

# **THE IMPACT OF THE PARTLY-OPENED KYUSHU SHINKANSEN (SHIN-YATSUSHIRO - KAGOSHIMA-CHUO)**

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## **1. INTRODUCTION**

History of world high-speed rail operation began with the opening of Tokaido Shinkansen line in 1964 in Japan. Since then, Japan has expanded its Shinkansen (high-speed rail) service through construction of Sanyo, Tohoku, Joetsu, Hokuriku, and Kyushu Shinkansen lines, and the Shinkansen railway network currently has an extensive operational distance totaling approx. 2,200 km (1,375 miles). The Kyushu Shinkansen (Kagoshima route) is a railway service planned to be stretching to a total length of approx. 260 km between the city of Fukuoka (in Fukuoka prefecture) and the city of Kagoshima (in Kagoshima prefecture). A section of the line linking Shin-Yatsushiro station and Kagoshima-Chuo station (a distance of about 130 km) in the southern half of the line, where a higher time-reduction effect had been expected, opened in March 2004.

Opening of the Shinkansen provides high-speed transportation service to communities along the line, giving the railway users various impacts including a time-reduction effect and expanded range of activities. More active human interaction arising from the time reduction and the expanded range of activities increase various flows between different areas, leading to other impacts such as local revitalization. Moreover, an environmental preservation effect, for example, reduction of carbon dioxide (CO<sub>2</sub>) contributing to global warming, is also expected.

This paper describes the impact of the partly-opened Kyushu Shinkansen service, including changes in transportation modes and various effects on passengers and economic impact on tourism, based on various statistical figures and results from questionnaire surveys.

## 2. OVERVIEW OF SHINKANSEN RAILWAY SERVICES

### 2-1 Development of Shinkansen network

While conventional railway lines in Japan have been developed as narrow gauge lines (1,067 mm), Shinkansen lines need to be constructed as dedicated lines having standard gauge (1,435 mm).

Since the launch of Tokaido Shinkansen service in 1964, Japanese Shinkansen railway network has expanded to have an operational distance totaling 2,200 km and to transport about 330 million passengers a year. Japan Railway Construction, Transport and Technology Agency (JRTT) is currently working on constructing some sections of the network in a total length of 430 km comprising; Tohoku/Hokkaido Shinkansen (approx. 230 km linking Hachinohe and Shin-Hakodate), Hokuriku Shinkansen (approx. 230 km linking Nagano and Kanazawa), and Kyushu Shinkansen (approx. 130 km linking Hakata and Shin-Yatsushiro, plus approx. 45 km linking Takeo-onsen and Isahaya).

