)[1]. Vehicle emissions standards are summarized in **Table 10.2-3**.

Table 10.2-3 Vehicle Emissions Standards

Engine shaft speed	Maximum CO concentration	Maximum permissible concentration of hydrocarbons, part by volume (mln-1) for engines with number of cylinders	
		Up to 4	More than 4
Nmin X.X	1.5	1,200	3,000
Nincr X.X 0.8 Nnom X.X	2.0	600	1,000

Source : Instruction on Implementation of State Control over Protection of Ambient Air from Emissions of Vehicle Pollutants, accessed on 12 November 2010 at : http://www.nature.kg/lawbase/acts/18_ins_polutant_emissions_air.xml

The national standards for emissions testing are following:

✓ GOST 17.2.2.03-87

Environment Protection

Atmosphere

Norms and Methods of measurement of contents carbon oxide and hydrocarbons in burnt gases of vehicles with gasoline engines

Safety Requirements

[1] "Analysis of air pollution" Web Site of "State Agency on Environment Protection and Forestry" (http://www.nature.kg/)

✓ GOST 21393-75

Vehicles with diesels

Black smoke of burnt gases

Norms and Methods of measurement

Safety Requirements

✓ GOST 17.2.2.03-87 defines the contents of carbon oxide (CO), hydrocarbons in burnt gases of vehicles with gasoline engines.

✓ GOST 21393-75 covers black smoke of burnt gases of vehicles with diesel engines.

In the Kyrgyz Republic, leaded gasoline was phased out in 2002[2].

(2) Water Quality

Water quality standards are defined in three general categories: Fisheries, drinking water, and wastewater discharge. Water quality standards include:

(a) Hygienic Normative GN 2.1.5.1315-03 Maximum Permissible Concentrations (MPC) of Chemical Substances in the Water of Water Bodies used for Drinking and Domestic - Recreation Purposes. The complete list of chemicals is available at: http://www.nature.kg/lawbase/acts/36_rgs_pdk_water.xml.

(b) Hygienic Normative GN 2.1.5.1316-03 Tentative Permissible Levels (TPL) of Chemical Substances in the Water of Water Bodies used for Drinking and Domestic-Recreation Purposes. The complete list of chemicals is available at the website: http://www.nature.kg/lawbase/acts/37_rgs_odu_water.xml.

(3) Noise

Noise standards of Kyrgyz are summarized in **Table 10.2-4**.

Table 10.2-4 Noise Standards

Description of Activity / Category	Leq	Lmax
Areas immediately adjacent to hospitals and sanatoriums	Day = 45 Night = 35	Day = 60 Night = 50
Areas immediately adjacent to dwellings, polyclinics, dispensaries, rest homes, holiday hotels, libraries, schools, etc.	Day = 55 Night = 45	Day = 70 Night = 60
Areas immediately adjacent to hotels and dormitories	Day = 60 Night = 50	Day = 75 Night = 65
Recreational areas in hospitals and sanatoriums	35	50
Rest areas at the territories of micro-districts and building estates, rest houses, sanatoriums, schools, homes for the aged, etc.	45	60

Source : Collection of the Most Important Records on Sanitary and Anti-epidemiological issues, Volume 2, Part 1, Information Publishing center of Goskomsanepidnadzor, Russian Federation, 1994.

[2] UNEP: Current status of Lead and Sulphur in Fuels in Central and Eastern Europe, the Caucasus and Central Asia (http://www.unep.org/transport/pcfv/PDF/MatrixCEE_FuelsApril_2010.pdf)

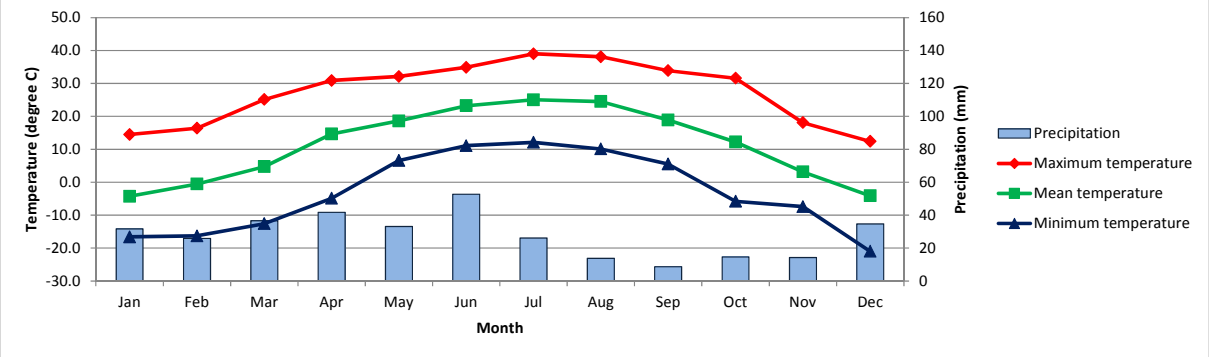
10.3 Environmental Baseline (Geographic, Climate, Air Pollution, Water Quality)

10.3.1 Geographic and Climate Condition of Bishkek City

(1) Location and Climate

Location and climate of Bishkek City is described in details in **Chapter 2**.

Temperature and precipitation of Bishkek City is shown in **Figure 10.3-1**.



Source : European Climate Assessment and Dataset (http://eca.knmi.nl/) 2011 data for Temperature, 1991 data for Precipitation

Figure 10.3-1 Temperature and Precipitation of Bishkek City

The climate of Bishkek City has the features of a continent. Maximum temperature in summer reaches 40 degrees Celsius, and minimum temperature in winter falls 10 degrees Celsius below zero. It has cool or chilly climate except in summer. Precipitation is approximately 400 mm per year, i.e., comparably dry. However, it is more than other countries of Central Asia because Kyrgyz has a lot of mountainous area. In the countries of Central Asia in the surrounding of the Kyrgyz Republic, progressing desertification has become a significant problem on the environment. The desertification, as typified by Aral Sea, has caused a lot of damage to the local environment.

Bishkek City is located in Chui valley. High mountain chains surround the City on south, east and northeast, and form a basin.

The conditions of Bishkek climate and location, mentioned above, can impact the environment.

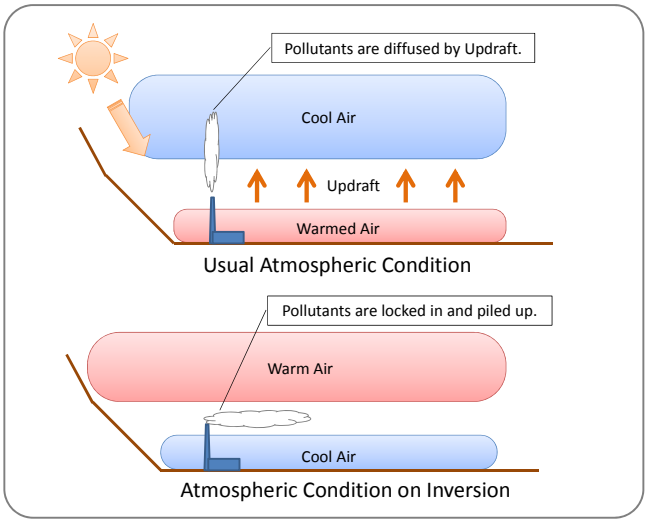
(2) Climate Condition which Affects the Environment

Temperature Inversion

There is a temperature inversion as one of the climate phenomenon that has adverse effects on the environment. In the daytime, the air usually gets warmer on the ground surface by sunlight, and moves upward. This movement promotes circulation of the atmosphere and the diffusion of air pollutants. On the other hand, certain conditions such as radiation causes low temperatures on the ground surface and high temperatures on the upper air. This forms a static and stable condition of atmosphere. This is the temperature inversion. The temperature inversion causes atmospheric harm by locking air pollutants in the lower elevation. The temperature inversion often occurs on

the condition of cooled ground surface in the autumn or winter, or influx of cold air below warm air. Topography surrounded by mountains also reinforces adverse effects. (See **Figure 10.3-2**)

Bishkek City combines these conditions (cool and cold climate except summer, and rimmed by high mountains) for forming the inversion. In the cold season, this climate phenomenon may cause air pollution in Bishkek City.



Source : JICA Study Team

Figure 10.3-2 Atmospheric Condition during Temperature Inversion

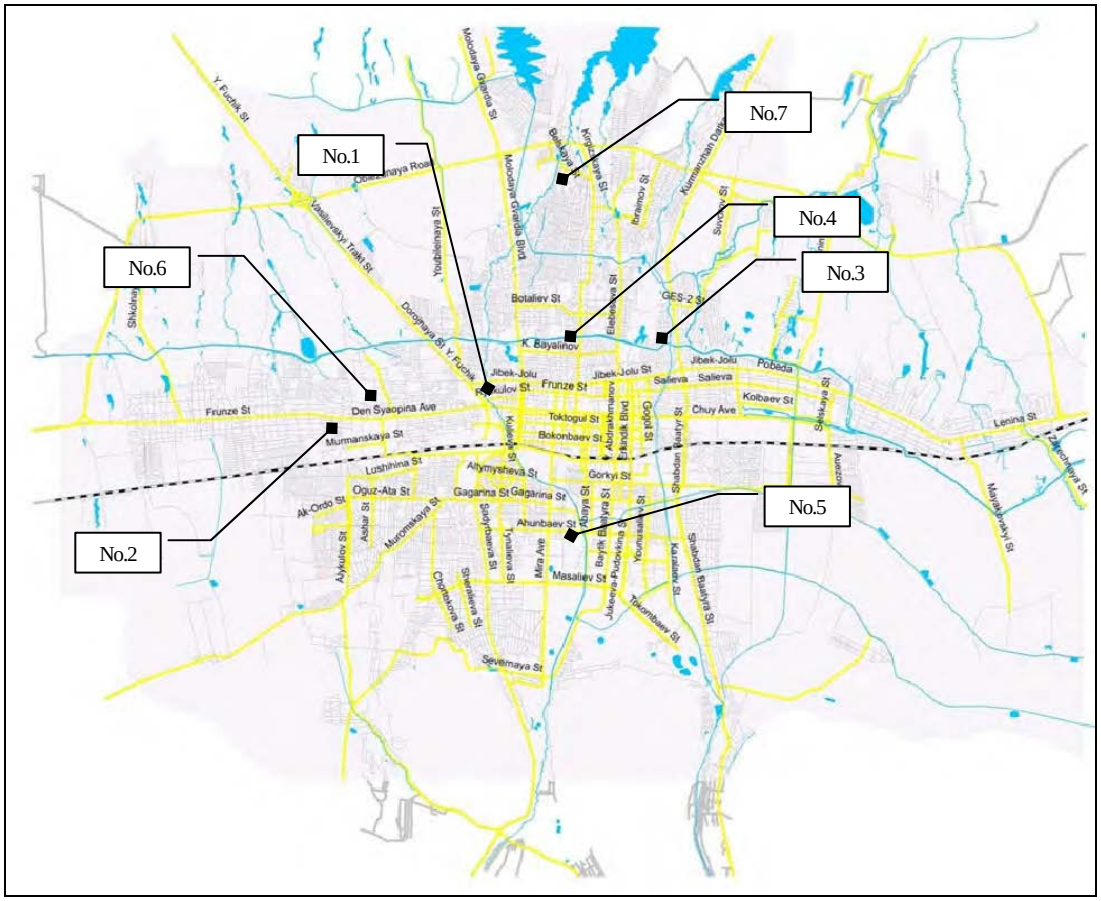
10.3.2 Air Pollution

In Bishkek City, Agency for Hydrometeorology under the Ministry of Emergency Situations of the Kyrgyz Republic is implementing continuous measurements of air pollution at seven observatories. The outlines of the atmospheric observatories are shown in **Table 10.3-1** and **Figure 10.3-3**.

Table 10.3-1 Atmosphere Observatories in Bishkek City

SN	Location	Measurement Matters				
		SO_2	NO_2	NO	NH_3	HCOH
1	Center of the City Roadside of Mir Avenue (Cross-section)	*	*	*		*
2	West of the City Residential area	*	*		*	
3	East of the City Residential area	*	*	*		
4	North-east of the City Roadside of Jibek-Jolu Avenue Residential area	*	*			*
5	South of the City Roadside of BaitikBaatyr St. Residential and school zone	*	*			
6	West of the City Residential area	*	*		*	
7	North of the City Suburb	*	*			

Source : JICA Study Team



Source : JICA Study Team

Figure 10.3-3 Location of the Atmospheric Observatories

The atmospheric observatories are distributed over the City, from the City Center to the outskirts. Each of the observatories are measuring the pollutants that correspond to their locations or features of the atmosphere (i.e. emissions).

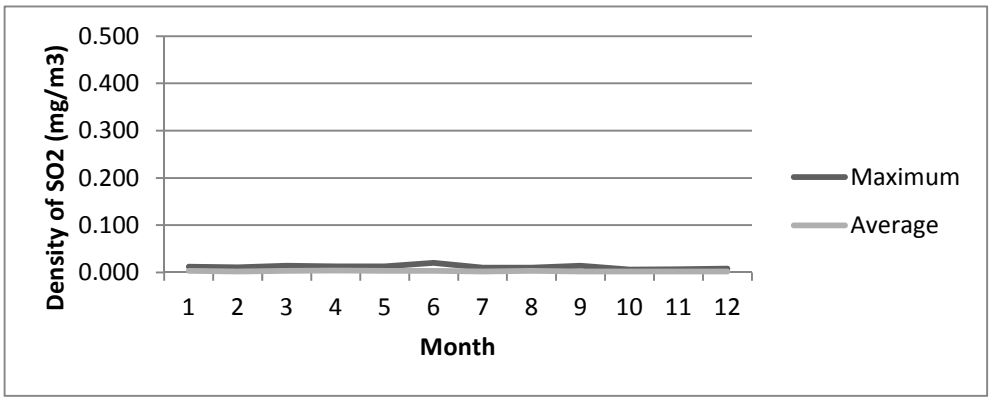
Measured data were provided on the Maximum Allowable Concentrations (MAC) based on RD52.04.186.89, Moscow, 1991.

A part of the measured data at the observatories[3] are described below.

(1) Sulfur Oxide (SO_2)

At all observatories Sulfur dioxide (SO_2) and Nitrogen dioxide (NO_2) are being measured. SO_2 is a product of fossil fuel combustion, usually oil and coal that contain sulfur. In Bishkek City, there is a central heating station (CHS) where coal is burned for the purpose of heating. In addition, vehicle fuel in the Kyrgyz Republic includes some sulfur[4]. It is believed that CHS and vehicles on road are the main emission of the atmospheric pollutants in Bishkek City[5].

[3] Preparatory Study of Improvement of Urban Transportation in Bishkek City of the Kyrgyz Republic (JICA)
[4] Status of Fuel Quality and Vehicle Emission Standards : East Europe, the Caucasus, Central Asia (UNEP)
[5] Attached material of Preparatory Study of Improvement of Urban Transportation in Bishkek City of the Kyrgyz Republic (JICA)



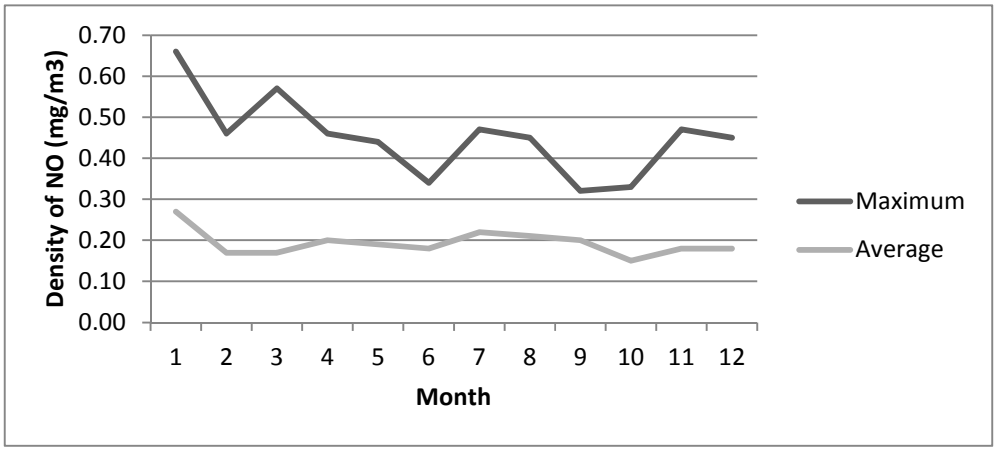
Source : JICA Preliminary Mission

Figure 10.3-4 Concentration of SO_2 in the Center of City (No.1 Observatory, 2010)

Figure 10.3-4 shows 2010s year transition of concentration of SO_2. Concentration of SO_2 fluctuates in the range from 0.002 mg/m^3 to 0.004 mg/m^3 (daily average), 0.006 mg/m^3 to 0.02 mg/m^3 (maximum). Concentration of SO_2 is significantly low compared with MAC (Maximum Allowable Concentrations: average 0.05 mg/m^3, maximum 0.5 mg/m^3). Other observatories also show similar tendency approximately. The measurement data shows that air pollution of SO_2 is vanishingly small in Bishkek City.

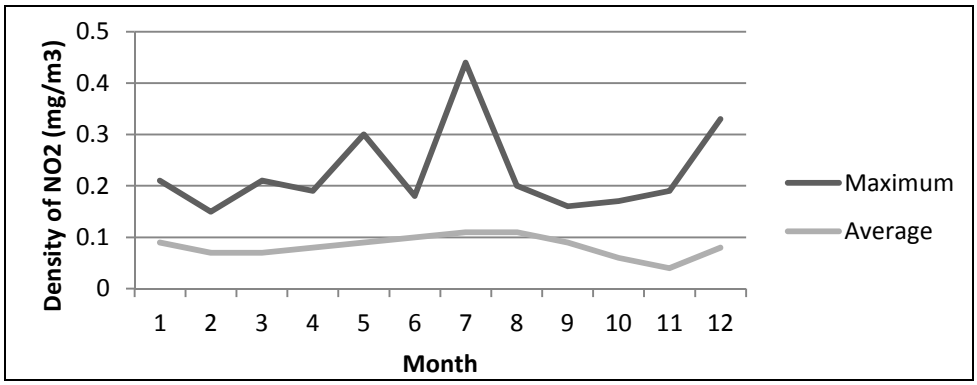
(2) Nitric Oxide

Nitric oxide (NOx) is produced during the combustion of fossil fuels: i.e., oil, coal, timber and gas. NOx including NO and NO_2, which result from the vehicle emission, can affect roadside environment. Nitrogen compound in vehicle emission is almost NO. After being emitted from vehicles to the atmosphere, NO_2 is produced through the process of photochemical reaction.



Source : JICA Preliminary Mission

Figure 10.3-5 Concentration of NO in the Center of City, Roadside of Manas Avenue (No.1 Observatory 2010)

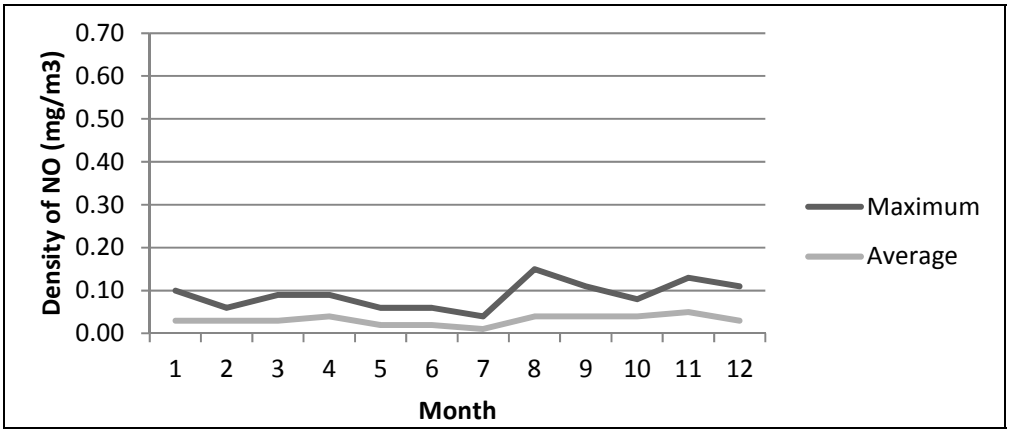


Source : JICA Preliminary Mission

Figure 10.3-6 Concentration of NO_2 in the Center of City, Roadside of Manas Avenue (No.1 Observatory, 2010)

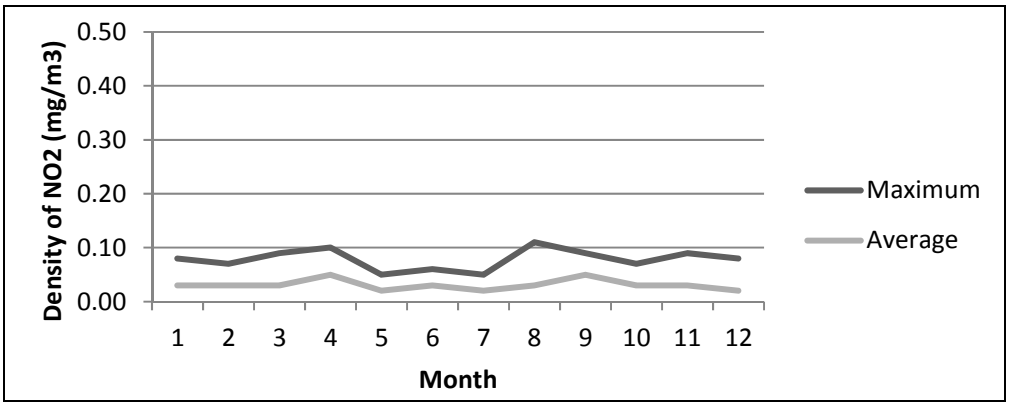
Figure 10.3-5 and **Figure 10.3-6** show NO and NO_2 concentration on the roadside of the City Center. NO concentration fluctuates in the range from 0.15 mg/m^3 to 0.27 mg/m^3 (daily average), 0.32 mg/m^3 to 0.66 mg/m^3 (maximum). NO_2 concentration fluctuates in the range from 0.04 mg/m^3 to 0.11 mg/m^3 (daily average), and 0.15 mg/m^3 to 0.44 mg/m^3 (maximum). Both concentration of NO and NO_2 highly exceeds MAC (NO: average 0.06 mg/m^3, maximum 0.40 mg/m^3, NO_2: average 0.04 mg/m^3, maximum 0.085 mg/m^3). No.1 observatory is located on the arterial road which has much traffic volume in the City Center. It is evident that vehicle emission causes air pollution of NOx because of no other noticeable emissions around. Ninety percent (90%) of NOx emitted from vehicle is NO. After being emitted, NO_2 is produced from NO through the photochemical reaction.

At most of the observatories in the City, measurement data of NOx exceed MAC. On the other hand, data of No.3 and No.5 observatories are moderately low. (See **Figure 10.3-7** and **Figure 10.3-8**) No.3 and No.5 observatories are located in the areas where are out of the impacts of vehicles. Therefore, it is clear that high concentration of NOx is derived from vehicle emissions.



Source : JICA Preliminary Mission

Figure 10.3-7 Concentration of NO in the East of the City, Residential Area (No.3 Observatory, 2010)

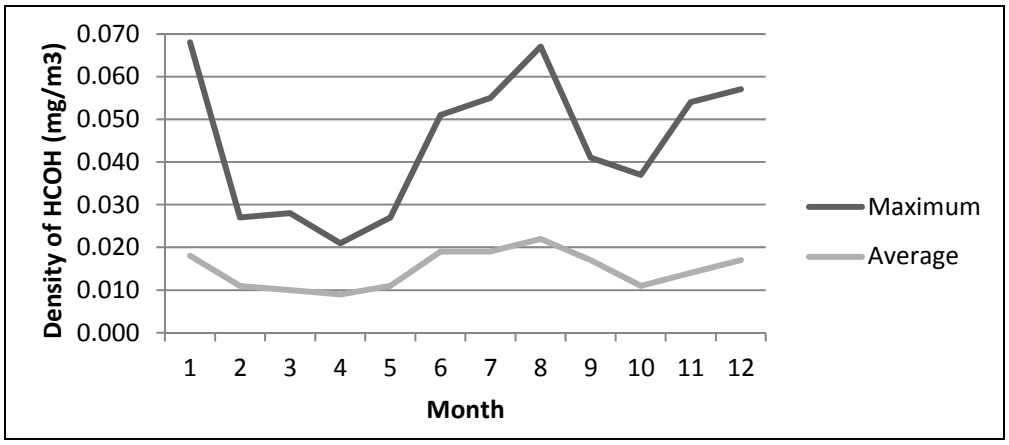


Source : JICA Preliminary Mission

Figure 10.3-8 Concentration of NO_2 in the East of the City, Residential Area (No.3 Observatory, 2010)

(3) Other Pollutant

No.1 observatory measures HCOH. HCOH is produced by imperfect combustion of fuel and photochemical reaction as a secondary product. **Figure 10.3-9** shows 2010s year transition of HCOH.

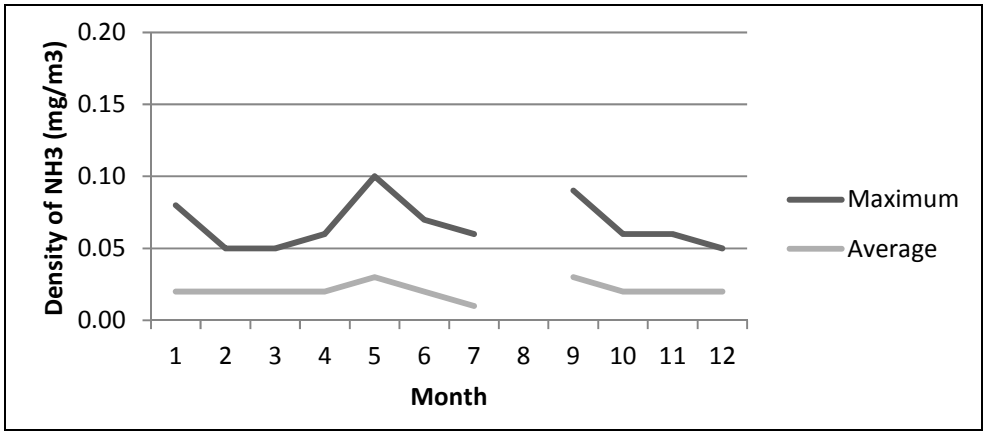


Source : JICA Preliminary Mission

Figure 10.3-9 Concentration of HCOH in the West of the City, Residential Area (No.1 Observatory 2010)

The average value fluctuates in the range of 0.009 mg/m^3 to 0.022 mg/m^3. The maximum value fluctuates in the range of 0.021 mg/m^3 to 0.068 mg/m^3. Both of average value and maximum value are high in the summer and winter. It is assumed that the causes of the high values are photochemical reaction in the summer and stagnation of the pollutant derived from the temperature inversion in the winter.

Furthermore, observatories located in the suburb measure ammonia (NH_3). (See **Figure 10.3-10**) This is mostly produced from the excretions of domestic animals. NH_3 has no relation with traffic related activities.

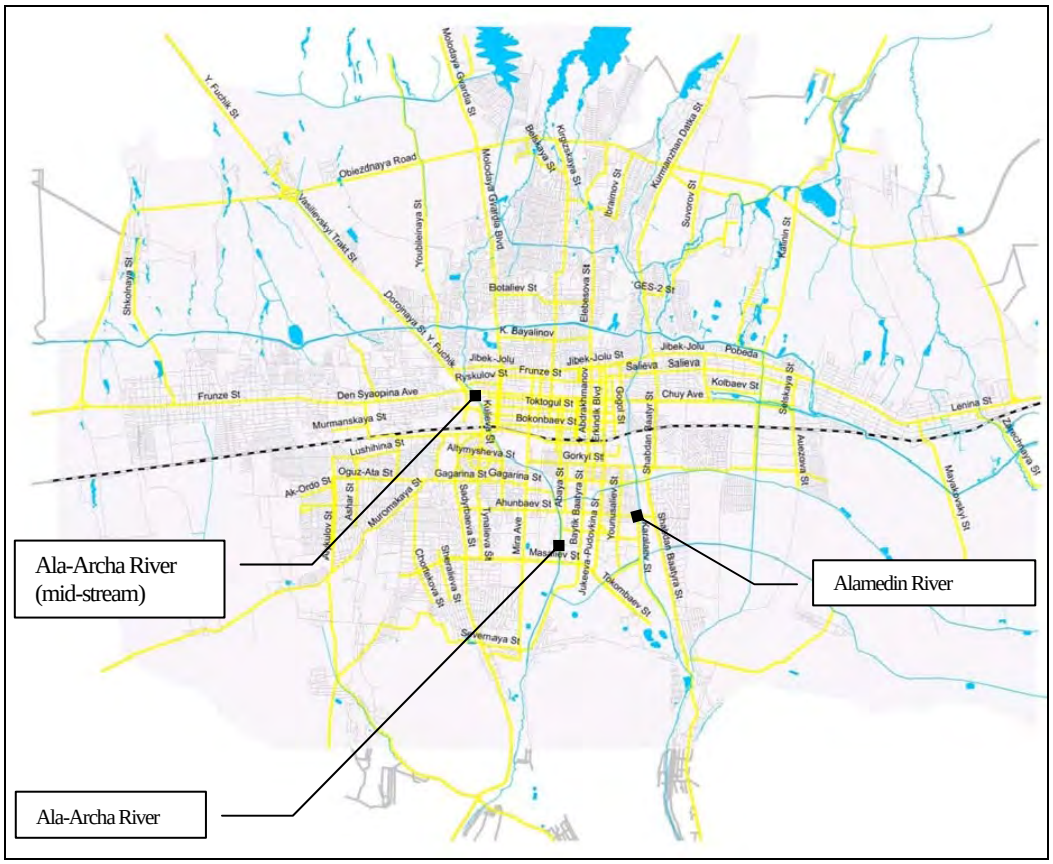


Source : JICA Preliminary Mission

Figure 10.3-10 Concentration of NH_3 West of the City, Residential Area (No.6 Observatory, 2010)

10.3.3 Water Quality

There are two major rivers in Bishkek City, the Ala-Archa River and Alamedin River. The Ala-Archa River and the Alamedin River are running from north to south through the City. (See **Figure 10.3-11**, **Picture 10.3-1** and **Picture 10.3-2**)



Source : JICA Study Team

Figure 10.3-11 Location of the Ala-Archa River and Alamedin River

Picture 10.3-1 Up - stream of the Aramedin River

Picture 10.3-2 Up - stream of the Ala-Archa River

Both rivers are comparatively clean. The water qualities, meet the Criteria for Surface Water Pollution Assessment except cupper[6]. (See **Table 10.3-2** and **Table 10.3-3**)

Table 10.3-2 Water Quality of Alamedin River in Bishkek City (2010)

Index	Alamedin river						Maximum allowable concentration, mg/l
	1 km upstream from Bishkek city			2 km downstream from Bishkek city			
	Mar	Aug	Nov	Mar	Aug	Dec	
pH	8.30	7.75	7.75	8.55	8.00	7.95	
oxygen	10.51	8.99	11.58	10.51	8.99	11.58	Winter 4.0 Summer 6.0
BOD5	0.84	0.22	1.35	0.77	0.67	1.19	3
oil products	0.01	0.00	0.01	0.01	0.00	0.01	0.05
phenol	0.000	0.000	0.000	0.000	0.000	0.000	0.001
synthetic surfactants	0.00	0.00	0.00	0.00	0.00	0.01	0.1
NH_4	0.02	0.00	0.07	0.02	0.00	0.09	0.5N (NH_4+) = 0.39
NO_2	0.040	0.008	0.003	0.010	0.010	0.005	0.08N (NO_2-) = 0.02
NO_3	1.12	0.62	1.16	2.11	1.75	1.63	40N (NO_3-) = 9.0
phosphorus	0.010	0.009	0.010	0.013	0.016	0.031	
iron	0.05	0.23	0.03	0.08	0.05	0.03	0.5
copper	0.002	0.001	0.000	0.002	0.002	0.001	0.001
zinc	0.000	0.002	0.000	0.000	0.001	0.000	0.01

[6] Attached material of Preparatory Study of Improvement of Urban Transportation in Bishkek City of the Kyrgyz Republic (JICA)

Table 10.3-3 Water Quality of Ala-Archa River in Bishkek City (2010)

Index	Ala-Archa River						Maximum allowable concentration, mg/l
	4 km upstream from Bishkek city			1 km downstream from Bishkek			
	Mar	Aug	Dec	Mar	Aug	Dec	
pH	8.25	7.65	7.85	8.40	7.85	7.95	
oxygen	10.51	9.14	12.00	10.21	8.54	12.07	Winter 4.0 Summer 6.0
BOD5	1.00	0.52	1.31	0.92	1.05	1.63	3
oil products	0.01	0.00	0.01	0.01	0.00	0.01	0.05
phenol	0.000	0.000	0.000	0.000	0.000	0.000	0.001
synthetic surfactants	0.00	0.00	0.00	0.02	0.02	0.04	0.1
NH_4	0.01	0.00	0.03	0.03	0.03	0.05	0.5N (NH_4+) = 0.39
NO_2	0.006	0.008	0.003	0.01	0.01	0.02	0.08N (NO_2-) = 0.02
NO_3	0.87	0.99	1.00	2.27	1.29	1.57	40N (NO_3-) = 9.0
phosphorus	0.010	0.010	0.004	0.016	0.014	0.025	
iron	0.03	0.31	0.01	0.03	0.09	0.02	0.5
copper	0.002	0.001	0.001	0.002	0.002	0.001	0.001
zinc	0.000	0.002	0.000	0.002	0.004	0.000	0.01

Source : JICA Preliminary Mission

Maximum allowable concentration: The list of maximum allowable concentrations and approximately safe impact of hazardous substances for water contained in fisheries ponds, Moscow 1990.

The Ala-Archa River passes through the side of the Osh Bazaar at the City Center. Around the Bazaar, a lot of garbage is dumped into the river without any treatment. The past records of water quality show the excess of NO_2 and BOD5 concentrations at the downstream.

Picture 10.3-3 The Ala-Archa River at the Osh Bazaar

Picture 10.3-4 Dumped Garbage on the Ala-Archa River at the Osh Bazaar

10.4 Opinions of the Citizen

10.4.1 Methodology

The Study emphasizes reflecting the opinions of the citizens in formulating a plan or vision. The JICA Study Team gathered the opinions by implementing questionnaires survey. The questionnaire respondents were divided into two groups, namely for authorities and for general public. The targeted respondents of group - 1 (authorities) includes the counterparts of the Study, who are working on view for the environment of Bishkek City, or directly tackling the environmental issues. The targeted respondents of group - 2 (general citizens) were general public of Bishkek City.

Targeting the former group (i.e., authorities), questionnaire survey was conducted with the member of counterparts in the workshop held on 5th June, 2012. For the latter group, questionnaire survey was conducted with the unspecified public in the Pedestrian Mall event which was held on 16 September 2012 in Bishkek City.

10.4.2 Outline of the Questionnaire Surveys

(1) Questionnaire for the Authorities

The questionnaire survey with the following questions was implemented with the authorities.

Question Items for the Authorities:

1. What do you think the current problems of Bishkek environment (general)? Please describe three of the environmental problems that you think the most important.
2. What do you think the current problems of Bishkek environment regarding to the urban traffic? Please describe three of the environmental problems regarding to the urban traffic that you think the most important. (Overlap with 1 is allowed.)
3. What is desirable environment for Bishkek City? Please describe desirable environment for Bishkek city for you.

(2) Questionnaire for the General Citizens

For the purpose of collecting the opinion of the general citizens, a questionnaire survey was implemented with the general citizens of Bishkek City. Contents of the survey included the comprehensive evaluation of Bishkek environment, the problems of the urban environment, and the desirable vision of Bishkek City in the future and their attributes.

The survey was implemented on the street festival *Pedestrian Mall* which was held on Kievskaya Street.

(a) Questionnaire survey on Bishkek environment

Date: 10:00 to 20:00, 16th (Sunday) September, 2012

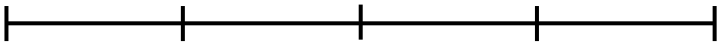
Location: Kievskaya Street from Isanova Street to Logvinenko Street

Target: Visitors and participants of *Pedestrian Mall*, 100 samples

Details of Questions:

Q1. How do you assess a quality of living environment in Bishkek City?
Please circle an appropriate level.

Good Fair Moderate Poor Bad



Q2. In Bishkek City, what do you think the problems of the urban environment?
(Environmental Impacts)
Air Quality, Water Quality (River, Lake), Waste, Soil Contamination, Noise and Vibration, Odor, Protected Areas (Forests, Park), Vegetation, Biodiversity,
Hydrology (Condition of River, Lake, Grand Water), Landscape, Others

Details (such as reasons, expected causes of the problems and so on)

Q3. This is a question regarding the environment due to the urban traffic. What do you think problems of the traffic environment in Bishkek City? Please check off the check box on the list.
(Environmental Impacts)
Traffic Congestion, Traffic Accident, Inconvenience for Pedestrians,
Inconvenience for Public Transportation Users, Air Quality due to the Emission Gas,
Dust from the Road, Traffic Noise and Vibration,
Ecosystem on the Roadside (Decrease of Vegetation, others), Others.

Details (such as reasons and expected causes of the problem).

Q4. What is your desirable vision of Bishkek City in future?

10.4.3 Results and Analysis of the Questionnaire Surveys

(1) Questionnaire for the Authorities

The answers of the questionnaire are shown as **Table 10.4-1**.

Table 10.4-1 Answers of the Questionnaire for the Authorities

	What do you think the current problems of Bishkek environment (general)?	
Air pollution	Exhaust fumes	Dust
	Lack of control of public transport on fumes	Decreasing of exhaust fumes
	Burning of auto-tyres by private sector	Air polluted
	Exhaust Fumes	
Waste	Waste cleaning up	Waste
	Waste cleaning up in time and closed dumpsters fixing	Cleaning of streets does not take place except central streets
Forestry /Green	Exterminations of plants	Shortening of green spaces
	(Necessary of) Tree planting for air antipollution and planting of greenery	
Traffic issue	Public transport (improvement)	Motor service defect
Others	(Lack of) Petrol Stations	Overpopulation
	(Lack of) Control	Lack of activity for environment protection

	What do you think the current problems of Bishkek environment regarding to the urban traffic?	
Air pollution	Exhaust Fumes	
	Burning of auto-tyres by private sector	
Traffic issue	Bad technical condition of public transport	Lack of trolleybuses
	Shortening number of public transport (minibuses) due to low capacity	(Necessary of) Traffic control to traffic jams excluding
	Public transport affects to pollution less than private	Public transport of low capability
	(should) Exclude midi-buses to trolleybuses	Increasing numbers of midi-buses and trolleybuses
	Too much of mini buses	Low quality of midi-buses
	Gathering more amount of trolleybus and midi-buses	Less numbers of minibuses
	Streets expanding and covering with asphalt to exclude jams	Decrease numbers of trolleybuses
	Too much number of mini-buses	Insanitary conditions of public transport
	(should) Start using electric transport	Mini-buses
Others	Noise and Vibrations	

What is desirable environment for Bishkek City?
Green and clean city without smokes and waste
Trees planting, canal systems reconstructions, irrigation water providing, cleaning around places of residence
Ecologically clean
Cleaned and greenish

Source : JICA Study Team

Regarding the environment, issues of air pollution were raised the most. These are vehicle emissions and dust which are direct issues of traffic. The second issue was waste. Furthermore, deforestation and decrease of greeneries were raised.

In response to the question regarding traffic environment, lack and deterioration of the public transportation were raised.

In response to question regarding desirable environment, opinions of clean, green and reconstruction of basic infrastructure which keeps the environment were proposed.

As mentioned above, regarding environment, the opinions of the authorities are summarized in air pollution, waste, conservation of forestry. Regarding the traffic, the lack or deterioration of public transportation are raised as the main issues.

(2) Questionnaire for the General Citizens

(a) Attributes of targets

Gender: male 49, female 50, no answer 1

Age: the proportion of ages and composition of ages by gender are shown in **Figure 10.4-1** and **Figure 10.4-2**. The respondents of age 20's are the highest and it accounts 39 percent of all respondents.

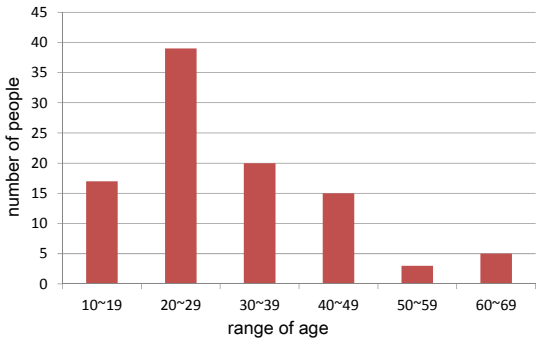


Figure 10.4-1 Composition of Ages

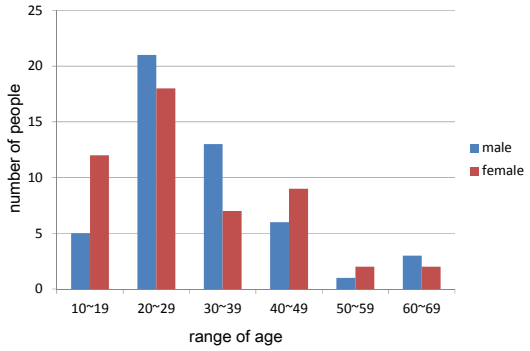


Figure 10.4-2 Composition of Ages by Gender

Occupation: the share of worker of all category is the highest (57%) among the various occupation followed by students (26%) and housewives (8%). (See **Figure 10.4-3**)

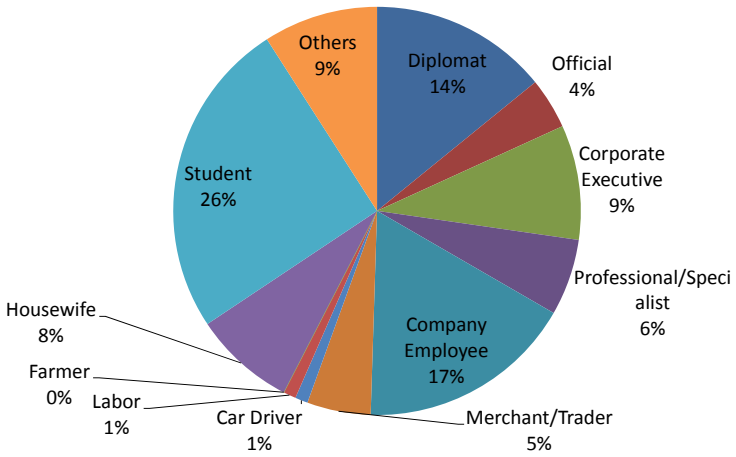


Figure 10.4-3 Composition of Occupations

(b) Q1: The quality of the living environment in Bishkek City

The answer for Q1 is summarized in **Figure 10.4-4**.

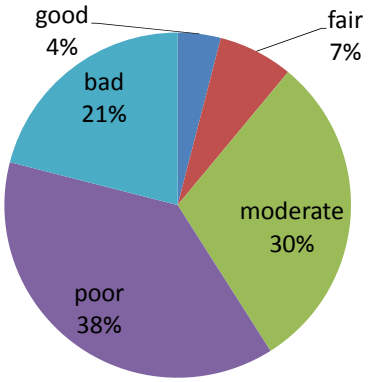


Figure 10.4-4 Evaluation of a Quality of Living Environment of Bishkek City

Positive or moderate evaluation (i.e. good, fair and moderate), accounts for 41 percent of all respondents. On the other hand, negative evaluation including bad and poor is 59 percent. More than half of the respondents evaluated the living environment of Bishkek City negatively.

(c) Q2: The problems of the urban environment in Bishkek City

The responses for the Q2 is shown in **Figure 10.4-5**.

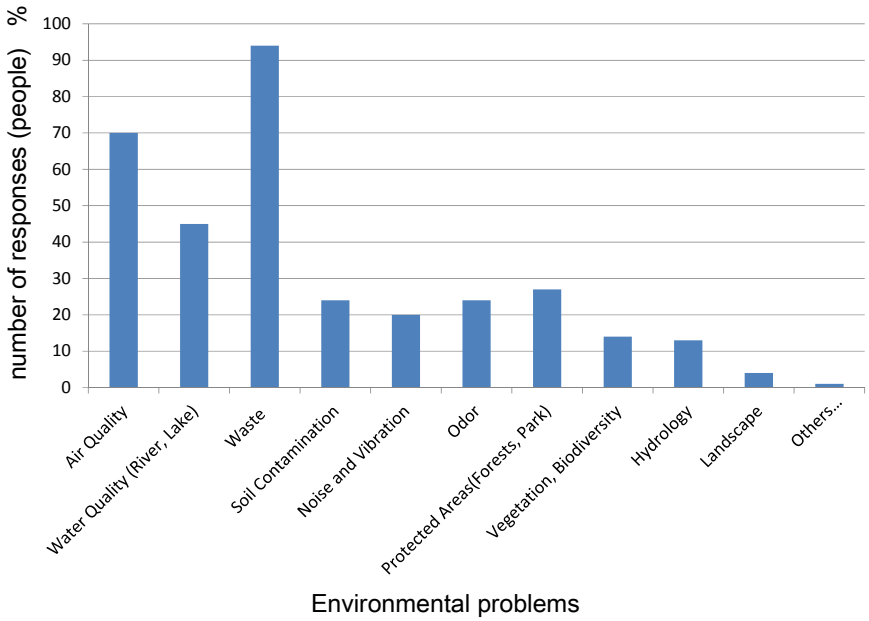


Figure 10.4-5 Environmental Problems Raised by Bishkek Citizens

Out of all , 94 percent raised *waste* as the major environmental problem of Bishkek City at present. Air quality problem was raised as the second major problem which was raised by 70 percent of all respondents. Moreover, half of the respondents have raised the above two matters as the environmental problems of Bishkek City. Similarly, 45 percent of respondents have raised water quality as the environmental problem of Bishkek City. The details of environmental problems identified by the Bishkek citizens are shown in **Figure 10.4-5**.

(d) Q3: The problems of the urban traffic environment in Bishkek City

Q3 was set for the purpose of collecting the environmental problems especially concerning the urban traffic. The responses for the Q3 are shown in **Figure 10.4-6**.

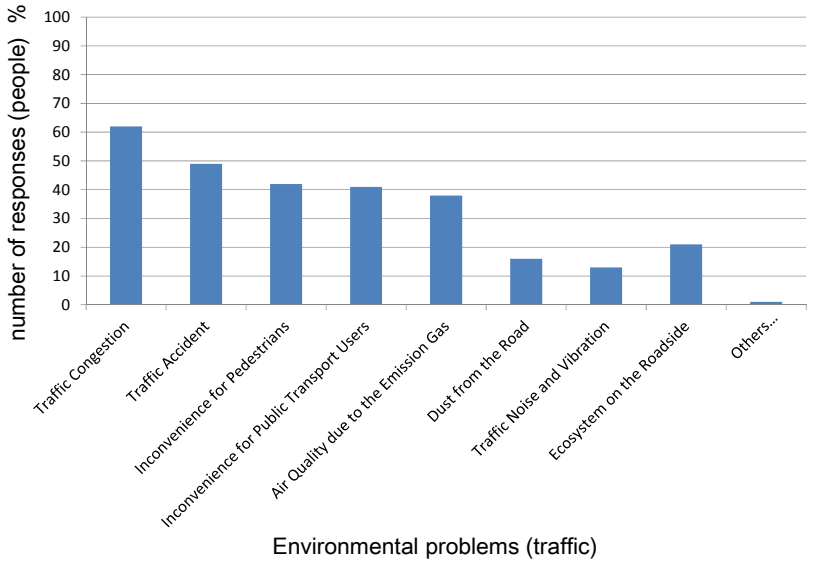


Figure 10.4-6 Environmental Problems due to the Urban Traffic Raised by Bishkek Citizen

Approximately 60 percent of respondents raised traffic congestion as the environmental problem due to the urban traffic in Bishkek City. Similarly, approximately 49 percent of respondents raised traffic accident as the environmental problems due to the urban traffic. The remaining problems were raised by less than 40 percent of respondents.

(e) Differences in opinions with the attributes of the respondents

Differences of the opinions by gender of the respondents are shown in **Figure 10.4-7**, **Figure 10.4-8** and **Figure 10.4-9**.

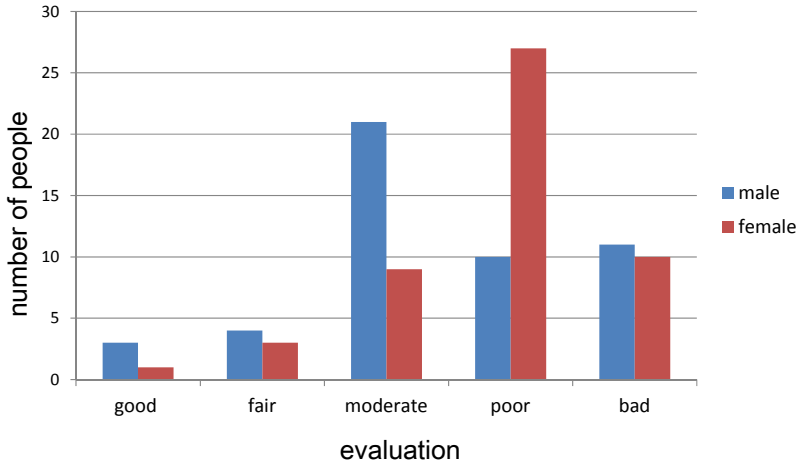


Figure 10.4-7 Differences in Opinions by Gender (quality of living environment)

As shown in **Figure 10.4-7**, nearly half of the male respondents evaluated the Bishkek City environment as moderate whereas most of the female respondents evaluated the Bishkek City environment as poor. Also, the result of questionnaire survey reveals that female respondents are more conscious of the current environmental condition than male respondents.

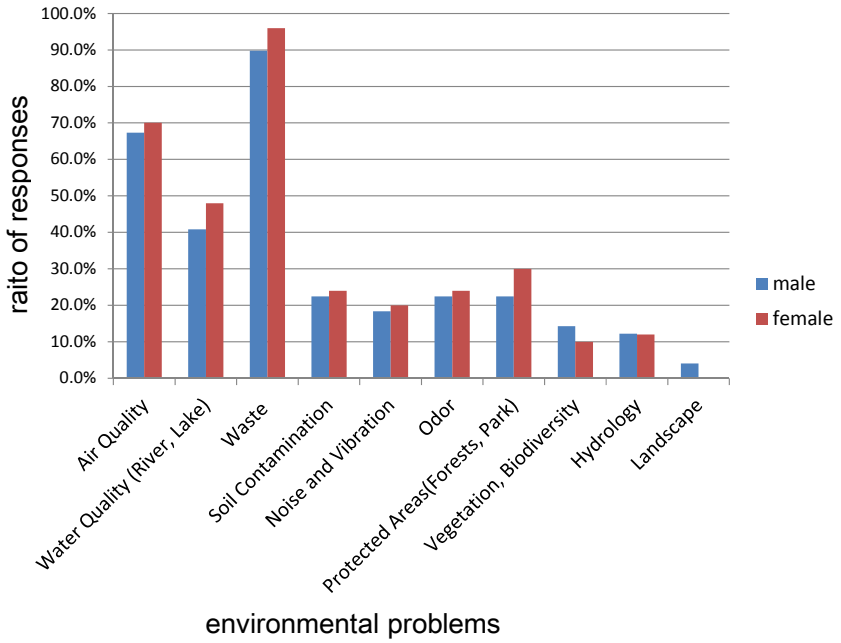


Figure 10.4-8 Q2: Differences in Opinions by Gender (environmental problem)

In response to Q2, the number of female respondents in raising the each category of environmental problem was more than male respondents.

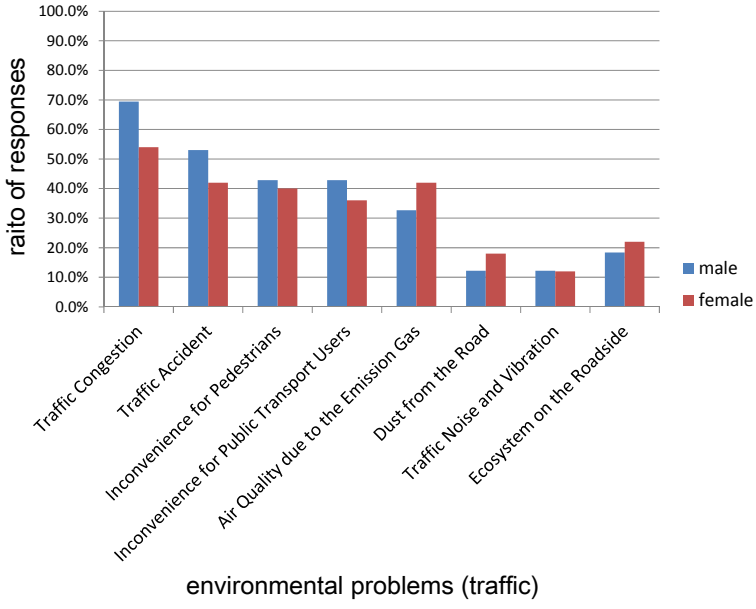


Figure 10.4-9 Q3: Differences in Opinions by Gender

Figure 10.4-9 shows the differences in opinions on the urban traffic environment by gender of the respondents. The problems on the environment such as air quality, dust and ecosystem were raised by the females more critically than the males. On the other hand, the problems on the traffic congestion were raised by the males critically than the females. This indicates that the males feel traffic problems more seriously than the females.

(f) Free descriptions on the environmental problems

Almost all respondents willingly accepted the request to answer Q2 and Q3, and described the environmental problems of Bishkek City freely. The collected answers were classified and summarized by considering commonalities and similarities. Moreover, environmental targets were derived from the summaries of opinions. The flows are shown in **Figure 10.4-10** and **Figure 10.4-11**.

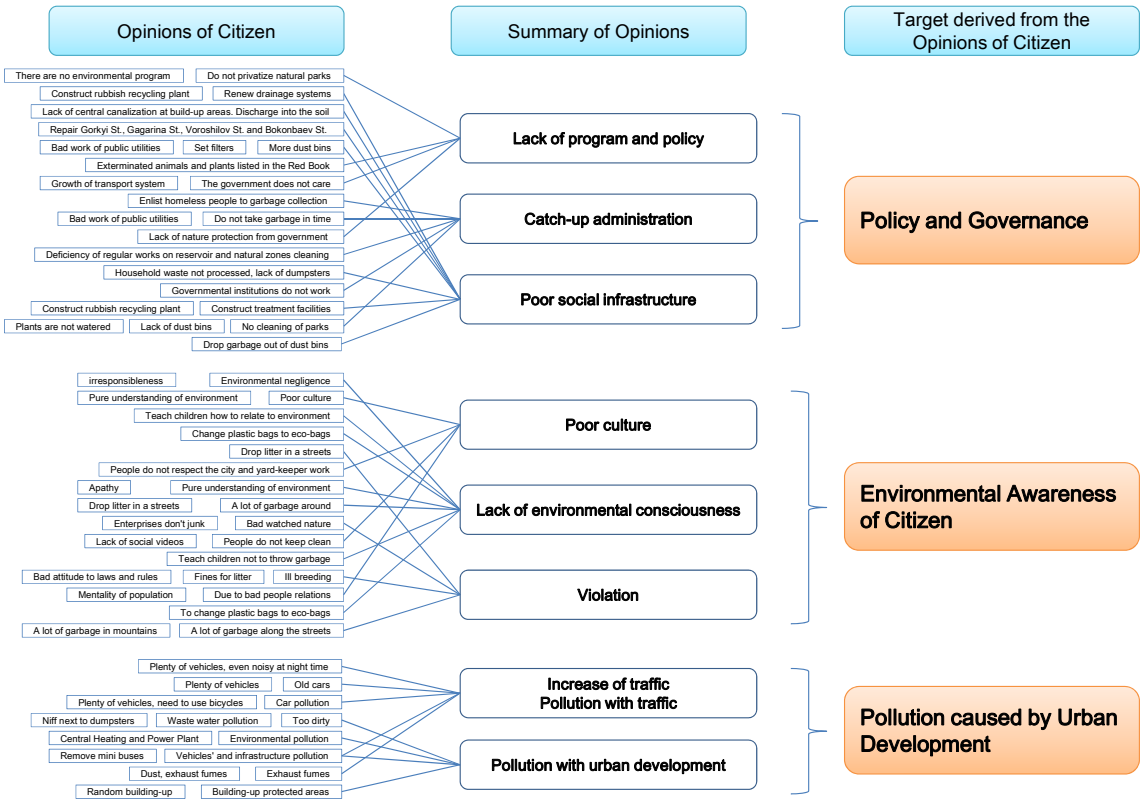


Figure 10.4-10 Q2: Summary of the Opinions (environmental problems) of the Citizens

In summary, of opinions in response to Q2 (environmental problems), the first group of the opinions summary include lack of program and policy, administration and poor social infrastructure. These opinions pointed out the issue on the perspective of the administration such as waste treatment. These opinions will derive the target of Policy and Governance.

The second group of opinions includes poor culture, lack of environmental consciousness and violation. These opinions pointed out the issues of citizen side such as littering in the streets, irresponsible, and poor culture.

The third group of opinions includes increase of traffic, pollution by traffic and pollution by urban development. These opinions point out largely the issues of traffic increase and pollution with urban development.

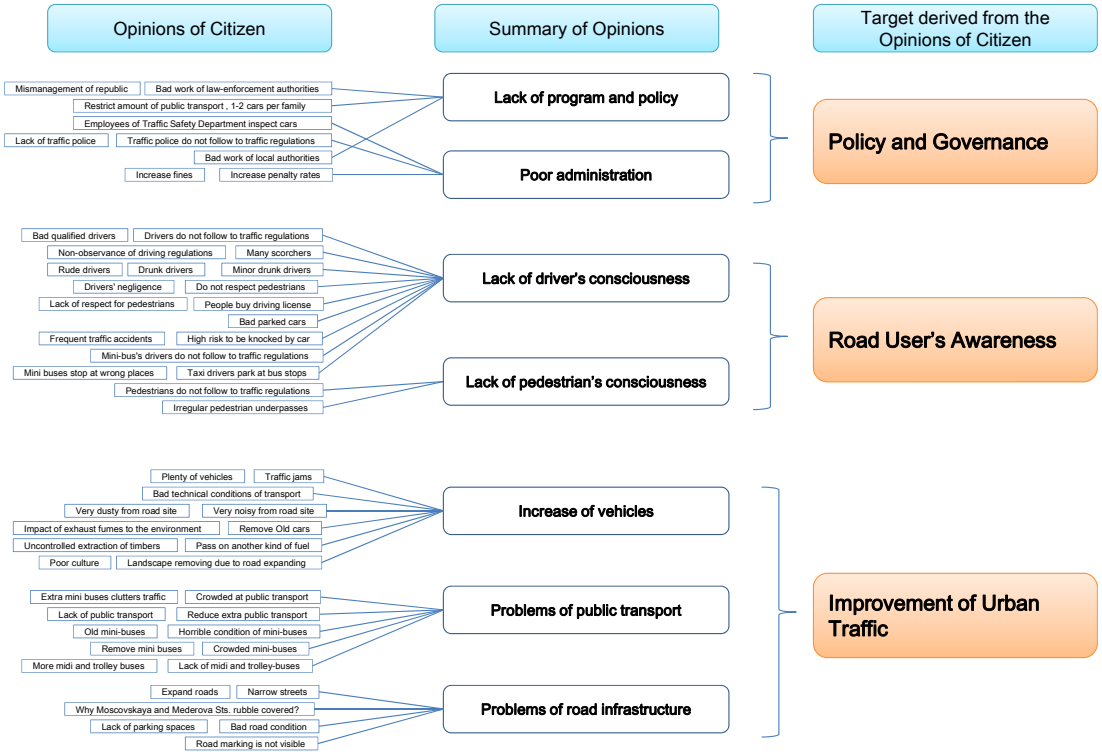


Figure 10.4-11 Q3: Summary of the Opinions of the Citizens

In summary, of opinions in response to Q3 (urban traffic), the first group of the opinions summary includes lack of program and policy and poor administration. These opinions pointed out the issue on the perspective of the administration such as traffic administration.

The second group of opinions includes lack of drivers' and pedestrians' caution. These opinions were mostly responded by drivers. Only a few number of pedestrians raised this issue.

The third group of opinions includes increase of vehicles, problems of public transportation and problems of road infrastructure. These are largely about the issues on the increase of urban traffic.

(g) Q4: Desirable vision of Bishkek City in future

Q4 is a free description for the future vision of Bishkek City desired by each respondent. Seventy nine respondents answered Q4. Based on the analysis, answers are summarized in four categories as shown in **Figure 10.4-12**.

(1) Clean and Attractive City, (2) Abundant Green, (3) Policy for the Environment and Development, (4) Sound Growth and Modernization of the City. (See **Table 10.4-2**)

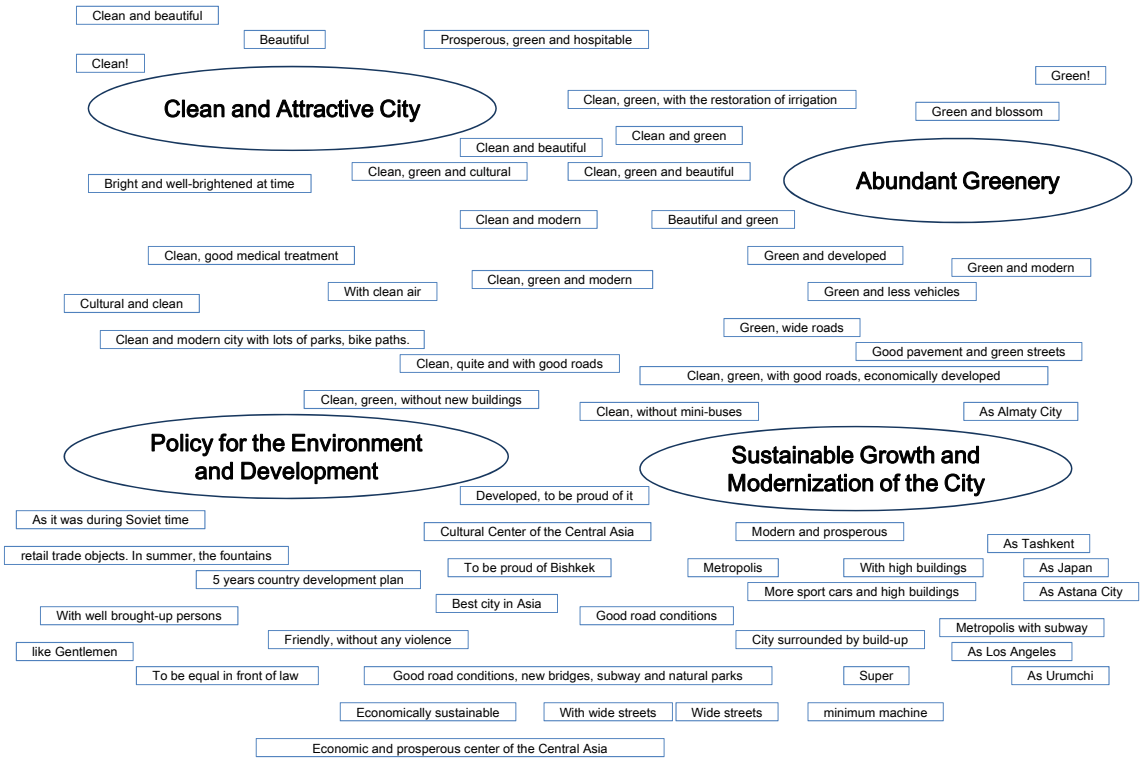


Figure 10.4-12 Summary of the Desirable Vision of Bishkek City in Future

Table 10.4-2 Summary of the Desirable Vision of Bishkek City in Future

Desired Category	No. of Respondents	Remarks
Clean and Attractive	46	Cultural,, clean, green and modern are also combined
Abundant Green	23	Like Almaty City
Policy for the Environmental Development	26	The strengthening of policy and governance, the promotion of sound development
Sustainable Development and Modernization of the City	45	Modern, green and advanced development

10.4.4 Interview on the Issues of Bishkek Environment

For the purpose of focusing the environmental issues and topics in Bishkek City, the JICA Study Team implemented an interview survey with the local specialist of the environment[7]. Information obtained by the interview is shown below.

- ✓ Environmental issues in Bishkek City are air pollution and dust.
- ✓ Causes of air pollution are emission of vehicle, houses, CHS (Central Heating Station).
- ✓ Currently, many households still use coal as fuel because gas fuel is expensive. Use of coal fuel can cause serious air pollution. (See **Picture 10.4-3**)
- ✓ Bishkek City is surrounded by the chain of mountains, and has chilly and cold seasons.

[7] Aidai BAYALIEVA (JICA Kyrgyz Republic Office)

- ✓ Temperature inversion formed under these conditions can make the air pollution worse.
- ✓ Dust is a significant and regional issue. Desertification is progressing in Central Asia and west of China around Kyrgyz Republic. It is assumed that dust occurring on the neighboring area has an influence on the atmosphere of Kyrgyz.
- ✓ Regarding noise issue, construction noise and night business noise are becoming the issues. There are few issues on traffic noise. (See **Picture 10.4-1** and **Picture 10.4-2**)

Picture 10.4-1 Construction Site in the City

Picture 10.4-2 Café at Night Time Business in the City Center

Picture 10.4-3 Smoke of Solid Fuel Emitted in the City Center

10.5 Current Practices of the Infrastructure and Traffic

10.5.1 Land Use (Building Concentration and Height, Road Width, Emission Facility)

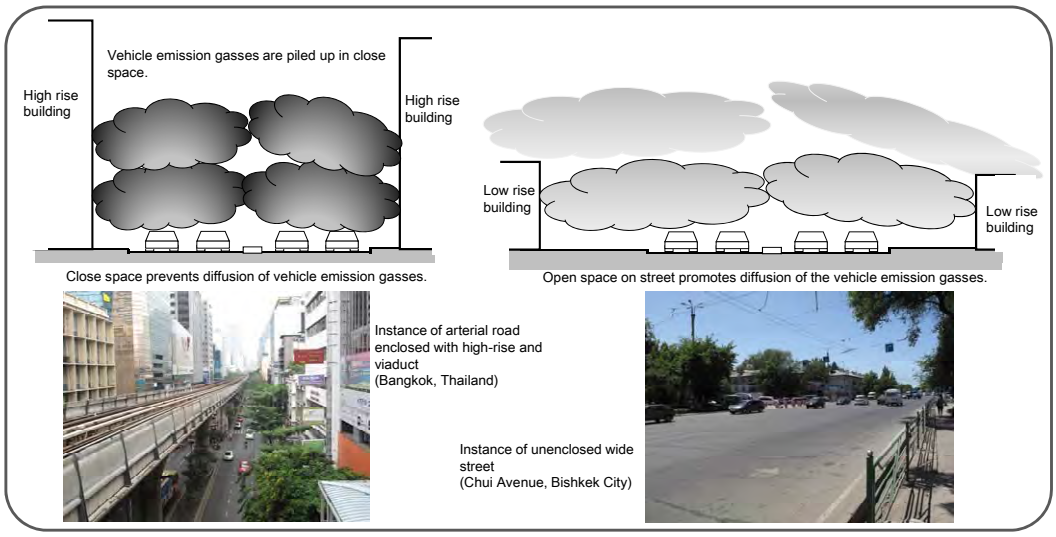
Land use is highly relevant to the environment of the City. Details of existing land use in Bishkek City are described in **Chapter 3 LAND USE COMPOSITION OF YEAR 2010**. The existing land use of Bishkek City is basically derived from General Plan 2006. The City area is orderly demarcated in a grid pattern. Streets and avenues have an open space and abundant greenery. (See **Picture 10.5-1**) In the main street, median strip is kept as a park as shown in **Picture 10.5-2**.

Picture 10.5-1 Wide Street (Chui Avenue)

Picture 10.5-2 Median Strip of Molodoy Gvardia Blvd

Further, many roadside buildings in Bishkek City are low-rise. At present, there are few high-rise buildings which prevent the dispersion of pollutants and noise.

Such conditions of the land use contribute to control the pollution derived from vehicle emissions. Wide and open space along the street promotes the dispersion of the air pollutants including vehicle emission gasses and vehicle noise. (See **Figure 10.5-1**)



Source : JICA Study Team

Figure 10.5-1 Pollutants Dispersion along the Roadside

Well-designed streets in Bishkek City have favorable conditions that keep the environment in good condition. In terms of the environmental consideration along the roadside, it is important to preserve the current condition of the land use including width of road and the floor area ratio of the roadside buildings. Based on the future economic growth (socio-economic framework), future land use was estimated. It is expected that core facilities will be constructed in the outskirts of the City Center to avoid the concentration in the City Center.

10.5.2 Current Condition of Road Infrastructure

Land use is well designed in accordance with General Plan 2006. However, road infrastructures are inferior. Interregional roads and arterial roads have asphalt pavement and pavement conditions are in acceptable levels. However, in some sub-arterial roads and collector roads, pavements of road shoulders or sidewalks are either badly deteriorated or unpaved. It is probable that the exposed soil is being transported to the roadway surface which eventually causes the increase of dust in the atmospheric air. (See **Picture 10.5-3** and **Picture 10.5-4**)

Picture 10.5-3 Deteriorated Road Shoulder Pavement

Picture 10.5-4 Unpaved Collector Road

10.5.3 Sources of Emissions

(1) Vehicle Emission

In Bishkek City, white or black smoke coming from vehicles are often found. Smoke discharged from vehicles contains PM (particulate matters), VOC (volatile organic compounds) which can affect human health. It is said that the causes of smoke emission are poor maintenance of vehicles or use of poor quality fuel. In 2012, Kyrgyz Republic abolished the mandatory technical inspection for private vehicles, which also might cause the poor maintenance of vehicles, and ultimately allowing the vehicles to discharge smoke emission. (See **Picture 10.5-5** and **Picture 10.5-6**)

Picture 10.5-5 Aging Vehicles Discharging White Smoke (1)

Picture 10.5-6 Aging Vehicles Discharging White Smoke (2)

The vehicles in the Kyrgyz Republic are aging. Vehicle aging status in the Central Asia is shown on **Table 10.5-1**.

Table 10.5-1 Vehicle Aging in the Central Asia, Russia (Vehicles Registered in 2005)

Country	Car type	0-5 years	6-10 years	11-15 years	16-20 years	>20 years
Armenia		N/R				
Azerbaijan	Passenger cars (%)	15.8	26.2	58.1		
	LDV (%)	5.7	16.5	77.8		
	HDV (%)	7.7	15.3	77.0		
	Buses (%)	11.8	20.1	68.1		
	Total (%)	14.3	24.3	61.4		
Georgia	Passenger cars (%)	4.4	12.2	26.3	24.6	32.5
	LDV (%)	0.8	12.7	42.5	31.0	13.0
	HDV (%)	2.2	9.2	18.1	43.4	27.2
	Buses (%)	2.3	1.2	38.4	36.0	22.1
	Total (%)	3.9	11.7	26.9	27.1	30.4
Moldova	Passenger cars (%)	6.51	7.93	18.89	20.15	19.81
	LDV and HDV (%)	0.85	4.01	4.87	6.59	5.83
	Buses and microbuses (%)	0.13	0.41	1.18	1.69	1.15
	Total (%)	7.49	12.35	24.94	28.43	26.79
Kazakhstan		N/A	N/A	N/A	N/A	N/A
Kyrgyzstan	Passenger cars (%)	1.6	6.3	21.4	70.7	
Russia	Passenger cars (%)	21.6	27.7	50.7		
	LDV and HDV (%)	14.0	23.5	62.5		
	Buses and microbuses (%)	26.2	26.8	47.0		
	Cars total (%)	20.6	27.0	52.4		
Turkmenistan		N/R				
Uzbekistan	Passenger cars (%)*	11.0	13.0	22.0	26.0	28.0
	LDV (%)	18.2	27.8	20.6	33.4	-
	HDV (%)	2.1	7.6	26.3	64	-
	Buses (%)	11.0	13.0	22.0	26.0	28.0
	Cars total (%)	10.6	15.4	22.7	37.4	14.0
(Reference) Japan	Passenger cars (%)	35.9	34.8	29.3		
	LDV (%)	34.9	26.2	38.8		
	HDV (%)	29.0	25.5	45.5		

Note : Data of Moldova (as of 1 January, 2008)
Source 1) : The Regional Environmental Center for the Caucasus (www.rec-caucasus.org) for the Central Asia and Russia[8]
Source 2) : Web Site of Automobile Information Center (http://autoinfoc.com/hoyu/heikindaisu/hy-heikindaisu-5.html) for data of Japan

In the Kyrgyz Republic, ninety two percent (92%) of vehicles have been operated or used more than ten years. Also, approximately seventy one percent (71%) of vehicles have been operated more than sixteen years. Aging vehicles have adverse effects to the environment. Deterioration of the engine has

[8] Fuel Quality and Vehicle Emission Standards Overview for the Azerbaijan Republic, Georgia, the Kyrgyz Republic, the Republic of Armenia, the Republic of Kazakhstan, the Republic of Moldova, the Republic of Turkmenistan, the Republic of Uzbekistan and the Russian Federation

also been resulting emission gasses worse. Operation of an aging vehicle cause significant obstacles in preventing air pollution.

(2) Traffic Flow (congestion and signal control)

At some intersections in the City, heavy traffic was observed. The congestion at intersection prevents the smooth flow of traffic. Moreover, the signal control system in the City is very old and lacks management. These situations are forcing vehicles to stop at most of the intersections of major roads. For details, please refer to **Chapter 6**, Traffic Survey and Analysis and **Chapter 9**: Traffic Control

Since vehicles produce more emission during acceleration than steady driving, unsteady vehicle flows with congestion have been causing the deterioration of air quality of the roadside.

(3) Stationary and Areal Sources

(a) Bishkek Central Heating Station

In Bishkek City, Central Heating Station (CHS) was installed and has been operating since a long time. (See **Picture 10.5-7** and **Picture 10.5-8**) The CHS is producing warm water and electricity. Fuel of CHS is coal, whose combustion produces some pollutants including sulfur dioxide (SO_2) and nitric dioxide (NO_2). These by-products (i.e. SO_2 and NO_2) may cause air pollution. All atmospheric observatories in the City observe SO_2. However, the volume of SO_2 in Bishkek City is very low at present.

Picture 10.5-7 Bishkek Central Heating Station (1)

Picture 10.5-8 Bishkek Central Heating Station (2)

(b) Emission of inhabitants

In the Kyrgyz Republic, many households use solid fuel due to lack of natural gas reserves. Therefore, pollutant emissions from households cannot be controlled in some areas. The pollution can become the worst, especially in the winter because of the distinctive atmospheric conditions such as temperature inversion[9].

[9] "Analysis of air pollution" Web Site of State Agency on Environment Protection and Forestry(KR) (http:ww.nature.kg/)

10.6 Summary of the Findings

(1) Summary of the Findings

As described in previous chapters, the JICA Study Team conducted survey on opinions of citizens, environmental baseline and current condition of infrastructure. Summary of findings of each survey are summarized below.

(a) Opinions of Citizens

Authorities of Bishkek City raised air pollution, waste, conservation of forestry and lack or deterioration of public transportation as the environmental problem of the City.

Similarly, general citizens of Bishkek City raised air quality (pollution), waste, water quality and traffic congestion as the environmental problem of the City.

(b) Baseline of the Environment (Baseline data, Law and Standards)

The concentration of nitric oxide is found higher than the standards (MAC). Since it is severe especially along the roadsides, it is believed that high concentration of NO is caused by vehicle emissions. Other significant factors of pollution were not found.

(c) Current Condition of the Infrastructure and Traffic

Land Use:

The spacious and well-designed land use of Bishkek City contributes to the dispersion of air pollutants and noise. It is also contributes for mitigation of urban pollution.

Road Infrastructure:

Some deteriorated and unpaved road are producing dust which ultimately making atmospheric air pollution.

Vehicle Emission:

Since vehicles in the Kyrgyz Republic are very old and poor condition due to lack of maintenance, it is believed that the vehicle emissions have more pollutants and harmful.

Traffic Flow:

Heavy traffic volumes at some intersections in the City prevent the smooth flow of traffic. Moreover, the signal control system is very old and lacking rational control. Therefore, these conditions are forcing vehicles to stop at almost every intersection of the major roads.

(2) Comparison to the Environmental Categories and Items of JICA Guideline

The JICA Study Team has proposed the projects related to effective use of transportation infrastructure, EST promotion, public transportation service improvement, traffic management, etc. These projects do not accompany with the big construction work which require EIA and RAP. Therefore, findings of the survey (i.e., survey on environment) should be applied effectively to the

recommendations on the environmental issues. **Table 10.6-1** shows the environmental items that should be considered are verified based on the categories and items of JICA Guideline.

Table 10.6-1 Evaluation of Environmental Items

Categories	Items	(1) Opinions of Citizens	(2) Baseline of the Environment	(3) Current Condition of the Infrastructure and Traffic	Requirement on traffic planning	Remarks
Anti-pollution	Air quality	A	A	A	A	As urban environment, *air quality, water quality, waste, noise and vibration* and *odor* should be considered. However, *water quality* and *waste* have no relation to the traffic planning. *Air quality* is a primary issue in all aspects.
	Water quality	C	C	C	D	
	Waste	A	N/A	A	D	
	Soil contamination	D	N/A	D	D	
	Noise and vibration	B	N/A	B	B	
	Subsidence	D	N/A	C	D	
	Odor	B	N/A	C	B	
	Sediment	D	N/A	D	D	
Natural environment	Protected areas	A	N/A	B	D	The JICA Study Team will not recommend the big project with huge construction work. Therefore recommendation have no impact to natural environment directly. However abundant environment of Bishkek city is facing a crisis, so *ecosystem* should be considered on the Study for the purpose of the conservation of the natural environment.
	Ecosystem	A	N/A	B	B	
	Hydrology	B	N/A	B	D	
	Topography and geology	D	N/A	D	D	
	Management of abandoned sites	D	N/A	D	D	
Social environment	Resettlement	D	N/A	D	D	The Study will not recommend the big project requiring the resettlement. Therefore the recommendations will have no impact to social environment.
	Living and livelihood	D	N/A	D	D	
	Heritage	D	N/A	D	D	
	Landscape	B	N/A	B	B	
	Ethnic minorities and indigenous peoples	D	N/A	D	D	
	Working conditions	D	N/A	D	D	

A : Significant impact is expected.
B : Impact is expected to some extent.
C : Extent of positive/negative impact is unknown. (Further examination is needed, and the impact could be clarified as the study progresses)
D : No impact is expected.

Table10.6-1 shows the environmental items of JICA Guideline and the necessities of consideration.

Regarding pollution, waste and air quality need to be considered. Opinions and findings on current conditions show their significance. However, issues of waste have no direct connection with the urban traffic. Regarding natural environment, protected areas, ecosystem and hydrology are the factors that should be considered. The protected area and ecosystem in Bishkek City are facing big problems due to uncontrolled or illegal development activities.

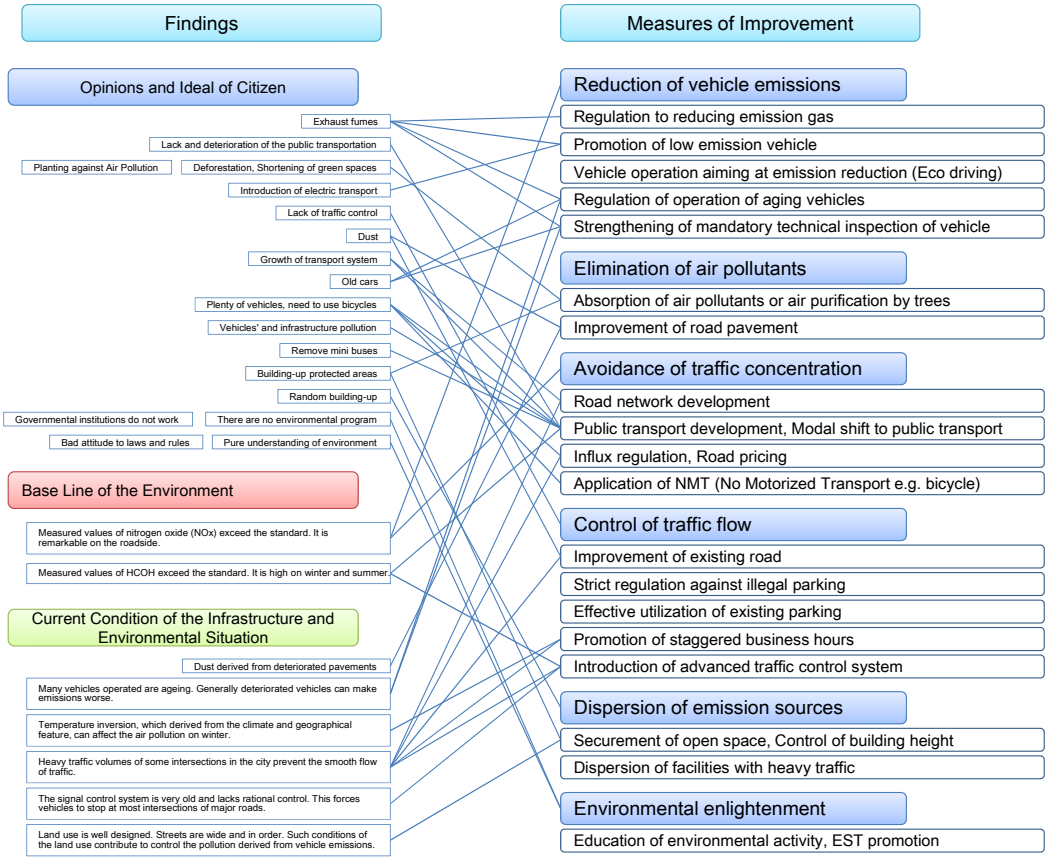
As mentioned above, the JICA Study Team has not proposed the projects that need a big construction work which requires EIA and RAP. Therefore, social environment is less important than the issues of pollution and natural environment.

In summary, consideration of air quality in respect of the urban traffic is most needed in Bishkek City. Improvement / conservation of air quality should be primarily considered.

10.7 Findings and Improvement Measures

Some improvement measures relating to environment are drawn from the findings of the survey.

Figure 10.7-1 shows relation between the findings of the survey (on the air quality) and corresponding improvement measures.



