

IMPROVEMENT OF CARRIER SORTING RATE OF LETTER IN POSTAL LOGISTICS*

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It is important to have the accuracy sorting plan for the save of postman work time and the fast delivery of the receipt mail. It's also very important to plan the proper carrier sorting plan at the situation where the number of pocket of letter sorting machine [LSM] is less than the number of postal code or the number of carrier. This paper describes the method for the carrier sorting plan and sorting rate improvement at the situation where the number of pocket of LSM is small. The sorting rate improvement effect more than 20% was showed by applying the proposed carrier sorting plan to 2 areas.

Keywords: Carrier Sorting Plan; Automatic Sorting Rate; Postal Logistics; Letter.

1. Introduction

It is faster than the consolidation of competitive power of the post business in the era of global competition and the efficient postal mail process such as receipt and delivery of mail are the inevitable matter for service and time. Therefore, the transaction step definition and the efficient improving of environment about the postal process including the mail receipt, a delivery and sorting, etc. are above anything else important. Generally, mail is receipted at post office, and the receipted mails are collected to mail distribution center for outbound sorting by LSM. After outbound sorting, the sorted mails are transported to destination mail distribution center for inbound sorting. The inbound sorted mails are sent to delivery center for delivery to final destination by postman. The mail is sorted by sorting machine through recognition of mail address and postal barcode. The sorting rate of the mail depends on whether the accuracy sorting plan has or not for sorting machine. To make the accuracy sorting plan it also depends on whether well-defined postal code is or not, and the number of pocket of sorting machine is enough or not. Presently, the postal code structure is comprised of the representative postal code based on administrative area boundary, the postal code based on administrative area number, and the postal code based on large amount mail in Korea [1, 2]. It's a difficulty to have the exact sorting information, and match between postal code and delivery unit for classify of postal letter. So, every

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postman needs over half or hour to classify the postal letter by carrier at delivery center after classify the postal letter by the prepared sorting plan based on postal code at mail distribution center. Therefore, more fast delivery of mail by postman and the saving of postman work time, it's important to have the accuracy sorting plan of sorting machine. In this paper we suggest to make the establishment method of sorting plan for sorting machine.

This paper is organized as follows. We describe the carrier sorting plan and sorting rate status of LSM in Korea, section II. Section III presents the method for establishment of carrier sorting plan, and its field application results. Section IV concludes with summary of this paper.

2. Sorting Rate of Letter

In 2007, presently there are 29 mail distribution centers [MDC], and 1 mail switching center [MSC] in order to classify the letter and parcel in Korea. There are about 150 the postal automation sorting machines in the filed. We describe the postal sorting plan establishment content and status of the carrier sorting rate of letter sorting machine in this section.

2.1. Installation Status of OVIS/LSM

Fig. 1 [1, 2] is the status of OVIS/LSM models which run for ordinary mail sorting in Korea. There are 43 NEC models such as NAV-AC18 and NAV-D1KR, etc and 10 Toshiba models such as TT1000 and TT1021.

OVIS/LSM Model		Installed OVIS/LSM at MDC in Korea	Remark
NEC (Total: 43)	NAV-PC1	Seoul [1]	Bin + OCR
	NAV-AC1	East Seoul [2]	
	NAV-D2KR	East Seoul [2]	Modified NAV-AC1
	NAV-AC11	Busan [4], Daegu [4], Daejeon [2], Kwangju [2], Cheongju [1], Anwon [1], Wonju [1]	
	NAV-AC16	Uijeongbu [3], Ulsan [4], Goyang [2], Seongnam [2], Anyang [2], Changwon [1], LSM [2]	
	NAV-S1KR	Changwon [1]	LSM + OVIS + 1 Level
	NAV-AC17	Seoul [1], Busan [1], Daegu [1], Kwangju [1], Jinju [1]	4 Level
	NAV-AC16	Seoul [2], East Seoul [1], Buchon [1], Daejeon [1]	4 Level
	NAV-M1KR	Seongnam [1], Goyang [1] → NAV-M2KR	AC16 + 4 Level + Registered Mail
	NAV-D1KR	Wonsu [1], Gyeon [1], Pohang [1]	AC16 + 2 Level + Registered Mail
Toshiba (Total: 10)	TT1000	Buchon [3], Jeju [1], Jinju [1]	
	TT1021	Kangnung [1], Inju [1], Seoncheon [1], Andong [1], Chonan [1]	

