

Change of passengers on airplanes due to the opening of the business of the Hokuriku Shinkansen

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Abstract

Hokuriku Shinkansen was extended from Nagano to Kanazawa on Mar. 14, 2015. There are many visitors from the Tokyo area to the district and the area is crowded with visitors. The number of passengers increased to around 3 times compared with before the extension. On the other hand, the number of passengers on airplanes from Haneda (Tokyo) has been dropping sharply. There are three airports in the Hokuriku area which includes three prefectures. Those airports are Komatsu, Noto-Satoyama and Toyama Kitokito. The passengers toward Haneda from Komatsu decreased by approximately 37 % and Toyama Kitokito decreased by 54 %. However, Noto-satoyama increased by 8 %. The Shinkansen line will be extended to Tsuruga (Fukui Prefecture) via Fukui on March 2023. The number for Komatsu will decrease in addition at that time. It is necessary to verify and estimate the decreasing characteristic, and the states of the Shinkansen and the airlines should be verified as an important transportation infrastructure. As the result of this investigation, rate of airplane passengers is decreasing as the seat-load time of the Shinkansen is shorter. It is necessary to construct a countermeasure for the decreasing characteristics of the two airports, especially after the Shinkansen extension to Tsuruga.

Keywords

Shinkansen, airplane, passenger, competition, Hokuriku District

1. Introduction

Japan has an issue of a declining birth rate and aging society, especially in rural areas, and the population decline will not stop [National Institute of Population and Security Research, 2018]. The exchanging population (visitors) is also decreasing remarkably in rural areas and the output of primary industry declines likewise. The Japanese government chants a slogan “regional revitalization” to improve the rural impoverishment [Ministry of Land, Infrastructure and Transport, 2017]. Rural means the regions except for large cities such as Tokyo, Osaka and Nagoya. One of the regional revitalization plans is “tourism” [Ministry of Internal Affairs and Communications, 2018]. The clue to stimulate the rural economy could be obtained by increasing the exchanging population, and the one supplies the decrease of the residential population. It is necessary to provide attractive resources (for example rural cultures and experiences) and offer information to promote tourism exchange. Furthermore, it is essential to develop ‘information’ and ‘transportation’ infrastructures to make it easy to visit [Japan Tourism Agency, 2018]. Soft infrastructure, including the local “omotenashi” which means a kind of hospitality, should be also integrated to promote a sustainable development [Foundation for the International Cities with Arts, Culture, and Soft Infrastructures, 2017].

The present situation of regional airports is reviewed by analyzing data for the passengers of airplanes and Shinkansen, which are important transportation infrastructures, after the Hokuriku Shinkansen extension in this study. They are a pivot

to revitalize rural areas. The investigation area is Hokuriku (Toyama and Ishikawa Prefectures). The Hokuriku Shinkansen Line was extended to Kanazawa from Nagano on Mar. 14, 2015. The train can arrive to Kanazawa from Tokyo in about 2 and a half hours. It takes about 2 hours and 15 minutes to Toyama from Tokyo. There are two airports in Ishikawa Prefecture, namely Komatsu (approximately 32 km away from Kanazawa Station) and Noto Satoyama (approximately 100km away from Kanazawa and Shin-Takaoka Stations respectively). There is an airport in Toyama Prefecture, namely Toyama Kitokito (approximately 8km away from Toyama Station). Many passengers of these three airports are using flights to Haneda (Tokyo). Some interesting characteristics are obtained in the passenger number, which depends heavily on the distance to a nearby Shinkansen station and the seat-load time. The co-existence of the Shinkansen line and airports is a big issue to expand the exchanging population in rural areas [Ministry of Land, Infrastructure and Transport, 2017]. The population of Toyama City, in which Toyama Kitokito airport is located, is about 0.42 million. The passengers of Haneda flights decreased remarkably in the airport by 54 %. The main cause of this decrease is due to the mutual nearness, namely Toyama Airport is about 8 km apart from Toyama Station and it takes about 20 minutes by bus. Many people use the Shinkansen instead of airlines because it is easier to utilize. In Komatsu Airport, it is convenient to use the airplane for local residents who are living in Fukui Prefecture (population is about 0.8 million) and Komatsu City (population is about 0.10 million) than the use of the Shinkansen. The residents of Kanazawa City (about 0.46 million) use the Shinkansen and the user can arrive in Tokyo earlier than with the use of an airplane. The number of pas-

sengers utilizing airplanes did not decrease in Noto Satoyama Airport, because the airport is far from the nearby Shinkansen stations (Kanazawa and Shin-Takaoka). The number increases by visitors from the Tokyo area and local residents. Recently the visitors from the Tokyo area participate in events like food and art festivals held in the Noto area.

