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ADJUSTMENT PLAN OF POSTCODE ACCORDING TO INTRODUCTION OF NATIONAL BASIC AREAS CODE IN KOREA

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Abstract. *Postcode has been used for improving efficiency of mail sorting since 1970. Current postcode became 6-digits code in 2000 which had been reformed two times. However, since 2015, we have to use the national basic areas code which is replaced with the postcode. The national basic areas code will be used to not only sort the mail but also indicate the location and area in the whole country. Especially, it is expected to affect considerably the courier and logistics areas. Therefore, we analyze the effect of postcode and national basic areas code. Firstly, we analyze the basic statistical data onto the postcode and the national basic areas code. Secondly, in the delivery sorting aspect, we compare the front 3 digits of the postcode and the national basic areas code using the geographic data. Finally, in the arrival sorting aspect, we propose adjustment scales and application using the geographic data by comparing and analyzing the whole 6-digits of the postcode and 5-digits of the national basic areas code.*
Keywords: Postcode, National basic areas code, Adjustment plan, GIS, Korea

1. **Introduction.** The postcode converts address to number according to the particular standard to code that is used to sort the mail by address. Korea began to use the postcode from 1970 for the first time and 6-digits postcode was introduced in 2000 in order to conclude the problem of the postcode system which was used previously [1]. The postcode used previously in 2000 was postcode of the administrative district unit and postal area has more than two postcodes. So, if the mail arrives, there was a cost-ineffective side that must input much time and human strength, since sorting work needs by postman units before usual route sorting. To improve effectiveness of the postcode and to reduce postman's load by sorting as postman unit, and to link with automation of sorting and introduction of the road name address system, Korea Post made current postcode system [2].

Current postcode is 6-digits code which consists of the front 3-digits delivery sorting postcode and the latter 3-digits detailed address arrival sorting postcode. Delivery sorting postcode of 3-digits is the number which is assigned to the administrative division of mail receiving points. It is used in the mail processing center of the delivery sorting. The first digit represents a wide area region (special city, metropolitan city, province, and special autonomous city) and the second digit represents an inhabitant's zone of life or mail processing center areas, and the third digit represents the sigungu (city-county-district). The arrival sorting postcode of 3-digits is used in a number to use when the mail is delivered to the receiver. In order to coincide with the postal area for each postman, this number subdivides and gives. Generally, it gives based on the legal dong (neighborhood). However, legal dong and administrative dong give each postcode when many administrative dongs exist in a legal dong. Exceptionally, the postcode is given onto the legal dong in case one administrative dong exists in several legal dongs. Therefore, the postcode is not given to the administrative dong [3].

The national basic areas code which divides the whole country into about forty thousand, is promoted in order to be utilized as the standard postcode in the unit of the public administrative service of the public institution and every kind of area official announcement and private physical distribution field, etc., including the postcode in Korea Post from the second half of the 2015 [4]. Each national basic area is established based on the geographical feature (river, road, railway, ridge, etc.) and the eupmyeondong (own-township-neighborhood) boundary simultaneously. The 5-digits is assigned to these areas by considering the utilization convenience [5-9]. Most of the countries with the road name address system used the postcode as a part of the address. Particularly, in the advanced countries, various domain sections set a minimum unit. They use the postal areas, statistical areas, and various administrative areas by aggregating minimum units [10-13]. The Geographic Information Systems (GIS) can be used in various fields [14,15]. In particular, it is a high utilization in the postal field (assignment of postcode, delivery area, etc.) [16-18]. In this paper, we compare and analyze the national basic areas code and the current postcode. Also, we suggest the direction of the adjustment of the postcode by statistically analyzing the effect of national basic areas code using GIS. The organization of this paper is as follows. In Section 2, we analyze the statistical data onto the postcode and national basic areas code. The national basic areas code and delivery sorting postcode are compared and analyzed in Section 3. In Section 4, we compare and analyze the national basic areas code and arrival sorting postcode, and suggest the direction of adjustment of the postcode. The conclusion is presented in Section 5.

2. **Statistical Data Analysis.** In this chapter, we analyze in whole viewpoints about the statistical data onto the postcode and national basic areas code. The number of unique postcode is 52,423 in 2012 and the duplication excluding the number of postcode is 31,586 [19]. Table 1 shows the number of postcode used to sido, sigungu, eupmyeondong, mass volume delivery points, and PO Box (Post Office Box) criteria. The number of sido criteria's unique postcode is 31,588 and two (31,588-31,586) postcodes are used duplicately. The number of sigungu criteria's unique postcode is 31,616 and 30 (31,616-31,586) postcodes are used duplicately. The number of eupmyeondong criteria's unique postcode is 31,756 and 170 (31,756-31,586) postcodes are used duplicately. The number of sido criteria's unique PO Box postcode is 452 and 2 (454-452) postcodes are used duplicately. The mass volume delivery point postcode is redundantly used, because postcode of the lot number was equally given to the other around mass volume delivery point (apartment) or the case of the large building (many companies are in one building).