Source : JICA Study Team

Figure 10.7-1 Relation between the Findings and Measures of Improvement

These measures are broadly classified into two categories as reduction of emission and promotion of pollutant dispersion. The reduction of emission is the primary measure with respect to the conservation of air quality and this measure should be implemented in advance in comparison with others. (See **Figure 10.7-2**)

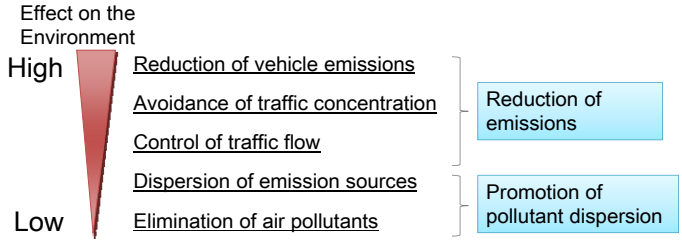


Figure 10.7-2 Effect of the Improvement Measures

10.8 Recommendation on Environmental and Social Consideration

Table 10.8-1 and **Table 10.8-2** shows practical approaches for Bishkek City for the improvement measures of the environment. The practical approaches also refer to EST (Bangkok Declaration for 2020).

Table 10.8-1 Practical Approaches for Environmental Improvement Regarding Urban Traffic (1)

Improvement Measures	Practical approach for Bishkek City
1. Reduction of vehicle emissions	
Reduction of emission gas	Shifting to European Emission Standards The emission gas is regulated by GOST17.2.2.03-87 and GOST 21.393-75. Developed countries are introducing European Emission Standards which is advanced and global standards of vehicle emissions. Russian Federation also has been introducing these standards. Shifting to European Emission Standards is hoped to reduce the vehicle emission.
Promotion of low emission vehicle	Introduction of EV, pHV Introduction of low emission vehicle such as EV (Electric Vehicle) and pHV (Hybrid Vehicle) is the most effective measure to control air pollution. Kyrgyz has abundant hydropower potential. Thus, introduction of EV may achieve zero emission in the traffic sector.
Vehicle operation aiming for emission reduction (Eco driving)	Eco Driving education for the public transportation drivers Driving mode affects fuel consumption and the vehicle emission. Improvement of driving mode (Eco Driving) may improve the vehicle emission. Especially, awareness education about eco-driving to the public transportation driver is effective because it is possible to control by devices such as a digital tachograph by installing it on the public buses.
Regulation for operation of aging vehicles	Regulation against trading or importing of aging vehicles Aging vehicles are manufactured based on the old standards which are low level in terms of environmental problem. Furthermore, deterioration of power plant aggravates the vehicle emission. Regulation against trading or importing of aging vehicles is believed to be effective.
Provision of mandatory technical inspection of vehicle	Regular maintenance and technical inspection for vehicles is very effective in controlling vehicle emission. Enforcing provision of mandatory technical inspection for vehicles is believed to be effective.

Source : JICA Study Team

Table 10.8-2 Practical Approaches for Environmental Improvement Regarding Urban Traffic (2)

Measures of Improvement	Practical approach for Bishkek City
2. Elimination of air pollutants	
Absorption of air pollutants or air purification by trees	Preservation of the existing greenery Trees have a function of absorption of air pollutants or natural air purification. Bishkek City has abundant greenery along the roadside. The existing greenery can control the air pollution. Preservation of the existing greenery is believed to be effective in controlling air pollution.
Improvement of road pavement	Controlling dust by repair of road pavement Reduction of bared ground can control dust in the atmosphere. Repair of deteriorated pavement is recommended. Also, plantation in the uncovered surface of the road shoulder is recommended.
3. Avoidance of traffic concentration	
Road network development	The improvement of transportation such as avoidance of traffic concentration and control of traffic flow increases efficiency and reduces redundant traffic. Hence, the improvement of the transportation system reduces the environmental burden too. The purpose of this study is improvement of the urban transportation. Transportation improvement plan are prepared and described in Part III of this report. Improvement plans are prepared by analyzing the current condition of the traffic in Bishkek City. Part III: Urban Transportation Improvement MP Implementation of the recommended plan will reduce the environmental burdens including air pollution.
Public transportation development, Modal shift to public transport	
Influx regulation, Road pricing	
Application of NMT (No Motorized Transportation e.g. bicycle)	
4. Control of traffic flow	
Improvement of existing road	
Strict regulation against illegal parking	
Effective utilization of existing parking	
Promotion of staggered business hours	
Introduction of advanced traffic control system	
5. Dispersion of emission sources	
Securement of open space, Control of building height	Land use of Bishkek City is open and spacious. Moreover, the buildings along the roadside are comparatively low-rise. This condition has advantage to keep the environment of the roadside in a good condition and this condition should keep as it is in the future as well.
Dispersion of facilities to control heavy traffic	Concentration of facilities attracting population makes the environment worse. Implementation of land use by dispersing public facilities in the outskirts of the City is believed to effective to reduce traffic concentration in the City Center.

Source : JICA Study Team

10.9 Conclusion

As discussed above, Bishkek City has significant environmental issues, such as waste, air pollution and natural environment. Regarding the traffic, the issue of air pollution has been becoming serious. However other issues due to traffic such as noise are not remarkable so far.

On the other hand, it should be noted that the Bishkek environment keeps fine conditions if abundant greenery is maintained as it is as shown in **Picture 10.9-1**. Since this condition is effective in the prevention of pollution, it should be preserved or be without any deterioration.

Picture 10.9-1 Street in Bishkek City with Abundant Greenery

The increase of traffic activity with future economic boom will cause the increase of pollution and deteriorate the environment. For tackling this issue, the measures mentioned previously are highly recommended. These preventive measures should be implemented without further delay because if it is implemented late, the environment might be worse. These measures help to keep the environment in a good condition and realize Environmental Sustainable Transportation (EST).

CHAPTER 11 SUMMARY OF PROBLEMS AND ISSUES IN CURRENT CONDITIONS

11.1 Problems and Issues

Based on the results of surveys and analysis in the previous chapters, problems and solutions to issues in current conditions in Bishkek are summarized as follows:

Category	Present Situation	Problems and Solutions to Issues in Transportation
(1) Socio - Economic Conditions	Trade : Expanding trade deficits (export : 1,488.4 million USD against import : 3,223.1 million USD in 2010) Tax League: Competitive advantage declining due to neighboring countries' membership to the WTO.	Problems ・Competitiveness declining due to increase of transport cost for a landlocked country ・Declining city status for a regional logistic terminal for ex-CIS countries Solutions to Issues ・More efficient transport by improving freight transport network to smoothen connection with international highways ・Ensuring the city's regional advantages by making the City a regional and state transport hub, with substantial urban transport development. ・Enhancement of International Logistic Center (Dordoi Market) with improving transport access
	The City Finance ・Increase of expenditure and reducing tax revenues causing financial deficits ・Reduction of state budgetary allocation to the city ・Improving financial situation of the City	Problem ・Declining level of city' public services ・Lack of public projects for income and tax generation ・Low payment by transportation facility users (road, transit, and parking user) Solutions to Issues ・Review transit fares, parking, etc. by beneficially-pay's principle ・Privatization of public transportation operation ・Promotion of private sector involvement in new transportation business ・Tax increase policy by stimulating urban economy through transportation improvement
	Demography ・1,173,000 habitants (estimate in 2010) ・Economically Active Population (62%) ・Inactive population (aged and children) (10.8%) ・Increase of labor population and insufficient employment opportunities in the near future ・Inflow of labor in the City and migration t overseas	Problem ・Rapid rate of population increase ・High unemployment rate Solutions to Issues ・Creating jobs for urban setting ・Development of urban industries by transport sector ・Promote urban tourism and business reactivation ・Traffic facility improvement for increase in the traffic vulnerable with barrier-free (universal design) and strengthening traffic safety
(2) Land Use	Urban Planning and Structure ・City construction by historical urban planning ・Urban structure with a grid road pattern ・Compact urban structure by planning	Problem ・Little awareness of city's history and buildings as tourist attractions ・Less usage of cultural facilities for tourism Solutions to Issues ・Preservation of historical streets ・*Spreading business cores to CBD and bazaars, and "flatting urban" without an urban core (land*

Category	Present Situation	Problems and Solutions to Issues in Transportation
		marks)
	Land use : CBD ・Low buildup with wider CBD where administrative and service facilities are located, including City hall, cultural buildings, universities, parks, ・Low apartments by mixed use of residence, shops, and office ・Insufficient attractive power to consumers by lack of business core ・Ongoing construction of tall complex buildings	Problem ・Declining competitiveness with surrounding shopping centers (bazaars), old CBD activities ・Lack of area renovation plan for CBD Solutions to Issues ・Planning of CBD renovation and implementation ・Arrangement of business spaces and specific facilities to attract pedestrian shoppers ・Utilizing Pedestrian Mall method as a successful social experiment
	Land use : Urban Area ・Disorderly dispersed exiting factories ・Vacant spaces in old factories along the rail station ・Rail grand crossing causing not so heavy congestion due to infrequent trains passing ・Railway undercrossing for trunk roads	Problem ・Discontinuation of town development by railway ・No clear renovation strategy for the existing factories and spacing near the rail station ・No planning for zone renovation in urban area Solutions to Issues ・Road planning to ensure continuation of town development ・Promotion of buildup of industrial factories and planning of efficient freight and passenger flows ・Renovation, urban planning of railways and stations ・Long-term review of city development as Transit Oriented Development (TOD)
	Land use : Suburbs ・Urbanization in the suburbs ・Illegal housing development against Land Use Plan (General Plan 2006)	Problem ・Unexplained and unauthorized land use ・Insufficient provisions for road and public transportation service ・Sprawling housing development causing difficult provision of public service Solutions to Issues ・Management of housing development due to insufficient road and transit services ・Requirement for public consultation for General Plan 2006 ・Formulate clear procedures for public participation to ensure accountability
(3) Road and Facilities, and Maintenance Management	Road Network and Structure ・Sufficient capacity as network (see (4) Traffic) ・Grid pattern road network ・Wide road right of way (ROW): 30 to 50 meters width for trunk road ・Complete separation between vehicle and pedestrian traffic ・North-south roads across railway mostly at-grade level	Problem ・Underused existing road assets ・Insufficient road and traffic facility repair and maintenance management ・Lack of improvement for roads other than trunk roads Solutions to Issues ・Development control of housing, and lacking road and transit services ・Establish or clarify road functions and classifications for the prioritization of road improvement ・Establishing road maintenance management
	Road Facilities and Maintenance ・Climate conditions having min -34°C	Problem ・Obstructions of smooth traffic flow caused by

Category	Present Situation	Problems and Solutions to Issues in Transportation
	in winter and max +43°C in summer causing rapid deterioration of pavement (cracks &potholes) ・Increasing maintenance required annual repair expense ・Maintenance of road markings every year due to poor quality materials used ・Deteriorated road drainage facilities such as uncovered and manholes. ・Limited traffic signs ・Unused underground pedestrian lanes crossing due to unsafe and dirty conditions	pavement damages during winter ・Requirement of road maintenance work of patching and sealing of cracks resulting in financial burden ・Inadequate repair of roads and traffic facilities ・Short life span of work on roads, pavements and facilities Solutions to Issues ・Optimization of maintenance budget by adopting proper road markings and technical specifications ・Establishing of road maintenance system with proper inspection and repair ・Reviewing cost-saving methods and new maintenance-free pavement (Concrete with asphalt cover) and supply of equipment to contractors ・Reviewing traffic sign location, including review of regulation and application of traffic signs for travel speed, one-way direction, reversible and exclusive transit way, parking, and roadside management ・Need of clearing and installation of surveillance cameras at underground crossings at North and South Bus terminals
	Road Greenbelt and Park in Road ・Locating parks and urban green belts in ROW providing highly environmental consciousness ・A sophisticated gravity irrigation canal / ditch system for the greens ・Park in roads becoming a “Pedestrian Reservoir” for citizen ・Reducing green belts by using parking space	Problem ・Insufficient repair of irrigation facilities ・Lack of knowledge in use of water cooling systems to mitigate summer heat ・Insufficient preservation of road greens ・Lack of comprehensive planning incorporating road green belts and parks Solutions to the Issues ・Establishment of repair and maintenance management for road drainages, green belts, and parks ・Promoting the road greening and reviewing usage of the irrigation system with roadside waterfront environment ・Using road spaces for preservation of urban ecosystem as “Green and Park City”
(4) Traffic (V/C = vehicle volumes/ road capacity)	Road capacity: V/C Ratio ・In 2011, 0.5 (daily traffic), 0.6 (peak hour), in 2023, increasing at 0.6 and 0.7, respectively Travel Speed ・In 2011, 30 km/h of daily traffic and 22.7 km/h of peak hour. In 2013, reducing at 15.1 km/h of peak hour. CO_2 Emission ・In 2011, 330 kilo ton/year, in 2023 increase at 416 kilo ton/year	Problem ・Sufficient road capacity as a network; but insufficient use of network capacity due to unclear road function and hierarchy Solutions to Issues ・Separating through traffic and local traffic by clarifying the road classifications ・Clear function for each road, such as transit priority, parking control, one way, pedestrians first, and others ・Reducing CO_2 emission from transport sector
	Traffic Congestion Ratio/ Bottleneck ・1.2 near Dordoi Market and 1.0 and more at intersections of CBD	Problem ・Congestions and bottlenecks at certain locations, intersections and near the markets Solutions to Issues ・Definitive measures taken at each bottleneck

Category	Present Situation	Problems and Solutions to Issues in Transportation
		(parking control, traffic flow smoothness at intersections, traffic signal control, area traffic improvement, and others)
(5) Public Transportation (PT)	Transit Modes and Management ・City trolleybus and city bus, and private minibus (Marshrutka) operating as public transportation mode ・Bus routes duplications causing congestions at bus stops ・Insufficient coordination among each PT departments of the City ・Unclear operating regulations for all transit modes ・Low numbers of riders (passengers by a bus) of city PT due to a lack of clear functioning policy and planning share for each PT mode ・Extension of minibus routes covering a no-service area by trolleybus and midibus ・A lack of PT service standards and no response to bus users' opinions on bus services	Problem ・Causing competition on service routes operated by all transit modes ・Improper functional distinction or definition of all modes ・Lack of service standards ・Prompting traffic obstructions and causing accidents through congestion and risky driving Solutions to Issues ・Review of mandate for all relevant departments and establishment of integrated authority covering all public transportation services ・Establishing PT service standards and regulating Level of Service (LOS) of bus operators ・Review of roles of trolleybus, midibus and minibus (Marshrutka) and proper allocation of all modes with improvement of LOS ・Review of City's public transport policy by introducing the private sector into public transportation service ・Management of safety operation and driver training
	City Trolleybus and Midibus ・New trolleybus (approximately 100 units) in 2013 and renewal of its route ・Restoration of 100 city buses in 2011 ・Fix fare system ・City subsidy for bus operation ・Infrequent and long distance between bus stops	Problem ・Low operation frequency and service routes ・Increase in the City financial deficiency by subsidies ・Inconvenient bus stop location due to a long interval for bus user Solutions to Issues ・Improvement of number of riders ・Improvement of LOS ・Establishment of a mechanism to obtain user and community opinions by periodic bus survey ・Review of new routes and route extension ・Review of introducing PPP ・Service improvement by Park and Ride
	Private Minibus (Marshrutka) ・Most used mode (90% of PT) ・During old city trolleybus and midibus service, only private minibuses are operating efficiently ・Operation on franchise contract by route with the City and the private firm	Problem ・Standing passengers in a small sized vehicle ・Neglect of safety and traffic rules by driver for his fare revenue ・No planning of route extension between CBD and suburbs Solutions to Issues ・Optimizing the number of midibus by introducing a big sized bus and improvement of profitability for each bus ・Control of safety driving ・Coordination of routes and frequency with the city trolleybus and bus ・Improvement of LOS by on-time operation by time table and introducing bus approach information

Category	Present Situation	Problems and Solutions to Issues in Transportation
		system at bus stop ・Clear function and role of minibus
	Bus Stop ・No bus time tables or a route map, only simple seats and shelters ・A lack of bus routes information covering all transits ・Unfavorable bus operation and bus stop location not to meet the users request ・Risk of bus and passenger accidents ・Improper taxi parking location at bus stops	Problem ・A lack of on-time operation at bus stop due to a lack of time table ・Inconvenient bus operation for users due to a lack of route maps and time table ・Risk of traffic accident ・Unsafe bus stop design Solutions to Issues ・Improvement of safety bus operation at bus stop ・Review of proper bus stop design ・Introducing bus information system ・Extension of an improving model of bus stop introduced during social experiment of the Study
	Bus Fare ・Inefficient bus fare collection and unsustainable bus fare system ・Introducing IC ticket to trolleybus by a feasibility study of PPP by EBRD	Problem ・Unclear fare collection system by cash handling Solutions to Issues ・Preparation of bus fare policy with detailed cost and passenger survey ・Introduction of "cashless fare" system for all transit modes
(6) City Parking	On Street Parking ・On-street parking causing traffic obstruction and congestion ・Traffic police and the city cannot control and remove illegally parked cars due to inappropriate parking law and regulation. ・Illegal on-street parking, unauthorized private parking lots along street due to the lack of penalty ・Illegal parking nearby intersections and bus stops by private car and taxies Off Street Parking ・Unclear regulations in setting up parking facilities by commercial and office buildings ・Unutilized off-street parking facilities due to the lack of parking information Parking Fee ・Low parking fee not covering all social costs ・Manual collection by the contractors	Problem ・On-street car parking becoming traffic obstruction ・Misuse of parking facilities due to a lack of information ・Illegal parking and insufficient parking control ・Low parking fees promoting car use in CBD ・Lack of parking laws and regulations ・Car parking obstructing bus operation Solutions to Issues ・Law enforcement against illegal parking ・Provision of parking facilities ・Preparation of parking laws and regulations ・Parking information system using ICT system of mobile phone system ・Introducing cashless parking fee collection system ・Introducing of PPP for parking operation ・Establishment of sole parking authority with coordination of relevant departments ・Parking control at intersections ・Introducing roadside (curb) management in coordination with all stakeholders and departments ・Parking policy coordination with traffic demand management in CBD ・Introducing no car and parking zone
(7) Intersection and Traffic Control	Intersection ・Improper configuration for increasing traffic of intersections ・Lack of safety facilities for pedestrian crossing	Problem ・Causing traffic congestions and accidents ・High risk of traffic accident for pedestrian crossing Solutions to Issues ・Improvement of intersection ・Priority for critical intersections to install pedestrian safety islands for smooth traffic flow and

Category	Present Situation	Problems and Solutions to Issues in Transportation
		pedestrian ・Introducing universal design for traffic ・Extension of an improving model of intersection introduced during social experiment of the Study
	Traffic Control ・A lack of management of traffic signals ・Use of old traffic signals ・Time for pedestrians crossing too short ・Inappropriate signal cycles and signal phasing with isolated and fixed pattern for all 203 signal units ・Outdated signal system (75% are more than 20 years old)	Problem ・Improper traffic control causing peak hour congestions ・High risk of pedestrian safety and traffic accidents Solutions to Issues ・Introduction of management of traffic signals with automatic traffic detectors in accordance with traffic volume at the intersections ・Extension of improved traffic control introduced during social experiment ・Introducing all city signal control connections with a control center system
Environmental and Social Considerations	・Abolishing of a vehicle inspection system (VIS)	Problem ・Causing increase in air pollution and traffic accidents by aged cars and a lack of car inspection system Solutions to Issues ・Review of the present VIS and improvement with new inspection system for car emission gas ・Promoting a low carbon car

PART II: FUTURE SOCIO - ECONOMIC FRAMEWORK, LAND USE AND TRAVEL DEMAND FORECAST

CHAPTER 12 FORECAST OF FUTURE SOCIO - ECONOMIC FRAMEWORK

12.1 Population Projection up to 2023

12.1.1 Estimated Population in Study Area, 2002 and 2005

In order to obtain indices on the changes in the pace of population growth, the population of 2002 and 2005 were estimated based on the available aerial photographs for respective years. The areas urbanized in the periods of 2003-2005 and 2005-2010 were initially identified by comparing these aerial photographs, and then, the population of 2002 and 2005 were estimated by subtracting the population in the built-up areas developed during these periods from the estimated population of 2010. **Figure 12.1-1** shows the identified built-up areas developed after 2002 and 2005. **Table 12.1-1** shows the estimated population in 2002, 2005, and 2010.

By the results of the above estimation, it is revealed that the immigration trend has been enhanced after 2005 as the annual growth rate increased from 1.15 percent to 1.70 percent in the Study Area as a whole. It should be noted that the annual growth rate was accelerated to 3.3 percent from 0.71 percent outside Bishkek City, while that of inside Bishkek City kept constant pace at around 1.26 percent.

Table 12.1-1 Estimated Population in the Study Area, 2002, 2005 and 2010

Area	Population (person)			Annual Growth Rate (% / year)	
	2002	2005	2010	2002 ~ 2005	2005 ~ 2010
Bishkek City	785,753	816,039	868,556	1.27	1.26
Outside Bishkek City	206,747	211,161	248,744	0.71	3.33
Study Area	992,500	1,027,200	1,117,300	1.15	1.70

Source : JICA Study Team

Figure 12.1-2 shows the average annual increase of population between 2005 and 2010 by traffic zone. It indicates that the growth rates are higher in the central area as well as the periphery areas, rather than the intermediate areas.

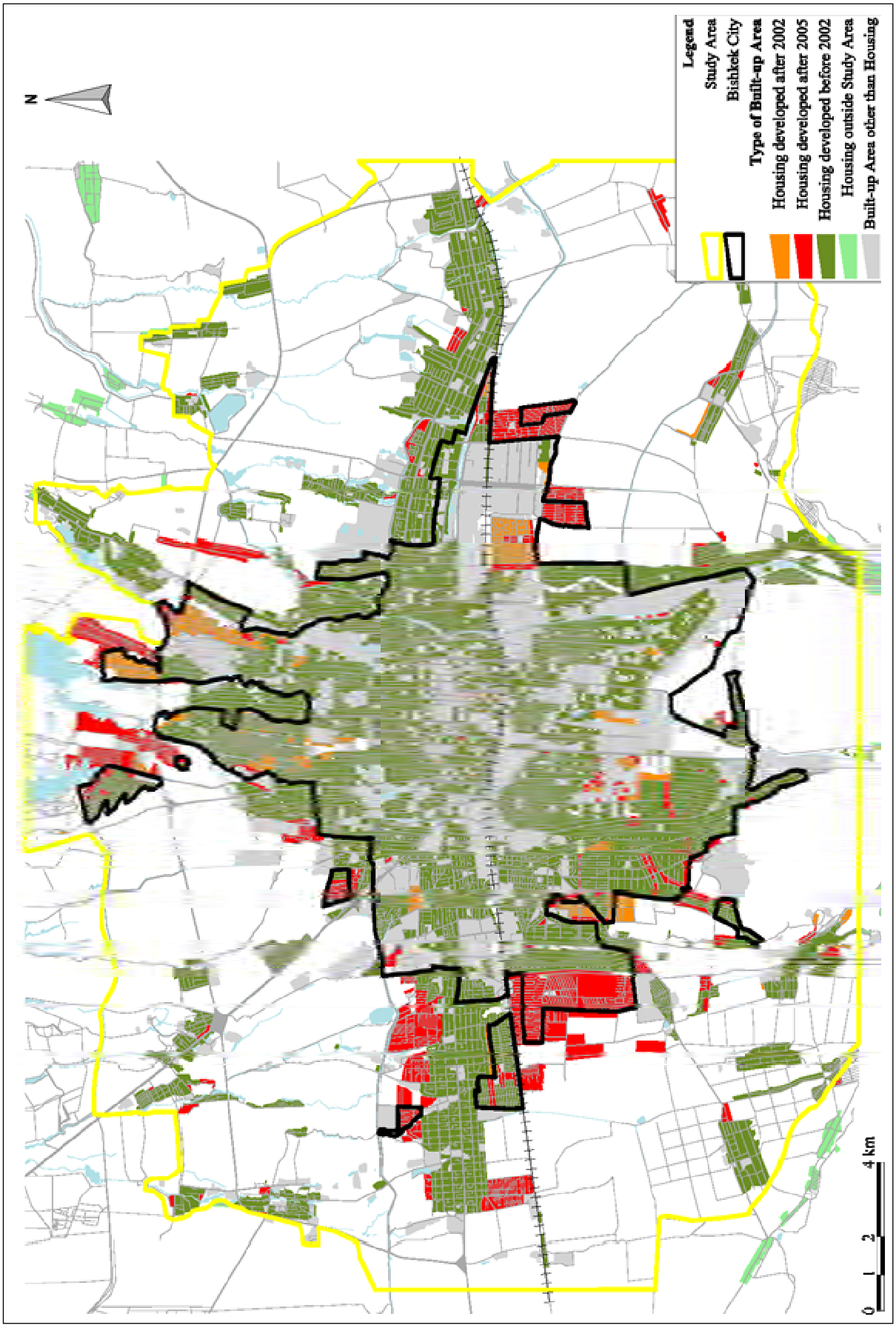


Figure 12.1-1 Built - Up Area Developed in Study Area after 2002 and 2005

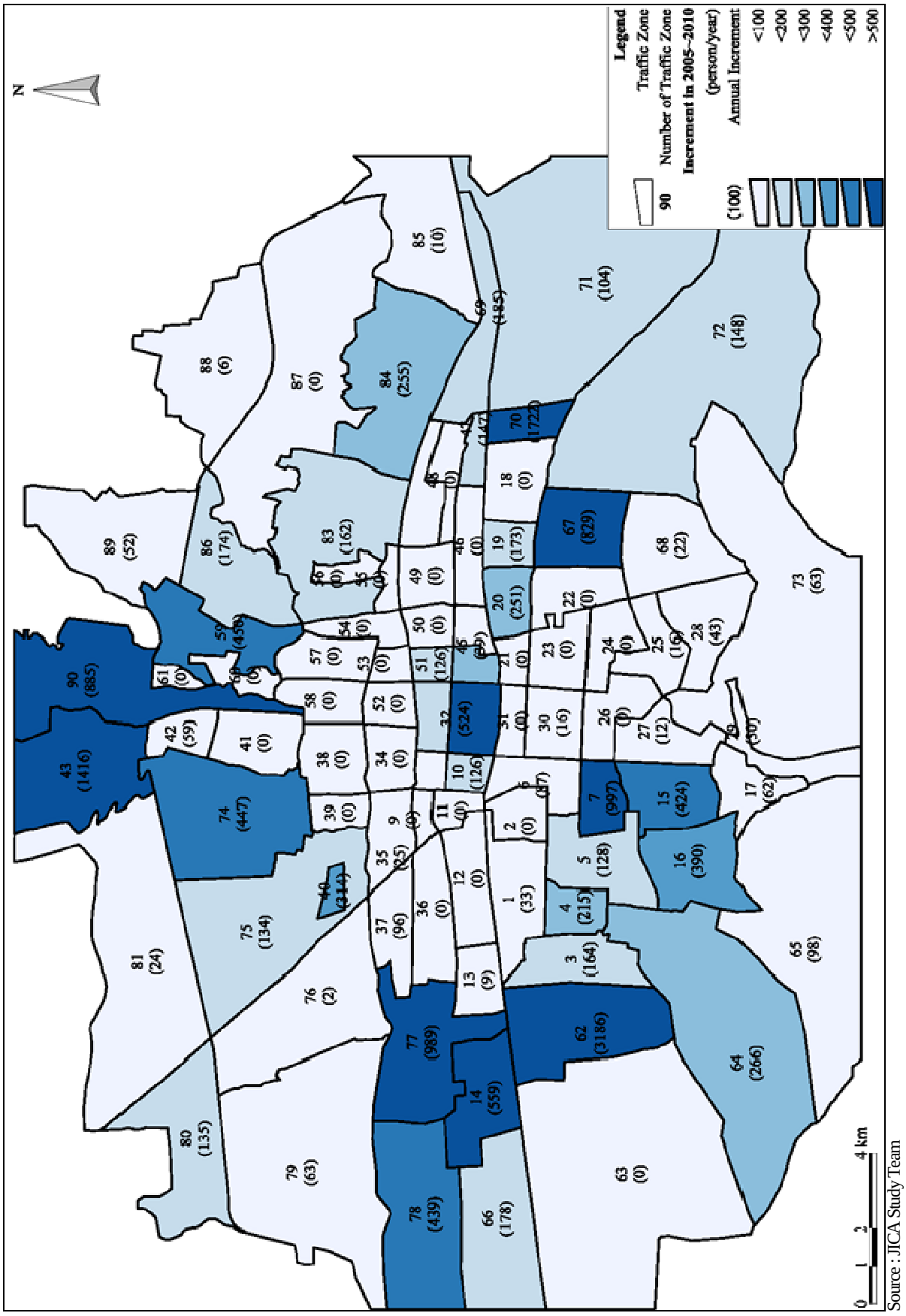


Figure 12.1-2 Annual Incremental Population in Study Area between 2005 and 2010

12.1.2 Population Projection up to 2023

The future population of the Study area is estimated for two cases by using different annual growth rates up to the years of 2013, 2018, and 2023. Case A assumes that the annual growth rate will be retained until 2023, at the same level in the period from 2005 to 2010 (1.7%). Case B assumes that the annual growth rate will further increase to 2.0 percent up to 2018 and then ease to 1.85 percent up to 2023. The latter can take place as the share of economically active population in the rural areas of the country was high at 67.0 percent in 2009. Migration to Bishkek City may be further accelerated in coming years. For planning purposes, the Case B was adopted as it is on the safer side to conduct the traffic demand forecast to be used for the transport master planning. The future population of the Study area is projected to be nearly 1.4 million persons in 2023, as shown in **Table 12.1-2**.

Table 12.1-2 Estimated Population in Study Area up to 2023

Year	Case A: Current Trend			Case B: Higher Trend		
	Population (1,000)	Growth Rate (% / year)	Annual Increment (1,000 / year)	Population (1,000)	Growth Rate (% / year)	Annual Increment (1,000 / year)
2002	992.5	-	-	992.5	-	-
2005	1,027.2	1.15	11.6	1,027.2	1.15	11.6
2010	1,117.3	1.70	18.0	1,117.3	1.70	18.0
2013	1,175.0	1.70	19.2	1,185.7	2.00	22.8
2018	1,278.0	1.70	20.6	1,309.1	2.00	24.7
2023	1,390.0	1.70	22.4	1,434.8	1.85	25.1

Source : JICA Study Team

12.2 Socio - Economic Framework up to 2023

The future socio-economic framework of the Study area was forecasted for the planning years of 2013, 2018, and 2023. It is assumed that the GRDP growth rates for the first three years will be around 6 percent until 2013, 5.5 percent from 2013 to 2018, and 5 percent from 2019 to 2023. These growth rates were employed based on a series of discussions with BCDA. The following scenarios were taken into consideration to set the growth rates for projection work.

(a) The economic growth of the city will be stable after recovering from the financial crisis and gain more maturity in the production and service provision.

(b) The agricultural industry will preserve the precious green areas in the periphery area of Bishkek City. It is expected that these areas will serve as the primary source of vegetables along with other agro-products for urban consumption.

(c) The Study Area will continue to be the center of the manufacturing industry of the country, while the service industry will continue to be the leading industry of the city.

(d) The enrolment rate at the compulsory education from G1 to G9 will be retained at 100 percent. The enrolment rate will gradually increase from 87 to 90 percent at the age group from 16 to 20

years old for secondary and higher education. The enrolment rate for the age group of 21 years old and over in the higher education will also increase along with the rise of the GRDP per capita.

Table 12.2-1 shows the result of the projection of socio-economy within the Study Area up to 2023.

Table 12.2-1 Socio - Economic Framework up to 2023

Item		Unit	2010	2013	2018	2023
GRDP		million SOMS	78,328	93,195	121,802	155,454
	Agriculture	million SOMS	614	665	720	744
	Industry	million SOMS	23,520	29,119	38,192	44,810
	Service	million SOMS	54,193	63,411	82,891	109,900
GRDP Growth Rate		% / year	-	6.0	5.5	5.0
	Agriculture	% / year	-	2.7	1.6	0.7
	Industry	% / year	-	7.4	5.6	3.2
	Service	% / year	-	5.4	5.5	5.8
GRDP Structure	Agriculture	%	0.8	0.7	0.6	0.5
	Industry	%	30.0	31.2	31.4	28.8
	Service	%	69.2	68.0	68.1	70.7
GRDP per Capita		SOMS	70,105	78,599	93,043	108,345
	Growth Rate	% / year		3.9	3.4	3.1
Economically Active Population		1,000	509,952	538,176	592,429	647,510
Employment Population		1,000	405,358	442,935	505,198	583,320
	Agriculture	1,000	2,976	2,905	2,828	2,800
	Industry	1,000	37,648	40,738	45,127	46,272
	Service	1,000	364,734	399,292	457,243	534,248
Employment Structure	Agriculture	%	0.7	0.7	0.6	0.5
	Industry	%	9.3	9.2	8.9	7.9
	Service	%	90.0	90.1	90.5	91.6
Unemployment Population		1,000	105	95	87	64
	Unemployment Rate	%	20.5	17.7	14.7	9.9
Student Population	G1 ~ G9	1,000	143,171	152,053	167,878	183,997
	G10 ~ G11	1,000	38,559	41,257	46,171	51,284
	Higher	1,000	97,930	106,582	118,811	131,344
Enrolment Rate	G1 ~ G9	%	99.9	100.0	100.0	100.0
	G10 ~ G11	%	33.0	33.2	33.7	34.1
	Higher (16 ~ 20 yrs. old)	%	53.9	54.3	55.1	55.9
	Higher (> = 21 yrs. old)	%	5.0	5.2	5.3	5.3

Source 1) : BCDA for GRDP in 2010
Source 2) : JICA Study Team for the other indicators

CHAPTER 13 FORECAST OF FUTURE POPULATION DISTRIBUTION BASED ON LAND USE PROJECTION

13.1 Considerations on Future Urbanization

The distribution of the future population was forecast based on the possible occupancy of land within the Study area. To this end, the future urbanization of the city was initially examined through considerations on the future urban structure and associated land use composition. These forecasts were made based on a series of intensive discussions with the Chief Architect Office of Bishkek City as well as BCDA.

13.1.1 Future Urban Structure

Regarding the future urban structure, two cases were examined:

(1) Future urban structure by trend basis

(2) Future urban structure by planned basis

These are briefly described below.

(1) Future Urban Structure by Trend Basis (Do Nothing)

This is a possible case of urbanization by letting the current urbanization trend continue. Without any policy interventions, the future urban structure may be formed as shown in **Figure 13.1-1**. Major characteristics may be itemized as follows.

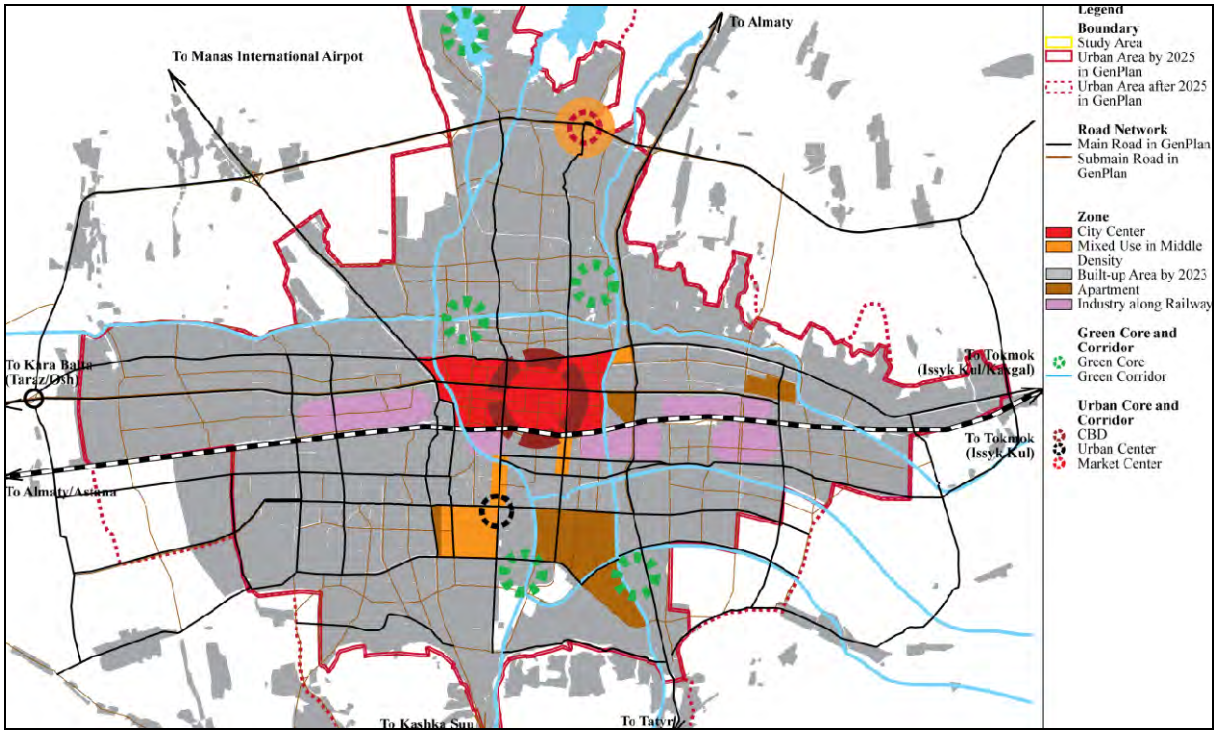
(i) The central area will continue to be the primary center of business and commercial activities and will further attract the investments in renovation and redevelopment of buildings.

(ii) A new urban center will be composed around the intersection of Akhunbaev Street and Mir Avenue located in the south of the railway. This new center may accommodate business, commercial, and higher education functions, together with apartment style housing facilities.

(iii) Most of the urbanization will take place in the form of low density detached houses, and will sprawl towards southwest and southeast directions.

(iv) The peripheral of the low density housing area will exceed the urban growth boundary which is envisaged by the General Plan 2006.

(v) No new urban axis will be formed clearly, to the level of changing the direction of urbanization trend.



Source : JICA Study Team

Figure 13.1-1 Future Urban Structure by Trend Basis

(2) Future Urban Structure by Planned Basis

This is another possibility of urbanization by guiding the private sector investments to follow the major urban development policies established by the General Plan 2006. Several policy interventions were discussed among relevant organizations, and possible adjustments to the current urbanization trends were clarified. The major policies are described below.

(i) Development of new urban axes and centers will be promoted to facilitate the construction of compact and efficient urban area, especially in the southern parts of the city.

(ii) Both existing and new urban axes will be facilitated with public transport systems that will interlink the major nodal points of the city.

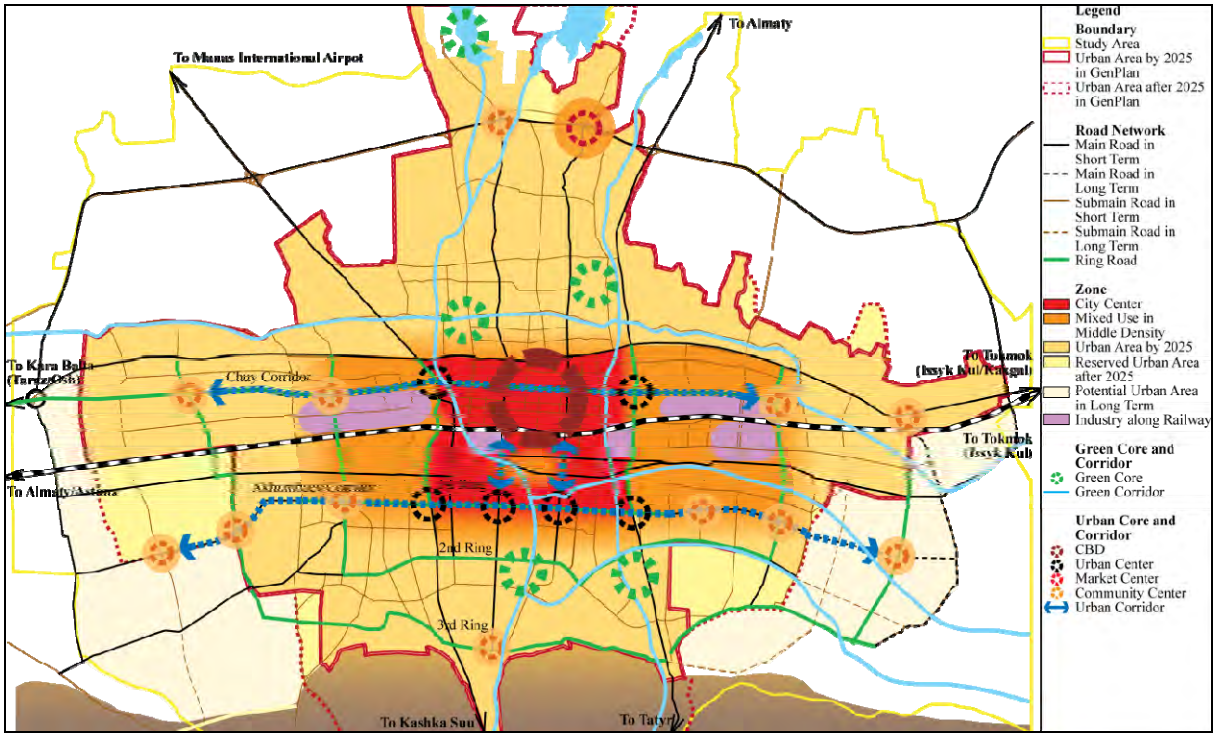
(iii) New urban centers along Akhunbaev Street will be linked with several new community centers in the suburbs.

(iv) The existing central area will be linked with the new urban centers in the south to enhance the balanced development of the expanded territory of the city, as planned by the General Plan 2006.

(v) A new urban axis of east-west direction will be created in the southern part of the city, facilitated by the creation of new urban centers.

Figure 13.1-2 shows the expected future urban structure of the Study area by integrating above

mentioned policies.



Source : JICA Study Team

Figure 13.1-2 Expected Future Urban Structure by Planned Basis

13.1.2 Future Land Use

For the forecast of land use composition, two alternatives were framed in accordance with the possible future urban structures.

(1) Future Land Use Composition by Trend Basis

The future land use by the trend basis is planned based on the following assumptions.

(i) The urban development will progress in the form of medium-rise buildings in the central area.

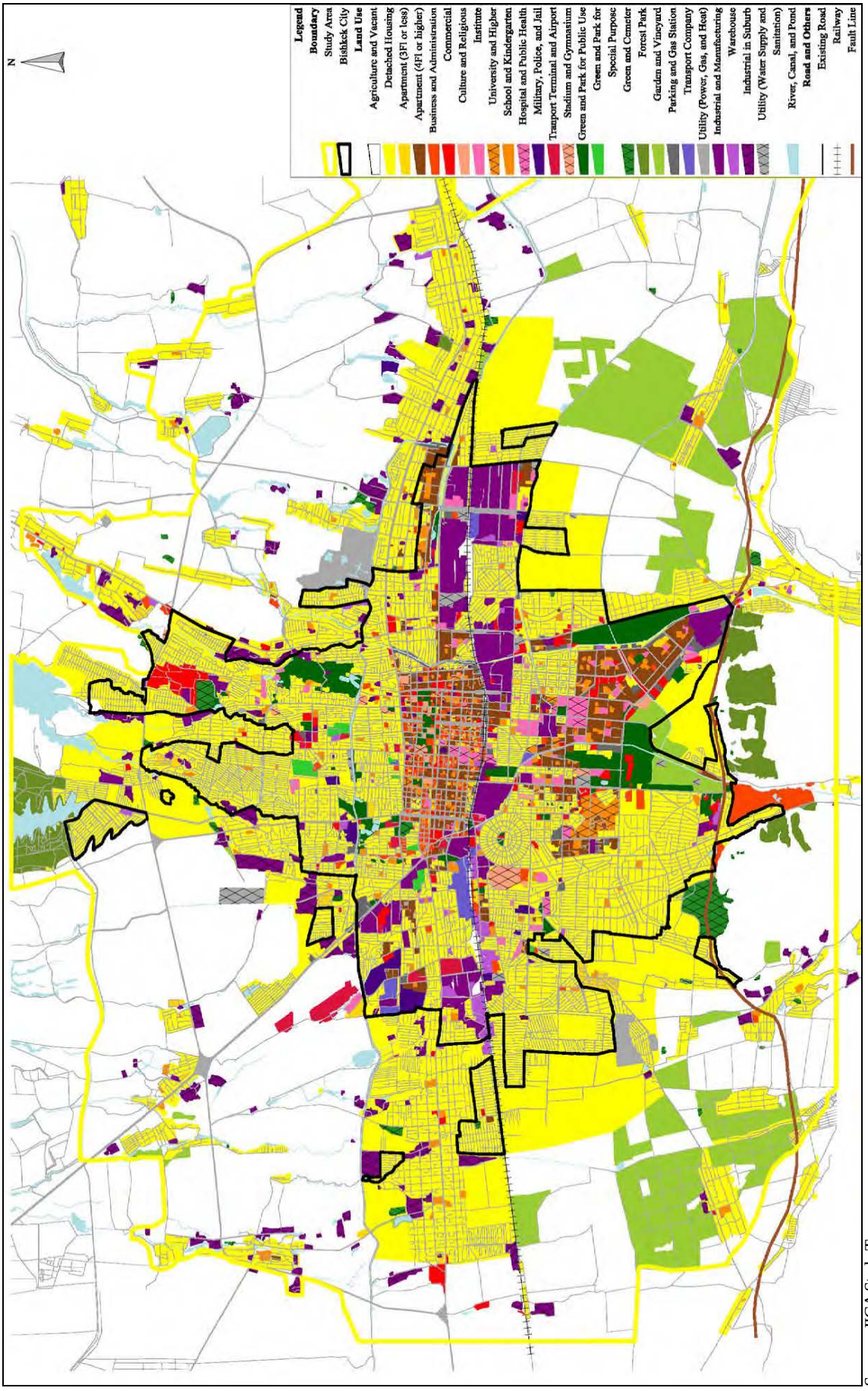
(ii) The detached housing area will expand to the suburbs and encroach to the area beyond the urban growth boundary set by the General Plan 2006.

(iii) The expansion of the built-up area to the north will encroach to the forest area.

(iv) The new urban axis will not be created, although the on-going urban development will be accomplished to create a new urban center along Akhunbaev Street and Mir Avenue.

(v) The conversion or upgrading of the existing industrial area along the railway will not take place.

Figure 13.1-3 shows the land use composition of the Study area for the year 2023 by the trend based urbanization.



Source : JICA Study Team

Figure 13.1-3 Expected Land Use Composition of 2023 by Trend Basis

(2) Future Land Use Composition by Planned Basis

(a) Areas for Policy Intervention

The General Plan 2006 depicted an ideal land use of the city for the future development. However, the recent urbanization has spoiled some of the major concepts of the General Plan 2006, largely due to the accelerated population growth, as well as the lack of effective tools to manage the land use under the market economy system. The future land use composition by planned basis (or policy intervention) is formulated in a way to pursue the concepts of the General Plan 2006 wherever applicable, while adjusting them to fit the current land use formed by the past developments. The major policies adopted are as follows.

(i) Expansion of Urbanization Area and urban Center

The urban growth boundary set by the General Plan 2006 seems insufficient to accommodate the total land demand up to 2025. Hence, the area allowed for urbanization needs to be expanded. This was done by taking some of the "reserve area" category designated by the General Plan 2006. The modified area for urbanization up to 2025 will contain 278 square kilometers. On the other hand, the urban control area is designated to prevent urbanization outside the urban promotion area.

(ii) Greenery in South and North

Lands in south and north of Bishkek City is designated as green areas to preserve existing forest areas, though the current urbanization encroaches on the forest areas. This designation aims to prevent the remaining forest areas from further encroachment. A green network is formulated to interlink the greenery in south and north with the existing parks and the open spaces along rivers as a basic form of the future urban structure.

(iii) Formulation of **U**rban **A**xis and **U**rban **C**enter

Urban centers are designated at the areas of on-ongoing urban development along Akhunbaev Street and the candidate sites according to the expected future urban structure. The urban centers are connected by the urban axes that will be formed by a public center, an apartment, and a large-scale commercial facility. The candidate site for the urban center includes an existing industrial area along the railway that will be regenerated into a new public center.

(iv) Restructuring of Industrial Area

A new industrial area is designated in the northeast, close to the outer ring road to accommodate the land for the industrial activities. The new industrial area has the access to the domestic and international transport. It will be surrounded by the green area to reduce a negative impact on a neighborhood housing area.

The green area and the urbanization control area cover the existing factories dispersedly located in a disordered manner in the Study area. This designation aims to prevent further deterioration in the

living environment.

(b) Land Use Category in Future Land Use Pattern in Planned Basis

Nineteen land use categories are defined to assign the future land use pattern in the Study area. Conditions and criteria for assignment of land use categories are summarized in **Table 13.1-1**.

Table 13.1-1 Criteria by Land Use Category in Future Land Use Pattern in Planned Basis

No	Land Use Category	Conditions and Policies of Assignment	Land Area	
			(ha)	(%)
1	Administrative and Cultural Center	Area containing the mixed land use of administrative offices, cultural facilities, and public parks to create the attractive feature of the City Center of Bishkek City.	93	0.2
2	Business and Commercial	Area containing commercial facilities and offices in a large-scale.	1,273	2.2
3	Mixed Use in Middle Density	Area to be mainly formed by an apartment in mixed use with commercial activities at the ground floor to form an urban axis.	3,770	6.5
4	Housing in High Density	Area to be mainly formed by apartment with four floors or higher like Micro District.	2,856	4.9
5	Housing in Middle Density	Area to be mainly formed by apartment with three floors or less and detached housing.	8,301	14.3
6	Housing in Low Density	Area to be mainly formed by detached housing.	2,265	3.9
7	Industrial	Area to be used for factories and warehouses.	818	1.4
8	Logistics	Area to be used for logistics.	154	0.3
9	Terminal	Area to be used for public transport such as a bus terminal.	15	0.0
10	Railway	Area to be used for a railway.	271	0.5
11	Water Intake	Area to be used for water intake facilities.	89	0.2
12	Sewage Treatment Plant	Area to be used for a sewage treatment plant.	116	0.2
13	Landfill	Area to be used for a dumping site for disposal from a heating plant.	103	0.2
14	Cemetery (Existing)	Area to be used for an existing cemetery.	296	0.5
15	Cemetery (Planned)	Area to be used for a new cemetery.	140	0.2
16	Greenery and Park	Area containing a public park and a green area including a forest and an open space along a river.	8,108	14.0
17	Greenery in Hilly Area	Area containing a green area in a hilly area.	2,761	4.8
18	Reserved UPA after 2025	Area to be reserved for an urban promotion area after 2025.	1,376	2.4
19	Urbanization Control Area	Area to be prevented from urbanization.	24,055	41.6
20	River and Water Surface	Area to be river and water surface	996	1.7
	Total		57,857	100.0

Note : The land area of 818 ha for Industrial includes the lands within the Study area only, though the future land use pattern indicates Industrial outside the Study area. The land area of Industrial outside the Study area is estimated at 469 ha.
Source : JICA Study Team

Figure 13.1-4 shows the future land use pattern in the planned basis in the Study area.

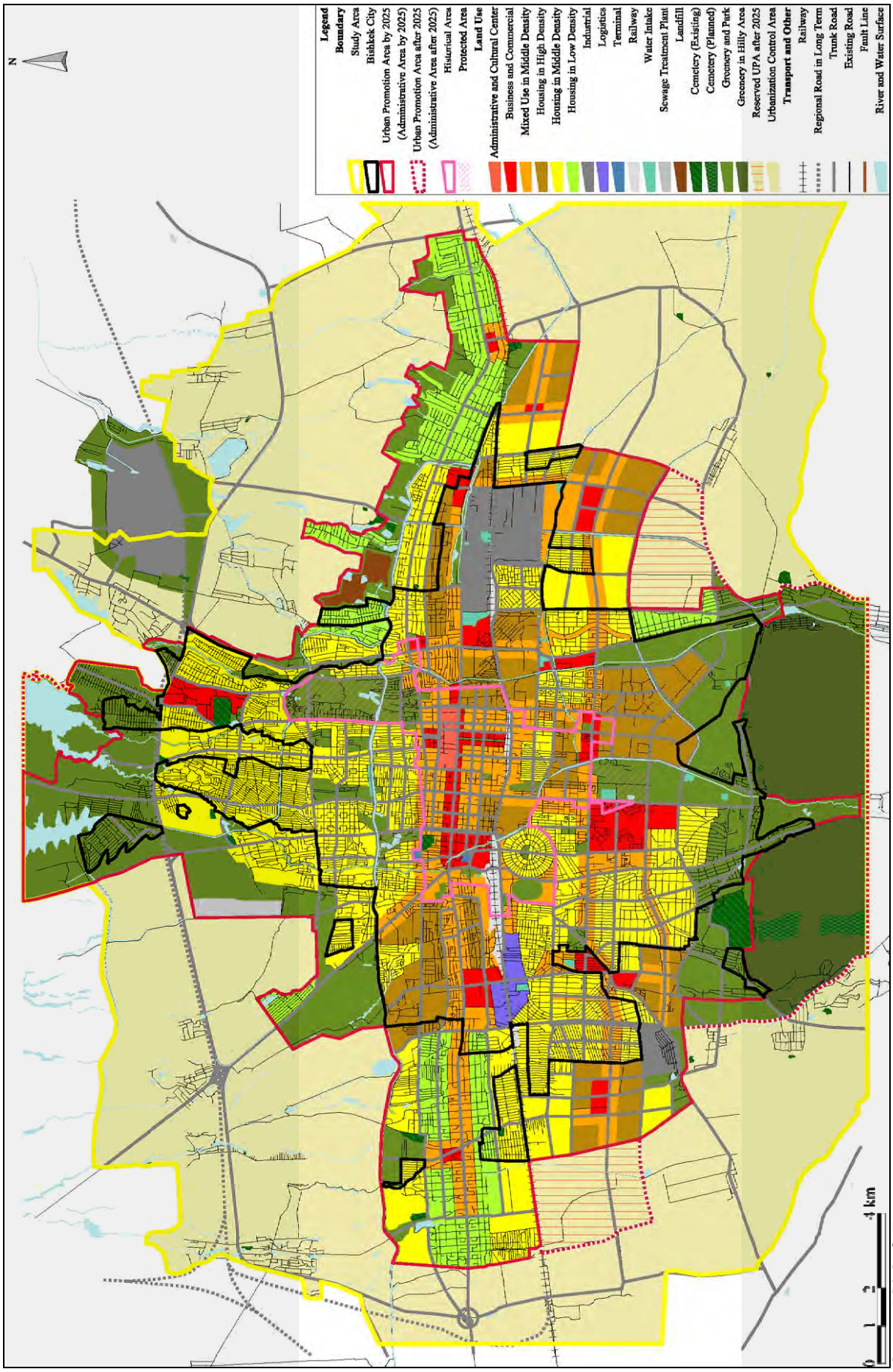


Figure 13.1-4 Future Land Use Pattern in Study Area in Planned Basis in 2023

13.2 Assignment of Population, Worker, and Student by Traffic Zone in Planned Basis in 2023

13.2.1 Distribution of Population based on the Trend Based Land Use

(1) Assignment of Population, Worker, and Student by Traffic Zone in Trend Basis in 2023

Assignment of population, worker, and student is established for each traffic zone to provide the planning conditions for the traffic analysis. The estimated population, workers, and students by traffic zone are shown in **Table A13-1** in **Appendix 13** of this report.

(a) Population

Housing areas under construction in 2010 will be fully developed to accommodate the incremental population. The surplus population will reside in the vicinity of Bishkek City. **Table 13.2-1** shows the estimated population and the annual growth rate by three areas consisting of the City Center, Bishkek City, and the periphery of Bishkek City until 2023. Since most lands were developed in the City Center and Bishkek City, the annual growth rate will decrease in these areas in the period from 2010 to 2023. On the contrary, the urban sprawl will boost the annual growth rate from 2.8 percent to 5.4 percent in the periphery of Bishkek City after 2010.

Table 13.2-1 Population and Growth Rate by Location in Trend Basis between 2005 and 2023

Location	Population (1,000)			Annual Growth Rate in 2010 to 2023 (%/year)	
	2005	2010	2023	2005 ~ 2010	2010 ~ 2023
City Center	171,082	177,433	185,646	0.7	0.3
Bishkek City	810,639	868,556	944,376	1.4	0.6
Outside Bishkek City	216,561	248,744	490,424	2.8	5.4
Study area	1,027,200	1,117,300	1,434,800	1.7	1.9

Source : JICA Study Team

Table 13.2-1 and **Figure 13.2-1** shows the annual incremental population by traffic zone between 2010 and 2023. The population increase will mainly continue outside Bishkek City. The relatively larger change in population is observed in three directions to north, southeast, and southwest.

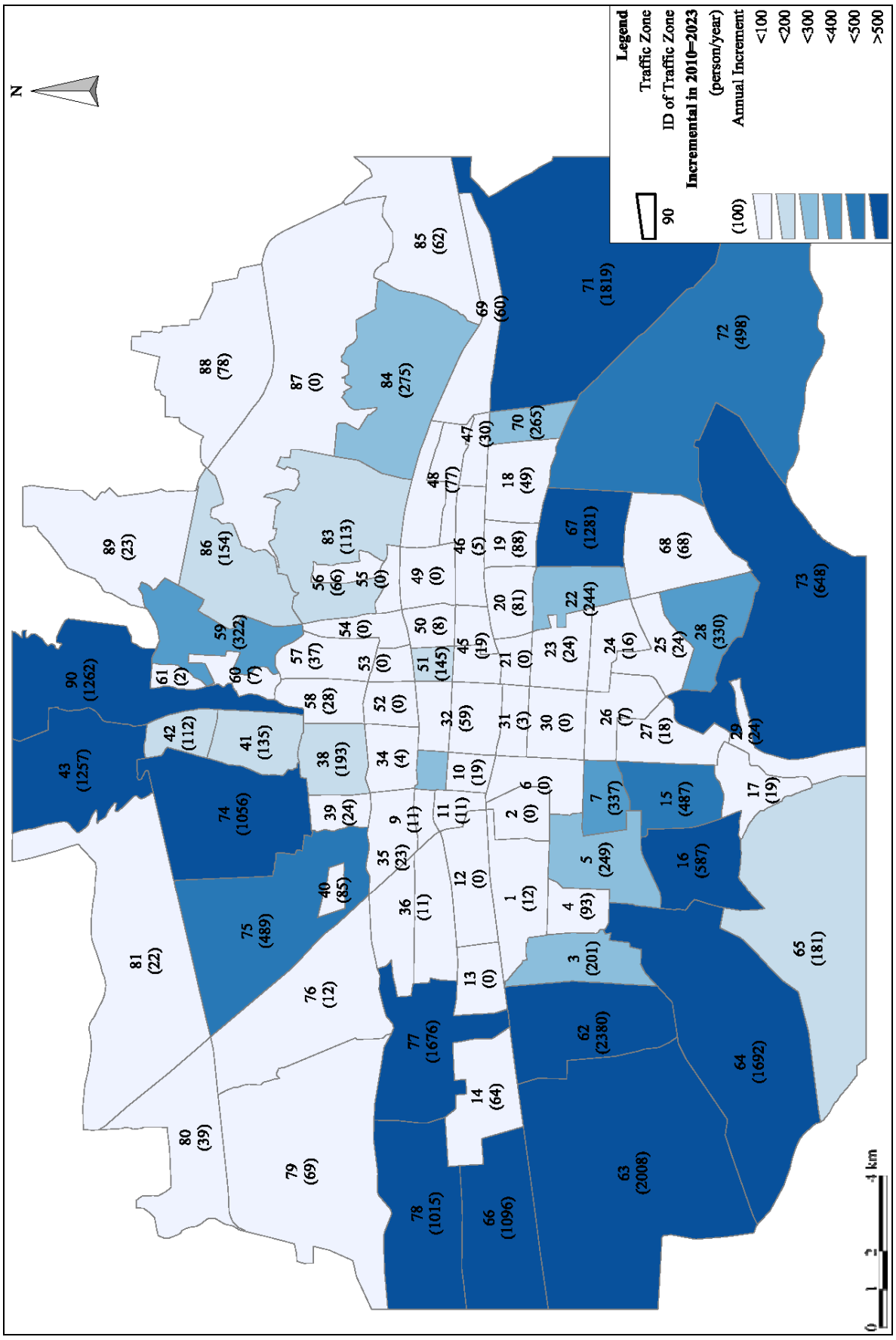


Figure 13.2-1 Annual Incremental Population by Traffic Zone in Trend Basis between 2010 and 2023

(b) Worker at Work Place

The number of workers in the agriculture industry is assigned by traffic zone in proportion to the land area of the agricultural land and the vineyard. Since the land use plan of General Plan 2006 does not specify a new industrial area, there is no definite direction to predict the location of a new industrial area. Therefore, the increment of workers in the manufacturing industry is assigned in proportion to the existing number of manufacturing workers in 2010 to reflect the current characteristics that the existing industrial areas are disorderly located in and around the city.

A growth of GRDP per capita will encourage the daily consumption by individuals in the Study area. It will generate the new employment in the housing area in the community level as the population-based job opportunity in the service industry. Furthermore, on-going urban development along Akhunbaev Street will create the new employment. Since a significant change of the urban structure is not predicted to modify the distribution of the employment in the service industry in the trend basis, the increment of workers, other than the new employees of the population-based and the new urban development mentioned above, is assigned in proportion to the existing number of service workers in 2010.

(c) Student at School Place

The number of students is distributed according to a ratio of the students to the population by traffic zone on assumption that the increments of students will be located at the place where the population will increase.

Figure 13.2-2 illustrates the nighttime population, the workers at work place, the students at school place, and the daytime population in charts by traffic zone in the trend basis in 2023.

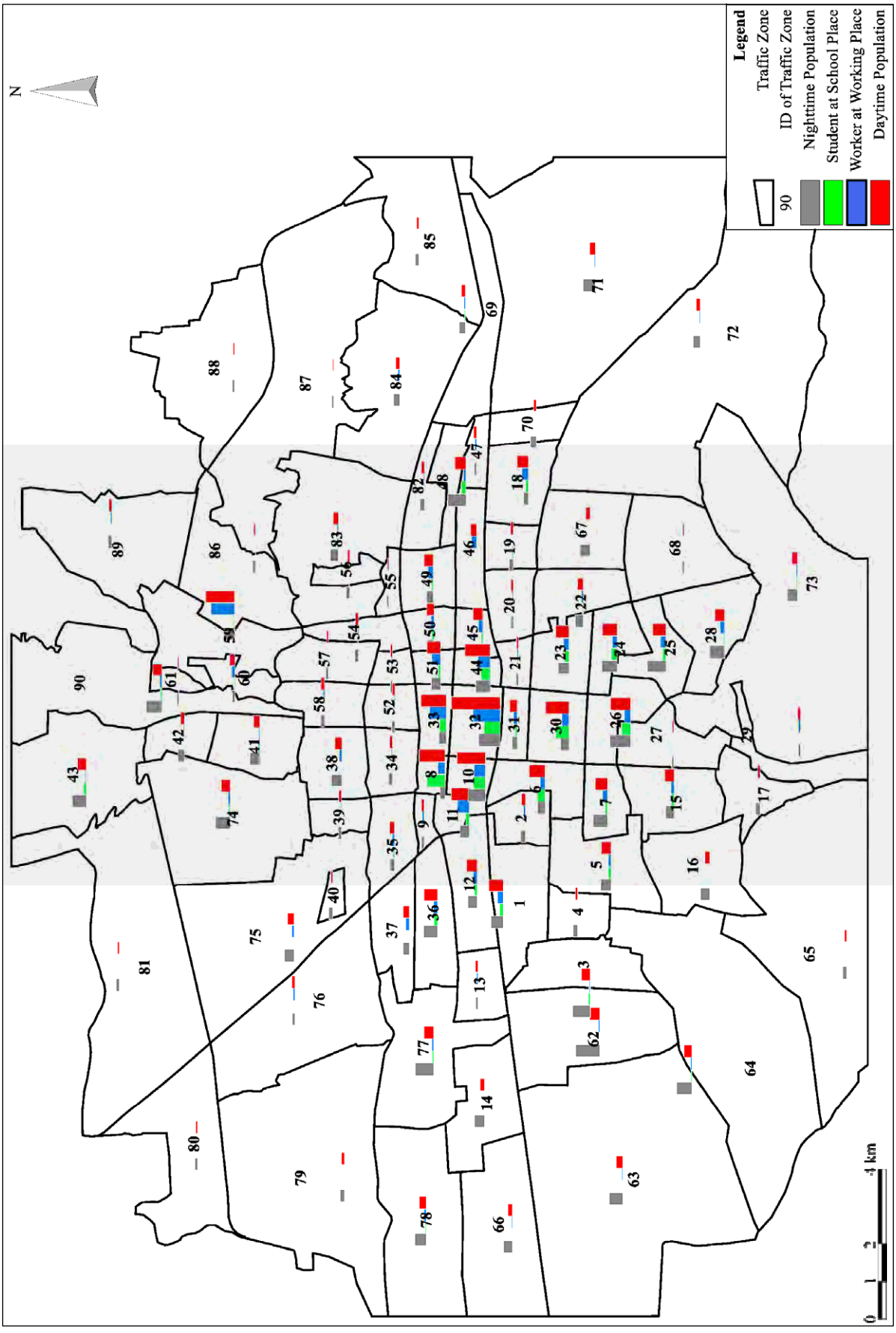


Figure 13.2-2 Nighttime Population, Worker, Student, and Daytime Population by Traffic Zone in Trend Basis in 2023

13.2.2 Distribution of Population by Policy Integrated Land Use

The future land use pattern is formulated to show the ideal future urban structure. Although it designates Greenery and Park on the lands currently used for housing and factories to improve the urban structure, it will take time to achieve the future land use pattern. On the other hand, the assigned population, workers, and students are used for the traffic analysis of an urban transportation master plan until 2023. Thus, the existing number of inhabitants, workers, and students is examined in a way to remain intact for the assignment of a socio-economic framework by traffic zone in 2023.

Table 13.2-2 shows the population density and density of worker by land use category to be applied for the assignment of population and worker.

Table 13.2-2 Population Density and Density of Worker by Land Use Category

Land Use Category	Population (person/ha)	Worker in Service (person/ha)
Administrative and Cultural Center	76	230
Business and Commercial	76	400
Mixed Use in Middle Density	335	165
Housing in High Density	242	47
Housing in Middle Density	51	1
Housing in Low Density	30	1

Source : JICA Study Team

(1) Population

The incremental population is distributed in Administrative and Cultural Center, Business and Commercial, Mixed Use in Middle Density, and housing areas within the urban promotion area. **Table 13.2-3** shows the population and the growth rate in three areas of the City Center, the urban promotion area, and outside urban promotion area. Since the incremental population is assigned in the urban promotion area only, the annual growth rate is estimated higher than that of the trend basis in the City Center and the urban promotion area.

Table 13.2-3 Population and Growth Rate by Location in Planned Basis between 2005 and 2023

Location	Population (person)				Annual Growth Rate (%/year)		
	2005	2010	2023		2005 ~ 2010	2010 ~ 2023	
			Trend	Planned		Trend	Planned
City Center	171,082	177,433	185,646	195,015	0.7	0.3	0.7
Urban Promotion Area	966,710	1,052,462	1,335,273	1,369,962	1.7	1.8	2.0
Outside Urban Promotion Area	60,490	64,838	99,527	64,838	1.4	3.4	0.0
Total (Study area)	1,027,200	1,117,300	1,434,800	1,434,800	1.7	1.9	1.9

Source : JICA Study Team

Figure 13.2-3 shows the annual change in population by traffic zone between 2010 and 2023. It shows the change in population smaller than that in the trend basis in traffic zones of 43, 90, and 73, because the new development is restricted in Greenery and Public Park in the planned basis. On contrary, it shows the lager amount of the incremental population than that in the trend basis in the traffic zones that contain the urban axis, the urban center, and the urban regeneration of the existing factories.

(2) Worker at Work Place

The number of workers in the agricultural industry is assigned in proportion to the agricultural lands within Urbanization Control Area, Reserved Urban Promotion Area after 2025, and Greenery and Public Park.

The incremental number of workers in the manufacturing industry is assigned in a new industrial area beside the outer ring road in the northwest of the Study area, while part of workers in the existing factories is shifted to the new industrial area.

Similar to the trend basis, the growth of GRDP per capita will encourage the daily consumption by individuals in the Study area. It will create the new employment as the population-based job opportunity in the service industry. Furthermore, the new urban center and the new urban axis will generate the new employment.

(3) Student at School Place

Similar to the trend basis, the number of students is estimated based on a ratio of the students to the population by traffic zone.

(4) Nighttime Population and Daytime Population in Trend Basis and Planned Basis

Figure 13.2-4 illustrates comparison of the nighttime population and the daytime population by traffic zone in the planned basis and the trend basis in 2023. It shows that concentration of the daytime population is reduced in the City Center and its vicinities, while the daytime population is shifted to the areas in the suburb along the urban axes.

The number of population, workers, and students by traffic zone in the planned basis are shown in **Table A13-4** in **Appendix 13** of this report.

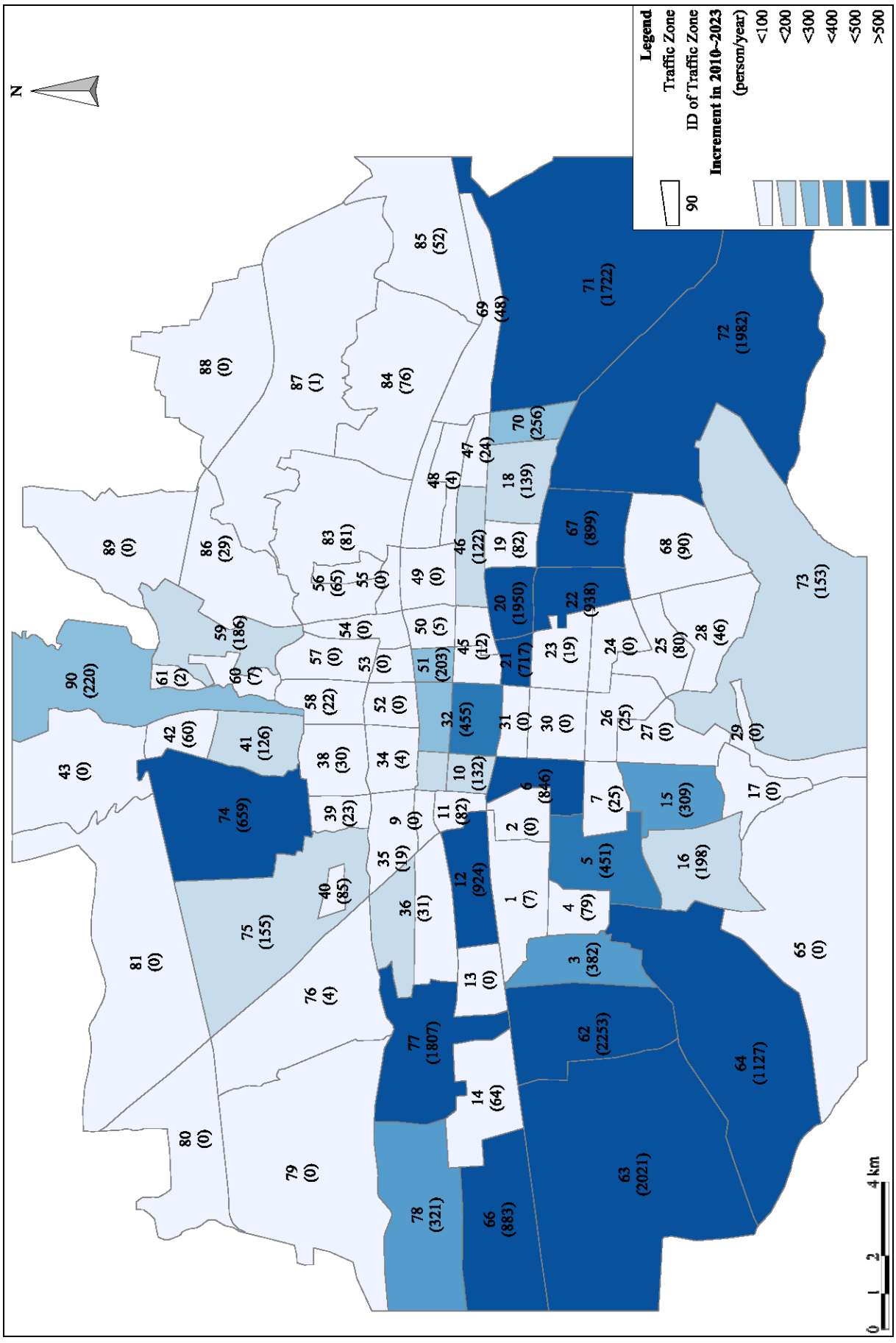


Figure 13.2-3 Annual Incremental Population by Traffic Zone in Planned Basis between 2010 and 2023

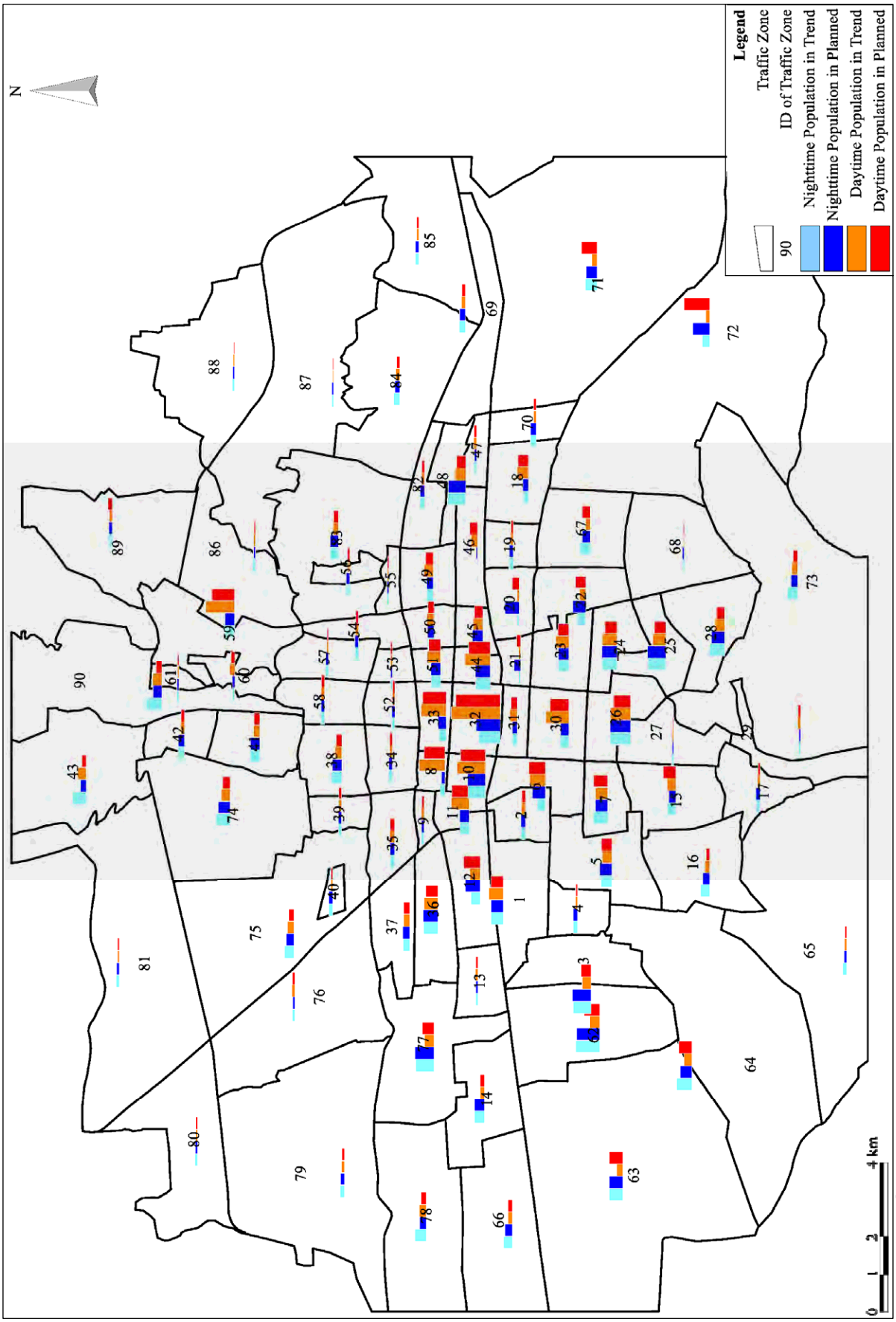


Figure 13.2-4 Nighttime Population and Daytime Population by Traffic Zone in Planned Basis and Trend Basis in 2023

13.3 Assignment of Population, Worker, and Student by Traffic Zone in Planned Case in 2013 and 2018

The population, workers, and students are assigned for each traffic zone in the intermediate planning years of 2013 and 2018 to establish the planning conditions for the traffic analysis.

The maturity of urbanization is estimated as a percentage of population in the intermediate years to population in 2023 as shown in **Figure 13.3-1** for 2013 and **Figure 13.3-2** for 2018, respectively.

The population and the number of workers and students by traffic zone are shown in **Table A13-2** for 2013 and **Table A13-3** for 2018 in **Appendix 13**.

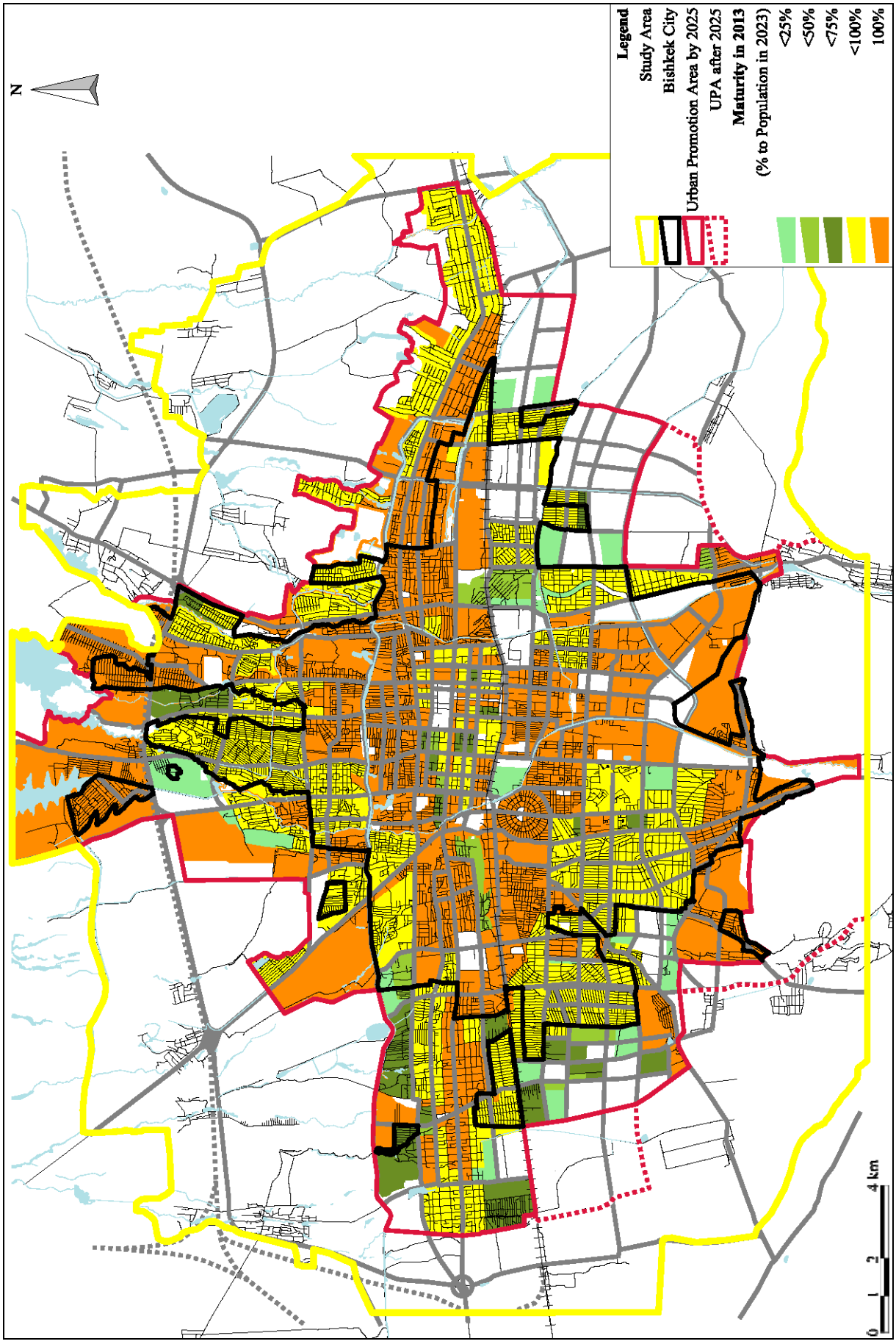


Figure 13.3-1 Maturity of Development by Area in UPA in Planned Basis in 2013

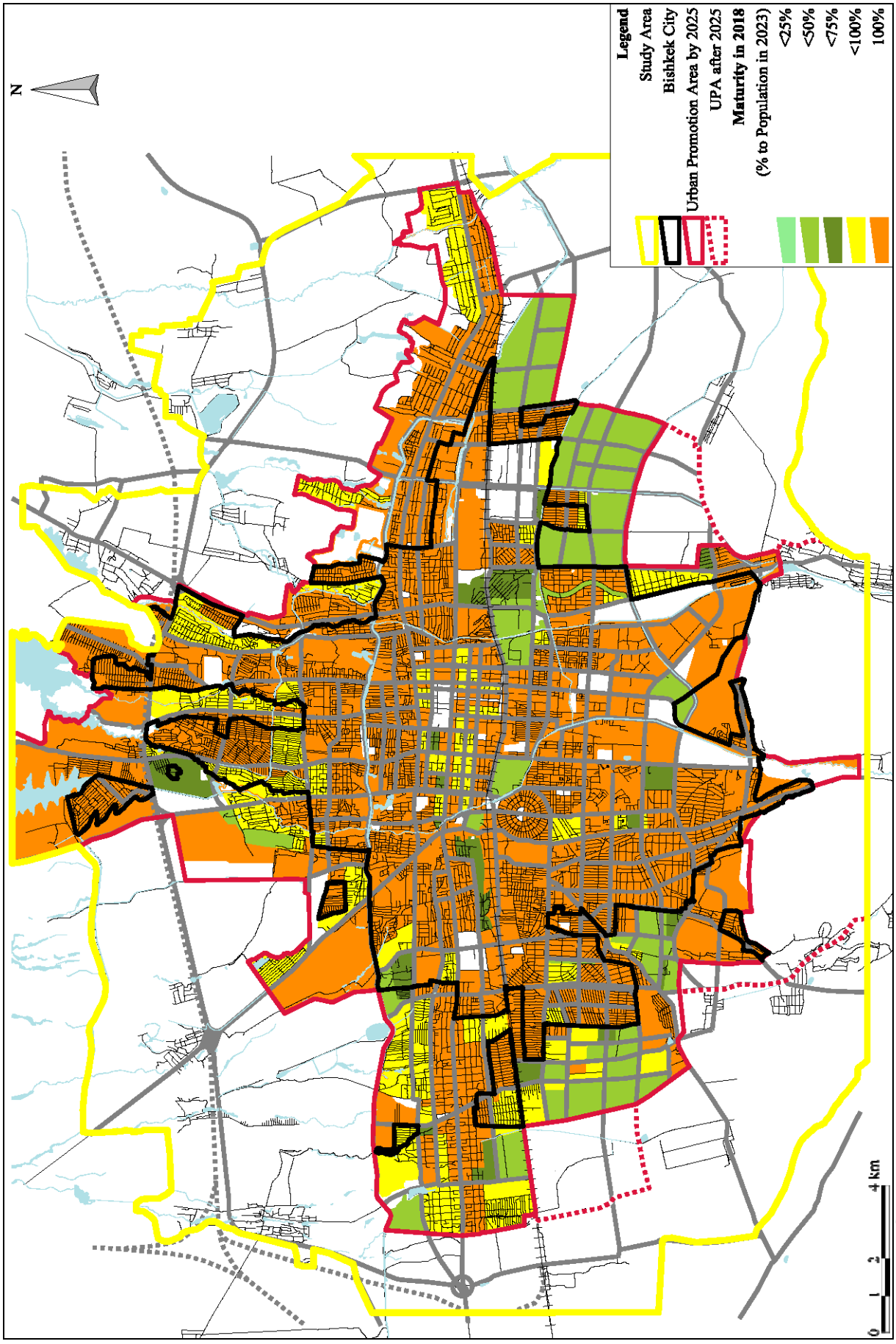


Figure 13.3-2 Maturity of Development by Area in UPA in Planned Basis in 2018

CHAPTER 14 TRAFFIC DEMAND FORECAST

14.1 General

A traffic demand forecast based on the current and future socio-economic conditions is necessary in formulating the transportation MP for the targeted years 2013, 2018 and 2023. It provides some scenarios as a basis for formulating transportation MP. In order to forecast future traffic demand, road network data, setting of the parameters and present OD (Origin-Destination) and future OD tables were prepared.

