A Study On The Application Of The South Gyeongsang Provincespecial Transportation Serviceintegrated Call Center DB

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ABSTRACT: South Gyeongsang Province has established and operated a Special Transportation Service Support Center(official name: Gyeongnam Special   Transportation Service Call Center) based on information and communication technology since August 1, 2009, while gathering and computing information to identify travel attributes. This study examined ways to improve the utilization of the vehicle dispatch history DB, which stores information generated from the call center, and to improve the quality of the data collected. Based on the established data, it is possible to identify the wheelchair-use ratio, user ratio according to the type of disability, time zone, and travel pattern by day. In particular, it is possible to identify the travel O/D pattern of the special transportation service users by using the origin and destination information.However, in order to identify the precise travel attributes, it is necessary to collect additional information such as the general attributes of the individual user(age, gender, income, car ownership status, etc.), the purpose of travel, which is the main component of the travel pattern, as well as the waiting time and travel time. In addition, the efficiency of the operating method needs to be improved by establishing a system that can generate the necessary information periodically and automatically and by introducing a membership system. Information from information technology-based data arehighly useful from a policy perspective when considering the accuracy and reliability of the information compared to the information based on surveys.

KEYWORDS -*special transportation service, travel attributes, mobility impaired, South Gyeongsang Provincecall center*

I   INTRODUCTION

1.1 Background and Purpose of Study

Since Seoul introduced a call taxi system for the disabled in 2002, the "Mobility Enhancement for the Mobility Impaired Act" was enacted in 2005 due to the increasing national interest for the mobility impaired. The act resulted in the establishment of "mobility enhancement plans for the mobility impaired" by each local government from 2007. The mobility enhancement plans for the local mobility impaired include various measures such as the introduction of special transportation services to guarantee the mobility of the mobility impaired, and all metropolitan municipalities, including Seoul and most provincial municipalities, currently operate their own special transportation service.

South Gyeongsang Province, the only province where the special transportation service introduction rate(134.6%) exceeds the statutory rate, has established and operated a special transportation service support center(official name: Gyeongnam Special Transportation Service Call Center) since August 1, 2009. The center integrates the operation of special transportation services under the responsibility of each city and county. South Gyeongsang Province is the only local government to operate a call center that integrates all of the special transportation services across the province. The province has played a leading role in building and operating the system and has invested the resources required for its construction and operation. Unlike the municipal government covering the same transport zone, in terms of the province, the integrated call center has a great advantage. The center can provide comprehensive transport services beyond the city and county boundaries by integrating the special transportation services provided by the local government. That is, the basic function of the South Gyeongsang Province Call Center is to operate and provide special transportation services for thewide-area transport for all of the provincial mobility impaired people, including wheelchair users. Theobjective is to guarantee the mobility rights of the mobility impaired, including the disabled.

The process of establishing the integrated call center provides an additional effect of collecting and computing a variety of information about the traffic pattern of the mobility impaired.As user information, such astime of use, destination, origin, and wheelchair-use status, is required for proper dispatch in response touser demand, various travel details are reported. The level of complexity in this travel information is unlike that of traditional survey results. The contents of the information, which is collected and computed,provide very practical and detailed data on the travel attributes of the mobility impaired and disabled.

This study proposes ways to utilize the information from the South Gyeongsang Province call center, which is currently under operation. This study

examines the extent of which, the travel attributes of the special transportation users, or mobility impaired and disabled people can be grasped by using the collected data. The study also intends to propose measures to improve the quality of the collected data.

1.2 Contents and Scope of Study

The contents and process of the study are summarized as follow.

First, laws related to the mobility impaired were reviewed. Second, an overview of the South Gyeongsang Province Special Transportation Service Call Center operating system and operation status through 2012 were examined for a comprehensive understanding of the study. Third, the dispatch history of the collected data was examined. Fourth, the contents of travel attributes that could be determined by using actual collected data were examined. Finally, this study concludes by suggesting improvement measures of the collected data, future research, and policy directions.