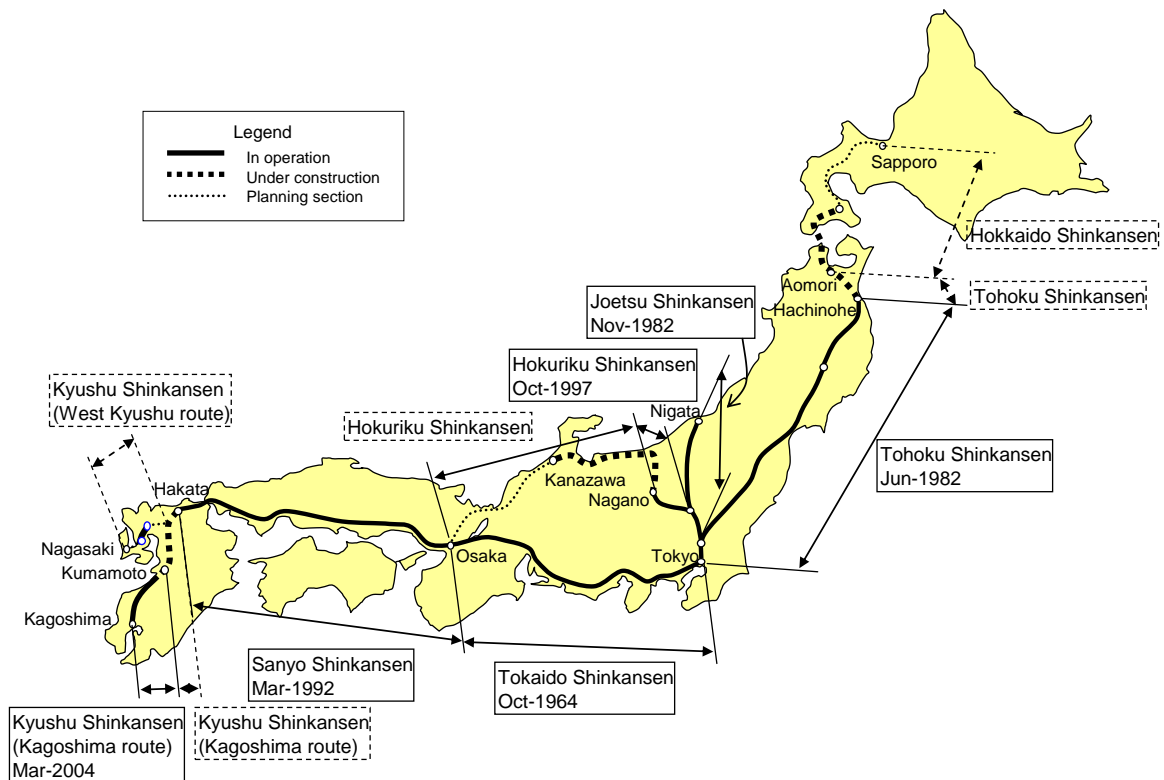
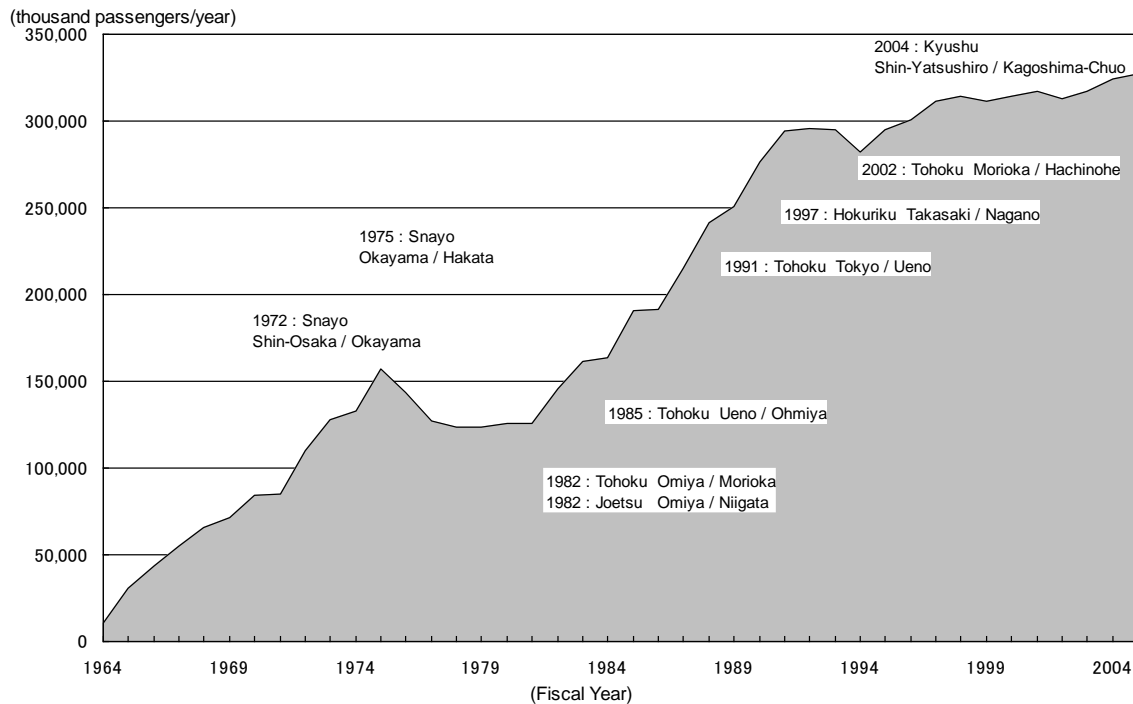


Figure 1 – Shinkansen network

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**Figure 2 – History of Shinkansen project and number of transported passengers**

Source: Annual Statistics on Railway Transportation

Note: Fiscal year: a 12-month period between April 1 of the year and March 31 of the next year in Japan

## 2-2 Overview of arterial transportation

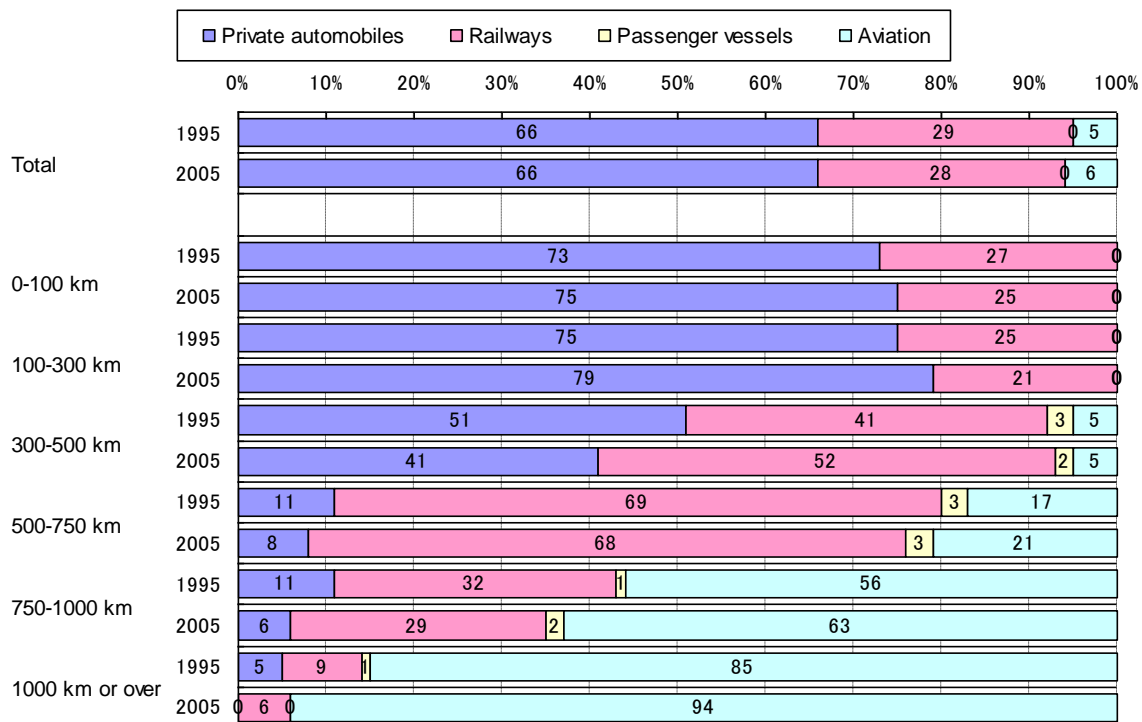
It tends to be thought that the share of automobiles in the entire passenger transportation in Japan is increasing due to progress of motorization. In fact, the number of automobiles owned in the country increased by 30 percent over a decade between 1995 (43 million) and 2005 (56 million).