The number of national basic areas code is 39,610 in 2012 and the average of sigungu criteria's code is 181 (Table 2). We can find that there is a large amount of the assigned number in the urban area. On the other hand, there is a small amount of the assigned number in the rural area.

3. **Comparative Analysis of Delivery Sorting Postcode.** In this section, we compare and analyze the front 3-digits of the postcode and the front 3-digits of national basic areas code. The front 3-digits of the postcode is used for delivery sorting. Most of the delivery sorting code corresponds to the distributing post office, but there are some exceptions. The front 3-digits of national basic areas code is represented at sigungu. However, a sigungu can have more than two national basic areas codes. We analyze the delivery sorting postcode from five viewpoints.

Firstly, the area comparative analysis is based on matching the regional communication office – mail processing center – distributing post office – sido – sigungu – national basic areas code – front 3-digits of the postcode. Currently, 218 distributing post offices exist. However, the number of sigungu is 230. Therefore, one front 3-digits postcode is not assigned to one distributing post office. It means that one distributing post office is

Table 1. Summary of the statistical data for the postcode

sido*	Number of postcode of sido* criteria	Number of postcode of sigungu* criteria	Number of postcode of eupmyeondong* criteria	Number of postcode of mass volume delivery point (duplication)	Number of postcode of mass volume delivery point criteria (unique)	Number of postcode of sido* criteria PO Box
Gangwon-do	1,506	1,511	1,552	466	397	30
Gyeonggi-do	6,291	6,314	6,378	3,656	3,255	71
Gyeongsangnam-do	2,181	2,181	2,183	715	667	19
Gyeongsangbuk-do	2,110	2,110	2,113	588	504	14
Gwangju-si	998	998	1,021	530	443	6
Daegu-si	1,492	1,492	1,493	884	701	13
Daejeon-si	813	813	813	445	419	6
Busan-si	1,989	1,989	1,991	957	911	25
Seoul-si	5,961	5,961	5,962	2,746	2,562	215
Ulsan-si	554	554	554	288	275	3
Incheon-si	1,222	1,222	1,223	571	541	11
Jeollanam-do	1,839	1,839	1,840	390	364	9
Jeollabuk-do	1,661	1,661	1,661	506	481	9
Jeju-do	373	373	373	99	94	3
Chungcheongnam-do	1,563	1,563	1,564	460	434	12
Chungcheongbuk-do	1,035	1,035	1,035	347	309	8
Sum	31,588	31,616	31,756	13,648	12,357	454

* sido: city, province; sigungu: city, county, district; eupmyeondong: town, township, neighborhood

Table 2. Summary of the statistical data for national basic areas code

sido	Number of postcode of sido criteria	Number of average postcode of sigungu criteria
Gangwon-do	2,078	115
Gyeonggi-do	7,108	229
Gyeongsangnam-do	2,715	151
Gyeongsangbuk-do	3,594	156
Gwangju-si	1,249	250
Daegu-si	1,664	208
Daejeon-si	1,259	252
Busan-si	2,746	172
Seoul-si	6,229	249
Ulsan-si	729	146
Incheon-si	1,520	152
Jeollanam-do	2,366	108
Jeollabuk-do	2,012	144
Jeju-do	577	289
Chungcheongnam-do	1,988	133
Chungcheongbuk-do	1,776	148
Sum (average)	39,610	181

matched with more than one national basic areas code. In these distributing post offices, the problem can be generated during the national basic areas code use for the front 3-digits sorting.

Secondly, in terms of the national basic areas code criteria analysis, the number of front 3-digits national basic areas code is 446 by sigungu unit level. The number of national basic areas code that a front 3-digits national basic areas code used more than two sigungus is 55. These 55 national basic areas codes are placed where there is the administrative gu on the general si. Therefore, the delivery sorting problems can occur because a front 3-digits national basic areas code cannot sort sigungu.

Thirdly, we analyze the postcode criteria due to differences in the front 3-digits postcode used in some sigungu. 218 distributing post offices used 257 front 3-digits postcode. In addition, the front 3-digits national basic areas code is used in 230 sigungus. Therefore, the code is redundantly used. The total 8 delivery sorting postcodes are duplicately used in more than two sigungus. It is all of the rural area.