The spatial coverage of the study results is limited to South Gyeongsang Province as this study utilizes the data collected from the South Gyeongsang Province Special Transportation Service Call Center. The validity of the traffic pattern is also limited to the corresponding period of the collected data.

II   LEGAL BASIS FOR INTEGRATED CALL CENTER

The special transportation service is a transportation means that was introduced and operated by the metropolitan municipalities and basic local governments. The services were made available for the mobility impaired and disabled as regulated by law. That is, each local government is responsible for introducing the vehicles and enacting the ordinances to achieve the target and determining the target user, service rate, and operation means. Each local government is responsible for the provision of service as well as the total cost of operation. Thus, it is the responsibility of the local government to increase the user service level and to improve the operational efficiency.

2.1 The Mobility Enhancement for the Mobility Impaired Act

According to the new Article 7, clause 2-3(establishment of the mobility enhancement plan for the mobility impaired, etc.), the governor or head of a county is required to establish a cooperation system for the wide use of the special transportation service. This includes the operation of a wide-area travel support center when establishing a mobility enhancement plan for the mobility impaired.

In addition, according to Article 16, clause 3, for cases where the governor considers it necessary for the effective operation of the special transportation service, it is possible to integrate and operate the travel support center upon consulting with the mayor and head of the county in the administrative district. Clause 6 was amended to allow the state or province to support some of the funds required to secure special transportation services or to establish a travel support center.

2.2 Ordinance on the Mobility Enhancement for the Mobility Impaired

In South Gyeongsang Province, irrespective of the Mobility Enhancement for the Mobility Impaired Act, Article 12 of the ordinance on the mobility enhancement for the mobility impaired established on August 18, 2011, prescribes the grounds for the operation of the call center. Article 13 prescribes the functions of the call center, and Articles 14 and 15 introduce details and budget support for introducing and operating a special transportation service integrated call center in South Gyeongsang Province.

2.3 Review of the Regulations and Ordinances regarding the Use of Special Transportation Service

Detailed information on the use of the special transportation service(service rates, service area, target user) is not specified in the 「Ordinance on the mobility enhancement for the mobility impaired in South Gyeongsang Province」, but the basic contents are established in the 「Regulations on the operation of the special transportation service call center in South Gyeongsang Province」.

The 「Regulations on the operation of the special transportation service call center in South Gyeongsang Province」 only specify details on out-of-province services, target users, are how the service fees are to be collected. On the other hand, details such as in-province service and service rates are subject to the jurisdiction of each city and county. Moreover, the scope of the target user regulates both the basic and reserved details of each city and county.

III   OVERVIEW OF SOUTH GYEONGSANG PROVINCE SPECIAL TRANSPORTATION INTEGRATED CALL CENTER

3.1 Background and Purpose of the Integrated Call Center

The integrated call center project began on April 21, 2009, with a contract between South Gyeongsang Province and the South Gyeongsang Province Taxi Association. After a 2-month test operation period during which the system was stabilized by identifying issues, the center launched its official operation on August 1, 2009.

3.2 Integrated Call Center Overview

As of October 2012, the integrated call center operates a total of 287 vehicles in 8 cities and 10 counties in South Gyeongsang Province(Hamyang County introduced 2 vehicles for its special transportation service, but their operation is not connected to the integrated call center). The total number of operating personnel is 20, including 1 director of the center and 19 call operators. The center operates 24 hours, 7 days a week throughout the year.