Despite the fact described above, the share of railway transport in 2005 is still 28 percent, down by only 1 percent compared to 1995.

Analyzing the data by the range of travel distance, it is found that the railways' share decreased in the distance range of less than 300 km, while it increased in the range of 300 to 500 km. The range of 500 to 750 km showed reduction but still maintained a proportion as high as over 65 percent. These ranges are in the distance where Shinkansen trains are more likely to exhibit their advantageous characteristics. In addition, three Shinkansen lines opened after 1995, namely Hokuriku (opened in 1997), Tohoku (in 2002), and Kyushu lines, are regarded to have contributed to the increased share of the railway transportation.

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**Figure 3 – Share of passenger transportation modes by distance**  
(average values for the whole country)

Source: Investigation and Analysis Report on Regional Flow of Cargo and Passengers

### 2-3 Characteristics of Shinkansen

Shinkansen railway service is highly safe mode of transportation, considering the fact that no passenger fatalities due to train accidents has occurred since the first Tokaido Shinkansen line opened. Another safety aspect is that the Shinkansen structures are built without installation any level crossing facilities, to prevent level crossing accidents with motor vehicles.

The Shinkansen service also has excellent reliability in punctuality. For instance, the Tokaido Shinkansen trains are running with average delay for 1 minute or less per train, providing a highly reliable transportation service. The line has also achieved high frequency of train operation, up to 14 trains per hour. As described above, Shinkansen is a transportation service which provides notable safety, reliability, and high density in its operation.

## 3. OVERVIEW OF KYUSHU SHINKANSEN (KAGOSHIMA ROUTE)

### 3-1 Overview of Kyushu Shinkansen (Kagoshima route)

The Kyushu Shinkansen (Kagoshima route) is a railway service planned to be stretching to a total length of approx. 260 km linking Hakata station in the city of Fukuoka (in Fukuoka prefecture), the largest city in the Kyushu region with a population of 1.45 million, to

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Kagoshima-Chuo station in the city of Kagoshima (in Kagoshima prefecture), the third largest city with 0.6 million, via Kumamoto station in the city of Kumamoto (in Kumamoto prefecture), the second largest city with 0.68 million.

