

工學碩士 學位論文

**The Computer Simulation Analysis  
for Urban Logistics Improvement**

指導教授 南 奇 燦

2001年 2月

韓國海洋大學校 大學院

物流 工學科

崔 豪 駿

本 論 文    孫 炳 錫    工 學 碩 士 學 位 論 文    認 准

委 員 長 工 學 博 士            李 哲 榮    ①

委 員 工 學 博 士            申 宰 榮    ①

委 員 工 學 博 士            南 奇 燦    ①

2000年 12月 16日

韓 國 海 洋 大 學 教 大 學 院

物 流            工 學 科

崔    豪    駿

# **The Computer Simulation Analysis for Urban Logistics Improvement**

Ho-June Choi

Department of Logistics Engineering  
Graduate School of Korea Maritime University

## **Abstract**

As a results of the expansion of the urban areas and economic activities, the concerns on freight distribution in urban areas are highly increasing. Main concerns are put on both the increase of transportation cost and the ineffectiveness of urban goods movement. Accordingly, to reduce the traffic of the freight vehicle and the time for loading & unloading, many alternatives are being discussed.

In this respect, this study introduces the concept of urban and CBD(Central Business District) logistics, and analyzes related problems. And then it introduces some cases of improvement of urban logistics. Based on these, several alternatives designed to improve urban logistics are suggested, and computer simulation analyses have been done to evaluate them. The results reveal that among those alternatives converting parking space to on-road loading space is most efficient. It is also suggested that for implementation more broad aspects such as legal and behavioral aspects need to be taken into account.

1.	.....	1
1.1	.....	1
1.2	.....	2
2.	.....	4
2.1	.....	4
2.2 C.B.D.	.....	10
2.3	.....	13
2.4	.....	15
2.5	.....	18
2.5.1	가 Satellite .....	18
2.5.2	Consolidation System .....	18
2.5.3	.....	19
2.5.4	.....	19
2.5.5	Depot .....	20
2.5.6	.....	21
2.6	.....	22

3.	.....	25
3.1	.....	25
3.2	.....	26
3.2.1	.....	26
3.2.2	.....	30
3.2.3	.....	33
4.	가 .....	36
4.1	.....	36
4.1.1	.....	36
4.2	.....	40
4.2.1	.....	40
4.2.2	.....	41
4.2.3	.....	45
4.2.4	.....	45
4.3	.....	47
4.4	.....	48
4.4.1	.....	48
5.	.....	50

< 1-1>	.....	3
< 2-1>	.....	5
< 4-2>	.....	38
< 4-3>	.....	39
< 4-4>	.....	39
< 4-5>	.....	40
< 4-6>	.....	42
< 4-7>	.....	44
< 4-8>	.....	45
< 4-9>	.....	47
< 4-10>	.....	49

< 4-1>	.....	37
< 4-2> CBD	.....	41
< 4-3>	.....	43
< 4-4>	.....	44
< 4-5>	.....	46

1.

1.1

가

가

가

(Trip-End) 가

가

가

가

가

가

가

가

가

1.2

가

가

1

2



. 3

. 4

가 .

5

가 가 가 .

< 1-1 >

		-
	CBD	-
	CBD	
		-
		- 가 ( , , )

## 2.

### 2.1 1)

#### 2.1.1

, ( )  
( ), ( 가 . . . .  
) ( 2-1).  
,  
(Transportation)  
(Pick-up) (Delivery) 가 .  
,  
(Storage) (Deposit) . 가 , 가가  
,  
(Picking) . : Material Handling); . . . . (Processing); 가  
, (Unit) , (Assembling) .  
, (Packaging) , 가가  
(Wrapping) .  
,  
, (Loading) . (Unloading) ,

---

1) ( ) , “ ”, 28

5가 , 가

< 2-1>

		(Traffic) (Access)
		(Node) (Node)
가	가 가 가	(Picking) · ( ) (Slice), (Unit) , (Assembling)
		: : : (Digital Picking) : POS · EOS · VAN · EDI :

2.1.2

1)

가 , (Goods  
 Movement, Freight Transportation) ,  
 (Physical Distribution) .