14.2 Establishment Present Road Network

14.2.1 Component of OD Table

The OD tables in 2011 were prepared based on the Person Trip (PT) survey and Cordon Line (CL) survey results. The PT survey was conducted within the Bishkek City boundary while the CL survey was conducted outside the Study area. Basically, OD table was prepared based on PT survey data, however PT survey did not cover the zones located in the outside of Bishkek City boundary (i.e. Zones 62 through 98). OD data which were not covered by PT survey were supplemented by CL survey data. The coverage of PT survey, CL survey and zone details are shown in **Table 14.2-1**. As the next step, estimated OD matrices were adjusted to observed traffic volume at each survey site.

Table 14.2-1 Traffic Zones and PT and Cordon Line Survey

<table>
<tr><th colspan="3" rowspan="2"></th><th colspan="2">Study Area</th><th rowspan="2">Out of Study Area</th></tr>
<tr><th>Bishkek City</th><th>Out of Survey Area</th></tr>
<tr><td colspan="3">Destination Zone
Origin Zone</td><td>1-61</td><td>62-90</td><td>91-98</td></tr>
<tr><td rowspan="3">Study Area</td><td>Bishkek City</td><td>1-61</td><td>PT Survey</td><td colspan="2" rowspan="3">Cordon Line Survey
(CL)</td></tr>
<tr><td>Out of Survey Area</td><td>62-90</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Out of Study area</td><td>91-98</td></tr>
</table>

14.2.2 Road Network and Present OD Table

Present OD, which was made based on PT data and CL data of the present condition, was distributed to the road network. Computed results and actual observed traffic volume (converted into PCU) were compared to verify or check the reproducibility of the assignment method.

14.2.3 Network Condition

Traffic zone for the demand forecast is same as the zone defined for traffic survey. The basic road network in the Study area was prepared based on the GIS map. The entire road network was divided into links and data related to the link such as length, maximum velocity and road capacity were added. These

parameters were set based on the result of traffic surveys.

As the condition of the road network, assumed capacity of road link and speed settings were set as shown in **Table 14.2-2**. In addition to link capacity and speed, other link conditions such as directional control, one way route and buses operating routes were also set.

Table 14.2-2 Settings of Road Link

Road Classification	Capacity (PCU / day)	Free Flow Speed
Inter-Regional	48,000-60,000 (4-lanes or more)	60 km/h-40 km/h
Major Arterial	48,000 (4-lanes)	50 km/h-40 km/h
Minor Arterial	24,000-18,000 (2-lanes)	40 km/h (Suburban Area) 30 km/h
Collector and Distributers	18,000 (2-lanes)	Less than 30 km/h

14.2.4 Reproducible Measurement

The Study compared the present condition of reproduction result with the traffic volume in the survey location as shown in **Table 14.2-3** and **Figure 14.2-1**. As a result of comparison, correlation coefficient of surveyed traffic value is high at 0.92 level. By this result, it was confirmed that the reproducibility of a present assignment model is high.

Table 14.2-3 Comparison of Calibration Assignment Result with Observed Traffic Volume at Survey Locations

Unit : PCU

Survey Location	No.	Survey Type	Observed Result (a)	Assignment Result (b)	Ratio (a) / (b)
Bakinskaya Street	1	CL1	16,237	18,735	0.87
Kurmanjan Datka Street	2	CL2	22,521	22,616	1.00
Kalinin Street	3	CL3	12,713	13,223	0.96
Pobeda Street	4	CL4	32,790	34,442	0.95
(Bound for Issyk-Ata)	5	CL5	11,425	11,302	1.01
Shabdan Baatyr Street	6	CL6	16,942	17,481	0.97
Dial Village	7	CL7	7,613	7,024	1.08
Kuntuu Village	8	CL8	8,789	8,825	1.00
Novopavlovka Village	9	CL9	43,830	44,718	0.98
Vasiyevskiy Trakt Street	10	CL10	17,305	11,676	1.48
Prigorodnoe Village	11	CL11	8,032	5,002	1.61
Molodaya Gvardia Street	12	CL12	21,400	20,830	1.03
Sadygalieyev Street	13	SL1	34,423	35,744	0.96
Kuliev Street	14	SL2	26,252	24,050	1.09
MolodayabGvardia Bulverde	15	SL3	64,682	60,548	1.07
Mir Avenue.	16	SL4	60,887	55,964	1.09
Logvinenko Street	17	SL5	15,275	16,657	0.92
Panfllov Street	18	SL6	17,586	16,224	1.08
Sovetskaya Street	19	SL7	50,658	52,926	0.96
Ibraimov Street	20	SL8	35,198	28,013	1.26
			25,956	20,169	1.29
Alma-Atinskaya Street	21	SL9	29,651	22,544	1.32
			24,871	27,447	0.91
Cholpon-Atinskaya Street	22	SL10	7,392	6,202	1.19

Survey Location	No.	Survey Type	Observed Result (a)	Assignment Result (b)	Ratio (a) / (b)
			7,298	5,815	1.26
Mir Avenue	23	SL11	60,874	57,037	1.07
Chui Avenue	24	SL12	34,828	40,530	0.86
Chui Avenue	25	SL13	36,539	37,231	0.98
Jibek-Jolu Avenue	26	SL14	24,519	18,065	1.36
			20,833	20,700	1.01
Bakinsata str.Togoko	27	SL15	40,426	41,518	0.97
Togolok Moldo street	28	SL16	28,859	25,830	1.12
Kirgizskaya street (Belskaya street)	28	SL17	9,878	6,961	1.42
Severnaya street (Kojoibergenova street)	30	SL18	3,011	2,032	1.48
Jct. Jibek-Jolu Avenue and Almatinskaya Street	31	IS01 N	30,859	27,201	1.13
	32	IS01 E	46,440	41,628	1.12
	33	IS01 S	37,534	37,916	0.99
	34	IS01 W	46,221	45,565	1.01
Jct. Jibek-Jolu Avenue and Chui Avenue	35	IS02 N	40,180	36,592	1.10
	36	IS02 E	26,083	26,119	1.00
		IS02 E	25,201	27,058	1.09
	37	IS02 S	30,816	22,721	1.36
		IS02 S	23,932	27,418	0.87
	38	IS02 W	29,071	24,280	1.20
		IS02 W	29,155	22,294	1.31
Jct. Gorky Street and Shabdan baatyr Street	39	IS03 N	64,122	54,328	1.18
		IS03 E	43,477	38,401	1.13
	40	IS03 S	54,186	45,086	1.20
	41	IS03 W	54,069	37,943	1.43
Jct. Chui Avenue and Ibraimov Street	42	IS04 N	20,028	18,099	1.11
		IS04 N	20,656	19,557	1.06
	43	IS04 E	52,988	53,545	0.99
	44	IS04 S	24,338	31,373	0.78
		IS04 S	25,406	20,270	1.25
	45	IS04 W	39,272	34,942	1.12
Jct. Gorky Street and Sovetskaya Street	46	IS05 N	23,443	26,589	0.88
		IS05 N	20,435	20,901	0.98
	47	IS05 E	24,447	25,523	0.96
	48	IS05 S	21,568	30,364	0.71
		IS05 S	19,128	33,577	0.57
	49	IS05 W	25,127	16,102	1.56
Jct. Akhunbaev Street	50	IS06 N	46,288	45,318	1.02
	51	IS06 E	38,718	32,966	1.17
	52	IS06 S	43,717	35,783	1.22
	53	IS06 W	44,609	39,037	1.14
Jct. Abdrakhmanov Street and Mir Avenue	54	IS07 N	17,103	23,282	0.73
	55	IS07 E	15,782	15,870	0.99
		IS07 E	7,450	14,788	0.50
	56	IS07 S	11,933	9,803	1.22
	57	IS07 W	12,139	11,603	1.05
	58	IS07 W	5,249	7,966	0.66
Jct. Chui Avenue and Mir Avenue	59	IS08 N	27,127	45,236	0.60
	60	IS08 E	37,961	35,457	1.07
	61	IS08 S	35,955	49,701	0.72
	62	IS08 W	35,745	33,090	1.08
Jct. Jibek-Jolu Avenue and Mahatma Gandi Street	63	IS09 N	37,213	38,878	0.96
	64	IS09 E	16,540	12,766	1.30

Survey Location	No.	Survey Type	Observed Result (a)	Assignment Result (b)	Ratio (a) / (b)
		IS09 E	18,094	14,706	1.23
	65	IS09 S	16,555	17,150	0.97
		IS09 S	24,004	27,424	0.88
	66	IS09 W	50,756	26,838	1.89
Jct. Jibek-Jolu Avenue and Fuchik Street	67	IS10 N	32,689	33,384	0.98
	68	IS10 E	27,667	15,783	1.75
	69	IS10 S	35,672	28,357	1.26

Note :
CL : Cordon Line Survey Location
SL : Screen Line Survey Location
IS : Intersection Traffic Count Survey Location

Correlation coefficient	**0.92**

In order to further verify reproducibility, the JICA Study Team compared the result of average speed calculated by traffic assignment with actual average speed of vehicle at peak hour as shown in **Table 14.2-4** and **Figure 14.2-2**. It falls in the degree of about eight percent of standard errors, judging from the link condition of the road network, it is believed that reproducible result of the present assignment is sufficient.

Table 14.2-4 Comparison of Calibration Assignment Result with Observed Travel Speed by Route

Unit : km/h

Route No	Road Name	Observed Result (a)	Assignment Result (b)
1	Mir Avenue	31.9	29.6
2	Tolstogo Street	28.6	29.3
3	Baha-Molodaya Gvardiya	31.2	30.8
4	Jibek-Jolu Avenue	34.5	30.9
5	12 md-Obezdnaya	32.8	30.3
6	Shabdan Baatyra Street	38.2	32.8
7	Muromskaya-Gorky Street	34.5	28.9
8	Den Syaopin Street-Chui Avenue	30.5	28.6
Average		32.8	30.3
		(b) / (a)	0.92

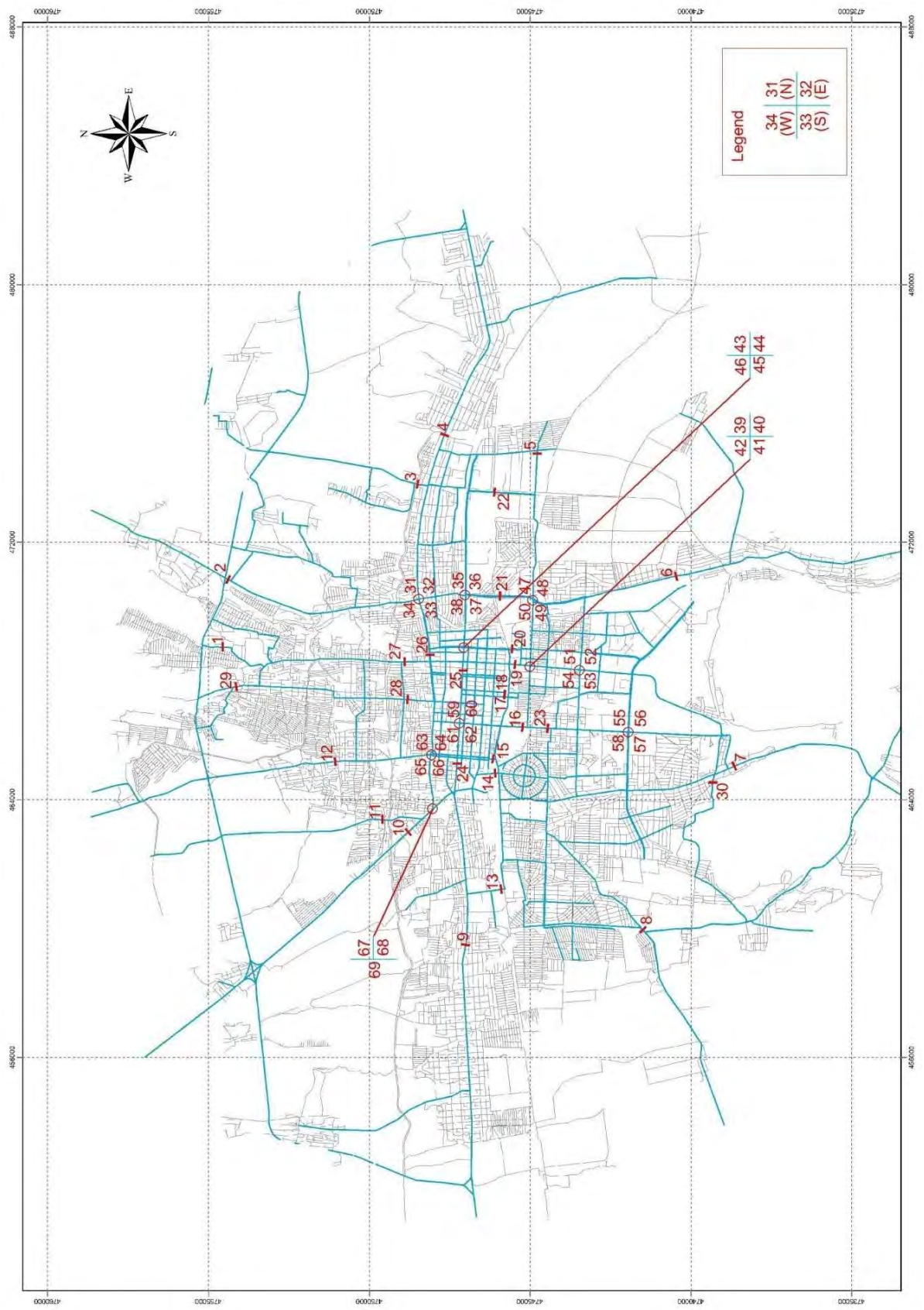


Figure 14.2-1 Location of Comparison Traffic Volume

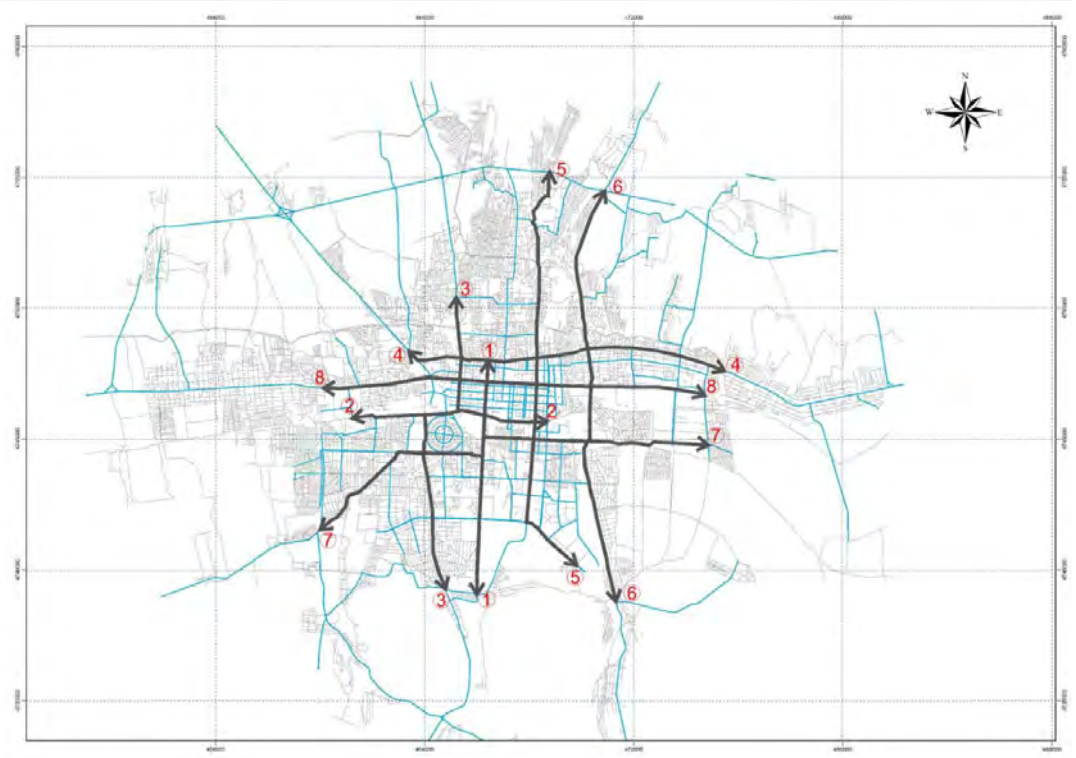


Figure 14.2-2 Route of Travel Speed Survey

14.3 Traffic Demand Forecast

Travel demand forecasting models have been built and run using a wide variety of model structures, computer software systems, and required data. The applied procedure for forecasting transportation demand is based on the conventional four step model as shown in **Figure 14.3-1**.

1. Trip Generation / Attraction: the prediction of total trips of the Bishkek City
   : the prediction of trips produced and attracted to each zone;
2. Trip Distribution : the prediction of origin-destination flows, the linking of trip ends predicted by trip generation;
3. Modal Split : the linking of trip ends the estimation of percentages of trip flows made by each transportation mode in the model; and
4. Traffic Assignment : the allocation of trips to routes in the transportation network.

The model targeted at representing the travel demand of the residents of the Study area, and their usage of private and public transportation such as private car, taxi, minibus, midibus, and trolleybus.

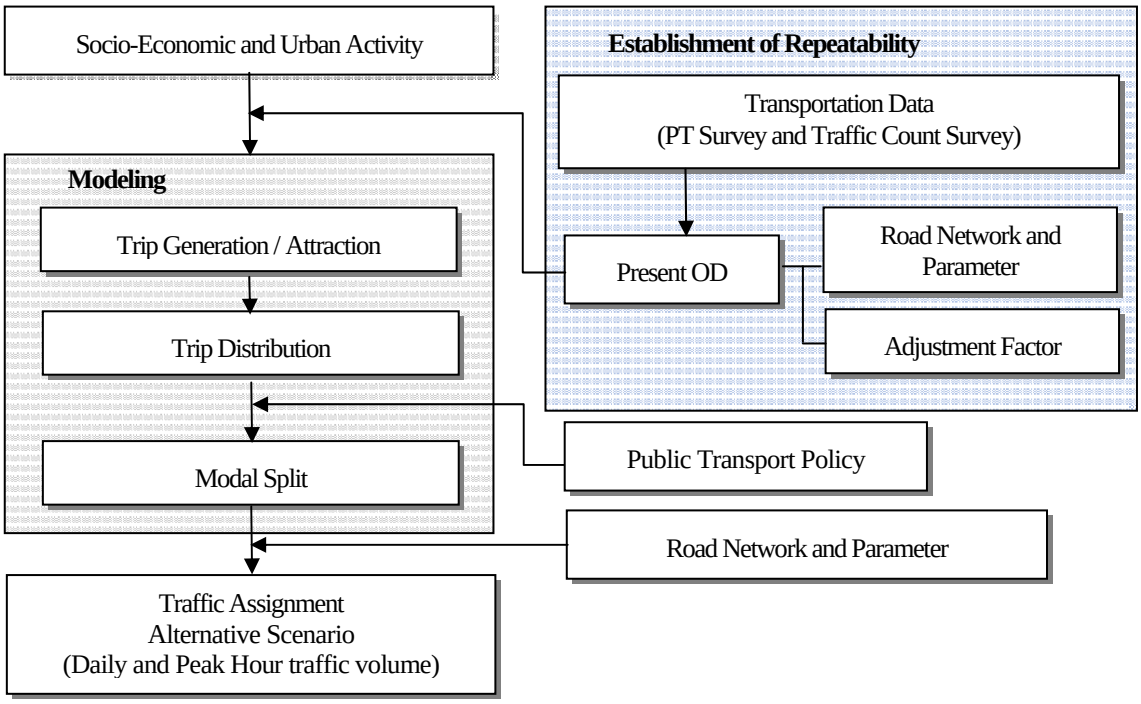


Figure 14.3-1 Concept of Four Step Approach of Transportation Modeling

14.3.1 Modeling and Forecasting Tool

During all steps of travel model calibrations and demand forecast, JICA STRADA system and MS EXCEL spread sheet were adopted. The software provides a set of tools for travel demand modeling and transportation models. For better precision, efficiency and minimization of trial errors, model calibrations and forecasts in trip generation, trip distribution and modal split steps were programmed by using Excel spreadsheet, and as the final step, traffic assignment stage was computed by JICA STRADA system.

14.3.2 Trip Production Model

Tip purpose category in Person Trip (PT) survey are classified into six (6). For Demand Forecast, since these purpose characters are not much well correlation between the survey data and analysis result, "Business", "Social and Shopping" and "Others" are summarized into one (1) category as shown in **Table 14.3-1**.

Table 14.3-1 Trip Purpose Category in Person Trip Survey

Trip Purpose Category in Person Trip Survey		Trip Purpose Category in Demand Forecast	
1	To Home	1	To Home (Home Trips)
2	To Work	2	To Work (Work Trips)
3	To School	3	To School (School Trips)
4	Business	4	Others (Business + Social and Shopping + Trips)
5	Social and Shopping		
6	Others		

This step of the four stage model aims to estimate the total traffic demand (by all modes) by the Survey Area by occupation and trip purpose. For this, trip rates are estimated from PT survey for each category of occupation by trip purpose. The estimated trip rates are shown in **Table 14.3-2**.

Generation basic unit in the Study was calculated by considering the expected future changes in industrial frame by zone. It adopted the generation basic unit by purpose.

Table 14.3-2 Trip Production of Purpose

Type of Occupation		To home	To work	To school	Others	Total
1	Agriculture	1.09	0.64	0.00	0.68	2.41
2	Manufacturing and Infrastructure	1.26	1.01	0.00	0.41	2.68
3	Service	1.26	0.98	0.02	0.51	2.77
4	Student	1.34	0.02	0.98	0.47	2.81
5	Housewife, Pensioner, Jobless, Others	1.27	0.32	0.02	1.08	2.69
Average		1.29	0.50	0.30	0.02	2.76

14.4 Trip Generation and Attraction Model

14.4.1 Trip Generation and Attraction Model Parameters

The objective of trip generation and attraction model is to forecast the number of PT that starts and arrives in each traffic zone within the Study area. The linear regression models by trip purpose were adopted in the Study. The model parameters were calibrated based on the PT survey as shown in **Table 14.4-1**.

$Oi = ai * X1i + bi * X2i$ $Dj = aj * X1j + bj * X2j$

where; *Oi* : *Trip Generation in zone i*

Dj : *Trip attraction in zone j*

X1i, X2j : *Attributes in zone i, j*

ai, aj, bi, bj : *Coefficient*

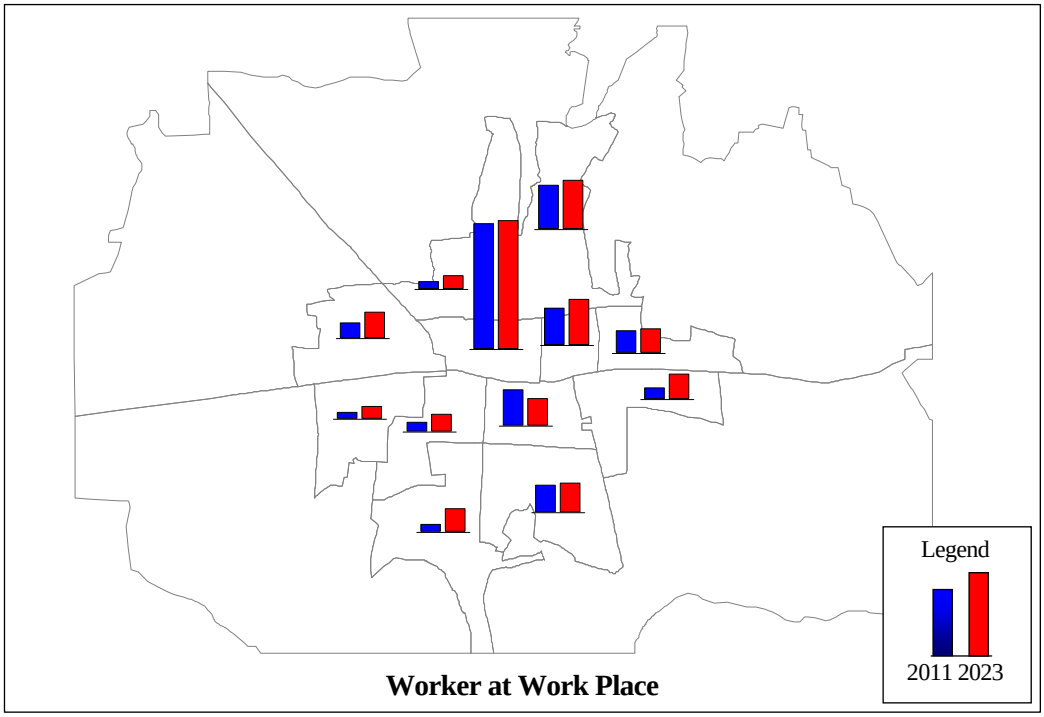
The generation and attraction model was built based on the multiple regression analysis as shown in **Table 14.4-1** which demonstrates explanation variable in generation and attraction by purpose by zones. The method of variable selection in multiple regression analysis was based on stepwise method.

Table 14.4-1 Trip Generation and Attraction Model Parameters

Model Type	Trip Purpose	Population	Generation			Attraction		Coefficient of determination	R-Square
			Tertiary Industry Worker	Student	All Sector's Worker	Tertiary Industry Worker	Student		
Trip Generation	To Home	-4.940	16.793				1.615	8,464.240	0.723
	To Work				2.063			-43.392	0.925
	To School			1.181				-69.689	0.965
	Others			1.113			-0.541	11,985.758	0.886
Trip Attraction	To Home				4.905	0.735	0.501	-1,224.319	0.934
	To Work						0.701	10,714.540	0.916
	To School						0.603	404.000	0.725
	Others			0.622			-0.493	12,071.528	0.935

14.4.2 Future Zonal Framework

The future framework in 2023 was compared with the 2011 framework as shown in **Figure 14.4-1**.



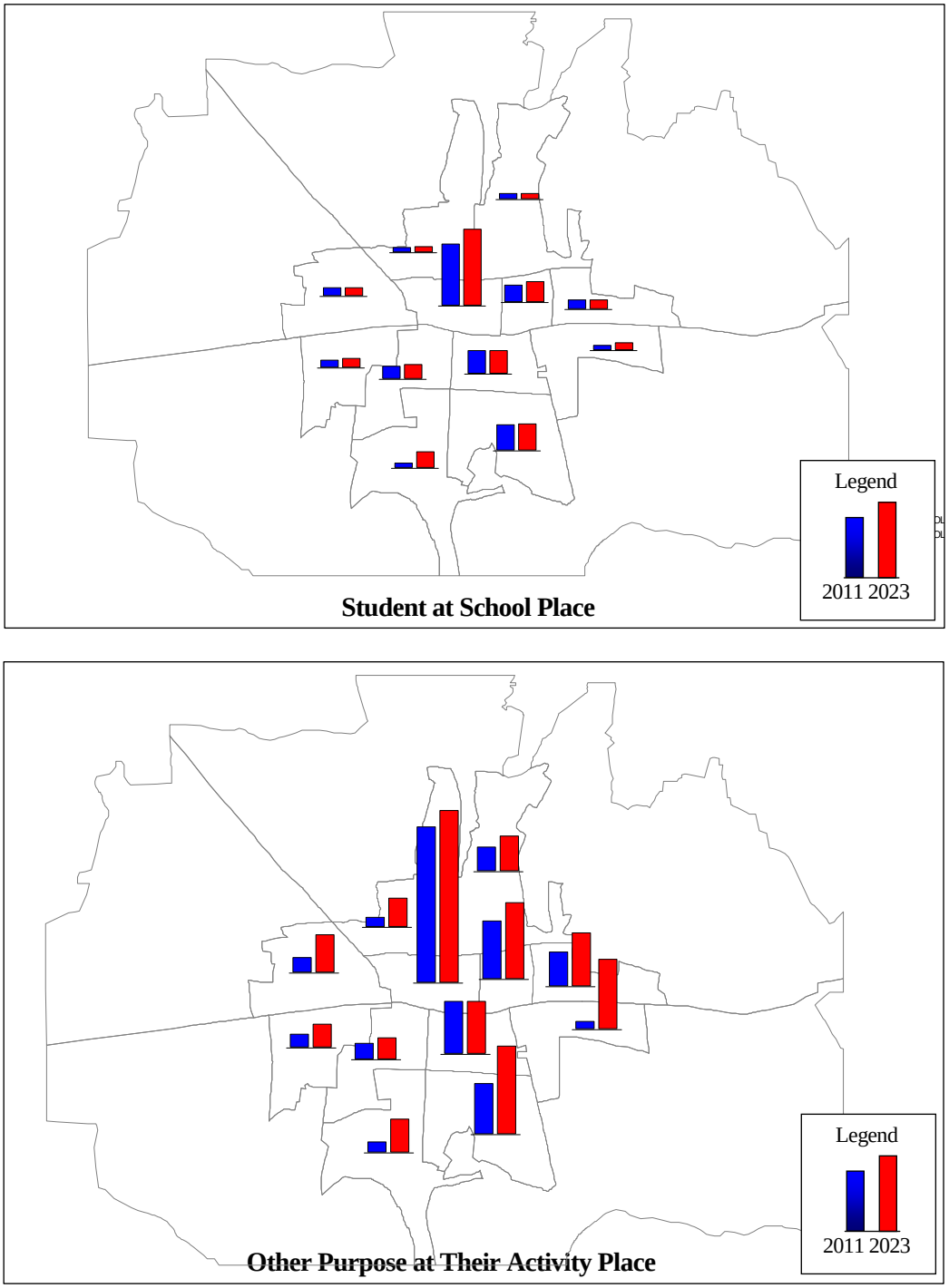


Figure 14.4-1 Zonal Framework in 2011 and 2023

14.5 Trip Distribution Model

Trip distribution is the second major step in the travel demand modeling process and it is the process of linking trip generation and attraction as pair of each zone. Present pattern method was applied linking the trip production and attractions to form the trip matrices. The unit of person trip convert to vehicle unit.

$$Tij^{(m+1)} = tij^{(m)} * Fi * Fj * \left(\frac{Li + Lj}{2} \right)$$

Where; $tij = present\ trips\ \ from\ zone\ i\ to\ zone\ \ j$

Fi : $produced\ growth\ factor\ for\ zone$

$$Fi = Gi / \Sigma jT_{ij}^{(m)}$$

Fj : $attracted\ \ growth\ \ factor\ \ for\ zone\ \ j$

$$Fj = Aj / \Sigma\, i\, T_{ij}^{(m)}$$

Li : $location\ \ factor\ \ for\ zone\ i$

$$Li = \frac{\Sigma_i tij^{(m)}}{\Sigma_i tij^{(m)} * Fi}$$

Lj : $location\ \ factor\ \ for\ zone\ \ j$

$$Lj = \frac{\Sigma_j tij^{(m)}}{\Sigma_j tij^{(m)} * Fj}$$

m : $repeated\ computation$

A short-term plan adopted the present pattern method assuming that it is suitable for calculation or estimation of future traffic volume in the zones where there are no changes in land use and transportation facilities in the future.

The **Figure 14.5-1** and **Figure 14.5-2** are comparing the trip distributions of all vehicle modes in 2011 and 2023. These distribution patterns were derived from the OD table calculated for traffic assignment model. Distribution pattern in 2023 is basically the same pattern as that in 2011. The volume will slightly expand because future population outside Bishkek City.

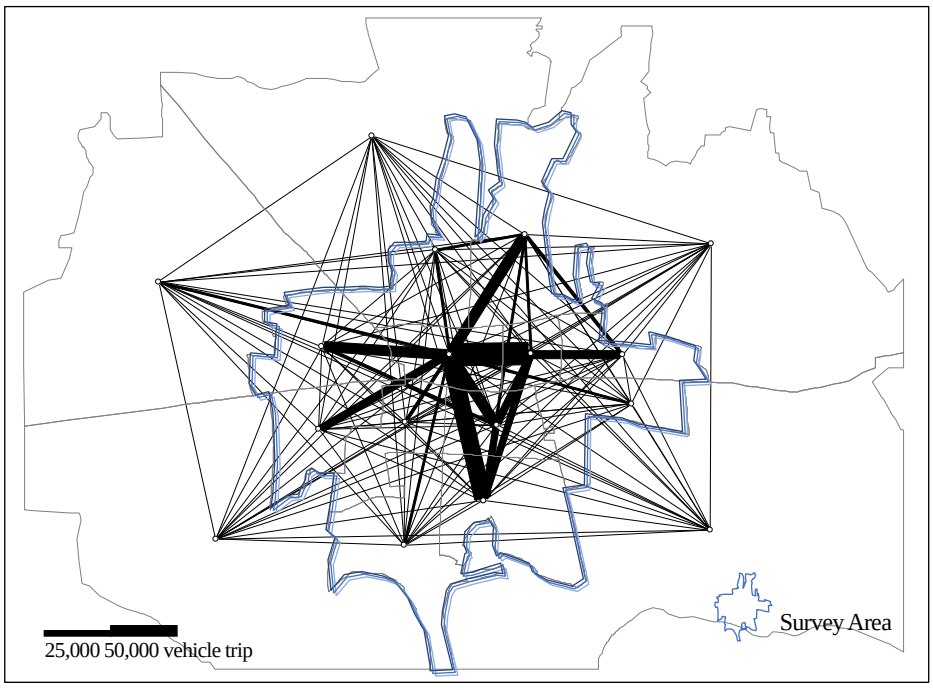


Figure 14.5-1 Future Trip Distribution Patterns by Desire Line (Year 2011)

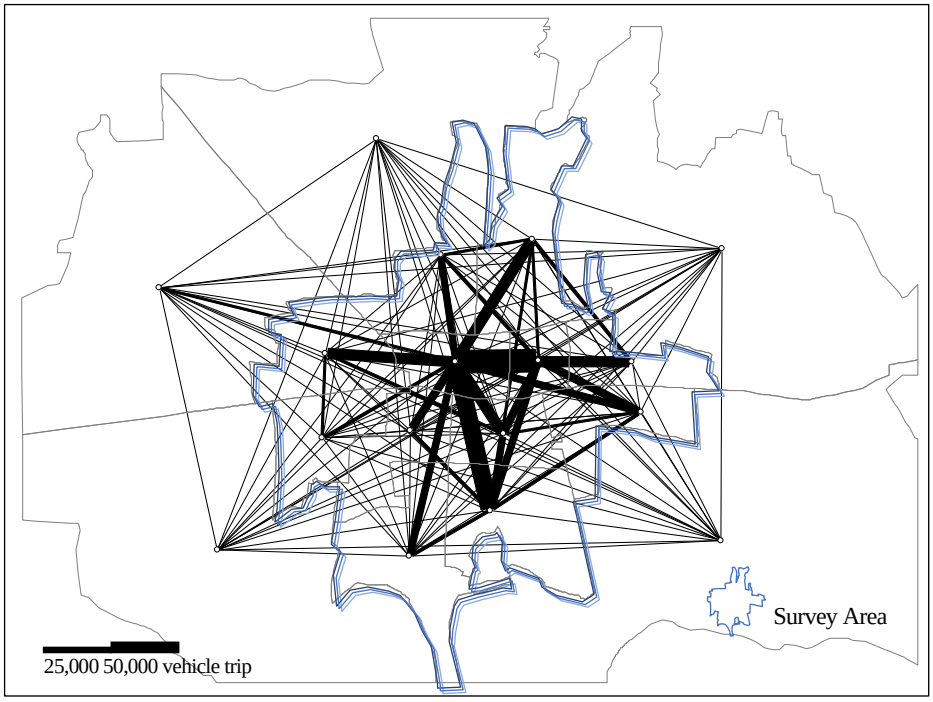


Figure 14.5-2 Future Trip Distribution Patterns by Desire Line (Year 2023)

14.6 Modal Split

Modal split models were assumed to analyze and forecast choices of individuals who choose the transportation modes when they make particular types of trips. Typically, the goal of this modeling is to predict the share or absolute number of trips by mode.

14.7 Traffic Assignment

Traffic assignment process allocates vehicle to road transportation networks and links. This step was taken as an input matrix that indicates the traffic volume between origin and destination pairs. By applying the traffic assignment stage, daily traffic volume for each road link were allocated.

In this study, Incremental Assignment Module of JICA STRADA was applied for vehicle assignment.

14.7.1 External Zone Traffic Demand

Traffic demand of traffic zones located outside of survey area but inside the Study area (i.e traffic zone 62-90) and external zone located outside of the Study area (i.e. traffic zone 91-98) were classified into external-external, internal-external, external-internal trips. The existing demand obtained from the CL Survey was added to the PT Survey data. Future demands of external zones were forecasted based on the socio economic growth factor.

14.7.2 Passenger Car Unit

In the traffic assignment, traffic volume is expressed in the form of Passenger Car Unit (PCU). The equivalent factors used in the traffic assignment are shown in **Table 14.7-1**.

Table 14.7-1 Equivalent Passenger Car Unit

Mode	Sedan	Minibus	Midibus	Trolleybus	Truck
PCU equivalents	1.00	1.5	2.0	3.0	2.5

14.7.3 Do Nothing Case

With the objective of formulating the transportation policy and undertaking countermeasures effectively, traffic demand forecast was made for the year 2013, 2018 and 2023. Four types of scenarios (i.e. Scenario 0, Scenario 1, Scenario 2 and Scenario 3) were considered on the road transportation networks of the Study area. Scenario 0 is referred to "Do Nothing" case where no improvement measures applied in supply-side and demand-side. Scenario 1, Scenario 2 and Scenario 3 were generated by considering three different cases of public transport policy interventions. The traffic demand assignment on the road network computed daily traffic volume and peak hour traffic volume. Modal shares by PT and vehicle trip are shown in **Table 14.7-2**. PT by minibus has the highest share of 42.8 percent, whereas the vehicle trip by Passenger car has the highest share of 87.5 percent. The analysis results of three (3) scenarios are elaborated in **Chapter 17**.

Table 14.7-2 Modal Share of Person Trip and Vehcile Trip in 2011

Transportation Mode	Passenger	Person trip/day (Bishkek City Zone 1-61)			Vehicle trip/day (All Zones 1-98)	
	(pax/v)	(trip/day)	(%)	PT share	Vehicle Trip/day	(%)
1.Trolleybus	28.2	68,768	3.4%	7.1%	3,045	0.3%
2.Midibus	27	24,538	1.2%	2.5%	7,804	0.9%
3.Minibus	17	874,961	42.8%	90.4%	88,987	9.9%
Total (Public Transport: PT)		968,267	47.3%	100%		
4.Truck	1.3	3,123	0.2%	-	12,326	1.4%
5.Passenger Car	1.5	525,209	25.7%	-	787,994	87.5%
6.Walk	-	548,554	26.8%	-		
Total		2,045,153	100%	-	900,156	100%

(1) Daily Traffic Volume Assignment Result

The vehicle assignment results in the existing condition in 2011 and future demand in 2013, 2018 and 2023 are summarized in **Table 14.7-3** and **Table 14.7-4**. Analyzing the volume of capacity ratio (VCR) shows the road congestion in each road section. The VCR on roads is within the desirable ratio (i.e. less than 1.00). In addition to VCR, CO_2 emission because of assigned traffic volume in 2011 and 2023 was calculated. CO_2 emission increases by 85,871 ton compared with year 2011.

Table 14.7-3 Summary of Vehicle Assignment Results

Average VCR (Volume Capacity Ratio)				Average Speed (km/hr)			
2011	2013	2018	2023	2011	2013	2018	2023
0.51	0.56	0.58	0.62	35.6	35.1	34.4	33.7

Table 14.7-4 Summary of CO_2 Emission Result in 2011 and 2023

2011 (ton)	2023 (ton)	2023-2011
330,360	416,231	+ 85,871

The VCR on most of the arterial roads in 2011 shows desirable ratio of about less than 1.2. However, the VCR at Chui / Fuchik intersection, Tolstoy / Molodaya Gvardiya intersection and near Dordoi market is more than 1.2. As a result, the daily average travel speed decreases from 35.1 km/hr (in 2011) to 33.7 (in 2023). **Figure 14.7-1 (1)** to **Figure 14.7-1 (4)** show the result of the traffic assignment in year 2011, 2013, 2018 and 2023 respectively.

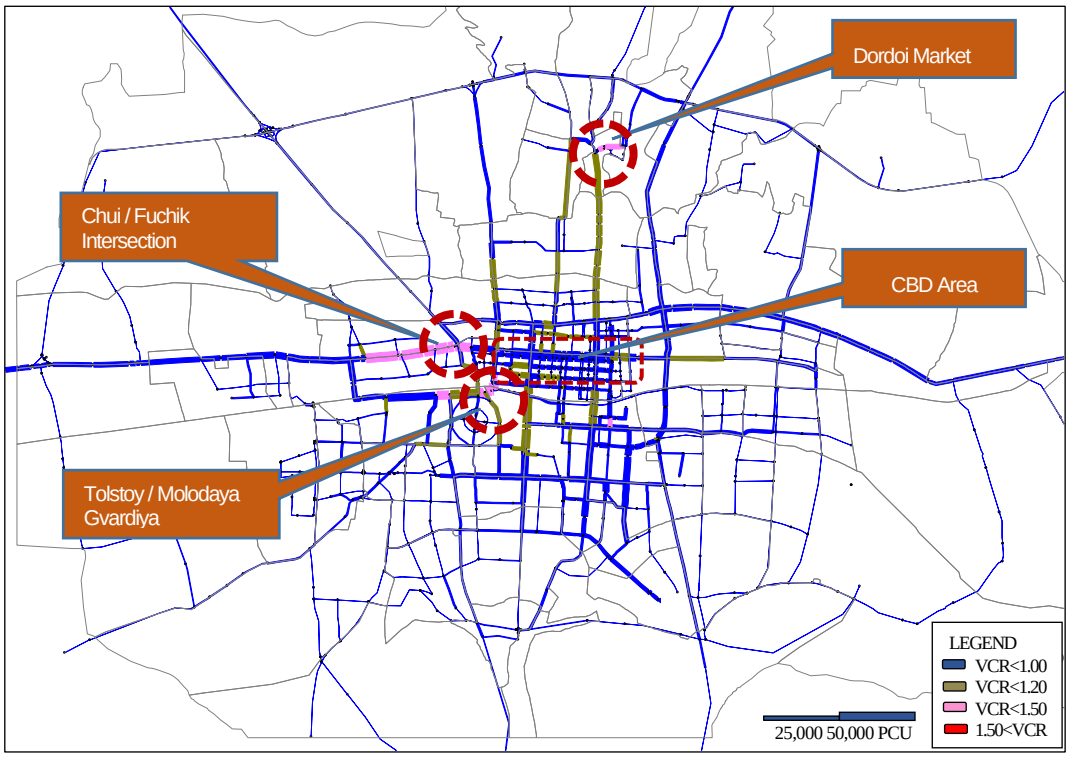


Figure 14.7-1 (1) Daily Traffic Assignment in 2011

In the road sections where VCR is greater than 1.2 forms a bottleneck. As a result, it causes congestion and vehicle speed reduction at bottlenecks in 2013, 2018 and 2023. The bottleneck occurs at Chui / Alma Atinskaya intersection and Jibek-Jolu or Elebesov intersection in 2018 and Mir / Tolstoy and Sovetskaya / Gorky intersection in 2023.

Table 14.7-5 Summary of Major Bottleneck Location

Locations	VCR			Average Speed (km/h)		
	2013	2018	2023	2013	2018	2023
Near Dordoi Market	1.30	1.31	1.34	33.1	32.9	32.7
Chui-Fuchik Intersection (East-West)	1.46	1.51	1.60	31.2	30.5	29.8
Tolstoy-Molodaya Gvardiya	1.35	1.40	1.50	32.5	32.0	31.0
Chui-Alma Atinskaya	-	1.27	1.29	-	33.4	33.2
Jibek-Jolu-Elebesov	-	1.22	1.24	-	34.0	33.8
Mir-Tolstoy	-	-	1.24	-	-	33.8
Sovetskaya-Gorky	-	-	1.24	-	-	33.9

The analysis shows that the result in the year 2013 is almost similar to that of the year 2011. The daily average travel speed is decreased from 35.1 km/hr in 2011 to 35.6 km/hr in 2013.

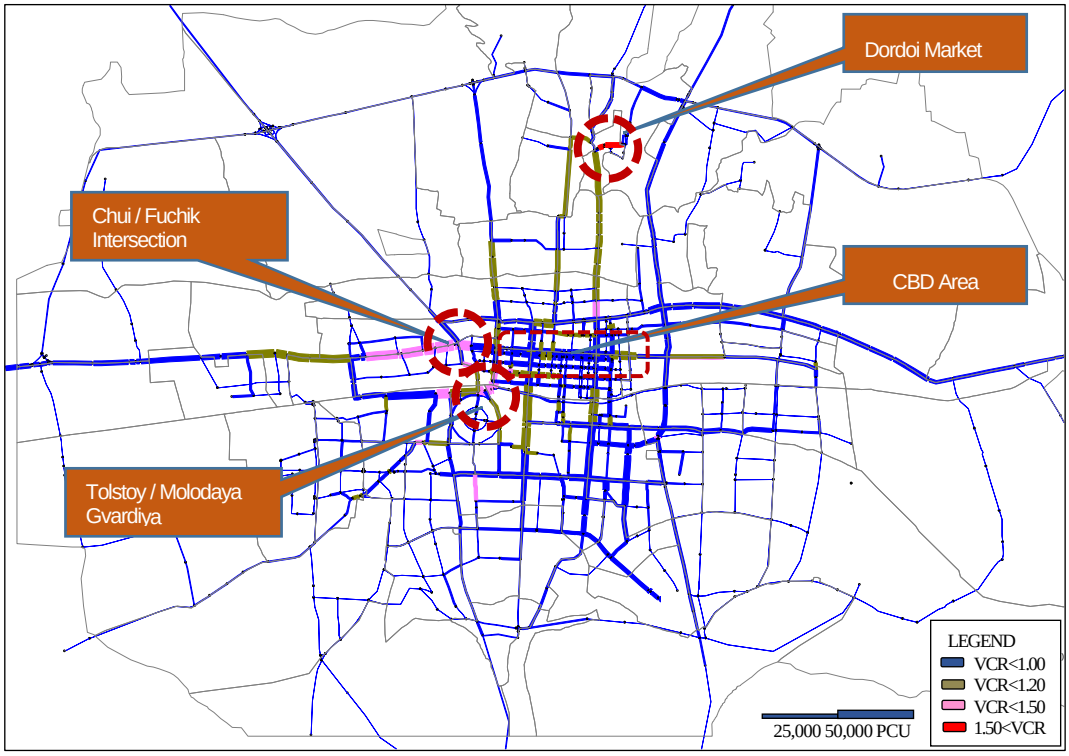


Figure 14.7-1 (2) Daily Traffic Assignment in 2013

The results of the year 2018 show that congestion in arterial roads approaching into the City Center (CBD) is gradually increasing. The daily average travel speed is decreased from 35.6 km/hr (in 2011) to 34.4 km/hr (in 2018).

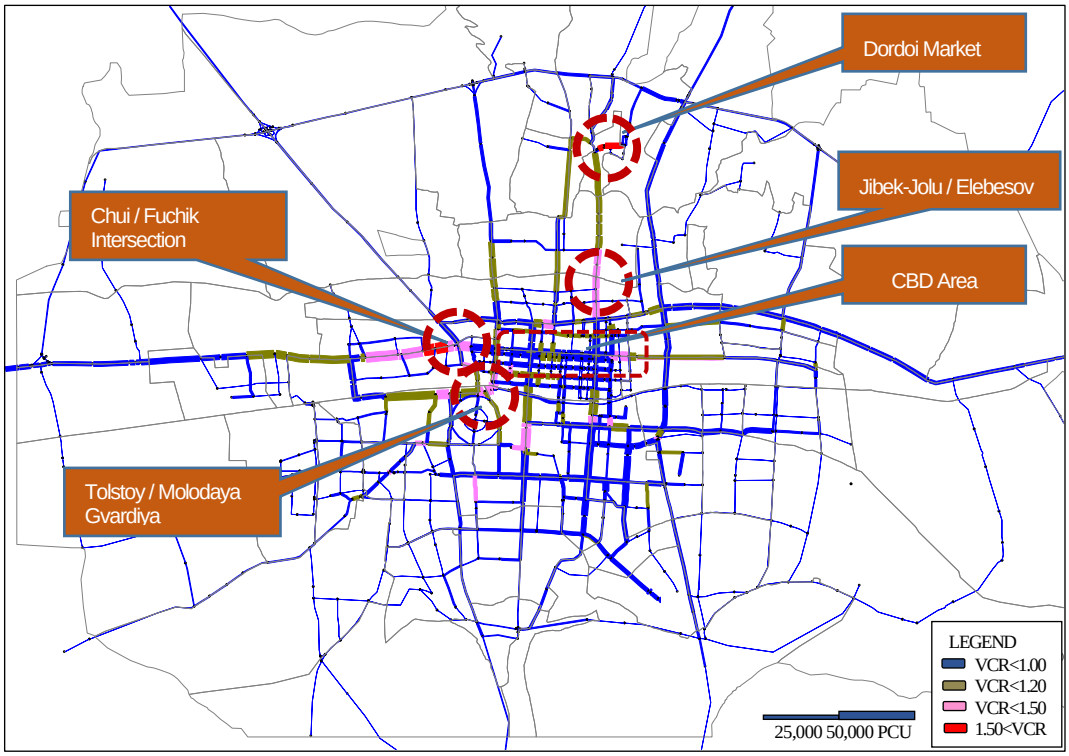


Figure 14.7-1 (3) Daily Traffic Assignment in 2018

The results of the year 2023 shows unacceptable level of traffic congestion in arterials roads around the periphery of the City Center because VCR is more than 1.20. As a result, the daily average travel speed is decreased from 35.6 km/hr in 2011 to 33.7 km/hr in 2023.

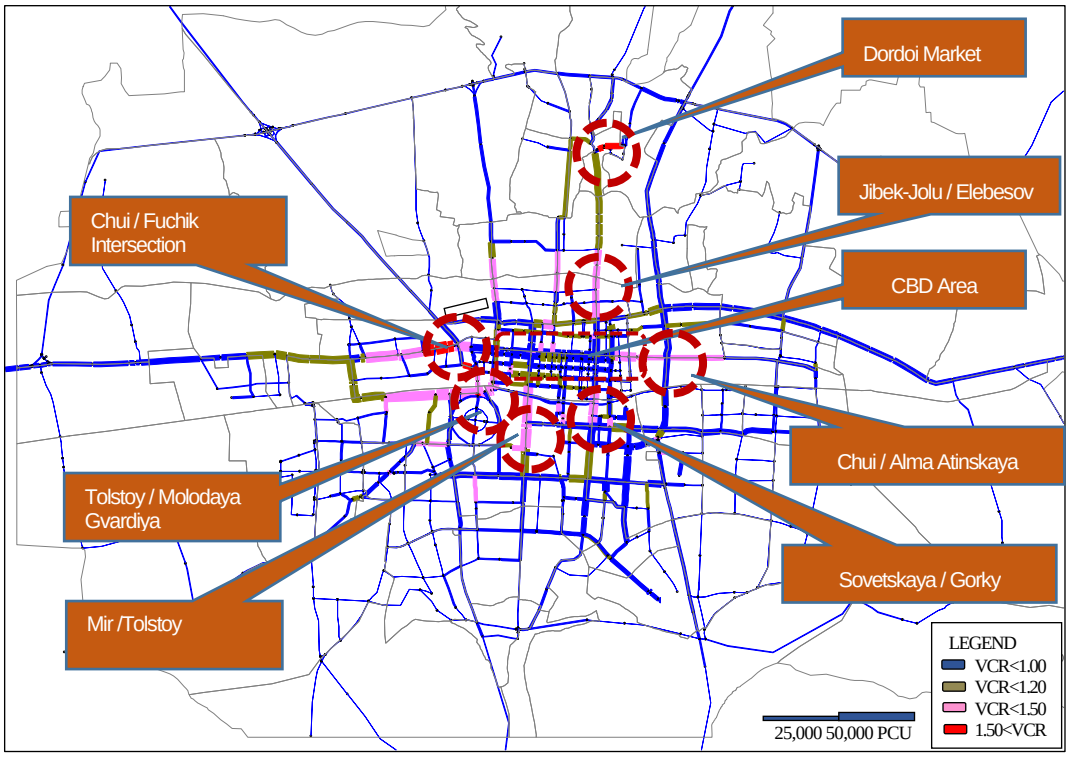


Figure 14.7-1 (4) Daily Traffic Assignment in 2023

(2) Peak Hour Assignment Result

The vehicle peak hour task results of the conditions in 2011 and future demand in 2013, 2018 and 2023 are summarized in **Table 14.7-6**. The average travel speed was decreased from 22.7 km/hr in 2011 to 15.1 km/hr in 2023 and VCR in 2023 reached to 0.77 which was 0.66 in 2011.

Table 14.7-6 Summary of Vehicle Assignment Results

Average VCR (Volume Capacity Ratio)				Peak Hour Speed (km/hr)			
2011	2013	2018	2023	2011	2013	2018	2023
0.66	0.69	0.73	0.77	22.7	22.0	18.9	15.1

Figure 14.7-2 (1) shows that the level of congestions at the peak hour. Traffic congestions are concentrated mainly at the entry points of the CBD area. A significant number of road links with VCR between 1.2 and 1.5 is observed during peak hour.

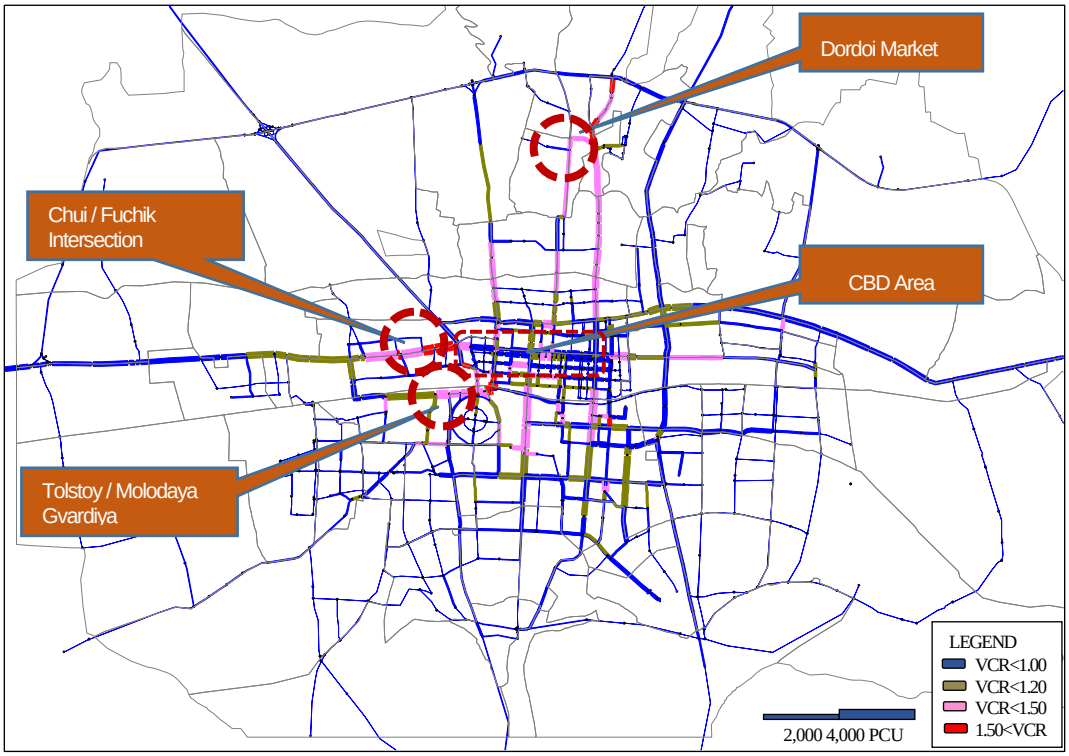


Figure 14.7-2 (1) Peak Hour Traffic Assignment in 2011

Figure 14.7-2 (2) shows that the number of bottleneck locations in CBD area are increased in 2013 and consequently travel speed is decreased to 22.0 km/hr.

Table 14.7-7 Summary of Major Bottleneck Location in Peak Hour

Locations	VCR			Peak Hour Speed (km/h)		
	2013	2018	2023	2013	2018	2023
Near Dordoi Market	1.97	2.01	2.11	5.0	5.0	5.0
Chui-Fuchik Intersection (East-West)	1.50	1.52	1.58	5.0	5.0	5.0
Tolstoy-Molodaya Gvardiya	1.45	1.53	1.81	13.4	5.0	5.0
Chui-Alma Atinskaya	1.32	1.37	1.48	17.0	15.6	12.5
Jibek-Jolu-Elebesov	1.37	1.39	1.46	15.6	14.9	13.0
Mir-Tolstoy	1.37	1.53	1.55	15.6	5.0	5.0
Sovetskaya-Gorky	1.37	1.43	1.48	15.6	14.0	12.6

The peak hour travel speed is 22.0 km/hr and VCR 0.69 in 2013.

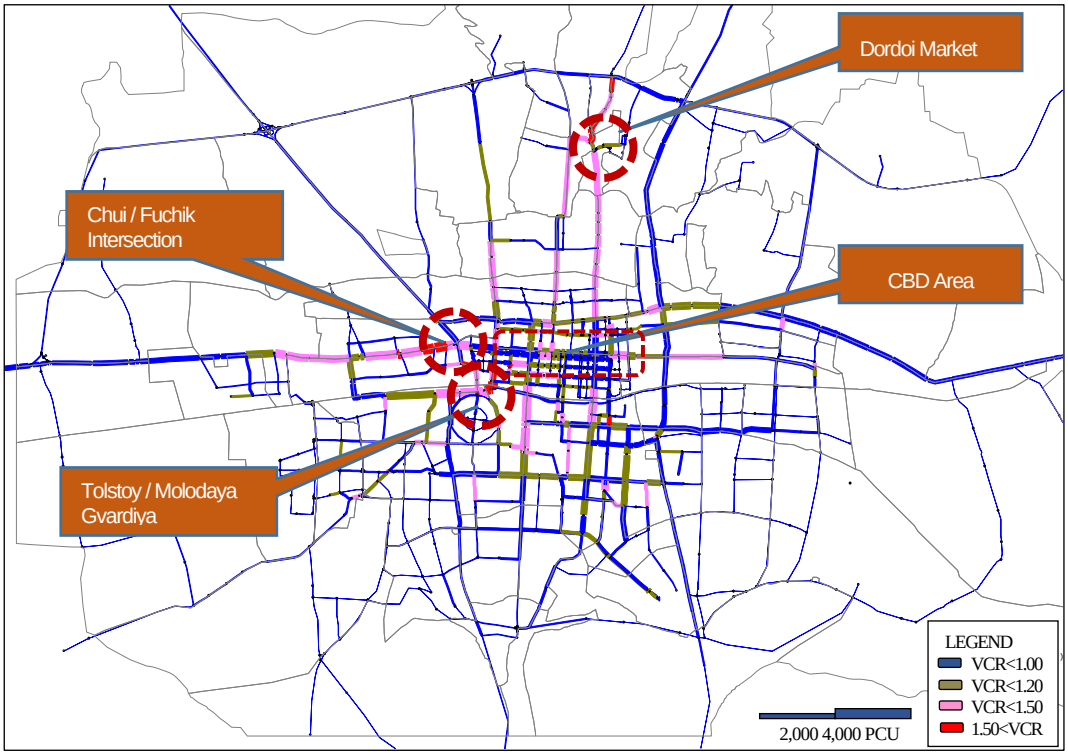


Figure 14.7-2 (2) Peak Hour Traffic Assignment in 2013

Figure 14.7-2 (3) shows more unacceptable level of traffic congestion at peak hours at the major intersections of arterial roads around the periphery of the City Center.

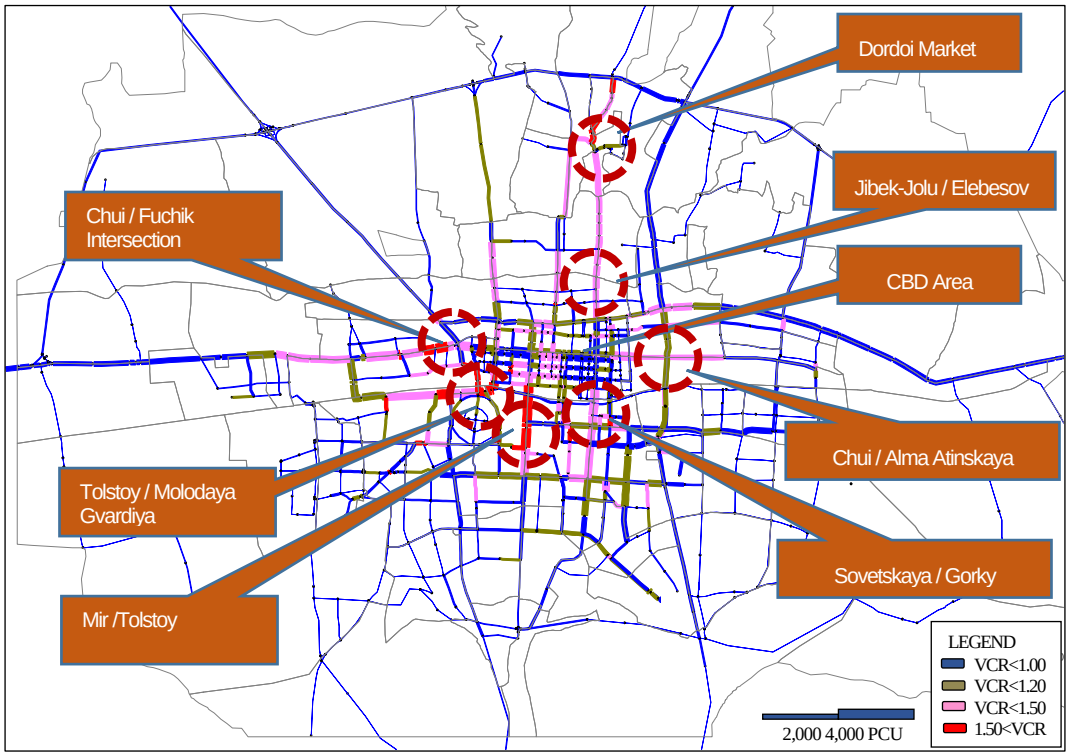


Figure 14.7-2 (3) Peak Hour Traffic Assignment in 2018

The peak hour travel speed is 15.1 km/hr in 2023 which is 7 km/hr less than in the year 2013.

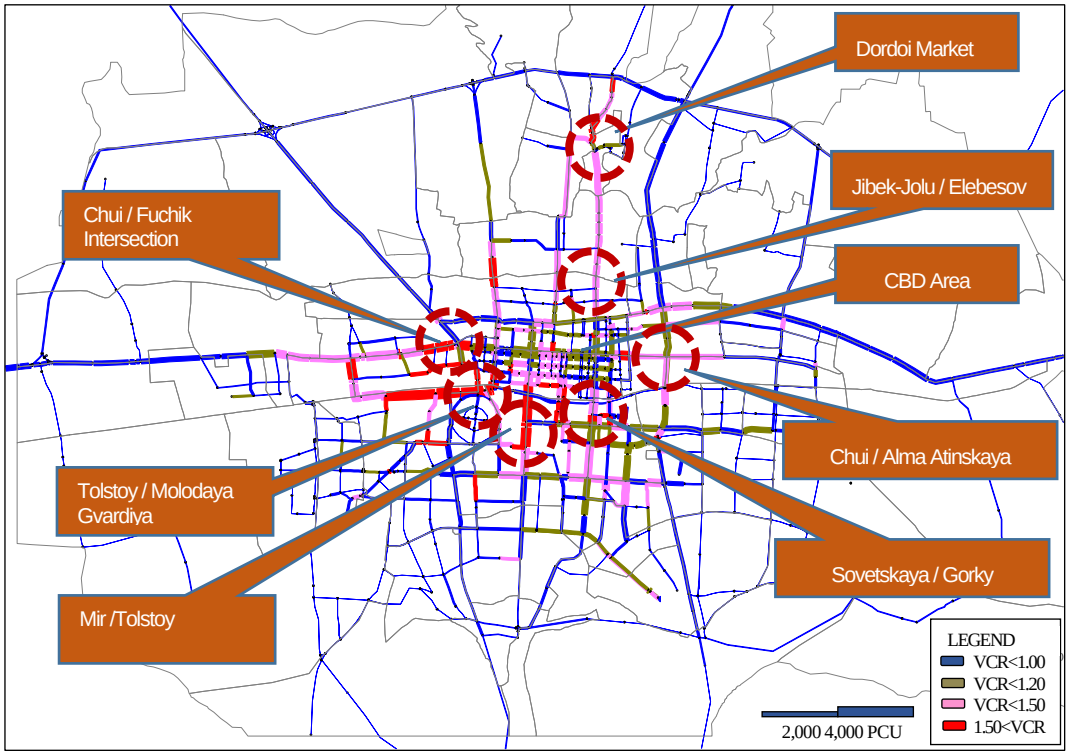


Figure 14.7-2 (4) Peak Hour Traffic Assignment in 2023

14.8 Public Transportation Demand Forecast

14.8.1 Public Transportation Corridor

Based on the demands of the public transportation passengers for 2023 utilizing the trolleybus, the midibus and the minibus, the future public transportation corridors are defined as shown in **Figure 14.8-1**.

(i) East-West Corridors: Chui Avenue / Kuevskaya Street, and Akhunbaev Street

(ii) North-South Corridors: Sovetsukaya Street, and Mir Avenue / Manas Avenue

(iii) Connection to East Bus Terminal: Lenin Stree, and Alma Atinskaya Street

(iv) Connection to West Bus Terminal: Makhatma Gandi Street

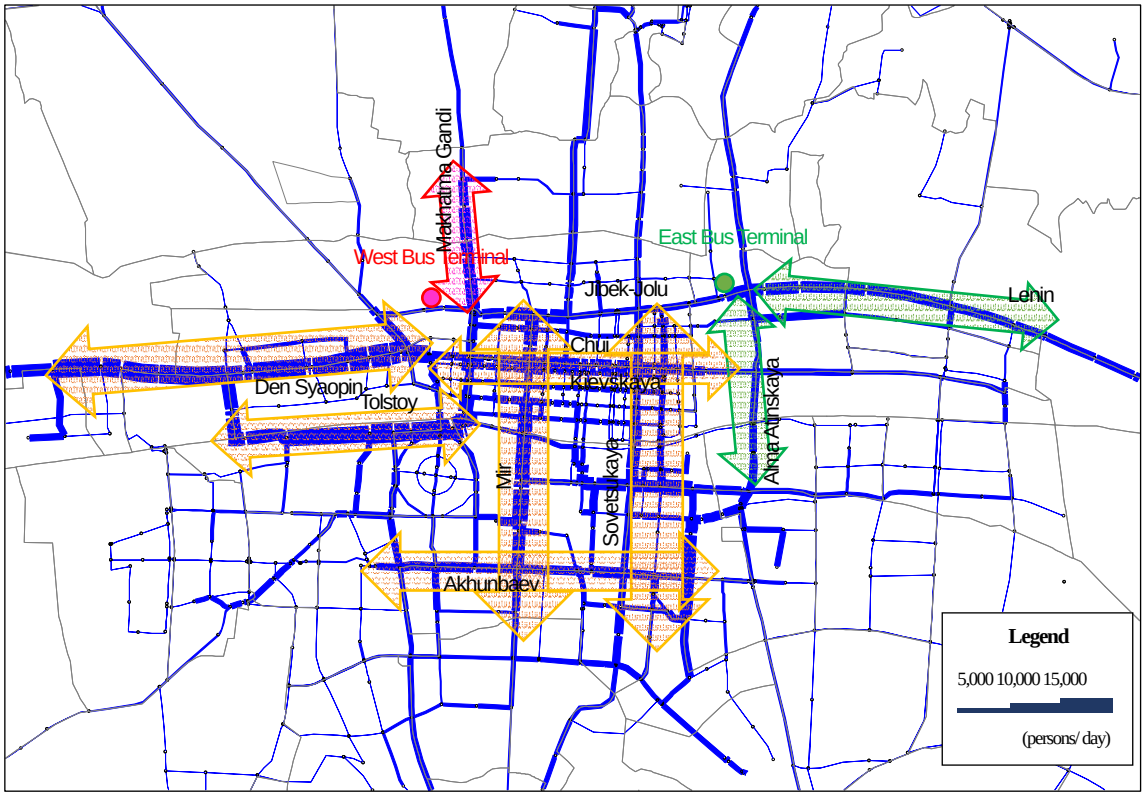


Figure 14.8-1 Public Transportation Corridor in 2023

14.8.2 Share of Public Transportation Vehicles on the Road

The share of person trips of each public transportation mode is shown in **Table 14.8-1** with numbers of vehicles in Bishkek City and the occupancy rate of each public transportation. There are many minibuses in the city frequently operating, carrying 90 percent of public transportation passengers. It is clear that larger vehicles such as trolleybus and / or midibus replacing the present minibus vehicles will reduce the total number of vehicles on the road and relieve traffic congestions. Additionally, the present occupancy rates of the trolleybus and the midibus are less than 60 percent. The Study

recommends introducing a bigger bus fleet replacing present minibus routes especially in the City Center.

Table 14.8-1 Trip Share in 2011

Transportation Mode	Person Trip share (2011)	Number of Vehicle in Bishkek City (2011)	Daily Occupancy Ratio (2012)
1.Trolleybus	7.1%	87	46%
2.Midibus	2.5%	460	54%
3.Minibus	90.4%	About 3,800	117%
Total	100%		

Note: Person trip share came out of the present OD.
Number of Vehilces in Bishkek City is infromed from UTD.
Daily Occupanccy Ratio is the results of the public transportation survey conducted in 2012. See **Chapter 7**.
Source: JICA Study Team

CHAPTER 15 CONSIDERATION OF FUTURE TRAFFIC

Future traffic forecast was conducted based on the present situation analysis and socio-economic framework. The results of the future traffic forecast and expected problems and issues in the transportation system of Bishkek City are summarized below.

<table>
<tr><th>Category</th><th>Summary of Analysis</th><th>Problem and Issue</th></tr>
<tr><td colspan="3">Road Network and Traffic</td></tr>
<tr><td>VCR
(Volume Capacity Ratio)</td><td>1. Entire Road Network
Analysis Results show that VCR in the entire road network of the Study Area will be increased both in daily average traffic assignment and peak hour traffic assignment. Road capacity has sufficient service level as a entire network in 2023.

<table>
<tr><th rowspan="2">Year</th><th colspan="2">VCR</th></tr>
<tr><th>Daily Average Traffic Assignment</th><th>Peak Hour Traffic Assignment</th></tr>
<tr><td>2013</td><td>0.51</td><td>0.69</td></tr>
<tr><td>2018</td><td>0.56</td><td>0.73</td></tr>
<tr><td>2023</td><td>0.62</td><td>0.77</td></tr>
</table>

2. Bottleneck Point
Major Road Bottlenecks and Their Locations (Year 2023).

<table>
<tr><th rowspan="2">Road and location</th><th colspan="2">VCR</th></tr>
<tr><th>Daily Average Traffic Assignment</th><th>Peak Hour Traffic Assignment</th></tr>
<tr><td>Near Dordoi Market</td><td>1.34</td><td>2.11</td></tr>
<tr><td>Chui / Fuchik
Intersection Chui ave. (East-West bound)</td><td>1.55</td><td>1.58</td></tr>
<tr><td>Tolstoy / Molodaya Gvardiya Boulevard</td><td>1.47</td><td>1.81</td></tr>
<tr><td>Chui / Alma Atinskaya str.</td><td>1.29</td><td>1.48</td></tr>
<tr><td>Jibelk-Jolu / Elebesov str.</td><td>1.24</td><td>1.46</td></tr>
<tr><td>Mir / Tolstoyt str.</td><td>1.24</td><td>1.55</td></tr>
<tr><td>Sovetskaya / Gorkey str.</td><td>1.24</td><td>1.48</td></tr>
</table>
</td><td>Problem:
1. More serious traffic congestion is expected during peak hours because traffic volume exceeds the road capacity.

Solutions to Issues
1. Preventive measures such as the traffic demand reduction are necessary in the entire network for eliminating future traffic congestion.
2. Traffic detours from the traffic congested areas or bottlenecks are necessary and traffic detours can be done by traffic management such as one-way traffic assignment and enforcement of traffic regulations.
3. Traffic capacity improvement in the bottleneck location and major roads for the resolution and mitigation.
4. Elimination of congestion at the bus stops and illegally parked vehicles are the hindrances to increasing traffic volume management.</td></tr>
</table>

<table>
<tr><th>Category</th><th>Summary of Analysis</th><th>Problem and Issue</th></tr>
<tr><td>Travel Speed</td><td>
1. Entire Road Network
The analysis of results shows that Travel Speed in the entire road network of the Study area will be increased both in daily average traffic assignment and peak hour traffic assignment.
<table>
<tr><th rowspan="2">Year</th><th colspan="2">Travel Speed (km/hr)</th></tr>
<tr><th>Daily Average Traffic Assignment</th><th>Peak Hour Traffic Assignment</th></tr>
<tr><td>2013</td><td>35.1</td><td>22.0</td></tr>
<tr><td>2018</td><td>34.4</td><td>18.9</td></tr>
<tr><td>2023</td><td>33.7</td><td>15.1</td></tr>
</table>
2. Bottleneck Point
Major Road Bottleneck and Their Locations (Year 2023).
<table>
<tr><th rowspan="2">Road and Location</th><th colspan="2">Travel Speed (km/hr)</th></tr>
<tr><th>Daily Average Traffic Assignment</th><th>Peak Hour Traffic Assignment</th></tr>
<tr><td>Near Dordoi Market</td><td>32.7</td><td>5.0</td></tr>
<tr><td>Chui / Fuchik Intersection Chui ave. (East-West bound)</td><td>29.8</td><td>5.0</td></tr>
<tr><td>Tolstoy / Molodaya Gvardiya Boulevard</td><td>31.0</td><td>5.0</td></tr>
<tr><td>Chui / Alma Atinskaya str.</td><td>33.2</td><td>12.5</td></tr>
<tr><td>Jibelk-Jolu / Elebesov str.</td><td>33.8</td><td>13.0</td></tr>
<tr><td>Mir / Tolstoyt str.</td><td>33.8</td><td>5.0</td></tr>
<tr><td>Sovetskaya / Gorkey str.</td><td>33.9</td><td>12.6</td></tr>
</table>
</td><td>
Problem:
1. Peak hour travel speed is reduced by 18.0 km in comparison with daily average speed in 2023.
2. Traffic congestion occurs in local areas by low speed.
3. Prolonged congestion during peak hours at the point of bottleneck in particular.

Solutions to the Issues:
1. Requirement to improve travel speed to eliminate traffic congestion.
2. Appropriate measures to avoid congestion during a peak hour is necessary.
3. Appropriate signal operation or control and repair of damaged roads can be reasonable measures.
</td></tr>
<tr><td colspan="3">Traffic Environment</td></tr>
<tr><td>Road Improvement</td><td>
1. CO_2 emission
CO_2 emissions increase due to an increase in traffic volume. The increase in emissions is due to low vehicle speed by congestions and lowering of vehicle speed by damaged road.
<table>
<tr><th rowspan="2">Year</th><th colspan="2">CO_2 Emission</th></tr>
<tr><th>ton / day</th><th>ton / year</th></tr>
<tr><td>2013</td><td>985.3</td><td>359,620</td></tr>
<tr><td>2018</td><td>1,050.0</td><td>383,238</td></tr>
<tr><td>2023</td><td>1,140.4</td><td>416,231</td></tr>
</table>
</td><td>
Problem:
1. Since arterial, collector and distributor roads are damaged, vehicles cannot run in its normal speed and consequently CO_2 emission is increased.
2. Since vehicle operation cost increases due to low speed, economic efficiency is also affected.

Solutions to the Issues:
1. Political action and soft environmental measures (an emission gas burden charge, an ecology car and so on).
2. Road improvements and rehabilitations are necessary.
</td></tr>
</table>

<table>
<tr><th>Category</th><th>Summary of Analysis</th><th>Problem and Issue</th></tr>
<tr><td colspan="3">Public Transportation</td></tr>
<tr><td>Public Transportation demand in 2023</td><td>The main bounds (axes) and facilities of the public transportation based on transportation demand in the future.

・East - West bound : Chui avenue / Kievskaya street
・North - South bound : Sovtsskaya street / Mir avenue / Manas avenue
・East Bus Terminal : Lenin street / Alma Atinskaya street
・West Bus Terminal : Makhatma Gandi street</td><td>Problem:
1. Bus terminals (east and west) are located in afar distance and the terminals are not connected by public transportation routes. Connection to the City center is also not good.
2. Route networks are not configured considering the mutual transfers.

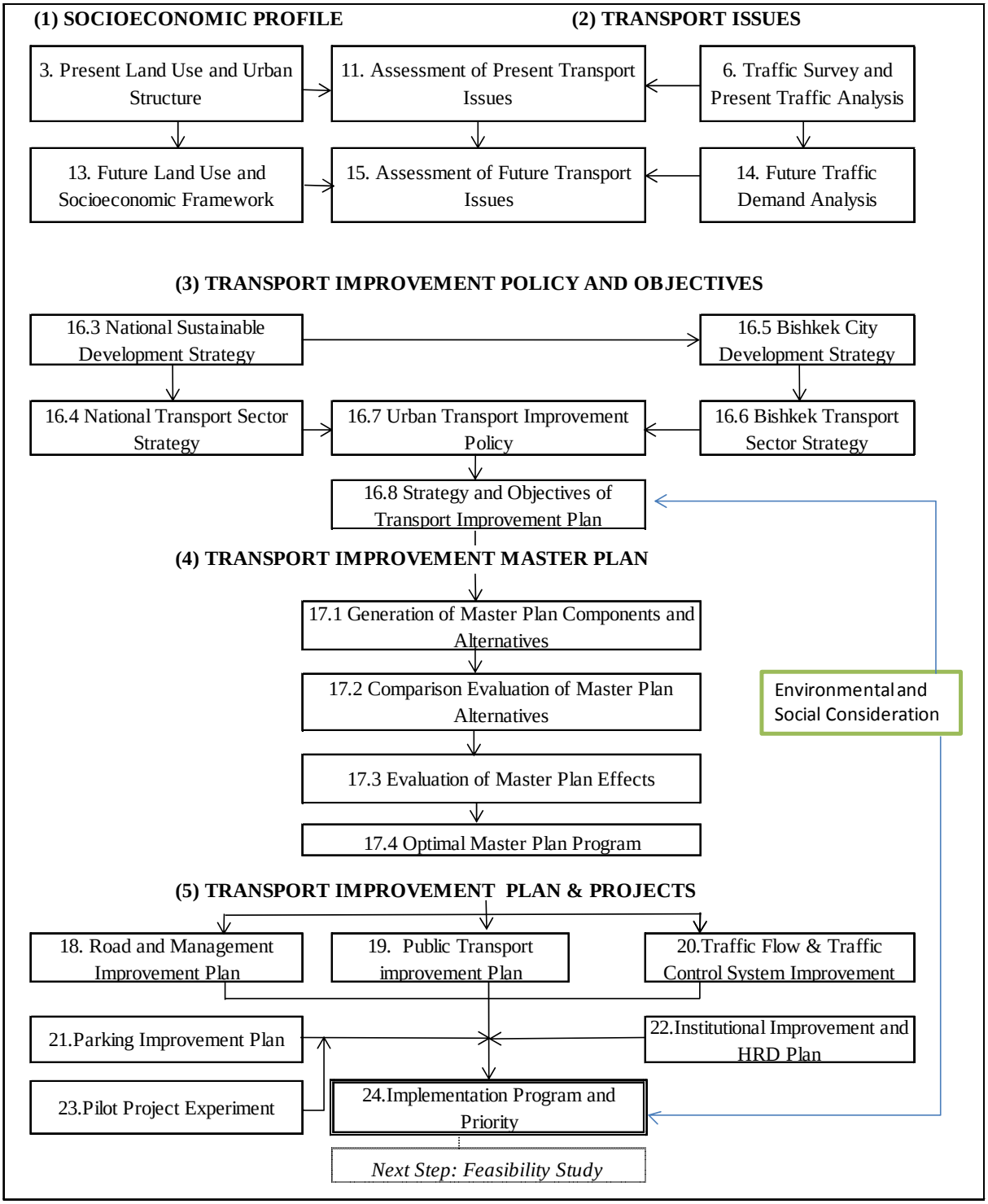
Solutions to Issues:
1. Bus route network reformation on the basis of public transportation demand for the year 2023.
2. Strengthening of transfer function and provision of bus terminal is the base for development of public transportation network.
3. Improvement of East-West bus terminal.</td></tr>
<tr><td>Composition ratio of Bus and Passenger</td><td>・Share of trolleybus and midibus among public transportation modes is 10% whereas the share of minibus is 90%.
・Number of minibus in the Bishkek City is about 3,800.
・Present occupancy rates of the trolleybus and the midibus are less than 60% whereas that of the minibus exceeds 100%, which means over loading or over the limits of capacity.