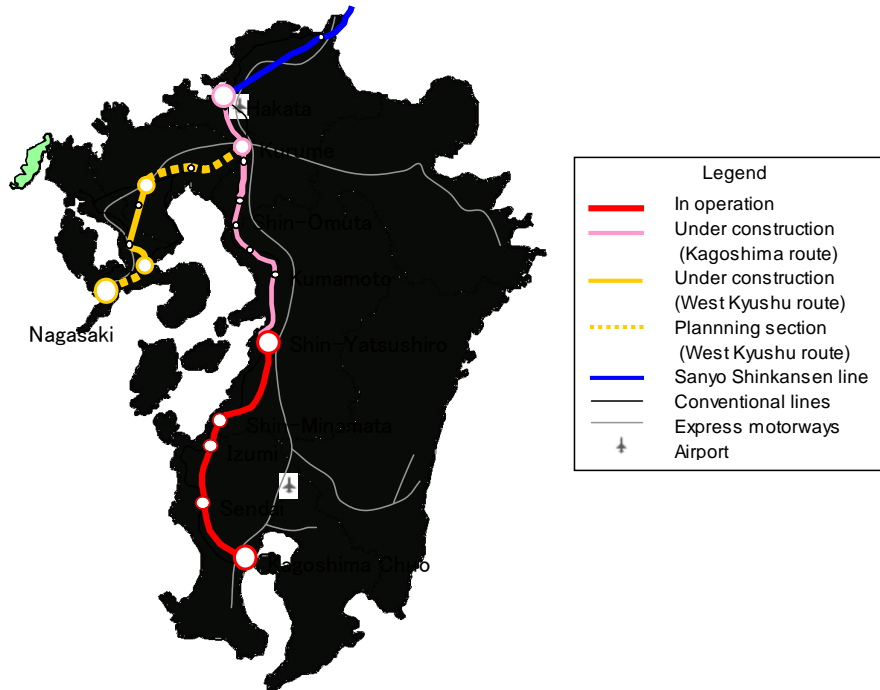


Figure 4 – Route map of Kyushu Shinkansen

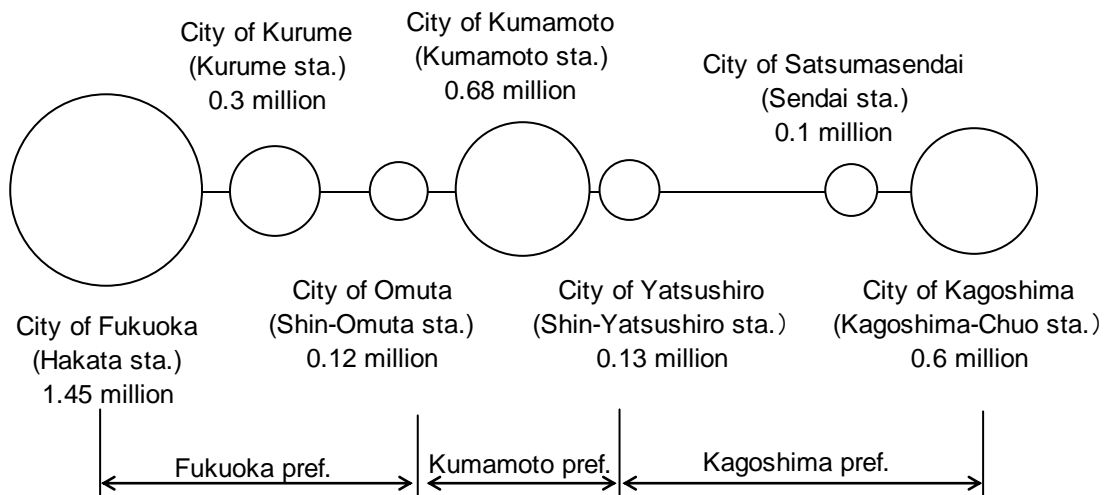


Figure 5 – Population of cities along Kyushu Shinkansen line (January 1, 2010)

Note: Cities with a population of 0.1 million or larger

The section was covered by a conventional line called Kagoshima Main Line of Kyushu Railway Company (JR Kyushu). Most of the southern half of the section was a single track and was curving due to its location in mountain areas, making the travel especially time-consuming. To solve the problem, the southern half of the line (between Shin-Yatsushiro and

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Kagoshima-Chuo stations), where a higher time-reduction effect had been expected, was developed prior to the other part of the line, and the Kyushu Shinkansen was partly opened in March 2004. Upon completion of the partial construction project, the railway distance in the section was shortened from 165.8 to 126.8 km, reduced by 39 km. The time required to travel the section was shortened to one forth, from 125 to 35 minutes, resulting in 90 minutes reduction.

As a result of prioritizing, the southern half of the line with higher time-reduction effect was constructed without being connected to the existing Shinkansen railway network. In 2011, the line is expected to be connected to the Shinkansen network, upon opening of an additional section between Hakata and Shin-Yatsushiro stations.

The conventional line linking Hakata and Shin-Yatsushiro stations has narrow gauge (1,067 mm), inconsistency with the gauge of Shinkansen (1,435 mm). Therefore, passengers need to change trains at Shin-Yatsushiro station. For the convenience of the passengers, the station was set to allow them to transfer between the conventional express line and Shinkansen line in only three minutes on the same platform. The unified seat number and ticket, and well-devised train diagram and common train information guide between the two lines have further reduced burden of the passengers to change trains.

Shinkansen

Conventional line



**Figure6** –Photo of Transfer at Shin-Yatsushiro station

### **3-2 Background of the project**

Kyushu Shinkansen was originally planned to be developed as a standard gauge line between Hakata and Kagoshima. However, it was really difficult to make the entire line a standard gauge due to financial problem. Therefore, it was decided that specified section should be constructed to cut the cost for the time being. In 1988 the committee for priority study, which consists of the government and the ruling party, suggested the plan to construct the southern section between Yatsushiro and Nishi-Kagoshima (renamed Kagoshima-Chuo for the Shinkansen opening) ahead of the other sections because most of the existing line in the area was single track with poor alignment and great time reduction effect was expected.

In 1990, based on the plan by the committee, the government and the ruling party agreed to start the construction of the Yatsushiro - Nishi-Kagoshima section adopting Shinkansen

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standard but narrow-gauge (maximum speed: 200 km/h) for through operation with an existing narrow-gauge line. The construction work was approved and started in 1991.

In 1998, the construction between Funagoya and Shin-Yatsushiro which is a part of the northern section was approved with Shinkansen standard and narrow gauge. Following this approval, the starting point of southern section was changed from Yatsushiro to Shin-Yatsushiro which is located in the north of Yatsushiro in the same year.

In 2000, the government and the ruling party agreed to build the line between Hakata and Nishi-Kagoshima to the full Shinkansen standard and aim to complete the southern section (Shin-Yatsushiro – Nishi-Kagoshima) by March 2003. As a result, in 2001, change of the construction plan was approved to build the southern section to the full Shinkansen standard.