Fourthly, in the sigungu criteria's comparative analysis, there is no duplicate front 3-digits postcode. The result of sigungu criteria, the number of sigungu using the duplicated front 3-digits postcode is 9. There is the postcode using the replication at the mountainous areas and island areas. This problem has occurred in the general si with the administrative gu, because the national basic areas code is not assigned to administrative gu's boundary.

Fifthly, the comparative analysis using the ArcGIS analyzes the digital map analysis, delivery sorting plan analysis, and adjustment scale of the national basic areas code about the discordance of administrative gu boundary. Figure 1 shows the example map. The left map shows the legal dong, postal area, national basic areas code, building, and postcode using the ArcGIS and the right map shows the satellite map. In the dotted line circle,

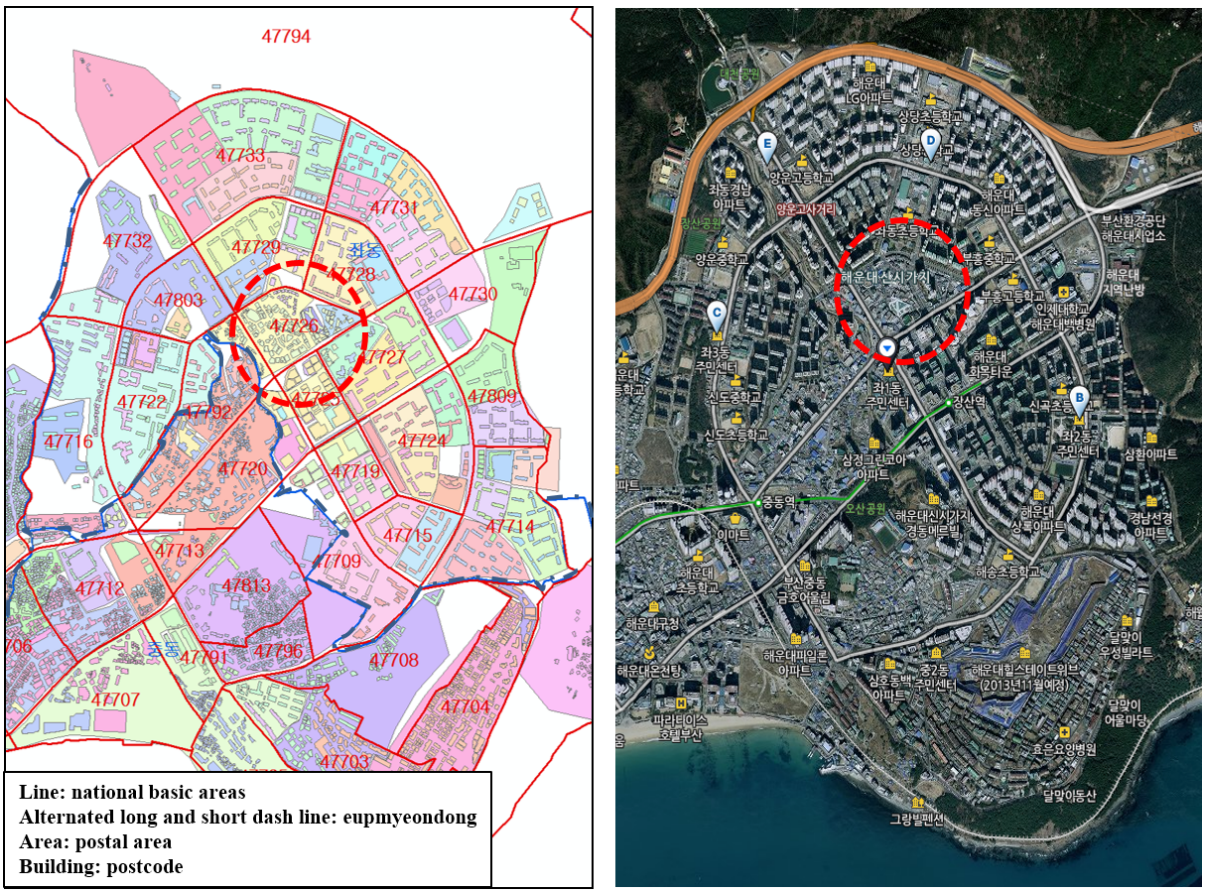

FIGURE 1. Case map of comparative analysis using the digital map

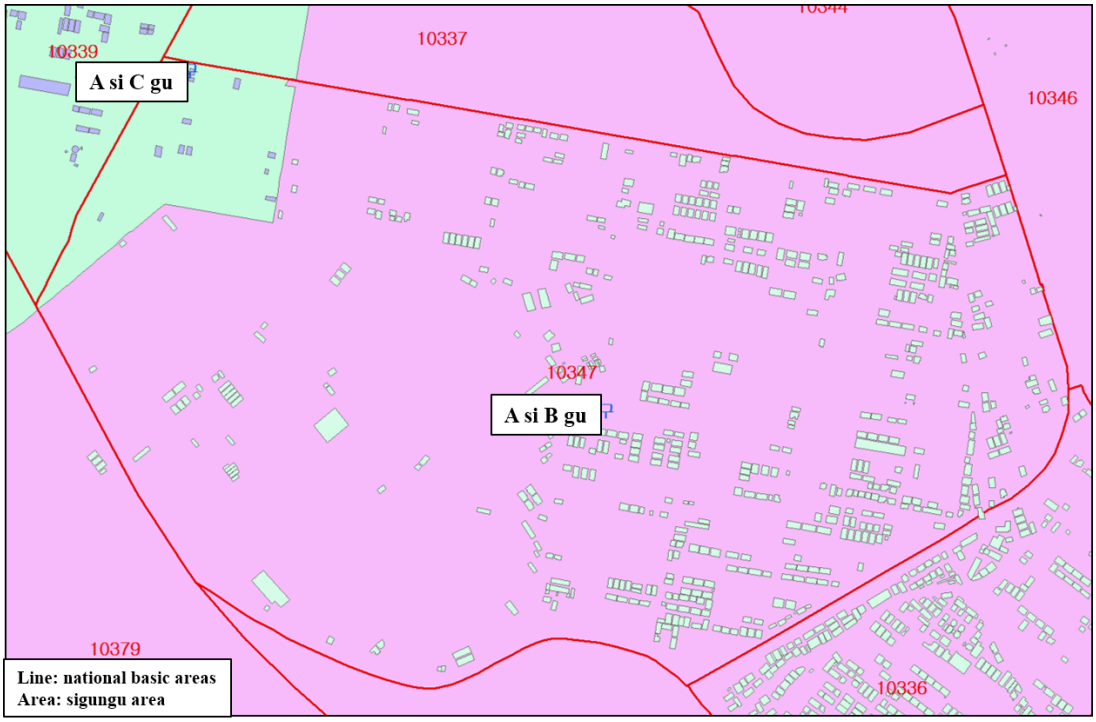

FIGURE 2. Case map of the administrative gu boundary discordant

the many postcode and postal areas exist, but the national basic areas code has only one. Therefore, this postal area needed adjustments.

In the delivery sorting plan analysis, we analyze 6-digits postcode in the delivery sorting plan using the digital map. Generally, the delivery sorting plan is made by using the front 3-digits postcode (distributing post office unit). There exists the partial eupmyeondong into the other distributing post office due to the close or new establishment of distributing post offices and far delivery distance. The delivery sorting plan using the front 3-digits postcode can be replaced with the national basic areas code, because of the national basic areas code being given the sigungu level. Therefore, we have to confirm the delivery sorting boundary by the detailed address. In these cases, the large-scale postal area adjustment is needed.