<table>
<tr><th>Transportation Mode</th><th>Person Trip share (2011)</th><th>Number of Vehicle in Bishkek City (2011)</th><th>Daily Occupancy Ratio (2012)</th></tr>
<tr><td>1.Trolleybus</td><td>7.1%</td><td>87</td><td>46%</td></tr>
<tr><td>2.Midibus</td><td>2.5%</td><td>460</td><td>54%</td></tr>
<tr><td>3.Minibus</td><td>90.4%</td><td>About 3,800</td><td>117%</td></tr>
<tr><td>Total</td><td>100%</td><td></td><td></td></tr>
</table>
Note: Person trip share came out of the present OD.
Number of Vehilces in Bishkek City is infromed from UTD.
Daily Occupanccy Ratio is the results of the public transportation survey conducted in 2012. See Chapter 7.</td><td>Problem:
1. Minibus is crowded with the boarding rates more than a riding capacity.
2. Average rate of riding public transportation is less than 60%.
3. Number of minibus is one of the congestion factors.
4. Safety and comfort are spoiled by excess of a riding capacity.

Solutions to Issues:
1. Shifting from passenger car to trolleybus and midibus.
2. Road congestion can be minimized by enlarging of the minibus.
3. Adaptation of proper public transportation.</td></tr>
</table>

PART III: URBAN TRANSPORTATION IMPROVEMENT MASTER PLAN
CHAPTER 16 TRANSPORTATION IMPROVEMENT POLICIES AND STRATEGY

16.1 Flow of Urban Transport Improvement Plan Formulation



Note : Indicated Numbers are Chapter Number.

Figure 16.1-1 Flow of Urban Transport Improvement Plan Formulation

Figure 16.1-1 shows a flow of urban transport improvement plan formulation as follows:

(i) A Socio-economic Profile

(ii) Transport Issues based on survey results in the previous chapters

(iii) **Chapter 16** studies Transport Improvement Policy and Objectives through a National Sustainable Development Strategy with a national transport sector strategy and a Bishkek City Development Strategy with its transport sector strategy in order to formulate the strategy and objectives of an urban transport improvement plan

(iv) **Chapter 17** covers Transport Improvement Master Plan

(v) Transport Improvement Plan & Project

Chapter 18 to **Chapter 23** proposes improvement plans for each transport issue, and **Chapter 24** summarizes an implementation program with priority.

16.2 Planning Steps

16.2.1 Socio - Economic Profile

The first step of socio-economic profile included two sequential-analysis sub-steps:

(i) The present land use and urban structure and its population in Bishkek City in **Chapter 3** and **Chapter 4**, respectively

(ii) Future development pattern of urban structures and socio-economic framework in **Chapter 12** and **Chapter 13**, respectively

Both analyses were based on the present authorized land use plan (General Plan 2006).

16.2.2 Transport Issues

The present traffic analysis with traffic surveys in 2011 was carried out in **Chapter 6**, thereby assessing the present transport situations and issues that were summarized in **Chapter 11**, and future traffic demand forecast by using a traffic model in the target year of 2013, 2018, and 2023, summarized in **Chapter 15**. Based on the future travel demand, assessment of future transport issues was worked out in **Section 16.2**.

16.2.3 Transport Improvement Policy and Objectives

The Government has introduced a new National Sustainable Development Strategy (NSDS) 2013-2017, including a national transport and communication sector strategy (See **Section 16.3**). Following NSDS, Bishkek City prepared Bishkek City Sustainable Development Strategy (BSDS) (a temporary title) to be prepared by reviewing the present Bishkek City Development Concept (2025). The Study considers these new strategies, both NSDS and BSDS, as basic policies for formulation of an urban transport improvement plan.

16.2.4 Transport Improvement Component and Alternatives in Master Plan

In accordance with RD with the City and JICA, a scope of the Study is defined as the simple Master Plan (MP) that limits to three components comprising public transportation improvement plan, traffic control system improvement plan, and traffic flow improvement plan. **Chapter 17** formulates MP; the components and alternative scenarios were generated in **Section 17.1**. Comparison evaluation was done in **Section 17.2**, effects evaluation of master plan in **Section 17.3,** and an optional program of the MP in **Section 17.4**.

16.2.5 Transport Improvement Plans and Projects

With the optimal program of MP, by reviewing results and learning of social experiment projects, the detailed improvement plans were prepared including:

(i) Public transportation,

(ii) Traffic flow and control

(iii) City parking

(iv) Institution and capacity development

In the preparation, environmental and social consideration was to be considered, and mitigation measures are proposed, in case, where negative impacts exist.

The plans and projects are further examined for the priority by criteria established from the City development strategies. The major criteria are as follows:

(i) Solution of fund constrain

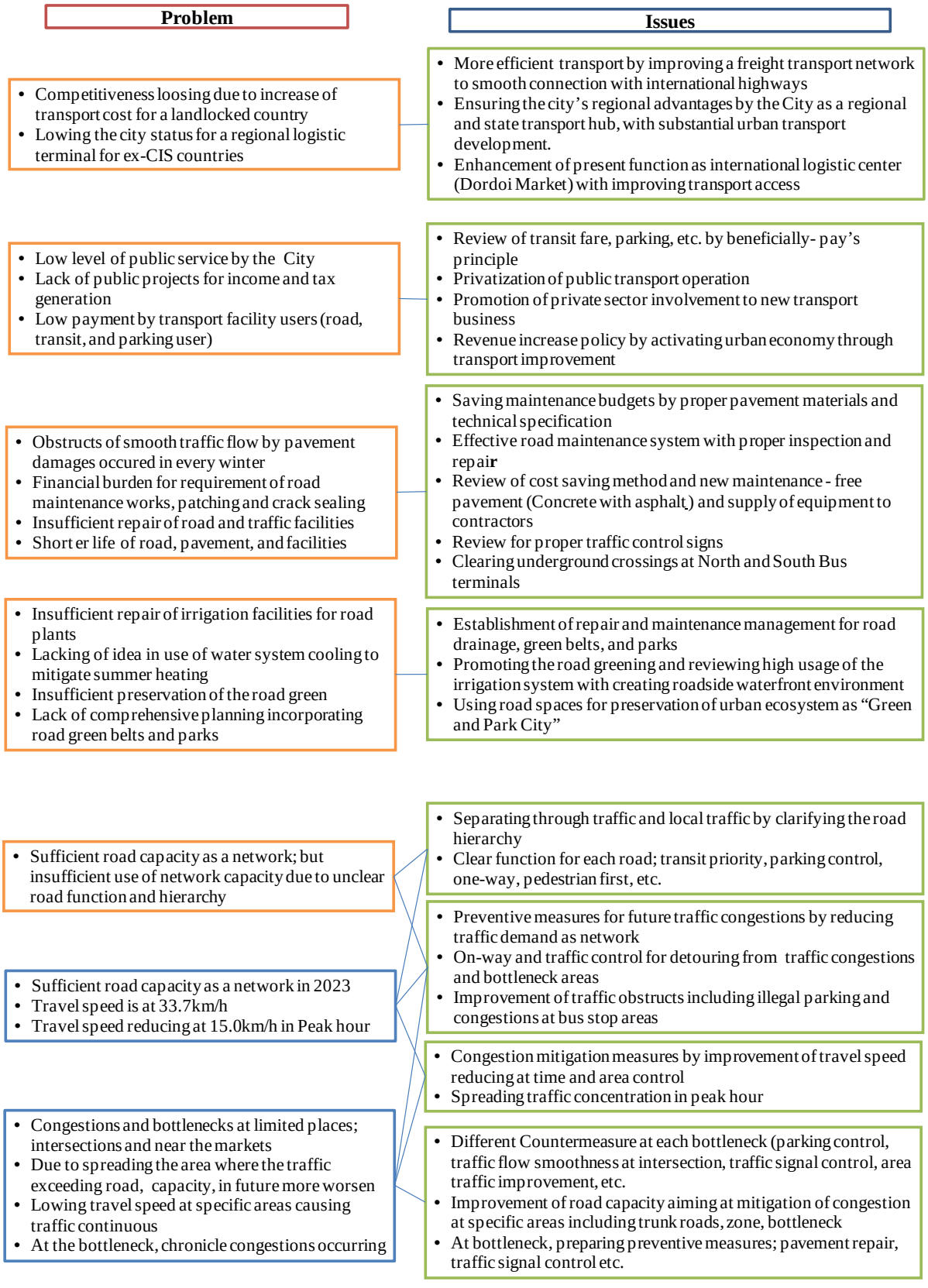
(ii) Strengthening of law and institutional capacity

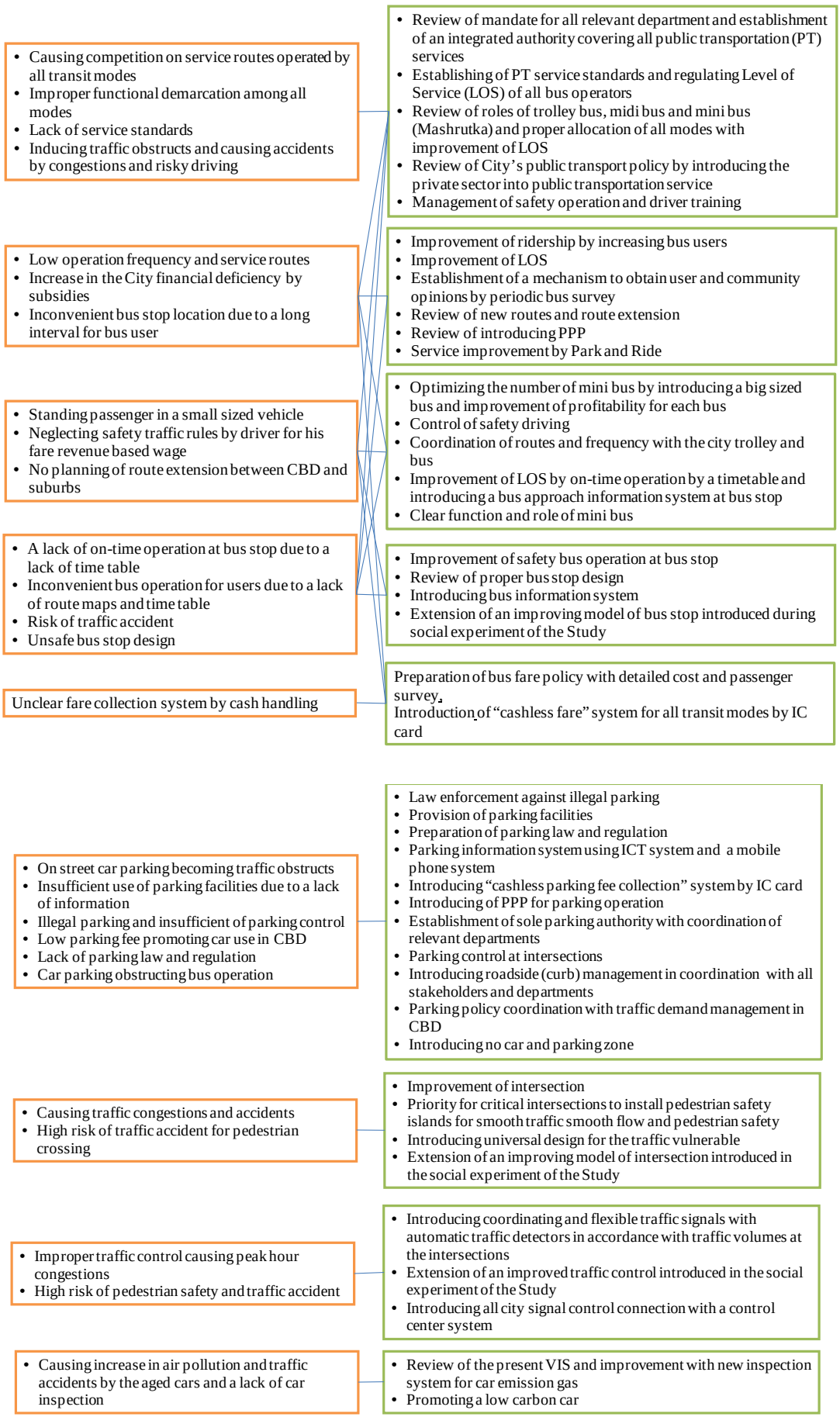
(iii) Promotion of EST

(iv) Practicability with three timeframes, the short-term (3-year), the mid-term (5-year) and a long term (10 year) implementation with staging by the year of 2016, 2018 and 2023.

As a result, In **Chapter 24**, a practicable Implementation Program (IP) covering each approach is formulated as a guide of actual implementation. With the involvement of stakeholders and development partnership, IP should be monitored and reviewed regularly.

16.3 Assessment of Present and Future Transportation Issues




• Causing competition on service routes operated by all transit modes
• Improper functional demarcation among all modes
• Lack of service standards
• Inducing traffic obstructs and causing accidents by congestions and risky driving
• Review of mandate for all relevant department and establishment of an integrated authority covering all public transportation (PT) services
• Establishing of PT service standards and regulating Level of Service (LOS) of all bus operators
• Review of roles of trolley bus, midi bus and mini bus (Mashrutka) and proper allocation of all modes with improvement of LOS
• Review of City's public transport policy by introducing the private sector into public transportation service
• Management of safety operation and driver training
• Low operation frequency and service routes
• Increase in the City financial deficiency by subsidies
• Inconvenient bus stop location due to a long interval for bus user
• Improvement of ridership by increasing bus users
• Improvement of LOS
• Establishment of a mechanism to obtain user and community opinions by periodic bus survey
• Review of new routes and route extension
• Review of introducing PPP
• Service improvement by Park and Ride
• Standing passenger in a small sized vehicle
• Neglecting safety traffic rules by driver for his fare revenue based wage
• No planning of route extension between CBD and suburbs
• Optimizing the number of mini bus by introducing a big sized bus and improvement of profitability for each bus
• Control of safety driving
• Coordination of routes and frequency with the city trolley and bus
• Improvement of LOS by on-time operation by a timetable and introducing a bus approach information system at bus stop
• Clear function and role of mini bus
• A lack of on-time operation at bus stop due to a lack of time table
• Inconvenient bus operation for users due to a lack of route maps and time table
• Risk of traffic accident
• Unsafe bus stop design
• Improvement of safety bus operation at bus stop
• Review of proper bus stop design
• Introducing bus information system
• Extension of an improving model of bus stop introduced during social experiment of the Study
Unclear fare collection system by cash handling
Preparation of bus fare policy with detailed cost and passenger survey,
Introduction of "cashless fare" system for all transit modes by IC card
• On street car parking becoming traffic obstructs
• Insufficient use of parking facilities due to a lack of information
• Illegal parking and insufficient of parking control
• Low parking fee promoting car use in CBD
• Lack of parking law and regulation
• Car parking obstructing bus operation
• Law enforcement against illegal parking
• Provision of parking facilities
• Preparation of parking law and regulation
• Parking information system using ICT system and a mobile phone system
• Introducing "cashless parking fee collection" system by IC card
• Introducing of PPP for parking operation
• Establishment of sole parking authority with coordination of relevant departments
• Parking control at intersections
• Introducing roadside (curb) management in coordination with all stakeholders and departments
• Parking policy coordination with traffic demand management in CBD
• Introducing no car and parking zone
• Causing traffic congestions and accidents
• High risk of traffic accident for pedestrian crossing
• Improvement of intersection
• Priority for critical intersections to install pedestrian safety islands for smooth traffic smooth flow and pedestrian safety
• Introducing universal design for the traffic vulnerable
• Extension of an improving model of intersection introduced in the social experiment of the Study
• Improper traffic control causing peak hour congestions
• High risk of pedestrian safety and traffic accident
• Introducing coordinating and flexible traffic signals with automatic traffic detectors in accordance with traffic volumes at the intersections
• Extension of an improved traffic control introduced in the social experiment of the Study
• Introducing all city signal control connection with a control center system
• Causing increase in air pollution and traffic accidents by the aged cars and a lack of car inspection
• Review of the present VIS and improvement with new inspection system for car emission gas
• Promoting a low carbon car

16.4 National Sustainable Development Strategy

The National Sustainable Development Strategy (NSDS) was formulated for a task of five-year (2013 to 2017) by the President's office, in cooperation with international donors, and issued in March 2013. The Study considers NSDS as higher strategies of MP. **Figure 16.4-1** summarizes a Scheme of National Sustainable Development Strategies.

NATIONAL SUSTAINABLE DEVELOPMENT STRATEGY

1. Strategic vision of Kyrgyzstan in the long term

- a strong and independent country that is part of the developed countries,
- a place that is comfortable for living,
- a place where their rights, freedoms and security are ensured,
- a multi-lingual and friendly domestic environment governed by the rule of law,
- a country with high level of education, healthy natural environment, public stability, international image of state with stable background, robust economic growth and high attractiveness for investors.

2. A task in the next five years (period of 2013-2017)

The Strategy is designed to ensure achievement of a task of succeeding as a democratic state with stable political system, dynamically growing economy and stable growth in the incomes of its citizen.

Local Self-Government Development Strategy

1. Improvement of organizational and legal framework
2. Separation of functions and authorities
3. Improvement of the system of delivery of municipal services
4. Improvement of inter-budget relations, ensuring financial sustainability and effective management of resources
5. Increase in the accountability
6. Increase in professionalism and capacity building for the municipal service.

Transportation Sector Strategy

1. Rehabilitation of five motorways of the Central Asian Regional Economic Cooperation (CAREC)
2. Preservation and improvement of the network of domestic paved roads
3. Ensuring transport independence to construct new bypass (detour) roads
4. Creation of an air transport hub

THREE MANDATORY CONDITIONS BY NSDS

1. Relying own resources;
2. Ensuring supremacy of law and rule of law;
3. Ensuring unity;

Figure 16.4-1 Scheme of National Sustainable Development Strategies

16.4.1 Long Term Strategic Vision and Task of NSDS

(1) Strategic Vision of NSDS

The strategic vision of Kyrgyzstan in the long term is defined as follows:

(i) A strong and independent country that is one of the developed countries

(ii) A place that is comfortable for living

(iii) A place where their rights, freedoms and security are ensured

(iv) A multi-lingual and friendly domestic environment governed by the rule of law

(v) A country with high level of education, healthy natural environment, public stability, international image of state with stable background, robust economic growth and very attractiven for investors

The National Sustainable Development Strategy (2013 to 2017) (NSDS) is designed to ensure achievement of succeeding as a democratic state with a stable political system, dynamically growing economy and stable growth in the income of its citizens. The NSDS has two parts:

(i) To succeed as a state and to establish a foundation for successful development of the Kyrgyz Republic; and

(ii) Economic development priorities for 2013 to 2017 with expected results and implementing projects for five strategic industries comprising agriculture, energy, mining, transport and communication, and tourism.

During 2013 to 2017, NSDS will consolidate the foundations of a rule-of-law state with robust governance systems, and strengthen economic and social development, social and national security and environmental protection. The state aims to strengthening of the legal system that should ensure protection of the rights of citizens and good faith legal entities, robust protection of the fundamentals of the economy, including the institution of private property. That will require carefully planned, coordinated and consolidated effort of all three branches of government: legislative, executive and judicial branches, as well as increased collaboration of the branches with the civil society.

(2) Highlight policies of NSDS

The highlights of NSDS are:

(i) Founding a rule-of-law state

(ii) Promoting the unity of the state

(iii) Improvement of level of quality by social development

(iv) Ensuring environment conservation and protection

(v) Promoting economic development

(vi) Ensuring sustainable development

(vii) Facilitation of business and investment

(viii) Promotion of financial sector development

(ix) Insuring national budget allocation for five strategic industries (agriculture, energy, mining, transport and communication, and tourism)

(3) The state role in market

The state role in market is defined as:

(i) To continue regulating processes only in those industries where there is a significant risk to human life and where government interference is justified.

(ii) In other areas, to reduce its presence through reducing the scope of regulation on entrepreneurship, licensing and permits (the number is to be at least halved), bringing inspections to a minimum and improving interaction between the business community and the government.

(iii) The state reserves the authority to regulate matters relating to environmental protection and conservation of ecosystem services for the benefit of future generations of Kyrgyzstanis.

16.4.2 Economic Development

(1) Macroeconomic and social quality of life indicators

Objectives of economic development will become sustainable and stable; the budget will be balanced and the inflation will be predictable. Targeted macro - economic indicators are shown in **Table 16.4-1**.

Table 16.4-1 Targeted Indicators by 2017

Macroeconomic and social quality of life indicators	Target rate
a) Macroeconomic	
Average annual GDP growth rate	7%,
Nominal GDP	630 Billion SOMS
Per capita GDP from 1,200 USD per capita	2,500 USD
Inflation : in 2013 - 2014	no more than 9%
-ditto- : from 2015	5%-7%
External public debt	about 60% of the GDP
b) Social quality of life	
Average life expectancy of population from 69 in 2012	73
Job creation	350,000
Average labor pay from 11,500 SOMS	26,000 SOMS
Reduction in poverty from 37%	25%
c) International Performance indicator	
International Doing Business[1] rating from no lower than 40th	the top-30
Corruption perception index	global top-50
Global Enabling Trade rating (no lower than 60th)	no lower than 60th

Source : NSDS

(2) Strategic Industry Policies

Directions of economic development is to switch from consumption-oriented economy to investment-oriented economy, with development based on strategically important industries such as agriculture, energy, mining, transport and communication, and tourism.

(3) Foreign Trade Policy

The trade policy aims to shape its place in the regional division of labor; to revive products of domestic manufacturers, to bear Kyrgyzstani brands, and to be recognizable both on the domestic and on foreign markets. Integration into global trade is to the expansion of the export capacity to create new jobs; and to

[1] in the global ranking of economic freedom; the top performer among all CIS countries

mobilize external resources for internal needs.

(4) International Center

The country will create a favorable platform for turning itself into one of the important financial, business, tourism and culture centers in Central Asia. A reliable international partner that plays an important role in regional and global development will be actively promoted using the country's membership in various international organizations.

16.5 National Urban and Transportation Sector Strategy

16.5.1 Development of Local Self - Government

Bishkek City is a special city that has the same title of authority of the region (Obrast). NSDS considers carrying out the reform of local self-government to focus on the following tasks, which should be considered for BCDS.

(i) Improvement of organizational and legal framework of local self-government

(ii) Separation of functions and authorities of government agencies and local self-government (LSG), with delegation of government authority

(iii) Improvement of the system of delivery of municipal services by local self-government bodies

(iv) Improvement of inter-budget relations, ensuring financial sustainability of local government and effective management of resources at the local level

(v) Increase in the accountability and role of bodies of local self-government, improvement in the formats of reporting to local communities and local legislatures

(vi) Increase in professionalism and capacity building for the municipal service.

16.5.2 Transport and Communication Industry Development

There are five objectives to achieve a state goal in order to increase the transport and transit potential of the country and to improve the access of the population to markets for goods and services. (See **Table 16.5-1**).

(a) Rehabilitation of five motorways that represent international transport corridors of the Central Asian Regional Economic Cooperation (CAREC)

Table 16.5-1 Projects of International Transport Corridor in CAREC

Road Name	Length
1. Suusamyr - Talas - Taraz	199 km
2. Bishkek - Naryn - Torugart	539 km
3. Osh - Batken - Isfana	360 km
4. Karakol - Tyup - Kegen	76 km
5. Isfana – Sulukta - Khujand to the Tajik border	44 km
Total	1,218 km

Source : NSDS

(b) Preservation and improvement of the network of domestic hard-surface roads

(i) To restore the top wearing surface of the roads by constructing a no-skid road surface along more than 300 km of roads

(ii) To overhaul at least 150 km of roads, with laying asphalt-concrete pavement

(iii) To strengthen transport controls to regulate the permissible weights and dimensions

(c) Ensuring transport independence of the country to construct a new bypass (detour) roads that will be routed around the territories of neighboring countries and amounts to about 170 km including in the Batken Oblast with about 125 km long.

(d) Completion of the feasibility studies/ commencement of construction of the Sino-Kyrgyz-Uzbek Trunk Railroad in first quarter of 2013, a railway branch connecting the North and the South of the country

(e) Creation of an air transport hub by reconstruction and modernization of the "Osh", "Issyk-Kul", "Batken", "Isfana" and "Manas" airports

(f) Introduction of e-governance system and transition to digital TV and radio-broadcasting

For this purpose, a Concept for Development and Modernization of e-government will be implemented and a transition to digital TV and radio broadcasting will be completed.

16.6 Bishkek City Development Strategy

16.6.1 Preparation and Relation of Other Development Strategies and Plan

In 2009, the City Council approved the Bishkek City Development Concept (BCDS) (2025) for a long-term development strategy. Follow directions of the National Sustainable Development Strategy (2014 to 2017) (NSDS), new City Council, elected in November 2012, reviews it for preparation of a new Bishkek City Development Strategy (2014 to 2017), and it is expected to be approved by the City Council in September 2013. A relation among both development strategies of the Government and Bishkek city is shown in **Figure 16.6-1**.

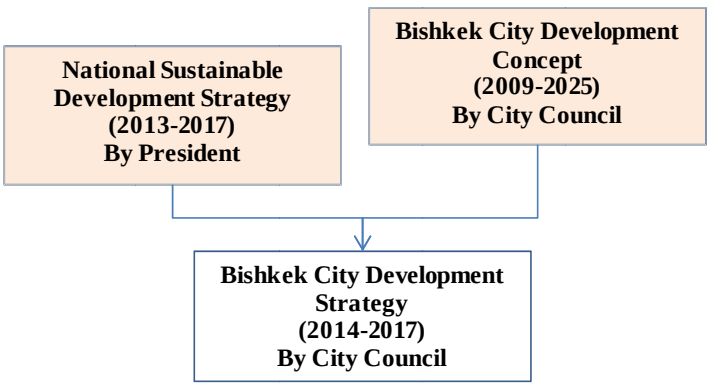


Figure 16.6-1 Relation of National and City Development Strategies

16.6.2 Bishkek City Development Concept "Renovated Capital of Kyrgyz Republic"[2]

(1) Vision and Future

Bishkek City today already is a functional place in the regional and global relations. In the future, the City can take on, as the hub for the development, a coherent vision of region strategic prospects and the development of regional partnerships, the development and implementation of joint programs to provide a forum for discussion of innovative programs for the republic and region.

(i) Bishkek uses potential of developed education systems across the country, becoming a regional center of education for neighboring countries. The city unfolds experimental platforms for technological and cultural innovation.

(ii) Bishkek is a city in which ideas of consumption and cultural diversity are implemented. Bishkek has become a center for the study of the Kyrgyz nomadic heritage.

(iii) Bishkek develops together with a number of global and regional communication centers and included in the global geo-political, geo-cultural and geo-economic processes.

(iv) Bishkek has a clear urban structure and intense urban environment of high aesthetic quality.

(v) Bishkek combines capital functions to ensure a high quality of citizens' life and provides the best of amenities for guests.

(vi) Bishkek is the regional leader in terms of the attractive business environment.

A Bishkek urban policy aims at stimulating the priority development of intellectual production, education, culture, tourism, business infrastructure and services. The people of the city have unity, are friendly and have community-based common goals. The city has sufficient intellectual, organizational, financial and human resources to ensure the effective management and development and have a reasonable policy. The basis of decision-making is a balance of interests. A clear legal framework and governance are based on clear and fair rules of coexistence, business and cultural life, and on the flexibility to respond to changing in social and business environment.

(2) Strategies and Objectives

The concept provides analysis of current city problems and prospects for future Bishkek City development for the long-term period until 2025, and defines a timeframe of the first three-year stage of city development -- Renovated Capital Program (RCP) for 2009 to 2012. The RCP is focused on expansion of participation of Bishkek in global economic system and capital significance promotion, its capitalization through appreciation of human capital assets and living environment.

The strategies are summarized as follows:

(i) Quality and convenience of citizens living improvement

(ii) Efficient implementation of capital functions

[2] The Concept is written in Russian. Translation to English is done only to use the JICA Study, but not authorized. The Strategies were approved by the City Council on 2 November 2009.

(iii) Investment attractiveness of the city

(iv) Urban environment diversity

(v) Cooperation between city authority and community for the city development management and problem- solving

The objectives are:

(a) Cooperative community

Social unity is one of the key indicators of Bishkek, since it expresses the activity of urban communities, determines the extent of the civil initiative, and as a consequence the level and quality of citizens' life.

The main characteristics of Bishkek can be attributed to internal factors of the urban communities are defined as:

(i) Low social activities of citizens and paternalism, a lack of development of local self-government, the difficulties in resolving the contradictions of group interests

(ii) Crisis of value system and as a consequence - criminalization, drug addiction of the population, reduced tolerance

(iii) Social and spatial differentiation of society, the low proportion of the middle class in the social structure and unequal access to social services for different sectors and territorial groups.

(iv) Low culture and the loss of traditional urban society

In addition, the Strategy projects and social programs take crosscutting issues of 1) civil society and civil authorities, 2) education, 3) culture, 4) health, and 5) social safety net into account.

(b) Dynamic economy

In this area, the following outcomes are to be expected:

(i) Creating conditions to be conducive to increase investment in the metropolitan economy

(ii) Growth of real money incomes of citizens

(iii) Improving the competitiveness of the products made in the capital

(iv) Gradual shift to knowledge-based production and development of export-oriented areas of the urban economy, and

(v) Development of tourism industry and enhancement of business travels

To achieve the above outcomes, the Concept aims to reduce barriers for business, provide business information services for creating conditions for fair competition. Qualitative improvement of financial management of the City is expected for allocating the budget for realization of demands of citizens. These can be done by improving management structure of the city budget including creating conditions for transition to a program budget. Social efficiency of budget expenditures is an important element of financial management of city.

(c) Positive environment

The capital environment is a collection of usable and taking all city environments from primary, private (court, household) to public (streets, squares, avenues, parks etc.). Positive city environment is a result of variety of entities, efforts from citizens, to agencies and local authorities. Creation of positive city environment of renovated capital will influence onto a long term and fundamental process of sustainable development of civil society including its values, most trustworthy to public institutions, internship between social groups, normative and behavioral stereotype, relative to the historical heritage and the conditions for the development of young people.

(d) Effective management

The city authorities play a key role not only in administrative and legal organization of the activities of all participants for budget planning and its attraction to the appropriate site preparation, but also in supports the interests of different population groups of urban community. The city authorities are responsible for creating the conditions for interaction of concerned parties and unprecedented transformation of urban spaces, which is going to promote positive changes. Effective management is based on a preliminary analysis of the situation that may cause the need for management intervention based on its socio-economic consequences. All the stated goals are supported by resources and lead to a specific and concrete results.

The Concept and Mid-term development programs will aim at building of the potential of the city. A plan including efficient urban planning, transport, and information policy forms the modern face of the city, creates a favorable climate for economic development, which will reduce the risks of business through the development of small business and after that will come to the city investment. It also will aim to maximize the potential of the city.

To create an expert analytical institute of City Mayor Office and its intellectual development will increase the efficiency of the entire system of functioning and development of the City. Introduction of new management and information technologies will provide increased efficiency of the city government, improve in working cultures of municipal employees, and simplify the procedure of interaction of citizens with municipal services. It is important that the development of systems and forms of local government to enable greater public participation in the socioeconomic problems of the city, as well as transparency of the municipal authorities.

16.6.3 Bishkek City Development Strategy (Draft)

(1) Recommended City Vision

The Study prepared a draft of Bishkek City Development Strategy with a vision of Bishkek, based on NSDS and BCDC, aiming to enhance a capital function.

A vision of Bishkek City should be a direction of Bishkek Urban Development Concept (2025). The vision is the desired future of Bishkek that outlines what the people want. The vision will provide a

framework for the city to develop in ways that meet the needs and aspirations of the citizen. The vision is a guide for the process and future requirement to be determined for the desired Bishkek urban and its transportation system. The system will be defined by goal and objectives. In addition, there is a topic to be considered: Bishkek has been awarded as "Green and Garden City" among the capitals in the Central Asian countries.

The previous Bishkek City Development Plan (2009-2012) specified a "Goals of Bishkek", in which the capital would provide "a good welfare and life security"; "an international level of quality of life"; "a strong sustainable economy"; "a regional ITC center"; and "a good city management for sustainable future".

The Study needs the vision and direction of urban development policy and new Bishkek Sustainable Development Strategies (2014-2017) is expected in September 2004. In order to prepare Urban Transport Improvement Plan, hence, the Study may propose the following vision and strategies to this purpose. A "Vision for Bishkek" to be created would be based on environmental sustainability, national economic driver, and country hub of the global economy. Urban transport strategies will start with the Vision of Bishkek City.

(2) Recommended Objectives

The Study recommends Bishkek urban sustainable development objectives in order to enhance the capital function.

(i) Capital playing a role of promoters for National Sustainable Development Strategy (NSDS)

(ii) Capital improving social welfare and living standards of citizen

(iii) Capital facilitating Foreign Direct Investment (FDI) to meet global economy

(iv) Capital strengthening hub functions of CIS & regional transportation and communications

(v) Capital promoting new urban industries tourism & S&M enterprises

(vi) Capital enhancing management capacity to maintain law and urban assets

(3) Tasks

To achieve the objectives, seven tasks are recommended.

(i) To promote NSDS through BSDS

(ii) To improve mobility and accessibility

(iii) To promote FDI in the urban transportation sector

(iv) To create transportation hub facilities for passengers and freight

(v) To promote Environmentally conscious (Green City)

(vi) To facilitate development of new industries (such as tourism) and SME

(vii) To promote citizen participation

(4) Implementing Directions of NSDS

The following directions for implementation are mentioned in NSDS.

(i) Relying own resources

(ii) Ensuring supremacy of law and rule of law

(iii) Ensuring the unity of the citizen

16.7 Bishkek City Urban Transportation Improvement Policy and Plan

16.7.1 Adopted Principles

National Sustainable Development Strategy (NSDS) includes

(i) Establishment of "law abiding country" governed by law,

(ii) Environmental policy for sustainable development,

(iii) Reduction of expenditure for financial reform,

(iv) Investment for strategic sectors such as transport and tourism, and

(v) Small government with deregulation and promotion of market economy.

Adopted principle for preparation of Bishkek Transportation Improvement Policy is summarized below, taking the above Bishkek City Development Strategy (Draft) into consideration.

NSDS Principles	Issue	Adopted Principle
1. Law	Transport law and institutional strengthening	・ Urban Transport Related Law ・ Institutional Strengthening &HRD
2. Environment	Environmentally Sustainable Transport (EST)	・ Reduction of GHG ・ Community unity ・ Participation
3. Finance	・ Economic promotion by transport ・ Income generation in new transport sector	・ International trade and transport hub function of state ・ Private sector participation into creating income generating projects
4. Transport and Tourism	Coordination with tourism sector	・ Road and transport facilities preservation ・ Tourism promotion by transport
5. Small government & promotion of market economy	Policy review of subsidy	・ Deregulation of transport sector ・ Promotion of private involvement

NSDS has five principles:

(i) Law and institutional reform

(ii) Environment

(iii) Finance

(iv) Transport as strategic industry

(v) Limit of the role of the state as small government, with balancing social security and environment sustainability, and promote market mechanism in the state institute and the business

In addition, the National Transport Sector Development Plan has three sub-sectors namely, development plan, highway and roads, railway, and airport. The objectives of all three sectors are to connect the country with international transport as a transport hub or center. All international highways in the country origin form Bishkek City, railway and air transport also will be renovated among Kirgiz and other countries. This supports in establishing a powerful regional transport and logistics center in the country. Bishkek will have more important roles of hub functions, although there is no clear mention for Bishkek function in NSDS, albeit "Dordoi" market development.

Following these principles, the JICA Study Team reviews the direction of approaches to formulating a transport improvement plan. We put the priority into urban and transport relating law preparation and reform, and institutional strengthening with HRD for its plan, implementation, and monitoring with fairness and accountability. Considering review of the laws and regulations, environment also concerns for NSDS. The JICA Study Team proposes to apply a concept of Environmentally Sustainable Transport (EST) for the project formulation and its priority. For solution of funding constraints that the Government and the City face, the JICA Study Team proposes to create an income-generating project and the private direct investment that NSDS proposes. The Roles of state and market mechanisms are the criteria for the project examination.

16.7.2 Bishkek City Urban Transportation Improvement Plan

The policy of Bishkek City Urban Transportation is shown below, which is formulated based on the Bishkek city development concept, taking NSDS and City Development Strategy into consideration.

(1) Goal and Strategies

A goal of Bishkek Urban Transportation Development Strategy is to support development of appropriate economic and social activities in Bishkek by establishing a proper transport system that follow the vision and strategies of Bishkek City. Urban transportation development strategies are considered as follows:

(i) To enhance the capita economic functions as driving force, contributing to national sustainable development by transportation

(ii) To respond to environmental challenges such as global warming issues in transportation

(iii) To apply aggressive deployment of world advanced transportation technology

(iv) To ensuring financial resources by the private sector for implementation in transportation sector

(v) To make institutional strengthening and capacity development of human resources

(2) Objectives

The following objective is to be achieved as urban transportation development strategies.

(i) To promote NSDS through BSDS

(ii) To improve mobility and accessibility

(iii) To provide laws and institutional strengthening and capacity development of City and BCDA

(iv) To promote EST for environmentally conscious as Green Park City

(v) To promote FDI in the urban transportation sector

(vi) To create transportation hub facilities for passengers and freight

(vii) To facilitate urban tourism by town

(viii) To promote Intelligent Transport System (ITS) Technology

(ix) To promote citizen participation for law and policy

(3) Approach

An objective analysis established the following approaches.

I.1: Assurance of effectiveness by strengthening the international and regional road networks by establishing transportation hub function

I.2: Urban transport development for improvement of capital functions and revitalization of urban economy

I.3: Promotion of tourism development by pedestrian malls and park roads

I.4: Increase in tax revenue by activation of business at CBD

II.1: Promotion of public transportation and traffic demand management

II.2: Promotion of Environmentally Sustainable Transportation;

II.3: Efficient utilization of existing infrastructure through the introduction of new transportation technology;

III.1: Promotion of balanced privatization in public transportation

IV.1: Introduction of private funds (DFI)

IV.2: Facilitation of Public and Private Partnership (PPP)

V.1: Development of technologies and measures that have been proven in social experiment during the Study; and

V.2: Implementation of human resource development and institutional improvement.

16.8 Transportation Improvement Plan

Table 16.8-1 summarized the above objective and approach in order to formulate a transportation improvement plan.

Table 16.8-1 Objective and Approach for Plan

Objective	Approach	Plan
I. Transportation to enhance the capital economic functions as a driving force contributing national sustainable development	1: Strengthen a function of international transportation hub to assure the effects of improvement of regional roads	1. Traffic coordination between a national road network and urban trunk roads for traffic flow improvement 2. Solution of traffic congestions and securing traffic safety at the points where national and urban roads connect together 3. Resolution of traffic bottlenecks and traffic congestions on national trunk highway in the urban areas 4. Smooth flow of local public transportation into the urban area 5. Traffic improvement at logistic centers (Bazars) that use international highways
	2: Develop urban transport for improvement of capital	6. Resolution of traffic bottlenecks on urban road network 7. Ensuring smooth traffic flow by an integrated traffic signal

Objective	Approach	Plan
	functions and revitalization of urban economy	control 8. Expansion of road capacity by curb management
	3: Promote Bishkek tourism resource development by transportation	9. Improvement of access to tourism sources by "walkable town". 10. Promotion of transport environment as "Environmentally Sustainable City"
	4: Increase urban economy and tax revenue by activation of commercial business at CBD;	11. Activation of Town by Transportation 12. Promotion of "people gathered" by pedestrian mall and fest 13. Creation of "a pedestrian reservoir" by improvement of pedestrian way
II. Transportation to respond to environmental challenges such as Global warming issues	5: Promotion of public transportation and traffic demand management; 6: Promote Environmentally Sustainable Transportation (EST) for reduction of CO_2	14. Improvement of public transportation service and promotion of PT use 15. Extension of environmental consciousness by introducing "Eco-Car" 16. Enhancing traffic safety 17. Improvement of pedestrian mobility
III. Transportation to do aggressive deployment of world advanced transportation technology	7: Do efficient utilization of existing infrastructure through the introduction of new modern technology	18. Improvement of maintenance technique of urban transport infrastructures and its asset management 19. Introductions of Intelligent Transport System (ITS) for efficient use and management 20. Introduction of modern transport ICT technology of Japan and developed countries 21. Introduction of environmental car (highbred car) for public use
IV. Securing financial resources to improve practicability	8: Promote balanced privatization in public transportation;	22. Review of comprehensive public transport preferential laws and policies 23. Creating an integrated institution for control of PT 24. Promoting PT management by service standards 25. Introduction of franchise system for 26. Remove of entry barriers for private enterprise
	9: Introduction of private funds (DFI)	27. Remove of entry barriers for private investment 28. Facilitation for entry of FDI to transport sector
	10: Facilitation of Public and Private Partnership (PPP)	29. Promotion of transport facilities having income generations 30. Introduction of facilities expanding PT services; like bus terminals 31. Applying "Park & Ride" facilities
V. Expand and establish outcomes of TIP	11: Develop technologies and measures that have been proven in social experiment during the Study	32. Extending design life of transport facilities by enhancement of road and transport maintenance management 33. Improvement of intersection for traffic flow improvement 34. Promoting pedestrian traffic safety policy 35. Curb management of bus stops and taxi parking 36. Activation of central business district by expanding pedestrian space
	12: Implement human resource development and institutional improvement.	37. Human capacity development of the City, BCDA and traffic police 38. Institutional improvement and strengthen

CHAPTER 17 MASTER PLAN COMPONENTS AND ALTENATIVE SCENARIOS EVALUATION

17.1 Generation of Master Plan Components and Alternatives

17.1.1 Approach

The study results show that the traffic capacity as road network is 1.0 or less even for traffic demand forecast in 2023. However, local and limited traffic congestions occur for certain time periods, in particular peak hours, and at specific bottleneck locations. Due to roadside conditions, it is difficult to increase the traffic volume through road development approach in road widening and elevated intersections, because they require new lands for expansion of the right of way.

In general, the road congestion and bottlenecks are caused by various factors, hence transport planning has to consider multiple components for their solutions. In addition, the Study limits the aims to reducing traffic congestion and eliminating traffic flow bottleneck at the specific road and intersections.

Under these conditions, MP will consider, as components for solutions on demands, promotion of utilization of public transportation and traffic management in order to reduce the traffic volumes and vehicle trips. As for solutions on supply, in order to recover road traffic capacity, the hindering factors in reducing road traffic volumes are examined, including repair of damage and conservation of road pavement and transportation facilities, improvement of bottleneck at intersection, and control of illegal road-side parking so on. MP will formulate alternative scenarios with high feasible components in the time frame and financial affordability of the City.

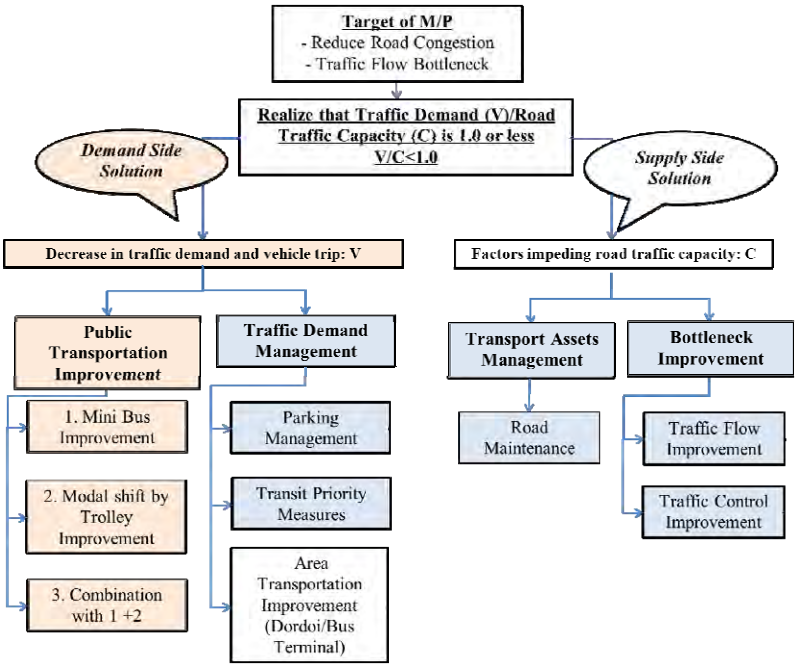


Figure 17.1-1 Approach of Generation of Master Plan Components

Figure 17.1-1 shows a principle approach that is to increase a vehicle/road capacity ratio (VCR) of urban road network and to control the number of the vehicle trips as "demand control". Therefore, the objective of generation of alternative scenarios is to improve the VCR by reducing the number of vehicles by promoting public transportation use. No component will increase road capacity (C) directly as "supply" side solution in this MP timeframe.

17.1.2 Review of Basic Conditions of Traffic Share (Do-Nothing Case)

The basic traffic conditions for compiling the scenario are shown below. Regarding Person Trips (PT), passenger cars account for 87 percent of the total number of vehicles when the PT rate is 25 percent. In comparison with the PT and the number of passenger cars, the passenger car transportation seems inefficient. The PT rate of minibuses is high at 42 percent and accounts for 98 percent by vehicle of the mode of public transportation. This shows that vehicle congestion is mainly caused by passenger cars. The trolleybus accounts for only three percent of the PT and below one percent of the number of vehicles. Thus, reduction of the number of trip of passenger cars and conversion to public transport are examined. Regarding public transportation, as the minibus causes traffic congestions at bus stops and on specified roads (overlapping routes), moderation of minibus operations need to be taken. The traffic shares of daily person trip and vehicle trip in 2013, 2018 and 2023 are estimated in **Table 17.1-1** to **Table 17.1-3**. The Study used these traffic shares as a base of "Do-nothing scenario".

Table 17.1-1 Trip Share by Mode in 2013 (Do-noting)

Mode	Passenger / Vehicle	Person trip/day (Bishkek City Zone 1-61)			Vehicle trip/day (All Zones 1-98)	
	Passenger	Trip No.	Share	PT Share	Trip No.	(%)
1.Trolleybus	28.2	72,181	3.2%	7.0%	3,194	0.3%
2.Midibus	27	27,750	1.2%	2.6%	8,619	0.9%
3.Minibus	17	934,832	42.0%	90.4%	94,119	9.8%
Total (Public Transport: PT)		1,034,763	46.5%	100.0%		
4.Truck	1.3	3,171	0.1%	-	12,966	1.4%
5.Passenger Car	1.5	560,234	25.2%	-	839,550	87.6%
6.Walk	-	629,316	28.3%	-		
Total		2,227,484	100%	-	958,448	100.0%

Source : JICA Study Team

Table 17.1-2 Trip Share by Mode in 2018 (Do-noting)

Mode	Passenger / Vehicle	Person trip/day (Bishkek City Zone 1-61)			Vehicle trip/day (All Zones 1-98)	
	Passenger	Trip No.	Share	PT Share	Trip No.	(%)
1.Trolleybus	28.2	76,506	3.2%	7.0%	3,371	0.3%
2.Midibus	27	28,094	1.2%	2.7%	8,712	0.9%
3.Minibus	17	985,263	41.3%	90.3%	98,381	9.7%
Total (Public Transport: PT)		1,089,863	45.7%	100.0%		
4.Truck	1.3	3,602	0.2%	-	14,803	1.5%
5.Passenger Car	1.5	599,130	25.1%	-	890,714	87.7%
6.Walk	-	690,595	29.0%	-		
Total		2,383,190	100%	-	1,015,981	100%

Source : JICA Study Team

Table 17.1-3 Trip Share by Mode in 2023 (Do-nothing)

Mode	Passenger / Vehicle	Person trip/day (Bishkek City Zone 1-61)			Vehicle trip/day (All Zones 1-98)	
	Passenger	Trip No.	Share	PT Share	Trip No.	(%)
1.Trolleybus	28.2	82,723	3.2%	7.1%	3,650	0.3%
2.Midibus	27	28,589	1.1%	2.5%	8,836	0.8%
3.Minibus	17	1,047,098	40.8%	90.4%	103,642	9.5%
Total (Public Transport: PT)		1,158,410	45.1%	100.0%		
4.Truck	1.3	4,453	0.2%	-	17,502	1.6%
5.Passenger Car	1.5	644,115	25.1%	-	957,456	87.8%
6.Walk	-	761,572	29.6%	-	-	-
Total		2,568,550	100%	-	1,091,086	100%

Source : JICA Study Team

17.1.3 Generation of Alternatives Scenarios

To reduce the number of vehicle trips, four (4) scenarios are examined.

Scenario 0 : Do-nothing

Scenario 1 : Minibus development plan (small minibus is replaced double capacity seats size)

Scenario 2 : Trolleybus development plan (shift from passenger car user to trolleybus)

Scenario 3 : Mixed plan with Scenario 1 and Scenario 2

(1) Scenario 1

Scenario 1 is the modal shift from utilization of passenger cars to public transportation utilization, with a study of policies. Initially, the small minibuses operated by the private companies will be changed to larger ones, thereby reducing the number of vehicles and its trips, then mitigating congestion on the minibus routes. It takes a big slice of budget and time until full-scale operation of new trolleybuses can be put into consideration. In addition, the minibus currently loads its passengers over the nominal passenger numbers and some passengers are forced to stand. Hence, increasing in mass or numbers of minibuses would contribute to better service and passenger safety. In this Scenario 1, the City only needs to set regulations and does not need additional expenditure.

(2) Scenario 2

Scenario 2 is to improve the efficiency of operation of new trolleybuses with repair and extension of its operation routes. Modal shift from passenger cars to trolleybuses is to be promoted by improving the level of service, such as the evaluation of optimum distance between bus stops, propmpt operation using the timetables, an information system of approaching buses and a park-and-ride scheme. The use of passenger cars must be limited with parking lot management, prompt time, zone and road management must be established. If passenger car control can be carried out simultaneously with the improvement of public transportation capacity and service, there will be a need to consult with citizens. The city government should decide whether they persuade people based on the guidance policies or enforce regulations, or both.

(3) Scenario 3

Scenario 3 would be as follows. If trolleybus operations improve and the limitations on use of passenger cars can be implemented, an integrated operational management of public transportation will be needed. It is necessary to clarify the functions and role of each mode, to establish an integrated management organization, to create a fare system with common IC card under the organization, and to guarantee the convenience of bus transfers in terms of improvement of service for users.

Table 17.1-4 shows a summary of scenarios in consideration of the issues described above.

Table 17.1-4 Summary of Alterative Scenarios

Scenario	Objective	Measures	Effects
Scenario 0	Do-nothing	No	No
Scenario 1	Using high occupancy bus for small mini bus	25% of small minibus trip share to big ones	Reduce the number of minibus trips
Scenario 2	Modal shift to trolleybus	10% in vehicle trip share of trolleybus	Increase trolleybus users
		10% reduction of passenger car trip	Decrease the number of car use along PT corridor
Scenario 3	Scenario 1 + Scenario 2	Combination of Scenario 1 and Scenario 2 ・ Measures to improve services ・ Establishment of integrated management organization ・ IC card introduction, etc.	Combination of effects of Scenario 1 and Scenario 2 ・ Improvement of convenience ・ Increase in users ・ Improvement of profitability

Source : JICA Study Team

17.1.4 Alternative Scenarios Procedures

(1) Scenario 1

Scenario 1 assumed that 25 percent of minibuses trips of small-sized vehicles will be replaced with vehicles double their size (twice the seating capacity) to reduce the number of trips of minibuses.

Currently 2,274 minibuses run in the city and its share is the largest among the transit modes. Minibuses are operated by the private companies paying concession fees to the City. There is no subsidy to this operation, thereby not affecting budget of the City.

Considering practicability and immediate solutions, Scenario 1 was prepared to maximize occupancy of the private minibuses. The scenario will target to reduce the number of minibuses having a 12 passenger capacity by changing them to minibuses having 24 passenger capacity. **Table 17.1-5** shows target reduction of vehicle trips in minibus.

Table 17.1-5 Minibus Vehicle Trip Decrease in Scenario 1

Year	Do Nothing (a)	Scenario 1(b)	Decrease (a) - (b)	Do Nothing	Target share
2013	94,119	70,766	23,353	9.8%	7.3%
2018	98,381	73,970	24,411	9.7%	7.1%
2023	103,642	77,926	25,716	9.5%	7.3%

Source : JICA Study Team

(2) Scenario 2

Scenario 2 assumed that modal shift from use of passenger cars to promoting use of trolleybuses, for the same purpose, that is, to increase use of trolleybuses and reduce car use. The City has increased trolleybuses utilization since the former Soviet era by approximately 200 units, with the restoration and extension of trolleybus lines. This improvement in infrastructure will take two to three years to complete. In addition, to be able to attract passengers using other traffic modes to the use of trolleybuses, the City needs to prepare a comprehensive program of service improvement including review of bus stop locations, bus information system, proper time schedule and operation frequency. As for the reduction of passenger car use, it also needs several measures of traffic control and management.

Table 17.1-6 and **Table 17.1-7** show vehicle trip increase in trolleybuses and decrease in passenger cars, respectively.

Table 17.1-6 Trolleybus Vehicle Trip Increase in Scenario 2

Unit : PCU x trip

Year	Do Nothing (a)	Scenario 2 (b)	Increase (b) - (a)	Do Nothing	Target share
2013	3,194	6,388 (+50%)	3,194	0.3%	0.7%
2018	3,371	6,742 (+50%)	3,371	0.3%	0.7%
2023	3,650	7,300 (+50%)	3,650	0.3%	0.7%

Source : JICA Study Team

Table 17.1-7 Passenger Car Vehicle Trip Decrease in Scenario 2

Unit : PCU x trip

Year	Do Nothing (a)	Scenario 2 (b)	Decrease (b) - (a)	Do Nothing	Target share
2013	839,550	763,227	76,323 (-10%)	87.6%	86.2%
2018	890,714	809,740	80,974 (-10%)	87.7%	86.3%
2023	957,456	870,414	87,015 (-10%)	87.8%	86.4%

Source : JICA Study Team

(3) Scenario 3

Scenario 3 assumed the case in which a combination of Scenario 1 with Scenario 2 is applied, with measures to improve services, establish integrated management organization and IT card introduction, etc..

17.2 Comparison Evaluations of Master Plan Alternatives

17.2.1 Assessment Indicators

The alternative scenarios are assessed by quantitative and qualitative indicators in the target year of 2023, thereby selecting the optimal alternative. The quantitative indicators are calculated by traffic analysis, which evaluate VC ratio, travel speed, vehicle-km for traffic efficiency, and vehicle-hour for travel time saving by both average daily traffic and peak-hour traffic together with effect of CO_2 emission reduction. The quantitative indicators are used for assessment of policy relevancy and effectiveness, practicability, costs, social acceptance and so on.

17.2.2 Evaluation by Daily Traffic

The vehicle assignment results of the existing condition in 2011 and future demand in 2013, 2018 and 2023 are summarized for VCR and travel speed in **Table 17.2-1** and for vehicle-kilometer and vehicle hour in **Table 17.2-2** and shown in **Figure 17.2-1** to **Figure 17.2-8** respectively. The results of analyzing the volume to capacity ratio VCR and average travel speed show degrees of road congestion in total road network of the City. The VCR shows ratio of less than 1.00 and travel speed is still above 30 km/hr in 2023 in Scenario 0. The City's road network capacity will be sufficient when traffic control and management can be made properly, in particular, by removing abstracts against traffic flow on the road, such as illegal parking cars, bus stop congestions, and bottleneck intersections.

Table 17.2-1 Summary of VCR and Average Speed by Daily Traffic

	Average VCR (Volume Capacity Ratio)				Average Speed (km/hr)			
Case	2011	2013	2018	2023	2011	2013	2018	2023
Scenario 0	0.51	0.56	0.58	0.62	35.6	35.1	34.4	33.7
Scenario 1	-	0.54	0.57	0.61	-	35.3	34.6	33.8
Scenario 2	-	0.52	0.53	0.58	-	35.4	34.7	34.0
Scenario 3	-	0.50	0.52	0.56	-	35.5	34.8	34.2

Source : JICA Study Team

The PCU-km of Scenario 0 (Do Nothing) is 8,818,000 PCU-km and the 7,910,000 PCU-km in year 2023 respectively. It decreases by 10 percent compared with the Scenario 0. On the other hand, the PCU-hour of Scenario 0 is 261,000 PCU-hour and the 231,000 PCU-hour in year 2023 respectively. It reduced traveling time 30,000 PCU-hours of a day.

Table 17.2-2 Summary of Vehicle-km and Vehicle Hour by Daily Traffic

	PCU Vehicle-km ('x 1,000)				PCU Vehicle-hour ('x 1,000)			
Case	2011	2013	2018	2023	2011	2013	2018	2023
Scenario 0	7,216	7,752	8,182	8,818	202	220	238	261
Scenario 1	-	7,481	7,899	8,515	-	212	228	251
Scenario 2	-	7,220	7,624	8,216	-	204	219	241
Scenario 3	-	6,946	7,339	7,910	-	195	210	231

Source : JICA Study Team

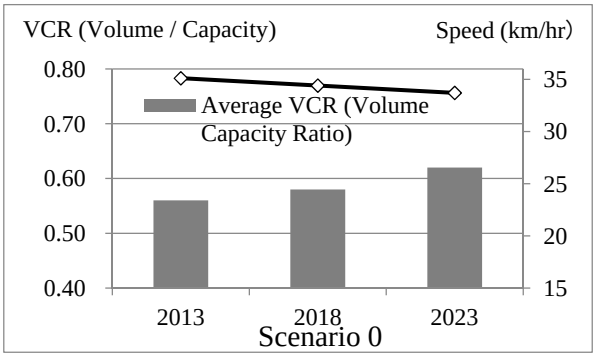


Figure 17.2-1 VCR and Speed in Scenario 0

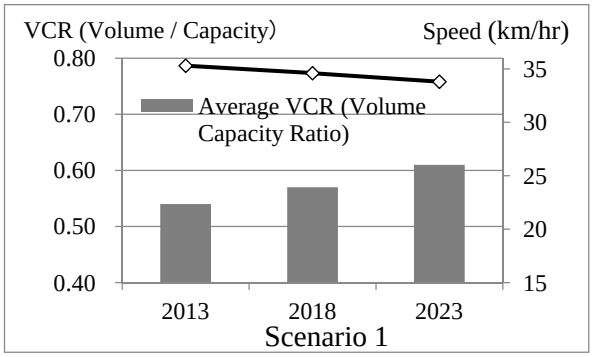


Figure 17.2-2 VCR and Speed in Scenario 1

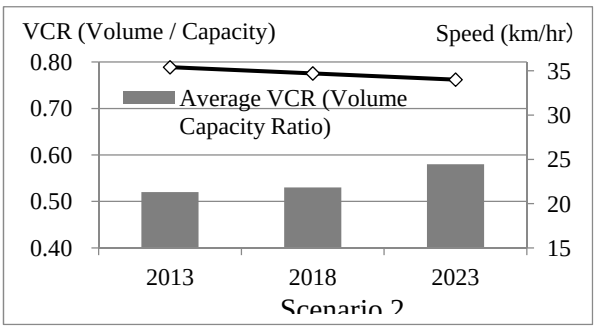


Figure 17.2-3 VCR and Speed in Scenario 2

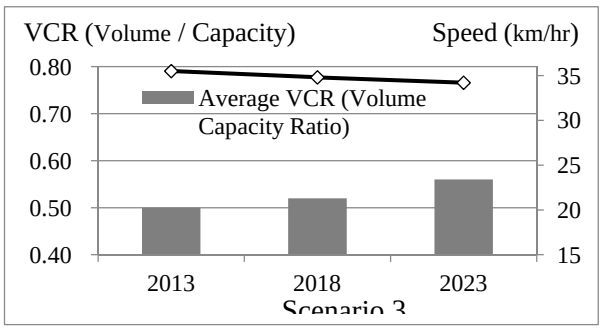


Figure 17.2-4 VCR and Speed in Scenario 3

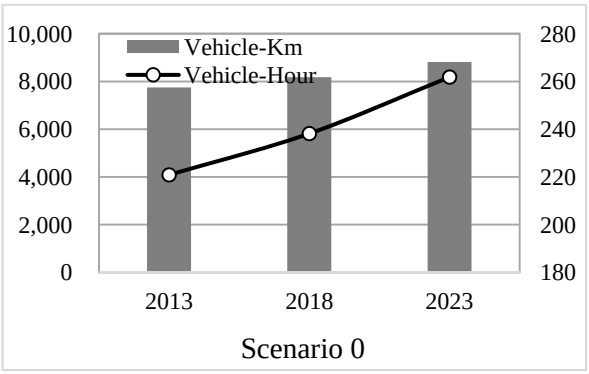


Figure 17.2-5 Vehicle-km & -hour in Scenario 0

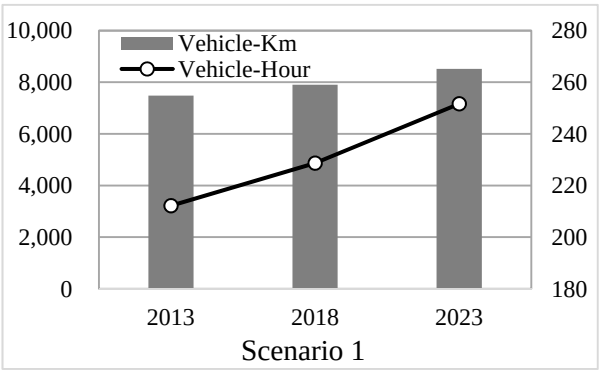


Figure 17.2-6 Vehicle-km & -hour in Scenario 1

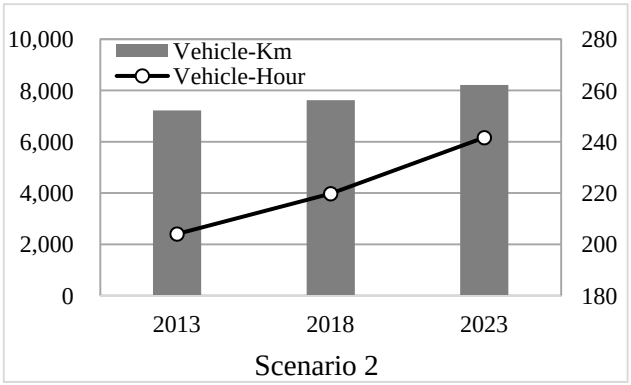


Figure 17.2-7 Vehicle-km & -hour in Scenario 2

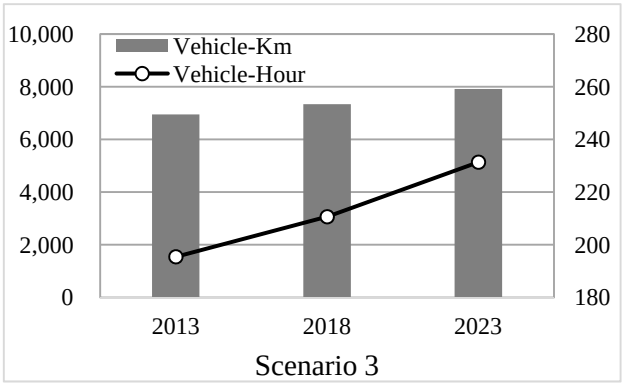


Figure 17.2-8 Vehicle-km & -hour in Scenario 3

17.2.3 Additional Evaluation by Peak- hour Traffic

The vehicle peak hour assignment results of the existing condition in 2011 and future demand in 2013, 2018 and 2023 are summarized in **Table 17.2-3** with **Figure 17.2-9** to **Figure 17.2-12**. As a result, the average travel speed is decreased from 22.7 km/hr. in 2011 to 15.1 km/hr. in 2023 and VCR in 2023 reached to 0.77, which means that the level of service on the road network will face severe situations, from the economic and environmental standpoint.

Table 17.2-3 Summary of VCR and Average Speed by Peak Hour Traffic

	Average VCR (Volume Capacity Ratio)				Average Speed (km/hr)			
Case	**2011**	**2013**	**2018**	**2023**	**2011**	**2013**	**2018**	**2023**
Scenario 0	0.66	0.69	0.73	0.77	22.7	22.0	18.9	15.1
Scenario 1	-	0.66	0.70	0.74	-	23.2	21.4	17.6
Scenario 2	-	0.65	0.68	0.73	-	23.2	21.9	18.0
Scenario 3	-	0.62	0.66	0.70	-	24.6	23.1	20.4

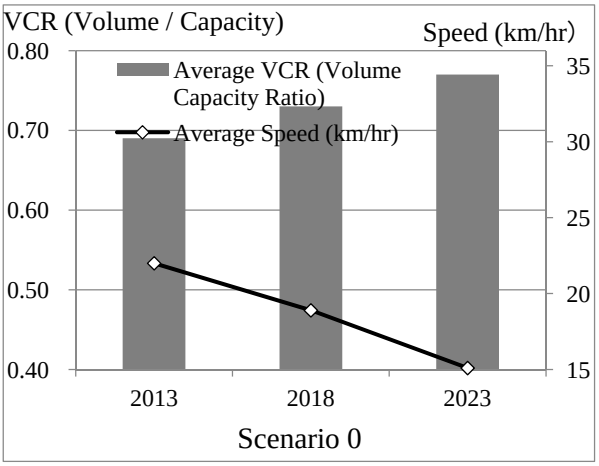


Figure 17.2-9 VCR and Travel Speed (Peak) in Scenario 0

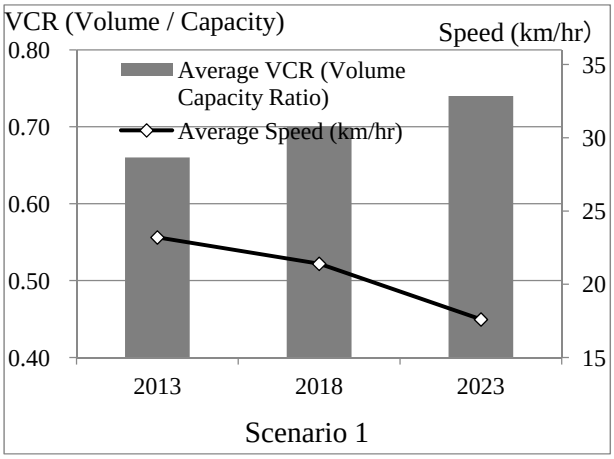


Figure 17.2-10 VCR and Travel Speed (Peak) in Scenario 1

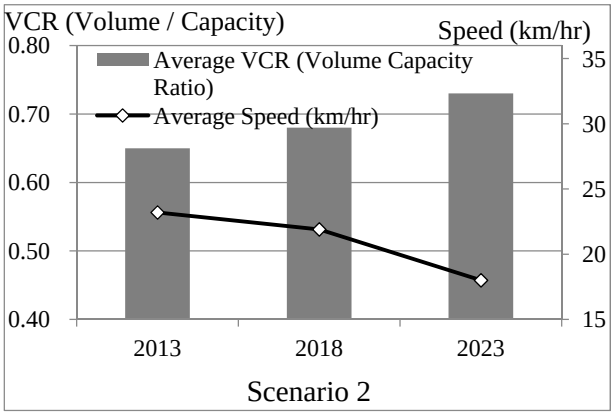


Figure 17.2-11 VCR and Travel Speed (Peak) in Scenario 2

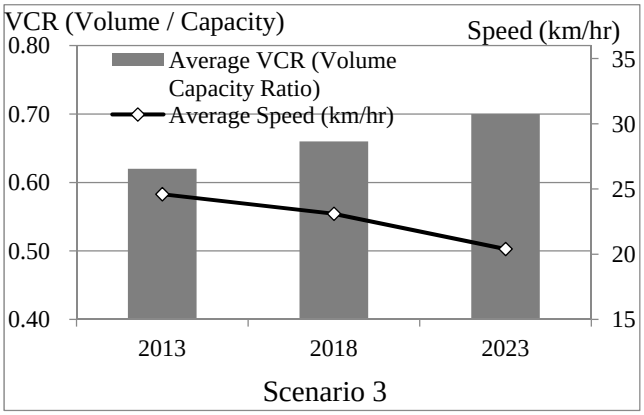


Figure 17.2-12 VCR and Travel Speed (Peak) in Scenario 3

17.2.4 Effect of CO_2 Emission Reduction

Table 17.2-4 and **Figure 17.2-13** shows results of reduction of CO_2 emission by Scenario. The Scenario 2 and Scenario 3 are effective with more than 40,000 t/year reduction of CO_2 emission.

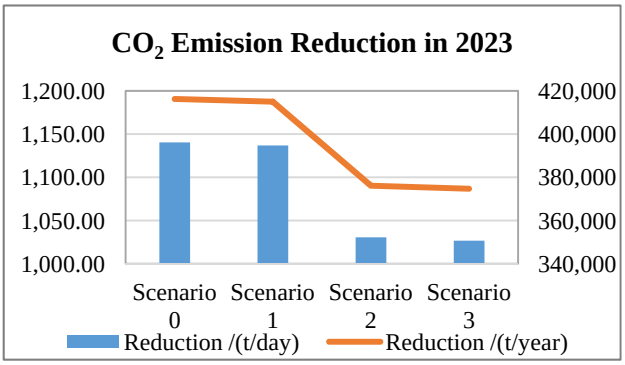


Figure 17.2-13 CO_2 Emission Reduction

Table 17.2-4 Summary of CO_2 Emission Result in 2023

	Reduction /(t/day)	Reduction /(t/year)	Reduction volume (t/year)
Scenario 0	1,140.4	416,231	-
Scenario 1	1,137.0	414,995	-1,236
Scenario 2	1,030.6	376,160	-40,071
Scenario 3	1,026.7	374,758	-41,473

17.2.5 Results of Evaluation of Alternative Scenarios

(1) Summary

Table 17.2-5 Results of Evaluation of Alternative Scenarios

Item	Do-nothing	Scenario 1	Scenario 2	Scenario 3
1.Average VCR	0.62	0.61	0.58	0.56
	-	(a)	(aa)	(aaa)
2.Travel Time (km/h)	33.7	33.8	34.0	34.2
	-	(a)	(aa)	(aaa)
3.Traffic efficiency (vehicle- km)	8,182,000	8,515,000	8,216,000	7,910,000
		(a)	(aa)	(aaa)
4.Time Saving (vehicle- time)	261,000	251,000	241,000	231,000
		(a)	(aa)	(aaa)
5.CO_2 (t/year)	416,231	414,995	376,160	374,758
		(a)	(aa)	(aaa)
6. Funding scheme	-	Private-oriented	Public	PPP
		(aaa)	(a)	(aa)
7. PT Promotion	-	Low	Medium	High
		(a)	(aa)	(aaa)
8. Civil work	No	Less	Medium	Medium
		(aaa)	(a)	(a)
9. Institutional Reform	-	No	Less	Required
		(aaa)	(aa)	(a)
10. Social Impact	-	Medium	High	High
		(aa)	(a)	(a)
11. EIA	-	Not required	Not required	Not required
		(aaa)	(aaa)	(aaa)
12. Practicability	-	High	Medium	Low
		(bbb)	(bb)	(b)
Total Evaluation	-	20a + 3b	20a + 2b	26a + b
Priority		Second	Second	First

(2) Conclusion

Table 17.2-5 shows summary of evaluation of alternative scenarios. Scenario 3 is highest in the total evaluation (total a point), followed by Scenario 2 and Scenario 1. However, this Scenario 3 needs preparation time for institutional and financial arrangement of the City and coordination with traffic control and management in order to promote modal shift from passenger cars to trolleybuses. Citizen awareness is also important. Therefore, the Scenario 2 and Scenario 3 are considered of lower practicability than Scenario 1. The Study recommends that Scenario 3 be implemented with two stages of time sequence that is, first Scenario 1 and then Scenario 2, based on practicability.

17.3 Evaluation of Master Plan Effects

17.3.1 Evaluation of Master Plan Effects

Scenario 3 assumes the case combined the Scenario 1 and Scenario 2. VCR of Scenario 3 in 2023 is 0.56. It is possible to maintain this condition of Scenario 0 in 2013. **Figure 17.3-1** to **Figure 17.3-3** show the result of the traffic assignment in year 2013, 2018 and 2023.

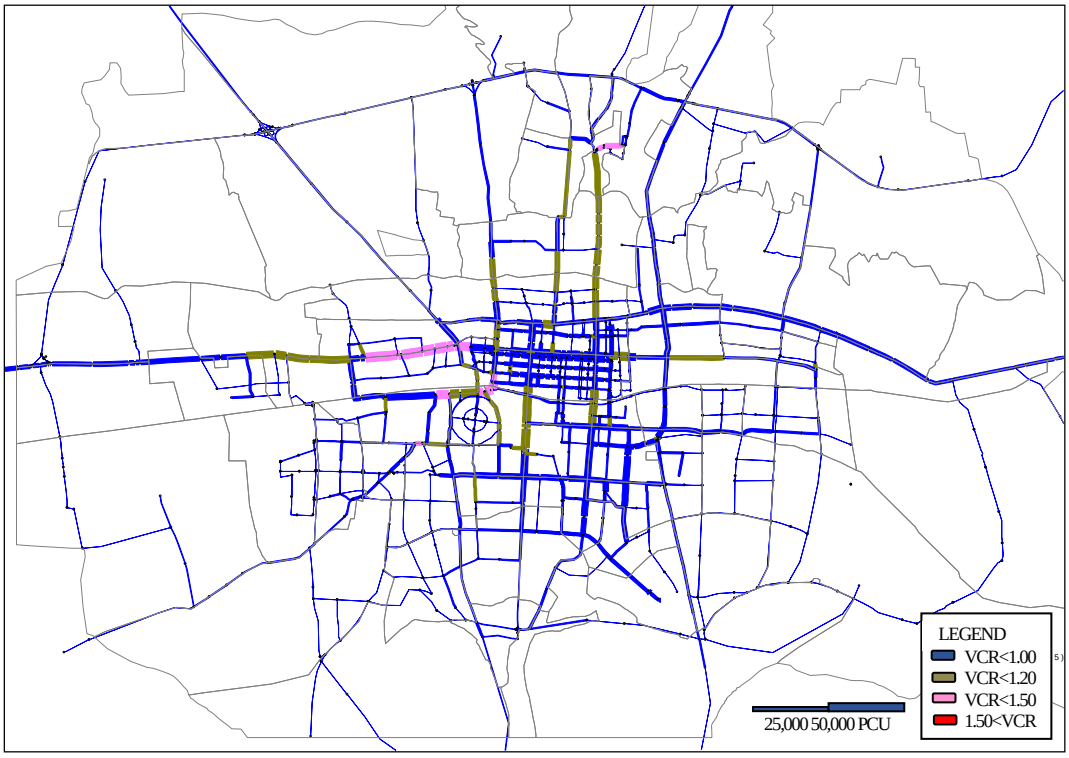


Figure 17.3-1 Daily Traffic Assignment in 2013 (Scenario 3)

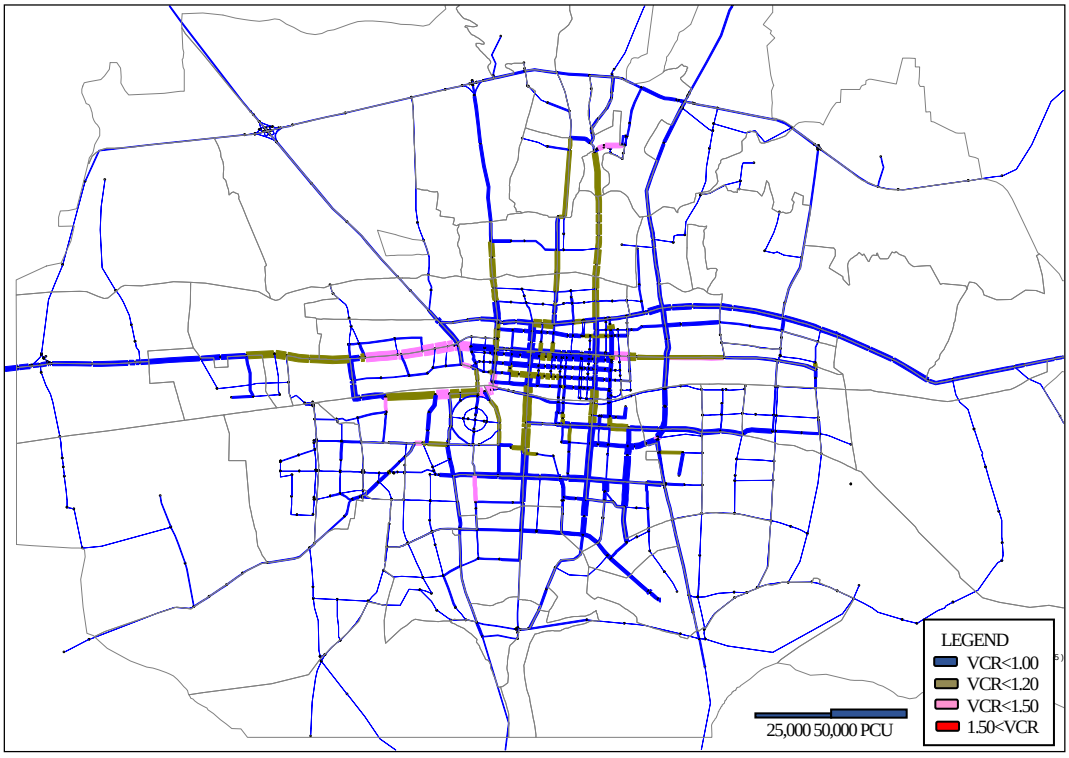


Figure 17.3-2 Daily Traffic Assignment in 2018 (Scenario 3)

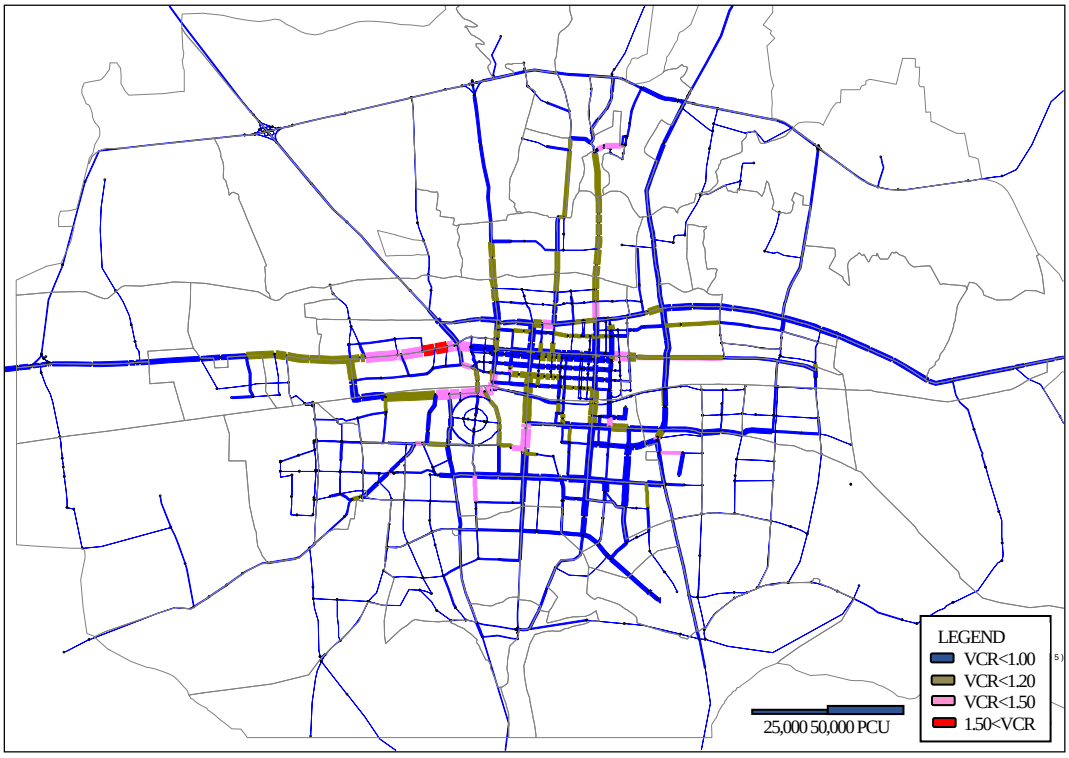


Figure 17.3-3 Daily Traffic Assignment in 2023 (Scenario 3)

17.3.2 Results of Traffic Assignment of Peak Hour in 2013, 2018 and 2023 in Scenario 3

Figure 17.3-4 to **Figure 17.3-6** shows the traffic assignment of peak hour in year 2013, 2018 and 2023.