### **3-3 Discrepancy between prediction of traffic volume at planning phase and result**

In 1988, the committee for priority study predicted that transport density (for fiscal 2000) would be 8,400 passenger-km per day per km (excluding commuter pass users). The result after opening was 7,400 passenger-km per day per km (excluding commuter pass users) in fiscal 2005, when the initial boom in demand for the new line was considered to have settled down, 88% of the predicted value. Possible reasons for this difference are as follows:

- Population ..... actual value is about 95% of predicted value
- Economic growth rate ..... actual value of GNP in 2000 is 85% of predicted value
- Journey time ..... actual journey time from Hakata to Nishi-Kagoshima is 4 minutes longer than prediction
- Fare ..... actual fare for a trip from Hakata to Nishi-Kagoshima is 450 yen higher than prediction
- Need for transfer ..... passengers have to transfer at Sin-Yatsushiro station

We conducted sensitivity analysis of the transportation demand by changing social and economic or transportation service conditions in accordance with each actual value. Fluctuations of the transportation demand by changing these conditions are as follows:

- The demand increase by 13% when social and economic conditions are changed
- The demand increase by 4% when transportation service conditions are changed

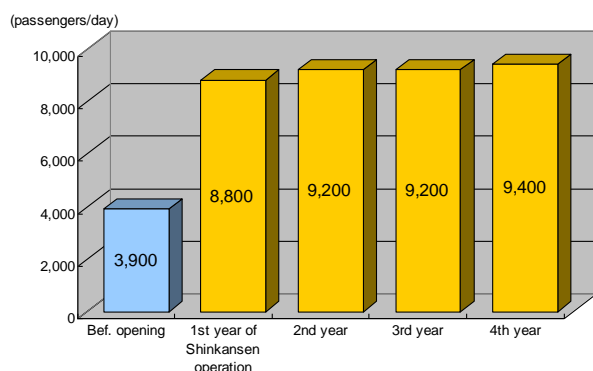
Based on this result, discrepancy between predicted social and economic conditions and actual conditions is regarded as the major factor for the difference between predicted value and result.

## 4. EFFECTIVENESS AND IMPACT BY THE DEVELOPMENT PROJECT

### 4-1 Changes in transportation volume

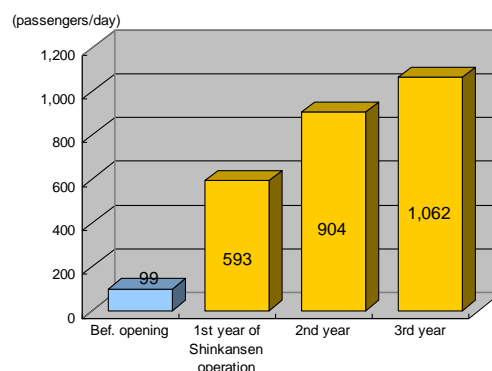
#### 4-1-1 Changes in railway transportation volume

Passengers carried by railway between Shin-Yatsushiro and Kagoshima-Chuo stations in 2004, the first year of the new Shinkansen line operation, were 8,800 per day, compared to 3,900 before the opening of the line (increased by 225 percent). In 2007, the fourth year of the new service, 9,400 passengers per day were recorded as the larger number than ever. The number of commuter pass users increased due to significant growth of daily commuters to work or school from the towns and cities along the line to the city of Kagoshima and others. The upward trend has been continuing in and after the second year. The number of commuter pass users reached to 1,100 per day in the third year (Jan. 1, 2007), showing an increase of almost 11 times as many as the passengers before the opening of the Shinkansen line. This means the new line is being established as a mode of transportation necessary for daily activities in the local communities.



**Figure 7** – Changes in the number of passengers carried

Source: JR Kyushu News release (website)



**Figure 8** – Changes in the number of commuter pass users

#### 4-1-2 Changes in various public transportation volumes

Fig.9 shows changes in transportation volumes by different means of public transportation between Fukuoka and Kagoshima prefectures.

The figures of the past railway users show that the numbers remained almost steady between 1990 and 2000. It turned to an upward trend in 2001 and considerably increased since the Shinkansen line was partly opened.

The aviation passengers were slightly on the increase since 1993. However, the number of the airline users decreased significantly since the Shinkansen opened. Although the aviation was superior to other means of transportation in terms of its high speed before the opening of the Shinkansen line, after the rail transportation gained improved speed through the