2)

, ( . . )  
 ( . . ) .  
 , .  
 , 가 . , .  
 .  
 ,  
 ( . . ) ,  
 ( . )가 , ,  
 ( . . . )  
 .  
 , . 가 ,  
 ( 가 , , 가 )  
 ( )  
 ( ) ( )  
 가 , )  
 ( 가 )  
 ( ) ( 가 )  
 ) .

3)

( ) ( ) . , ( 가  
 ,  
 가 가 가  
 . 가  
 , 가 .  
 가 , (Logistics) ,  
 . ,  
 ( : Physical Supply),  
 ( : Physical Distribution)  
 3가 . ,  
 가 , 가 .  
 , , , , 4가 가  
 . 4P  
 (Product) · (Place) · (Promotion) · 가 (Price)  
 . ( ) ( )  
 ) . , 3  
 가 P .

4)

가 ,

,  
,  
,  
( )  
가  
가  
.  
.  
.

2.13

, 가  
.  
가  
가  
“ ”  
“  
가  
6가 ”  
.  
.

2.14

‘ ’ , 가

가  
가

## 2.2 C.B.D.

### 2.2.1

(functional differentiation) .

가 .

가 . Proudfoot(1937)

(central business district), (outlying business centers), 가 (principal business thoroughfare), (neighborhood store clusters) . Berry (centers): CBD, regional centers, community centers, neighborhood centers.

(ribbons): 가, 가, 가.

(specialized areas): 가, 가,

### 2.2.2



가 , 가  
 가 . , , ,  
 3 .  
 6가 40%  
 , 4% .  
 , ,  
 .

2.2.3

가 (Maximum accessibility point) , 1)  
 , 2) , , 3)  
 , 4) ,  
 (Minimum aggregate travel) .  
 가

2.2.4 CBD

CBD . 가 가  
 CBD 가 . 가 가  
 가 . 가 가

(Minimum travel distance)

1).

(Shopping center) 2).

3). 가

가 (commercial centers)

가 ,

neighborhood shopping center ,  
Community shopping, regional shopping center, CBD

### 2.2.5 CBD

(Central Business District) (controlling function)

(Business and service function) 가 ,

가, CBD

가 가

가

## 2.2.6

(Trip-End) 가

· , ( )

, , , 가

· ,

, , , 가

가

가

,

·

## 2.3

### 2.3.1

, 가 , ·

( ) 가 · ·

, JIT (Just-In-Time)

· · 가 ·

(Needs)

가 ·

,

가 ·

가 , (Lead Time)

( 가 ) 3

가 (POS, EOS ) ,

가 ( )

가 가

가 가 가

가 가

가 가

가 가

가

2.3.2

가

가

가

(Unit) , (Piggy Back),

(Ferry) ,

(Unit Load System) .

가  
(Loading & Unloading)  
가  
( )가 가

## 2.4

### 2.4.1

1)

JIT  
( ) 가 , ( ) 가 가  
가 ( 2-2).  
가 , , 가

가 가 .

2)

가

3)

( ) ( ) 가  
(NO<sub>x</sub>) (CO<sub>x</sub>) , .

가

가 .

4)

( ) ,  
( ) 가 ,  
가 .



3)

가 , 가 ,

2.5

2)

2.5.1

가 Satellite

	가 Satellite	TSM (Transportation System Management)
32	42	40
Case Study	72	
가		(
	)	,

Satellite

2) ( )

, “ ”, 28



가 .

가 .

## 2.5.2 Consolidation System

Consolidation System

(Random)

가 73

가

Consolidation Depot

## 2.5.3

(77 )

(79 ),

(81 )

Compartment ( )