Fig. 1. Installation Status of OVIS/LSM Machines in Korea

In case of the NAV-AC16 model there are 3-4 OVIS/LSM at the Uijeongbu, 1-2 OVIS/LSM at Changwon, and 2 OVIS/LSM at Goyang, Seongnam, and anyang mail distribution centers respectively. There are also 2 NAV-D2KR which was remodeled of NAV-AC1 in the East Seoul mail distribution center. And there are 2 NAV-M1KR models which have the automatic classification job handling function of the regular size registered mail at Seongnam and Goyang mail distribution centers respectively. The new

NAV-D1KR model with the automatic classification processing of the regular size registered mail runs at Pohang, Youngam, Mokpo, and Ulsan mail distribution center respectively in 2007.

2.2. Sorting Plan of OVIS/LSM

The sorting plan of sorting machine is used to divide mail into postman base and delivery sector. Therefore, it's important to establish and deployment of the sorting plan on the sorting machine because the classification time by carrier and the quick delivery of the postal letter depend on the sorting plan whether it's a good establishment or not. And the mail sorter is the high price, and moreover, a sorting machine usually accommodates many delivery centers in consideration of the cost down including the sorting machine installation space and operational manpower. So, each delivery center is partitioned to the limited pockets of sorting machine, an establishment and application of the more effective sorting plan are needed. Fig. 2 shows an establishment and deployment process of the sorting plan which becomes to the sorting machine in mail distribution center. Firstly, the number of whole pocket divides with the number of delivery center based on the amount of materials. The corresponding 1 or 2 postal code of the representative copper and representative same region is assigned to one pocket. It is applied after checking the double assignment or no of the next receiving station postal code form. Moreover, if the postal area adjustment or the postal code addition is generated, it reflects by the form assigning the adjusted postal code to the regional representative copper postal code division partition. While being so, the sorting rate of the postal matter which has been being classified at the mail distribution center is the very low actual condition.

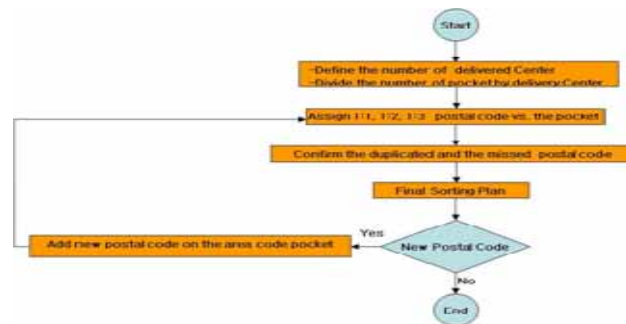


Fig. 2. Carrier Sorting Plan Establishment and Deployment Process

2.3. Carrier Sorting Rate

Because the number of pocket of a sorting machine is limited, the sorting rate of the postal letter more falls and due to this, postman additionally takes over the half hour to 2 hours to classify manually the postal letter at the delivery center. 40 % among the amount of mails from mail distribution center has been getting mixed more two delivery sectors,

30% has been being classified into the representative copper, and 30 % has been being classified into the postman. The following is the carrier sorting rate situation of the Daejeon mail distribution center which remarkably dually runs the NEC equipment and the Dunsan post office that is the delivery center, and the Cheonan mail distribution center operating the Toshiba equipment and the Cheonan post office as delivery center is the same like the step side next.

2.3.1. NP > NC Case

In this case, we studied Daejeon mail distribution center and Dunsan post office as the number of pocket (NP) of sorting machine is greater than the number of carrier (NC).