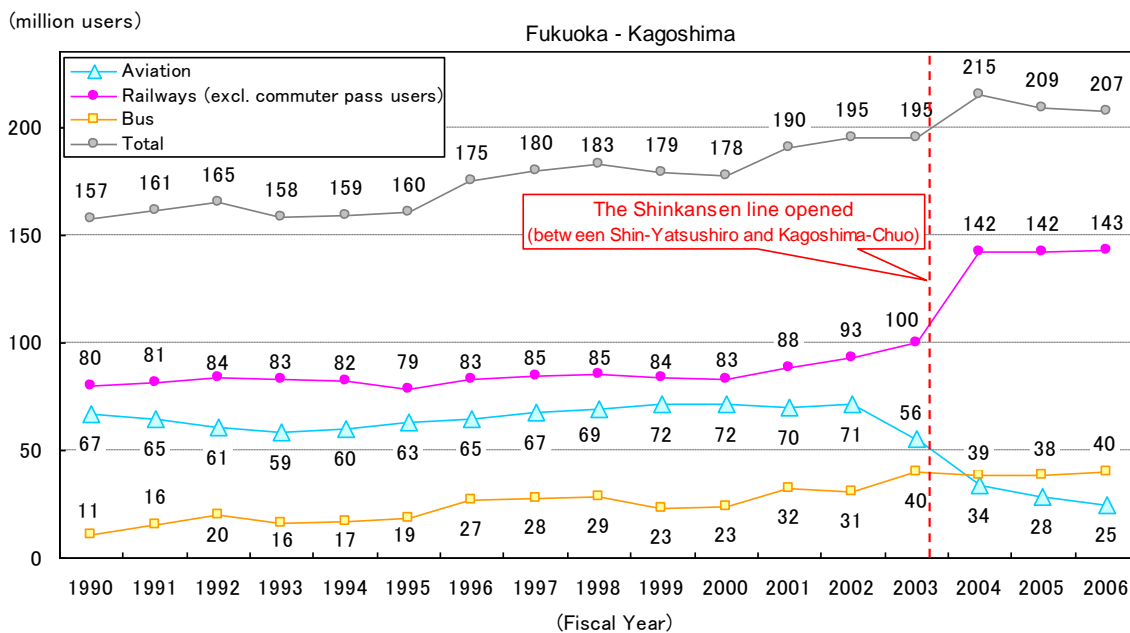
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launch of the high-speed rail service, more passengers shifted their means of travel to the railway which requires lower fare. By the way, the drop of the air passengers in 2003, a year before the launch of the new Shinkansen operation, is considered to be impacted by the cancelation of Air Nippon's air service covering the area (4 round trips per day) because of low profitability of the company.

The figures of express bus users show an upward trend since 1990 and remained almost steady after the opening. The bus service is characterized by a longer travel time and lower fare compared to aviation or railway transportation. Therefore, the bus users were already in a category of travellers different from the passengers of high-speed transportation including Shinkansen, resulted in the small impact by the opening of the bullet train service.

From the comparison of the shares of public transportation modes between Fukuoka and Kagoshima prefectures in 2003 (before the opening) with those in 2005 (after the opening), the share of railways increased by 17 percentage points (from 51 to 68 percent), and aviation decreased by 15 percentage points (29 to 14 percent), impacted by the opening of the Shinkansen in March 2004. Although the number of bus users has been grown, the share dropped by 2 percentage points (20 to 18 percent) due to significant increase of railway passengers.



**Figure 9** – The number of public transportation modes (Fukuoka pref. - Kagoshima pref.)

Source: Investigation and Analysis Report on Regional Flow of Cargo and Passengers

#### 4-1-3 Changes in choice of transportation modes

This section shows the results from questionnaires to Shinkansen users asking “What transportation mode did you used to take before the high-speed rail opened?”

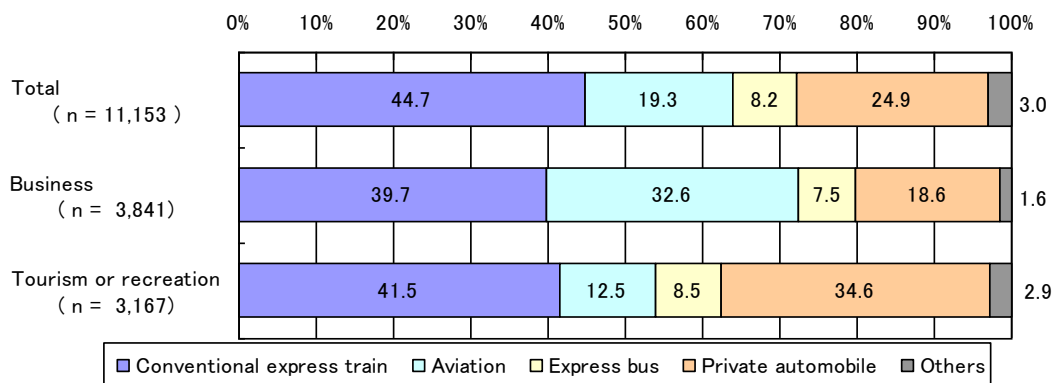
Of the entire Shinkansen users, former aviation users and former automobile users account for approx. 20 percent and 25 percent, respectively.

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In terms of purpose of the Shinkansen travels, approx. 33 percent of passengers with business purpose are former aviation users and approx. 35 percent of passengers with sightseeing or recreational purpose are former automobile users. As you may see from the above results, the means of transportation used before the launch of the high-speed rail widely defer depending on the purpose of the travels.

The three largest reasons why the respondents decided to take Shinkansen trains are “Shorter journey time”, “punctuality”, and “high safety.” This means that high speed, reliability, and safety of the Shinkansen service are highly appreciated.