, 3

, Compartment

가

, , , , 가

2.5.4

가 2

가 . 87  
가

87 가  
1 . 1 2

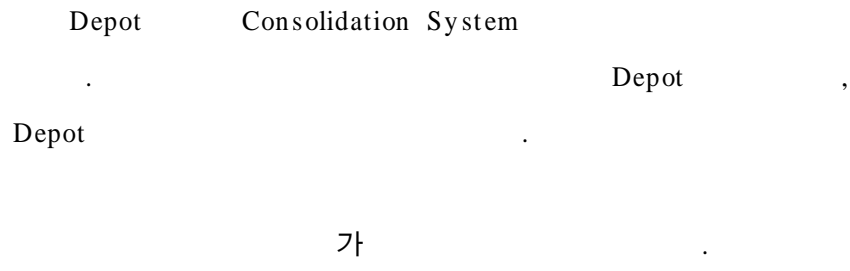
가 30 65%, (km/日)  
69%, 17%

1 가 1  
198% 가

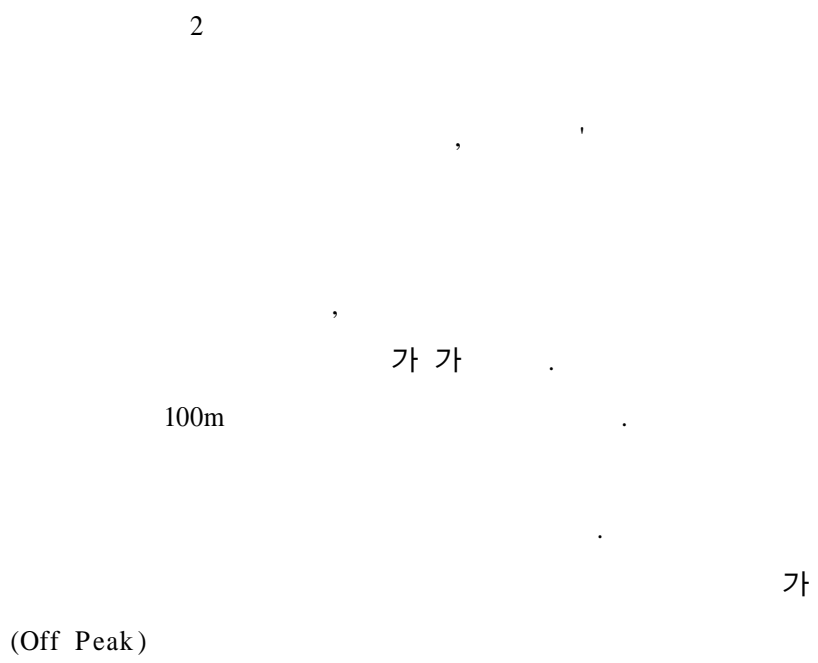
가 . 全 가,

가 .

2.5.5 Depot



2.5.6



2.6

가

가 1970

가

(1987)

'90

, Arrow et al.(1974)

가

. Eric Mohr(1974)

Wood et al(1982)

( , 가 )

( , )

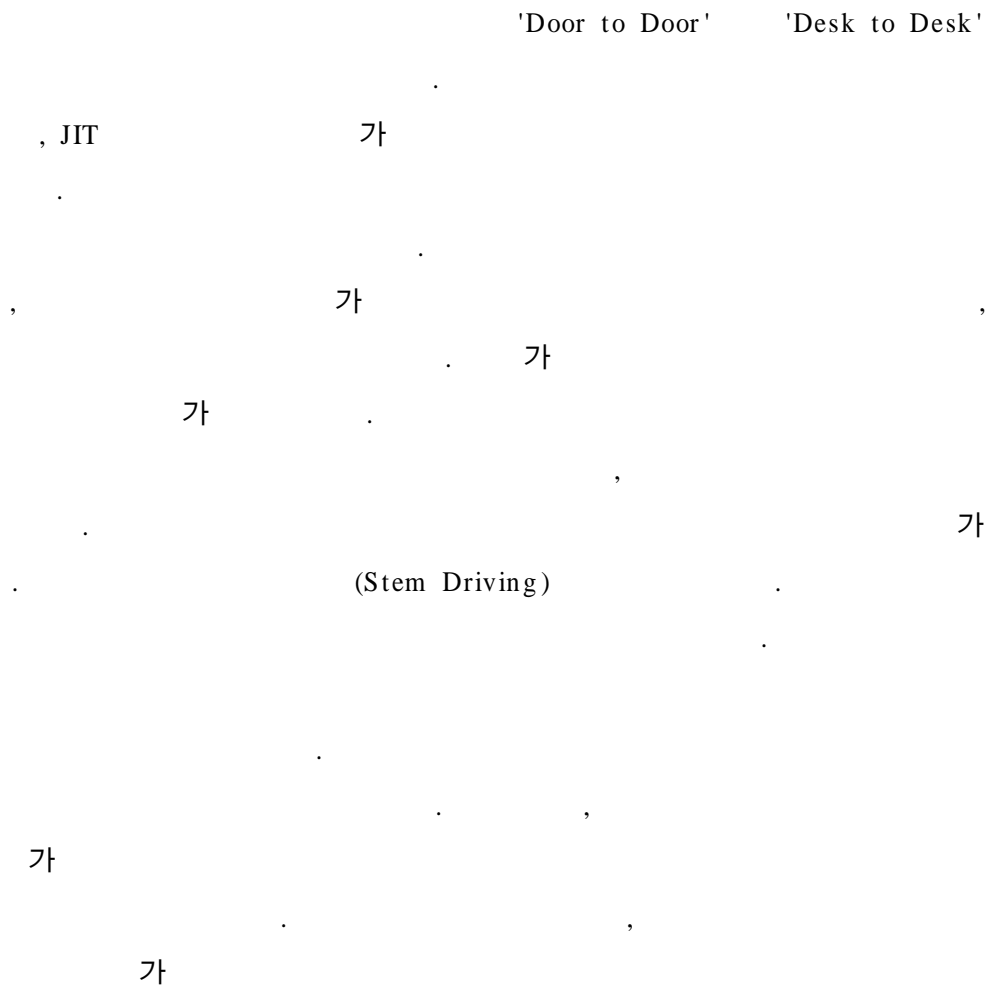
Toshinori(1997)