DunSan Delivery Center (one Month, 2006.4)		
Number of Carrier	Number of Mail Volume	Rate (%)
1	875463	31.81%
2	780250	28.3496
3	484180	17.5922
4	282022	10.247
5	132587	4.81742
6	108455	3.94061
7	89283	3.24401

Number of Group	Number of Mail Volume	Rate (%)
1	2402474	87.2916
2	178522	6.48643
3	171244	6.22199

Fig. 3. Carrier Sorting Rate of DunSan Post office

The Daejeon mail distribution center sets up the NEC OVIS / LSM 2 part having 276 pockets in March 2000. The Daejeon mail center also sets up the NEC OVIS/LSM 1 part subsequently having 312 pockets in July 2004, and runs. Therefore, in April 2006, current, the Daejeon mail distribution center applies the OVIS / LSM 3 part. And we actually use 817 among 864 total division partitions and the division partition assigned to the Dunsan post office, that is the receiving station of the Daejeon mail distribution center, is the total 132 partition. The division throughput performance of each sorting machine is 30,000 mails per hour. The postal code, customer bar code, and fluorescence bar code recognition rate show 99 % or greater. The covered delivery center in the Daejeon mail distribution center is grapped as. The average of a day division amount of materials processed through a sorting machine is about 2 million mails at Daejeon mail distribution center. The average of a day 160,000 mails delivers at Dunsan post office. Also the covered delivery center received in the Daejeon mail distribution center is 29 in April 2006. The Dunsan post office has 119 delivery sectors and 9 delivery teams for the delivery and sequence sorting of 160,000 mails a day in October 2006 [3, 4]. There are 210 postal codes which used in the Dunsan post office. The sorting rate is low for the use

of the representative copper postal code. The postal area adjustment occurs in the postman defect or the amount of mails enlargement and postal code addition with at any time but the sharp postal area control is about one time in year. They take 1 or 2 hours to classify the mail by carrier at delivery center before the posman delivers the mail to the receiver. As to fig. 3, the sorting rate with current sorting plan of Dunsan post office is 31%, and the delivery team section rate is low as about 87 %.

2.3.2. NP < NC Case

In this case, we studied Cheonan mail distribution center and Cheonan post office as the number of pocket of sorting machine (NP) is lower than the number of carrier (NC).

CheonAn Delivery Center (one Month, 2006.4)		
Number of Carrier	Number of Mail Volume	Rate (%)
1	280944	16.0851
2	293933	16.8288
3	269972	15.4569
4	116371	6.66268
5	199096	11.399
6	302504	17.3195
7	62989	3.60636
8	220801	12.6417

Number of Group	Number of Mail Volume	Rate (%)
1	1419495	81.2714
2	250711	14.3541
3	76404	4.37442

Fig. 4. Carrier Sorting Rate of CheonAn Post Office

The Cheonan mail distribution center sets up the Toshiba OVIS/LSM 1 part in November, 2002. The total division partition number is 336 but if the total division partition number excludes the reject partition, etc. The actual use division partition is 314 partitions. The division throughput performance of the Toshiba equipment used in the Cheonan mail distribution center is 30,000 mails per hour. The postal code, customer bar code, and fluorescence bar code recognition rate show 99 % or greater. The covered delivery center in the Cheonan mail distribution center is 18 with 443 carriers in April 2006. And the Cheonan mail distribution center processes about 600,000 mails a day. The 74 pockets among 314 of the Toshiba equipment at Cheonan mail center is assigned for Cheonan post office which delivers about 90,000 mails a day in October 2006. The Cheonan post office which uses 168 postal codes is composed of 7 delivery teams with 92 carrier sectors [3, 4]. The sorting rate of the Cheonan post office is lower than the Daejeon Dunsan post office. As to fig. 4, the sorting rate with current sorting plan of the Cheonan post office is 16%, and the sorting rate of delivery team is low as about 81 %.