Table 1 Number of vehicles operated by city and county (as of October, 2012)

| City	Changwon (CW)	Jinju (JJ)	Tongyeong (TY)	Sacheon (SC)	Gimhae (GH)	Miryang (MY)	Geoje (GJ)	Yangsan (YS)
Number	100	22	20	9	50	20	21	20
County	Goseong (GS)	Changnyeong (CY)	Namhae (NH)	Haman (HA)	Geochang (GC)	Uiryeong (UY)	Hapcheon (HC)	Hadong (HD)	Sancheong (SC)	Hamyang (HY)
Number	4	3	4	3	3	2	2	3	1	2

In addition to call control and consultation between the special transportation service and the users, the major tasks of the call center include all matters necessary for the operation of the call center and travel support for the mobility impaired, including collecting and providing information, handling complaints, cooperating and supporting information between cities and counties, promoting call center operation, and managing website operation.

Per the call center handling process (Figure 1), the center collects information from the entire travel process starting with the user's call request. The information includes details on vehicle dispatch and reports the times of passenger pick-up and drop-off.

Figure 1 Call center call-handling flowchart
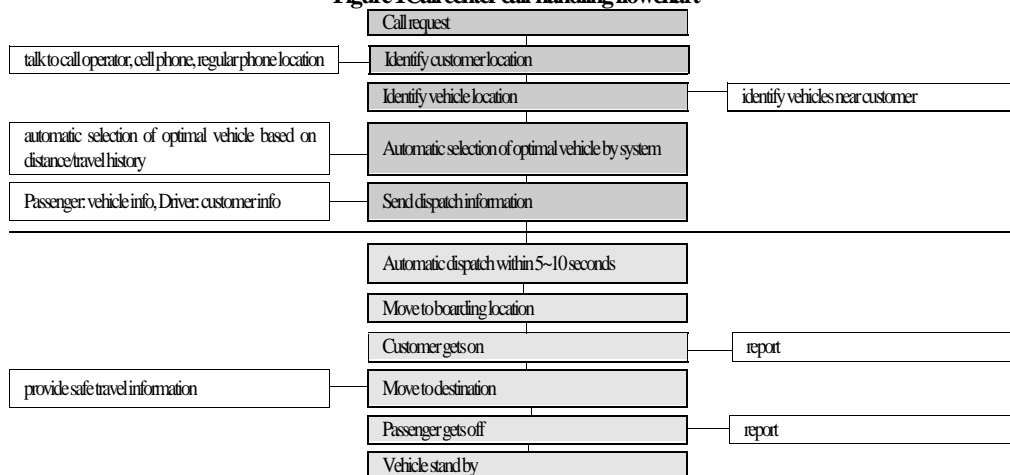
Due to the improvement of service convenience and activation of wide-area travel, along with the gradual expansion of participating local governments and the expansion of special transportation services, passenger usage has greatly increased from 62,668 cases in the second half of the first year of operation to 425,931 cases in 2012. The service number by vehicle increased over 50% from 2.6 times per day in 2009 to 4.3 times per day in 2012. (Figure 2)

Figure 2 Change in daily service number per vehicle by year
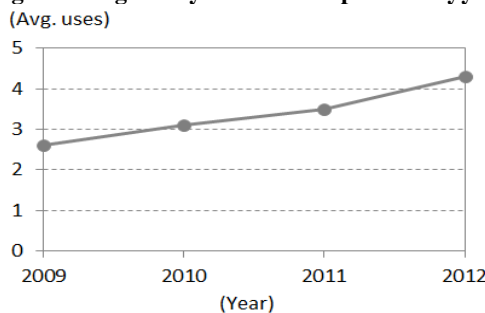
IV   TRAVEL ATTRIBUTES ANALYSIS BASED ON COLLECTION DB

4.1 Collection DB Overview

The data collected is referred to as the dispatch history DB. The DB comprise a total of 10 items, including reception time, result time, vehicle number, origin and destination, departure and arrival messages, dispatch result, and the reason for failure.