### 3.

#### 3.1



## 3.2

### 3.2.1

1)

(Trip-End)

, 가 , 가 가  
가 가  
가

가 5  
가 , 1



가 . 가  
가  
가  
(  
, 가  
)  
가 .

2)

3)

4) 가

가

,  
( )  
CBD

) 가 , ( ) 가 ( )  
가 ,  
가 가 가  
, 가 가  
( ) 가  
가

5) (Dual-Use)

/

가

가

CBD

CBD

日本橋( ) 横山町( ) 가

가 가

VAN

6)

3.2.2

1) ( )

가

가

가

3.8m

가

가

2)

가

가

가

가

( )

가

가

가

3)

가

가  
가  
가  
가

4) Park & Ride

Park & Ride  
가  
가  
가  
가  
가  
가

가

3.2.3

1)

1  
5%

가

가

가

가

CBD

1

94 1

2)

CBD

. , 가  
가 .

3)

. 가  
.

4)

가 가 .  
가 가 .  
가 .



5)

6)

가

## 4. 가

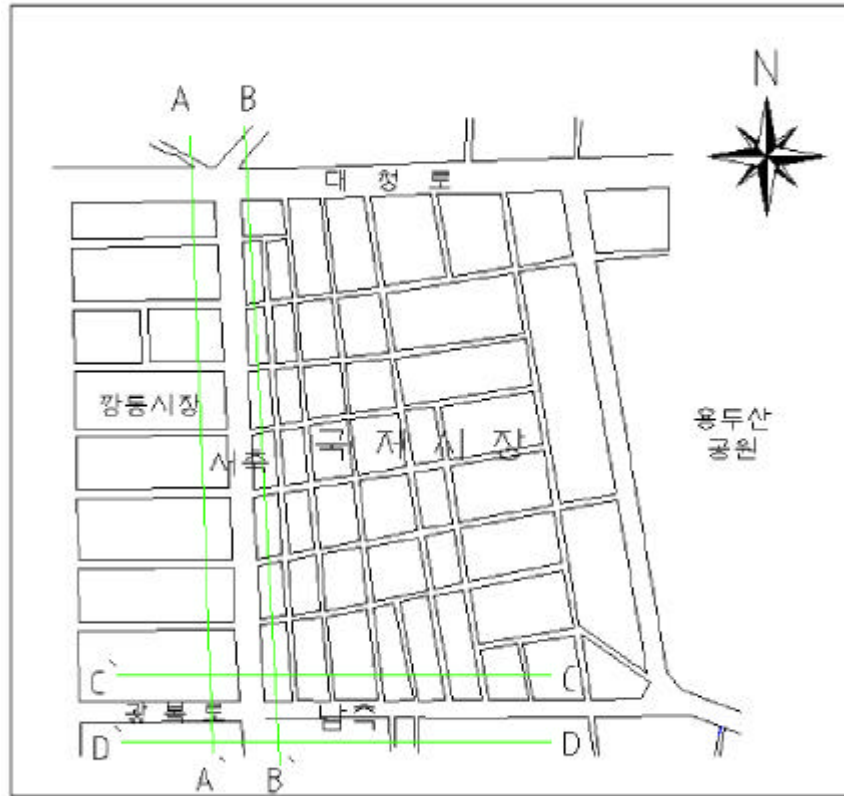
### 4.1 3)