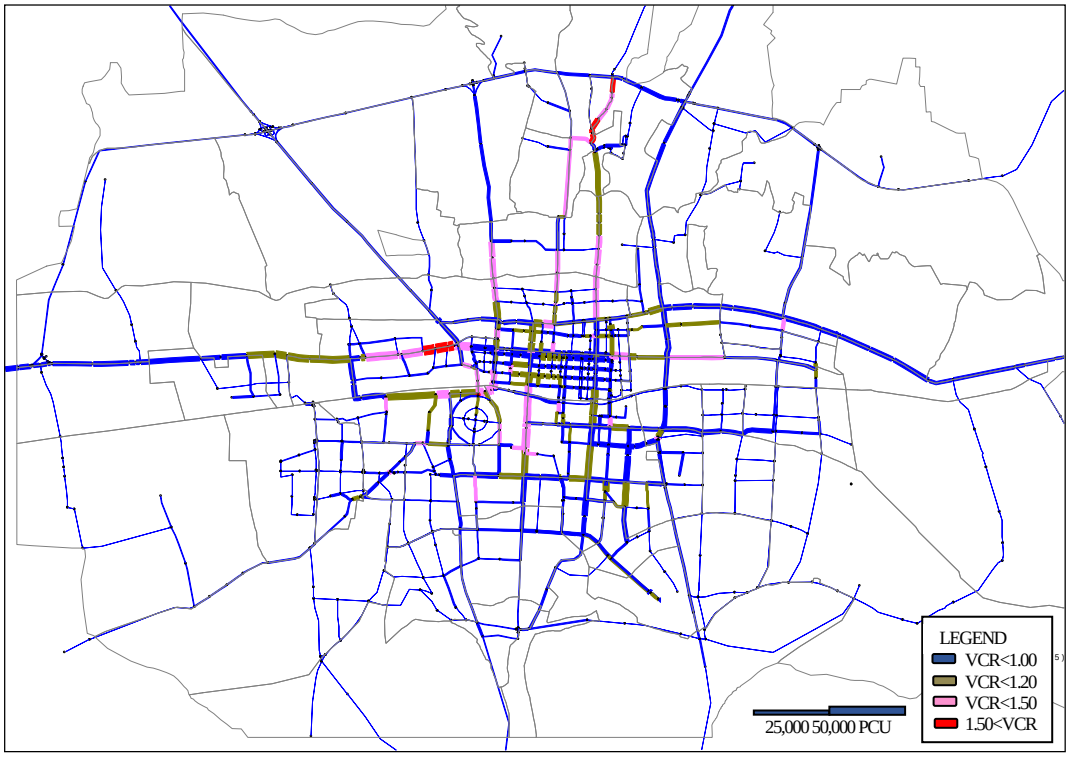


Figure 17.3-4 Peak Hour Traffic Assignment in 2013 (Scenario 3)

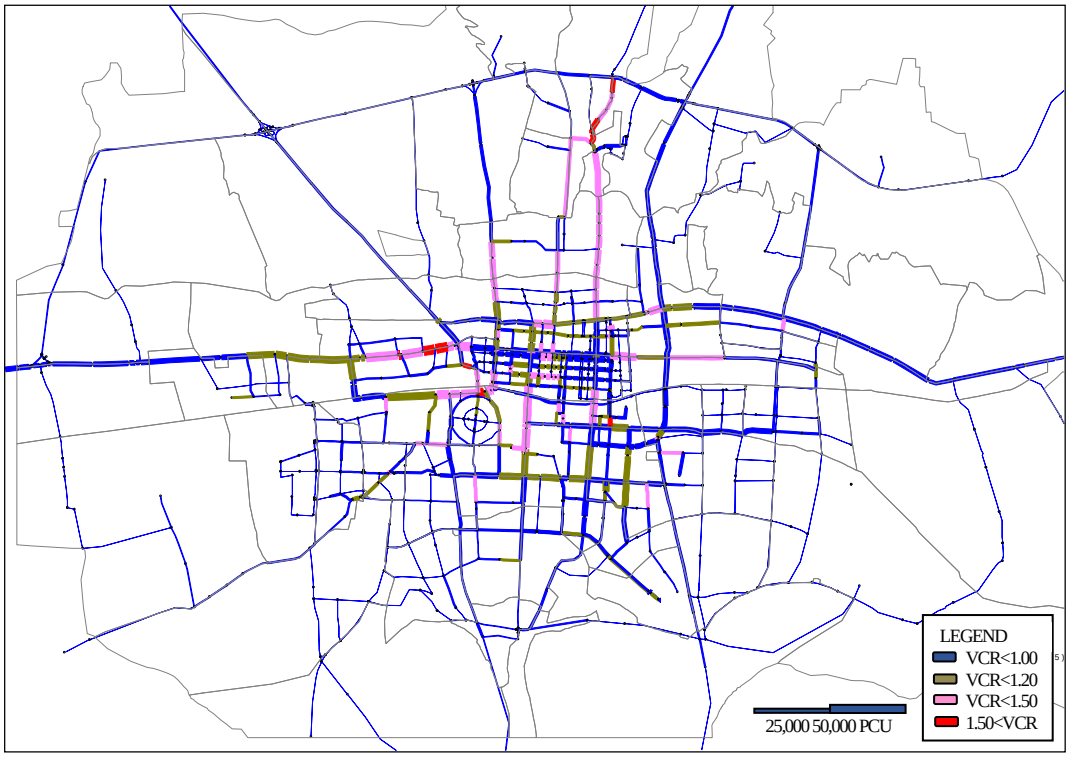


Figure 17.3-5 Peak Hour Traffic Assignment in 2018 (Scenario 3)

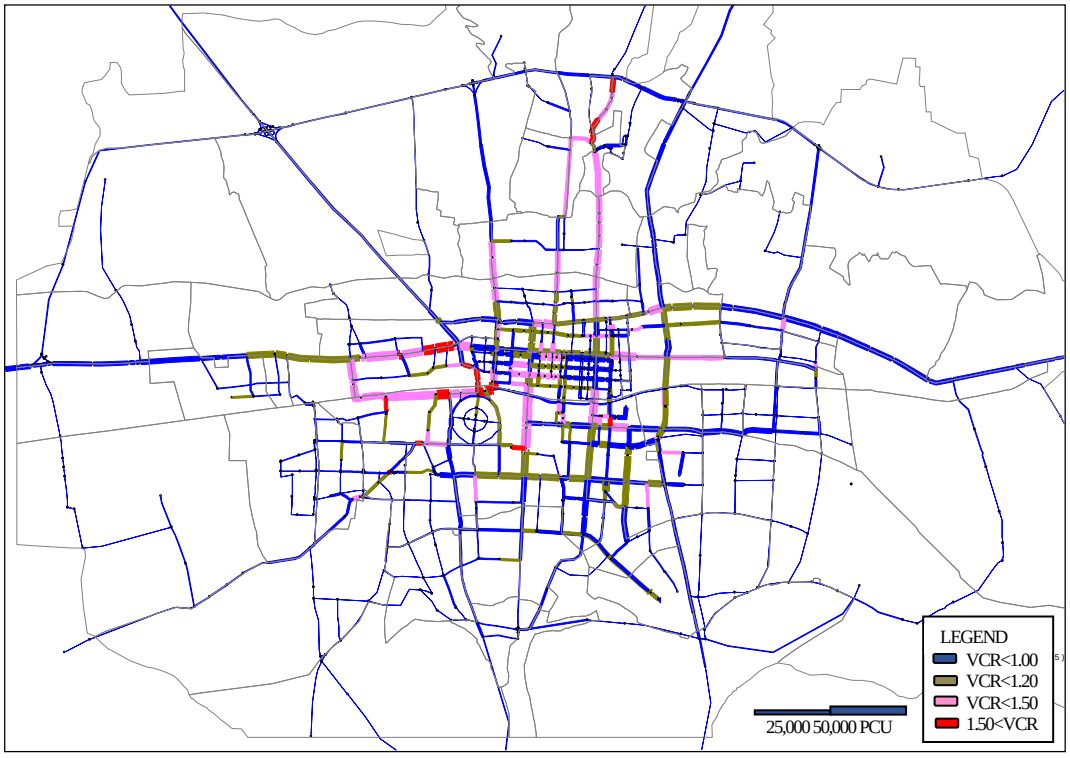


Figure 17.3-6 Peak Hour Traffic Assignment in 2023 (Scenario 3)

17.3.3 Needs of Peak Hour Solution by 2023

The following are major measures and activities for urgent solution in peak hours by 2023.

(a) Public Transport Priority Measures

(i) Provision of bus private or priority lanes to increase bus speed at the peak hours

(ii) Control of the intersection traffic for bus priority with configuration and signal arrangement

(b) Control Passenger Car Use in Peak Hour

(i) Increase in occupancy ratio from averagely 1.5 passengers

(ii) Limit of entering the city core in the peak hour

(iii) Preparation of Park and Ride at trolleybus terminal

(c) Solution of Bottleneck at Intersections and along Corridors

(i) Improvement of intersection

(ii) Improvement of signalization

(d) Roadside Management for Bus and Taxi

(e) Parking System Improvement at Critical Section of Roads

After the target year of 2023, we need to enhance public transportation capacity with modal shift from passenger car users. In addition, preparation of LRT or MRT is to be required in future.

17.4 Optional Master Plan Program

(1) Short Term Implementation in three (3) to five (5) years

The Study applied the Scenario 3 with time sequence because all scenarios are supportive to improve traffic situations. The implementation sequence is based on practicability. In the first three (3) to five (5) years, Scenario 1, utilizing high occupancy vehicle in minibus, will be implemented because the City does not need any financial investment and may use the present institutional framework. The Study considers this task will be achieved within 3 to 5 years. A detailed road map with task breakdown is required in the further study.

(2) Second Term Implementation in five (5) to ten (10) years

Scenario 2 aims to improve trolleybus operation and promote modal shift from passenger car use. Scenario 2 will include preparation of a comprehensive program for improvement of public transportation having an integrated public transport authority, coordination with trolleybus, midibus and minibus, review of fare system and service standards.

MP will also introduce traffic management to reduce and restrict travel demands for private car use in the city core during peak hours: this means averaging peak-hour traffic by application of staggering time and flexible time for working places, park & ride systems, travel control in the city core.

In addition, MP proposes strict control of roadside car parking, in particular, illegal parking, where VCR is found worse for road capacity improvement, and traffic flow smoothness by intersection improvement.

During the three to five years for Scenario 1 implementation, the City is expected to improve financial constraints for affordability to provide financial support to the City owned public transportation services, trolleybus and midibus. Both public companies will also improve management and level of bus services in order to reduce outside financial support and run with fare revenue with limited subsidies.

Table 17.4-1 Master Plan Implementation Scheme

Year	Scenario 0	Scenario 1	Scenario 2	Scenario 3
2013	−	Full Scale	Preparation	Scenario 1
2018	○	Full Scale	Full Scale	Scenario 1 + 2
2023	○	Full Scale	Full Scale	Full Scale M/P

CHAPTER 18 ROAD AND MAINTENANCE IMPROVEMENT PLAN

18.1 Policy Background

18.1.1 Deterioration of Road Pavement and Yearly Repair Work

While trunk roads in Bishkek City have good pavement conditions and provide high travel speed, other road types, including distributor types, collector types and streets, need repairs for damages on asphalt surfaces each year. Due to low temperatures in winter, small cracks expand to traverse and longitudinal cracks, thereby causing huge pot holes. The city is forced to provide a huge slice of its budget for repair work every year. These damages decrease vehicle mobility, resulting in traffic congestion and accidents. Traffic control signage to ensure smooth traffic flow such as traffic signals and road markings, are broken, damaged and decayed. Roads and traffic facilities are very important to urban transport infrastructure. Damages and aging or wear and tear aversely affect urban economic activities. In particular, asphalt concrete (AC) pavements are easily damaged by temperature change. The existing road management system repeats expensive repair work on damages annually. This work becomes a big burden on the city budget. To solve these problems, the Study proposes as major solutions the promotion of privatization, reviewing concrete pavements from AC, advancement of private construction companies, and application of new pavement technology. There are private contractors for road maintenance in Bishkek. Through promotion of privatization, preventive maintenance methods will be recommended.

18.1.2 Discussion

Bishkek City carries out road maintenance and improvement by using a big slice of its budget. Major maintenance and improvements are being contracted with the private contractors, although minor maintenance is done by the City. There are sufficient road maintenance and improvement contractors in the City. However, there are many arguments from the citizens against cost, quality and construction speed. The City intends to enforce account maintenance and improvement with the City's own equipment and manpower in relevant departments.

The JICA Study Team proposed different strategies as follows:

(i) Promotion of the private road contractors with the equipment rental market and financial supporting system

(ii) The distinction between construction work and supervision

(iii) This policy also follows the promotion of privatization of road maintenance and management.

18.1.3 Privatization of Road Maintenance and Situation of Private Construction Company

The JICA Study Team proposes promotion of the private road contractors with the equipment rental market and financial support system, and the differentiation or distinction between construction work and supervision.

This policy also follows the promotion of privatization of road maintenance and management.

The contractors in Bishkek have the following issues, compared to ones in developed countries:

(1) Needs of Equipment Rental Companies

There are no options to rent equipment and machines they need in accordance with the nature of work. Therefore, they buy all equipment unneeded for all workdays. Due to financial constraint, they must use very old equipment inappropriate to ensure the work quality and within the period. It causes financial burden in addition to losing competitiveness against international contractors. In developed countries, the contractor can rent any equipment at any time and period whenever the work requires.

Private equipment rental companies need huge capital. The City should provide such facilities until private rental companies are available. In addition, the City should apply equipment and supply based maintenance contracts that only the prospective contractors propose for prices of materials, labor, and overhead. Equipment price is calculated by fixed hour rentals.

(2) Regiment of Financial Support to SME

The private contractors have received very unfavorable financial conditions when they borrowed the money from the private banks for operations expenditure during the construction period. Under the contract, the contractor is able to receive an advanced, periodical, and final payment. They need operation cost until payment is realized. The bank requested 120 percent of collateral and 12 percent to 15 percent interest rate. These transaction costs should be included in the price of the contract. They are also factors that increase the contract price.

(3) Consideration of Time for Work, only Six Months from April to October

In Bishkek City, the work must be finished by winter. The contract period can only be six months in the summer season. The Contractors are requested to speed up the work by using more equipment-intensive method. If they purchase equipment, they have a six-month idle time. All equipment costs should be covered within six months of work. This is also a factor to increase the contract price.

(4) Request of Proper Supervision of Quality Control due to a Lack of Test Equipment and Technical Capacity

There are few private consultants for road designs and supervision. However, due to a lack of test equipment for work quality control, or staff with technical capacity for supervision at the sites, proper quality control is difficult for the Contractor and the Consultant. The City should provide the site test equipment to the Contractor and the Consultant, and carry out laboratory tests by its own assurance of quality for the Owner.

(5) Requirement of Tax Preference in Donors Project by the State Law

In international donor projects, the foreign contractor may enjoy their tax-free status according to the loan agreement. Further, the local contractor must obey the tax law.

18.2 The Project of Enhancement of Road Maintenance Capacity

18.2.1 Project Purpose

The project's purpose is to develop and facilitate the private contractor's capacity for road maintenance and management by several measures to overcome the above problems, and to reduce the cost of works and then the burden on the City's maintenance budgets, together with ensuring quality of the work.

The JICA Study Team proposes the following measures:

(i) Equipment supply contract

(ii) Facilitation of general fund

(iii) Introduction of equipment- intensive and labor- intensive pavement design and method

(iv) Enhancement of quality control with proper test equipment and Human Resource Development (HRD)

18.2.2 Equipment and Plant Supply for Road Pavement Improvement

There are two plans needed for road pavement improvement. A cement concrete (CC) plant and an asphalt concrete (AC) plant. **Table 18.2-1** shows comparison for two plans in terms of privatization of road improvement. No market for asphalt or an asphalt plant should be owned and operated by the City. A cement concrete plant should be owned and operated by the private companies. **Table 18.2-2** shows urban road management by privatization.

Table 18.2-1 Comparison of Asphalt and Concrete Plans and Pavement

	Asphalt Plant	Concrete Plant
Main Market	Road pavement	Private sector for building
Road market	-Ditto-	Concrete pavement
Ownership	City own	Private
Privatization	PPP	Private
Contract method	Material supply by the City	Material purchase
Pavement life	AC: 3 to 5 year design life	CC: 5 to 10 year design life
Maintenance cost	High maintenance cost	Low maintenance cost

Source : JICA Study Team

Table 18.2-2 Urban Road Management by Privatization

Item	Periodic (by 3-5 year)	Routine (every year)	Urgent / Special
Repair Work	Overlay Reconstruction	Potholes/Crack Canal repairs	Damage/Snow remove
Contractor	Contract with Big and Medium Enterprises	Contract with SME Force-account	Force-account Outsourcing
Supervision			
1. Laboratory Test	The City	The City	The City
2. Site Supervision	Consultant	The City/Consultant	The City

Source : JICA Study Team

18.2.3 Role of the City

(1) Provision of Equipment and Materials for Road Maintenance

The City intends to purchase plant equipment for road maintenance and cleaning to preserve the road and traffic facilities.

(2) Private Contractor Supporting Policy

The City, together with the State government should prepare a private contractor support policy. The policy will include equipment supply, financial support, tax review, and technical support. The City also should clarify definition of maintenance work or distinguish between the public and the private work. Public work should be limited to urgent specific work that the private firms cannot enter into, because of the small size and unpredictability or needs of specific technical and engineering skills.

(3) Preventive Maintenance Plan Preparation

The City should prepare a program for 3 to 5 years with annual plan according to a survey of road and traffic facility condition in order to introduce a preventive maintenance plan. For the road conditions, JICA has provided Vehicle Intelligent Monitoring System (VIMS)[1], measurement equipment of road surface roughness (IRI) under the technical assistance project to MOTC.

(4) Contract Management

The Capital Construction should manage the contract and supervision of equipment supply. This contract management is new for the Capital Construction and the Contractor. Therefore preparation of the guidelines and contract training with the pilot project are required.

18.2.4 Project Components

To fulfill the above-mentioned tasks, the proposed project includes the following components:

(i) Equipment procurement: 10 million USD

(ii) Pilot project for equipment-supply contract

(iii) Pilot Project for new pavement of Roller Compacted Concrete Pavement (RCCP) by concrete

(iv) Pilot Project for preparation of preventive maintenance program by VIMS survey

(v) Institutional strengthening and HRD

[1] VIMS was use by JICA, The Project For the capacity Building Road Maintenance in Kyrgyz Republic, 2008-2011

CHAPTER 19 URBAN PUBLIC TRANSPORTATION IMPROVEMENT PLAN

19.1 General

19.1.1 Flow of Urban Public Transportation Improvement Plan

In this Chapter, present and future issues discussed in **Chapter 7 Urban Public Transportation** and **Chapter 15 Consideration of Future Traffic** are summarized in the standpoint of public transportation. Also, it summarizes public transportation concerning plans and programs from the Transportation Improvement Plan and MP in **Chapter 16 Transportation Improvement Policies and Strategy** and **Chapter 17 Master Plan Components and Alternative Scenarios Evaluation**. Projects are proposed to solve the present and future issues in complying with the public transportation improvement plan and programs. A case study, the Trolleybus Route Operating Plan, is conducted to introduce the methodology. A study of ICT fare collection system to public transportation in Bishkek City is elaborated. **Figure 19.1-1** shows flow of the Urban Public Transportation Plan.

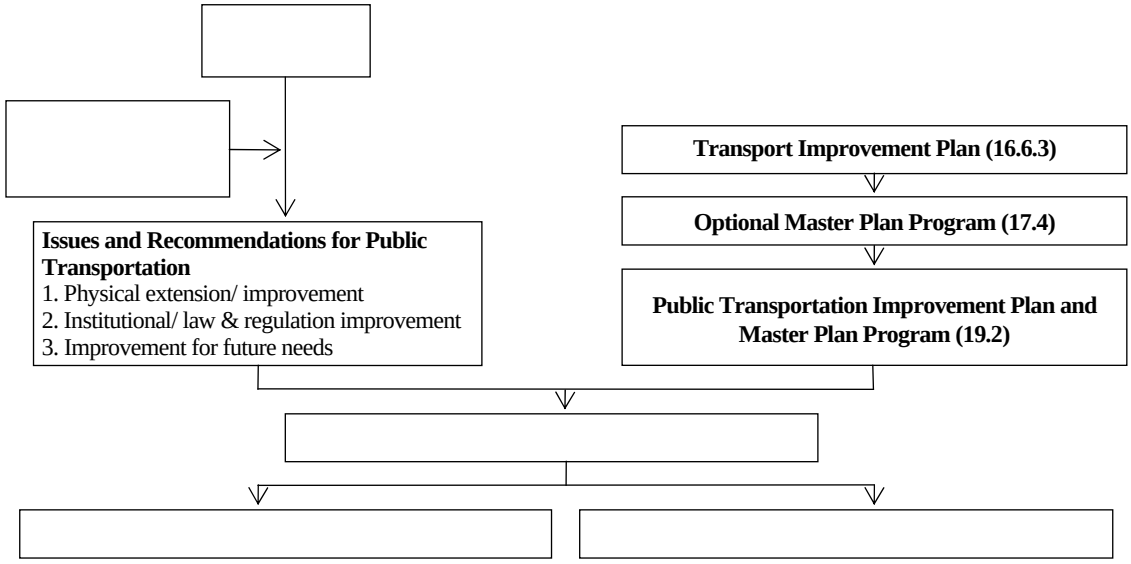


Figure 19.1-1 Flow of Urban Transportation Improvement Plan

19.1.2 Necessity of Public Transportation Enhancement

The efficiency of public transportation utilizing road space is clearly shown in **Figure 19.1-2**. A public transportation vehicle has advantages against private vehicles in carrying the same number of passengers as follows:

(i) Less traffic volume

(ii) No parking space

(iii) Less traffic accident rates

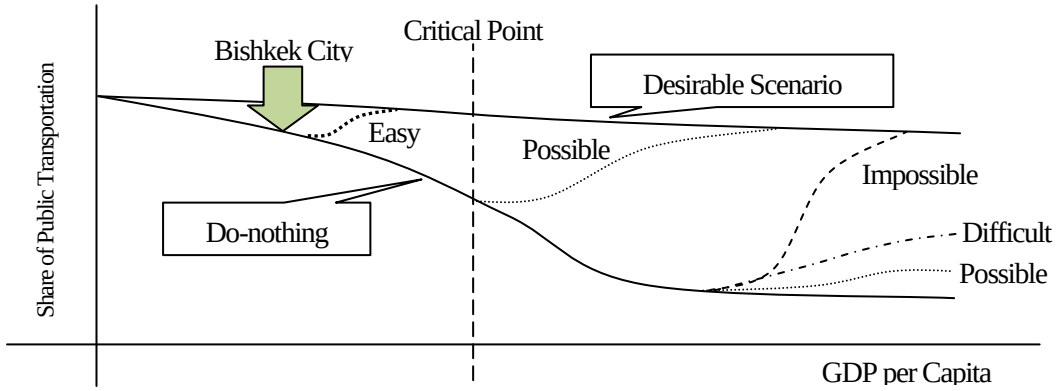
(iv) Less energy consumption and

(v) Less pollution emissions

Many metropolitan areas have experienced a rapid drop of public transportation passengers due to increasing car ownerships brought by increasing of GDP per capita. Bishkek City is also experiencing increasing of the number of private vehicles.

Source : Bus Rapid Transit Planning Guide 3rd edition, GTZ, June 2007.

Figure 19.1-2 Images Comparing the Amount of the Road Space to Move Persons by Private Vehicles and Public Transportation



Source: JICA Study Team based on the study on urban transportation policies of metropolises in Asia , Colloquium No.79, Institute for Transport Policy study, Vol.9 No.1 2006 Spring

Figure 19.1 3 Necessity of Measures against Decreasing Share of Public Transportation

As shown in **Figure 19.1-3**, it requires proper measures to keep a desirable share of public transportation at the critical point, otherwise, the transportation would be at an irreparably low level. Fortunately, Bishkek City utilizes public transportation at a high percentage[1]. High rates of public transportation usage are owed to small capacity minibuses with frequent operation. It must therefore be considered in shifting from small bus vehicles to bigger ones, and in the proper ratio.

19.2 Issues and Recommendations for Public Transportation

The public transportation related plans and programs were extracted from Transportation Improvement Plan and Optional Master Plan Program, and shown in **Table 19.2-1**.

[1] According to the House Hold Interview conducted in 2011, 67% of daily trips of vehicles is done by public transportation such as trolleybus, midibus and minibus.

Table 19.2-1 Public Transportation Improvement Plan and Master Plan Program

Transport Improvement Plan (16.6.3)	Optional Master Plan Program (17.4)
4. Smooth flow of local public transportation into the urban area 8. Expansion of road capacity by curb management 11. Activation of Town by Transportation 14. Improvement of public transportation service and promotion of PT use 20. Introduction of modern transport ICT technology of Japan and developed countries 22. Review of comprehensive public transport preferential laws and policies 23. Creating an integrated institution for control of PT 24. Promoting PT management by service standards 25. Introduction of franchise system 26. Remove of entry barriers for private enterprise	1. Utilizing High Occupancy Vehicle in Minibus 2. A Comprehensive Program for Improvement of Public Transportation Having an Integrated Public Transportation Authority 3. Review of Fare System and Service Standards 4. To Improve Financial Constraint of the City to Public Transportation

Source : JICA Study Team

The present limitations of public transportation were identified in **Chapter 7**, and the future traffic congestions at the peak hours in 2023 were predicted. To address those issues, complying with the Public Transportation Improvement Plan and the Optional Master Plan Program, actions or measures were considered. The JICA Study team recommends measures as shown in **Table 19.2-2**.

Table 19.2-2 Issues and Recommendation for Public Transportation in Bishkek City

Issues	Recommendation		Measures
➢ Physical Extension/ Improvement			
1. Bus routes are duplicated and excessive competition between public and private sectors, even between private companies is occurring.	Reform public transportation network to be more efficient and smooth	⇨	1. Bus Route Network Reformation 2. BRT Introduction Plan 3. ICT Ticket for All Transit Modes 4. Bus Information System 5. Bus Lanes for Peak Hours 6. Bus Priority Signal Installation 7. Bus Operation Monitoring System 8. Bus Approach Information System 9. Public Bus Enhancement 10. Improve Terminals at East and West Bus Terminals
2. Entire bus route information and bus operation frequency are not sufficiently provided to citizens.	Provide an entire bus route information to the public		
3. Fare collection system is inefficient due to manual collection method.	Revise fare and ticketing system with design of e-ticketing system		
4. Transportation terminals are not well designed with the view of connectivity to the City center, neither their facilities are not well designed to transfer.	Improve bus terminals to provide one-stop service		
5. It is required to improve bus service speed.	Improve bus service speed		
➢ Institutional/ Law and Regulation Improvement			
1. Minibus driver has an incentive to catch passengers as much as possible rather than obeying traffic rules and working rules.	Monitor public transportation service	⇨	11. Curb management 12. Public Transportation Management and Service Level Improvement 13. Public Transport Priority System
2. Minibus operation is controlled by planned vehicle numbers and reported actual operated vehicle numbers from private companies, thus, actual operation records,	Evaluate public service level on a regular basis in the view of users and the view of service provider		

Issues	Recommendation		Measures
such as frequencies, are not reported to UTD.			
3. Financial conditions of BTD and BPTE are in continuously deficit.	Balance revenue and expenditure of BTD and BPTE		
4. Revision of tariffs of public transportation, which came into force on 1st of May, 2012, caused decline of trolleybus users.	Formulate comprehensive public transportation policies		
5. Cheap fare rate and fare exemption affect profitability on public transportation revenue.			
➢ Capacity Development			
1. UTD is designed to have right to form urban transportation network in Bishkek City, however, UTD is parallel to two other public companies and does not work as comprehensive transportation planning bureau.	Reform urban transportation sector in Bishkek City	⇨	14. Capacity Development on Public Transportation Management in Bishkek City
➢ Peak Hour Solution in 2023			
1. Increase bus at the peak hours.	Develop exclusive bus lanes	⇨	15. Bus Lanes for Peak Hours (repeated)

Source : JICA Study Team

19.3 Public Transportation Improvement Projects

19.3.1 Utilizing High Occupancy Vehicle in Minibus

(1) Introducing High Occupancy Vehicle in Minibus

As it also discussed in **Sub-chapter 14.8.2**, the Study recommends introducing a bigger bus fleet, gradually replacing the minibuses used at present to reduce the number of vehicles on the road and relieve traffic congestions, especially in the City center.

(2) Necessity of Monitoring System of Public Transportation

The bigger bus operators were assumed as both BPTE and private companies. In general, operation costs of larger vehicles are higher than that of minibuses operation costs. As a result, more passengers are needed, to be able to profit from one operation. Profitability of bus operations should be considered as well, in conjunction with punctuality. Under the present contracts of minibus companies with drivers, drivers are obliged to wait for passengers until they reach assumed profitable income rather than keep punctuality of bus operations. The BPTE has likewise reduced midibus routes due to non-profitability. To consider the issues mentioned, a monitoring system of each bus fleet is needed.

(3) Incentives for Higher Occupancy Vehicle for Private Bus Company

Bishkek City started giving incentives to private bus companies using higher occupancy 18-seat bus fleets, adding special points at the tendering of franchise bus routes. To attract investments,

Bishkek City has also discussed with private companies about lengthening their franchise periods when introducing new, bigger buses. The Study further encourages this policy for additional (such as 30 units) bigger buses.

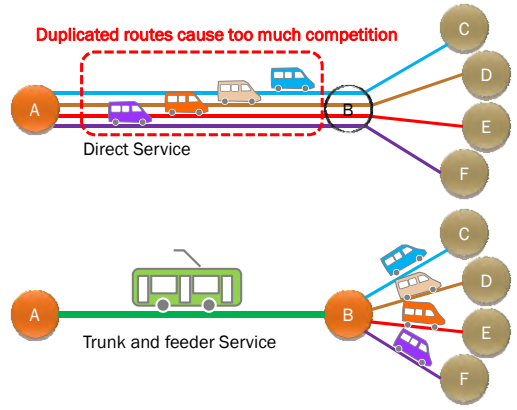
(4) Securing Financial Methods for Private Bus Companies

To facilitate investments on new high occupancy vehicles, it is necessary to establish certain financing methods for bus fleet procurement, or lease system of bus fleet. Simultaneously, the JICA Study Team recommends enhancing the corporate responsibilities of private bus companies, to establish a robust public transportation in Bishkek City.

19.3.2 Tentative Proposal of Trunk-feeder System in Bishkek City

(1) Public Transportation Network System

The present public transportation network system provides many direct connections in various places in Bishkek City. As a result, there are numerous duplications of public transportation routes by the minibuses, trolleybuses and midibuses. In addition, passengers feel difficulty selecting a proper route to go to an unfamiliar destination. The following issues should be studied:



Source : JICA Study Team

Figure 19.3-1 Trunk-feeder System

(i) Duplicated route assignments cause excessive competition between bus companies and drivers in getting passengers. They disturb the traffic flow and cause congestion.

(ii) Passengers prefer direct travel than transfers. Passengers would rather ride on board and feel more reluctant to spend hours waiting at an interchange station. Insufficient information at bus stations creates more severe situations.

The sensible network structure could be simple as providing a choice of routes, making passengers easily select. It should link all points in accordance with passengers' demands, and likewise, operations should be efficient. Thus, it is recommended to restructure the public transportation network as a trunk-feeder system to accomplish smooth and efficient transportation in Bishkek City. The concept of the trunk-feeder system is shown in **Figure 19.3-1**. The trunk-feeder system defines trunk routes and feeder routes. The trunk routes are used by the trolleybuses, the midibuses and the high occupancy minibuses with frequent operation, while feeder routes are used by minibuses. The interchange stations are also important and construction should be expedited. Advantages and disadvantages of stakeholders are summarized in **Table 19.3-1**.

Table 19.3-1 Advantages and Disadvantages of Trunk-feeder System

	Advantages	Disadvantages
For Passengers	- Increase travel speed of bus. - Increase capacity of vehicles and frequency of bus service on trunk routes. - Public transportation network would be simpler and a passenger can select bus routes easily for a travel to an unfamiliar destination.	- Times of transfer for a long travel will increase. - Interchange stations would hinder a travel if they would not provide sufficient information of bus operation, such as a route map and time tables. - Using both trunk and feeder routes would hike the total fare for a travel under the present fare system.
For Operators	- Excessive competitions would be reduced. - Operators can appoint bus vehicles to proper routes by size in accordance with demands.	- Coordination between trunk operation and feeder operation is required especially between different firms. - Working conditions and opportunity revenue of drivers will be more variety.
For Administrators	- Easy to monitor actual operation due to simplified public transportation network and operators.	- Stronger enforcement of keeping time table for operators is required to ensure the system consistency. - Under the present fare exemption system, the total amount of subsidy of the City to BTD would increase if fare exempted passengers increased.
For Government	- Road congestion would be relieved.	- Without understanding of passengers, criticize on changing the system would be raised.
For Road Users	- Road congestion would be relieved.	-

To avoid or lessen disadvantages, following issues should be considered:

(iii) Enhance attractions of interchange stations

(iv) Revise fare and ticketing system

(v) An organization which has overall coordination functions on public transportation should be established

(vi) Consider new working regulation or contract for drivers

(vii) Enhance the governance of public transportation operation

(viii) Implement new service with public involvement.

(2) Proposed Network Structure

Figure 19.3-2 shows proposed bus trunks, considering heavily duplicated bus routes and volume of passengers. The following avenues and streets are proposed as bus trunks,

(i) Primary Bus Trunk: Chui Avenue and Kievskaya Street

(ii) Secondary Bus Trunk: Manas Avenue, Mir Avenue and Sovetsukaya Street

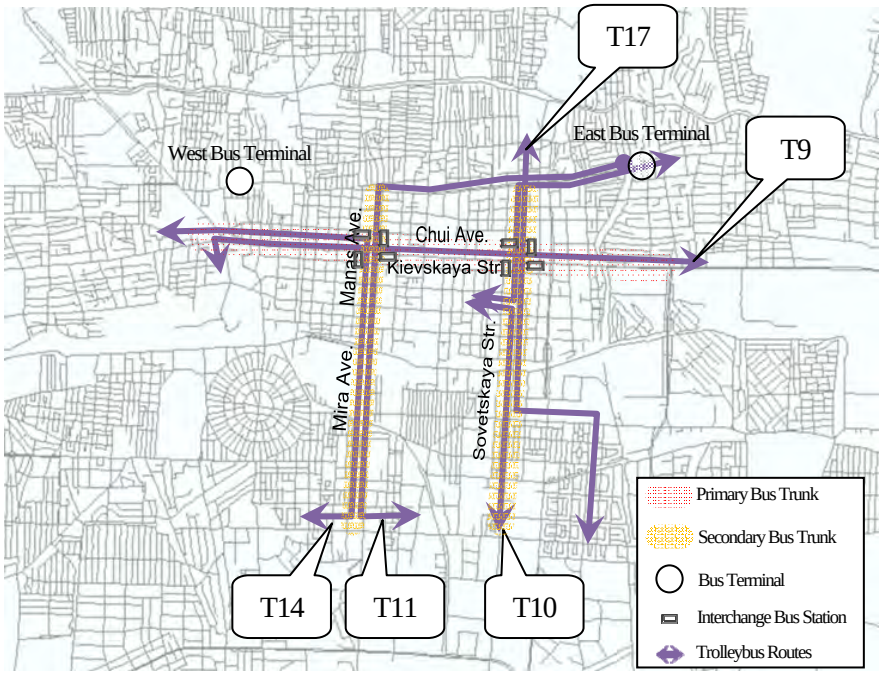


Figure 19.3-2 Primary Secondary Network for Public Transportation

Those bus trunk routes should be operated by high occupancy vehicles. The high occupancy vehicles may be operated by both BPTE and private bus companies.

(3) Provisional Estimation of Passengers for Bus Trunks

At present, the minibuses carry about 70 percent of public transportation passengers. Based on assumptions of increasing occupancy ratio of a vehicle and a frequency (headway) as shown in **Table 19.3-2**, shares of the trolleybus are planned at 40 percent and that of the midibuses (including present midibuses), and new high occupancy vehicles at 60 percent, as shown in **Figure 19.3-3**. Required midibuses vehicles are 74 units for Chui Avenue/ Kievskaya Street, 74 units for Mir Avenue/ Manas Avenue, and 47 units for Sovetskaya Street, respectively.

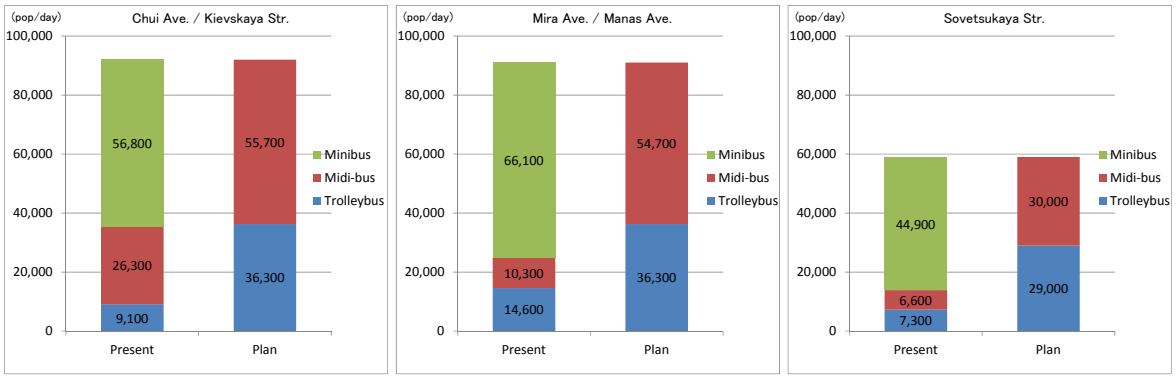


Figure 19.3-3 Passengers by Public Transportation Modes at Present and at Plan

The method used for planning required quantities of high occupancy vehicles was as follows:

(i) Estimate the number of passengers on the corridor.

(ii) Initially, assign passengers to trolleybuses, then assign the rest of the passengers to high occupancy vehicles (midibuses).

(iii) Calculate the planned quantity of operating trolleybuses and midibuses respectively, which will facilitate all the assigned passengers. The number of operation derives an average headway as its inverse number.

Table 19.3-2 Present Operation and Planned Operation

		Present / Plan	Chui Ave. Kievskaya Str.	Mir Ave. Manas Ave.	Sovetsukaya Str.
Number of Operation (times/day)	Trolleybus	Present	143	205	121
		Plan	240	240	192
	Midibus	Present	675	242	177
		Plan	960	960	600
	Minibus	Present	3,213	3,705	2,680
		Plan	-	-	-
Average Headway (minutes)	Trolleybus	Present	6.7	4.7	7.9
		Plan	2.0	2.0	2.5
	Midibus	Present	1.4	4.0	5.4
		Plan	0.5	0.5	0.8
	Minibus	Present	0.3	0.3	0.4
		Plan	-	-	-
Required Number of Midibus in Plan			74	74	47

(4) BRT Introduction Plan

As mentioned, bus trunks require two minutes intervals for trolleybuses and 30 seconds interval for midibuses. To realize this operation, the Bus Rapid Transit (BRT) system should be considered. The BRT system is a high-quality bus based public transportation system that drives fast, comfortable, and provides cost-effective urban mobility through the provision of a segregated right-of-way infrastructure, rapid and frequent operations and excellence in marketing and customer service. The system may have bus exclusive lanes and pronounced high capacity buses and newly developed bus stations. The following issues should be considered:

(i) Project preparation: demand forecast, corridor selection, etc.

(ii) Operating design: network and service design, system capacity and speed, intersection and signal control, customer service, etc.

(iii) Physical design: infrastructure, technology, etc.

(iv) Integration: modal integration, TDM and land-used integration, etc.

(v) Business plan

(5) Provide One-stop Service at Interchange Bus Station and Bus Terminal

To make a transfer smooth, interchange bus stations should be developed. The interchange bus stations should attract users for using buses and terminals, it is recommended to develop commercial facilities and branch office of administrations such as police department for registration of changing address, in bus terminals. To say, one-stop service providing much service in one place attracts users with its convenience. These services are also recommended to develop in the existing terminals by the same reasons.

(6) Transfer Ticket System with E-ticketing System

To alleviate users' reluctance to change buses at interchange stations by the trunk-feeder system, the transfer ticket system should be installed. The system should identify the station where a user alights and record that time. When the user boards on the other midibus or trolleybus again, the system checks the time and as far as within the certain period designed by the system, it applies a transfer discount or a continuous fare system to the user.

The fare system reconstruction is also recommended when the network would be restructured. Zonal tariff system or distance based system should be considered and e-ticketing system would be able to realize such system efficiently.

(7) Comprehensive Information Provision

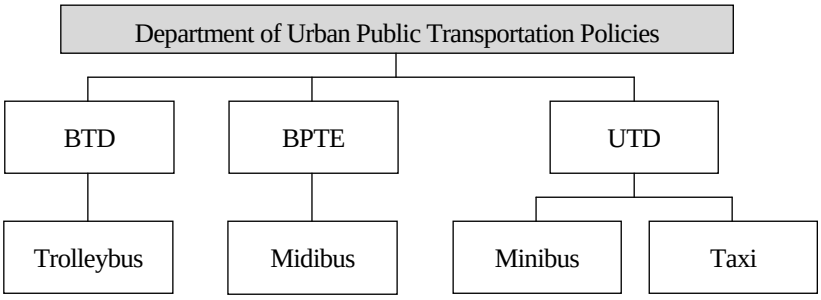
Accompanying maps and information make the public transportation system more user-friendly.

(i) Clear route maps and operation frequency should be shown at bus stops and vehicles. The information should be shown by private bus companies also.

(ii) Expected bus arrival times should be displayed at bus stops to attract attention or be noticed by waiting passengers. That can be provided by real-time information displays and web sites. SMS could be utilized for this purpose.

19.3.3 Restructure of the Urban Public Transportation Sector in Bishkek City

The recommended structure of the urban public transportation sector in Bishkek City is shown in **Figure 19.3-4**. It is recommended to create a new department which has jurisdiction over comprehensive public transportation policies. Three (3) organizations, under the new department, manage and operate the trolleybuses, the midibuses, the minibuses and taxis in an integrated manner.



Source: JICA Study Team

Figure 19.3-4 Structure of the Urban Public Transportation Sector in Bishkek City

19.3.4 Review of Fare System and Service Standards

(1) Review of Fare System

Review of the present fare system and proposal of an ICT fare system for public transportation in Bishkek City is conducted in **19.5 Introduction of ICT Fare Collection System to Public Transportation in Bishkek City**.

(2) Review of Service Standards

It is essential to enhance monitoring function of UTD to monitor and control actual bus operations. At present, all bus companies including BTD and BPTE submit the daily quantity of vehicles to UTD, with an honor or trust system. Since there is no evidence, there is no reliability.

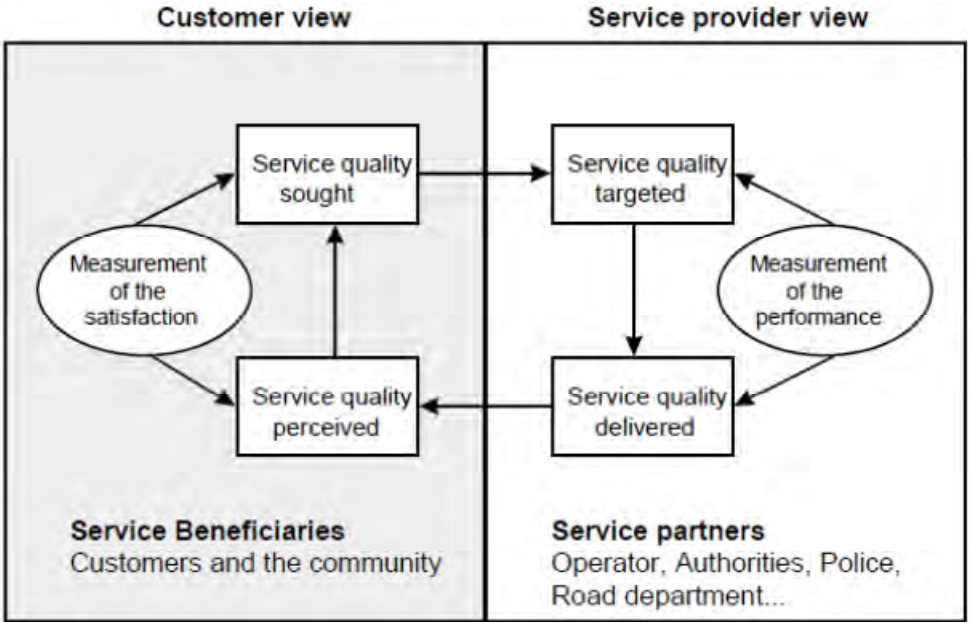
The frequency of operations of vehicles is planned by BTD and BPTE respectively. However, the occupancy survey revealed that midibuses operated in almost half of the planned operation. This issue is recognized by Bishkek City and measures are discussed in the city council to install GPS on midibuses in order to control municipal equipment properly.

The Study recommends installing the service quality cycle for evaluation and improving public transportation service. The points of the cycle are:

(i) Records indicators of transportation services, such as number of operation, frequency, punctuality etc.,

(ii) Open those indicators to the public

(iii) Evaluation by the customer view and feedback the evaluation to service quality targets of public transportation service providers. As it works properly, the quality of public transportation service will improve gradually. **Figure 19.3-5** shows concept of the service quality cycle on public transportation services.



Source: EN13816:2002 (E)

Figure 19.3-5 Service Quality Cycle

19.3.5 Other

(1) Taxi Services

To provide supplemental public transportation service, taxi stands should be developed. The taxi stand is a location where taxi can wait for passengers on the road. Parking should be prohibited within 5 meters near the intersection for road safety of waiting passengers. It is necessary to clear driver's view at near intersection for road safety. This measure should be considered in curb management.

19.3.6 Proposed Projects for Urban Public Transportation

Proposed projects are summarized as follows. The outline of each project is described in **CHAPTER 24**.

Table 19.3-3 Proposed Projects and Implementation Plan

Project Title Agency	Purpose	Cost (mil. USD)	Implementation Plan Short	Medium	Long
1. Physical Extension/ Improvement					
Bus Route Network Reformation (UTD, BTD, BPTE, Transport Inspectorate)	Reform public transportation network to be more efficient and effective	0.3			
BRT Introduction Plan (BCDA)	Introduction to major line New BRT vehicle development	0.5			
ICT Ticket for Trolleybus (EBRD) (Bishkek City)	Introduction of ICT ticket by PPP	1.0			
ICT Ticket for All Transit Modes (Bishkek City) (BCDA, UTD, BTD, BPTE)	Cashless public transportation（Midibus Minibus）	1.0			
Bus Lanes for Peak Hours (BCDA)	Introduction of public transportation priority system with ITS technology	0.8			
Bus Priority Signal Installation (BCDA)	Introduction of bus priority signal with ITS technology.	0.8			
Bus Operation Monitoring System (BCDA, UTD, BTD, BPTE)	Introduction of bus operation monitoring system with ITS system	0.8			
Bus Approach Information System (BCDA, UTD, BTD, BPTE) (BPTE)	Introduction of bus approach information system with ITS system	1.0			
Improve Terminals at East and West Bus Terminals (MOTC, BCDA)	Rural and urban traffic interchange improvement Bus terminals rehabilitation by PPP	1.0			
2. Institutional/ Law and Regulation Improvement					
Roadside Management for Bus Stops with Tax and Car Parking (Curb management) (BCDA)	Bus stop facility improvement Allocation among transit modes Taxi, car, and truck parking	0.5			
Public Transportation Management and Service Level Improvement (Transport Inspectorate)	Integrated public transportation management with ITC (Bus control center) Private sector involvement and PPP by Service Level	0.9			
Public Transport Priority System (BCDA)	Introduce public transportation priority system with ITS technology	1.0			
3. Capacity Development					
Capacity Development on Public Transportation Management in Bishkek City (BCDA, UTD, BTD, BPTE)					

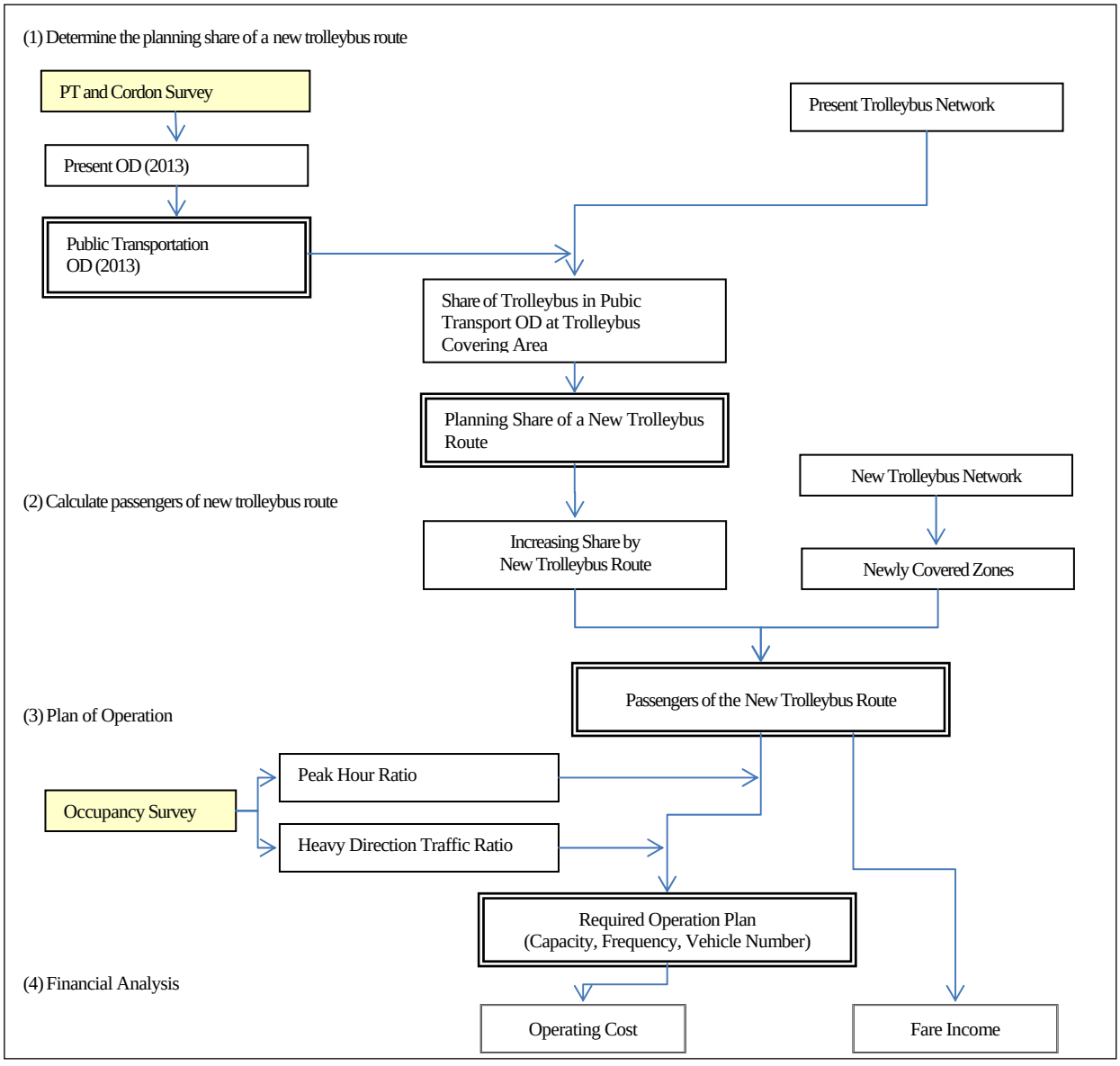
Source : JICA Study Team

19.4 Case Study: Trolleybus Route Operating Plan

19.4.1 Background and Objectives

The Study conducted comprehensive traffic surveys and formulated the traffic demand forecast. Now, Bishkek City has a set of Origin - Destination (OD) data as a basis of transportation planning. At this moment, Bishkek City is introducing new trolleybuses to enhance its operation, with a plan of reviving or newly introducing some trolleybus routes. It is highly recommended to utilize the OD data to study the most suitable and efficient route of trolleybus to be installed. Hence, this section shows a case study of a plan of new trolleybus route operation to introduce a methodology of using the OD data.

19.4.2 Planning Procedure



Source : JICA Study Team

Figure 19.4-1 Planning Flow of a New Trolleybus Route

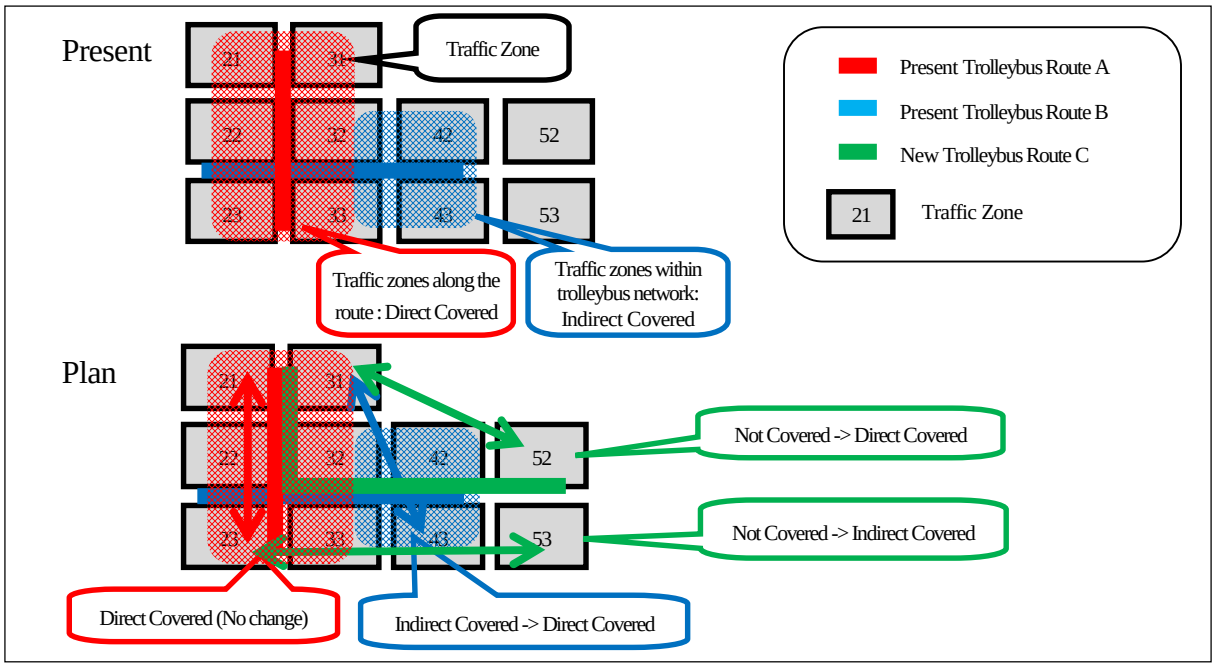
19.4.3 Planning Share of a New Trolleybus Route

(1) Types of Traffic Zone Pairs

The share of trolleybus is calculated by two types of traffic zone pairs as shown in **Figure 19.4-2**:

(a) Share in traffic zones along the route, between the zones can travel using the trolleybus route without interchange, and

(b) Share in traffic zones within trolleybus network, between the zones can travel using trolleybus routes with interchanges.



Source : JICA Study Team

Figure 19.4-2 Two Types of Traffic Zone Pairs and Their Changes by a New Route

(2) Direct Covered Traffic Zone Pairs of Each Existing Route

Table 19.4-1 shows the zones passed by existing trolleybus routes. The zone number is same as the traffic zone which is prepared for traffic MP of this Study.

Table 19.4-1 Direct Covered Traffic Zone Pairs

No.	Route No.	Traffic Zones Passed by Trolleybus Route
1	TR04	11, 10, 32, 32/44, 33/51, 52/53, 58/57, 60
2	TR08	1, 1/2, 6, 10/11, 10, 32, 32/44, 33/51, 51/53, 50/54, 55/49
3	TR09	1, 1/2, 6, 10/11, 11, 8/10, 32, 51/44, 50/45, 49/46, 49/48, 82, 82/48
4	TR10	28, 25, 26, 26/24, 30/23, 31/21, 32/44, 32, 10, 11/12, 11
5	TR11	25, 25/24, 24, 23/24, 30/26, 6/30, 6/31, 10/32, 8/33, 33/34, 33/52, 53/51, 53/50, 54/50
6	TR14	36/12, 11, 8/10, 10/32, 6/31, 6/30, 6/7, 7, 5/15
7	TR17	25, 24/25, 25, 23, 23/21, 31/21, 21/32, 32/44, 33/51, 52/53, 58/57, 60

Note : Traffic zone numbers written in the form of (" / ") are the zones where the trolleybus route passes through the border between these two zones

Source : JICA Study Team

(3) Planning Share of a New Trolleybus Route

The share of a trolleybus in public transportation by each trolleybus route is calculated as shown in **Table 19.4-2**. The average of direct covered zone pairs is 11 percent and that of indirect zone pairs is nine percent. These averages are set as the planning share of a new trolleybus route.

Table 19.4-2 Share of Trolleybus in Public Transportation by Route

No.	Route No.	Share of Trolleybus in Public Transportation (by person)	
		Direct Covered (Zone Pairs along the Route)	Indirect Covered (Zone Pairs Within Trolleybus Network)
1	TR04	17%	10%
2	TR08	13%	9%
3	TR09	11%	9%
4	TR10	12%	9%
5	TR11	7%	9%
6	TR14	9%	9%
7	TR17	10%	9%
Average		**11%**	**9%**

Source : JICA Study Team

19.4.4 Planning New Routes

Following four routes are the candidate of revival or newly introducing trolleybus routes for Bishkek City. In this case study, TR 16 is selected to plan of operation, since the route is newly planned and.

(1) TR 5 (New): Route from M. Lermontov St to Djal-29 district

Description: M. Lermontov St - Jibek-Jolu Ave - East terminal - Sovetsukaya St - Maksim Gorky St - Mir Ave - Isa Akhunbaev St - Tynaliev St - Yozhnaya Magistral St

(2) TR 7 (Revive): Route from Zavod Frunze to Tunguch micro district

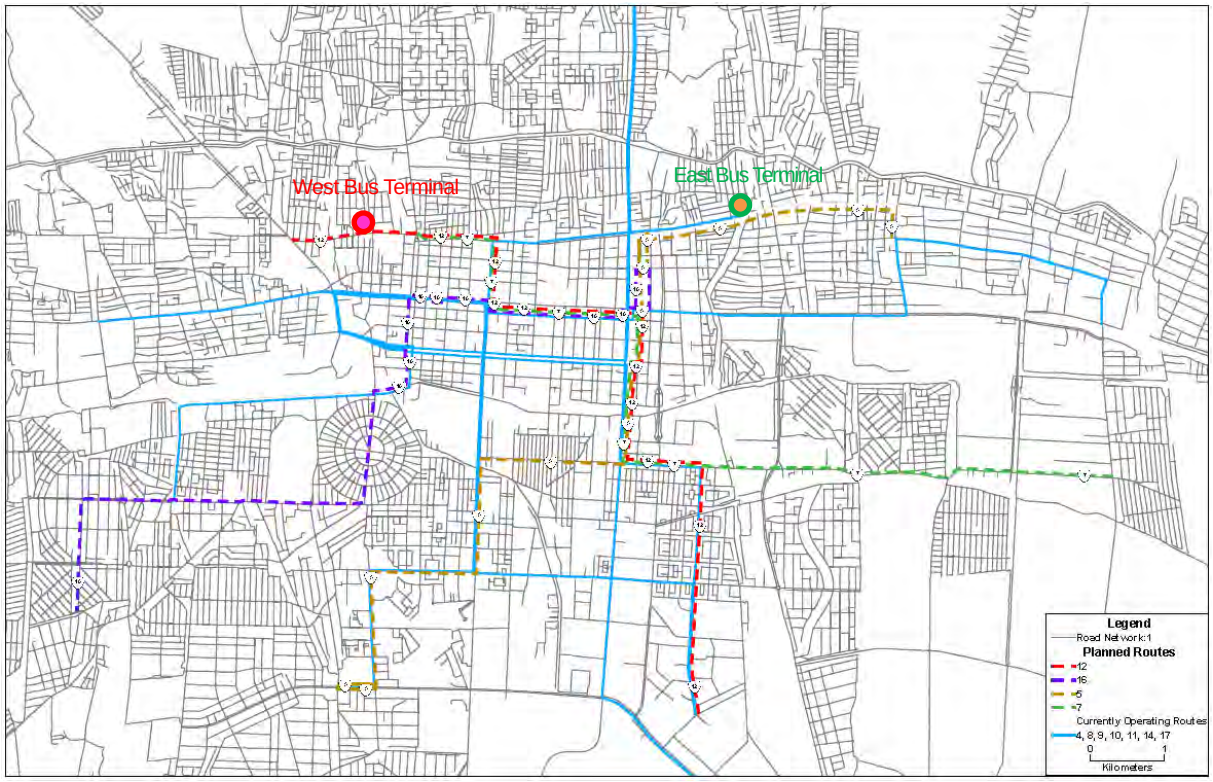
Description: Intergelpo St - Chui Ave - Manas Ave - Kievskaya St - Sovetskaya St - Jukeeva Pudovkina St - Gorky St

(3) TR 12 (New): Route from 6 micro district to West Terminal

Description: West terminal - Jibek-Jolu St - Manas Ave - Erkindik Blvd - Sovetskaya St - Mederova St - Younusalieva St - 6 micro dist

(4) TR 16 (Revive): Route from Ak-Orgo to Cirk

Description: Ak - Orgo - Gagarin St - Nekrasova St - Lva Tolstogo St - Makhatma Gandi Ave - Moskovskaya St - Beishenalieva St - Manas Ave - Kievskaya St - Sovetskaya St - Ivanicyna St - Shopokova St - Chui Ave



Source : JICA Study Team

Figure 19.4-3 Existing and Candidates Trolleybus Routes in Bishkek City

19.4.5 Passengers of New Trolleybus Route

(1) New Trolleybus Network

The new trolleybus route to be planned is TR 16 and its passing zones are shown in **Table 19.4-3**.

Table 19.4-3 Traffic Zones Passed by TR 16

Route No.	Traffic Zones Passed by Trolleybus Route
TR 16	3, 1/4, 1/5, 2/5, 2, 6, 10/11, 8/10, 32, 32/44, 33/51, 51/44, 51

Note : Traffic zone numbers written in the form of (/) are the zones where the trolleybus route passes through the border between these two zones

Source : JICA Study Team

(2) Newly Covered Zones

To compare existing trolleybus routes covering zones and the new trolleybus route covering zones, Service condition were changed in zone pairs as shown in **Table 19.4-4**.

Table 19.4-4 Traffic Zones to be Changed by Passing TR 16

Service Condition	Zone Pairs
"Not Covered" to "Direct Covered"	1-3,1-4,2-3,2-4,3-3,3-4,3-5,3-6,3-8,3-10,3-11,3-32,3-33,3-44,3-51,4-4,4-5,4-6,4-8,4-10,4-11,4-21,4-33,4-44,4-51
"Not Covered" to "Indirect Covered"	3 to each covered zone, and 4 to each covered zone
"Indirect Covered" to "Direct Covered"	1-5, 2-5,5-33,3-44,5-51

Source : JICA Study Team

(3) Passengers of the New Trolleybus Route

Based on the **Table 19.4-4**, OD volume and increment trolleybus users of each OD pairs, where the service condition changed, are calculated and summarized in **Table 19.4-5**. The number of increment passengers is simple increase from existing trolleybus users, which does not include transferring passengers from existing trolleybus to the new route. This is a moderate estimation.

Table 19.4-5 Estimated Passengers of TR 16 in 2011

Service Condition	Number of Public Transportation Users (pax / day)	Present Trolleybus Users (pax / day)	Planned Share by New Route (%)	Number of Passengers Increasing (pax / day)
"Not Covered" to "Direct Covered"	35,922	2,033	11%	2,309
"Not Covered" to "Indirect Covered"	51,101	2,148	9%	3,084
"Indirect Covered" to "Direct Covered"	4,866	162	11%	373
Total Number of Passengers	**91,888**	**4,343**		**5,766**

Source : JICA Study Team

Table 19.4-6 shows the numbers of passengers from 2011 to 2023.

Table 19.4-6 Estimated Passengers of TR 16 in 2011, 2013, 2018 and 2023

Year	Number of Passengers Increasing (pax / day)
2011	5,766
2013	6,255
2018	6,147
2023	6,243

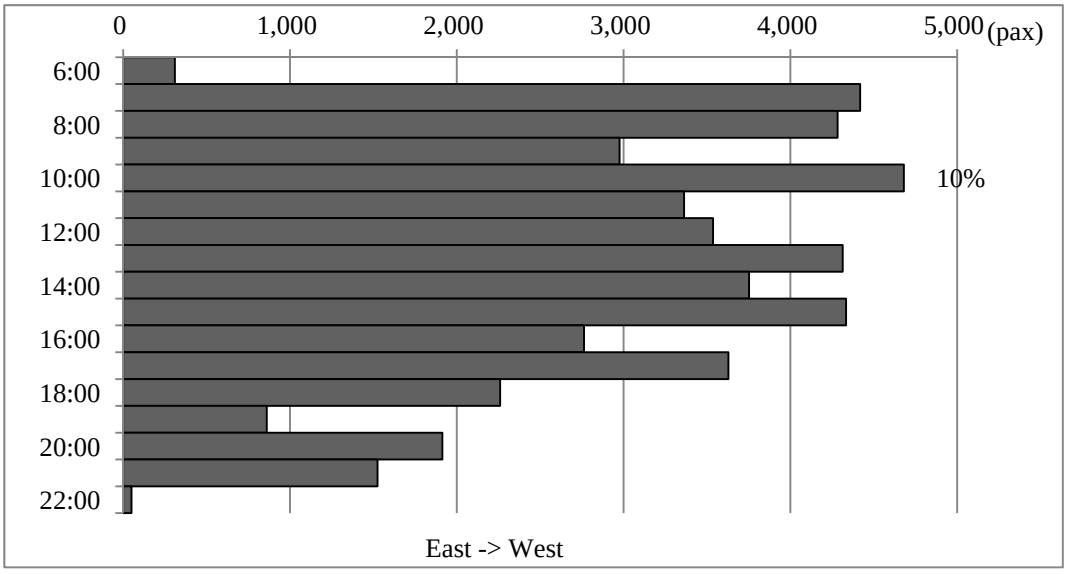
Source : JICA Study Team

19.4.6 Plan of Operation

As thus far described, daily passengers of the new route are estimated. However, it is required plan of operation which focuses on peak hours in heavy direction.

(1) Peak Hour Ratio

Occupancy Survey conducted in June 2012 revealed the hourly passenger volume on road as shown in **Figure 19.4-4**. The peak hours are in the mornings and afternoons, the highest is recorded at 10 percent. Thus, the target peak hour is set at 10 percent.



Note : Hourly Passengers estimated at survey station No.3 (Akademiya nauk) of Occupancy survey conducted in June 2012.
Source : JICA Study Team

Figure 19.4-4 Hourly Passenger Volume Observed at Occupancy Survey

(2) Heavy Direction Traffic Ratio

Heavy direction passengers traffic ratio is 53 percent as shown in **Table 19.4-7**.

Table 19.4-7 Heavy Direction Traffic Ration

Direction	Number of Passengers from 7:00 A.M. to 10:00 A.M. (pax)	Ratio
East -> West	11,678	47%
West -> East	13,401	53%
Total	25,079	100%

Source : JICA Study Team

(3) Required Vehicle

As shown in **Table 19.4-8**, required vehicle operation quantity are from 4.0 to 4.4 per hour. However, in those cases, interval of each vehicle is about 20 minutes and that is a very scarce operation frequency. In the standpoint of service levels, it is recommended 10 to 15 minute intervals[2] to be competitive to a minibus. As a result, vehicle quantity should be five per hour and requires seven vehicles including spare vehicles.

[2] Average Interval (Headway) of 10 - 14 minutes is the level of service B , second level of service, defined by "Transit Capacity and Quality of Service Manual -2nd Edition", TCRP, 2003

Table 19.4-8 Required Vehicle Numbers of TR 16 in 2013, 2018 and 2023

Year	Number of Passengers Increasing (pax / day)	Peak Hour Ratio	Heavy Direction Traffic Ration	Peak Hour Heavy Direction Passengers (pax / hour)	Required Frequency (Vehicle / hour)	Required Vehicle Operation Number	Required Vehicle Number
	(1)	(2)	(3)	(4) = (1) x (2) x (3)	(5) = (4) / 126 pax	(6) = (100 min) / (60 min)* x (5)	(7) = (6) / 80%**
2013	6,255	10%	53%	332	2.6	4.4	5.5-> 6
2018	6,147			326	2.6	4.2	5.3-> 6
2023	6,243			331	2.6	4.4	5.5-> 6
Required Vehicles in the View of Intervals						5.0	6.3 -> 7

Note : * 100 min is a rough estimation of turnaround time for one vehicle on TR 16. This is a calculation how many vehicles are required to operate in peak hour
** 80% is a usage ration of the vehicle
Source : JICA Study Team

19.4.7 Financial Analysis

(1) Operating Cost

The operating cost is roughly estimated in this case study. The unit operation cost of a vehicle by one round trip is calculated based upon statistics of 2008, 2009 and 2010. It is estimated at 500 SOMS per one round trip.

Table 19.4-9 Estimated Yearly Cost of TR 16 in 2013, 2018 and 2023

Year	Required Vehicle Operation Number	Operating Hours (Hour)	Number of Trips	Unit Operation Cost* (SOMS / Roundtrip)	Daily Operation Cost (SOMS / day)	Yearly Operation Cost (1,000 SOMS / year)
	(1)	(2)	(3) = (1) x (2)	(4)	(5) = (3) x (4)	(6) = (5) / 365
2013	4.4	15	66	500	33,000	12,045
2018	4.2		63		31,500	11,498
2023	4.4		66		33,000	12,045

Note : *Unit Operation Cost is average of that total cost of BTD divided by the number of all round trip in 2008, 2009 and 2010.
Source : JICA Study Team

(2) Fare Income

The fare income of a day is calculated by estimating the number of passengers multiplied by fare of eight SOMS.

To estimate annual income, it should be considered that the passengers during the weekends are less than that during weekdays. According to the occupancy survey, number of passengers in the weekend is 93 percent of that in weekdays. The number of weekdays in a year is assumed at 247 days and that of the weekends is assumed at 118.

Thus, yearly fare incomes are calculated as shown in **Table 19.4-10**.

Table 19.4-10 Estimated Yearly Fare Income of TR 16 in 2013, 2018 and 2023

Year	Number of Passengers Increasing in the Weekday (pax / day)	Number of Passengers Increasing in the Weekend (pax / day)	Number of Weekdays	Number of Weekends	Fare	Yearly Fare Income (1,000 SOMS / year)
	(1)	(2)	(3)	(4)	(5)	(6)={(1)x(2)+(3)x(4)}x(5)
2013	6,255	5,817	247	118	8	17,851
2018	6,147	5,717				17,543
2023	6,243	5,806				17,817

Note : *Unit Operation Cost is average of that total cost of BTD divided by the number of all round trip in 2008, 2009 and 2010.

Source : JICA Study Team

(3) Profit

Based on the above mentioned assumptions, profits by operating TR 16 is estimated as shown in **Table 19.4-11**.

Table 19.4-11 Estimated Profits of TR 16 in 2013, 2018 and 2023

Year	Yearly Operation Cost (1,000 SOMS / year)	Yearly Fare Income (1,000 SOMS / year)	Profit (1,000 SOMS / day)
	(1)	(2)	(3) = (2) - (1)
2013	12,045	17,851	5,806
2018	11,498	17,543	6,045
2023	12,045	17,817	5,772

Source : JICA Study Team

19.4.8 Issues to be Considered

- The unit cost of vehicle operation is very roughly estimated and more it is required to study precisely.
- The amount of subsidy should be considered in the standpoint of what is affordable by the City budget.

19.5 Introduction of ICT Fare Collection System to Public Transportation in Bishkek City

19.5.1 Background

The current public transportation fare collection system in Bishkek City adopts a basic system which collects coins from alighting passengers by a bus driver. Therefore, management of fare collections is not convenient. Moreover, no passenger data is accumulated by bus enterprise, information which can be vital data for adequate bus time tables, or route setting based on actual demand.

The EBRD is supposed to fund for ICT card fare (E-PAY) collection system introduction to trolleybus enterprise as a Public - Private Partnership scheme. However, the project has not started yet. In order to

enforce the ICT card system introduction, which is feasible to Bishkek City public transportation, the JICA Study Team suggested to EBRD to implement the pilot project for the ICT card fare collection system, based on the result of public transportation survey in Bishkek City which was conducted by the JICA Study Team in July 2012. EBRD has requested to use recommendations made after implementing pilot project on ICT card fare collection system introduction by JICA. However, selection of the consultant for the E-PAY system installation on trolleybus by EBRD has not been carried out as previously scheduled. The consultant for the Feasibility Study was selected in later half of April 2013. Thus, efficient detailed discussion about the EBRD E-PAY project has not been done between EBRD side and the JICA Study Team during the JICA Study period.

Therefore, the JICA Study Team raises the issue of necessity of discussion for the introduction of ICT fare collection system to Bishkek City public transportation in this report.

19.5.2 Definition of ICT System

The ICT system uses a reloadable, contactless electric money card, which has been used for public transportation fare collection system such as e-money, security card key, and identification cards all over the world. The ICT Card System has numerous benefits such as no need to carry small coins to pay every time, less risk of card wear and tear compared to magnet or contact type cards (which were formerly used before contactless ICT cards), possible to register personal data and accumulate bus users' origin and destination (OD) data which will be vital data for route networks, fare policy and frequency of bus operation planning. Further, fare collection systems using ICT card is able to provide various services such as transfer discounts, monthly pass, student/senior discounts, frequent user discounts, and at the same time can be used as prepaid e-money at store as well.

19.5.3 Overseas Practices

The ICT fare collection systems are widely used around the world. The following table shows some examples of ICT fare collection card system around the world and their characteristics. Each case has its own method of card selling and reloading fare payment, but the basic mechanism of using card is similar. Some of them have multi-functions of money reloading, balance check and different purpose of use like prepaid e-money for shopping as well.

Table 19.5-1 Examples of ICT Fare Collection Card System in Overseas

	Name of card	Location	Function of use	Key Features
1	Octopus Card	Hong Kong	MTR, Bus, Ferry, LRT, Tram and other transactions, e-money	- Reloadable at station and convenience store
2	Istanbul Card	Istanbul	Bus, Metro, Tram, Funicular, Ferry, sea-bus, Future: other transactions, Civic services, e-campus	- Sell at Kiosk - No registration required
3	Suica and Other ICT cards	Tokyo	Japan Railways, Metro, Bus, Railways run by private companies	- Need registration for purchase. - Refundable

	Name of card	Location	Function of use	Key Features
			and other transactions, E-money.	- Use for Public transportation and shopping - Auto reload from bank account to the card / mobile is possible
4	Oyster Card	London	Bus, Tube, Tram, DLR, Over ground, National Railway	- Reloadable through web site. - Auto reload is possible
5	S-pass card	Dhaka	Public Bus	- Reloadable at ticket shop - Planning to introduce same card for current Bangladesh railway, ferry and future BRT / MRT

Source : JICA Study Team



Automated, safe and accurate fare collection

No need to prepare small coins

Smooth boarding and alighting

Accumulate users' data for demand analysis and marketing


Source : JICA Study Team

Figure 19.5-1 Key Features of ICT Card and Photos of ICT Card Use in Different Occasions

19.5.4 ICT Card System Mechanism

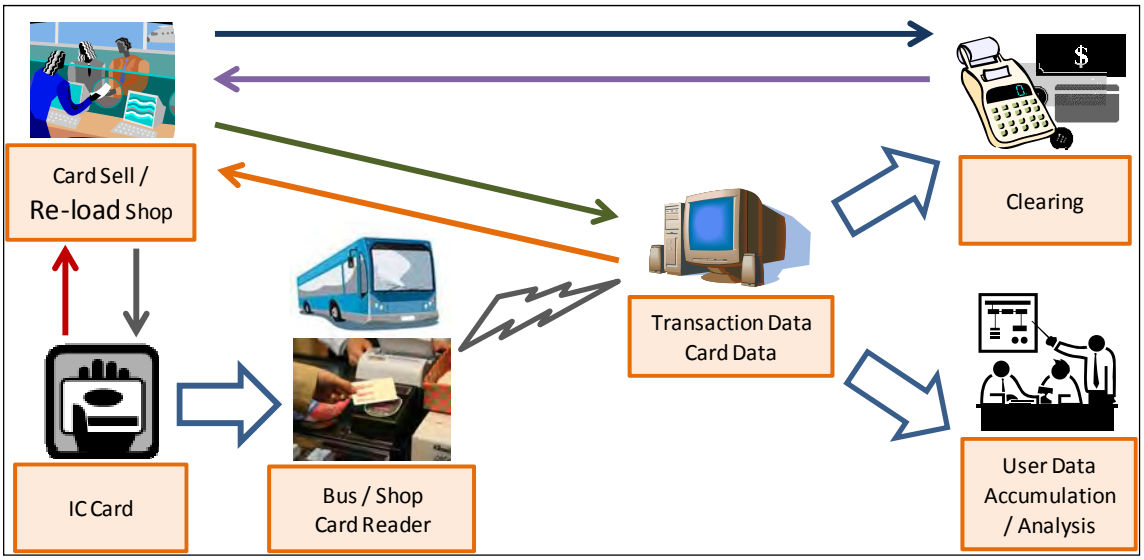
The flow of ICT card use mechanism which is being implemented around the world in general is described in **Figure 19.5-2**. The optimum ICT system for the public transportation in Bishkek City should be considered during feasibility study or pilot project implementation stage of ICT fare collection system introduction.

(a) First, public transportation user needs to obtain ICT card at card ticket shop and deposit money in the card to pay fare.

(b) Passengers have to touch the ICT reader / writer terminal when boarding and alighting to pay the fare. Passenger can reload money to the card at the card shop and other locations if the balance becomes low.

(c) Passenger can check the balance stored in ICT card through card reader device display in the bus/train or card selling shop.

(d) When the balance stored in the card is not enough to pay for public transportation, the passenger needs to reload money in the ICT card at shop before boarding.



Source : JICA Study Team

Figure 19.5-2 Flow of IC Fare Collection System

19.5.5 Role of Relevant Agency for the ICT Fare Collection System[3]

(1) Government Agency

The government agency will be responsible for the administration of the fare collection system using ICT card. The role of government agency is to:

- Establish the standard of ICT fare collection system operation.
- Regulate ICT fare collection system among the public transportation modes in Bishkek City.
- Set up the strategy of future optimum ICT card system in Bishkek City.
- Monitor the system operation and evaluate whether the system is functioning as intended.
- If any defect is reported in the system operation, instruct the relevant agency to fix the defect or improve the system operation.
- Plan and implement measures to improve fare collection system operation and passenger services.

Fare collection system using ICT card will help improve the role of the government agency in the following three aspects:

- Public transportation operation monitoring
- Public transportation service planning and improvement

[3] This section contents are referred to the final report of JICA Project for Improving Fare System of Mass-Transportation in Dhaka City Area through ICT Proposal and Recommendation for ICT Card System including Clearing House September 2012

- Fare policy formulation
- Fare collection system operation monitoring

(2) Card Issuer

All ICT cards prepared for the card management system operated by the card issuer. Status of each card such as user's data, issuance, reload, withdraw, return, lost, stolen and abandoned will be recorded in the card database and updated. Balance stored in the card is also recorded in the card database and updated as the card is used for payment.

The amount of money paid by the passenger as prepaid deposit will be deposited in the clearing house's account. Card issuer records a black list of the cards that have been invalidated due to loss or theft and cannot be used for payment.

It is possible to have multiple card issuers in the fare collection system or other applications as long as the card is the same type and have the same data structure. In this case, card issuer must be identified in the data stored in the card.

Fare collection system must be equipped with high level security system to prevent fraud and protect itself from malicious attack. Data stored in the ICT card must be encrypted and authentication is required before the data is exchanged between ICT card and card reader/writer. Security keys used for the system must be centrally managed by the card issuer.

(3) Clearing House

Clearing house is indispensable for ICT card toll collection system if multiple bus operators or other service providers are involved. Clearing house has the two major functions, as follows:

- Transaction processing
- Fare collection settlement

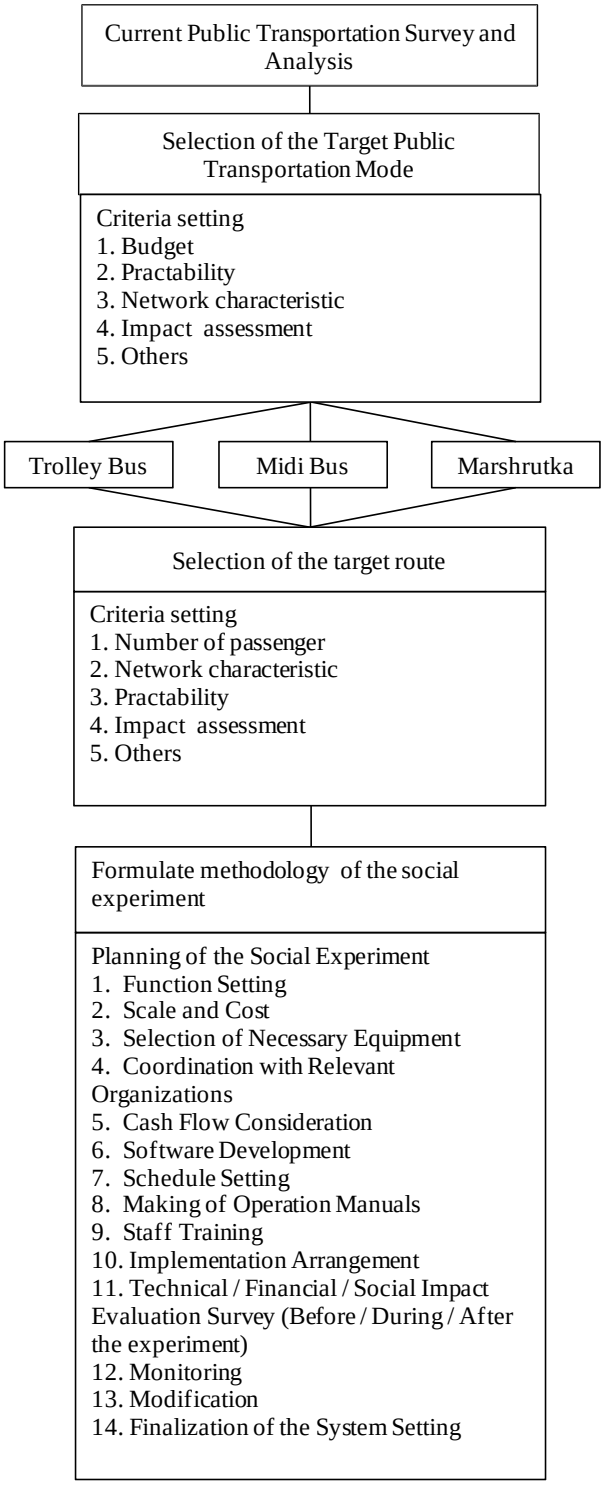
All ICT card transaction data will be sent to the clearing house for fare settlement. Clearing house will process these data and calculate the amount payable to each bus operator and service provider.