The reception time is the date and time when the user called the call center, the result time is the time when the dispatched vehicle was confirmed, and the designated vehicle number is the number of the dispatched vehicle assigned by the call center. The origin and destination are recorded as the user's origin and destination address received in the call center, and the departure and arrival messages provide details reported by the driver such as the name of the building where the user was picked up and dropped off, or the user's name. In addition to the destination details, the arrival message indicates the type of disability and the wheelchair-use status to the call center. Wheelchair users are entered with a ★ symbol. No ★ symbol indicates non-wheelchair users. The type of disability may vary according to the target user specified by the ordinance of each basic local government, as shown in Table 3. The dispatch history DB is divided into highly detailed categories by numbers such as the disabled in the 1st and 2nd degree, the elderly over 65 who experience

discomfort whenusing public transportation, and pregnant women. Finally, the dispatch result shows whether the user actually boarded the vehicle. When the passenger has not boarded the vehicle or when the dispatch resulted in a failure, the reason for failure is recorded separately as a cancellation by the customer or driver. The vehicle number is the number of the vehicle actually used.

Table 2 Type of disability according to classification number

Classification #	Type of disability
1	Physical disability
2	Visual disability
3	Kidney disability
4	Hearing disability
5	Elderly over 65
6	Pregnant women
7	Intellectual disability
8	Autistic disability
9	Brain lesion disability

4.2 Travel Attributes Analysis

In order to analyze the travel attributes that can be identified by using the dispatch history DB, the dispatch history DB during the one-week period from October 8 to October 14, 2012, was collected from the South Gyeongsang Province Special Transportation Service Call Center.Reporting on a total of 9,453 travels, all of the data collected were valid.

4.2.1. Wheelchair User Ratio

The wheelchair user ratio was identified among all users. Of the total of 9,453 users, 3,960(41.2%) were wheelchair users, which is less than half of the total users.As even non-wheelchair users can use the wheelchair-supported vehicles in the special transportation service under the current law, the wheelchair user ratio is an important indicator of the actual utilization of the wheelchair-supported vehicles. Depending on the circumstances, wheelchair users may be limited from using the wheelchair-supported vehicles as non-wheelchair users can use the same special transportation service.

Table 3 Number of wheelchair users

	Wheelchair users	Non-wheelchair users	Total
Number of users	3,960	5,493	9,453
Ratio(%)	41.2	58.1	100.0

Table 4 Dispatch history

Reception time	Result time	Designated vehicle number	Origin	Departure message	Destination	Arrival message	Dispatch result	Vehicle number	Reason for failure
2012-10-09 0:39	2012-10-09 0:52	1111	**City **gu **dong	Front of ** building	**City **gu**dong	**Hospital(1 ★	On board	1111	-
2012-10-09 1:06	2012-10-09 1:16	1234	**City **dong	**Hospital	-	-	Dispatch failure	-	Passenger cancellation

4.2.2. Distribution of Users by Type of Disability

As shown in Table 5, a total of 8,828 people with disabilities in the 1st and 2nd-degree comprise 93.4% of the total. Among them, 3,506 were physically disabled and 2,167 were disabled from brain lesions,which account for more than 50% of the users with 1st and 2nd degree disabilities. The number of hearing-impaired and autistic users was 98 and 42, respectively, accounting for about 1.4% of the total with a relatively small number of users. The number of elderly users over 65 was 230, accounting for 2.4% of the total. The number of pregnant women and other users was 395, accounting for 4.2% of the total. The numbers show that the special transportation service is mainly used by users with severe disabilities.

Table 5 Special transportation service users

Sort	Disabled in the 1st and 2nd degree								Elderly over 65	Pregnant women and others	Total
	Physical disability	Visual disability	Kidney disability	Hearing disability	Intellectual disability	Autistic disability	Brain lesion disability	Sub total			
People	3,506	1,500	964	98	551	42	2,167	8,828	230	395	9,453
%	37.1	15.9	10.2	1.0	5.8	0.4	22.9	93.4	2.4	4.2	100.0