3. Sorting Plan Establishment Method and Rate Improvement

The sorting rate of the postal matter which has been being classified at a discriminator is low and postman needs the suitable time to sort mail by carrier and sequence sorting before the postal matter delivers to the destination. Due to this, the additional sorting work hours of the postmen are burdensome. So, an establishment and application of more effective, systematic postal area division plan of sorting machine at mail distribution center are needed. Thus, more systematic, effectually improving the sorting plan establishment and it's application of sorting machine at mail distribution center, the time when postmen perform to sort by carrier and sequence sorting in the delivery center can be reduced. Moreover, the postal area section rate is enhanced through the postal area division plan establishment improvement and the work hours of the postmen are reduced and the mail is more rapidly delivered.

3.1. *Sorting Plan Establishment Method*

Fig. 5 shows the improved sorting plan establishment method based on the postal code and mail address. First of all, we need to check how many delivery sector and postal code they have in each delivery center, and how many pockets they have in sorting machine for establishment of the sorting plan. If the number of pocket which can be assigned to delivery center is more than the number of postal code or the number of delivery sector in delivery center, postal codes which are for mass mail zone and the representative copper or the overlapped address postal area will be assigned the possible pocket one to one. If the number of pocket which can be assigned to delivery center is less than the number of postal code or the number of delivery sector in delivery center, 50 ~ 60% among postal codes which are for mass mail zone will be assigned the possible pocket one to one. The pocket of the sorting machine for postal code of the representative copper area of the delivery center should be assigned one to one, and the pocket of the sorting machine for postal code of the special sector of the delivery center should be assigned one to 2-3.

There is also the routine for assignment of postal code to pocket of sorting machine based on the recognition postal code and postal address in fig. 5.

The unassigned rest postal codes of delivery such as postal code of administrative area number are assigned to a pocket by 2 - 6 postal codes in consideration of the amount of mails and delivery team boundary. In this way, all postal codes of the corresponding receiving station are allocated to the pocket of sorting machine, and check whether there is double assignment of the postal code or not. And then the carrier sorting rate of the delivery center calculates based on the proposed algorithm. The sorting rate is calculated freshly according to the rate of the assigned pockets for large amount mail delivery and special sector of the delivery center, and seeks out the best sorting plan based on the proposed procedure for the delivery center. And it decides as the final sorting plan of the receiving station and it applies to the sorting machine at mail distribution center. If the postal code freshly added at delivery center by means of the city development or the amount of mails enlargement and postal area adjustment, the new postal code should be assigned to the pocket of the sorting machine based on the proposed procedure and the

according to the proposed sorting plan establishment method can confirm the improved thing to 39% in existing 16%. Moreover, the carrier team sorting rate can confirm the improved thing to 95% in the existing 81%.

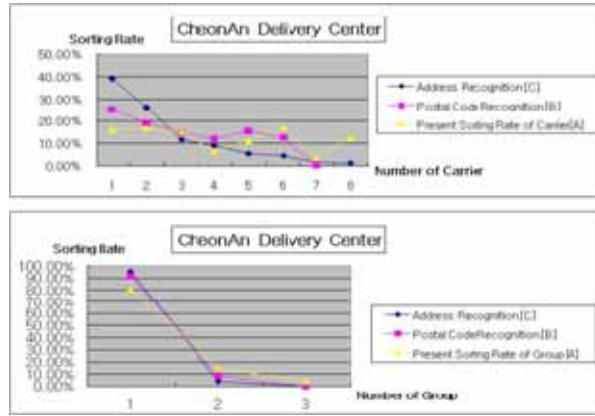


Fig. 6. Test Result of the Proposed Sorting Plan Establishment Method in Case 1

In this case, as shown in Fig. 7, the PCSP (the Proposed Sorting Plan by recognition of Postal Code) is the manual sorting time and the cost reduced by the sorting plan proposed under the postal code recognition base. And the ASP (the Proposed Sorting Plan by recognition of Postal Address) is the manual sorting time and the cost reduced by the sorting plan proposed in the mail address recognition base. The PSP (Present Sorting Plan) is the manual sorting time and the cost generated under the existing sorting plan. It can be improved in which postmen additionally classify the manually postal area division ahead of the postal matter delivery.