In this study, the passenger numbers of three airports in the Hokuriku area and the Shinkansen line are discussed to increase the exchanging population in future.

2. Passengers of the Hokuriku Shinkansen Line

The Hokuriku Shinkansen line was extended to Kanazawa from Nagano and it opened on March 14, 2015. It had been running between Tokyo and Nagano (about one and half hours) until that time, and it opened on Oct. 1, 1997. It will extend to Tsuruga (Fukui Prefecture) from Kanazawa in March, 2023 and extend to Shin-Osaka via Kyoto (total extension approximately 700 km). The Hokuriku Shinkansen Line can take on a bypath-function role of the Tokaido Shinkansen Line after the extension. Three Shinkansen stations will be made newly according to the extension to Tsuruga, namely Komatsu, Kaga-onsen and Fukui and the users of Komatsu Airport will decrease still more. Positional relation among the Shinkansen stations and three airports is shown in Figure 1.

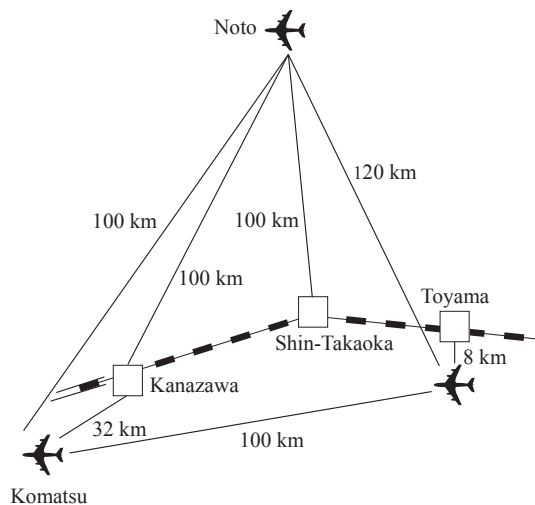


Figure 1: Rough geographical location of three airports and nearby JR Shinkansen stations

The trend in the passenger number of the Hokuriku Shinkansen Line after the extension to Kanazawa is indicated in Figure 2. The measurement was carried out between Joetsu-myoko and Itoigawa Stations by JR (Japan Railways) [Hokuriku Chunichi Shinbun, 2018]. In the figure, each year (the abscissa) means the period of March 14 to March 13 of the following year. Because the line opened on March 14, 2015. Namely the year 2017 means the term of March 14, 2017 to March 13, 2018 and the value (passengers) was 8.569 million. The number of the passengers before the opening of business was 3.17 mil-

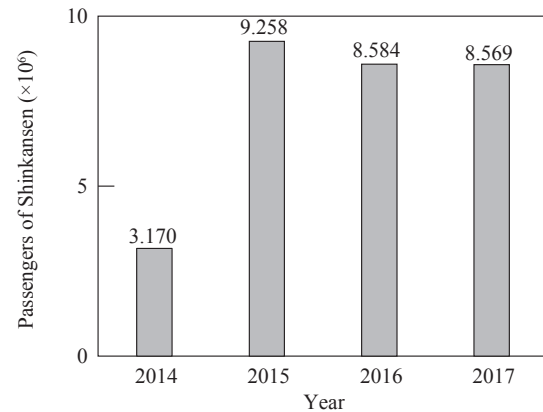


Figure 2: Trend in the number of passengers from 2014 to 2017
Note: Each year period means from March 14 to March 13 of the following year.

lion, and it exceeded approximately 2.9 times in the first year of opening business and it recorded 2.7 times in third year. The value is stable. The effect of the Shinkansen line connecting to the Tokyo area (Tokyo, Saitama, Chiba and Kanagawa Prefectures) is large. The area population is about 35 million. The Hokuriku Shinkansen Line was not cancelled due to the heavy fall of snow and strong winds in 2018. The passenger number of the Hokuriku Shinkansen was a maximum in August, and the ones in October and November follow. It has few passengers in January and February.