#### 4.1.1

가  
가 .  
.  
.  
가  
가 .  
가 , 가  
11,453m<sup>2</sup>, 9,452m<sup>2</sup>, 1,142 1 8.3m<sup>2</sup>  
. 가 6,817m<sup>2</sup>, 3,421m<sup>2</sup>,  
242 1 14m<sup>2</sup> .  
가 .

---

3) (1998), “ ”,



< 4-1 >

< 4-1 > 가 가

	(m <sup>2</sup> )	(m <sup>2</sup> )	
가	11,453	9,452	1,142
가	6,817	3,421	242
	18,270	12,873	1,384

, 가 가 가 ,  
 . A-A`, B-B`, C-C`, D-D` , 211 .  
 , , A-A` 58

, , , , 20 35%  
 , B-B` 82  
 61% , C-C`, D-D`

< 4-2>

		A-A`	B-B`	C-C`	D-D`
, , , ,	24	20	4	-	-
,	10	4	6	-	-
( , )	9	2	5	2	-
, ,	20	1	19	-	-
	7	1	-	5	1
	4	4	-	-	-
	1	1	-	-	-
, ,	5	3	2	-	-
	7	3	-	3	1
,	3	-	3	-	-
, ,	30	-	30	-	-
,	3	1	2	-	-
/	8	4	4	-	-
	3	-	2	-	1
,	48	6	2	10	30
/	5	2	1	-	2
	3	2	-	1	-
	2	2	-	-	-
( , , )	5	-	-	5	-
	1	-	-	1	-
	4	-	-	2	2
( , , 가)	9	2	2	2	3
	211	58	82	31	40

가

57

가

2

가 , 가

< 4-3>

	75	57
	9	7

, 9 , 7 가

< 4-4>

	가					
	378	368	746	114	125	985
	3,012	2,712	5,724	2,332	1,827	9,883
	3,390	3,080	6,470	2,446	1,952	10,868

: '99 10 28 ( ) 07:00~20:00 13

: '99 , 2000.1

40%

14.32km/h

24.73km/h

< 4-5 >

					가	
	27.38	24.73	27.15	49.09	53.99	14.32

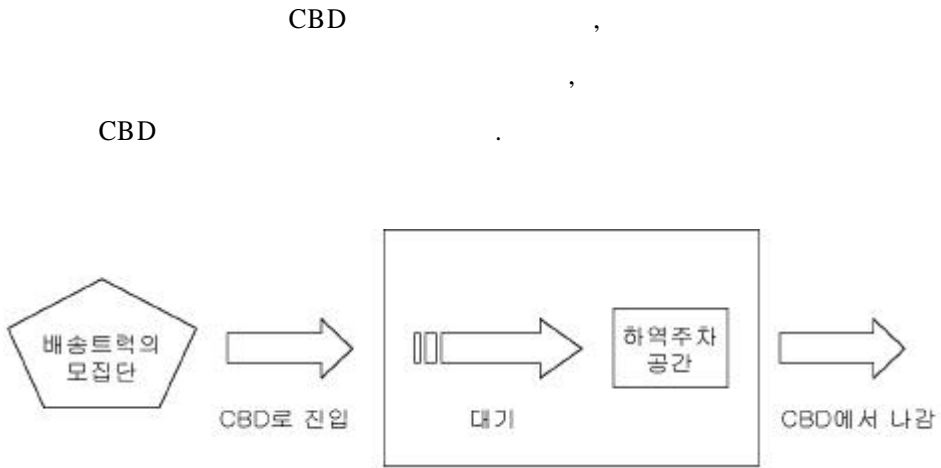
: '99 , 2000.1

## 4.2

### 4.2.1

가 ,  
 (Queueing Theory) CBD  
 ,  
 가

(Dynamic Simulation model) ,  
 (Statistical)  
 가 (Discrete System) . ,



4.2.2

가.