Based on the transaction processing results, clearing house will transfer the amount of fare they collected from card issuer's account to each bus operator. This will be done through fund transfer between the accounts kept by clearing house.

19.5.6 Consideration of the Pilot Project

(1) Preparation for Public Transportation ICT Fare Collection System Pilot Project

The flow of the public transportation ICT card fare collection system pilot project tasks is shown below. The details of each task are described in the next section.



Source : JICA Study Team

Figure 19.5-3 Flowchart of the Pilot Project Preparation

(2) Selection of the Target Public Transportation Mode

Public transportation survey was conducted by the JICA Study Team in July 2012 as shown in **Table 19.5-2**. Based on the result of the survey, feasibility of the ICT card fare collection system pilot project was evaluated as shown in **Table 19.5-3**. The JICA Study Team recommends trolleybus as the target mode. However, it is preferable to cover all public transportation modes in Bishkek City in future as common ICT fare collection system.

Table 19.5-2 Public Transport Mode in Bishkek City (As of 2012 August)

Transportation Mode	Current Condition		Practicability for Pilot Project
Trolleybus	Operation body	Public: Bishkek Trolleybus Department (BTD)	EBRD will support ICT card fare collection system introduction in future.
	Route and Length	7 Routes with 87 fleets / 104 km	
	Modal share	5% share in public transportation	
	Fare	Flat fare rate : 8 SOMS Monthly ticket : 225 SOMS Common Monthly ticket for Trolleybus and MidiBus : 495 SOMS Monthly ticket for Student : 175 SOMS	
Midibus	Operation body	Public: Bishkek Passenger Transportation Enterprise (BPTE)	Possibility to introduce ICT card fare collection system introduction in future.
	Route and Length	17 Routes with 283 fleets in the City / 418 km	
	Modal share	2% share in public transportation	
	Fare	Flat fare rate : 8 SOMS Express minibus : 12-17 SOMS Common Monthly ticket for Trolleybus and Midibus : 495 SOMS Monthly ticket for Student : 175 SOMS	
Minibus	Operation body	Private: 41 companies	It is difficult to conduct ICT card fare collection system pilot project by international donor.
	Route and Length	118 Routes running with 2,000 fleets per day during peak season / 4,300 km	
	Modal share	60% share in public transportation	
	Fare	Flat fare rate : 10 SOMS (12 SOMS after 21:00 P.M.)	
Taxi	Operation body	Private own :13 companies	Possibility to introduce ICT card fare collection system introduction in future.
	Route and Length	None / Over 2,000 taxi are operating	
	Modal share	Very Low	
	Fare	Distance based	
All public transportations fare in Bishkek City is collected by bus driver in cash without any fare collection device.			

Source : JICA Study Team

Table 19.5-3 Evaluation of Priorities for Implementation of ICT Fare Collection System Introduction Pilot Project by Transportation Mode in Bishkek

	Transportation Mode	Practicability	Cost	Sustainability
1	Trolleybus (Support from EBRD)	Good Flat fare / Fixed route / fewest operation routes easy to monitor	Good Limited route so that easy to control but limited passenger	Good EBRD is supposed to implement E-ticket system to trolleybus.
2	Midibus	Good Flat fare / Fixed route / Limited operation routes	Fair Limited routes so that easy to control large number of user will be expected if the government expand midibus route in future.	Fair It is preferable to consider the introduction in future in terms of user's convenience and OD data accumulation.
3	Minibus	Poor 2 types of fare / Private Own / Largest and complicated operation routes	Poor Potential ICT card user number is the highest. But introduction is difficult because of the vehicle operation system.	Poor Minibus adopts franchise system and drivers are working independently so that it is difficult to introduce the system as international aid scheme. However, it is preferable to consider the introduction in terms of user's convenience since minibus plays significant role for public transportation in Bishkek City.

Source : JICA Study Team

(3) Items to be considered for ICT fare collection

(a) Administration Organization of ICT Fare Collection System

To establish ICT fare collection system for public transportation modes for Bishkek City, the government needs to play the role as administrative organization. Urban Transportation Department (UTD) of Bishkek City mayor's office is the current governmental responsible agency for all public transportation modes including public and private sectors for transportation fare planning and transportation operating route consideration. If the current existing governmental organization is utilized for the ICT fare collection card system for the public transportation modes in Bishkek City, UTD is a potential administrative organization. In that case, it is necessary for UTD to strengthen its administrative capacity to govern the ICT fare collection card system and public transportation operation control.

(b) System Setup

(c) ICT Card and Fare Setting

(d) Social Experiment Preparation

Items to be considered for ICT fare collection system introduction are described in **Table 19.5-4**.

Table 19.5-4 Items to be Considered for ICT Fare Collection System Introduction

Institution and Law, Regulation, Guideline			
	Item	**Detail to be Discussed**	**Remarks**
1	Administration organization	Responsible agency of ICT card system for public transportation	Urban Transportation Department of Bishkek City mayor's office (UTD) is candidate as existing governmental agency considering their role for public transportation in Bishkek.
2	Clearing house	If ICT card system will cover all public transportation modes and the number of the ICT card exceed a certain number in the future, clearing house need to be set up under ICT card authority.	-Need to consider if it uses as e-money for shopping purpose as well. -Mobile Company or Bank in Bishkek would be the candidate for clearing house setting. Mobile company might be suitable considering mobile use expansion in Kyrgyzstan while fewer rate of bank account holder in Kyrgyzstan.
3	Card issuer	Operation and management method of ICT system in Bishkek City	The issuer would be expanding the card business operation for other fields.
4	Radio wave law	Relevant for sending data from card reader to server	Need to confirm if there is relevant law for radio wave use.
5	E-money governing law	Relevant to ICT card use for bus fare payment and e-money use	Need to confirm if there is relevant law for e-money commerce.
6	Account and auditing regulations governing e-money	Relevant to ICT card clearing house control	Need to confirm if there is relevant law for clearing house account and auditing e-money.
7	Privacy protection law	Relevant to ICT card user information registration	Need to confirm if there is relevant law for privacy protection.
8	Company law	In case of PPP establishment for ICT card fare collection system operation	Need to confirm if there is relevant law for PPP.
9	Drivers' wage system	Informed consent among bus drivers and financial division of bus enterprise about new ICT fare collection system	Need to consider adequate salary for drivers to sustain ICT card fare collection system.

System Setup			
	Item	**Detail to be Discussed**	**Remarks**
1	Software development	- ICT card function setting and operation management method - Necessary data items for OD data - Necessary function for reload, withdraw, card information display - Data protection	Need to discuss future potential use additional functions such as e-money from the development stage.
2	Operation cost estimation	Running cost for ICT fare collection system	Method of introduction and operation contract.
3	Fare collection management system and work flow	- On line or off line setting during transportation operation - Device data transmission system and its work method	On line is required if the system covers card loss and refund system.
4	Selection of the equipment (IC Type / Card Type / Kinds of cards)	Security level, transaction speed, cost, single use or multipurpose use, support system, type of function, maintenance cost, etc.	Consider future expansion use (ex. ICT card use, coverage area and function).

ICT Card and Fare Setting

	Item	Detail to be Discussed	Remarks
1	Fare collection and reload setting	- Flat rate / Distance based fare - ID registration / No registration - Setting of card reload amount - Bus stop setting	Current fare system is flat fare rate. However need to consider future possibility of fare system change at programming stage for ICT card system setting.
2	Card refund, damage and loss	Refund system, in case of card damage or loss	ID registration is required if the systems include refund, damage and loss service.
3	Items to be legislate on display / receipt	- Boarding / alighting point - Amount of fare / deposit - Date - Language (ex. Russian, Kyrgyz, English)	Receipt will be issued at card shop. Display will be installed at ticket shop / inside of public bus.
4	Process of card use	- How to withdraw / reload fare - Location of card reader setting	Relevant facilities setting need to consider together with the method.
5	Method of card sales and reload	- Set up ticket sell and reload shop - Incentive for IC card use - Set up amount of card reload (maximum / medium / minimum)	Consider based on average monthly expense for public transportation users for commuting.
6	Card function setting (Present / Future)	Expansion of use (ex: E-money, public utility reloads payment)	Need to discuss future potential use additional functions such as e-money from the development stage.
7	Registration of card holder information	Registration of personal data / no registration type	It is related to card refund, damage, loss service and monthly pass card system.
8	Balance check	- Card reader device - Device setting place to check the balance - Possibility to use internet HP access	Balance check through HP will be required ID registration system setup.

Social Experiment Preparation

	Item	Detail to be Discussed	Remarks
1	Method of fare withdraw, reload, data accumulation	- Role of ICT card use for the public transportation - Reload location and amount	For operation staff and ICT card users
2	Prepare training manuals for the social experiment	Manuals for the devise use, guidance to users, data management, clearing system	For operation relevant staff
3	Training of ICT card fare collection system operation	Staff training (Bus driver, ticket shop, data management, clearing and users)	Efficient information of ICT card fare collection system needs to be well explained and discussed among relevant officers and drivers.
4	Publicity of the social experiment	- Usage of ICT card information - Publicity means - Duration of the publicity	For public transportation users
5	Evaluation survey (Before, During and after the experiment)	- Monitoring of the operation - Financial analysis - Data collection - Interview survey from operation staff and card users	Both technical and social impact survey is required.

Source : JICA Study Team

19.5.7 Recommendations for Public Transportation ICT Card Fare Collection System Introduction in Bishkek City

- ✓ Although ICT card system was supposed to be introduced to trolleybus by EBRD, other public transportation also need to be put in place for effective and sustainable card use, from the standpoint of user's convenience and to accumulate public transportation use data (OD data) for public transportation operation analysis. In addition, from the standpoint of sustainable ICT card system operation business, it is necessary to expand both card user and card use number to cover operation cost by expanding coverage public transportation mode and the area.
- ✓ To enhance ICT card use among card holders, it is important and effective to introduce card use incentives by providing discount / point system by reload amount or withdraw amount. In Kyrgyzstan, shopping point card system has already been introduced in some stores by using ICT card to attract customer and for the shop marketing strategy. If the public transportation ICT card will be able to introduce discount or point system only for the ICT card use, the card use would be popular among citizens.
- ✓ Since bank account holder and credit card user quantities in Kyrgyzstan are few, development of potential prepaid card (e-money) system usage, as in the cases of USA and Philippines[4] might yield high usage because of clear account record, easy reload and payment method and limited amount of reload cash. It would particularly target for small scale commerce such as bus fares and supermarket shopping. Therefore, if the public transportation fare ICT card and multipurpose function of the ICT card combine as e-money with user's incentives, ICT card use and the card business sustainability would be strengthened and grow. In addition, mobile companies can be a potential significant actor for ICT card system business by introducing mobile based payment and reload system to public transportation modes in Bishkek City.
- ✓ There are some boycott and disuse of ICT fare collection system by drivers in other countries due to decrease of driver's income by the introduction of the system. Consideration of adequate drivers' wage level and drivers' performance evaluation system based on their good driving manners and safe driving are recommended. Therefore, introduction of driving manners and safe driving are recommended together with the ICT fare collection system to maintain ICT card fare collection system and improvement of bus service quality effectively.

[4] Wal-Mart Stores Inc. and American Express Co. form a team on a reloadable prepaid card for shoppers in USA. PVB Card Corporation (PVBCC) and JCB International Co, Ltd., in partnership with the City Government of Bacoor of Philippine issued the first prepaid card combined with City identification card. Both of the prepaid cards are targeted on non bank account holder group.

CHAPTER 20 AFFIC FLOW AND CONTROL SYSTEM IMPROVEMENT PLAN

20.1 Traffic Flow Improvement Plan

20.1.1 Introduction

Traffic flow improvement refers to a set of traffic engineering solutions or measures that are intended to improve traffic movement in the road network particularly at bottleneck points, where traffic flow is impeded by various factors such as physical constraints and inadequate traffic treatment. These traffic engineering solutions or measures are a cost effective way to improve traffic flow. They can be implemented in a relatively short time and with low cost as they do not require acquisition of additional land and large-scale physical construction work. On the other hand, knowledge of traffic flow characteristics and experience in the traffic management solutions or measures are required for the design and implementation of the effective solutions or measures.

The road network in the central area of Bishkek City has a grid type formation and most of the intersections are of standard type four-leg intersections. In principle, physical solutions or measures such as modification of intersection geometry are not necessary for these types of intersections. However, there is room for traffic flow improvement. Signal phase sequencing and timing plan may need review and updating. Lane assignments can be modified to increase effective intersection capacity. Pavement markings need to be drawn at most of the intersections. Prohibition of roadside parking that reduces road capacity and disturbs smooth flow must be strictly enforced.

There are several irregular shaped intersections in the city where traffic flow can be improved by applying physical solutions or measures within the existing right of way in addition to the soft solutions or measures mentioned above.

This chapter presents the proposed traffic flow improvement plan that takes up intersections identified as candidates for traffic flow improvement and discusses solutions or measures to be implemented. It is noted that the proposal has been formulated after a short site visit and limited traffic related data available. Detailed analysis of traffic conditions at the selected intersections based on the traffic count data is required to finalize the improvement plan.

20.1.2 Procedure

The Traffic Flow Improvement Project is carried out by following the steps:

(i) Selection of candidate locations as bottleneck point

(ii) Analysis of traffic behavior at bottlenecks

(iii) Identification of issues and problems

(iv) Formulation of plausible interim solutions or measures

(v) Cost estimate

(vi) Selection of project locations

(vii) Implementation of plausible solutions or measures

(viii) Post implementation evaluation

Each step of the procedure is explained in the following sections.

20.1.3 Bottleneck Points

A tentative list of candidate locations for traffic flow improvement has been prepared based on the information given by the counterpart staff. The list is not necessarily conclusive and can be flexible. Thus, the list will be updated during the course of the project.

Site visits were thence conducted to observe general traffic conditions and physical conditions of the candidate sites. A total of 29 intersections and locations are selected as candidate locations for traffic flow improvement. They are shown in **Table 20.1-1** and in **Figure 20.1-1**. The locations where improvement solutions or measures are implemented will be selected among these candidate locations based on the selection criteria which include traffic volume, number of public transport routes, significance of issues, and degree of improvement expected, among others.

Table 20.1-1 Candidate Locations for Traffic Flow Improvement

No.	Location	
1	Chui	Julius Fuchik
2	Jibek-Jolu	Julius Fuchik
3	Jibek-Jolu	Molodaya Gvarida
4	Moscowskaya	Asanaliyev
5	Sovetskaya	Bayalinov
6	Jibek-Jolu	Alamedin River
7	Jibek-Jolu	Almatinskaya
8	Almatinskaya	Salieva
9	Chui	Ibraimov
10	Lev Tolstoi	Asanaliev
11	Lev Tolstoi	Molodaya Gvardia
12	Lev Tolstoi	Chapaeva
13	Gorky	Sovetskaya
14	Jukeev Pudovkina	Akhunbaev
15	Jukeev Pudovkina	Suyerkulov
16	Chui	Almatinskaya
17	Almatinskaya	Ahunbaeva
18	Chui	Naberejnaya
19	Pravda	Funze
20	Kulatova	Ibraimova
21	Jibek-Jolu	Togolok Moldo
22	Bakinskaya	Anul
23	Gagarina	Baha-Frunze
24	Profsoyuznaya	
25	Narksa	Suhe Batora
26	Gagarin	Doronbek Sadyrbayev
27	Mir	Gorky
28	Jibek-Jolu	Kuliev
29	Jukeev Pudovkina	Suerkulov

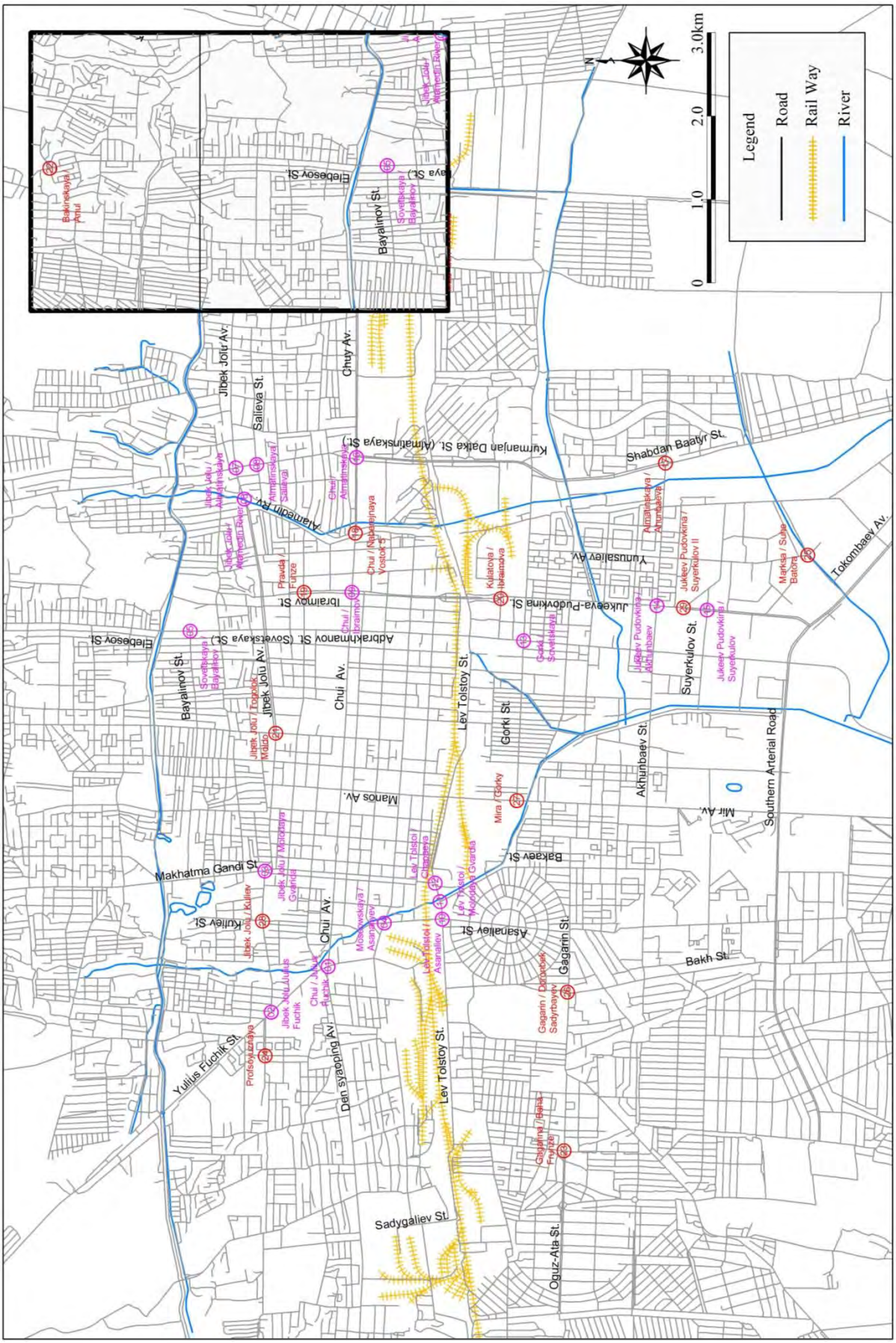


Figure 20.1-1 Candidate Locations for Traffic Flow Improvement

20.1.4 Typical Problem

The site observation was conducted to monitor the traffic conditions and possibly identify the problems at the candidate locations. The typical problems found by the site observation are presented as follows:

(1) Intersection Geometry

Inadequate intersection geometry such as skewed connections, large intersection areas, offset legs and sudden change of road width often reduces the intersection capacity and cause traffic congestion. Irregular shapes also increase possibility of traffic accidents.

(2) Traffic Signal

The traffic signal is a device which controls right of way of vehicles and pedestrians at the intersection. Properly designed signals can efficiently handle the conflicting traffic flows without sacrificing the capacity. On the other hand, if phase sequence or timing plan is not adequately set, it will adversely affect the smooth flow, reduce intersection capacity, and cause congestions.

(3) Lane Assignment

Lane assignment means designating the direction of movement of vehicles on each lane of multilane road. Lane assignment at intersection approach often needs to be different from that at mid-section to cater for turning movements of vehicles. Additional lanes may be created to segregate vehicles of different movements.

The direction of movement is normally specified by pavement markings and overhead signs. If lane assignment does not match the traffic demand, or if lane assignment is not specified, traffic flow becomes irregular and capacity will be reduced due to swerving actions of vehicles.

In Bishkek City, the number of lanes and lane assignment at intersection approach is always same as that at mid-section. Although additional right turn lane is provided at the approach of some intersections, no additional left turn lane that caters for the turning vehicles exists at intersection approach.

(4) Pavement Marking

The pavement marking is a tool to guide vehicles and pedestrians on their orderly flow. Lack of pavement markings often creates irregular movement that reduces traffic capacity and could result in traffic accidents.

(5) Deteriorated Pavement

Deteriorated pavements are factors that reduce the road capacity as vehicles are forced to slow down unnecessarily. These are also traffic hazards to safe driving as drivers often swerve sideways to avoid potholes.

(6) Roadside Parking

Although there are paid roadside parking with attendants, parking is not properly managed in Bishkek. Illegal and inadequate parking is rampant. Roadside parking takes up almost full lanes resulting in the reduction of road capacity.

(7) Traffic Volume

If total traffic volume at an intersection reaches potential intersection capacity determined by intersection geometry, congestion occurs regardless of the traffic management solutions or measures applied. It is important to determine by observation and data analysis whether potential intersection capacity is fully utilized or not in developing traffic flow improvement solutions or measures.

20.1.5 Issues at Bottleneck Points

Preliminary observation of the site was conducted to observe the traffic condition and to identify the traffic management issues at each location. Traffic management issues at the selected locations are summarized in **Table 20.1-2**. Description of the issues is presented in the next section together with the plausible interim solutions or measures proposed.

Table 20.1-2 Traffic Management Issues at Selected Locations

	Intersection	Intersection geometry	Signal	Lane assignment	Pavement marking	Pavement	Roadside parking	Traffic volume
1	Chui / Julius Fuchik	X	X	X	X			X
2	Jibek-Jolu / Julius Fuchik	X	X	X	X			
3	Jibek-Jolu / M Gvardia	X	X	X	X			
4	Moscowskaya / Asanaliyev		X		X			
5	Sovetskaya / Asanaliyev		X	X				X
6	Jibek-Jolu / Alamedin River		X	X	X		X	
7	Jibek-Jolu / Bayalinov	X	na					X
8	Almatinskaya / Salieva	X	X	X	X			
9	Chui / Ibraimov		X		X			
10	Lev Tolstoi / Asanaliev		X	X	X			
11	Lev Tolstoi / M Gvardia		X		X			
12	Lev Tolstoi / Chapaeva	X	X		X			
13	Gorky / Sovetskaya		X		X		X	
14	J Pudovkina / Akhunbaev		X		X			
15	J Pudovkina / Suyerkulov		X		X	X	X	
16	Chui / Almatinskaya	X	X		X			
17	Almatinskaya / Ahunbaeva		na		X			
18	Chui / Naberejnaya	X	na		X			X
19	Pravda / Funze	X	na		X	X		
20	Kulatova / Ibraimova		X		X	X		X
21	Jibek-Jolu / T Moldo	X	X		X			
22	Bakinskaya / Anul				X			X
23	Gagarina / Baha-Frunze		na		X	X		
24	Profsoyuznaya	X	na		X	X		
25	Narksa / Suhe Batora	X	X		X		X	
26	Gagarin / D Sadyrbayev				X			
27	Mir / Gorky		X	X				
28	Jibek-Jolu / Kuliev		na		X		X	
29	J Pudovkina / Suyerkulov		na		X	X		

Note : "na" under signal column denotes "not applicable" as there is no signal at the intersection.

20.1.6 Plausible Interim Solutions or Measures

Various traffic management solutions or measures can be applied to improve traffic flow and enhance traffic safety. General description of the traffic management solutions or measures is presented first followed by the issues and plausible interim solutions or measures for the selected locations. Normally several improvement solutions or measures will be selected and applied to a bottleneck point. A sample of these improvement solutions or measures is presented as follows:

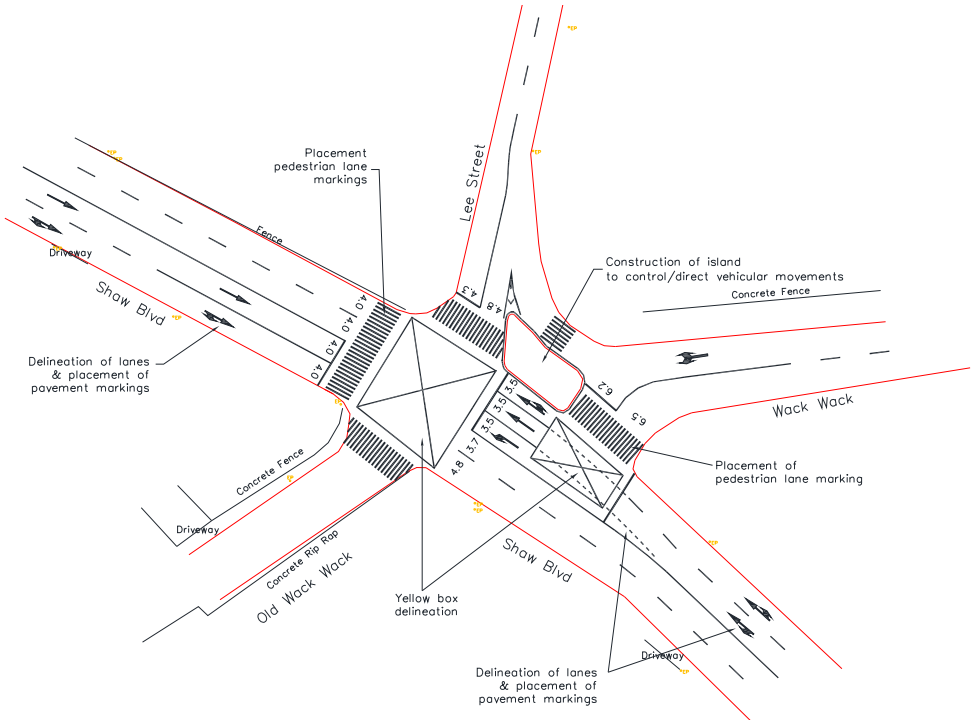


Figure 20.1-2 Example of Intersection Geometric Improvement

(1) Intersection Geometric Improvement

Modification of intersection geometry is sometimes required to make traffic flow regulated, segregate movements, ensure pedestrian safety or reduce accident possibility. Typical geometric improvement works include the following:

(i) Modification of corner radius

(ii) Provision of corner island

(iii) Provision / extension of median island

(iv) Construction of left/right turn bay

(2) Modification of Signal Phase and Timing Plans

It is noted that the existing traffic signals in Bishkek City has only one phase sequence and timing plan. They apply the same signal control throughout a day regardless of the traffic conditions. Thus there is a limitation on the efficiency and green time is wasted most of the time. Signal control efficiency will be

much improved if multi-pattern time-of-day signal possibly with actuated control is installed.

(3) Left Turn Lane

Provision of additional left/right lanes can increase the intersection capacity by segregating left/right turn vehicles from through traffic. There are intersections where the road width is wide enough to accommodate additional left turn lanes at approach. In fact, at some intersections, three lines of traffic flow are formed at two-lane roads near the intersection and left-turn vehicles form a queue. Typical left-turn lane layout is shown in **Figure 20.1-3**.

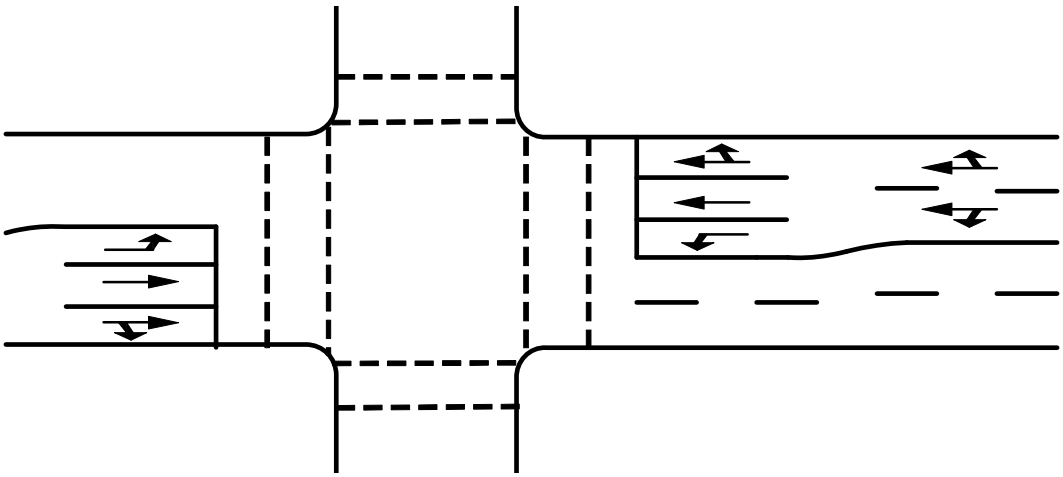


Figure 20.1-3 Typical Left Turn Lane on Intersection Approach

(4) Pavement Marking

Pavement markings are effective tools to regulate traffic flow. All roads must be provided with pavement marking of adequate design. As an intersection is a location where conflicting movements cross each other and pedestrians cross roads, pavement markings must be provided and maintained without fail.

There are two types of pavement marking materials, paint and thermoplastics. Paint is easy to apply and much cheaper than thermoplastics, but it lasts only a couple of months. On the other hand, thermoplastics are more durable and last longer. The life of thermoplastic markings is considered at least one year under normal traffic conditions. It must be mentioned that quality of thermoplastic marking materials varies and poor quality materials have much shorter life and the color is greyish. Application of thermoplastic markings requires skill. It must be applied by a qualified person following the manufacturer's instructions.

20.1.7 Issues and Plausible Interim Solutions or Measures

Traffic management issues and plausible interim solutions or measures to alleviate the problems for each bottleneck point are summarized in the succeeding section. It is noted that the summary has been prepared based on the site observation conducted one time only. It is not based on the traffic count data or other quantitative data. Thus further review of the traffic condition based on the numerical data is necessary before implementation of plausible solution or measures.

Table 20.1-3 Issues Identified and Plausible Solutions or Measures

	Intersection	Road and traffic condition	Plausible Solutions or Measures
1	Chui / Julius Fuchik	・Diagonally intersecting roads with large space at south east corner. ・Relatively large left turn volume from all approaches except east approach. ・Conflict between vehicle and pedestrian due to large left turn volume,	・Provision of corner island at southeast corner. ・Provision of median island. ・Modification of signal phase. ・Pavement marking to designate lane assignment. ・These solutions or measures are implemented by pilot project.
2	Jibek-Jolu / Julius Fuchik	・T-shaped intersection with slant angle. ・Large intersection area. ・Large left turn volume from Jibek-Jolu. ・No left turn phase for north approach. ・No pavement marking.	・Review and redesign signal phase and timing. ・Pavement marking to regulate traffic volume. ・Corner island may be constructed.
3	Jibek-Jolu / M Gvardia	・Large irregular shaped intersection with center island. ・Merging on south exit of intersection. ・Only one signal for south approach. ・Traffic signal not clearly visible.	・Make intersection smaller by providing median and corner island. ・Provision of additional signal to south approach. ・Pavement marking to regulate flow. ・Renewal of traffic signal ・Pedestrian signal may be installed
4	Moscowskaya / Asanaliyev	・Standard 4-leg intersection. ・North approach is one-way inflow from Osh Bazar. ・All vehicles from south approach must make right/left turn. ・High ratio of right turn from west approach and left turn from south approach. ・Pavement marking exists and in acceptable condition.	・Review and redesign signal phase and timing. ・Provision of left turn phase to south approach. ・Pedestrian signal may be installed
5	Sovetskaya / Asanaliyev	・Standard T-shaped intersection. ・Wide one lane on all approaches. ・Near saturated or saturated during peak hours. ・Large left turn from south approach. ・2-lane when queuing and 1-lane when running on all approaches. ・No pavement markings	・Provision of left turn lane on south approach. ・Provision of pavement markings ・Actuated signal control
6	Jibek-Jolu / Alamedin River	・4-lane road reduced to 2-lane road at bridge	・Widening of bridge
7	Jibek-Jolu / Bayalinov	・Large intersection of 6-lane and 4-lane roads. ・Located near market. ・Parking in and around intersection. ・Loading/unloading activities. ・No pavement marking.	・Pavement marking ・Parking restriction ・Review and redesign signal phase and timing. ・Pedestrian signal improvement

	Intersection	Road and traffic condition	Plausible Solutions or Measures
8	Almatinskaya / Salieva	・Standard 4-leg intersection. ・Large corner radius. ・Relatively high left turn ratio.	・Review and redesign signal phase and timing. ・Left turn phase may be provided.
9	Chui / Ibraimov	・One of main north-south corridor. ・Wide median on Ibraimov ・Faded pavement marking	・Review and redesign signal phase and timing. ・Additional signal lantern to control left turn from Ibraimov ・Provision of pavement markings. ・Pedestrian signal may be installed
10	Lev Tolstoi / Asanaliev	・Standard 4-leg intersection. ・Large left turn volume from east and west approaches ・No left turn phase ・No pavement markings	・Review and redesign signal phase and timing. ・Provision of pavement markings.
11	Lev Tolstoi / M Gvardia	・Standard T-shaped intersection. ・Large intersection area ・Left turn phase provided to east approach	・Review and redesign signal phase and timing. ・Actuated signal may be installed. ・Pavement markings.
12	Lev Tolstoi / Chapaeva	・T-shape intersection. ・North approach is upward slope after underpass below railway. ・Downward slow of east and west approaches ・Intersection area not properly defined. ・Left turn phase provided to west approach. ・Lane assignment sign provided.	・Review and redesign signal phase and timing. ・Provision of left turn lane to west approach ・Pavement marking
13	Gorky / Sovetskaya	・Standard 4-leg intersection. ・No parking regulation applied. ・Near saturated or saturated during peak hours.	・Review and redesign signal phase and timing. ・Left turn prohibition except trolleybus may be considered. ・Pavement markings ・Pedestrian signal improvement
14	J Pudovkina / Akhunbaev	・4-leg intersection. ・North leg is narrower than other legs ・Deteriorated pavement. ・No pavement marking.	・Review and redesign signal phase and timing.
15	J Pudovkina / Suyerkulov	・4-leg intersection with wide median on north-south. ・Deteriorated pavement ・Roadside parking. ・Market located at south-east corner. ・No pavement marking.	・Review and redesign signal phase and timing. ・Pavement improvement. ・Pavement marking. ・Roadside parking management.

	Intersection	Road and traffic condition	Plausible Solutions or Measures
16	Chui / Almatinskaya	・4-leg intersection with large intersection area. ・North-south approaches (Almatinskaya) are offset. ・Large left turn from east and south approach. ・Inadequate signal layout and signal timing ・Inadequate location of pedestrian crossing on west leg. ・No pavement marking	・Reduction of intersection area. ・Relocation of signal post. ・Review and redesign signal phase and timing. ・Provision of left turn phase to east and south approaches. ・Actuation control may be introduced. ・Pavement marking.
17	Almatinskaya / Ahunbaeva	・Large round about. ・Minibus terminal inside roundabout. ・Bare soil and narrow sidewalk. ・No pavement markings.	・Construction of island at connecting points of approach and circle. ・Pavement markings. ・Sidewalk improvement.
18	Chui / Naberejnaya	・Bridge section narrower than road section. ・Sidewalk provided which cannot be used as carriageway.	・Only construction of additional bridge is solution.
19	Pravda / Funze	・Large 4-leg intersection with wide median on north-south road. ・Exit side of north leg is not paved and closed to traffic. ・Due to above, irregular traffic movement. ・Good pavement marking on west leg only.	・Make intersection smaller by extension of median, provision of corner island, or modification of corner radius. ・Opening of exit side of north leg. ・Pavement marking.
20	Kulatova / Ibraimova	・Offset intersection. ・North leg is much wider than south leg ・South leg is one-way inflow and vehicles from north must make either right or left turn.	・Construction of median on north leg. ・Review and redesign signal phase and timing. ・Pavement marking.
21	Jibek-Jolu / T Moldo	・Irregular shaped 4-leg intersection with median only on east leg. ・South leg is one-way inflow. ・Inappropriate signal layout. ・Roadside parking on both sides of south leg.	・Widening of west leg exit. ・Signal layout modification. ・Review and redesign signal phase and timing. ・Pavement marking
22	Bakinskaya / Anul	・4-leg intersection but west leg is minor street.	・Review and redesign signal phase and timing. ・Pavement marking.
23	Gagarina / Baha-Frunze	・4-leg intersection with median on west leg. ・Turnaround point of trolleybus route. ・Small traffic volume. ・Deteriorated pavement.	・Pavement improvement. ・Pavement markings.
24	Profsoyuznaya	・Undeveloped road parallel to Den Shaoping ・Unpaved narrow road west of intersection with Boroduna Aleksandra	・Pavement improvement. ・Pavement markings.

	Intersection	Road and traffic condition	Plausible Solutions or Measures
25	Narksa / Suhe Batora	・Large 4-leg intersection skewed north leg. ・South leg is narrow access road ・Signal on near side only ・Waiting taxis at south-east corner ・No pavement markings.	・Make intersection smaller with median/corner island. ・Provision of signal on far side. ・Review and redesign signal phase and timing. ・Pavement markings.
26	Gagarin / D Sadyrbayev	・4-leg intersection with large center island on north leg ・Small center island on south leg ・Left turn from south approach to go around center island ・Deteriorate pavement ・No pavement markings	・Review and redesign signal phase and timing. ・Pavement improvement. ・Pavement markings. ・Installation of traffic sign showing direction of flow.
27	Mir / Gorky	・3-leg intersection. ・Large left turn volume from north approach. ・Vehicles form three lanes at north approach	・Review and redesign signal phase and timing. ・Provision of left turn lane at north approach.
28	Jibek-Jolu / Kuliev	・Intersection near west terminal ・Legal and illegal roadside parking ・Pedestrian barrier provided to median along Jibek-Jolu. ・Underground path provided across Jibek-Jolu. ・Large pedestrian volume. ・No pavement markings.	・Setting up of no parking signs at no parking area. ・Pavement markings.
29	J Pudovkina / Suyerkulov	・3-leg intersection with Suyerkulov diagonally connected. ・Median provided to Pudovkina on south side only. ・Deteriorate pavement. ・No pavement markings.	・Pavement improvement. ・Pavement markings.

20.1.8 Inventory Survey for Additional Candidate Intersections

It is important that all candidate intersections are classified as priority ranking. Improvement of intersections should be initiated with higher priority as pilot intersections. This overall score in **Table 20.1-4** is one of elements to create priorities. Ultimately, priority settings should be considered including locations, costs, packages etc. Thus, the inventory survey for additional candidate intersections was carried out in September 2012 with the same survey method of July 2011. **Table 20.1-4** shows the result for new candidate intersections.

Table 20.1-4 Table of Survey Result for New Candidate Intersections

#	Intersection Name	Location		Area (Size)		Traffic Signal		Number of Entering Lanes or Width of Carriage Way *4				Number of Public Transport Lines *5						Bus Stops		Parking Spaces		Road Condition		Land Use		Overall Evaluation	
		*1		*2		*3		W-E Axis		N-S Axis		Trolley Bus		Midi Bus		Mini Bus		*6		*7		*8		*9		*10	
	Multipliers	*2.0*		*2.0*		*2.0*		*1.0*		*1.0*		*3.0*		*2.0*		*1.0*		*2.0*		*2.0*		*1.0*		*1.0*		*Full Score* *100*	
17	Almatinskaya / Ahunbaeva St.	Urban	4	4,250	1	Lamp	5	3-lane	5	2-lane	3			4-line	4	14-line	1	126 48, 160, 117 25	5	On-Road	5	Good	5	Residential	3	65	3rd
18	Chui Ave. / Naberejnaya-Vostok 5	Urban	4	1,000	3	Lamp	5	2-lane	3	2-lane	3	1-line R09,	1	5-line	5	38-line	3	- 98, 61 35	5	On-Road	5	Good	5	Commercial	5	76	2nd
19	Pravda / Frunze	Urban	4	2,600	1	Lamp	5	3-lane	5	3-lane	5					24-line	2			On-Road	5	Good	5	Commercial	5	52	4th
20	Kulatova / Ibraimova	Urban	4	1,100	3	Lamp	5	2-lane	3	3-lane	5					2-line	1	104 86	4	On-Road	5	Good	5	Commercial	5	61	3rd
21	Jibek Jolu / Togolok Moldo	Urban	4	1,500	2	Lamp	5	3-lane	5	3-lane	5	1-line R11	1	4-line	4	19-line	1	68,128	4	On-Road	5	Good	5	Commercial	5	72	2nd
22	Bakinskaya / Aul	Urban	4	820	4	Lamp	5	3-lane	5	2-lane	3	2-line R04,17	2	3-line	3	18-line	1	40	5	On-Road	5	Poor	3	Residential	3	73	2nd
23	Gagarin / Baha - Frunze	Urban	4	750	4	Lamp	5	1-lane	1	1-lane	1	1-line R09	1	3-line	3	11-line	1	32,89,189	5	On-Road	5	Poor	3	Residential	3	64	3rd
24	Profsoyuznaya	Urban	4	620	4	Lamp	5	2-lane	3	1-lane	1			2-line	2	5-line	1			Off-Road	3	Poor	3	Residential	3	47	5th
25	K. Marksa / Suhe Batora	Urban	4	1,450	3	Lamp	5	3-lane	5	3-lane	5	2-line R11, 17	2	4-line	4	17-line	1	175 40,170	5	On-Road	5	Poor	3	Residential	3	75	2nd
26	Gagarin / Doronbek Sadyrbayev	Urban	4	1,300	3	Lamp	5	2-lane	3	2-lane	3			3-line	3	11-line	1	250, 102	3	On-Road	5	Poor	3	Industrial	1	57	4th
27	Mira / Gorky	Urban	4	1,100	3	Lamp	5	2-lane	3	3-lane	5	2-line R11, 14	2	4-line	4	27-line	2	277 115, 208	3	Off-Road	3	Good	5	Commercial	5	70	2nd
28	Jibek Jolu / Kuliev	Urban	4	940	4	Lamp	5	3-lane	5	1-lane	1			4-line	4	11-line	1	68, 73	4	On-Road	5	Good	5	Commercial	5	69	3rd
29	Jukeev Pudovkina / Suyerkulov II	Urban	4	920	4	Lamp	5	1-lane	1	3-lane	5			2-line	2	15-line	1			On-Road	5	Poor	3	Institute	5	55	4th

20.1.9 Estimated Cost

The main points of estimation of construction costs are as listed in the succeeding section:

(i) Costs are computed in United State Dollars (USD). This is applied to both foreign currency portion and local currency portion. Although official local currency is Kyrgyz SOMS, USD is widely used in actual business and trades.

(ii) Costs are computed with prices in the year 2012.

(iii) Costs of traffic surveys and civil works are computed based on the unit prices of pilot projects in Bishkek.

The cost of traffic survey, analysis and design are shown in **Table 20.1-5**. This cost is for one intersection and this survey should be carried out at candidate intersections to consider the scope of work. At the moment, the unit prices and quantities of tentative work items are computed based on this pilot project according to **Table 20.1-3**. It is to be noted that the unit price of pavement marking and pavement improvement are computed based on the intersection area to facilitate a calculation for estimated cost. The unit price of works is as shown **Table 20.1-6** and estimated cost of candidate intersections is as show in **Table 20.1-7**.

Table 20.1-5 Cost of Traffic Survey, Analysis and Design (1 intersection)

Survey, Analysis and Design	Unit	Quantity	Unit Price (USD)	Amount (USD)
Traffic Count Survey	man-day	2	100	200
Data Processing and Analysis	man-day	2	150	300
Base Drawing Preparation	man-day	2	150	300
Improvement Design	man-day	3	500	1,500
Total				2,300

Table 20.1-6 Unit Price of Works

Tentative Work Items	Unit	Unit Price (USD)
Pavement Marking	m^2	25
Pavement Improvement	m^2	57
Traffic Island	m^2	145
Median Island	m^2	145
Side Walk Improvement	m^2	130
Traffic Signal Installation	unit	130,000
Traffic Signal Redesign	unit	11,000
Pedestrian Signal Installation	unit	5,000
Construction of Additional Bridge	m^2	10,000

Table 20.1-7 Estimated Cost of Candidate Intersections

#	Intersection Name	Overall Evaluation *10		Items	Pavement Marking	Pavement Improvement	Traffic Island	Median Island	Side Walk Improvement	Traffic Signal Installation	Traffic Signal Redesign	Pedestrian Signal Installation	Construction of Additional Bridge	Total
	Multipliers	*Full Score*		*Unit Price*	25	57	145	145	130	130,000	11000	5,000	10,000	US$
		100		*Unit*	m2	m2	m2	m2	m2	unit	unit	unit	m2	
1	Chui / Dan Sayopin Ave. w / Julius Fuchik St.	83	1st	Q'ty	2,800		50	6	144	1				
				Cost	70,000		7,250	870	18,720	130,000				226,840
2	Jibek Jolu Ave. w / Julius Fuchik St.	57	4th	Q'ty	2,700		54				1			
				Cost	67,500		7,830				11,000			86,330
3	Jibek Jolu Ave. w / MolodayaGvardia Blvd.	70	2nd	Q'ty	8,900		178	45		1		1		
				Cost	222,500		25,810	6,525		130,000		5,000		389,835
4	Moscowskaya St. w / Asanaliyev St.	75	2nd	Q'ty	1,400				600		1	1		
				Cost	35,000				78,000		11,000	5,000		129,000
5	Sovetskaya St. w / Bayalinov St.	67	3rd	Q'ty	400				200		1			
				Cost	10,000				26,000		11,000			47,000
6	Jibek Jolu Ave. w / Alamedin River	64	3rd	Q'ty									300	
				Cost									3,000,000	3,000,000
7	Jibek Jolu Ave. w / Almatinskaya St.	74	2nd	Q'ty	1,839	1,839			800		1	1		
				Cost	45,975	104,823			104,000		11,000	5,000		270,798
8	Almatinskaya St. w / Salieva St.	58	4th	Q'ty	1,300	1,300					1			
				Cost	32,500	74,100					11,000			117,600
9	Chui Ave. w / Ibraimov St.	72	2nd	Q'ty	3,000	3,000			500		1	1		
				Cost	75,000	171,000			65,000		11,000	5,000		327,000
10	Lev Tolstoi St. w / Asanaliev St.	75	2nd	Q'ty	950	950			500		1			
				Cost	23,750	54,150			65,000		11,000			153,900
11	Lev Tolstoi St. w / MolodayaGvardia Blvd.	67	3rd	Q'ty	1,350				250	1				
				Cost	33,750				32,500	130,000				196,250
12	Lev Tolstoi St. w / Chapaeva St.	61	3rd	Q'ty	1,050				250		1			
				Cost	26,250				32,500		11,000			69,750
13	Gorki St. w / Sovetskaya St.	82	1st	Q'ty	1,080						1	1		
				Cost	27,000						11,000	5,000		43,000
14	Jukeev-Pudovkina St. w/ Akhunbaev St.	66	3rd	Q'ty	620	620					1			
				Cost	15,500	35,340					11,000			61,840
15	Jukeev-Pudovkina St. / Suyerkulov St.	57	4th	Q'ty	1,230	1,230					1	1		
				Cost	30,750	70,110					11,000	5,000		116,860
16	Chui Ave. w / Almatinskaya St.	78	2nd	Q'ty	3,700		74				1			
				Cost	92,500		10,730				11,000			114,230
17	Almatinskaya / Ahunbaeva St.	65	3rd	Q'ty	4,250		85		500					
				Cost	106,250		12,325		65,000					183,575
18	Chui Ave. / Naberejnaya-Vostok 5	76	2nd	Q'ty	1,000	1,000	20						375	
				Cost	25,000	57,000	2,900						3,750,000	3,834,900
19	Pravda / Frunze	52	4th	Q'ty	2,600		52							
				Cost	65,000		7,540							72,540
20	Kulatova / Ibraimova	61	3rd	Q'ty	1,100		22	75			1			
				Cost	27,500		3,190	10,875			11,000			52,565
21	Jibek Jolu / Togolok Moldo	72	2nd	Q'ty	1,500	150	30				1			
				Cost	37,500	8,550	4,350				11,000			61,400
22	Bakinskaya / Aul	73	2nd	Q'ty	820	820	16				1			
				Cost	20,500	46,740	2,378				11,000			80,618
23	Gagarin / Baha - Frunze	64	3rd	Q'ty	750	750	15							
				Cost	18,750	42,750	2,175							63,675
24	Profsoyuznaya	47	5th	Q'ty	620	620	12							
				Cost	15,500	35,340	1,798							52,638
25	K. Marksa / Suhe Batora	75	2nd	Q'ty	1,450	1,450	29			1	1			
				Cost	36,250	82,650	4,205			13,000	11,000			147,105
26	Gagarin / Doronbek Sadyrbayev	57	4th	Q'ty	1,300	1,300	26				1			
				Cost	32,500	74,100	3,770				11,000			121,370
27	Mira / Gorky	70	2nd	Q'ty	1,100		22				1			
				Cost	27,500		3,190				11,000			41,690
28	Jibek Jolu / Kuliev	69	3rd	Q'ty	940		19							
				Cost	23,500		2,726							26,226
29	Jukeev Pudovkina / Suyerkulov II	55	4th	Q'ty	920	920	18							
				Cost	23,000	52,440	2,668							78,108
													Total	10,166,643

20.1.10 Implementation Schedule

The implementation of intersection improvement is divided into three phases for three years. In phase I, the baseline survey will be carried out at all candidate intersections to handle priorities and to create the plans of phase II and III. The construction will be carried out with five pilot intersections due to prioritization of the survey in phase I. As to the climate in Bishkek, the construction cannot be implemented from December to February or winter season. The tentative schedule is shown as follows:

Activities	Phase I								
	March	April	May	June	July	August	September	October	November
Baseline Survey (29 Candidate Intersections)									
Traffic Count Survey									
Data Processing and Analysis									
Base Drawing Preparation									
Improvement Design									
Plan Schedule									
Planing of Phase II and III									
Selection of Contractor									
Preparation of Tender Document									
Tender									
Construction (5 Pilot Intersections)									
Improvement of Intersection									

Activities	Phase II								
	March	April	May	June	July	August	September	October	November
Baseline Survey (12 Candidate Intersections)									
Traffic Count Survey									
Data Processing and Analysis									
Base Drawing Preparation									
Improvement Design									
Selection of Contractor									
Preparation of Tender Document									
Tender									
Construction (12 Intersections)									
Improvement of Intersection									

Activities	Phase III								
	March	April	May	June	July	August	September	October	November
Baseline Survey (12 Candidate Intersections)									
Traffic Count Survey									
Data Processing and Analysis									
Base Drawing Preparation									
Improvement Design									
Selection of Contractor									
Preparation of Tender Document									
Tender									
Construction (12 Intersections)									
Improvement of Intersection									

20.1.11 Evaluation

Improvement solutions or measures will be evaluated after implementation. Both quantitative and qualitative evaluation will be made. Quantitative evaluation solutions measure the effect of improvement in terms of traffic volume, intersection delay, occurrence of queue and its length, or saturation rate. It would be ideal if

traffic accident data at project intersections are available for the periods before and after the project. However, the current accident report system does not specify the accident location in sufficient detail to be used for evaluation.

Qualitative evaluation includes drivers' and pedestrians' opinion about their perception on the condition of intersection before and after the project. Interview survey will be made to collect the road users' opinion.

The indicators that will be adopted for evaluation will be discussed and decided later.

20.2 Traffic Control System Improvement Plan

20.2.1 Objective

The Bishkek City government has implemented several traffic management solutions or measures including installation of the new traffic signals and introduction of one-way system. The City has once owned and operated a centralized traffic signal control system in which traffic signals are controlled directly by the computer in the control center with the timing plan most suitable for the prevailing traffic condition. The system gradually lost functions and effectiveness due to lack of spare parts, absence of human resources and insufficient operation and maintenance budget. Currently, it is no longer functioning and all traffic signals are operating in an isolated mode.

This chapter proposes introducing an area traffic control system once again to Bishkek City. Technology and equipment of area traffic control system has changed largely since the time of the defunct system. Advance in the information and communication technology in recent years has made the system more user-friendly and easy to operate. Bishkek City needs such an advanced area traffic control system.

20.2.2 Issues of Current Signal System

The existing signals in Bishkek have two drawbacks. First, all of them are fixed time signals applying a single timing parameter plan regardless of traffic condition, time and day of the week. If signal timing is designed to meet the high demand during peak hour traffic condition, it is not suitable for off-peak hour traffic when traffic is light. If signal timing is designed for off-peak hour traffic, it is not effective in handling the peak hour traffic and congestions will occur. Traffic conditions are normally light during night time and on Sundays and holidays but the existing signals do not adjust their timing according to time of day and day of the week.

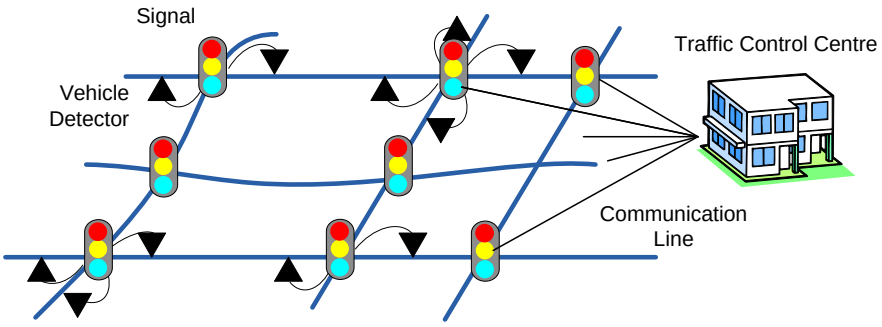
Second, all signals in the City are isolated signals operating independently without coordination with neighboring signals. In urban areas where intersections are closely placed, signal operation becomes inefficient if they are not coordinated and vehicles are required to stop at every intersection.

In addition to the issues mentioned above, observation of the existing signals revealed that the signal phasing and timing plan are not optimized and green time is often wasted creating unnecessary delays.

20.2.3 Area Traffic Control System

20.2.3.1 System Configuration

An area traffic control system controls traffic signals with the signal timing parameters best suited to the prevailing traffic condition to manage the traffic efficiently and minimize the delay. Thus it needs to gather traffic condition data and vehicle detectors should be installed at around the major intersection and streets for this purpose. Communication line is required to send the traffic data to the center and receive control command from the Center. A conceptual configuration of Area Traffic Control (ATC) system is shown in **Figure 20.2-1**.



Source : JICA Study Team

Figure 20.2-1 Area Traffic Control System

20.2.3.2 System Operation

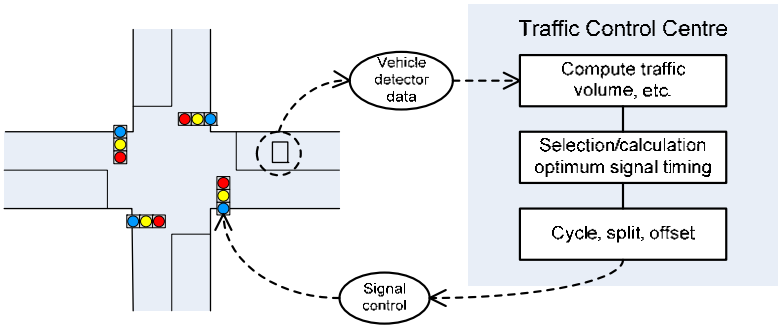
In order to gather traffic condition data, a vehicle detector, a device that detects presence or passage of vehicle, is required and installed in the road network. Depending on the type of signal control method, a vehicle detector is installed at different location, such as at stop line, near the stop line, exit side of upstream intersection, etc.

Vehicle detection data from vehicle detectors are sent to the Traffic Control Center through local controller. Data from several vehicle detectors are combined to share a common communication line.

The data received from vehicle detectors are processed at the Traffic Control Center and traffic flow parameters such as traffic volume, occupancy rate, or speed is calculated.

Based on the traffic condition data thus gathered and processed, the signal timing parameters are determined. There are several different methods to calculate or select signal-timing parameters.

Timing parameters are then converted to real-time command, and signal is remotely controlled by the command sent from the Control Center through the communication system. The same communication line is used for both data uploading and command issuing.



Source : JICA Study Team

Figure 20.2-2 Signal Control Mechanism

20.2.3.3 Benefits of ATC System

Benefits to be brought about by ATC system are generally recognized as follows:

(i) Efficient traffic operation (less number of stoppings, shorter delay and higher travel speed).

(ii) Safer traffic (less number of accidents).

(iii) Reduction of fuel consumption resulting in less emission of CO_2 and other pollutants.

The extent of the benefit depends on various factors such as the road network, traffic volume and its composition, congestion level, and types of existing signals. The examples in other cities show that cost of ATC system can be recovered in a couple of years. It is pointed out that the benefit to each vehicle is not tangible and may not be perceived by the drivers. The total benefit will be, however, significant as large number of vehicles receive benefits.

The existing signals in Bishkek are isolated type with fixed pattern and no coordination is maintained among the signals. Thus, there would be a large potential for improvement and the size of the benefits is expected to be significant.

20.2.4 Description of Proposed Area Traffic Control System

20.2.4.1 Coverage Area

Currently there are a total of 203 units of traffic signal in Bishkek city. The proposed ATC system will cover about half of these signals located in the central business district. If a signal is located far from other signals and coordination is not required, the signal will not be connected with the Control Center system. Vehicle actuation or other signal control technique can be applied to these intersections to improve their operation.

After the review of the location and traffic condition of the existing signals, it is proposed that a total of 113 signals will be covered by the system. There would be minor changes of the coverage area and actual signals to be connected with the system will be determined during the design stage.

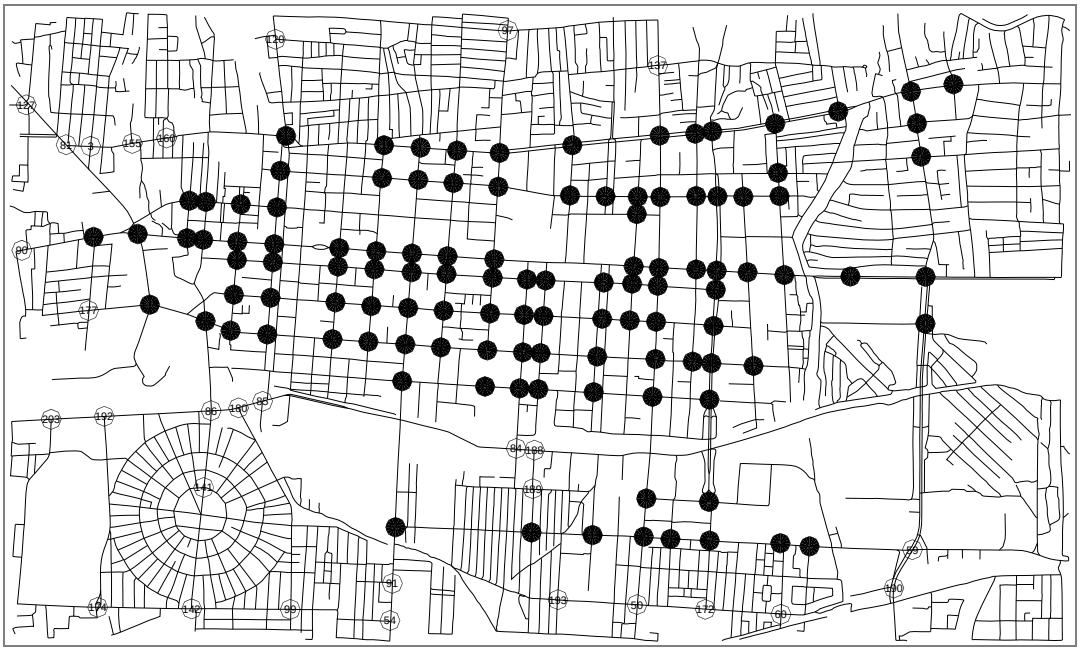
The selection criteria adopted for selection of ATC signal is as follows:

(i) Signals at critical intersections where volume/capacity ratio is high during peak hours and efficient signal control that considers traffic condition is required.

(ii) Signals located along arterial streets; coordination of which is effective and required for better signal performance and shorter delay.

(iii) Signal located in the vicinity of other signals and coordinated operation is required.

The location of the tentatively selected signals is shown in **Figure 20.2-3**.



Source : JICA Study Team

Figure 20.2-3 Location of ATC Signals (Tentative)

20.2.4.2 Local Controller

There are no global standards for local controllers for the ATC system. The type of local controller for ATC system differs from supplier to supplier, or from country to country. They are not compatible with each other. Thus, selection of the local controller for the first stage system determines the type of local controller in the future expansion.

On the other hand, ATC local controllers currently in use have almost same functionality and performance so that their selection is not a critical factor in designing and introducing ATC system. In other words, functional requirements must be defined for ATC system for Bishkek in sufficient detail, and selection of the type of control mechanism and local controller will be left to the system supplier.

20.2.4.3 Signal Lantern

Currently, two types of lanterns, incandescent and LED, are used for the traffic signals. Most of the signals installed before year 2000 have incandescent lamps while new signals installed in 2000's and later adopt LED

lamps. The incandescent lamp is an old type and inferior to LED in terms of life and power consumption. In the proposed project, signal lanterns using incandescent lamps at the signals covered by the system will be replaced with LED type lanterns.

Out of 113 signals for area traffic control systems, 83 signals use incandescent lamps. They will be replaced with LED type when new local controller is installed. The existing LED lantern will be retained for the remaining 30 signals.

20.2.4.4 Vehicle Detector

There are several types of vehicle detectors used for the Area Traffic Control Systems (ATC). Varieties include inductive loop, ultrasonic, video image and infrared types. Each type has its own advantages and disadvantages. For Bishkek, the inductive loop type vehicle detector is recommended as it is simple in configuration and mechanism, and relatively lower in cost. In addition, the inductive loop detector is most commonly used as there are many suppliers.

20.2.4.5 CCTV Camera

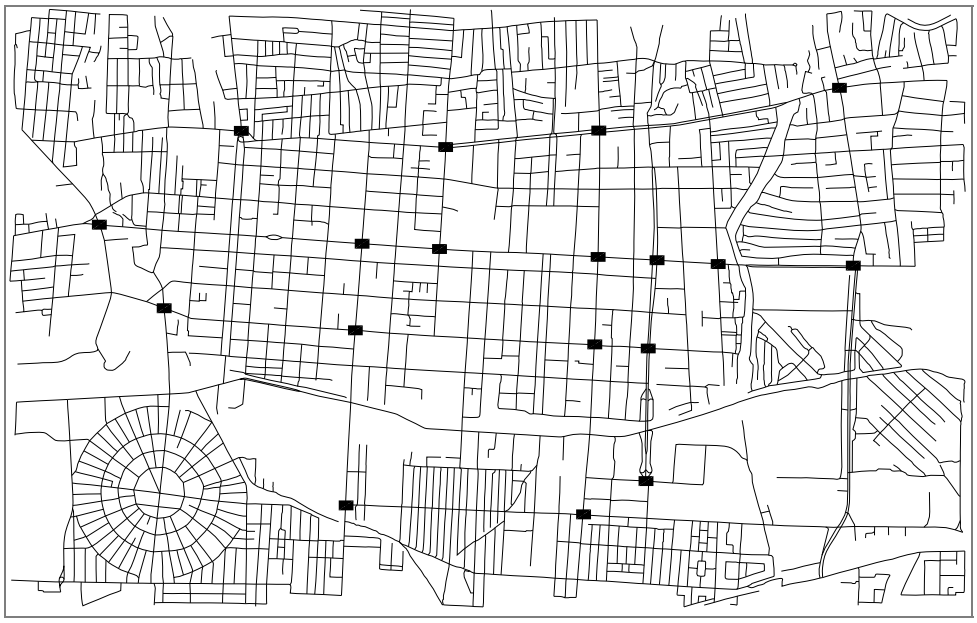
Although CCTV cameras are not necessarily required for signal control, it is very common for ATC system to be equipped with CCTV camera surveillance systems to monitor the traffic conditions at the critical intersections. Although the traffic conditions can be obtained through vehicle detectors and expressed by such traffic flow parameters as traffic volume, average speed and queue lengths, they are not effective in understanding traffic conditions. Images taken by CCTV camera provide traffic conditions at a glance, thus it is a very helpful tool of traffic management.

The CCTV cameras for traffic monitoring will be installed at major intersections. Basically, one camera will be installed at each intersection. The camera must have pan, tilt and zoom (PTZ) functions to cover the entire intersection area so that desired object can be targeted and closed up.

It is noted that transmission of video image data requires much higher bandwidth or speed than that for signal control. Thus, cost of communication line is higher than the cost of telephone grade line that the signal control system requires. If more cameras are to be installed, sufficient amount of operation and maintenance budget must be secured.

In order to minimize the bandwidth requirement for the video transmission system, MPEG4 will be adopted for video signal compression.

A total of 18 intersections are selected for CCTV camera locations as shown in the succeeding section. Traffic volume and saturation levels of traffic flows are main criteria for selecting camera location. All of the traffic signal at these intersections are the signals controlled by the ATC system.



Source : JICA Study Team

Figure 20.2-4 CCTV Camera Location (Tentative)

20.2.4.6 Communication Line

(1) Leased Cable or Self-owned Cable

There are basically two approaches about securing communication lines - leased telephone line or self-owned cable. If the communication line is available from the Telecommunications Company or cable network company, it is normal practice and more economical in the long run to lease lines from the company in exchange for the payment of monthly lease fee. In this case, it is the Telecommunications Company's responsibility to maintain the line and no maintenance staff with the knowledge of telecommunication and network systems is required on the part of Traffic Control Center. On the other hand, annual budget for communication lines must be secured.

If leased lines are not available, or if it is judged technically feasible and more economical to own communication lines due to high lease costs, self-owned cable systems will be constructed. In this case, there will be no annual payments of lease fee, but the cable network must be maintained by Traffic Control Center staff. Thus, skilled engineers and technicians who are capable of maintaining the cable network must be employed by the Control Center.

In order to determine the type of communication cable, it is necessary to examine the availability and amount of cost of the leased line separately for signal control and video image transmission. At the same time, possibility of hiring and retaining necessary number of competent technical staff by the Control Center must be examined.

Bishkek City has an optical fiber cable network already. The cable network is constructed and owned by a private company called Akhet. Their optical fiber cable network extends more than 1,300 km in the City covering almost all parts except peripheral areas. As of present, use of Akhet network is considered as a

feasible option for the communication system for ATC system. Further study and consultation with Akhet is, however, required before the final selection.

(2) Requirement for Communication Line

Two types of data transmission, signal control and CCTV system, are carried out by the system over the communication line. They are summarized in **Table 20.2-1**

Table 20.2-1 Data Transmission

	Application	Direction	Contents	Timing
1	Signal control	Center -> controller	Signal control command	Every 1 second
		Controller -> Center	Detector data Controller status	Continuous Every 1 second
2	CCTV system	Center -> camera	Camera control	Upon operation
		Camera -> Center	Video stream	Continuous (MPEG4)

Source : JICA Study Team

(3) Network Topology

Network topology available to the system depends on the fiber cable network to be leased from cable network company. As of August 2012, the details of Akhet fiber cable network such as route, number of cores, carrier speed, hub location, etc. are not known.

Assuming that the network can be configured in a way suitable for the system, two tiers of optical fiber cable network, backbone fiber cable and distribution fiber cable will be formed. Backbone fiber cable connects the Control Center with the hubs in the network and distribution fiber connects hub with each device (local controller and CCTV camera).

For backbone fiber cable network, ring topology is suggested for higher reliability. A ring starting from the Control Center and connecting multiple hubs will be formed. There will be multiple rings to cover all local controllers and CCTV camera. Data can travel around the ring in either direction. Thus there will be two paths, a primary and a backup, between the Control Center and each hub. If a link is cut, communication equipment switches to the backup path for the devices whose primary path is affected.

In order to utilize the automatic switching function of the ring topology, the communication protocol has the mechanism to search and establish the communication path. Internet Protocol (IP) will be suitable for this purpose as it can cope with the change in the communication path. The communication network design presented above must be discussed with the fiber cable network provider (Akhet or other company) for its technical feasibility and cost.

20.2.4.7 Traffic Control Center

The Traffic Control Center is the place where traffic conditions are monitored, traffic information is gathered and necessary instructions are issued in case of incidents. Signal control server in the Control Center directs all traffic signals to operate with the timing plan best suited with the traffic condition.

As described above, however, Traffic Control Center exists in the Traffic Police buildings but it is no longer functioning as a control center. It is necessary to rehabilitate the center and install necessary equipment to establish a new Traffic Control Center. The equipment shall be supplied to the Control Center are following:

(i) Signal control server

(ii) Signal monitoring workstation

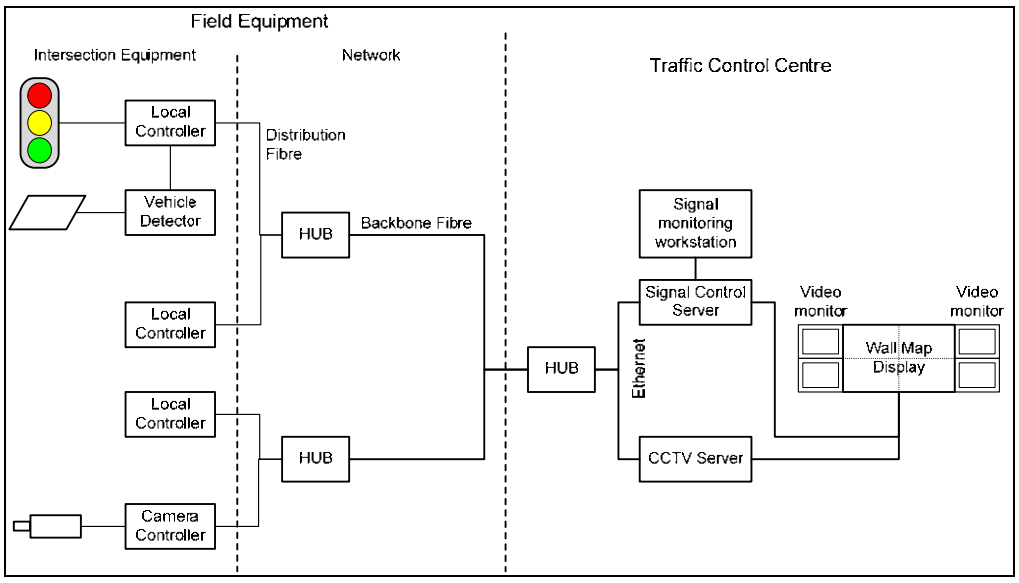
(iii) CCTV server

(iv) Wall map display

(v) CCTV monitors

(vi) Communication equipment

A maintenance shop shall be established in the Control Center as the base for maintenance operation. Repair work of the damaged equipment will be conducted for minor defect that can be repaired at the shop. Maintenance equipment and spare parts will be kept in the maintenance shop. Conceptual system configuration of the proposed area traffic control system is shown in **Figure 20.2-5**.



Source : JICA Study Team

Figure 20.2-5 System Configuration

20.2.4.8 Pavement Markings

Pavement marking in Bishkek City is in poor conditions. Most of them are almost invisible. Lack of pavement markings contributes disorderly traffic flow.

In the proposed project, pavement marking will be applied to the all intersections covered by the system. The Center line and lane line will be drawn for 100 meters from the stop line for major streets, and 50 meter for the minor street. Stop line will be provided to all approaches to the intersection and pedestrian crossing marking will be provided to all pedestrian crossings. Other markings such as directional arrow and chevron markings will also be provided as necessary.

One of the drawbacks of the existing pavement marking is its low quality. The color is not white enough, glass bead is not used at all and markings are worn out quickly. Pavement marking material of better quality must be used and correct application method must be adopted in the proposed project.

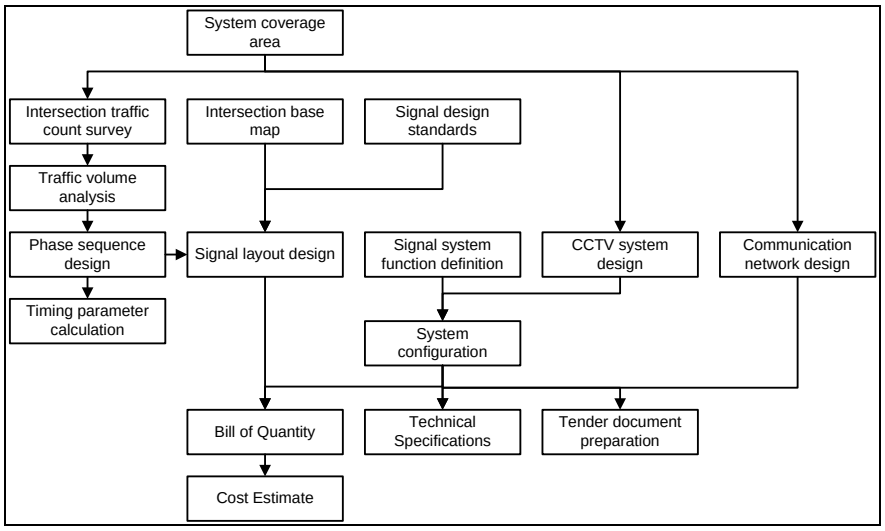
20.2.4.9 Intersection Geometric Improvement

A factor that is often causing the traffic problem is inadequate geometry of the intersections. Solutions or measures such as provision or removal of corner island or medians, modification of corner radius, additional right or left turn lane, etc. sometimes improves the efficiency and enhance the safety at the intersection. Pedestrian barrier is also effective in preventing the jaywalkers. Geometry of bottle neck intersections will be studied and appropriate solutions or measures will be undertaken, if necessary. However, no acquisition of additional right of way is involved.

Traffic control devices such as traffic sign, delineator, chatter bar, lane divider, etc. are cost effective ways to control the vehicle flow and enhance the traffic safety. These traffic control devices are not sufficiently applied to the intersections resulting in chaotic and hazardous traffic situation. The traffic management problems of the intersections covered by the system are first studied, the causes of the troubles are identified and then necessary solutions or measures will be developed and applied.

20.2.5 System Design

Introduction of an area traffic control system requires system design before implementation. Major activities of the system design are shown in **Figure 20.2-6**. The task requires technical assistance by a team of consultants consisting of traffic and system engineers who have sufficient knowledge and experiences in the design of the system.



Source : JICA Study Team

Figure 20.2-6 System Design Flow

20.2.6 Project Cost

Tentative project cost is estimated based on the cost data available. The total project cost including two-year maintenance by the system supplier is estimated at 10.4 million USD. The system will install 113 units of new local controllers, LED type signal lanterns at 83 intersections and 18 units of CCTV camera. The cost of communication system is not covered by the cost estimate as the optical fiber cable network including the device that connect local controller and CCTV camera with the cable network is assumed to be leased from the cable network company.

Table 20.2-2 Estimated Project Cost

	Particular	Amount (USD)
1.	Control Center hardware	324,500
2.	Control Center software	796,200
3.	Intersection signal equipment	3,843,500
4.	Installation work	863,600
5.	CCTV system	72,000
6.	Pavement markings	734,500
7.	Spare parts (5%)	331,720
8.	Project management (20%)	1,393,210
9.	Contingency (10%)	835,923
10.	2-year maintenance	1,159,133
Total		10,354,286

Source : JICA Study Team

The estimated cost does not include the cost of system design, which is necessary before procurement of the system and to be provided as technical assistance. Project management cost includes such costs as project office, system design approval, acceptance testing, documentation, training, insurance, transportation and tax and custom duties. Two-year maintenance will be provided by the system supplier for two years after the commissioning of the system.

20.2.7 ATC System Project Implementation

Introduction of an ATC system requires careful planning as the system is highly technical and each stage takes several months to one year. Tentative schedule is shown in **Figure 20.2-7**.

The design of the system requires involvement of consultant team who specializes in the ATC system design. On-the-job training will be provided to the counterpart teams during the design stage. They will become capable of designing the system and the expansion of the system in future will be undertaken by the staff of the counterpart teams.

Manufacturing of local controllers and other equipment will take eight (8) to ten (10) months including time for testing and shipment. Establishment of Control Centers and installation of local controller at each intersection are expected to take one year.

A Traffic Control Center must be established with the adequate number of staff of required skill and knowledge. The existing Traffic Control Center in the Traffic Police building will be renovated. It must be in place before the start of design stage so that the staff will be involved in the design and technology transfer will be made.

The second training will be provided by the system supplier during the latter half of the construction stage so that when system is completed, there will a team of local staff who is familiar with the system.

	Year 1	Year 2	Year 3	Year 4
Traffic survey and system design				
Tender document preparation				
Tendering and contractor selection				
Manufacturing, factory test and shipment				
System construction, testing and commissioning				
Training On-the-job System training				

Source : JICA Study Team

Figure 20.2-7 System Implementation Schedule

20.2.8 Conclusion

Area Traffic Control system is an indispensable system for a modern city to make road traffic more efficient and safer. Traffic conditions in Bishkek City have already reached the level that warrants the introduction of such system. There is a huge potential of improvement as the existing signals are still at very primitive level or obsolete. As introduction of the system takes some time, it is high time to consider it.

CHAPTER 21 CITY PARKING IMPROVEMENT PLAN

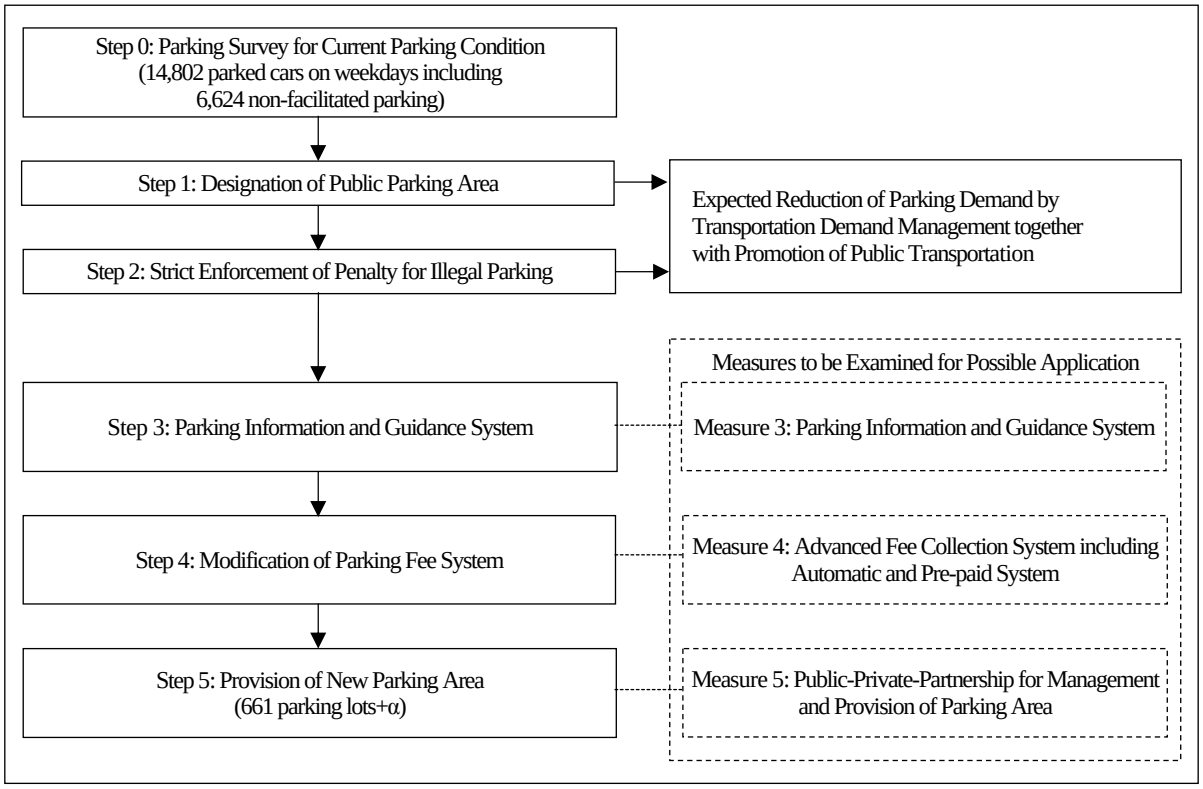
21.1 Improvement of Parking in the City Center

21.1.1 Improvement of Current Parking Condition

The necessary measures to improve the parking conditions were examined by using the parking survey data. These measures consist of six steps as shown in **Figure 21.1-1**. The following sub-clauses describe the contents of the necessary measures in each step.

(1) Step 0: Parking Survey or Current Parking Condition

The parking survey was carried out by the JICA Study Team. The survey collected the basic information of the current parking conditions in the City center.



Source : JICA Study Team

Figure 21.1-1 Steps and Measures to Improve Existing Parking Condition

(2) Step 1: Designation of Public Parking Area

A public parking area needs to be defined as the basis for managing the parking area in the City center. This definition will be fundamental to enforce the ban on the illegal parking.

The JICA Study Team assumed two options to examine the definition of the public land allowable for parking. Option-1 was considered as a base case in which the non-facilitated parking area will not be allowed for parking, though Option-2 was set up as a more ambitious case to relocate all the parked cars on the shoulder and traffic lane. It means the parking will not be allowed at the

non-facilitated parking area and the facilitated on-street parking area in Option-2.

The number of parked cars that would be removed from the current parking areas was estimated for two options. Option-1 needs to remove 3,251 cars on weekdays and 661 cars on weekends as shown in **Table 21.1-1** and **Table 21.1-2**, though Option-2 needs to relocate 8,598 cars on weekdays and 3,133 cars on weekends as shown in **Table 21.1-3** and **Table 21.1-4**.

Since the number of parked cars on weekends largely included the cars parked by residents, it was obvious that the implementation of Option-2 would be difficult to relocate more than 3,000 cars parked in the City center on weekends. Thus, Option-1 was selected for further examination. It should be noted that the facilitated on-street parking that obstructed the traffic of the public transport should be relocated, although the facilitated on-street parking was allowed in Option-1.