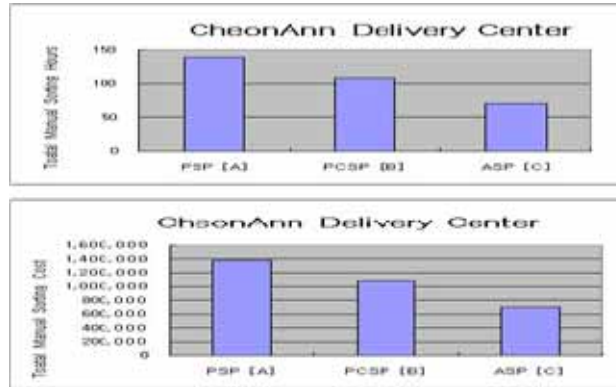


Fig. 7. Cost and Carrier's Work Time in Case 1

3.2.2. Case 2 : NP < NC (NPC) Case

The allocated pocket number on the sorting machine for Dunsan post office which has 104 carriers is 132 as the allocated pocket number of sorting machine is enough case by postman division partition. The improvement of the sorting machine application result carrier sorting rate could be brought through the application of the sorting plan method proposed in this situation. In case of applying the proposed sorting plan establishment method, fig. 8 shows the improved sorting rate of carrier and delivery team. The carrier sorting rate based on the post code recognition according to the proposed sorting plan establishment method can confirm the improved thing to 53% in existing 31 %. Moreover, the delivery team sorting rate can confirm the improved thing to 94% in the existing 87%. And the carrier sorting rate based on the Korean address recognition according to the proposed sorting plan establishment method can confirm the improved thing to 85% in existing 31 %. Moreover, the carrier team sorting rate can confirm the improved thing to 95% in the existing 87%.



Fig. 8. Test Result of the Proposed Sorting Plan Establishment Method in Case 2

In this case, as shown in Fig. 9, the PCSP (the Proposed Sorting Plan by recognition of Postal Code) is the manual sorting time and the cost reduced by the sorting plan proposed under the postal code recognition base. And the ASP (the Proposed Sorting Plan by recognition of Postal Address) is the manual sorting time and the cost reduced by the sorting plan proposed in the mail address recognition base. The PSP (Present Sorting Plan) is the manual sorting time and the cost generated under the existing sorting plan. It can be improved in which postmen additionally classify the manually postal area division ahead of the postal matter delivery.

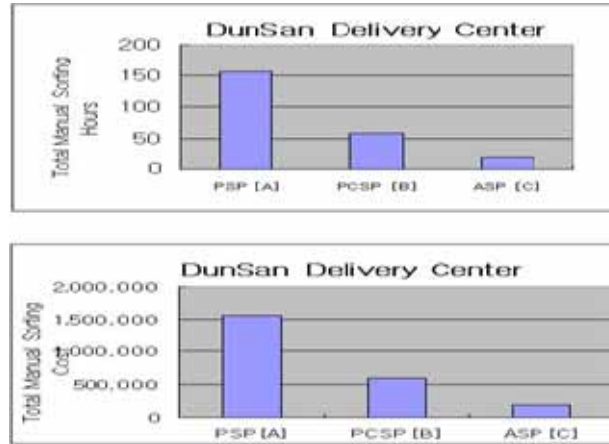


Fig. 9. Cost and Carrier's Work Time in Case 2

4. Concluding Remarks

In this paper, the establishment method of sorting plan for sorting rate improvement of carrier and delivery team. The proposed method of sorting plan is based on assignment method of postal code to the pocket of sorting machine. We showed the test results of the postal code and Korean address recognition based on the proposed sorting plan establishment method for sample areas such as Dunsan which has enough pocket number of sorting machine for carrier, and Cheonan which has insufficient pocket number of sorting machine for carrier.

We also showed manual sorting time and cost at delivery center reduced if the proposed sorting plan establishment method applied to the sorting machine at mail distribution center.

But the sorting plan and rate of carrier by sorting machine at mail distribution center still should be more improved for cost down and reduction of postman working time of manual sorting at delivery center.

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