1)

50 , 99

< 4-1>

62% , 가 38%

9 11 2

43.4% 가 , 가 31.3%, 가 25.3%

(van)

81.8%

< 4-6 >

		(%)				(%)		
	50	38.0	50	-	99	100.0	81	18
	-	-	-	-	31	31.3	23	8
	19	38.0	19	-	25	25.3	21	4
	31	62.0	31	-	43	43.4	37	6

2)

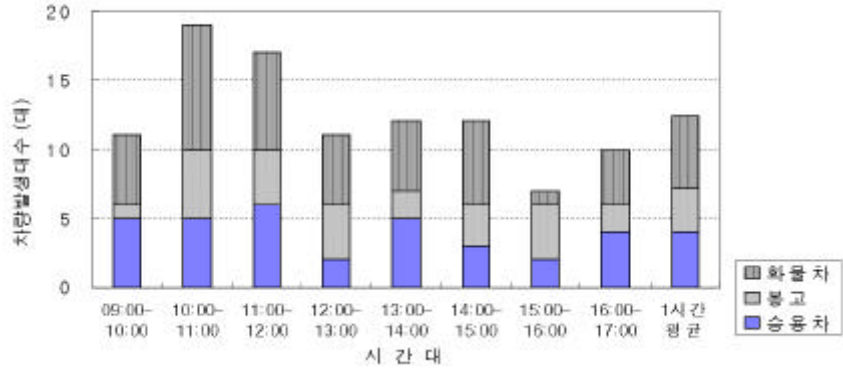
< 4-1 >

10 11 19 가 , 15 16  
 가 7 가 . 1 13  
 9 10  
 19 , 10 11 31 가 .

0.153/m/hr

0.087/m/hr



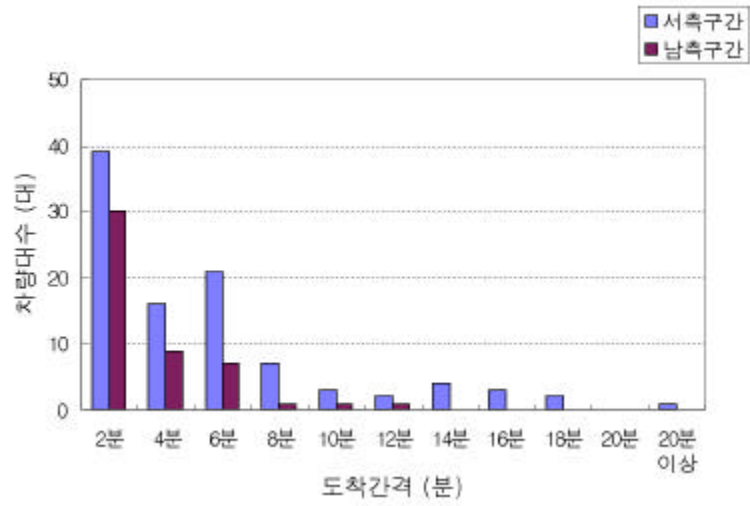


< 4-3>

3)

< 4-2>

가  
 2  
 , 80% 10  
 20  
 가  
 12  
 , 4.83  
 ,  
 2.43



< 4-4 >

4)

. . . . . < 4-3 > . . . . . 12.74 ,  
 9.41 . . . . . 가  
 , . . . . . 가  
 . . . . .  
 , . . . . . 14.63 , . . . . . 10.76  
 가 . . . . . 가 ,