3. Passengers of three airports in Hokuriku

In Japan, airports are classified in four categories by the Airport Act, namely hub airport (28), local government managing airport (54), other airport (7) and military-civilian airport (8). There are 97 airports in total. There are three airports in the Hokuriku district, namely Toyama Kitokito Airport (Toyama Prefecture), Noto Satoyama Airport (Ishikawa Prefecture) and Komatsu Airport (Ishikawa Prefecture). These airports are called Toyama, Noto and Komatsu Airports. Toyama and Noto belong to local government managing airport, and Komatsu belongs to military-civilian airport, which is a common use airport with the Japan Self-Defense Forces (JSDF). There are many airports in the Japanese country areas and the airport infrastructure is important in these areas. Fukui Prefecture also has an airport which is managed by the local government. There are no scheduled flights in the airport and it is used only for training and trafficking of private propeller planes (and gliders), therefore it could not be included in the classification by the Act.

3.1 Komatsu Airport

Komatsu Airport is a common use airport with JSDF and managed by the Ministry of Defense. The airport is always maintained for JSDF airplanes to arrive and depart, and there are few cancelled private flights throughout the year. The users from Kanazawa decreased after the extension of the Hokuriku Shinkansen, however many inhabitants who are living in the

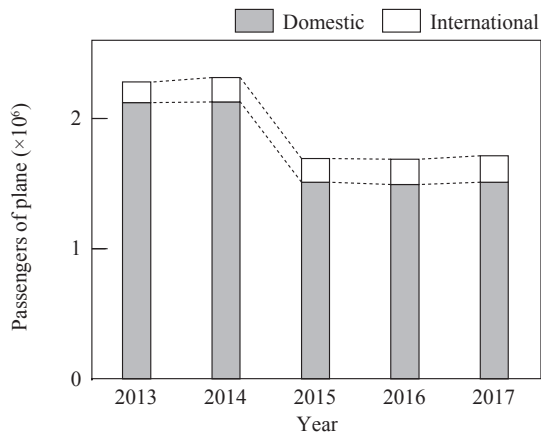


Figure 3: Yearly change in plane-passengers of Komatsu Airport

southern part of Ishikawa Prefecture (mainly Komatsu and Kaga Cities), and the northern part of Fukui Prefecture, are still using Komatsu Airport. Yearly change in plane-passengers of Komatsu Airport is indicated in Figure.3 [Hokuriku Chunichi Shinbun, 2018]. The horizontal axis means the fiscal year (FY: from April to March of the following year). There were 1.51 million in domestic flight users in 2017 (FY) and the value is 71 % of the one in 2014 (before the extension of the Hokuriku Shinkansen). The number of international flight users was about 203 thousand in 2017 and it increased 7.8 % compared with the one in 2014. This feature is thought as a spreading effect of inbounds (who visit Japan from foreign countries and travel in Japan). The total user number of international and domestic flights was 1.713 million in 2017.

The passengers who used the flights between Komatsu and Haneda was about 1.1 million in 2017 and the rate accounted for 72.7 % of domestic flight passengers. The number (1.1 million) decreased by 37.3 % compared with the one in 2014. The yearly change in plane-passengers between Komatsu and Haneda is indicated in Figure 4. The characteristic decreases after the extension of the Shinkansen, but it is stable in the latter two years. It is anticipated that the number could decrease further by the

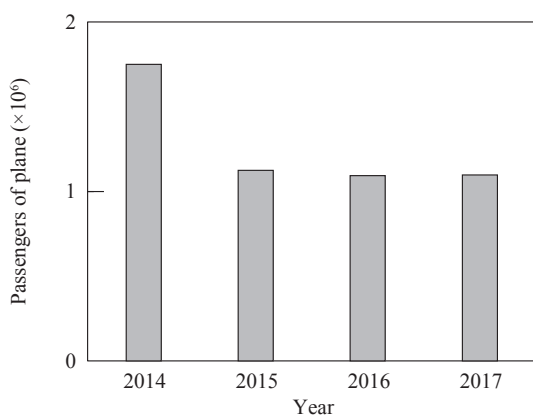


Figure 4: Yearly change in plane-passengers between Komatsu and Haneda

extension of the line to Tsuruga in 2023. The passengers of the flights other than Haneda (namely Fukuoka, Sapporo, Naha and Sendai flights etc.) and international flights (Taipei, Seoul and Shanghai) increased. In addition, globalization is demanded furthermore in the airport. It is also better that the passengers of the flights with an intermediate stop and a change of aircraft at Haneda (Haneda transit) increases. The convenience for passengers will increase when the flights of Haneda transit increases. It is also necessary that the number of flight cancellations due to snow damage and strong wind is decreased.