Table 21.1-1 Option 1: Available Capacity after Improvement on Weekdays
(Facilitated On - Street Parking will be allowed)

Zone	Remaining Capacity (parking lot)							Non - facilitated Parking (car)	Balance (car)
	Municipal	Other Facilitated Parking					Total		
		Off - street	On - Street	Other	Off - street in Site	Total			
8	0	48	312	0	0	360	360	488	-128
9	0	49	64	10	0	123	123	261	-138
10	47	225	247	0	0	472	519	589	-70
11	316	35	96	0	0	131	447	991	-544
32	84	50	611	0	0	661	745	1,958	-1,213
33	0	121	266	12	0	399	399	996	-597
44	104	22	156	0	0	178	282	861	-579
45	0	35	65	0	0	100	100	137	-37
50	18	12	58	0	0	70	88	108	-20
51	68	50	610	0	0	660	728	235	493
Total	637	647	2,485	22	0	3,154	3,791	6,624	-3,326

Note : Since the off-street parking in site may be exclusively used for visitors on premises of a building, the remaining capacity was set at nothing in this examination.
Source : JICA Study Team

Table 21.1-2 Option 1: Available Capacity after Improvement on Weekends
(Facilitated On - Street Parking will be allowed)

Zone	Remaining Capacity (parking lot)							Non - facilitated Parking (car)	Balance (car)
	Municipal	Other Facilitated Parking					Total		
		Off - street	On - street	Other	Off - street in Site	Total			
8	0	105	523	0	0	628	628	207	421
9	0	57	69	14	0	140	140	223	-83
10	63	304	341	0	0	645	708	403	305
11	363	36	163	0	0	199	562	818	-256
32	199	157	1,503	0	0	1,660	1,859	474	1,385
33	0	324	630	14	0	968	968	438	530
44	82	29	282	0	0	311	393	626	-233
45	0	32	78	0	0	110	110	199	-89
50	24	12	83	0	0	95	119	110	9

Zone	Remaining Capacity (parking lot)							Non - facilitated Parking (car)	Balance (car)
	Municipal	Other Facilitated Parking					Total		
		Off - street	On - street	Other	Off - street in Site	Total			
51	24	57	681	0	0	738	762	143	619
Total	755	1,113	4,353	28	0	5,494	6,249	3,641	-661

Note : Since the off-street parking in site may be exclusively used for visitors on premises of a building, the remaining capacity was set at nothing in this examination.
Source : JICA Study Team

Table 21.1-3 Option 2: Available Capacity after Improvement on Weekdays

(Facilitated On - Street Parking will not be allowed)

Zone	Remaining Capacity						Need for Improvement			Balance (car)
	Municipal	Other Facilitated Parking				Total	Facilitated On - street	Non - facilitated Parking	Total	
		Off - street	Other	Off - street in Site	Total					
8	0	48	0	0	48	48	270	488	758	-710
9	0	49	10	0	59	59	77	261	338	-279
10	47	225	0	0	225	272	298	589	887	-615
11	316	35	0	0	35	351	266	991	1,257	-906
32	84	50	0	0	50	134	1,317	1,958	3,275	-3,141
33	0	121	12	0	133	133	479	996	1,475	-1,342
44	104	22	0	0	22	126	506	861	1,367	-1,241
45	0	35	0	0	35	35	52	137	189	-154
50	18	12	0	0	12	30	55	108	163	-133
51	68	50	0	0	50	118	325	235	560	-442
Total	637	647	22	0	669	1,306	3,645	6,624	10,269	-8,963

Note : Since the off-street parking in site may be exclusively used for visitors on premises of a building, the remaining capacity was set at nothing in this examination.
Source : JICA Study Team

Table 21.1-4 Option 2: Available Capacity after Improvement on Weekends

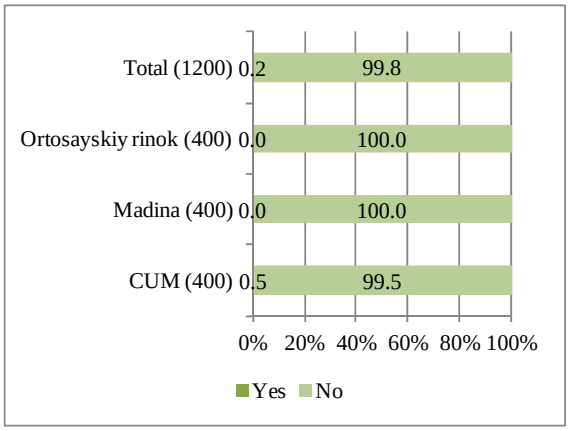
(Facilitated On - Street Parking will not be allowed)

Zone	Remaining Capacity (parking lot)						Need for Improvement (car)			Balance (car)
	Municipal	Other Facilitated Parking				Total	Facilitated On - street	Non - facilitated Parking	Total	
		Off - road	Other	Off - road in Site	Total					
8	0	105	0	0	105	105	59	207	266	-161
9	0	57	14	0	71	71	72	223	295	-224
10	63	304	0	0	304	367	204	403	607	-240
11	363	36	0	0	36	399	199	818	1,017	-618
32	199	157	0	0	157	356	425	474	899	-543
33	0	324	14	0	338	338	115	438	553	-215
44	82	29	0	0	29	111	380	626	1,006	-895
45	0	32	0	0	32	32	39	199	238	-206
50	24	12	0	0	12	36	30	110	140	-104
51	24	57	0	0	57	81	254	143	397	-316
Total	755	1,113	28	0	1,141	1,896	1,777	3,641	5,418	-3,522

Note : Since the off-street parking in site may be exclusively used for visitors on premises of a building, the remaining capacity was set at nothing in this examination.
Source : JICA Study Team

(3) Step 2: Strict Enforcement of Penalty for Illegal Parking

After the designation of the public parking areas, the illegal parking should be strictly prohibited with a penalty. The penalty may be set up at the level that would be enough to discourage a driver to park his or her car at any illegal parking space. For instance, the penalty will include a point-off system and a fine system. If a driver was taken off its point higher than a specific level, its driving license will be suspended in the point-off system. Furthermore, a fine will be set higher than the current level of 300 SOMS. In the interview survey, almost all respondents expressed that they would not park their cars at any illegal parking space, in case the fine will be increased by ten times as shown in **Figure 21.1-2**.



(This is the respond to a question whether a driver will park its car where it is prohibited, if the fine will be increased by ten times.)

Source : JICA Study Team

Figure 21.1-2 Perception by Driver to Park his / her Car at Illegal Parking Space, if Fine will be Increased

(4) Step 3: Use of Designated Public Parking Space

Measures in Step 1 and Step 2 would encourage a driver to park his or her car at a designated parking area. This provision or change will increase an occupancy rate of an existing facilitated parking area. The parking survey revealed that the existing facilitated parking area still has the remaining capacity of 3,791 parking lots on weekdays.

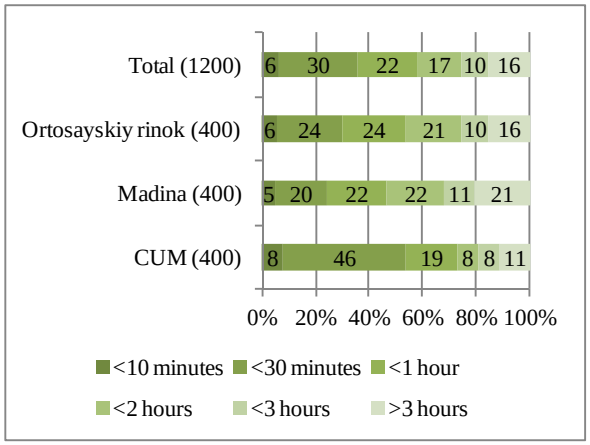
An advanced system will be a tool to raise the occupancy rate by installing a parking information and guidance system that will disseminate the information of the remaining capacity of each public parking to a driver.

(5) Step 4: Modification of Parking Fee System

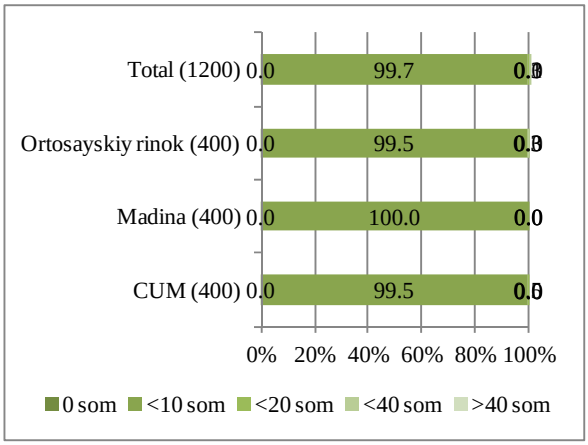
A parking fee system shall be a tool to disperse the parking in the City center. It will be modified from a current fixed rate to a variable rate. For instance, the parking fee will be estimated based on the duration of the parking. Furthermore, the unit price of the parking fee will be rated based on the location. The higher unit price will be set to the parking area in central part of the City center. It is anticipated that by this measure it would mitigate the concentration of the parking demands in central part of the City center.

According to the interview survey, 58 percent of the respondents parked their cars for one hour or less. Most of them were charged a parking fee at 10 SOMS (99.7%). A half of the respondents (or 52%) expressed their acceptance to pay the parking fee in the range from 10 SOMS to 25 SOMS. Since 89 percent of the respondents expressed their opposition to the parking fee of hourly basis, it would take some time to make consensus building with citizens. The public awareness will need to be promoted for the transport demand management as part of a future prospect of Bishkek City.

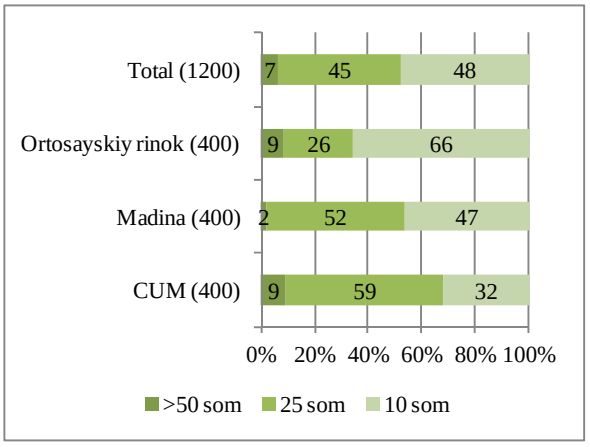
It will be an issue for the modification of the parking fee to make the payment by all the users of the parking area compulsory.



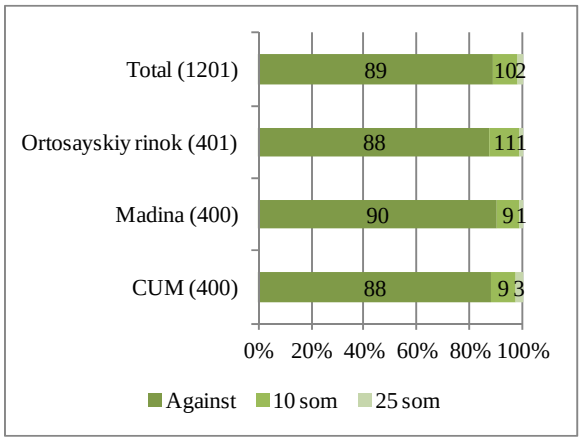
Q1 How long do you park at the parking space?



Q2 How much do you pay for parking?



Q3 How much can you pay for parking feeing the maximum?



Q4 If parking fee becomes hourly basis, what tariff is preferable (SOMS/hour)?

Source : JICA Study Team

Figure 21.1-3 Duration and Willingness to Pay for Parking in Interview Survey

(6) Step 5: Provision of New Parking Area (661 parking lots)

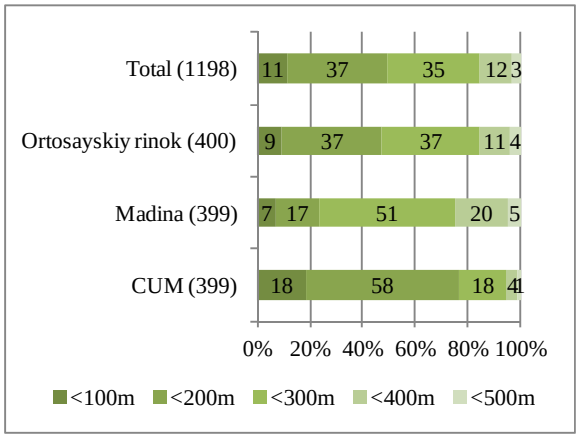
A new parking area will be required to meet the parking demands, if Step 1 and Step 2 will be implemented as counter-measures. The city government would be requested to provide the new

parking areas that will receive the relocated cars. A tentative target of 661 parking lots will be required to meet the parking demands on weekends, because the cars parked were largely from residents near the City center as shown in **Table 21.1-2**.

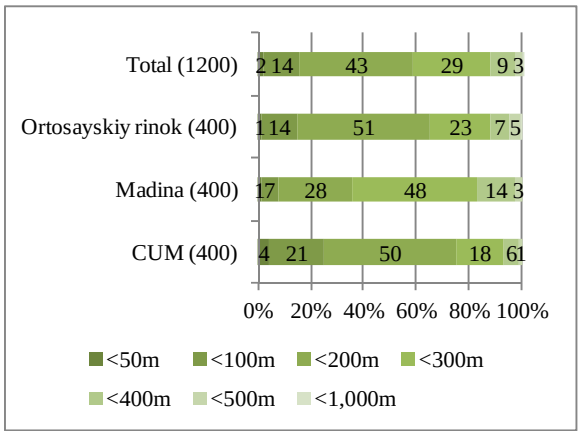
Since the number of parked cars was estimated at 14,802 cars on weekdays and 8,748 cars on weekends, the incremental number of parked cars amounted to 6,624 cars on weekdays. The lack of parking lots in Option-1 was estimated at 3,326 on weekends of which 661 parking lots will be provided to meet the demands on weekends. Thus, the lack of parking lots will be 2,665 or 40 percent of the incremental number parked cars on weekdays. The city government will need to decide whether they will provide more than 661 parking lots to meet the parking demands on weekdays.

In the course of provision of the new parking area, the Public Private Partnership would play a significant role in examining the involvement of the private sector in providing and management of parking areas.

According to the interview survey, the respondents expressed their preference that the parking area would be located within 300 meters from their destination.



Q1 How long do you walk from the parking space to your destination?



Q2 How long can you walk from the parking space to your destination?

Source : JICA Study Team

Figure 21.1-4 Preferable Distance from Parking Area to Destination in Interview Survey

21.1.2 Future Parking Demands

In addition to the improvement for the existing parking condition, further measures will be required to prepare for the parking demands of the future. It should be noted that the provision of a new parking area would be a factor to encourage the further parking demands. Even if a driver of a private car would pay a parking fee at his or her destination, he or she would have to drive down a road where construction and maintenance costs are taxable. The owner of the parking lot (at the destination) will profit from the parking fees and benefit from economic activities, with the driver. Taking the nature of parking demands and the social equity into account, the provision of parking areas should be strategically planned to not meet the parking demands, or should not be on the same level. From the

standpoint of transportation demands management, the provision of parking areas should be set at a level lower than the parking demands. The following sub-clauses describe the measures to be taken for preparation for future parking demands.

(1) Updating of Technical Standard for Mandatory Parking Lots by Type of Building

The existing technical standards for a mandatory parking lots was outdated or obsolete and unable to meet the current parking demand. The provision of a minimum number of parking lots has to be modified. The new standard needs to be revised to meet the parking demands, particularly of apartments and a large-scale building that will require a large number of parking spaces.

(2) Formulation of Plan of Parking Area in Specific Area

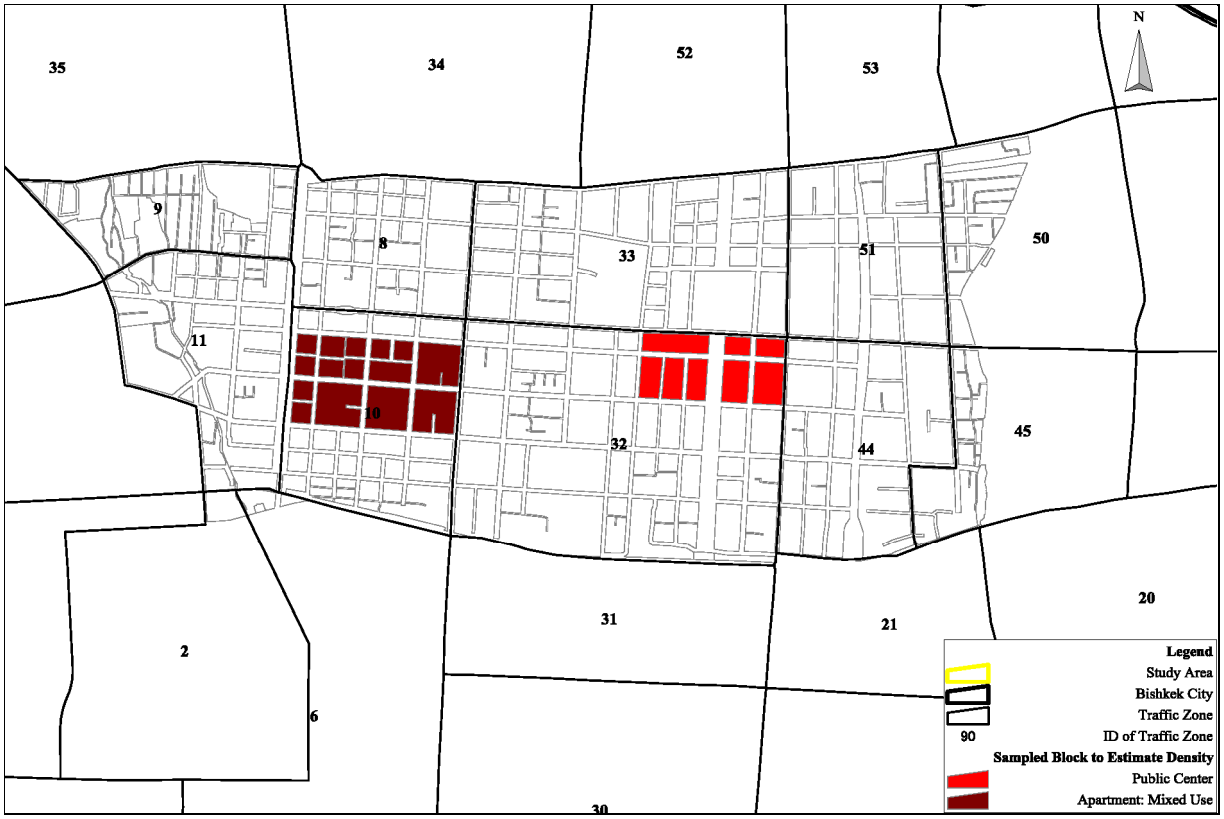
It will be important to formulate a plan for parking areas, to manage the parking demands and the capacity of the parking area in a specific area or the City center.

The future parking demand was tentatively estimated on the assumption that existing detached housing will be redeveloped into Public Centers and Apartments in the long-term. The volume of current parking demands was used for this estimate. It should be noted that the definition of the current parking demands was not accurate, since it is mixed up, with different types of parking demands by residents and visitors. Therefore, the estimated future demands must be considered as the provisional estimate. A sample block was selected at 23 locations to estimate the volume of the current parking demands as shown in **Table 21.1-5**. The sample block covered the mixed use areas of apartment and economic activities. It is considered that the economic activities are being carried-out at the ground floor of the Apartment and the blocks of the Public Center in central part of the City center.

Table 21.1-5 Density of Parking Demands by Type of Land Use

Type	Number of Sample (location)	Density of Parked Car (car / ha)	
		Weekdays	Weekends
Apartment	15	13.9	9.0
Public Center	8	34.9	13.9

Source : JICA Study Team



Source : JICA Study Team

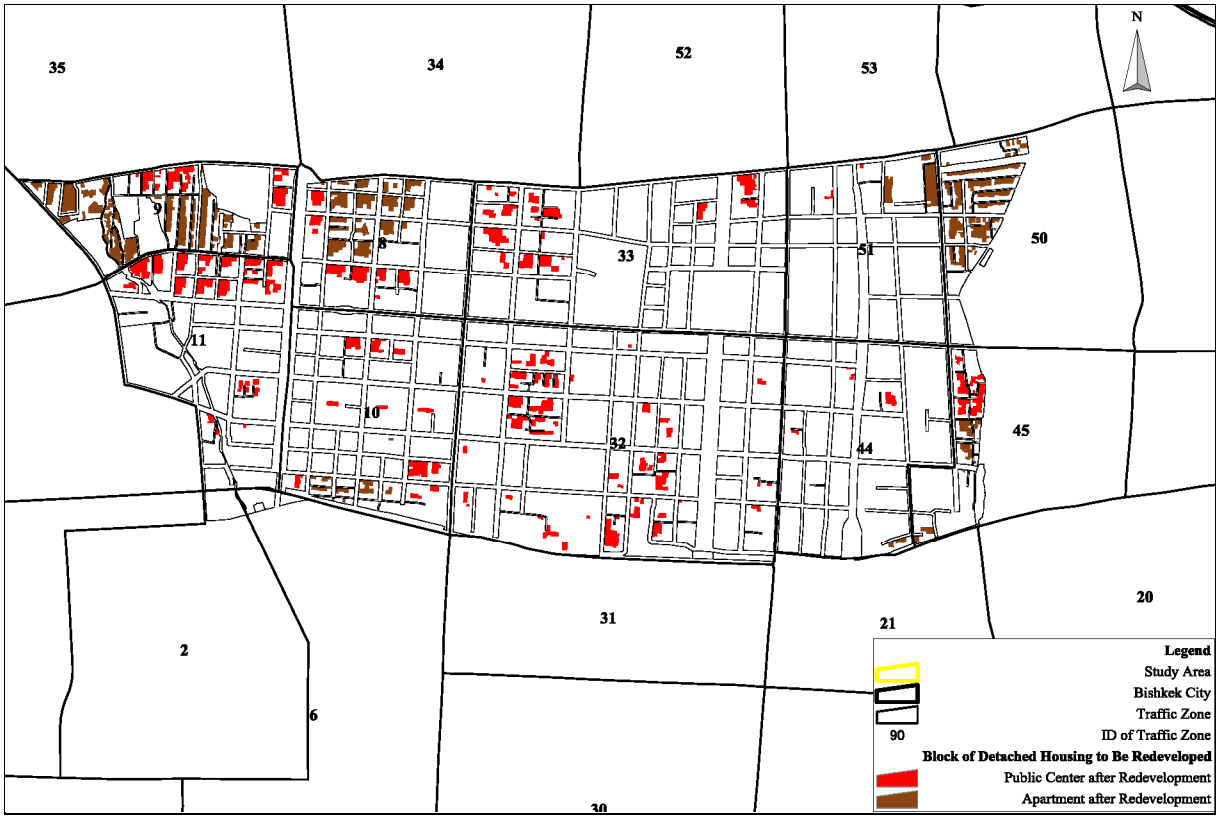
Figure 21.1-5 Location of Sampled Block to Estimate Volume of Parking Demands

The additional parking was estimated at 3,465 cars on weekdays and 1,614 cars on weekends as shown in **Table 21.1-6**. Since the parking demands on weekends would be largely covered by the mandatory parking lot of housing, the remaining parking demands will be 1,851 cars. This incremental number of parking demands have to be managed by the mandatory parking lot by type of building, the provision of new municipal parking, and the traffic demands management.

Table 21.1-6 Additional Parking Demands in the City Center after Development

Zone	Land Area of Future Development (ha)		Additional Parking Demands after Development (car)	
	Public Center	Apartment	Weekdays	Weekends
8	6	15	424	221
9	7	24	572	313
10	6	4	275	124
11	17	0	579	231
32	18	0	640	255
33	11	0	369	147
44	2	1	82	35
45	4	4	202	94
50	0	16	222	144
51	2	3	99	50
Total	73	67	3,465	1,614

Source : JICA Study Team



Source : JICA Study Team

Figure 21.1-6 Detached Housing to be Redeveloped in Long - Term

21.2 Improvement Policy for Parking

The JICA Study Team formulated the improvement policy for parking based on **Sub-chapter 21.1**. There are significant numbers of vacant parking lots in the City center, but many cars are parked on streets. Since the existing fee collection system allows non-payment, parking fee is not collected steadily. Since traffic volume will increase with economic development of Kyrgyz Republic, traffic from outside of the City center should be controlled or managed to prevent traffic congestion. To solve these issues the Study formulated following policy:

- ✓ To promote the use of parking in order to reduce the on-street parking
- ✓ To establish a parking fee collection system for collecting from all users
- ✓ To introduce a new parking operation system to control traffic flow in the City center

21.3 Improvement Measures for Parking

The Study proposes following measure for improvement of parking.

Table 21.3-1 Improvement Measures for Parking

Operation	Facility	Legislation
・Parking information and guidance system ・Parking fee collection system ・Parking fee system (pay-for-use by time, different unit price by location) ・Time limits parking	・Construction of parking in the City center ・Construction of parking outside of the City center (Fringe Parking, Park and Ride Parking)	・Parking rule campaign ・Modification of parking operation / fee regulation ・Strict enforcement of penalty for illegal parking ・Modification of technical standard for mandatory parking ・Parking space around car owner house

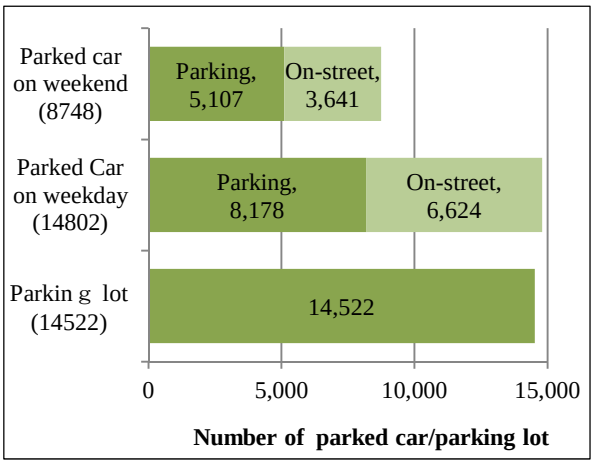
Source : JICA Study Team

21.3.1 Parking Operation

(1) Parking Information and Guidance System

This system is introduced to promote the use of parking properly. There are 14,522 parking lots in the City center and 14,802 cars parked on weekdays and 8,748 cars parked on weekends. There are 6,344 vacant parking lots on weekdays and 9,415 vacant parking lots on weekends. There are many vacant parking lots, but many cars are parked on streets. Therefore, utmost attempts shall be made for proper utilization of the existing parking lot.

Informing parking location and parking occupancy condition to drivers is effective to promote the use of parking.



Source : JICA Study Team

Figure 21.3-1 Number of Parking Lot and Parked Car

(a) Parking Location, Occupancy Condition, Informative Signs or Signage

This traffic sign informs location and occupancy condition of parking to the drivers. Drivers will be able to find vacant parking lots easily. Introducing ITS (Information and Communication Technology) for displaying parking location and occupancy condition information will be appropriate.

(b) Parking Information System

The parking information system is able to provide information of parking locations, parking occupancy conditions, and other parking information for users. The parking occupancy condition is sent to the central computer (server) from each parking area, and parking information are shown on web site. The

parking lot user is able to get parking information in real time by personal computers and mobile phones. Introducing ITS will be appropriate for this type of parking information system.

Source : JICA Study Team

Figure 21.3-2 Image of Parking Location and Occupancy Condition Information Sign

Source : JICA Study Team

Figure 21.3-3 Image of Parking Information System

(2) Parking Fee Collection System

The person in charge of Department of Municipal Parking collects parking fee from users, but the parking fee is not collected steadily, because the existing fee collection system allows non-payment. Therefore, introduction of strict, secure and transparent parking fee collection systems will be appropriate for effective parking fee collection systems.

(a) Pre-paid System

This fee collection system is the same as the mobile phone system in Kyrgyz Republic. Parking users get the card and charge the card with certain amounts. Parking users pay parking fee from the balance available on the card when they use parking. Parking users do not need to use money in cash when they pay parking fees in the parking area.

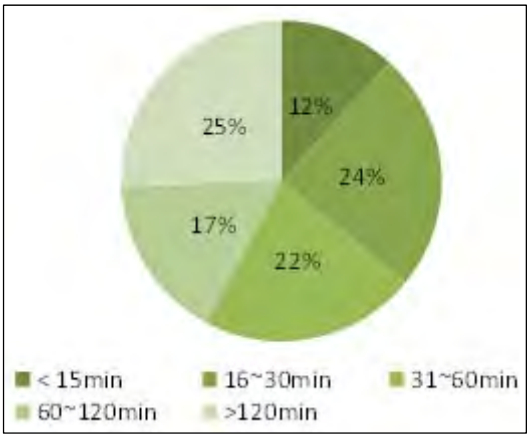
(b) Parking Ticket

This ticket provides authorization to park a car within a regular span of time after parking users pay the parking fee. Parking users get the ticket by money or pre-paid card from automatic ticket vending machines or the person in charge before he or she uses parking. The person in charge checks the ticket, so the ticket should be kept on the dashboard of the car to be able to check from outside of the car. This system is effective for on-street parking, because this system does not need big equipment. Two-thirds of parking in the City center is on-street parking. This system is particularly suitable for Bishkek City. However, the existing traffic legislation should be modified to forbid parking use beyond regular time periods to comply with this system.

(3) Parking Fee System (pay-for-use by time, different unit price by location)

This parking fee system is a tool to diffuse the parked cars around the City center and provide opportunity to park cars in the nearest location. The current fixed parking rate needs to be shifted to a variable rate.

The existing parking fee of municipal parking is set up at 10 SOMS regardless of parking time. The interview survey reveals that approximately 58 percent of cars are parked for less than one hour.



Source : JICA Study Team

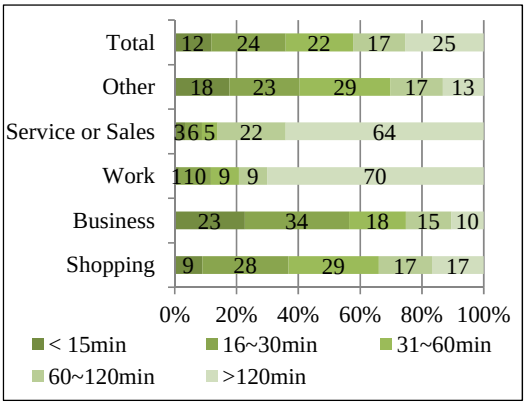
Figure 21.3-4 Parking Time

The Pay-for-use by time parking fee system is effective to provide opportunities to park for as many cars because it is assumed that parking users will be discouraged to use parking for a long time since they have to pay by the duration of parking.

Different unit price by location and time and duration is effective to diffuse parked cars. The parking fee in congested areas and congested time is set up higher than other areas and time. It is believed that as a result of higher unit price, parked cars will be diffused to other areas or time zone from the congested area or time.

(4) Time Limits Parking

To provide opportunity to park for as many cars, this parking system is effective. Parking time limit for each area can be set up to provide opportunities to park for many users because the parking duration is significantly different by trip purpose as revealed by parking survey results (70 percent of parked cars are for Service or Sales and Work trip purpose which are parked for more than 120 minutes, whereas 57 percent of parked cars for Business trip or purposes are parked less than 30 minutes).



Source : JICA Study Team

Figure 21.3-5 Parking Time by Trip Purpose

21.3.2 Parking Facility

If many parking facilities are constructed in the City center, the number of cars parked in the parking area will be increased. With the increase in traffic volume in the City center, traffic congestions will also increase if parking facilities are not constructed to accommodate the increased traffic volume. Therefore, it is necessary to construct at least a minimum number of parking facilities in the City center to accommodate the existing and future estimated traffic. In addition to provision of parking facilities in the City center, some parking facilities shall also be constructed in the outskirts of the City center.

(1) Parking Lots in the City center

Parking lots in traffic Zone 9, 44 and 45 are insufficient on weekends as shown in **Table 21.3-2**. Minimum necessary number of parking lots required is 1,469 lots after adding parking demands calculated in **Sub-chapter 21.1**.

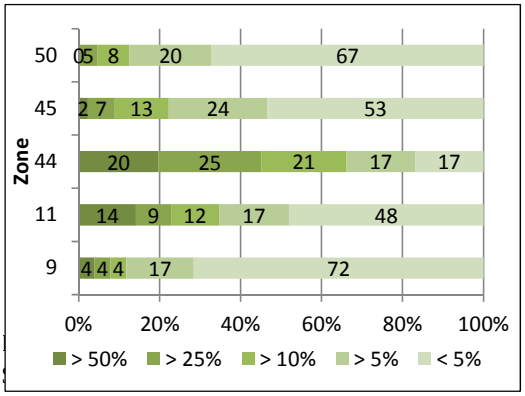


Figure 21.3-6 Parked Car Occupancy Ratio on Road

Table 21.3-2 Shortage Number of Parking Lot on Weekends

Zone	Capacity (parking lot)	On-Street Parking (car)	Additional Demands	Balance (car)
8	628	207	221	200
9	140	223	313	-396
10	708	403	124	181
11	562	818	231	-487
32	1,859	474	255	1,130
33	968	438	147	383
44	393	626	35	-268
45	110	199	94	-183
50	119	110	144	-135
51	762	143	50	569
Total	6,249	3,641	1,614	-1,469

Source : JICA Study Team

Occupancy rate of on-street parking by each street is shown in **Figure 21.3-6**. It shows that Market areas (Zone 44, 11) have many high occupancy rate streets; however, parked cars are dispersed in residential areas. Parking characteristic is different by land use. Therefore, detailed parking survey should be conducted for parking planning.

(2) Parking Outskirts of the City center

It is proposed to construct parking in the outskirts of the City center, to control traffic entering from outside of the City center. If adequate numbers of parking lots are constructed in the City center, most of the vehicles enter into the City center and consequently cause traffic congestion in the City center. Therefore, to control the traffic in the City center, parking lots constructed in the outskirts of the City center (in addition to parking lots constructed in the City center) will be very much effective.

The number of parked cars in the City center on weekdays is larger than on weekends. It is assumed that traffic from outside of the City center on weekdays is larger than on weekends. If traffic flow is not controlled, traffic congestion will occur in the City center on weekdays. To decrease traffic volume in the City center, the use of parking in the outskirts of the City center should be promoted. (See **Table 21.3-3**)

Table 21.3-3 Shortage Number of Parking Lot on Weekdays

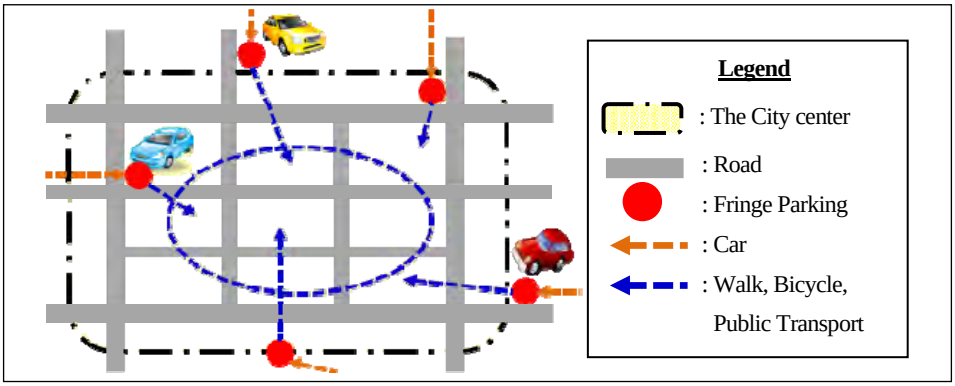
Zone	Capacity (parking lot)	On-Street Parking (car)	Additional Demands	New Constructed Parking in the City Canter (parking lot)	Balance (car)
8	360	488	424	0	-552
9	123	261	572	396	-314
10	519	589	275	0	-345
11	447	991	579	487	-636
32	745	1,958	640	0	-1,853
33	399	996	369	0	-966
44	282	861	82	268	-393
45	100	137	202	183	-56
50	88	108	222	135	-107
51	728	235	99	0	394
Total	3,791	6,624	3,465	1,469	-5,223

Source : JICA Study Team

(a) Fringe Parking

Fringe Parking is a parking that is constructed around fringe areas of the City center to control traffic flow into the City center. Passengers to the City center will go to their own destination by public transportation or bicycle or on foot by parking their cars in Fringe Parking areas. This parking system is able not only to reduce traffic from outside of the City center but also provide parking space to passengers in the outskirts of the City center.

It is proposed to construct fringe parking near the markets or the public transportation stations or terminals in fringe areas of the City center. The site proposed for Fringe Parking is around Chui Market and Jibek-Jolu Avenue in Bishkek City because parking demand in these areas is relatively high in the fringe areas of Bishkek City, as shown in **Figure 21.3-7**.



Source : JICA Study Team

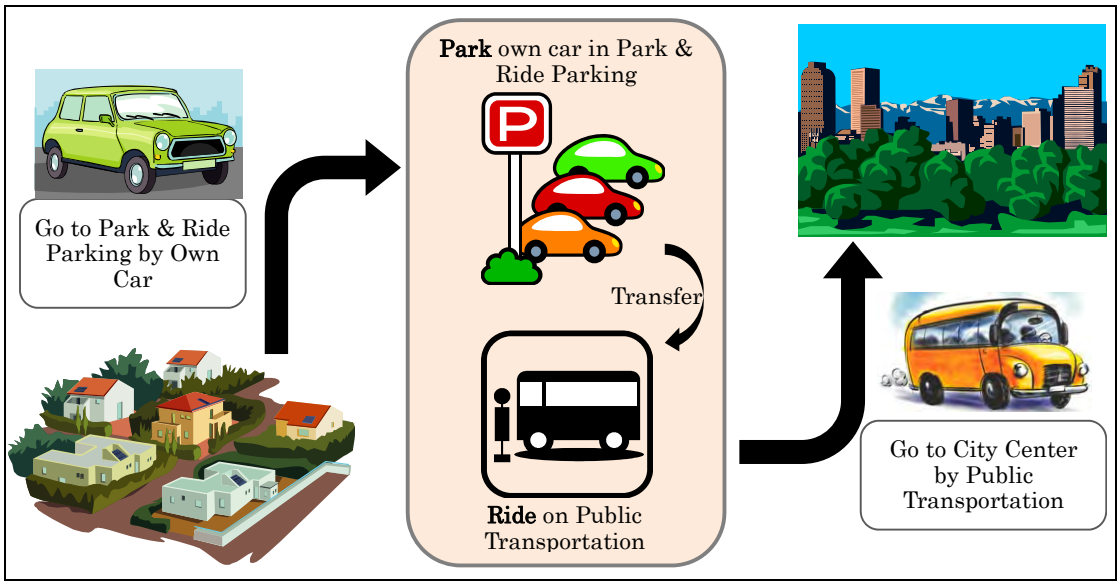
Figure 21.3-7 Image of Fringe Parking

(b) Park and Ride Parking

Park and Ride Parking is a parking where car is parked in the parking area located near public transportation stations or terminals and commuters ride public transport that allows them to travel

into the City center. Therefore, commuters park or leave their vehicles and transfer to a bus, or rail system for the rest of their trip. Park and Ride Parking reduces the vehicle inflow to the City center by transferring to public transport from their vehicles.

The site proposed for Park and Ride Parking is nearby east and west bus terminals in Bishkek City. These sites are proposed because these bus terminals are in outskirts of the City center and many bus passengers and buses go to the City center via these terminals. Park and Ride Parking scheme is illustrated in **Figure 21.3-8**.



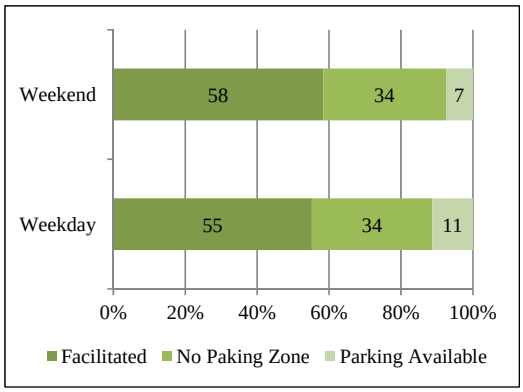
Source : JICA Study Team

Figure 21.3-8 Image of Park and Ride Parking

21.3.3 Parking Legislation

(1) Parking Rule Campaign

The traffic rule campaign is effective to make traffic rules understandable and reduce illegal car parking. Survey results reveals that 34 percent of parked cars use illegal parking Zone in the City center. On-street parked cars obstruct the safe passage of pedestrians and obstruct the path for emergency vehicles, and reducing the traffic capacity. Therefore, making citizens aware of these facts is important for urban transportation management. This campaign can be conducted together with other traffic campaigns such as traffic safety lessons at school and during driving licensure tests.



Source : JICA Study Team

Figure 21.3-9 Location of Parked Car

(2) Modification of Parking Operation / Fee System

Existing parking fee of municipal parking is set up at 10 SOMS regardless of parking time and duration.

This parking fee was set up by decree of Bishkek City Parliament. It is fact that parking problem can be controlled by enforcing parking fees to some extent. Since existing parking fee is very cheap and not controlled strictly, a revision on the fee system is necessary to discourage long duration parking and manage parking facilities properly.

Furthermore, existing legislation for parking does not allow to setting up limited-time parking. Since a time limit parking is effective to provide parking opportunity for many users, existing legislation needs to be revised.

(3) Strict Enforcement of Penalty for Illegal Parking

Many cars are parked in illegal parking Zone despite many vacant parking lots. A fine for the illegal parking is set at relatively low level (300 SOMS). This low fine is insufficient to discourage drivers to park their cars at an illegal parking space. The result of the parking survey reveals that more than 99 percent of respondents expressed that they would not park their cars at any illegal parking space, if the fine will be increased by ten times.

Source : JICA Study Team

Picture 21.3-1 Parked Car in Illegal Parking Zone

Some users do not pay their parking fees and the existing regulation also does not allow the City to impose fine against non-payment users. Therefore, a new / revised regulation with additional provisions is necessary which allows the City to:

- Increase the fine for illegal parking
- Establish the fine for non-payment of parking fee

(4) Modification of Technical Standard for Mandatory Parking by Type of Building

Construction of buildings in the City center is in progress. If many buildings are constructed in the City center, traffic volume and parking demands in the City center will also increase. Therefore, parking space for building customers or residents should be provided within the premises of each building compound to manage the future parking demands.

Source : JICA Study Team

Picture 21.3-2 Parked Cars on Street

Technical standards for mandatory parking by type of building was established in the Soviet era, however this technical standard has already abolished. A new technical standard for mandatory parking by type of building needs to be established.

(5) Parking Space around Car Owner's House

Car owners in the City center use the apartment premises as parking space. If the number of car holder increase, parking space will be insufficient, then car holders will use on street as parking space. It should be mentioned under technical standards to secure a parking space by each car holder to prevent increasing of on-street parked cars.

Source : JICA Study Team

Picture 21.3-3 Parked Cars in the Apartment Premise

21.4 Improvement Project for Parking

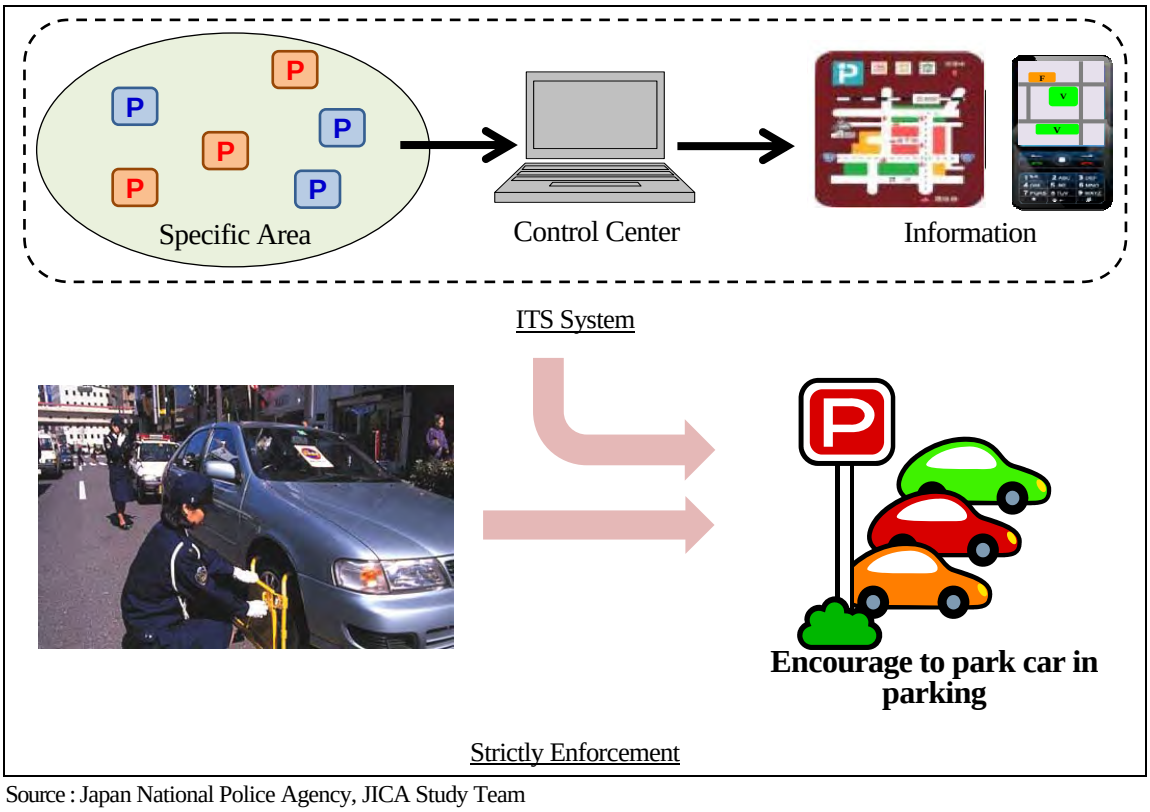
21.4.1 Illegal Parking Prevention at Specific Areas

(1) Objective

The objective is to prevent illegal parking by ITS technology and law enhancement or enforcement.

(2) Background

Although the facilitated parking areas still have remaining capacity, the large number of cars was parked on street. Steps should be taken to encourage drivers to park their cars in the facilitated parking areas. ITS technology and law enhancement or enforcement are effective to prevent illegal parking.



Source : Japan National Police Agency, JICA Study Team

Figure 21.4-1 Illegal Parking Prevention Measures

(3) Contents of the project

(i) Analysis of current status of illegal parking

(ii) Formulate prevention plan of illegal parking

(iii) Support to establish parking lot

(iv) Preparation of pilot project plan

(v) Implementation of pilot project

(vi) Evaluation of pilot project and make necessary recommendation

21.4.2 Introduction of Parking Fee Payment Card

(1) Objective

The objective is to establish secure parking fee collection system.

(2) Background

The person in charge of Department of Municipal Parking collects parking fee from users, but parking fee is not collected steadily, because the existing fee collection system allows non-payment and exemption for, but not limited to, officials and military services. Therefore, introduction of strict, secure and transparent parking fee collection system will be appropriate for effective parking fee collection system. Pre-paid parking system and Parking ticket is are effective parking fee collection system.

Image of Pre-Paid Parking

Parking Ticket Vending Machine

Source : Tokyo Metropolitan Police Department

Figure 21.4-2 Parking Fee Payment Card

(3) Contents of the project

(i) Analysis and planning of suitable parking fee system

(ii) Cost estimation for ICT parking system

(iii) Preparation of pilot project plan

(iv) Implementation of pilot project

(v) Evaluation of pilot project and make necessary recommendation

21.4.3 Integrated Parking Law and Management

(1) Objective

The objective is to revise the parking law and enhance capacity of the organization for parking management.

(2) Background

Many cars are parked in illegal parking Zone despite many vacant parking lots. On-street parked car is obstructing the safe passage of pedestrians and obstructing the path for emergency vehicles, and reducing the traffic capacity. Result of the parking survey reveals that more than 99 percent of respondents expressed that they would not park their cars at any illegal parking space, if the fine will be increased by ten times.

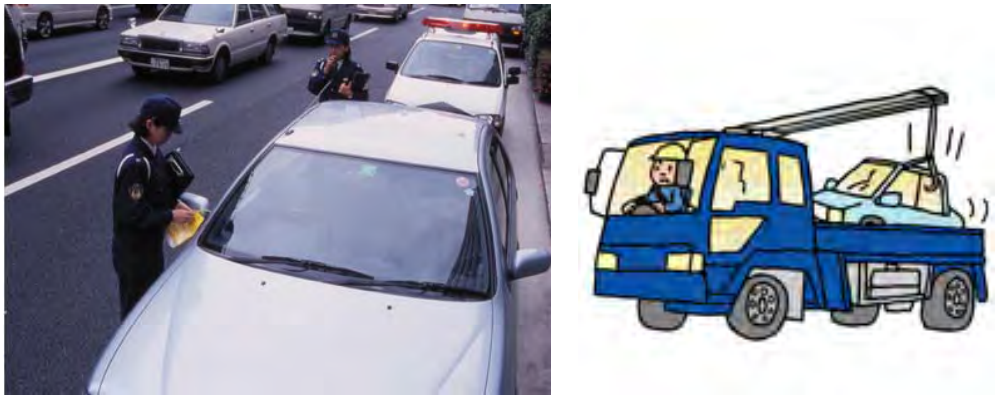


Image of Strictly Enforcement

Source : Japan National Police Agency, Bifuka Police Station of Hokkaido Prefecture Police

Figure 21.4-3 Integrated Parking Law and Management

(3) Contents of the project

(i) Formulation of new parking law framework

(ii) Assistance to establish new parking law

(iii) Assistance to establish management organization for parking

(iv) Assistance to strengthen institutional capacity and human resource development relating to parking management

21.4.4 Parking Facility Construction

(1) Objective

The objective is to introduce parking facility in parking insufficient area by PPP scheme.

(2) Background

If many parking facilities are constructed in the City center, number of cars parked in the parking will be increased. With the increase in traffic volume in the City center, traffic congestion will also increase if parking facilities are not constructed to accommodate the increased traffic volume. Therefore, it is necessary to construct at least minimum number of parking facilities in the City center to accommodate the existing and future estimated traffic. In addition to provision of parking facilities in the City center, some parking facilities shall also be constructed in the outskirts of the City center. It is proposed to construct fringe parking near the markets or the public transportation stations or terminals in fringe area of the City center.

Parking Facility

Source : Airport Environment Improvement Foundation, Oita Prefecture Government

Figure 21.4-4 Parking Facility Construction

(3) Contents of the project

(i) Analysis of parking demands

(ii) Preparation of parking construction plan of the parking facility

(iii) Preparation of operation plan of the parking facility

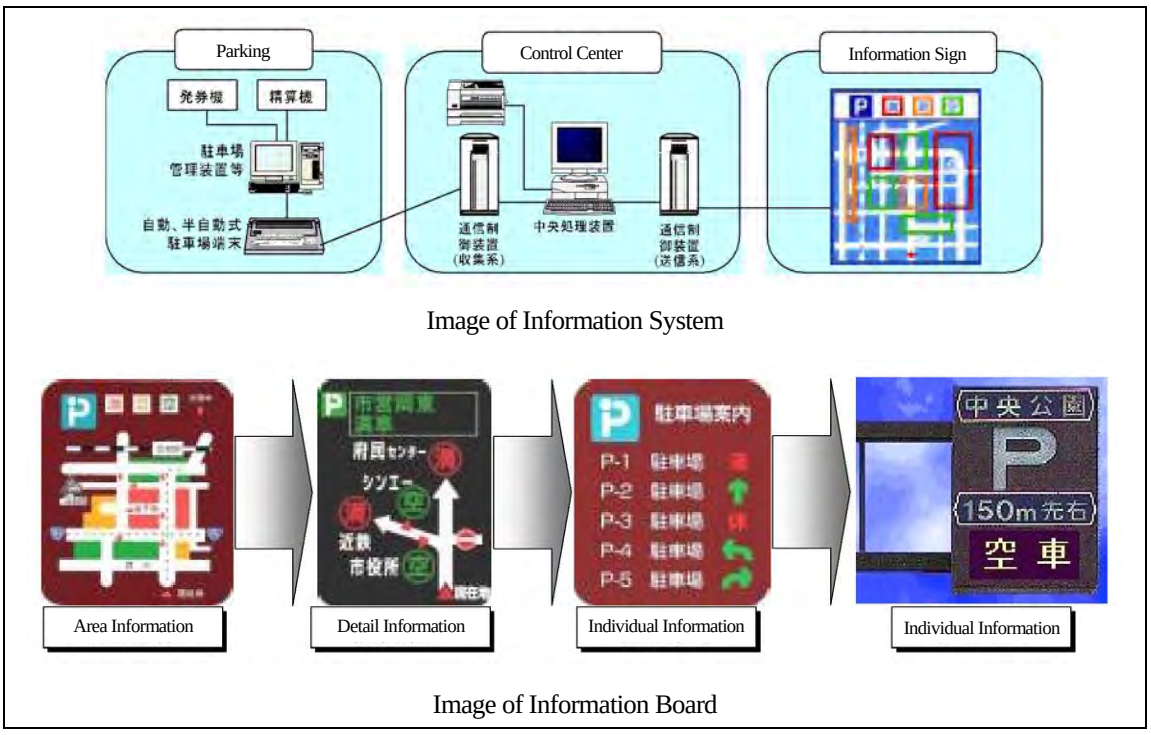
21.4.5 Parking Information System

(1) Objective

The objective is to introduce advance information system on parking by taking advantages of information technology.

(2) Background

Many cars are parked in illegal parking zones in spite of many vacant parking lots. On-street parked cars obstruct the safe passage of pedestrians and obstruct the path for emergency vehicles, and reduce the traffic flow. Therefore, utmost attempts shall be made for proper utilization of the existing parking lot. Informing parking locations and parking occupancy conditions to drivers is effective to promote the use of parking.



Source : Bureau of Urban Development Tokyo Metropolitan Government

Figure 21.4-5 Parking Information System

(3) Contents of the project

(i) Design the parking information system for Bishkek City

(ii) Preparation of plan for parking information system

(iii) Implementation of pilot project

(iv) Evaluation of pilot project and make necessary recommendation

21.4.6 Promotion of Park and Ride Parking

(1) Objective

The objective is to introduce Park and Ride Parking.

(2) Background

If many parking facilities are constructed in the City center, the number of cars parked in the parking will be increased. With the increase in traffic volume in the City center, traffic congestion will also increase if parking facilities are not constructed to accommodate the increased traffic volume. Therefore, it is necessary to construct at least minimum number of parking facilities in the City center to accommodate the existing and future estimated traffic. In addition to provision of parking facilities in the City center, some parking facilities shall also be constructed in the outskirts of the City center. It is proposed to construct Park and Ride Parking near the public transportation stations or terminals in the outskirts of the City center.

Park and Ride Parking in Istanbul

Source : JICA Study Team

Figure 21.4-6 Park and Ride

(3) Contents of the project

(i) Analysis of current practices of parking use

(ii) Selection of location of Pilot Project for Park and Ride Parking

(iii) Design park and ride parking

(iv) Cost estimate for park and ride parking

(v) Preparation of pilot project plan

(vi) Implementation of pilot project

(vii) Evaluation of pilot project and make necessary recommendations

CHAPTER 22 INSTITUTIONAL IMPROVEMENT AND HUMAN RESORUCE DEVELOPMENT PLAN

22.1 Institutional Strengthening and Management Enhancement for Master Plan Implementation

For the Bishkek City to implement the MP effectively, the key is to improve each department capability as well as to develop staffing functions of BCDA, through institutional strengthening and human resource development, for coordination with each agency. The institutional strengthening and human resource development of BCDA consist of enhancing project management, identification, and implementation. It is necessary to provide technical assistance as stated in subsequent sections.

22.2 Bishkek City Urban Transport Management Capacity Development

22.2.1 Needs for Capacity Development in BCDA

To develop the management capability of each department related to urban transportation, technical assistance will be provided to BCDA with institutional strengthening of coordinating and training functions among the city departments.

(1) Capacity of Management and Coordination of International Donors' Project

The purpose is to improve operational capacity as a coordinating agency, for coordination with international donors and management and review of the progress of the assistance projects to be carried out in Bishkek city.

(2) Capacity of Project Formulation and Implementation

The purpose is to improve the capacity for preparation of draft policy and its ordinances required to meet Sustainable Development Strategy of Bishkek city, the related project formulation, and implementation by ensuring the budgets, with a set-up of specialty division in BCDA.

(3) Training Enhancement

The Study conducted workshops for urban planning, public transport policy and environmental issues, seminars of GIS training and traffic analysis software JICA STRADA training together with several pilot projects. BCDA should continue these trainings to administration staff, education institutions, and consultants, and others, to improve technical capability and competence and to extend the results of the pilot project to implement this MP.

22.2.2 Proposed Project Design Matrix

Table 22.2-1 proposes the project for capacity development of BCDA for MP implementation in the project design matrix (draft).

Table 22.2-1 Project Design Matrix of Capacity Development of BCDA for MP Implementation

Project Description	Indicator	Source	Externality
1. Overall Goal: The MP is implemented by the City	(Performance Indicators, its source and each externalities to be worked out)		
2. Project Purpose Priority projects are implemented.			
3. Output: (1) BCDA improved operational capacity,			
(2) BCDA prepared a draft policy and implemented the related project.			
(3) BCDA trained the City departments and other relevant staffs			
4. Activities:	**Input:**		
1.1 To coordinate with international donors 1.2 To manage the projects 1.3 To review the progress of the donor's assisting projects 1.4 To coordinate among the line department of the City	**Experts** a) Transport policy/plan b) Pilot project plan c) Human Resource Development plan d) Public Participation e) Training of GIS f) Training of JICA STRDA g) Public transportation h) Parking i) ITS		
2.1 To prepare a draft policy and ordinances 2.2 To grasp peoples' needs 2.3 To plan the related projects, 2.4 To plan and implement pilot projects, 2.5 To plan and implement pilot projects 2.6 To monitor the pilot project 2.7 To prepare the project report			
3.1 To prepare HRD and training program 3.2 To conduct workshops for MP project implementation 3.3 To conduct seminars of GIS training and traffic analysis software "JICA STRADA" etc. 3.4 To evaluate training results 3.5 To prepare the report of the training results	**Pilot Project** a) Parking system with ITS b) Pedestrian mall event extension		

22.3 Institutional Strengthening of Administration of Public Transportation

22.3.1 Background

(1) Introduction of New Technology

The Study proposes to introduce new technology into public transportation in order to improve its service.

- ICT ticket system for trolleybus fare collection
- Bus operation management and control system with GPS
- Install announcements of bus stops, display inside each bus an advertisement for passenger service and income generation
- Bus location information system for bus users through smart phones

(2) Institutional Reform in Public Transportation in Bishkek City

The Study considers institutional reform by reviewing the current public transportation policies and operation as follows:

- The City will set up a traffic committee consisting of legal staff, city council members, and citizen representatives. The traffic committee will be granted authority to consider and review traffic-related punitive actions and observation of law. (Adoption scheduled for the 24th May.)
- With the increase of trolleybus with EBRD assistance (approximately 150 units), the City will prepare the future plan for expansion of the trolleybus operation routes parallel with excluding minibus service from the center of the City.
- The City will plan to construct car-parking buildings and facilities to absorb the parking demand in the center of the City in order to control roadside illegal parking which prevent smooth operation of bus services.
- The City will review the introduction of new routes between the City center and the suburbs by the city bus.
- The City will introduce a new rule for the bidding of minibus franchise routes due to expire in 2014. The new rule will include obligation to use the bus stop for passenger boarding and alighting, introduction of punitive action to minibus company against violation of safety operation regulations, and in case, as imposing a penalty, to effect the route contract.

22.3.2 Establishment of Organization for Comprehensive Administration of Public Transportation

Currently, Urban Transportation Department of Bishkek City mayor's office (UTD) is responsible for public transportation service. However, it is necessary to enhance its ability by the establishment of an organization which will cover all jurisdiction and mandates relating to the public transportation administration in the future to support the improvement of public transportation for both technical and administrative aspects. To maintain and expand the public transportation system in the future, this organization will cover the following tasks, but not to be limited to:

- Transportation policy for the construction of linkage system and effective sharing of each public transportation mode
- Operation planning of public transportation
- Public transport road-use planning
- Route planning of public transportation
- Traffic data analysis
- Marketing the needs of transportation users
- Safety operation management
- Pricing policy with centralized ICT card system
- Business of facility management of bus stops and bus terminals

In order to carry out tasks of introduction of a new system and improvement of public transportation, the Study suggests establishing a department to carry out research, analysis, planning, plan, implementation for overall public transportation matters, and to manage, regulate and control various transit modes and public transportation companies by studying a model in EU countries.

CHAPTER 23 PILOT PROJECT AND CAPACITY DEVELOPMENT

23.1 Pilot Projects

23.1.1 Background and Objectives

The main purpose of the pilot project is to examine new methods for improving transportation conditions in Bishkek City. It is then expected to subsequently utilize proven methods in order to solve similar issues in the future. It is also expected that all necessary considerations and coordination are clarified and experienced by counterparts through the process of implementing the pilot projects of the Study. These experiences will help them to conduct further projects by themselves.

23.1.2 Contents of Pilot Projects

Four Pilot Projects were selected. Three projects were determined in line with the Transportation MP targets, Traffic Flow Improvement, Traffic Control system Improvement and Public Transport Facility Improvement. Those were conducted at Chui-Fuchik Intersection and nearby. The other project was Pedestrian Mall, which was the first pedestrian mall in Bishkek City. The location was determined at Kievskaya Street.

The traffic flow improvement was implemented twice, in the first phase of the Study in 2011, and the second phase of the Study in 2012. The first one was conducted with road painting and installation of cushion drums. However, it turned out needing further improvement taking into consideration the not-so-moderate driving manners in Bishkek City.

The contents of these Pilot Projects are summarized in **Table 23.1-1**. The outlines of the pilot projects are described in **Table 23.1-2** and **Table 23.1-3**. Further detailed descriptions are given in **Appendix 23-1**.

Table 23.1-1 Summary of Pilot Projects

Section	Main Task	Figure	Period
Traffic Flow Improvement (Pilot Project I)	Improvement of Intersection by Installing of New Road Markings and Road Signs.		September 2011 to October 2011
Traffic Flow Improvement (Pilot Project II)	Construction of Traffic Island in Intersection, Improvement of Side Walk, and Reline Road Markings.		January to October 2012

Section	Main Task	Figure	Period
Traffic Control System Improvement	Installation of Traffic Lanterns, Traffic Detector and Controller		August 2012 to October 2012
Public Transport Facility Improvement	Improvement of Bus Stop and Approach Area, Installation of New Design Bus Shelter, Improvement of Pedestrian Underpass		January to October 2012
Pedestrian Mall	Traffic Safety Awareness and Pedestrian Rights		September 16 2012

Table 23.1-2 Outlines of Pilot Projects

Pilot Project	Description	Volume of Construction
Traffic Flow Improvement (Pilot Project I)	Thermoplastic Road Marking	3,181.75 l.m 345.46 sq.m
	Road Sign and Barrier Traffic Signal Removal and Install	Lump Sum
Traffic Flow Improvement (Pilot Project II)	Traffic Island	65.06 sq.m
	Side Walk	144.52 sq.m
	Drainage	23.0 m
	Road Marking	362.4 sq.m
Traffic Control System Improvement	Supply of Traffic Signal Lanterns & Accessories	6 Aspect 300 dia. Signal : 8 pcs 3 Aspect 200 dia. Signal : 2 pcs 2 Aspect Pedestrian Signal : 12 pcs 3 Aspect 200 dia. Signal : 6 pcs
	Local Controller and Detector	Local controller with coordination function: 2 sets Connection box with voltage limiter: 2 sets Inductive loop vehicle detector: 1 set
	Construction & Mounting of Traffic Signal System	Chui - Fuchik and Intergelpo Intersection
Public Transportation Facilities Improvement	Pedestrian Underpass	43.8 m
	Bus Stop Shelter	1 unit
	Bus Stop Cage Marking	138 sq.m

Table 23.1-3 Summary of Pedestrian Mall

Item	Content
Date and Time	16 September 2012: 10:00 A.M. - 22:00 P.M.
Target Area	Kievskaya Street from Isanova Street to Logvinenko Street
Main Events	The following five events' blocks were prepared at Kievskaya Street and various shops; show, exhibition and workshop were set up during the pedestrian mall. ・Traffic Safety Block ・Sports Block ・Art Block ・Dance Block ・Music Block  **Figure 23.1-1 Poster of Pedestrian Mall**
Main Implementation Body	・Bishkek City Mayor's Office ・Bishkek City Development Agency (BCDA) ・Traffic Police (MOI：Ministry of Interior) ・JICA Study Team

23.1.3 Conclusion

Through the Working Group Meetings for the pilot projects, all necessary works were conducted by counterparts with the assistance of the JICA Study Team. Those works included selection of the site, study on design of improvement, coordination between relevant organizations, approval of the pilot projects, implementation and evaluation. Counterparts recognized that the necessity of preliminary modelling and simulation on proposed improvement to decide proper countermeasures to be taken. BCDA performed as a focal point of coordination between practical implementing organizations such as the Capital Construction Department and Traffic Police Safety Department.

The Pedestrian Mall was a first experience in Kyrgyz and successfully organized by BCDA. An average of around 2,600 people visited the event hourly and expressed appreciation of the event, hoping to continuously conduct the same type of event in Bishkek City. Bishkek City succeeded in getting sponsors for donations to activate the event and compensate the event expenses as some of the sponsors offered sponsorship for similar events. In the standpoint of traffic safety, it is effective to assert and prioritize pedestrian traffic manners by employing a pleasant event and instigate traffic safety awareness. Targetting on priority for children, it is expected to have a spill over effect on their parents, some of them are drivers as well. The event contributed to change the behavior through publicity and education and capacity development

23.1.4 Activities

(1) Seminar and Training in Kyrgyz

The JICA Study Team held Work Shops fifteen times over to confirm the pilot projects, to exhibit the progress of the Study and to explain methodologies of specific subjects. The first and fifth and tenth workgroups were concerning the pilot projects.

To formulate the master plan with a scientific approach, the Geographic Information System (GIS) and the Transportation Demand Forecast are currently indispensable tools. Hence, the JICA Study Team conducted two trainings for GIS and JICA STRADA.

Table 23.1-4 The List of Conducted Main Meeting, Work Shop, Seminar and Training

Activity and Title	Date	Venue	Contents	Number of Participants
1st WG Workshop	3 August 2011	Architecture and Construction Department	Explanation of the JICA Study Activities	18
1st Steering Committee	5 August 2011	Bishkek City Mayor's Office	Explanation of the JICA Study Activities	12
2nd WG Workshop	17 August 2011	BCDA	Intersection Improvement Plan, Simulation of output samples	13
3rd WG Workshop	16 September 2011	BCDA	Introduction of Traffic Survey and Progress of Pilot Project	15
Seminar at University	19 September 2011	Kyrgyz state University of Construction, transport and Communication	Explanation of the JICA Study, EIA in Japan	120
4th WG Workshop	13 October 2011	BCDA	Intersection Improvement Plan, progress of Pilot Project	13
5th WG Workshop	30 November 2011	BCDA	Signal Control and Results of Intersection	11
6th WG Workshop	12 December 2011	BCDA	Explanation of Work Progress of Urban Planning and GIS Related Activities	8
7th WG Workshop	16 December 2011	BCDA	Explanation of Traffic Survey	12
8th WG Workshop	16 December 2011	BCDA	Progress of Urban Planning	9
9th WG Workshop	16 December 2011	BCDA	Overview of GIS	9
2nd Steering Committee	16 February 2012	Bishkek City Mayor's Office	Explanation of Urban Plan, Public Transportation Survey, Pedestrian Mall.	12
10th WG Workshop	4 May, 2012	BCDA	Pilot Project III- Traffic Signal System Improvement Work	7
11th WG Workshop	5 June, 2012	BCDA	Environmental and Social Considerations	9

Activity and Title	Date	Venue	Contents	Number of Participants
12th WG Workshop	28 August 2012	BCDA	Parking Survey Analysis and Public Transportation Survey Results	11
1st training	29 August 2012	BCDA	GIS software operation training	14
13th WG Workshop	6 September 2012	BCDA	Approach of Environment Improvement regarding Traffic on the JICA Study	6
2nd training	1 November	BCDA	Traffic Demand Forecast using JICA STRADA	6
14th WG Workshop	18 April 2013	BCDA	Evaluation of intersection improvement social experiment.	11
15th WG Workshop	30 April, 2013	BCDA	Land Use Management and Public Transportation Improvement Plan	13

(2) Training in Japan

Two training groups were organized to visit Japan to study Japanese urban transportation systems. Each training group consisted of seven to eight members, headed by a Vice -Mayor.

The first training in Japan was conducted for two weeks during 29 January to 11 February 2012 in order to obtain knowledge and information on traffic planning related situations in Japan. In addition to Japan, the training group visited Istanbul, Turkey to review the JICA project on Istanbul Historic District Traffic Demand Management.

The second training in Japan was conducted from 11 to 24 May 2013. The main objective was traffic demand control and discussion on Bishkek Sustainable Development Strategy.

Table 23.1-5 Outline of the Training in Japan

Period	Organizations of Participants	Main Topics	Visited Sites
1st: From 29 January to 11 February, 2012	・First Vice mayor ・Life Infrastructure Department ・Urban Transport Department ・Traffic Safety Department ・Bishkek City Main Department of Architecture & Construction ・BCDA (2 persons)	Citizen's participatory in Urban Planning, Traffic System in Japan, Site visit of Traffic Control Center, Road maintenance in snow, Person Trip Survey, Site Visit of LRT, Urban Transportation Plan in Hiroshima, BRT, Istanbul municipal office traffic control division	Tokyo, Sapporo, Hiroshima, Kyoto, Istanbul
2nd: From 11 to 24 May, 2013	・Second Vice Mayor ・Financial Department ・Urban Transport Department ・Capital Construction ・Traffic Safety Department ・BCDA (2 persons)	Urban planning, Participation of citizen for Urban Planning, Traffic System in Japan, Consideration of ideal urban transportation from the cases of overseas, Discussion of Kyrgyz National sustainable development strategy, TDM in Kanazawa city, Smart city in Toyama, Site Visit of Bus System in Nagoya	Tokyo, Kanazawa, Toyama, Nagoya

23.1.5 Training on Geographic Information System (GIS)

(1) Introduction and Objective

Geographic Information System (GIS) has been emerging as a powerful tool in various fields including transportation planning. In this Study also, GIS has been used for land use analysis and planning, public transportation route analysis and planning, traffic and parking survey analysis, and others. The GIS training was conducted for counterparts to enhance their capacity in using GIS for analysis and planning for improvement of urban transportation system. By familiarizing them about GIS software, various tools can be used for planning purposes and GIS data developed in the Project.

(2) Outline of the Training

Outline of the GIS training is summarized in **Table 23.1-6**. The details of the GIS training are explained in **Appendix 23-2.5.1**.

Table 23.1-6 Outline of GIS Training

Items	Description
1. Trainees	13 trainees from Architectural Department, Capital Construction, Urban Transport Department, and Traffic Safety Department
2. Training Program	- One day training on 29th August, 2012 - Classroom and exercises using ArcGIS
3. Training Materials and Methods	A comprehensive training material was prepared and provided for self-practice and for the future training by trainees. GIS data and maps prepared by the JICA Study Team for the Study were used as much as possible to make counterpart officials familiar with the details of data developed under the Study. A trial version of ArcGIS 10.1 was installed in eight computers of BCDA and all trainees practiced ArcGIS software for analysis, planning and making maps by utilizing GIS and also by creating new GIS data by trainees themselves. 
4. Outcomes of the Training	Trainees were evaluated before and after the training. The result of pre-training evaluation revealed that almost 75% of trainees either do not know or little knows about ArcGIS. Similarly, result of post-training evaluation revealed that 77% of trainees responded that they little know about GIS after the training which was only 15% in pre-training evaluation. Also, all trainees responded that they want to attend GIS training either as OJT or theoretical class or practical classes, etc. in the future too.

23.1.6 Training on JICA STRADA

(1) Introduction and Objectives

JICA STRADA is a package system for transportation demand forecast. The system developed in

cooperation with authoritative Japanese experts from government, academia and private consultants. Since the development, continual upgrading has been conducted and version 3.0 as the newest package for international edition was provided to Bishkek City through the Study. The JICA Study Team conducted future demand forecast using JICA STRADA in this Study and the set of data for demand forecast is transferred to Bishkek City. The data are expected to be utilized as fundamental data for further transportation planning. Thus, counterpart officials of Bishkek City who are in charge of transportation plan should be able to handle the data.

Incidentally, this training gave outline of traffic demand forecast and practices of actual manipulation of JICA STRADA to the counterparts.

(2) Outline of the Training

Outline of the JICA STRADA training is summarized in **Table 23.1-7**. The details of the GIS training are explained in **Appendix 23-2.5.2**.

Table 23.1-7 Outline of JICA STRADA Training

Items	Description
1. Trainees	Participants were average six (6) persons from Urban Transport Department, Bishkek trolleybus Department, Bishkek Passenger Transport Enterprise, and BCDA.
2. Training Program	Training was conducted once on 1st November, 2012. As per request from BCDA, the JICA Study Team conducted follow-up training for two days on 26th and 29th April, 2013.
3. Training Materials and Methods	Training Materials for classroom were prepared and lectured. The training materials included an introduction of transportation demand forecast, an introduction of JICA STRADA, an actual process of modeling using JICA STRADA and exercises of JICA STRADA using computer. 
4. Outcomes of the Training	Through this training, participants learned a concept of traffic demand forecast and experienced actual manipulation of JICA STRADA. However, it requires further training, especially in an OJT manner to fully understand and master the technique of traffic demand forecast using the software.

23.1.7 Conclusion

Through the Study and Trainings, Bishkek City recognized the necessity of upgrading GIS data and OD data for traffic forecast provided by the JICA Study Team, utilizing them for urban city or transportation development. Bishkek City requests further trainings of GIS and Traffic Demand Forecast.

CHAPTER 24 IMPLEMENTATION PROGRAM AND PRIORITY

24.1 Projects for Improvements

24.1.1 Summary of Project

Table 24.1-1 Summary of Proposed Projects by Scope of the Study.

Table 24.1-1 Summary of Projects by the Scope of the Study

Unit : million USD

Improvement plan	Project	Cost
I. Road and maintenance	1. Enhancement of road maintenance and improvement capacity	10.0
	2. Local Road and Pavement Improvement in the Poor Area	15.0
II. Public transportation	3. High occupancy vehicle for minibus	-
	4. Roadside management for bus stops with tax /car parking	0.5
	5. Public transportation management and service improvement	0.9
	6. Bus route network reformation (TA)	0.3
	7. BRT introduction plan	0.5
	8. ICT ticket for trolleybus (on-going with EBRD)	1.0
	9. ICT ticket for all transit modes	1.0
	10. Public transport priority system	1.0
	11. Bus lane for peak hour	0.8
	12. Bus priority signal installation	0.8
	13. Bus operation monitoring system (FS)	0.8
	14. Bus approach information system (FS)	1.0
	15. East and west bus terminal improvement (FS)	1.0
III. Traffic flow improvement	16. Traffic flow improvement at bottleneck intersection	15
IV. Traffic signal control	17. Traffic signal control improvement	15
V. City Parking	18. Illegal parking control at specific areas	0.8
	19. Introduction of parking fee payment card (PPP)	1.0
	20. Integrated parking law and management (TA)	0.3
	21. Parking facility construction (PPP by ADB)	0.6
	22. Parking information system (PPP)	1.0
	23. Promotion of parking and ride (PPP)	1.0
VI. Economic Vitalization	24. Pedestrian mall for vitalization of town's economy	-
	25. Introduction of area traffic management at Dordoi market	2.0
	26.Pilot Project for transit corridor improvement	1.0
	27. Urban section of Bishkek-Osh road improvement	50.0
	28. Police community post for tourism promotion	0.1
VII. EST and Smart City	29. Introduction of bicycle lane for NMT promotion	0.2
	30. Eco-car promotion	1.0
	31. Pedestrian way rehabilitation	1.0
	32. Traffic safety promotion for accident reduction program	1.0
	33. Driving manner improvement program	0.1
	34. "No car day for commuting" program	0.1
	35. Staggered office hours campaign	0.1
VII. Institutional and Capacity Development	36. Capacity Development of BCDA	1.0

24.1.2 Portfolio of Bishkek Urban Transportation Improvement Plan

The Study proposed the projects for road and maintenance improvement plan in **Chapter 18**, public transportation in **Chapter 19**, traffic flow and control system improvement plan in **Chapter 20**, city parking

improvement plan in **Chapter 21**. **Table 24.1-1** summarized the proposed projects in addition to the projects elaborated from BSDS and the results of pilot projects. **Figure 24.1-1** shows the project structure as a portfolio of urban transportation improvement plan.

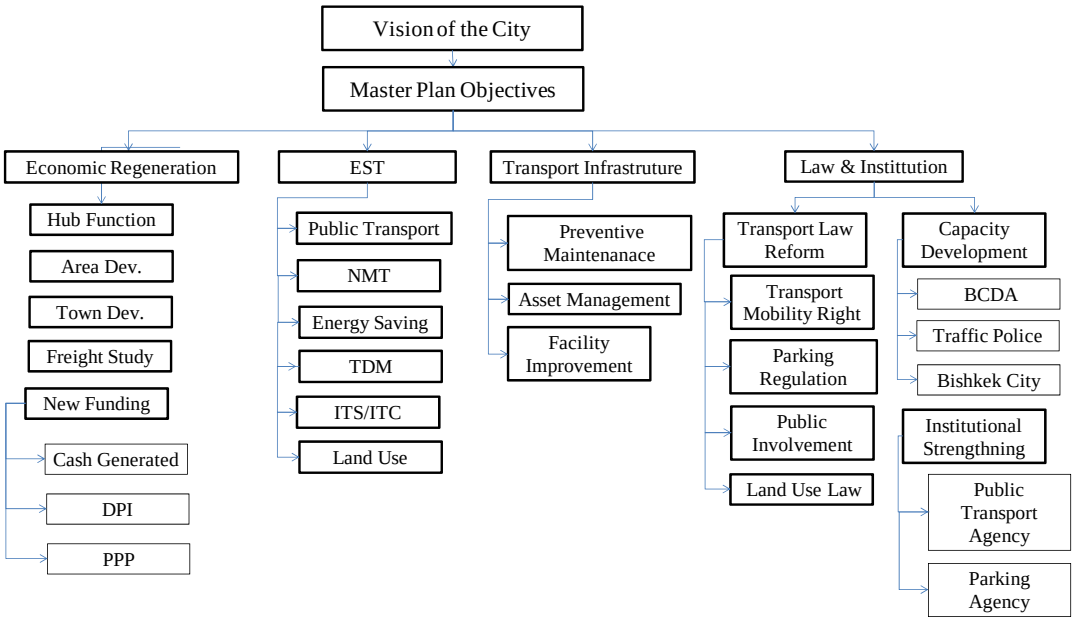


Figure 24.1-1 Portfolio of Bishkek Urban Transport Improvement Plan

24.2 Implementation Approach of the Project Formulation

24.2.1 Planning Principle

The study scope excludes big capital investments such as road development and widening, and other big transport projects that need huge public budgets as well as a long leading time for preparation and environment impact assessment, in case of acquisition of additional road of right of way (ROW). In addition, we consider that funding is a very real constraint, and proposed using the existing road network with bottleneck reduction and through proper management and maintenance in the Master Plan. Only financially viable projects are suggested for candidates in a long termed period and for the future feasibility study.

The Study considers financial constraint and implementing capacity are of very important issues to examine the practicability for immediate solution to traffic problems within 5 to 10 years. EST and preservation of road and transport facility are added. In particular, EST is the principal objective of the National Sustainable Development Strategy (NSDS). The followings are principles to be applied for the project examination.

(a) Financial constraint

(b) Environmentally Sustainable Transportation (EST)

(c) Preventive maintenance of infrastructure of transport

(d) Institutional strengthening and implementing capacity

24.2.2 Financial Constraint

This criterion is coming from funding constraints. The NSDS has directed the funding to be own resource for the policy of sustainability. The City is required to find its own resources.

The City budgets are shown below.

Year	Amount (1,000 SOMS)	Amount 1,000 (USD equivalent)
2011	4,786,161.7	99,712
2012	5,158,265.5	107,464
2013	6,509,218.8	135,608

Note : USD = 48 SOMS
Source : BCDA

In 2012, the City allocated approximately 4.0 million SOMS out of 5.2 million SOMS for social budges of education and health. The total debt of the City is 200 million SOMS for the city midibus procurement by Chinese government. The City should pay this debt and debt of EBRD for trolleybus purchase, together with other accumulated debts. There seems no room to allocate the city budget for development.

Therefore, until the City will be able to receive more tax and state allocated budgets, the Study recommends starting the projects with low requirement of budgets and income and tax generation projects such as parking fee collection, public bus ridership improvement, private sector participation (PPP), prolonged design life of road and transportation facilities, introduction of new maintenance free pavement, economic vitalization of urban center by pedestrian mall, DorDoi market area traffic improvement and so on.

24.2.3 Environmentally Sustainable Transportation (EST)

(1) NSDS and Transportation Policy

The National Sustainable Development Strategy puts the priority for environmental protection to ensure sustainable development. Kyrgyzstan expressed adherence to long-term sustainable development via promotion of green economy[1]. For the transportation sector, we apply Environmentally Sustainable Transportation (EST)[2].

[1] National Council for Sustainable Development of the Kyrgyz Republic, National Development Strategy for the Kyrgyz Republic for the period of 2013-2017 (English version), **Chapter 5**, 2012

[2] EST Strategy is an approach integrating 12 programs; i) public health, ii) road safety and maintenance; iii) traffic noise management; iv) social equity and gender perspectives; v) public transport planning and transport demand management(TDM); vi) non-motorized transport (NMT); vii) environment and people friendly urban infrastructures; viii) cleaner fuels, ix) strengthening road side air quality monitoring and assessment; x) vehicle emission control, standards, and inspection and maintenance (I/M), xi) land use planning, and xii) strengthening knowledge base, and xii) public participation and awareness.