4.2.3. Travel Attributes by Time Zone

A detailed understanding of the travel attributes by time zone can be of considerable help for planning vehicle operation. As a result of analyzing the travel attributes by time zone based on the collected data, the travel patterns of the disabled showed different patterns from those of the ordinary people. As shown in Table 6, the travel of non-disabled users is concentrated during the peak 6 hours of the morning and evening rush hours between 7a.m. to 10a.m. and 6p.m. to 9p.m. In contrast, the travel of special transportation service users is concentrated during the off-peak 6 hours between 10 a.m. to 1p.m. and 2p.m. to 5p.m. The number of travels by special transportation users is 4,982,which comprise 52.7% of the total. The time

zone with the most travel is from 10a.m. to 1p.m., while the time zone with the least travel is from 1a.m. to 4a.m. The travel pattern of the special transportation service users is somewhat unique from that of the non-disabled users as the travel purpose is more frequent for personal needs, such as visiting the hospital, rather than for business or academic purposes such as commuting to and from work or school.

Table 6 Number of users according to time and day

Day / Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
1~4	4	8	7	10	5	19	6	59
4~7	27	30	30	23	26	23	9	168
7~10	347	323	333	315	320	192	148	1,978
10~13	426	431	383	393	435	263	199	2,530
13~16	415	405	395	399	412	224	202	2,452
16~19	223	255	239	246	264	129	138	1,494
19~22	88	76	96	82	120	68	69	599
22~1	26	20	23	27	27	25	25	173
Total	1,556	1,548	1,506	1,495	1,609	943	796	9,453
Average	1,543					870		1,350

4.2.4. Travel Attributes by Day of Week

As a result of analyzing the travel attributes by the day of the week, the travel frequency was reported in descending order as follows: Friday(17.0%), Monday(16.5%), Tuesday(16.4%), Wednesday(16.0%), Thursday(15.8%), Saturday(10.0%), and Sunday(8.4%). More travel was recorded during the weekdays than during the weekends. The travel volume for each day of the week did not show a significant difference, which indicated there is no significant difference compared to the travel pattern of non-disabled people.

Table 7 Special transportation service operation O/D table (for 7 days)

D \ O		Within the province																		Sub total	Outside the province	Total
		CW	IJ	TY	SC	GH	MY	GJ	YS	UY	HA	CY	HS	NH	HD	SC	HY	GC	HC			
Within the province	Changwon	3,112	18	8	16	119	26	12	17	33	81	13	3	4	0	1	0	0	1	3,464	1	3,465
	Jinju	11	531	6	37	1	0	4	3	1	0	0	3	0	6	10	0	1	4	618	0	618
	Tongyeong	6	13	480	0	1	0	38	1	0	0	0	12	0	1	0	0	1	0	553	4	557
	Sacheon	4	44	0	249	0	0	0	1	0	0	0	2	3	0	0	0	0	0	303	1	304
	Gimhae	145	0	3	0	1,439	9	2	24	1	2	0	0	1	1	1	1	0	1	1,630	63	1,693
	Miryang	29	0	1	0	9	777	0	15	1	1	4	0	0	0	0	0	0	0	837	11	848
	Geoje	12	3	35	0	2	1	558	0	0	0	0	2	1	0	0	0	0	0	614	1	615
	Yangsan	17	2	0	1	21	15	1	729	0	0	1	0	0	0	0	0	0	0	787	88	875
	Uiryeong	27	1	0	0	2	1	0	0	32	1	0	0	0	0	0	0	0	0	64	0	64
	Haman	65	2	0	0	0	1	0	0	1	22	0	0	0	0	0	0	0	0	91	0	91
	Changnyeong	15	0	0	0	0	4	0	1	0	0	15	0	0	0	0	0	0	0	35	0	35
	Goseong	2	3	10	1	0	0	2	0	1	0	0	29	0	0	0	0	0	0	48	0	48
	Namhae	3	0	0	4	0	0	0	0	0	0	0	0	80	1	0	0	0	0	88	0	88
	Hadong	0	2	0	0	0	0	0	0	0	0	0	0	1	38	0	0	0	0	41	0	41
	Sancheong	1	11	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	18	0	18
	Hamyang	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	Geochang	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	27	0	30	1	31
	Hapcheon	1	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	25	31	1	32
	Sub total	3,451	634	543	308	1,595	834	617	791	70	107	33	51	90	47	18	4	29	31	9,253	171	9,424
Outside the province		0	0	0	0	2	10	0	16	0	0	0	0	0	0	0	0	0	0	28	1	29
Total		3,451	634	543	308	1,597	844	617	807	70	107	33	51	90	47	18	4	29	31	9,281	172	9,453