3.2 Toyama Airport

Toyama Airport (opened in 1963), is installed in the riverbed area (Jinzukawa River) and it is a local government managing airport, which is managed by Toyama Prefecture. It is difficult to extend the runway because there is the Hokuriku Expressway on the north side. The rate of cancellation flights due to strong wind and heavy snow (low visibility) is slightly high in the airport. It is close to Toyama Station and access to the airport is good. There is free parking and some people from Kanazawa City also use the airport, especially users of international flights. There is only one domestic flight to Sapporo (annual passengers: 66 thousand) in addition to Haneda. There are international flights to Taipei, Seoul, Shanghai and Dalian, and these destinations almost overlap with those of Komatsu.

Yearly change in plane-passengers of Toyama Airport is explained in Figure 5. The total users including international and domestic flights in 2017 were 564 thousand and the value was 33 % of the one for Komatsu Airport. The horizontal axis means the fiscal year. The one for Toyama Airport in 2014 (before the extension of the Shinkansen line) was 987 thousand and it decreased by 43 %. Most of the decreasing rate was the flight users to Haneda. It is important to exchange with the Tokyo area in the Toyama region. Yearly change in plane-passengers between Toyama and Haneda is shown in Figure 6. The passengers were 376 thousand in 2017 and it decreased by 54 % compared with the one in 2014. The rate of Haneda flights was 66.8 % for the total flights in 2017. The rate was 64.1 % in

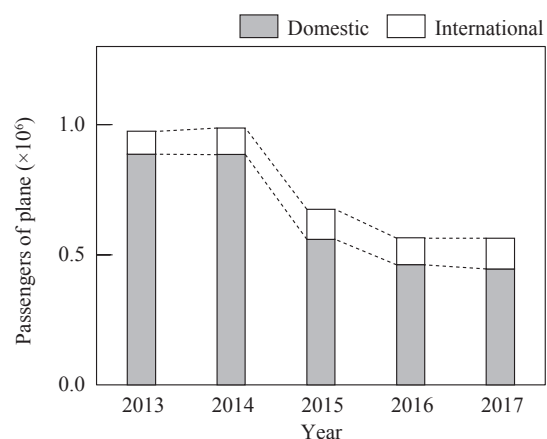


Figure 5: Yearly change in plane-passengers of Toyama Airport

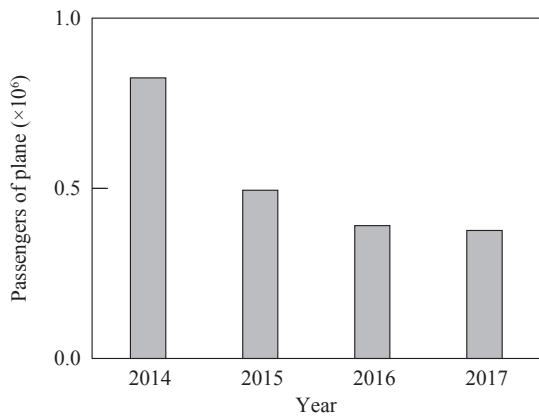


Figure 6: Yearly change in plane-passengers between Toyama and Haneda

Komatsu Airport, and dependability of Haneda flights in Toyama Airport was slightly higher. The passenger rate of Haneda flights decreased due to the Shinkansen line extension because it was 83.5 % in 2014.

3.3 Noto Airport

Noto Airport opened on July 7, 2003 and there are only two flights per day between Noto and Haneda and 15 years passed on July 6, 2018. The data in each year is measured from July 7 to July 6 of the following year as one year. The airport is considerably separated from the Shinkansen stations (Kanazawa and Shin-Takaoka) and it is not influenced by the line-extension. However, aging and de-population have been advancing significantly in the Noto area, and passengers living in the area are decreasing. The boarding rate is maintained by events on food and art held in the area, in which there are many participants from the Tokyo area.