In the administrative gu boundary's inconsistent analysis of the national basic areas code, the national basic areas code does not reflect the administrative gu boundary of the general si. Many boundaries are inconsistent, because they are not conformed to the administrative area boundary of the road name address. The case without the building has no problem, because the mail is not generated. However, the adjustment is needed if the building will be generated in this area later. If there are buildings, the chaos occurs because the sigungu information of national basic areas code does not accord with sigungu information of administrative area information. And manual sorting task is necessary additionally. Figure 2 shows that the 11 buildings of C gu in A si are included in the national basic areas code 10347 of B gu in A si. In this case, the 11 buildings can be sorted to B gu when they are sorted by the national basic areas code. Therefore, the boundary adjustment is certainly needed in order to do the delivery sorting with the front 3-digits national basic areas code.

4. **Comparative Analysis of Arrival Sorting Postcode.** In this section, we compare and analyze the 6-digits of the postcode and the 5-digits of national basic areas code. The analysis sites selected each one sigungu (Busan-si Haeundae-gu, Chungcheongbuk-do Chungju-si Heungdeok-gu, Seoul-si Joong-gu, and Seoul-si Jongro-gu) according to the regional characteristics. The national basic areas code information can be produced at

the building record unit using the spatial join by ArcGIS, because the building DB of the road name address digital map includes the postcode information provided with the Korea Post. According to the result of analysis, there is a large number of postcode in the major and big cities, whereas there is a small number of national basic areas code in the other areas.