(2) Summary State Policy and EST Approach

Table 24.2-1 Summary of State Policy and Primary Objectives and EST Approach

State Policy	Primary Objectives	EST Approach
A gradual shift to a system of strategic planning of sustainable development	Improvement of legislation for "green" investments and adaptation to climate change	i) Law for tax preference of promoting eco-transportation: public transport and eco-car ii) Introducing CO_2 Credit Mechanism iii) EST promotion iv) Capacity and Human Resource Development v) Creating a system for a polluter pays all social costs in traffic congestions and parking by application of ICT. vi) Tax preference of eco-cars vii) Promotion of use of electricity in public and private transport viii) Promotion of NMT (walking and cyclist) ix) Smart City
Minimization of adverse environmental consequences under economic growth	Ensuring environmental impact assessment	
A fee basis for the use of nature and reimbursement of damages to the environment	Improvement of a system for accounting for, and reporting on environmental pollution	
Accessibility and openness of environmental information	Creation of a sustainable system of environmental control and monitoring and rational nature use	
Participation of all interest groups in decision making on environmental protection and rational use of nature	New financial tools to promote green technologies via green taxes, customs duties, green procurements, and green investments	
	Rational use of renewable natural resources	
	Increase in energy efficiency and reduction of losses	
	State support of sectors of the economy aimed at creating "green" jobs	

Source : NSDS and developed by the Study for EST approach

24.2.4 Preventive Maintenance for Preservation of Road and Transport Assets

The Study considers that the planning principle must be of efficient use of the present transport infrastructures and assets as make best use of existing transport infrastructure and services first[3].

All public transportation vehicle and passenger cars use the current road network. However, the road conditions are getting worse year by year. To preserve the road network conditions, and preventive road and facility maintenance is required.

24.2.5 Institutional Reform and Human Capacity Development Needs

If the project needs an institutional reform with human capacity development, the project requires a preparation period for new legislation and arrangement of the new organization. If the project implementing agency has insufficient capacity, training and new recruitment will be required. These will affect the project practicability. Therefore, the priority will be put on small scale projects which will be implemented in the present authority and its capacity.

[3] Queensland Government, "A guide for transport planning, integrated transport planning framework", p46, 2003.

24.2.6 Land Use and Conditions

For future urban structure, a Compact City (CPC) is proposed. The CPC has merits that are efficient use of public transportation as well as other urban basic utilities, electricity, heat, potable water, and sewerage. This CPC is also applied in General Plan 2006. The Study proposes transit oriented development to promote public transportation with land use.

24.3 Proposed Projects in Urban Transportation Improvement Plan

24.3.1 Effective Use of Transport Network and Infrastructures

Project No. 1	**Enhancement of Road Maintenance and Improvement Capacity**
Project Purpose:	To improve road maintenance capacity of the private contractor
Project Components:	(1) Equipment supply, (2) Financial facilitation for MSE, (3) Capacity development of contract and quality management
Project Cost:	10 million USD (City)
Project Outline:	
The City will carry out the road improvement and road maintenance by using the private contractors following the privatization policy that the Government and ADB/WB promote. Private contractors have down sides although they have good technical capability. The project aims to enhance the private contractor capability for road maintenance through equipment-supply contract, general fund facilitation, together with capacity development of contract management and supervision capacity of the City. The maintenance program with the priority will be prepared by using VIMS for road deterioration ratio.	

Project No. 2	**Local Road Pavement Improvement in the Poor Area**
Project Purpose:	Road and pavement improvement at the new towns
Project Components:	Construction
Project Cost:	15 million USD (estimated temporary for 3 years) (City)
Project Outline:	
The total road length of the City is approximately 1,700 km. Most of the road is paved but in the new town where the relatively poor live, the road is still using gravel. The City intends to improve their quality of life through the road improvement. The Study proposes to introduce Rolled Compact Concrete Pavement (RCCP) taking into consideration of a life cycle cost, of which calculation, an initial cost and maintenance costs during the design life will be added. A pilot project of interlocking pavement with concrete block also will be also introduced as a labor- intensive method to generate employment opportunities. The improvement plan and program will be required for its B/C and priority.	

24.3.2 Public Transportation Improvement

Project No. 3	**High Occupancy Vehicles for Public Transportation Service**
Project Purpose:	To mitigate traffic congestion by improving VCR on the congesting roads by using a high occupancy vehicle for a minibus
Project Components:	Private sector involvement and PPP
Project Cost:	Private Sector
Project Outline:	
The Project will promote to change small size minibus (less 10 passengers) to three big size minibuses (16 passengers) on the City Center roads to reduce the number of minibuses in order to improve VCR. The City will consider tax incentives or other financial support. New HOC minibus will be equipped with bus control system and information system to each bus stop by applying ICT. Integrated public transportation management with ITC (Bus control center) is also proposed.	

Project No. 4	**Roadside Management for Bus Stops with Taxi and Car Parking**
Project Purpose:	To introduce smooth traffic flow and safe bus operation at bus stops and near intersection by controlled parking of bus, taxi, and private car.
Project Components:	Pilot Project and Technical Assistance
Project Cost:	0.5 million USD
Project Outline:	

The project aims to improve roadside parking as Roadside Management at bus stops and intersections, bus users waiting outside of bus stop areas and rush to take the bus. In addition, the drivers do not stop at bus stops. Taxi park also prevent bus operation. Proper roadside management is required. The Project consists of pilot project and technical assistance for capacity building for proper roadside management, with minor facilities improvement. The major activities are:

a) To develop typical street types and their roadsides lane usage
b) To Select a target area for Social experiment on roadside management at bus stops together with taxi and car parking in the City Center
c) To design roadside lane usage in the target area, such as parking, no parking, commercial loading and passenger loading area
d) To implement bus stops upgrading, signal installation and road marking
e) To evaluate the social experiments

Project No. 5	**Public Transportation Management and Service Level (SL) Improvement**
Project Components:	Technical Assistance
Project Cost:	0.9 million USD
Project Purpose:	To improve transportation management ability of Bishkek city and improve public transportation service
Project Outline:	

The project aims to promote a quality approach to transportation operators and focus interest on customers' needs and expectations. Through this project, Bishkek city defines the target and measurements of quality of service in public transportation services, evaluates and check them and improves operation in the PDCA problem solving cycle. The major activities are:

a) Bishkek City defines service level (SL) of public transportation
b) Implement PDCA cycle of public transportation service
c) Public transportation service is improved
d) Define public service indices and their service level
e) Survey present service quality
f) Evaluate service quality and plan improvements
g) Survey improved service quality
h) Evaluate improved service quality

Project No. 6	**Bus Route Network Reformation**
Project Purpose:	To reform public transportation network more efficiently and effectively
Project Components:	Operation and Technical Assistance
Project Cost:	0.3 million USD
Project Outline:	

The project aims to prepare a reformed simple, easy-understanding and less duplicated public transportation network, to create an operation plan in accordance with new bus route network, and improvement of profitability of public transportation sector in total, through stakeholders participation. The major activities are:

a) To define new trolleybus network and operation frequency (Assistance from EBRD),
b) To share the rest of network with the midibus and minibus routes, providing the maximum service to bus users,
c) To minimize the cost for operation and review bus fare and revenues
d) To define public transportation capacity to comply with passenger demand, and
e) To define operation frequency to comply with passenger demand, and
f) To review the privatization policy for public transportation run by the City

Project No. 7	**Bus Rapid Transit (BRT) Introduction**
Project Purpose:	To speed up the bus during peak hour by BRT introduction
Project Components:	Pilot project with TA
Project Cost:	0.5 million USD
Project Outline:	

The project aims to conduct preliminary assessment of introduction of BRT in Bishkek city, to recommend alternatives of BRT network and operation plan, to conduct technical and financial feasibility study on the recommended alternatives, and to implement a pilot project on this alternative route. The major activities are:

a) To establish a BRT framework (political vision, legal basis, project structure, work plan and timetable, budget, analysis and public involvement)
b) To design BRT operation plan (route, transshipment, passenger capacity and customer service plan)
c) To design business structure (private or public organization, institutional structure, operational cost analysis, tariff options and revenue distribution)
d) To design Infrastructure (bus ways, stations, terminals, depots, control center and utilities)
e) To prepare a system design (fare collection system, intelligent transportation system and vehicle)
f) To Estimate construction / operation cost
g) To conduct implementation of the plan as a pilot project and its monitoring

Project No. 8	**ICT Ticket for trolleybus (on-going)**
Project Purpose:	To introduce cashless fare by ICT ticket for trolleybus
Project Components:	PPP introduction study for ICT ticket to trolleybus (EBRD)
Project Cost:	1.0 million USD (EBRD)
Project Outline:	

The project of EBRD is composed of preparation of technical and functional specification of the ICT ticket system for trolleybus, Implementation plan, cost estimates and financial model, tender document for system procurement, and its project evaluation. The major activities are:

a) To develop technical and functional specification system,
b) To develop implementation plan, Estimate cost for system development and create financial model,
c) To prepare tender document,
d) To assist in tender and contract negotiation,
e) To assist in implementation supervision, and
f) To evaluate the project

It is recommend that monitoring and evaluation of the project social impacts through a pilot project for preparation of full-scaled extension.

Project No. 9	**ICT Ticket for All Transit Modes**
Project Purpose:	To extend cashless fare by ICT ticket for all transit modes
Project Components:	Study of extension use of ICT ticket for all transit modes with pilot project
Project Cost:	1.0 million USD for FS and the Pilot Project
Project Outline:	

The project aims to review the ICT ticketing to be introduced by PPP with EBRD assistance and to extend its fare system to all transit modes. The major activities are:

a) Analysis of existing system and current fare system
b) Vision and general principles of electronic ticketing system
c) Recommendation of new fare system
d) Pilot project of ICT ticketing system on midibus and minibus

Activities

1) Analyze existing system and current fare system
2) Develop technical and functional specification system
3) Select target area and/or routes for pilot project of ICT ticketing system
4) Design ICT ticketing system for pilot project
5) Conduct pilot project
6) Evaluate project

Project No. 10	**Public Transport Priority System**
Project Purpose:	To introduce public transportation priority system with ITS technology
Project Components:	Study of PTS system with pilot project
Project Cost:	1.0 million USD for FS
Project Outline:	

The project aims to study introduction of a public transport priority system with Intelligent Transport System (ITS) design, and implement a pilot project with its evaluation. The major activities are:

a) To establish public transport priority framework (political vision, legal basis, project structure, work plan and time table, budget, analysis and public involvement)
b) To design public transport priority system plan (route and reallocation of right of way to public transportation)
c) To design Infrastructure (bus ways, stations, utilities and ITS system)
d) To estimate construction cost for bus priority system
e) To prepare an implementation plan for pilot project
f) To implement a pilot project
g) To evaluate the pilot project and make recommendation

Project No. 11	**Bus Lanes For Peak Hours**
Project Purpose:	To introduce exclusive bus lanes for peak hours
Project Components:	Feasibility study and a pilot project
Project Cost:	0.8 million USD for FS and Pilot Project
Project Outline:	

The project aims to study and implement a pilot project to introduce exclusive lanes for public transportation in peak-hour to avoid traffic congestion in peak hour at critical routes. The major activities are:

a) To establish a public transport priority framework (political vision, legal basis, project structure, work plan and timetable, budget, analysis and public involvement)
b) To select a location of pilot project for exclusive bus lanes for peak ours
c) To design Infrastructure (bus ways, stations, utilities and ITS system)
d) To estimate construction cost for peak our exclusive bus lane system
e) To prepare a plan for a pilot project
f) To Implement the pilot project
g) To evaluate the pilot project impact and make its recommendation

Project No. 12	**Bus Priority Signal Operation**
Project Purpose:	To Introduce bus priority signal with ITS technology
Project Components:	Feasibility Study (FS) and a pilot project
Project Cost:	0.8 million USD for FS and Pilot Project
Project Outline:	

The project aims to study and implement a pilot project to introduce bus priority signal to speed up the bus, in particular, to avoid traffic congestion in peak hour at bottleneck intersections. The major activities are:

a) To establish public transport priority framework (political vision, legal basis, project structure, work plan and timetable, budget, analysis and public involvement)
b) To select a location of pilot project for bus priority signal system
c) To design Infrastructure (correspondence system between bus fleets and signal, and signal control system)
d) To estimate construction cost for bus priority signal system
e) To prepare an implementation plan for a pilot project
f) To implement the pilot project
g) To evaluate pilot project and make recommendation

Project No. 13	**Bus Operation Monitoring and Control System Study**
Project Purpose:	To introduce bus operation monitoring and control system with ITS technology
Project Components:	Feasibility Study (FS)
Project Cost:	0.7 million USD
Project Outline:	

The project aims to establish a comprehensive bus information and control system and to create a central bus control center. The major activities are:

a) To design a comprehensive bus information system (informational contents, information board design of the bus station, correspondence between bus fleets and bus stops and/ or information center, data integration and report format)
b) To design a monitoring system (GPS, correspondence, data integration and reporting format)
c) To design bus information system to mobile phone
d) To implement a pilot project
e) To evaluate pilot project and make its recommendation

Project No. 14	**Bus Approach Information System**
Project Purpose:	To introduce a bus approach information system at bus stops
Project Components:	
Project Cost:	1.0 million USD for FS (Social experiment)
Project Outline:	

The project aims to introduce bus approach information system at important bus stops in order to provide bus approaches to waiting bus users by digital display. The major activities are:

a) To design bus approach information system (informational contents, information board design of the bus station, correspondence between bus fleets and bus stops and/ or information center, data integration and report format)
b) To implement a pilot project
c) To evaluate the pilot project and make its recommendation

Project No. 15	**East and West Bus Terminals Improvement**
Project Purpose:	To rehabilitate the west and east bus terminals for rural and urban traffic interchange by application of PPP schemes
Project Components:	Feasibility Study and Pilot Project
Project Cost:	0.5 million USD for FS
Project Outline:	

The project aims to prepare a rehabilitation plan for west and east bus terminals by introducing PPP funding scheme in order to facilitate interchange of urban and rural bus uses.

a) Service design for bus terminals to attract more users
b) Overview of present condition of west and east bus terminals
c) Service design of new terminals to attract more users such as providing public services at one stop
d) Project cost estimation
e) Economic evaluation and financial analysis
f) Risk management
g) Business plan and project structuring

24.3.3 Traffic Flow Improvement

Project No. 16	**Improvement of Bottlenecked Intersections**
Project Purpose:	To improve the smoothness of traffic flow at traffic bottlenecks to mitigate traffic congestions
Project Components:	Design and Civil Work
Project Cost:	15 million USD
Project Outline:	
The project aims to improve bottleneck intersection for traffic flow smoothness based on the results of the pilot project at Chui-Fuchika intersection that the Study conducted. The preliminary survey was carried out for 28 intersections according to the City request.	

24.3.4 Traffic Signal Control Improvement

Project No. 17	**Traffic Signal Control Improvement**
Project Purpose:	To improve traffic signal for smoothness of traffic flow to mitigate traffic congestions and traffic safety
Project Components:	Design and Civil Work
Project Cost:	15 million USD
Project Outline:	
The Project will improve and renew the old traffic signal system in the center of Bishkek, where traffic congestion gets worse, together with intersection improvement under the Project 3. The latest new ITS technology and equipment including traffic detectors and control system (central or coordinating) are also considered. New technology from overseas.	

24.3.5 City Parking Improvement

Project No. 18	**Illegal Parking Control at Specific Areas**
Project Purpose:	To control and prevent illegal parking by ITS technology and law enhancement
Project Components:	Feasibility Study and Pilot Project
Project Cost:	0.8 million USD for FS (Social experiment)
Project Outline:	

The parking management aims to restrict illegal or uncontrolled car parking. The current parking situation worsens the traffic flow and causes traffic accidents. The City and ADB consider parking system improvement is emergent issues due to rapid increase in the private cars use. The JICA Study Team conducted surveys for parking supply capacity and its demand and planed a parking system improvement. This scope will develop for a total parking system, including creating a new parking agency to deal with all private car parking in the City, IT parking system, parking facilities construction by PPP, which is being promoted with ADB and the City, and Park and Ride with public transport as proposed projects.

The Project aims to manage and control to reduce illegal parking cars. The major activities are ;

a) To conduct analysis of existing state of illegal parking
b) To establish prevention plan for illegal parking
c) To apply a new parking control law
d) To make a plan for a pilot project
e) To implement the pilot project
f) To evaluate the pilot project and make its recommendation

Project No. 19	**Cashless Parking Payment System introduction**
Project Purpose:	To establish a secure parking fee collection system
Project Components:	Feasibility Study and Pilot Project
Project Cost:	1.0 million USD for FS (Social experiment)
Project Outline:	

The Project aims to introduce prepaid card for parking fee to establish a secure system for parking fee collection. The major activities are:

a) To establish new parking fee and fee collection system
b) To introduce cashless parking by prepaid cards
c) To conduct analysis and planning of suitable parking fee
d) To make cost estimation for the ITC parking system
e) To prepare a plan for the pilot project
f) To implement the pilot project
g) To evaluate the pilot project and make its recommendation

Project No. 20	**Integrated Parking Law and Management**
Project Purpose:	To conduct parking law revision and organizational reform for parking management
Project Components:	Technical Assistance
Project Cost:	0.3 million USD
Project Outline:	

The project aims to establish an integrated parking law and management together with organizational reform of parking management and its human resource capacity development. The major activities are:

a) To establish a new parking law framework
b) To assist in establishing a new parking law
c) To assist to establish an integrated management organization for parking
d) To assist to strengthen institutional capacity and develop human resource relating to parking car management

Project No. 21	**Parking Facility Construction and Management**
Project Purpose:	To construct parking facilities in urban center by PPP scheme
Project Components:	FS for Introduction of PPP for parking facility construction and management
Project Cost:	0.6 million USD for FS
Project Outline:	

The project aims to study the FS for the introduction of PPP for parking facility construction and management. The major activities are:

a) To conduct analysis of parking demand
b) To make a parking construction plan for the parking facility
c) To make an operational plan for the parking facility
d) To assess its feasibility
e) To prepare PPP funding scheme

Project No. 22	**Parking Information System**
Project Purpose:	To Introduce a parking information system
Project Components:	Feasibility Study and Pilot Project
Project Cost:	1.0 million USD for FS and Pilot Project
Project Outline:	

The plan is to introduce park and ride system at the fringe of the City. The major activities are:

a) To conduct analysis of car parking use
b) To select the location of pilot project for Park and Ride Parking
c) To design the Park and Ride Parking
d) To estimate costs for Park and Ride Parking
e) To make the plan for the pilot project
f) To implement the pilot project
g) To evaluate pilot project and make recommendation

Project No. 23	**Park and Ride Promotion**
Project Purpose:	To introduce park and ride parking at trolleybus terminals by PPP
Project Components:	FS and Pilot Project for PPP
Project Cost:	1.0 million USD for FS (Social experiment)
Project Outline:	

The project aims to introduce Park and Ride Parking at the fringe of urban areas for PPP. The major activities are:

a) To select the location of pilot project for Park and Ride Parking
b) To design the Park and Ride Parking
c) To estimate costs for Park and Ride Parking
d) To make the plan for a pilot project
e) To implement the pilot project
f) To evaluate the pilot project and make recommendation for PPP

24.3.6 Economic Vitalization with EST and Smart City

Project No. 24	**Pedestrian Mall Extension**
Project Purpose:	To extend results and learning of the pilot project of pedestrian paradise in Kiefskaya Street to the CBD
Project Components:	Implementation by PPP
Project Cost:	Cash generation by sponsors
Project Outline:	

The town revitalization by transport is planned based on successful results in social experiments of Pedestrian Mall at Kiefskaya Street. The plan aims to reactivate and renovate the shopping streets in the central areas, where they are losing attraction of consumers, by gathering people for particular organized events with target of awareness of street for people, ecological campaign and traffic safety, exclusively by walk without any motorized vehicles. This scope developed, by the citizen initiative, to organize city gathering for education with Otombaef Foundation, and the City intends to hold a pedestrian mall every year. This scope also promotes Unity of the citizen which is one of the important issues in NSDS.

The project aims to extend the results of the pilot project of Pedestrian Paradise at Kiegfskaya Street to city shopping and commercial areas for its revitalization in other three districts. The project cost will be covered by sponsors of the private sectors. The major activities are:

a) To select the date and location of the project for a pedestrian mall with the community
b) To plan the events of the pedestrian mall with sponsors
c) To coordinate its preparation and implementation with relevant city departments
d) To implement the project
e) To evaluate the project and make recommendation for the next events

Project No. 25	**Introduction of Area Traffic Management at Dordoi Market**
Project Purpose:	To mitigate the traffic congestions in the area of Dordoi Market by introducing area-wide traffic management including public transportation with park and ride, parking control, one-way routes, road improvement and a pilot project.
Project Components:	FS and Pilot Project
Project Cost:	2.0 million USD
Project Outline:	

The project aims to conduct FS and a pilot project in order to mitigate the traffic congestions at Dordoi market by introducing area-wide traffic management, which will include coordination of public bus uses and car use control by park and ride, one way route setting, road improvement for NMT. FS also will include a logistic study and future perspective of Dordoi market in the Central Asia.

The major activities are:

a) To define the area and scopes to be studied
b) To plan the TOR for FS
c) To conduct traffic surveys including logistics and freight transportation
d) To prepare the plan for the pilot project
e) To coordinate its preparation and implementation with the stakeholders
f) To implement the pilot project and FS
g) To evaluate the pilot project and make recommendation for the next events

Project No. 26	**Pilot Project for Transit Corridor Improvement**
Project Purpose:	To increase VCR though the transit corridor by improvement of traffic flow smoothness improvement, where the traffic congestion is anticipated to worsen within 5 to 10 years
Project Components:	FS and pilot project for traffic control and management
Project Cost:	1.0 million USD
Project Outline:	

The project aims to reduce the traffic demand and promote the smooth flow of public transportation. The FS will include travel demand management to restrict road-side parking, and passenger car use, park-and ride, time of a day control etc. The major activities are:

a) To define the corridor and scopes to be studied
b) To conduct traffic and conditions survey on the corridor including roadsides parking, bus stops and pavement conditions
c) To prepare the plan for the pilot project
d) To coordinate its preparation and implementation with the stakeholders
e) To implement the pilot project and FS
f) To evaluate the pilot project and make recommendation for the next events

Project No. 27	**Urban Section of Bishkek-Osh Road: Traffic Congestion Improvement**
Project Purpose:	Road Design and Construction Project
Project Components:	Pilot project and Human Resource Development of Traffic Police
Project Cost:	50 million USD: State Budget
Project Outline:	

The Project aims at improvement of M39 highway of Bishkek-Osh Road with widening the section from KARABALTA to SHPOKOF four (4) -lane from the existing two (2) -lane, with providing pedestrian ways and cyclist ways for road safety, to be separated by green belt. The design will cover all a 43 km long of road, but construction will be at staging according to financial affordability and traffic conditions. This will include intersection improvements and all works are to be within Right of Way (ROW), so no substantial EIA required. The pavement should be applied concrete pavement for maintenance-free. Sound feasibility study is required taken into consideration of a life cycle cost.

Project No. 28	**Police Community Post for Tourism Promotions**
Project Purpose:	To secure the safety of the city and to promote tourism for providing the city information to tourist
Project Components:	Pilot project for installation of a police community post (KOBAN in JAPAN)
Project Cost:	0.1 million USD
Project Outline:	

The project aims to install police community posts at the City Center where the tourists visit frequently in order to secure the safety and to promote the tourism. The major activities are:

a) To define the location of installation of police community post with stakeholders of community
b) To conduct a public campaign for the citizen and the tourists
c) To prepare the plan for the project
d) To coordinate its preparation and implementation with the stakeholders
e) To install the police community posts
f) To evaluate the project and make recommendation

24.3.7 EST and Smart City

Project No. 29	**Introduction of Bicycle Lane**
Project Purpose:	To prepare a bicycle lane to promote NMT use from car use
Project Components:	Pilot project for installation of bicycle lane
Project Cost:	0.2 million USD
Project Outline:	

The project aims to install bicycle lanes for promotion of Non-Motorized Transport (NMT) in order to promote modal share from car use. The major activities are:

a) To define the location of installation of bicycle lanes
b) To conduct a public campaign for the new bicycle lanes
c) To prepare the plan for the pilot project
d) To coordinate its preparation and implementation with the traffic police and relevant authorities
e) To install the bicycle lane as a pilot project
f) To evaluate the pilot project and make recommendation

Project No. 30	**Eco-Car Promotion**
Project Purpose:	To promote electric and hybrid car in order to reduce emission of CO_2 and to reduce import of carbon fuels in the Smart City concept
Project Components:	Pilot project for eco-car use
Project Cost:	1.0 mil lion USD
Project Outline:	

The project aims to promote the use of an electric car and a hybrid car of which the engine is combined with electric batteries and a combustion engine, in order to reduce emission of CO_2 and to use hydric-electricity instead of imported petrol. The first provision of eco-car is for the traffic police and city administration. The major activities are:

a) To define the policy of eco-car use
b) To prepare promotion tax or incentives for eco-car use
c) To prepare the plan for the pilot project
d) To coordinate its preparation and implementation with the relevant authorities
e) To study BOCM (Bilateral Offset Credit Mechanism) under COP framework
f) To evaluate the pilot project and make recommendation

Project No. 31	**Pedestrian Way Rehabilitation with Canal Improvement**
Project Purpose:	To improve of walking mobility and to introduce universal design for the aged and the disabled
Project Components:	Study and pilot project for rehabilitation of pedestrian way in the city
Project Cost:	1.0 million USD
Project Outline:	

The project aims to rehabilitate the pavement of pedestrian way in order to improve mobility of walk. The City has separated pedestrian way having the total length of approximately 2,600 m-long. The pavement of narrow pedestrian way having 1.0 to 1.5 m width are mostly damaged due to a lack of maintenance comparing to the carriage way. The walking of these conditions becomes seriously difficult for the pedestrian, in particular, for the aged, the disable, and the traffic vulnerable. It causes traffic injures and poor mobility for the pedestrian. The project will rehabilitate the pavement of pedestrian ways and apply a concept of universal design to prevent obstructs for walking for all, which the pilot project applied for the improvement of Chui-Fuchika intersection. In addition, along the pedestrian way, the project will improve the existing irrigation ditch system for the tree with clean water stream and widening for water stagnation for small canal and pond for the citizen in order to mitigate temperature in summer and to enjoy the water for children as a pilot project. The major activities are:

To survey the pedestrian way conditions

a) To survey irrigation ditch system and its conditions
b) To prepare a rehabilitation plan
c) To prepare the plan for the pilot project
d) To coordinate its preparation and implementation with the relevant authorities
e) To implement a pilot project
f) To evaluate the pilot project and make recommendation

Project No. 32	**Traffic Safety Promotion for Accident Reduction Program**
Project Purpose:	To reduce traffic accident at the back spots analysis and HRD of traffic police (on-going by Organization for Security and Co-operation in Europe: OSCE)
Project Components:	Pilot project and Human Resource Development of Traffic Police
Project Cost:	1.0 million USD
Project Outline:	

The project aims to reduce the traffic accidents at the black spots where traffic accidents frequently occur by strengthening the capacity of traffic police by introducing a scientific way of analysis of cause of traffic accidents and mitigation measures. The major activities are:

a) To define the “black spot” location
b) To survey and record the traffic accident situations and conditions with GPS, GIS, measurement tools, and standards recording book (OSCE)
c) To collect and analyze the traffic accident causes
d) To prepare mitigation measure with the relevant authorities
e) To prepare a physical improvement plan
f) To prepare the plan for the pilot project
g) To coordinate its preparation and implementation with the relevant authorities
h) To implement a pilot project
i) To evaluate the pilot project and make recommendation

Project No. 33	**Driving Manner Improvement Program**
Project Purpose:	To reduce traffic accident by education to the car drivers with introduction Eco-drive of Japan for safety and fuel saving drive
Project Components:	Pilot project and Human Resource Development of Traffic Police
Project Cost:	0.1 million USD with Sponsors' funding
Project Outline:	

The project aims to re-educate car drivers with “eco-driving” to reduce the traffic accidents and save the fuel consumption for EST. The major activities are:

a) To prepare a campaign plan for eco-drive promotion with all stakeholders
b) To coordinate its preparation and implementation with the relevant authorities
c) To implement a pilot project
d) To evaluate the pilot project and make recommendation

Project No. 34	**"No Car Day for Commuting" Program**
Project Purpose:	To introduce no-car day for commuting to promote public transportation use
Project Components:	Pilot project
Project Cost:	0.1 million USD with Sponsors' funding
Project Outline:	

The project aims to promote the citizen awareness for using public transportation for commuting, and to facilitate to use NMT instead of the private car use. The major activities are;

a) To define the day and the target area of no-car use
b) To prepare the plan for the pilot project
c) To coordinate its preparation and implementation with the relevant authorities
d) To implement a pilot project
e) To evaluate the pilot project and make recommendation

Project No. 35	**Staggered Office Hours Campaign**
Project Purpose:	To reduce traffic congestions by spreading the starts of office time during the peak hours
Project Components:	Pilot project
Project Cost:	0.1 million USD with Sponsors' fund
Project Outline:	

The project aims to mitigate the traffic congestions and to average the public transportation use concentrating during peak hour by introducing staggered office working hours to some offices. The major activities are:

a) To define the day and the target area of Staggered Office Hours campaign
b) To prepare the plan for the pilot project
c) To coordinate its preparation and implementation with the relevant authorities
d) To implement a pilot project
e) To evaluate the pilot project and make recommendation

24.3.8 Law Enhancement and Institutional Strengthening

Project No. 36	**Capacity Development of BCDA and the City with training of town traffic management and development**
Project Purpose:	To develop capacity of management and coordination of BCDA for urban transport planning and relevant technologies, and through BCDA to provide training to the City officers and traffic police
Project Components:	Technical Assistance
Project Cost:	1.0 million USD
Project Outline:	
The project aims to provide technical assistance for implementation of the master plan to BCDA and the city relevant department staff in order to ensure continuity of the results of training during the Study. The major activities are: a) To define PDM for technical assistance b) To prepare the plan for the pilot project c) To coordinate its preparation and implementation with the relevant authorities d) To implement technical assistance with a pilot project e) To evaluate the pilot project and make recommendation	

24.3.9 Long Termed Projects

The following projects are proposed for the long termed project. All proposed projects require the project preparation study.

Project Tittle	Contents
LRT introduction plan	Introduction of LRT on major corridors
Urban train plan	Renovation of existing rail way for urban commuter trains
Train station elevation plan	Connection of divided areas by the present railway
Northern highway bypass construction	Distribution of entering traffic from rural roads; Introduction of tool system with ITS of Japan
Intensive use of old factory areas	Development of the old factory area with concept of compacts and eco-city

24.4 Examination of the Priority

24.4.1 Examination Criteria

Table 24.4-1 shows examination criteria with indicators. The six criteria are considered; i) finance examining for budget constraints, ii) implementation capacity for relevant departments and authority, iii) EST for sustainability, iv) effectiveness for policy relevancy to upper strategies and policies such as NSDS and BCDS, v) efficiency for output or outcome ratio per input, and vi) impact for requirement of EIA for negative environmental impacts. Each criterion has weighting share according to its comparative importance among total policy considerations, and indicator has examination point for one to three. Total examination points for each project are multiplies by weighting share in order to calculate a total point for each project for its priority. **Table 24.4-2** summarizes results of examination and its order.

Table 24.4-1 Examination Criteria

Criteria	Weight	Performance Indicators						
	Max pts.	Indicator	Item	Pts.	Item	Pts.	Item	Pts.
1.Finance	30%	Amount of investment	Low	3	Medium	2	High	1
	1.8	Funding scheme	Private	3	PPP	2	Public	1
2.Capacity	20%	Ability of implementation	High	3	Medium	2	Low	1
	1.2	Institutional preparedness	No	3	Less	2	Reform	1
3.EST	20%	CO_2 reduction	High	3	Medium	2	Low	1
	1.2	Reduction amount	High	3	Medium	2	Low	1
4.Effective	10%	Direction of NSBS/BSDC	High	3	Medium	2	Low	1
	0.6	Master plan direction	High	3	Medium	2	Low	1
5.Efficiency	10%	Output/input	High	3	Medium	2	Low	1
	0.6	Outcome/input	High	3	Medium	2	Low	1
6.Impact	10%	EIA requirement	No	3	IEE	2	Yes	1
	0.6	-	-	-	-	-	-	-
Total	100%	-	-	-	-	-	-	-
	6.0	-	-	-	-	-	-	-

Note : IEE : Initial Environment Examination

Source : JICA Study Team

Table 24.4-2 Results of Examination and its Priority

Proposed Project	Fin			Cap			EST			Eefective			Eficiency			Imp		Total	Priotity
1. Enhancement of road maintenance and improvement capacity	3	1	1.2	3	3	1.2	3	2	1	3	3	0.6	3	3	0.6	3	0.3	4.9	2
2. Local Road and Pavement Improvement in the Poor Area	1	1	0.6	3	3	1.2	2	1	0.6	3	3	0.6	3	3	0.6	3	0.3	3.9	25
3.High occupancy vehicle for mini bus	3	3	1.8	2	2	0.8	3	3	1.2	3	3	0.6	3	3	0.6	3	0.3	5.3	1
4.Roadside (Kerb) management for bus stops with tax and car parking	3	1	1.2	3	3	1.2	2	1	0.6	3	3	0.6	3	3	0.6	2	0.2	4.4	11
5.Public transportation management and service level improvement (TA)	1	1	0.6	3	3	1.2	1	1	0.4	3	3	0.6	3	3	0.6	3	0.3	3.7	31
6.Bus route network reformation	3	1	1.2	3	3	1.2	1	1	0.4	3	3	0.6	3	3	0.6	2	0.2	4.2	19
7.BRT introduction plan	2	1	0.9	2	2	0.8	3	2	1	3	3	0.6	3	3	0.6	3	0.3	4.2	19
8.ICT ticket for trolley bus (on-going with EBRD)	1	2	0.9	3	3	1.2	1	1	0.4	3	3	0.6	3	3	0.6	1	0.1	3.8	29
9.ICT ticket for all transit modes	1	2	0.9	3	3	1.2	1	1	0.4	3	3	0.6	3	3	0.6	1	0.1	3.8	29
10.Public transport priority system	2	1	0.9	3	3	1.2	3	2	1	3	3	0.6	3	3	0.6	2	0.2	4.5	9
11.Bus lane for peak hour	2	1	0.9	3	3	1.2	3	2	1	3	3	0.6	3	3	0.6	2	0.2	4.5	9
12.Bus priority signal installation	2	1	0.9	3	3	1.2	3	1	0.8	3	3	0.6	3	3	0.6	2	0.2	4.3	14
13.Bus operation monitoring system	1	1	0.6	2	2	0.8	3	3	1.2	3	3	0.6	3	3	0.6	3	0.3	4.1	21
14.Bus approach information system	2	2	1.2	2	2	0.8	2	1	0.6	3	3	0.6	3	3	0.6	3	0.3	4.1	21
15. East and west bus terminal improvement (PPP)	3	2	1.5	3	3	1.2	1	1	0.4	3	3	0.6	3	3	0.6	3	0.3	4.6	7
16. Traffic flow improvement at bottleneck intersection	2	1	0.9	3	3	1.2	2	2	0.8	3	3	0.6	3	3	0.6	3	0.3	4.4	11
17. Traffic signal control improvement	2	1	0.9	3	3	1.2	2	2	0.8	3	3	0.6	3	3	0.6	3	0.3	4.4	11
18. Illegal parking control at specific areas	3	1	1.2	1	1	0.4	1	1	0.4	3	3	0.6	3	3	0.6	1	0.1	3.3	35
19. Introduction of parking fee payment card (PPP)	3	2	1.5	1	1	0.4	1	1	0.4	3	3	0.6	3	3	0.6	1	0.1	3.6	33
20. Integrated parking law and management	3	1	1.2	1	1	0.4	1	1	0.4	3	3	0.6	3	3	0.6	1	0.1	3.3	35
21. Parking facility construction (PPP by ADB)	3	2	1.5	1	1	0.4	1	1	0.4	3	3	0.6	3	3	0.6	1	0.1	3.6	33
22. Parking information system (PPP)	3	2	1.5	1	1	0.4	2	1	0.6	3	3	0.6	3	3	0.6	3	0.3	4.0	24
23. Promotion of parking and ride (PPP)	3	2	1.5	1	1	0.4	2	1	0.6	3	3	0.6	3	3	0.6	2	0.2	3.9	25
24. Pedestrian mall for vitalization of town economy	3	3	1.8	3	3	1.2	1	1	0.4	3	3	0.6	3	3	0.6	3	0.3	4.9	2
25. Introduction of area traffic management at Dordoi market	3	1	1.2	2	2	0.8	3	1	0.8	3	3	0.6	3	3	0.6	1	0.1	4.1	21
26.Pilot Project for transit corridors improvement	2	1	0.9	2	2	0.8	3	3	1.2	3	3	0.6	3	3	0.6	2	0.2	4.3	14
27. Urban Section of Bishkek-Osh Road: Traffic congestion improvement	1	1	0.6	3	3	1.2	2	2	0.8	3	3	0.6	3	3	0.6	1	0.1	3.9	25
28. Police community post for tourism promotion	3	1	1.2	3	3	1.2	1	1	0.4	3	3	0.6	3	3	0.6	3	0.3	4.3	14
29. Introduction of bicycle lane for NMT promotion	2	1	0.9	1	1	0.4	3	2	1	3	3	0.6	3	3	0.6	2	0.2	3.7	31
30. Eco-car promotion	3	3	1.8	1	1	0.4	3	3	1.2	3	3	0.6	3	3	0.6	3	0.3	4.9	2
31. Pedestrian way rehabilitation	2	1	0.9	3	3	1.2	3	3	1.2	3	3	0.6	3	3	0.6	3	0.3	4.8	5
32. Traffic safety promotion for accident reduction program	3	1	1.2	2	2	0.8	1	1	0.4	3	3	0.6	3	3	0.6	3	0.3	3.9	25
33. Driving manner improvement program	3	3	1.8	2	2	0.8	1	1	0.4	3	3	0.6	2	2	0.4	3	0.3	4.3	14
34. "No car day for commuting" program	3	3	1.8	1	1	0.4	3	3	1.2	3	3	0.6	3	3	0.6	1	0.1	4.7	6
35. Staggered office hours campaign	3	3	1.8	1	1	0.4	2	2	0.8	3	3	0.6	2	2	0.4	3	0.3	4.3	14
36. Capacity Development of BCDA	3	2	1.5	3	3	1.2	1	1	0.4	3	3	0.6	3	3	0.6	3	0.3	4.6	7
37. LRT introduction plan	1	1	0.6	1	1	0.4	3	3	1.2	2	1	0.3	1	1	0.2	1	0.1	2.8	37
38. Urban train plan	1	1	0.6	1	1	0.4	3	3	1.2	2	1	0.3	1	1	0.2	1	0.1	2.8	37
39. Train station elevation plan	1	1	0.6	1	1	0.4	1	1	0.4	2	1	0.3	1	1	0.2	1	0.1	2.0	40
40. Northern highway bypass construction	1	1	0.6	1	1	0.4	3	2	1	2	1	0.3	1	1	0.2	1	0.1	2.6	39
41. Intensive use of old factory areas	1	1	0.6	1	1	0.4	1	1	0.4	2	1	0.3	1	1	0.2	1	0.1	2.0	40

24.4.2 Overall Implementation Program

An overall implementing program with budget allocation by three-year for 2013 to 2023 is shown in **Table 24.4-3**, taking into consideration of the priority order and financial constraints of the city government.[4]

Table 24.4-3 Implementation Program for 2013 to 2023

Unit : million USD

Priority	Project (Project type)	Cost	Urgent	Short	Mid.
			2014-16	2017-19	2020-23
1	3. High occupancy vehicle for minibus: (private)	-	0.0		
2	1. Enhancement of road maintenance and improvement capacity: (equipment procurement + technical assistance (TA))	10.0	10.0		
2	24. Pedestrian mall for vitalization of town economy: (private)	-	0.0		
2	30. Eco-car promotion: (pilot project (PP))	1.0	1.0		
5	31. Pedestrian way rehabilitation: (FS + PP)	1.0	1.0		
6	34. “No car day for commuting” program: (PP)	0.1	0.1		
7	15. East and west bus terminal improvement: (FS + PP)	1.0	1.0		
7	36. Capacity Development of BCDA: (technical assistance (TA))	1.0	1.0		
9	10. Public transport priority system: (FS + PP)	1.0	1.0		
9	11. Bus lane for peak hour: (FS + PP)	0.8	0.8		
11	4. Roadside management for bus stops with tax and car parking (PP + TA)	0.5	0.5		
11	16. Traffic flow improvement at bottleneck intersection: (design (DD) + construction (CW))	15.0	5.0	5.0	5.0
11	17. Traffic signal control improvement: (DD + CW)	15.0	3.0	12.0	
14	12. Bus priority signal installation: (FS + PP)	0.8	0.8		
14	26. Pilot Project for transit corridors improvement: (FS + PP)	1.0		1.0	
14	28. Police community post for tourism promotion: (PP)	0.1		0.1	
14	33. Driving manner improvement program: (PP + traffic police human resources development (HRD))	0.1		0.1	
14	35. Staggered office hours campaign: (PP)	0.1		0.1	
19	6. Bus route network reformation: (PP + TA)	0.3		0.3	
19	7. BRT introduction plan: (PP + TA)	0.5		0.5	
21	13. Bus operation monitoring system: (FS)	0.8		0.8	
21	14. Bus approach information system: (FS + PP)	1.0		1.0	
21	25. Introduction of area traffic management at Dordoi market: (FS + PP)	2.0		2.0	
24	22. Parking information system (PPP): (FS + PP)	1.0			1.0
25	2. Local Road and Pavement Improvement in the Poor Area: (DD + CW)	15.0			15.0
25	23. Promotion of parking and ride (PPP): (FS + PP)	1.0			1.0
25	27. Urban Section of Bishkek-Osh Road improvement (national budget)*: (FS + CW)	(50.0)			(50.0)
25	32. Traffic safety promotion for accident reduction program: (PP + HRD)	1.0			1.0
29	8. ICT ticket for trolleybus (on-going with EBRD)	1.0		1.0	
29	9. ICT ticket for all transit modes: (FS + PP)	1.0		1.0	

[4] 7.7 million USD is required (8 percent of 135 million USD of the total budget in 2013.)

Priority	Project (Project type)	Cost	Urgent	Short	Mid.
			2014-16	2017-19	2020-23
31	5. Public transportation management and service improvement: (FS + PP)	0.9		0.9	
31	29. Introduction of bicycle lane for NMT promotion: (PP)	0.2			0.2
33	19. Introduction of parking fee payment card (PPP): (FS + PP)	1.0			1.0
33	21. Parking facility construction (PPP by ADB): (FS)	0.6			0.6
35	18. Illegal parking control at specific areas: (FS + PP)	0.8			0.8
35	20. Integrated parking law and management: (PP)	0.3			0.3
	Total Cost	**76.9**	**25.2**	**25.8**	**25.9**

Note : * The MPWT is in charge of the project for the zone outside Bishkek area. However, the national budget (NB) that is included as it is in the affected area is not included in the total cost of the city budget.

: City revenue increase project

Source : JICA Study Team

The implementation program is divided into four (4) stages: emergency in 2013-2016, short-term in 2017-2019, medium-term in 2020 -2023, and long term beyond 2024. The project is scheduled with its priority, and total cost in each term is adjusted with finance affordability of the City. Each year the City will need averagely 7.5 to 10 million USD for its implementation. Out of approximately 130 million USD based in 2013 of the City total budget, approximately 30 million USD will be allocated for development purposes, which is 20 percent of the total budget after 80 percent for allocating for social expenditures. The City may provide 30 percent of the development budgets for implementation of Master Plan.

CHAPTER 25 CONCLUSION AND RECOMMENDATION

25.1 Purpose and Scope of the Study

The Study aims to formulate a Master Plan (MP) with the scope limiting to devise a public transport plan, a traffic control system improvement plan, and a traffic flow improvement plan, having target year 2023, and tackles short - and medium term challenges on which actions needs to be taken immediately. Through the Study, it is found that car parking is a serious issue. Hence the MP includes a parking improvement plan to examine transportation improvement comprehensively.

Japan International Cooperation Agency (JICA) dispatched a study team formed by Katahira and Engineers International (KEI), Tokyo, Japan (as Leading Consultant) in joint venture with RECS International, Tokyo, Japan (JICA Study Team) and the Study began in July 2011 and completed in October 2013. The Study is summarized as follows:

(a) To formulate a simple[1] urban traffic MP of Bishkek with the target year of 2023

(b) To implement technical transfer for improving the executing structure and capability development related to urban traffic in the city

25.2 Study Approach and Outcomes

25.2.1 Scientific Approach

The Study was the first MP of Bishkek City based on a scientific survey and approach. It differs significantly from conventional surveys in three aspects:

(i) Scientific survey and approach,

(ii) Demonstration by social experiments, and

(iii) Human resource development

The Study was able to obtain and analyze current detailed geographic situations and measured traffic data as original data. With a traffic survey and a land use and population survey, the latter to prepare a social and economic frame. The Study was able to obtain and analyze current detailed geographic situations and measured traffic data as original data. This scientific survey and approach were new to Bishkek City, even to the Country.

The traffic survey included a person trip survey of approximately 4,000 home interviews, (representing 1.7 percent of total population), roadside traffic surveys to obtain traffic conditions covering the all city urban areas and these data were compiled in an origin and destination table (OD Table) showing traffic characteristics in Bishkek City. In addition, a public transportation survey with including an onboard survey, a bus stop-facilities survey, a passengers and drivers interview survey, and a parking demands and supply

[1] The target area is limited to the three sectors and the target year is set as 2023, and short- and mid-term challenges on which action needs to be taken urgently are tackled. The land use is the current city structure in principle.

capacity survey based a parking survey of a parking facility survey, an on-road or curb parking survey, and a parking user survey, and a survey to improve intersections with a traffic volume survey, a queue length and residual queue length survey, a signal cycle survey, a travel speed survey, and public interview survey. These were conducted systematically to examine the current traffic problems and issues.

In the socio-economic frame survey, statistics of GDP and population census were analyzed. The latest satellite photographs and GIS (Geographical Information System) were used to estimate the existing land use and characteristics and population distribution to identify the population characteristics in each traffic zone. Based on the population increase and city development trend, traffic demand in 2023 was studied. The traffic analytical model applied was a four-step estimate model which consists of trip generation and attraction, trip distribution, modal shift, and route assignment. The results in 2013 were shown as Do-Nothing Case (DNC), i.e., Business as usual, with traffic congestions and bottlenecks. The MP proposes a transport improvement plan after evaluating alternative scenarios based on public transportation principally in combination with other transport improvement plans. The results were summarized in the Project Implementation Program with its priorities in **Chapter 3**.

As a result of travel demand forecast based on the scientific approach and the current road capacity survey, it was found fortunately that the existing road network has affordable road capacity even when congestions and bottlenecks occur at the critical points and areas. Thus it was determined that a certain level of traffic flows can be secured with planning and implementation of efficient and effective investment even under the city budget constraints. The Study shows that the present urban plan and public transportation policy of the City seemed to be competent. However, since chronicle traffic congestions and bottlenecks will occur across the city due to traffic volume increase in the near future, preventive measures have to be taken before these problems become serious. It is necessary to utilize the MP for comprehensive transport and urban development that will work for removal of traffic bottlenecks, efficient traffic network, town preservation and efficient use of the present road and transport facilities. The current compact urban form based on the city planning should be reevaluated in terms of Low Carbon City and Environmentally Sustainable Transport (EST) and examine development into a bold Smart City concept.

25.2.2 Demonstration through Pilot Projects

The Study conducted the social experiments such as Pedestrian Mall method, traffic flow smoothness by intersection improvement, traffic signal control improvement and bus stop facility improvement, which showed its successful results. In particular, the Pedestrian Mall method was appreciated by residents. This method was used in the event to promote education through the former president's foundation. These social experiments achieved the desired results by utilizing very limited budget effectively, which provide an innovative example under extreme conditions of the city budget constraints, centered on the idea. The details of social experiments are shown below.

No.	Pilot Project	Project Site	Implementation Schedule
1	Traffic Flow Improvement (I)	Chui-Fuchika intersection	September - October 2011
2	Traffic Flow Improvement (II)	Chui-Fuchika Intersection	January - October 2012
3	Traffic Control System	Chui-Fuchika Siaopina Intersection	August - October 2012
4	Public Transport Facility Improvement	Chui-Fuchika Intersection / Chui Avenue	January - October 2012
5	Pedestrian Mall method	Kiyevskaya Street, Bishkek City	September 16th, 2012

25.2.3 Outcomes of Human Resources Development and Training in Japan

The scientific approach and pilot projects described above were used as means of human resources development. Various workshop programs were provided mainly by BCDA for human resources development of city employees and organizational capacity improvement of BCDA. BCDA and the city government experienced the Pedestrian Mall method in planning, implementation and evaluation stages and their capacity improvement deserves recognition. As JICA provided pricy hardware and software for the GIS seminar, their effective use and continuous training is expected. Training in Japan was provided in two sessions. The trainees learned advanced examples and city development approaches in Japan and this led to the introduction of compact city development, bus location system and exclusive bus lanes. The implementation of the Pedestrian Mall method is also one of the outcomes of the training.

25.3 Current Conditions

25.3.1 Urban Structure Plan and Land Use

(1) Historical Background

The origin of Bishkek can be traced back to a caravan rest established along one of the branches of the Silk Route in the ancient times. In 19th century, the Tsarist Russian settled a garrison and built a town. After the establishment of the socialist regime, the government of the Soviet Union helped formulate the General Plan 2006 of Bishkek City.

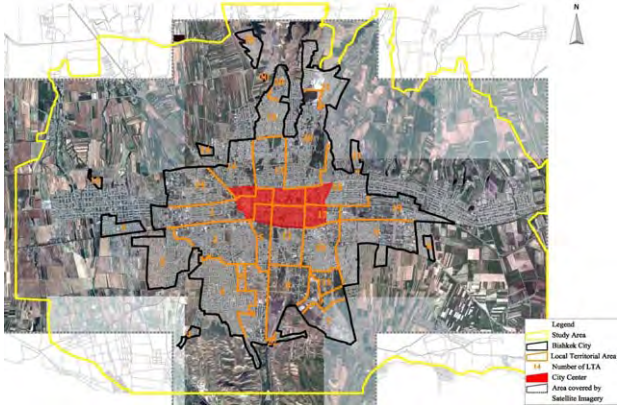


Figure 25.3-1 Bishkek City Study Area

(2) Current Urban Structure

The urban structure was designed as mono-centric patterns with a relatively large City center and low-rise housing areas surrounding it. The City center was designed by a grid style road network and land blocks mostly occupied with medium-rise apartments with a common neighborhood playground constructed during the former Soviet era. The low-rise housing area extends from the City center along the trunk roads. A railway running east to west direction separates the developed area into two parts.

The existing General Plan was formulated and authorized in 2006, covering the developed area to the year 2025 with a land area of 268 square kilometers. In addition, it designates a set of **reserved land** for further urban beyond 2025, covering 332 km^2.

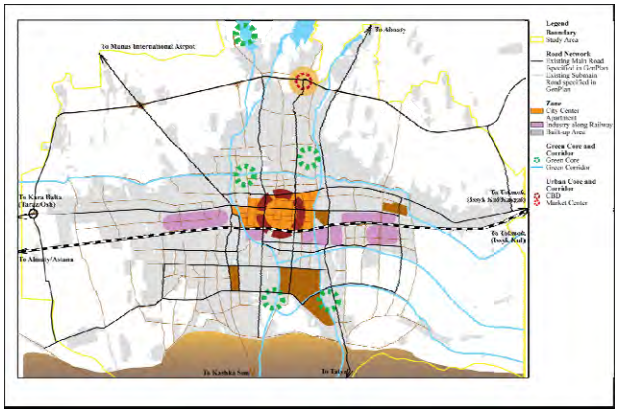


Figure 25.3-2 Bishkek City Urban Structure

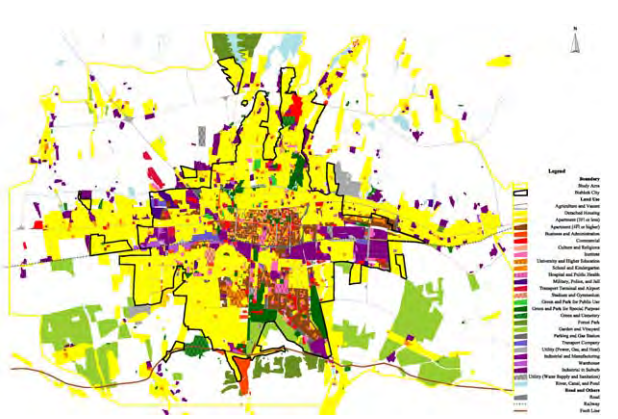


Figure 25.3-3 Bishkek Land Use

25.3.2 Urban Population

The population in 2010 was estimated at 868,556 persons in Bishkek City, and at 1,117,800 persons in the Study area, respectively. **Figure 25.3-4** shows population pyramid in the Study area.

25.3.3 Population Projection up to 2023

Case B was adopted for planning purposes, for demand forecast to be used for the transport master planning. The future population of the Study area is projected to be nearly 1.4 million persons in 2023. (See Table below)

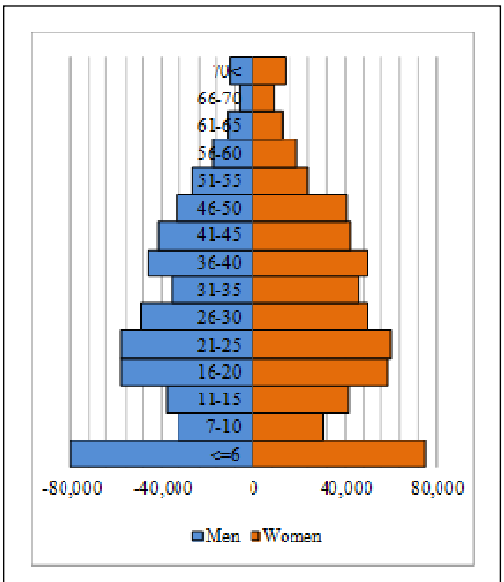


Figure 25.3-4 Population Pyramid

Table 25.3-1 Estimated Population in Study Area up to 2023

Year	Case A: Current Trend			Case B: Higher Trend		
	Population (1,000)	Growth Rate (% / year)	Annual Increment (1,000 / year)	Population (1,000)	Growth Rate (% / year)	Annual Increment (1,000 / year)
2002	992.5	-	-	992.5	-	-
2005	1,027.2	1.15	11.6	1,027.2	1.15	11.6
2010	1,117.3	1.70	18.0	1,117.3	1.70	18.0
2013	1,175.0	1.70	19.2	1,185.7	2.00	22.8
2018	1,278.0	1.70	20.6	1,309.1	2.00	24.7
2023	1,390.0	1.70	22.4	1,434.8	1.85	25.1

Source : JICA Study Team

25.3.4 City Road

Table 25.3-2 Road Length by Classification in Bishkek City

Road Classification	Pavement Type	Length (km)	
Urban Major Arterial	Asphalt	232.95	721.6
Regional Major Arterial	Asphalt	488.65	
District Major Collector and Distributor	Asphalt	61.60	534.7
	Gravel	473.10	
Total			1,256.3

Source : Kyrgyz dortransporekt, State Design Institute (SDI), 2005

25.3.5 Traffic Conditions

(1) General Findings

(a) Morning peak hours were observed from 9:00 A.M. to 9:30 A.M., notwithstanding the fact that most of the offices, schools and universities start at 8:00 A.M. Therefore, morning peak do not seem to be trips by students and workers.

(b) The average occupancy rate of minibuses was 1.50 (i.e. quantity of actual passenger / quantity of seat available average). However, average passenger occupancy rates of midibuses and trolleybuses are 1.05 and 0.80 respectively. The average occupancy rate of trolleybuses was 0.80 only, which means that there are still vacant seats available on trolleybuses. Therefore, to make trolleybuses more preferable or profitable, the trolleybuses service or facility need improvement.

(c) Travel time of minibuses was longer than other modes because of the scattered location of origin and destination (i.e., longer trip length).

(d) There are equal incoming and outgoing traffic volume along the boundary line and the largest volume is observed in the west of the City. Also, incoming and outgoing from the east and west direction of the City is larger in comparison to the traffic incoming / outgoing from the north and south. Further, volume of traffic from north to the City center was larger than that from the south. The most possible reason might be the locations of the bazaar and arterial road. This trend of traffic will be considered during traffic demand forecasting.

(e) Vehicle ownership was approximately 54 percent of total sampled household. However, most of the vehicles are either second-hand (used) or aged vehicles which might cause serious environmental problems in the future.

(f) From the HIS, it was revealed that current number of students was more than current number of workers which reveals that there are sufficient number of working forces for the future.

(2) Traffic Management

(a) At all surveyed intersections, significant residual queues observed which reveals that there are inappropriate signal cycle and signal phasing. Signal phasing and signal cycles at intersections are fixed regardless of directional traffic volumes.

(b) Average travel speed with stop time was approximately 35 km/hr which was relatively higher in the urban area. This result was taken as reference while defining travel speed of road link in the JICA STRADA (traffic simulation software).

(c) The quantities of legal and illegal parking are almost equal. Bus stops allocated are frequently occupied by other traffic (i.e., non-public transportation). Also, there was no provision of parking penalty or fine for illegal parking, it does not discourage illegal parking and eventually causes problems for public transportation users since public vehicles are forced to stop in inappropriate locations. Therefore, more parking spaces are necessary to accommodate parking.

(d) Parking time on the weekend was relatively longer than that on the weekday.

(3) Public Transport

(a) The minibuses are approximately 43 percent of the travel modes. This shows that minibuses are the main mode of public transportation. While replacing or restricting minibuses in the CBD, the matter should be handled carefully otherwise since strong protests may arise from minibus operators.

(b) Public transportation users have responded that the reasons of choosing public transportation are comfortable and good accessibility. Private transportation users have responded that the reason for not using public transportation was due to being uncomfortable. Therefore, the actual reason should be good accessibility since minibuses are utilized to collect and drop passengers from any place along the route (i.e., regardless of bus stop) and relatively provide the nearest door to door service.

(c) Private car users responded that the alternate mode of transportation available for them was the minibuses. To discourage using private cars and minibuses, the midibus and trolleybuses operation should be made to have more regular and good accessibility.

25.4 Summary of the Study Findings

25.4.1 Socio - Economic Condition

Current Issues
・Higher Economically Active Population Share (62%) with larger unemployment rate (10.8%) and increasing working forces in near future expected ・Expanding trade deficits (export: 1,488.4 against import: 3,223.1 in 2010) ・Reducing tax revenues and state budget allocation to the city

Activities

(a) Revitalization of urban economy with transport supporting urban tourism and Pedestrian Mall method in the central shopping areas in business districts

(b) Making the city a center of transportation hub to vitalize of national economy

(c) Promotion of cash generating and private sector involvement in transport sector

25.4.2 Land Use

Current Issues
・Historical city planning with a grid road pattern ・Mixed use of residence and office ・Primitive compact city with many walking trip ・Encroachment on unsuitable land for urbanization ・Improper urban development against Land Use Plan (General Plan 2006) ・Sprawling house development without road and public transportation planning ・Disorderly distribution of existing factories ・Town is divided at center by railway

Activities

(a) Needs of public involvement and consultation for General Plan 2006 formulation and clear procedure for accountability

(b) Industrial zone planning with a freight transportation and a worker commuter plan

(c) Using railway and its station areas to revitalize the city with an urban railway network plan in the future

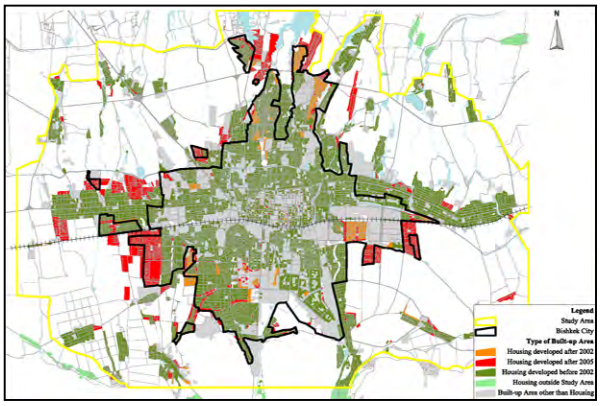


Figure 25.4-1 Built - Up Area Developed in Study Area after 2002 and 2005

25.4.3 Road and Network

Current Issues
・The vehicle congestion at peak hour is 0.77 in the year 2023. It increases by 15 percent compared with the year 2011. ・The travel speed at peak hour is 15.1 km/h in the year 2023. It decreases by 15 percent compared with the year 2011. ・Sufficient road capacity with many intersections without clear road function and hierarchy ・Traffic flow is not smooth due to the lack of clear road function and hierarchy. ・Wider carriageway and bigger intersections requiring longer travel time for crossing traffic vehicle traffics and pedestrians and consequently causing frequent accidents. ・Longer pedestrian crossing time required due to wide carriage way and its short green time causing traffic accidents ・Complete separation between cars and pedestrian traffic ・North-south roads passing railway mostly at-grade level crossings ・Rework of road markings every year due to using poor quality materials ・Spend unnecessary maintenance budgets without proper technical specification ・Deteriorated road drainage facilities like uncovers and wastes in the holes ・No care of minor road facilities ・Unregulated traffic signs ・Insufficient road maintenance works of patching and crack sealing every year ・Unutilized underground pedestrian crossing due to unsafe and dirty conditions

Activities

(a) Needs of high standards for Environmental Sustainable Transport EST and advanced road system

(b) Green and Park City by conserving bio-sphere using road space

(c) Improvement of a railway crossing design by considering a road hierarchy and traffic volumes

(d) Reducing of maintenance budget by adopting proper road marking type and specification

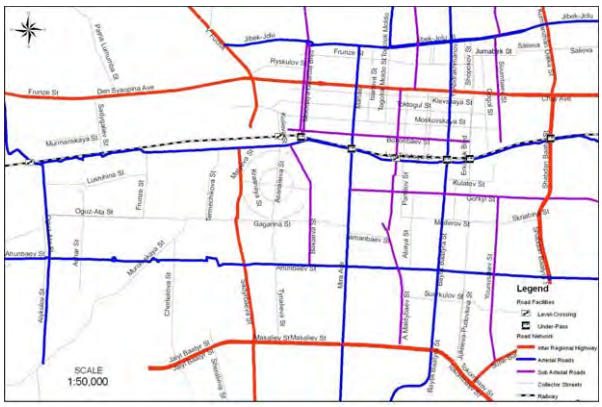


Figure 25.4-2 Road Network in the Center

(e) Urgent investigation of road and transport facilities damages and its repairs required for planning a preventive maintenance system

(f) Improvement of bottleneck intersections in terms of pedestrians crossing with traffic safety islands, configuration of intersection, traffic signal review, and universal design for the traffic vulnerable

(g) Review of regulation and application of traffic signs for travel speed, one-way direction, reversible and exclusive transit way, parking, and roadside management

(h) Need of clearing and installation of surveillance cameras at underground crossings at North and South Bus terminals

(i) Re-consider cost saving method of road maintenance with new maintenance-free pavement (Concrete with asphalt cover) and provision of sufficient equipment for contractors

(j) Promotion of Water Stream and Urban Green along the roadside by renovating the sophisticated irrigation ditch system on ROW to mitigate urban heating in summer

(k) Improvement of pedestrians crossing with traffic safety islands, configuration of intersection, traffic signal review, and universal design for the traffic vulnerable

(l) Review of regulations of travel speed, one-way direction, transit, parking with roadside management

25.4.4 Public Transportation

Current Issues
・Incomprehensive urban public transport networks with bus routes duplications due to lack of coordination of all modes by the City ・Insufficient bus routes information because of no bus time tables nor route maps ・Inefficient bus fare collection system and unsustainable bus fare system ・Improper bus stop design causing bus and passenger unsafe ・Unregulated public transport operation rules ・Uneven share distributions causing inappropriate and insufficient occupancy rate and among public transportation modes ・Minibuses routes stretching from origins to destinations to cover the areas having a lack of trolleybuses and midibus services ・Different user's satisfactions by three public transportation services without public Level of Service (LOS) standards ・Inefficient operational frequency and interval of bus stops on midibus and trolleybuses services

Activities

(a) Review of mandate for all relevant departments and need of an integrated authority managing all public transportation modes

(b) Establishing of standards of LOS for public transport passenger

(c) Review of bus operation and need to establish city's transit service regulations and standards of level of services

(d) Preparation of bus fare policy with detailed cost and passenger survey, and introduction of cashless fare system

(e) Review of proper bus stop design with bus information system

(f) Review of City's public transport policy by balancing market-oriented in public transportation service in consideration of mobility right of the citizen

(g) Balance privatization policy for public transportation, considering city budget affordability to achieve a planned fare revenue ratio.

(h) Review of roles of trolleybuses, midibuses and minibuses (Mashrutka) and proper allocation of all

modes with improvement of level of services (LOS) of two city' buses (trolleybuses and midibuses)

(i) Establishing of mechanism in response of bus user's opinions and improvement of standards of LOS of bus operators

(j) Periodic survey of bus users and meetings of communities along bus routes for improvement of LOS and improvement of LOS of two city' buses

25.4.5 City Parking

Current Issues
・Unutilized off-street parking facilities due to a lack of parking information ・Illegal on-street parking, unauthorized private parking lots along street with insufficient penalty ・Unsustainable parking fee system (Too low and too much exemption) with manual collection ・Outdated technical standards for mandatory parking space requirement ・Illegal parking nearby intersections and bus stops by taxies

Activities

(a) Needs of parking information system using ICT system and study of possibility to use of mobile phone system

(b) Need of sole parking authority covering parking regulation, provision of parking spaces and information and cashless parking fee collection system under new parking law and regulation

(c) Review of fare collection system by applying ICT and cashless fee parking

(d) Review of parking requirement in collaboration with all city departments and establishment of a city parking authority

(e) Introducing roadside management (kerb management) in coordination with all stakeholders and departments

25.4.6 Traffic Control

Current Issues
・Inappropriate signal cycle and signal phasing by isolated and fixed pattern (all 203 units) causing peak hour congestions and incurring travel time and cost of fuel ・Outdated signal system (75 percent of them are more than 20 years old) ・Improper configuration of intersections causing traffic congestions and accidents

Activities

(a) Need of coordinating and flexible traffic signals with automatic traffic detectors in accordance with traffic volumes at the intersections

(b) Need of emergency renewal of city signal and a control system

(c) Improvement of critical intersections for smooth traffic flow and safety with proper traffic signals and pedestrian safety islands

25.4.7 Environmental and Social Considerations

Current Issues
・CO_2 emission of passenger car is 416,231 tons in year 2023. It increases by 85,871 tons compared with the year 2011. ・Aging vehicles with abolishment of a vehicle inspection system (VIS) causing increase in pollution gas and traffic accidents ・Local climate conditions having min -34℃ in winter and max +43℃ in summer causing easy deterioration of pavement and increasing costs by short annual work time

Activities

(a) Review of the present VIS and improvement with new inspection system for car emission gas

(b) Proper design of pavement and planning of its implementation

25.4.8 Conclusion of the Study

The study can be concluded as follows:

(a) Bishkek city will be able to avoid the traffic congestions for a time being by implementing investment as planned in the time-frame proposed in MP even with financial constraints, unless otherwise the congestions would paralyze the entire city functions in future,

(b) Taking advantages of opportunities to utilize the time before the traffic problems become serious, it is important to implement small-scale projects and social experiments proposed herein and conduct various surveys for the future projects.

25.5 Generation of Master Plan Components and Alternatives

25.5.1 Approach

The study results show that the traffic capacity as road network is 1.0 or less even in terms of traffic demand in 2023. However, local and limited traffic congestion occurs for certain time periods, in particular peak hours, and at specific locations. Due to roadside conditions, it is difficult to increase the traffic capacity by road development approach to road widening and elevated intersections as they require land. Because road congestion and bottleneck are caused by a combination of various factors, transport planning have to consider multiple components for their solutions.

Since the MP aims to reduce traffic congestion and eliminate traffic flow bottlenecks that occur in the limited road sections, points and areas, the promotion of public transportation use and traffic demand management for reducing the traffic demand and quantity of vehicle trips are indispensable as components for solutions of demand side. Concurrently, in order to recover road traffic capacity, the impeding factors to reduce road traffic capacity are examined as components for solutions of supply side. They are repair of damage and conservation of road pavement and transportation facilities, improvement of bottleneck at intersection, and control of illegal road-side parking so on.

As shown in Figure below, the scenario of the MP will be compiled as highly feasible components in the chronological order and based on financial capacity.

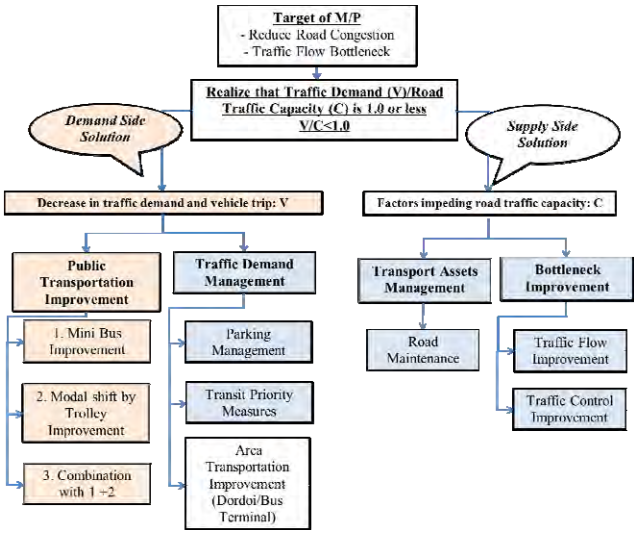


Figure 25.5-1 Approach to Generation of Master Plan Components and Alternatives

25.5.2 Basic Traffic Conditions (Do-Nothing Case)

The basic traffic conditions for compiling the scenario are shown below. Of the person trip (PT), passenger cars account for 87 percent of the total quantity of vehicles when the PT rate is 25 percent. In comparison with the PT and the quantity of passenger cars, the passenger car transportation seem inefficient. The PT rate of minibuses is high at 42 percent and accounts for 98 percent by vehicle of the mode of public transportation. This shows that vehicle congestion is mainly caused by passenger cars. The trolleybuses account for only three percent of the PT and below one percent of the number of vehicles. Thus, reduction of the number of trip of passenger cars and conversion to public transport were examined. Measures for minibuses operations have to be taken for public transportation, as the minibuses cause traffic congestions at bus stops and on specified roads (overlapping route).

Table 25.5-1 Trip Share by Mode in 2013 (Do-nothing)

Mode	Passenger / Vehicle	Person trip/day (Bishkek City Zone 1-61)			Vehicle trip/day (All Zones 1-98)	
	Passenger	Trip No.	Share	PT Share	Trip No.	(%)
1. Trolleybus	28.2	72,181	3.2%	7.0%	3,194	0.3%
2. Midibuses	27	27,750	1.2%	2.6%	8,619	0.9%
3. Minibus	17	934,832	42.0%	90.4%	94,119	9.8%
Total (Public Transport: PT)			46.5%	100.0%		
4. Truck	1.3	3,171	0.1%	-	12,966	1.4%
5. Passenger Car	1.5	560,234	25.2%	-	839,550	87.6%
6. Walk	-	629,316	28.3%	-		
Total			100%	-	958,448	100.0%

Source: JICA Study Team

25.5.3 Alterative Scenarios

Scenario 1 is that larger minibuses will be introduced, to reduce the quantity of vehicle trips, in consideration of financial constraints of the city, until the time of full-scale operation of new trolleybuses, and to improve the traffic congestion in the minibuses route. The minibuses currently transport passengers over the specified capacity and some people are standing. The change to larger minibuses contributes to better service and traffic safety. The city government only needs to set regulations without need for any additional expenditures.

As Scenario 2, efforts will be made to improve the efficiency of operation of new trolleybuses. It will repair and extend routes while promoting modal shift from passenger cars. For this purpose, the convenience of trolleybuses will be improved. The distance between bus stops will be reviewed and efforts will be made to carry out on-time operation in accordance with the timetable, and introduce the system to inform that a bus is approaching and the park-and-ride scheme. The use of passenger cars will be regulated. Parking lots will be regulated on accordance with time and time zone will be established. The passenger car regulation will be carried out with the improvement of public transport capacity and service. There is a need to consult with citizens to decide whether they are carried out based on the guidance policies or enforced as regulations.

In Scenario 3, integrated operation management of public transport is needed as the trolleybus operation capacity improves and the passenger car regulation is agreed on. Thus, it is necessary to clarify the function and role of each mode in terms of improvement of service for users, establish an integrated management organization, create a fare system with common IC card under the organization, and guarantee the convenience of transit. The table below shows a summary of scenarios in consideration of the issues described above.

Table 25.5-2 Summary of Alterative Scenarios

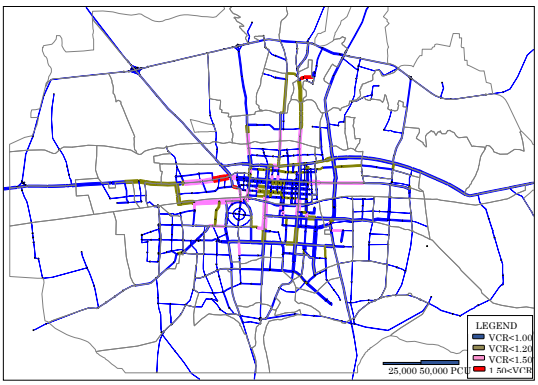
Scenario	Objective	Measures	Effects
Scenario 0	Do-nothing	No	No
Scenario 1	Using high occupancy bus for small minibuses	25% of small minibuses trip share to big ones	Reduce the quantity of minibuses trips
Scenario 2	Modal shift to trolleybuses	10% in vehicle trip share of trolleybuses	Increase trolleybuses users
		10% reduction of passenger car trip	Decrease the quantity of car use along PT corridor
Scenario 3	Scenario 1 + Scenario 2	Combination of Scenario 1 and 2 ・Measures to improve services ・Establishment of integrated management organization ・IC card introduction, etc.	Combination of effects of Scenario 1 and 2 ・Improvement of convenience ・Increase in users ・Improvement of profitability

Source: JICA Study Team

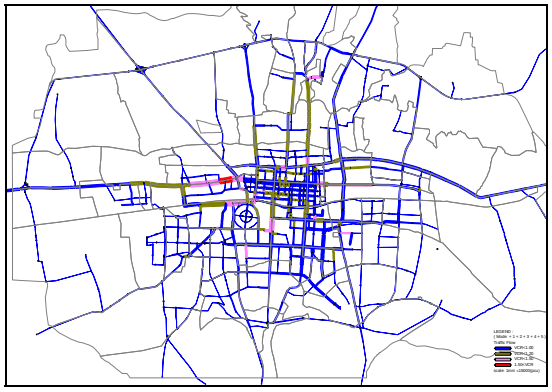
25.5.4 Impacts of Scenarios

The impacts of the three scenarios above are shown in comparison of daily traffic volume in the Do-Nothing case in 2023 and peak-time congestion rate and speed. It shows reduction of congestion in

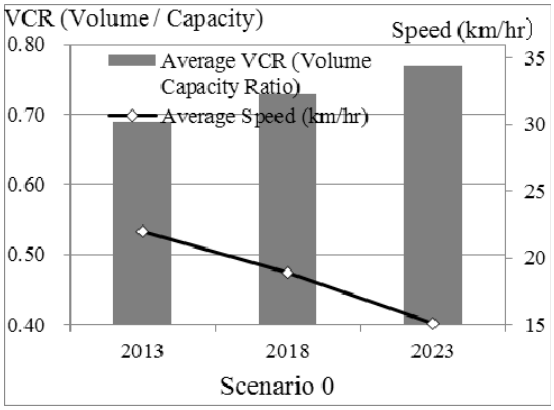
the road networks. The congestion rate improves from 0.77 to 0.70 and average speed improves from 15.1 to 20.4 km/hr. The public transportation and the modal shift need to be promoted further.



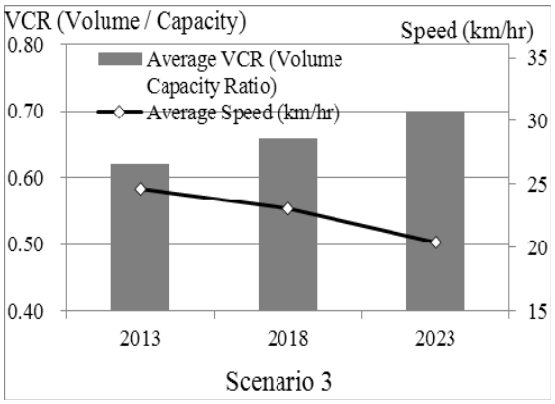
Daily Traffic Assignment in 2023
(Do-nothing)



Daily Traffic Assignment in 2023
(Scenario 3)



VCR and Travel Speed (Peak) in 2023 (Do-nothing)



VCR and Travel Speed (Peak) in 2023
(Scenario 3)

25.6 Project Implementation Plan

A project implementation plan is shown in below in according to priority and budget of the city government:[2]

Table 25.6-1 Implementation Program

Unit: million USD

Priority	Proposed Project (Project type)	Cost	Urgent	Short	Mid.
			2014-16	2017-19	2020-23
1	3. High occupancy vehicle for minibuses: (private)	-	0.0		
2	1. Enhancement of road maintenance and improvement capacity: (equipment procurement + technical assistance (TA))	10.0	10.0		
2	24. Pedestrian Mall method for vitalization of town economy: (private)	-	0.0		
2	30. Eco-car promotion: (pilot project (PP))	1.0	1.0		
5	31. Pedestrian way rehabilitation: (FS + PP)	1.0	1.0		
6	34. “No car day for commuting” program: (PP)	0.1	0.1		
7	15. East and west bus terminal improvement: (FS + PP)	1.0	1.0		

[2] 7.7 million USD is required (8 percent of 135 million USD of the total budget in 2013.)

Priority	Proposed Project (Project type)	Cost	Urgent	Short	Mid.
			2014-16	2017-19	2020-23
7	36. Capacity Development of BCDA: (technical assistance (TA))	1.0	1.0		
9	10. Public transport priority system: (FS + PP)	1.0	1.0		
9	11. Bus lane for peak hour: (FS + PP)	0.8	0.8		
11	4. Roadside management for bus stops with tax and car parking (PP + TA)	0.5	0.5		
11	16. Traffic flow improvement at bottleneck intersection: (design (DD) + construction (CW))	15.0	5.0	5.0	5.0
11	17. Traffic signal control improvement: (DD + CW)	15.0	3.0	12.0	
14	12. Bus priority signal installation: (FS + PP)	0.8	0.8		
14	26. Pilot Project for transit corridors improvement: (FS + PP)	1.0		1.0	
14	28. Police community post for tourism promotion: (PP)	0.1		0.1	
14	33. Driving manner improvement program: (PP + traffic police human resources development (HRD))	0.1		0.1	
14	35. Staggered office hours campaign: (PP)	0.1		0.1	
19	6. Bus route network reformation: (PP + TA)	0.3		0.3	
19	7. BRT introduction plan: (PP + TA)	0.5		0.5	
21	13. Bus operation monitoring system: (FS)	0.8		0.8	
21	14. Bus approach information system: (FS + PP)	1.0		1.0	
21	25. Introduction of area traffic management at Dordoi market: (FS + PP)	2.0		2.0	
24	22. Parking information system (PPP): (FS + PP)	1.0			1.0
25	2. Local Road and Pavement Improvement in the Poor Area: (DD + CW)	15.0			15.0
25	23. Promotion of parking and ride (PPP): (FS + PP)	1.0			1.0
25	27. Urban Section of Bishkek-Osh Road improvement (national budget)*: (FS + CW)	(50.0)			(50.0)
25	32. Traffic safety promotion for accident reduction program: (PP + HRD)	1.0			1.0
29	8. ICT ticket for trolleybuses (on-going with EBRD)	1.0		1.0	
29	9. ICT ticket for all transit modes: (FS + PP)	1.0		1.0	
31	5. Public transportation management and service improvement: (FS + PP)	0.9		0.9	
31	29. Introduction of bicycle lane for NMT promotion: (PP)	0.2			0.2
33	19. Introduction of parking fee payment card (PPP): (FS + PP)	1.0			1.0
33	21. Parking facility construction (PPP by ADB): (FS)	0.6			0.6
35	18. Illegal parking control at specific areas: (FS + PP)	0.8			0.8
35	20. Integrated parking law and management: (PP)	0.3			
	Total Cost	**76.9**	**25.2**	**25.8**	**25.9**

Note: * The MPWT is in charge of the project for the zone outside Bishkek area. However, the national budget (NB) that is included as it is in the affected area is not included in the total cost of the city budget.

: City revenue increase project

Source: JICA Study Team.

25.7 Recommendations

Recommendations for Bishkek City

(a) The city government should approve the MP and implement it according to as implementation program.

(b) The city government should organize the utilization of Pedestrian Mall method as there is popular demand from citizens.

(c) The city government should establish an integrated management organization for all public transportation modes.

(d) The city government should introduce funding schemes to involve the private sector in public transport operation.

(e) The city government should establish a new public parking management authority to alleviate the issue of parking.

(f) The city government should promote Compact City and future Smart City concepts as its vision, aiming to develop a Low-Carbon City.

Recommendation of enhancement of BCDA functions

(a) BCDA should improve the functions in planning and implement a city or urban planning and a transportation planning.

(b) BCDA should enhance the coordinating function with the donors and the private investors.

(c) BCDA should independently assume the responsibility for new mandate (i.e. Public-Private Partnership), in which other city departments or agencies will not be involved.

(d) BCDA should improve education and training functions for technical competence of the City staff.

Recommendation of continuation and extension of the social experiments and pilot projects

(a) Development of Pedestrian Mall scheme for the vitalization of the City center and tourism promotion

(b) Expansion of intersection improvement in consideration of traffic safety of pedestrians and universal design

(c) Expansion of outcomes of traffic light improvement

(d) Expansion of outcomes of bus-stop improvement

Urgent policy recommendation for aid or support agencies

(a) Aid or support agencies should establish and promote results, or aid assets, from past technical cooperation.

(b) Government and aid or support agencies should recognize the strategic importance of Urban

Development.

(c) Government and aid or support agencies should recognize the importance of technical assistance and ensure continuity.

(d) Government and aid or support agencies should exchange views on aid policies and strategies in urban transport and city development.

Recommendations for urgent action

(a) The city government should act to implement urgent projects based on the MP.

(b) The city government should act to implement the projects that expect to increase city revenues, by utilizing the private sector.

(c) The city government should act to implement the capacity improvement of BCDA including the PPP as city think-tank.