< 4-7>

( )	12.74	10.48	12.52	14.63	9.41	-	7.87	10.76

4.2.3

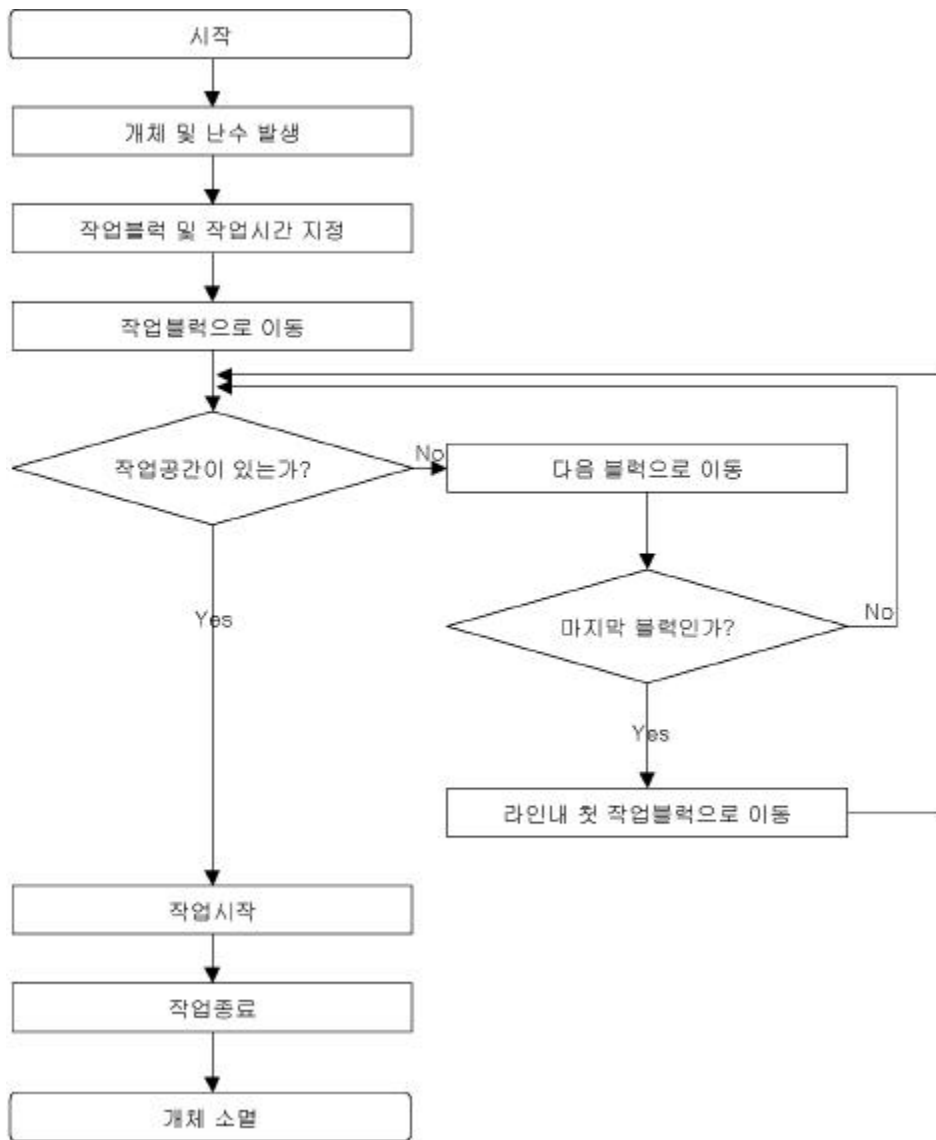
3

< 4-8>

	100	100	90
	200	100	100
	300	100	120
가	100	100	80
	150	200	80
	200	100	100

4.2.4

가



< 4-5 >

1)

4.3

4.2

13.6  
16.4 가 855  
, 64.3%

< 4-9>

			->	->			
	13.6	13.6	10.3	13.2	7.9	13.6	19.6
	16.4	16.4	13.1	16.0	10.7	16.4	22.4
	64.3	60.2	49.7	58.7	39.2	79.1	50.2
	855	873	882	869	876	839	873

#### 4.4

##### 4.4.1

1) ( )

가

가

가

가 가 ,

가

가

2)

3)

< 4-10 >

5.

가

가

CBD

가

가

가

가 가





1. (1995), “ ”,  
 , 2 , 1 .
2. (1987), “ ”, 87-06.
3. (1995), “ ”, 95-10.
4. (1997), “ 1 ( )”,  
 .
5. (1998), “ ”,  
 .
6. (1996), “ ”,  
 96-11.
7. (1998), “ ”,  
 , 16 , 1 .
8. (1994), “ ”.
9. (1995), “ ”.
10. (1997), “ ”.
11. (1998), “ ”,  
 .
12. (1999), “ ”,  
 .
13. (1999), “ ”,  
 , No. 6.
14. ( ) , “ ”,  
 28 .
15. (2000), “ 가 ”,  
 .
16. (1999), “ ”,  
 , 3 ,  
 .
17. (1998), “ ”,  
 .
18. (1996), “ ”,  
 ,  
 96-11.
19. Arrow, Michale M., Coyle, James J. and Brian Ketcham(1974), "Environmental