**Figure10** – Transportation modes current Shinkansen users were using before the opening

Source: Questionnaire survey (in Oct. 2004) by JR TT

## 4-2 Effect and impact on transportation users

### 4-2-1 Time-reduction effect and changes in transportation cost

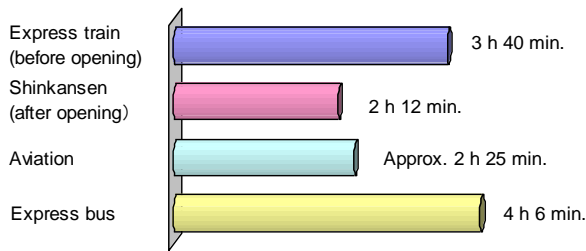
The time required for railway travel between Hakata and Kagoshima was reduced by almost 90 minutes, from 3 h 40 min to 2 h 12 min, after the Shinkansen line opened. The improved railway journey time is 10 minutes shorter than aviation travel.

The number of trains running per day, which used to be 16 before the opening, has almost doubled to 30 trains. Meanwhile, the number of air flights which was 13 in 2002 started to show a drop right before the opening and decreased to 6 in 2005. Then, it showed a slight recovery to 8 flights in 2008 due to some measures including downsizing of aircrafts. Since Shinkansen trains run more frequently than others, the passengers have larger flexibility in their departure time, which has contributed to improved traveller convenience.

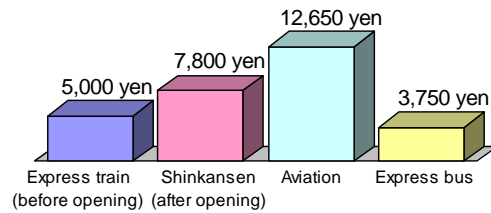
The transportation cost after the launch of the Shinkansen service increased by 2,800 yen from 5,000 to 7,800 yen; however, the fare is still lower by 4,850 yen than airfare.

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**Figure 11 – Reduction of journey time between Fukuoka and Kagoshima pref.**



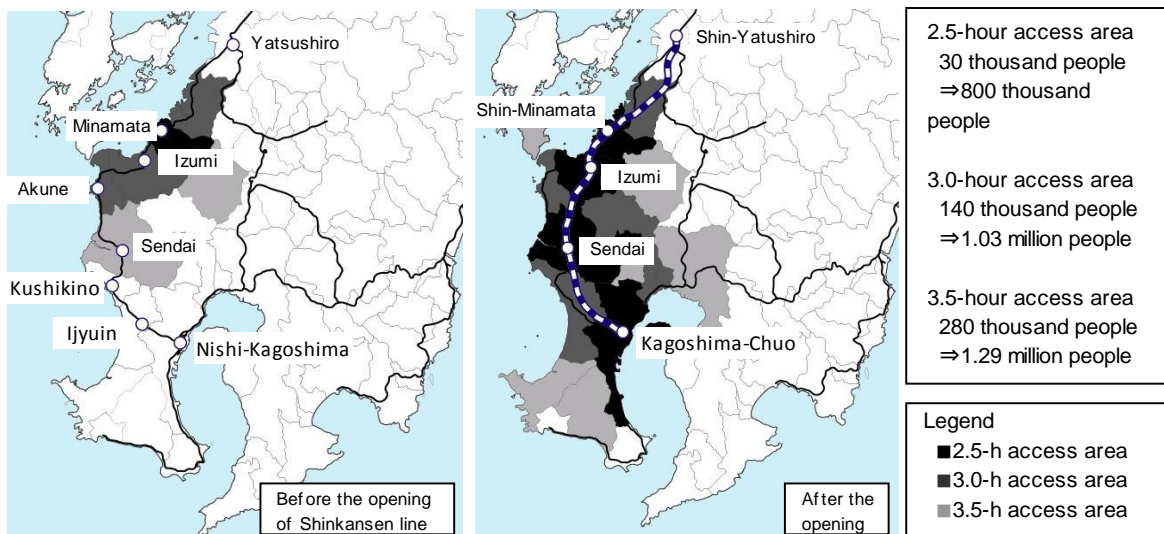
**Figure 12 – Transportation cost between Fukuoka and Kagoshima pref.**

Source: JTB Timetables

Note: Railway and Express bus: The shortest journey time and the price of commutation ticket.

Aviation: The shortest journey time and special discount price on the largest price range, taking access and egress time into consideration.

Fig.13 shows some areas which would benefit from the opening of the Kyushu Shinkansen (between Shin-Yatsushiro and Kagoshima-Chuo stations) in terms of reduced journey time to Hakata station. Among southwest part of Kyushu Island, population of the “3.5-hour access area” to Hakata Station has grown fourfold, from about 0.28 to 1.29 million, showing an expanded range of activities of citizens in the areas.



**Figure 13 – Changes in the areas accessible from Hakata within a specific period of time**

Note: Population of 3.5-h access area is equal to the sum of population of 2.5-h, 3.0-h and 3.5-h access area.

Access time from each municipal office to the Shinkansen station is taken into consideration.