The trend in the plane-passengers between Noto and Haneda is represented in Figure 7 [Yomiuri Shinbun, 2018]. It is obvious that the characteristic is not influenced by the extension of the Shinkansen line. The passenger number increases contrarily. The passenger number in 2017 (from July 7, 2017 to

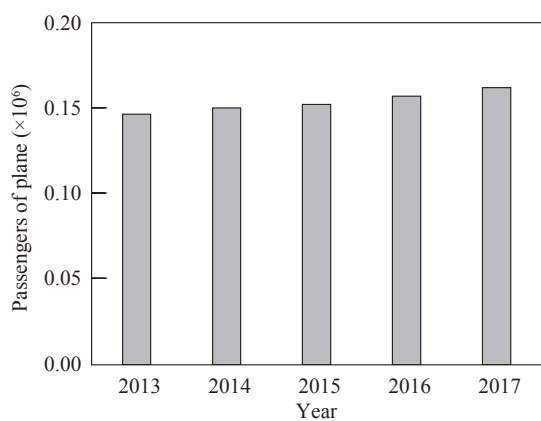


Figure 7: Yearly change in plane-passengers between Noto and Haneda

July 6, 2018) was 162.7 thousand (the rate of inhabitant is 16 %) and the boarding rate was 69.1 %. The data was published by the Noto Airport administrative office. The target boarding percentage by Ishikawa Prefecture is 62 % and it exceeds the value. It is necessary to exceed the value due to developing tourism resources and providing them to promote regional business, especially the regional tourism industry. The passengers increased due to the participants of the Noto International Art Festival held in Suzu City in 2017. Tours to taste globefish also contribute to the increase. It is necessary to focus on the promotion for inviting foreign tourists, school excursions, and trips of local women's societies in the future. The merit (foreign and domestic people can transit at Haneda) should be an appeal to tourists and inhabitants. The passengers of the charter flights (mainly from Taiwan) were 3.152 thousand in 2017 (from July 7, 2017 to July 6 of the following year). There were 22 flights (using an airplane for 160 passengers) and the boarding rate is about 90 %. The data is not included in the figure.

4. Influence to the passenger number of three airports due to the extension of Shinkansen line

Tourism will become an important industry which derives the Japanese economic growth. The increase of foreign tourists (inbounds) is expected especially due to the era of globalization [Oyabu *et al.*, 2017]. The Japan Tourism Agency published that the number of inbounds was 28.69 million in 2017 (29.97 million in FY 2017). The achievement of 40 million foreign people as a governmental goal in 2020 will be almost certain. Most inbounds are visiting the golden route which connects Osaka with Tokyo. It is necessary that the inbounds are guided to rural districts. Shinkansen and airport (transportation infrastructure) are absolutely essential to guide the inbounds to regional areas [Japan Tourism Agency, 2018]. Improvements of the expressway network and the soft infrastructures (mainly human resource development) are also required. Transmitting information to which visitors are attracted is less in rural areas than that of urban areas, consequently various kinds of 'information infrastructures' (Wi-Fi devices and translation apparatus etc.) are also essential.

In this study, the decreasing phenomenon in airplane passengers in Noto Airport could not be recognized after the extension of the Hokuriku Shinkansen Line, which has only two flights per day between Noto and Haneda (2 round services per day). There are fewer passengers compared with the other two airports and there are many regular customers including local inhabitants.

4.1 Influence to Komatsu Airport

Komatsu Airport is 30 km away from Kanazawa Station and it takes 40 minutes by an airport limousine bus. So Kanazawa citizens visiting the Tokyo area generally use the Shinkansen. Komatsu (population: about 100 thousand), Kaga (67 thousand) and Fukui (264 thousand) citizens mainly use the airport when they visit the area. However, Kanazawa citizens use the airport when they visit other local areas. There are five domestic

flights (between Komatsu and Fukuoka (Fukuoka flight: the passengers, 169.102 thousand in 2017), Sapporo (80.799 thousand), Naha (73.286 thousand), Sendai (73.286 thousand) and Narita flights (34.281 thousand)) except for Haneda flights. The passenger number of international flights is not influenced by the opening of the Shinkansen. There are three international flights (Taipei: passenger number is 104.178 thousand in FY 2017, Seoul: 36.624 thousand and Shanghai: 35.787 thousand) and some charter flights (26.299 thousand).