We present a direction about how to adjust the postcode to the arrival sorting national basic areas code. We find out that the number of postcode and national basic areas code with si criteria is almost the same, whereas national basic areas code has been assigned more than postcode with gun and gu criteria. We assumed that the area of the national basic areas code used to be the postal area. Generally, the distributing post office exists as the sigungu unit and the postal area is divided into the postman. Therefore, we propose two postal area's adjustment plans, according to the relationship of the number of postcode and national basic areas code in sigungu. Firstly, in the case of lots of the national basic areas code, one postcode is comprised of several national basic areas codes. Therefore, one postman delivers several national basic areas codes. In Figure 3, left map shows that one postman delivers to the buildings having the same postcode expressed as the same color. For example, the buildings (national basic areas code 28180, 28182, 28183, 28186, and 28187) are delivered by one postman. Secondly, in the case of lots of the postcode, several postcodes are comprised of one national basic areas code. Therefore, several postmen deliver one national basic areas code. The delivery area of each postman is assigned to separating from the postcode or the building group of the same road names referring to the delivery load. In Figure 3, right map shows that several postcodes have consisted of one national basic areas code. In national basic areas code 47733, four postmen are assigned. Therefore, the delivery area of each postman is each postcode or the building group of the same road names.

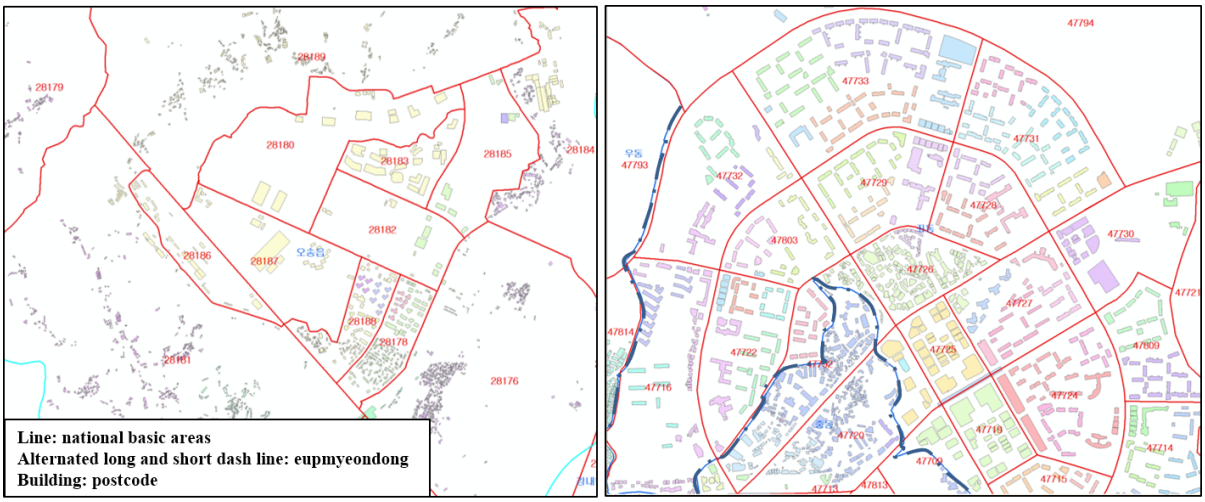

FIGURE 3. Case map of relationship between national basic areas code and postman

5. **Conclusion.** In this paper, we present the direction of the adjustment plan according to the introduction to the national basic areas code by geographic data and statistically analyzing the effect of national basic areas code. The results of statistical data analysis can be used as the basic data onto the verification of the national basic areas code and the analysis of the influence on postal business. Particularly, it can be used in predicting the load of the postman's collection and delivery. In the result of the delivery sorting postcode analysis, there exists a case where the region is divided into the eupmyeondong unit which is the subordinate administrative area of the sigungu. And also, there exist several cases which do not keep the administrative gu and eupmyeondong boundary. Therefore, the

region adjustment is surely necessary for the accurate delivery sorting. In the result of the arrival sorting postcode, there is a large number of postcode in the major cities, whereas it is small in the number of national basic areas code in urban-rural complex areas, and rural area. We proposed an adjustment plan according to the relationship of the numbers of postcode and national basic areas code. In the area with lots of national basic areas code, a postman delivers several national basic areas codes; on the contrary, several postmen deliver a national basic areas code.

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