4.2.5. O-D Pattern

Based on the origin and destination of the collected data, it is possible to derive the travel O/D of the special transportation service users.The results are shown in Table 7.

Of a total of 9,453 travels, 9,253 travels were within the South Gyeongsang Province, accounting for 97.9% of the total. Travels beyond the province, or the number of travels between the inside and outside of the province were only 199, accounting for 2.1% of the total. Wide-area travel within the province, or the number or travels that crosses the boundaries between the cities and counties were 1,104, accounting for 11.7% of the total. Travels within each city and county were 8,149, accounting for 86.2% of the total.

Although the data is self-explanatory, a large volume of wide-area travel was reported between neighboring cities. Centering around Changwon as the major city, the travel between Changwon and the neighboring city Gimhae, in particular, showed the most travel(264 travels, 23.9% of wide-area travels), followed by travels between Changwon and Haman(146 travels, 13.2%), Jinju and Sacheon(81 travels, 7.3%), and Geojae and Tongyeong(73 travels, 6.6%). On the other hand, despite the close proximity between the Geochang and Hapcheon regions, only 11 travels were reported.

Haman showed more wide-area travels between regions compared to the travels within the region, with 154 wide-area travels accounting for 77.8% of the total of 198 travels, followed by Sancheong(66.7%), Changnyeong(55.9%), and Uiryeong(52.2%). This can be explained as the users' desired destinations are primarily located in other local governments. For example, inHaman where medical facilities are insufficient, 66.7% of the total wide-area travels are analyzed as medical-related travels to hospitals and pharmacies that are located in other areas.

V   CONCLUSION

Since the "Mobility Enhancement for the Mobility Impaired Act" was enacted in 2005, various policies have been proposed to support the mobility impaired. Since 2007, each local government has established "regional mobility enhancement plans for the mobility impaired" to seek various measures. The South Gyeongsang Province has made a significant contribution to improving the user convenience of the special transportation service as the number of users has increased rapidly since establishing the integrated call center.

The call center uses information technology to compute the dispatch history DB data. This study proposed a method to utilize the computed DB data and analyzed the travel attributes that can be identified based on the actual history DB.

By using the established data, this study presented the capability ofidentifying the wheelchair user ratio, user ratio according to the type of disability, and traffic pattern by time zone and day of the week. In particular, it was possible to identify the travel O/D pattern of the special transportation service user by using the origin and destination information.

The travel attributes identified by the collected data are more useful from a policy perspective because they provide more accurate and detailed information compared to the travel attributes identified from previous surveys. Nevertheless, additional information must be collected as operation plan improvements are made. In order to identify more precise travel attributes, the following information is necessary.

First, additional information is required to provide more comprehensive travel attributes, including general attributes of the individual user(age, gender, income, car ownership status, etc.), the purpose of travel, which is the main component of the travel pattern, as well as the waiting time and travel time. The inclusion of these general attributes is intended to serve as the basic data for future policies. In addition, the efficiency of the operating method must be improved by establishing a system that can generate the necessary information periodically and automatically. Finally, by implementing a membership system for regular users of the special transportation service, more efficient means of operation may be possible by identifying the travel patterns, including the forecasted number of use by individual and major routes.

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