A scatter diagram between the passengers for airplanes (Komatsu-Haneda flight) and Shinkansen is demonstrated in Figure 8, however the one for the former JR line express is used in FY 2014. In the figure, the left upper circle stands for the plot (3.17, 1.75) which means the passengers of the former JR line express and Haneda flights in 2014 (before the Shinkansen opening). The passengers to Haneda decreases and the one for the Shinkansen increases after the extension. The plot in 2014 is located separately, and other plots are at the same point. The data is stable after 2015.

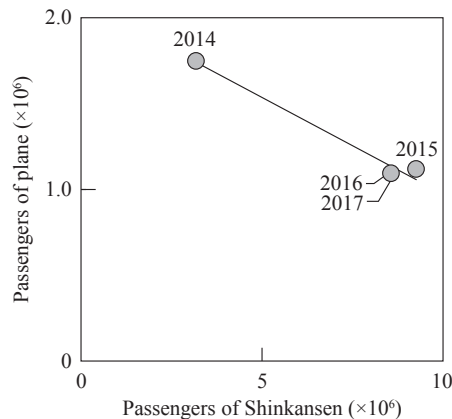


Figure 8: Scatter diagram of passengers between airplanes (at Komatsu) and Shinkansen

4.2 Influence to Toyama Airport

Toyama Airport is relatively near Toyama Station and it takes 20 minutes by a public bus. Therefore, most citizens of Toyama and neighboring cities (including towns and villages) use the Shinkansen rather than airplanes when they visit the Tokyo area. It takes 133 minutes from Toyama to Tokyo by the fastest Shinkansen. An increase of the airplane passengers in flights between Toyama and Haneda (Haneda flight) is not expected. There is only one domestic flight besides the Haneda flight in the airport, that is, Sapporo flight (the total passenger number was 66.734 thousand in FY 2017). It is necessary for further efforts to increase the regular flights to other cities for the promotion of human exchange. Of course, the increase of transit passengers at Haneda should be brought into the way of thinking. The increase of international flight passengers is also necessary in the airport operation and maintenance. There are four flights from the airport at present, that is, Taipei (the total passenger was 57.701 thousand in FY 2017), Seoul (25.405

thousand), Shanghai (17.452 thousand) and Dalian (14.163 thousand). Moreover, there are some charter flight passengers, namely domestic (1.925 thousand in FY 2017) and international (3.923 thousand). The one for international flights is more than the one for domestic (about two times), so it is better to promote exchange with some overseas local airports.

A scatter diagram of passengers between airplanes (Toyama-Haneda flight) and Shinkansen is demonstrated in Figure 9. In the figure, the left upper circle stands for the plot (3.17, 0.825) which means the passengers of the former JR line express and Haneda flight in 2014 (before the Shinkansen opening). The Haneda flight passengers decrease remarkably and the one for the Shinkansen increases after the extension. The plots for 2016 and 2017 are close and stable.

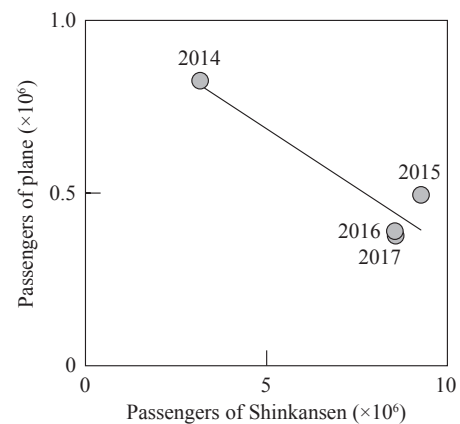


Figure 9: Scatter diagram of passengers between airplanes (Haneda flight) and Shinkansen