- impact of goods movement activity in New York city", TRR 496
20. Brown, M. and Allem, J.(1998), "Strategies to reduce the use of energy by road freight transport in city", Transport Logistics, Vol. 1, No. 3.
  21. Campbell, James F.(1995), "Using small truck to circumvent large truck restriction : Impacts on the emissions and performance measure", Transportation Research, Vol 29A, No. 6.
  22. Clark, Gordon M.(1978), "Urban goods consolidation terminal investment and location decision", TRR 668.
  23. Dennis, R. McDermott and James, F. Robeson(1974), "The role of terminal consolidation in urban goods distribution", TRR 496.
  - 24.. Habib, Philip A.(1985), "Urban Freight Practice-A Evaluation of Selected Examples", TRR, 1038.
  25. Habib, Philip A. and Crowley, Kenneth W.(1976), "Economic approach to allocation curb space for urban goods movement", TRR 591.
  26. Hall, Randolph W.(1996), "Pickup and delivery system overnight carriers", Transportation Research A, Vol 30, No. 3.
  27. Hasell, B., Foulkes, M. and Robertson, J.(1978), "Freight planning in London : The existing system and its problem", Traffic Eng. Control 19(1).
  28. Hicks, S.(1977), "Urban freight in : Urban Transportation Economics", D.Hensher(Ed), Cambridge University Press, Cambridge.
  29. Hiroshi T., Yan L., Fumitada o. and Tomoaki N.(1997), "A simulation model of the delivery truck's movement in the CBD of OSAKA", Journal of Eastern Asia Society for Transportation Studies, Vol. 2, No. 6, Autumn.
  30. Hutchinson, B. G.(1974), "Estimating urban goods movement demands", TRR 496.
  31. Lea, Norman D. and Hartman, John R.(1974), "Canadian studies of urban goods movement - A status report", TRR 496.
  32. Lobel, Samy A. and Crowley, Kenneth W.(1976), "Aspect of demand for urban goods movement in city centers", TRR 591.
  33. Meyburg, Arnim H. and Stopher, Peter R.(1974), "A framework for the analysis of demand for urban goods movement", Transportation Res. Record 496.
  34. Mohr, Eric(1974), "Some fallacies in urban goods movement", TRR 496.

35. Ogden, K. W.(1992), "Urban Good Movement : A Guide to Police and Planning", Ashgate Publishing Company.
36. Richard de Neufville, Nigel H. M. Wilson and Louis Fuertes(1974), "Consolidation of urban goods movement :□ critical analysis", TRR 496.
37. Slavin, Haward L.(1976), "Demand for Urban Goods Vehicle Trips", TRR 591.
38. Starkie, D. N. M.(1974), "Forecasting urban truck trips in the united kingdom", TRR 496.
39. Sullivan, Edward C.(1974), "Can regional planning improve truck transportation?", TRR 496.
40. Taniguchi, Eiichi and Rob E. C. M.(2000), "An evaluation methodology for city logistics", Transport Review, Vol. 20, No. 1.
41. Taylor, S. Y. and Ogden, K. W.(1998), "The utilization of commercial vehicle in urban areas", Transport Logistics, Vol. 1, No. 4, 1998
42. Toshinori Nemoto(1997), "Area-wide inter-carrier consolidation of freight in urban area", Transport Logistics, Vol. 1, No. 2.
43. Wood, R. T.(1974), "Basic data needs for urban goods movement analysis", TRR 496.
44. Wood, W. G., Suen, L. and Ebrahim, A.(1982), "Urban goods Movement Research : Canadian Experience in the Seventies", Transportation Planning and Technology, Vol. 7.
45. Yoji Takahashi, Tetsuro Hyodo, Mikio Kubo, Masato Shimizu and Tamaoki Watanabe(1995), "An analysis on promoting efficiency of ruban goods flow from a viewpoint of distribution", , Vol 30, 1995.
46. Yoji T., Tetsuro H. and Hirohito K.(1997), "A study on modeling of truck's behavior and policy analysis of transportation system management in C.B.D.", Journal of Eastern Asia Society for Transportation Studies, Vol. 2, No. 6, Autumn.
47. Zattero, David A.(1976), "Suggested approach to urban goods movement and transportation planning", TRR 591.