4.3 Seat-load time of Shinkansen and the passenger number of airplane

There are various effects on the passenger number in a local airport due to the opening of a Shinkansen line in a region. The Shinkansen connected to Tokyo has significant influences to a Haneda flight. It is said that the airplane passengers for the areas where the seat-load time (riding time) is less than three hours, will largely decrease. Most airplane users in local areas visit mainly large cities like Tokyo and there is a tendency that the airplane user decreases because the seat-load time of the Shinkansen to the destination becomes shorter. The users of Komatsu and Toyama Airports are affected due to the opening of the Shinkansen. The tendency of the decreasing rate for Haneda flight has to be understood well, and the study will become a good guide to the areas where the opening of new Shinkansen lines are planned. The relationship of the seat-load time of the Shinkansen and the decreasing rate of Haneda flights is explained in Figure 10. The unit of time is in minutes. The rates for Toyama Airport decreased by 40 % (the rate in 2014 was a standard) in 2015, and it decreased by 52.64 % in 2016 and 54.36 % in 2017 respectively. The rate has an increasing tendency. The one for Komatsu Airport decreased by 35.75 % in 2015, 37.51 % in 2016 and 37.26 % in 2017. The tendency

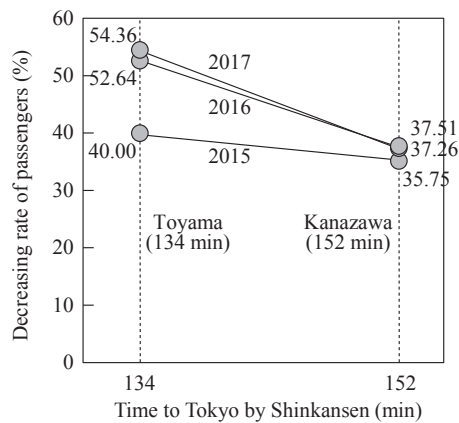


Figure 10: Scatter diagram between decreasing rate of airplane passenger and the seat-load time of Shinkansen

tends to be a stable. The plots between Toyama and Kanazawa in 2017 could be expressed using the following primary function equation (1).

$$y = -0.95x + 181.66 \quad (1)$$

y means the rate (%) and x is the seat-load time (minutes). y becomes 100 % when x is 86 (minutes), and y becomes 30 % when x is 160 due to equation (1). It means that the airplane user becomes zero in the area where a passenger can arrive at the destination in one and a half hours using the Shinkansen. However, it is better to use a quadratic function instead of the primary function, because the decreasing rate of the airplane user is bigger when the seat-load time is shorter and the influence to the rate decreases when the seat-load time is longer.

The head offices of many companies as well as government agencies are integrated in Tokyo, therefore citizens and workers living in local areas have to visit Tokyo frequently. Business chances could increase markedly in the areas located near Shinkansen stations because access to Tokyo will improve largely in those areas. Local residents, business persons and visitors are mainly using local airports. The management expense of local airports is in deficit (over 15 billion yen altogether) and tax is applied to them. The effort to derive annual maintenance cost is strongly required. Local airports have the following advantages and it is necessary to manage and operate sustainably in those airports.

- To connect to other areas without the Shinkansen line in a short time
- To utilize in an emergency such as a disaster
- To utilize when the railway is blocked

5. Conclusion

The population of the metropolitan (Tokyo) area occupies 30 % (35 million) of the total Japanese population. The market of human exchange is mainly created by connecting to the Tokyo area using the Shinkansen line and the connecting will become

a trigger to increase the exchanging population (positive factor). On the other hand, the passenger number on airplanes decreases. It is a negative factor. Although an airport is an important infrastructure, it costs a large amount of administrative expense and needs some degree of flights and passengers. Good competition measures between the Shinkansen and airplanes are expected in each region. The passenger number decreased largely at Toyama and Komatsu Airports after the opening business of Shinkansen, namely the rates were 35 % at Komatsu and 55 % at Toyama. It increased 8 % at Noto Airport. Utilization measures of an airport are also important as well as the prosperity of the local businesses. There are many small and medium advanced enterprises in the Hokuriku district and the companies are expanding in the Asia region. It is a good factor to open regular flights with the regions. Globalization may also advance. The exchanges with other regions due to Haneda transit would be effective.

It is thought that the results of this study will be useful for other regions which are inviting the Shinkansen. It is necessary to construct a measure which considers always the area population in departure and the arrival places. Trends of inbounds have to be surveyed and those results should be applied to tourism policies.

Acknowledgement

The adopted passenger data were published by each airport administrative office. We thank heartily those offices.

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