**4-2-2 Increased allowed time to spend in the destination**

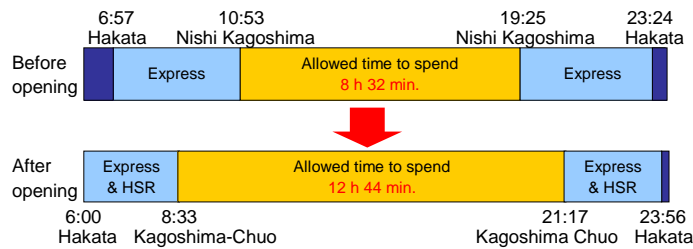
Fig.14 shows a comparison of allowed time to spend in the destination between before and after the opening of the Shinkansen service on a day trip using the first and last trains between Hakata and Kagoshima-Chuo stations. Due to the time-reduction effect and revisions of timetable, the allowed time to spend in the city of Kagoshima (Kagoshima-Chuo station) has significantly increased by 4 h 10 min, from 8 h 30 min to 12 h 40 min. The

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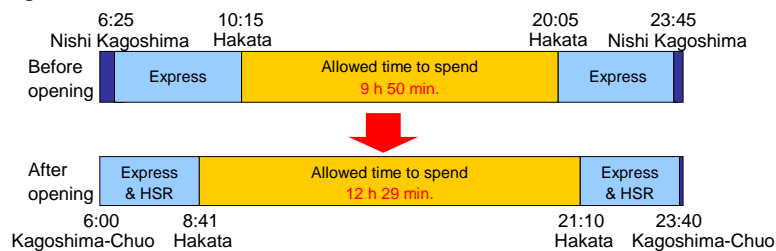
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allowed time to spend in the city of Fukuoka (Hakata station) has also greatly increased by 2 h 40 min, from 9 h 50 min to 12 h 30 min.

Leaving Hakata station



Leaving Kagoshima-Chuo station



**Figure 14** – Changes in allowed time to spend in the destination

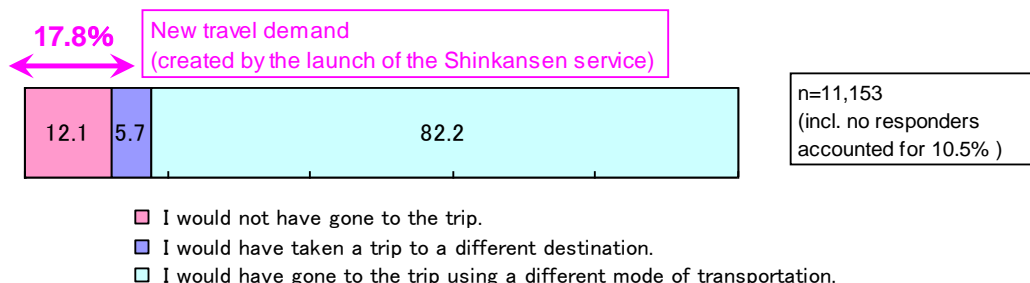
Source: JTB Timetables

Note: Upon opening of the Shinkansen line, Nishi-Kagoshima station was renamed to Kagoshima-Chuo station.

**4-2-3 Creation of new travel demand**

This section shows the responses to the questions in the questionnaire addressed to Kyushu Shinkansen users on “Would you have made this trip if the Shinkansen service had not been in operation?”

“I would not have gone to the trip” and “I would have taken a trip to a different destination” accounted together for 17.8 percent. These responses were from the passengers who would not have gone on a trip itself or would have changed the destination of the trip if the Shinkansen had not been opened. This means that the launch of the new high-speed rail service created an additional travel demand. Assuming that the 17.8 percent of 3.5 million passengers, which were total Kyushu Shinkansen users in 2004, represents additional travelers, a new demand with 310 thousand people was created in the year by the opening.



**Figure 15** – Created new demand

Source: Questionnaire survey (in Oct. 2008) by JR TT

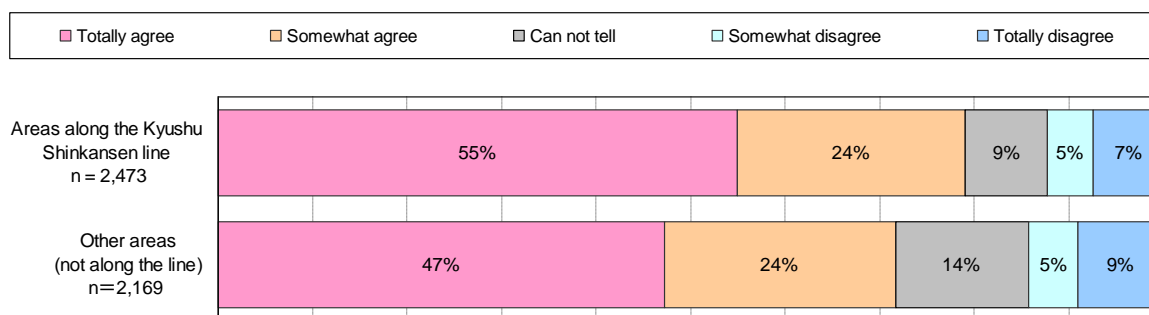
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**4-3 Effect and impact on regional economy**

*4-3-1 Enhanced human interaction*

It is considered that improved traveller convenience based on the development of the new high-speed rail has expanded travellers' choice of destination and contributed to enhancement of active human interaction. To the question in the questionnaire survey asking "Has the range of possible destinations for your trip expanded by using Shinkansen service?", approx. 80 percent of the Shinkansen users in the areas along the line responded that "it expanded." Approx. 70 percent of the passengers living in other areas (not along the line) also responded so. These results demonstrate that the opening of the high-speed rail has given a great impact on both the areas along the line and other areas.

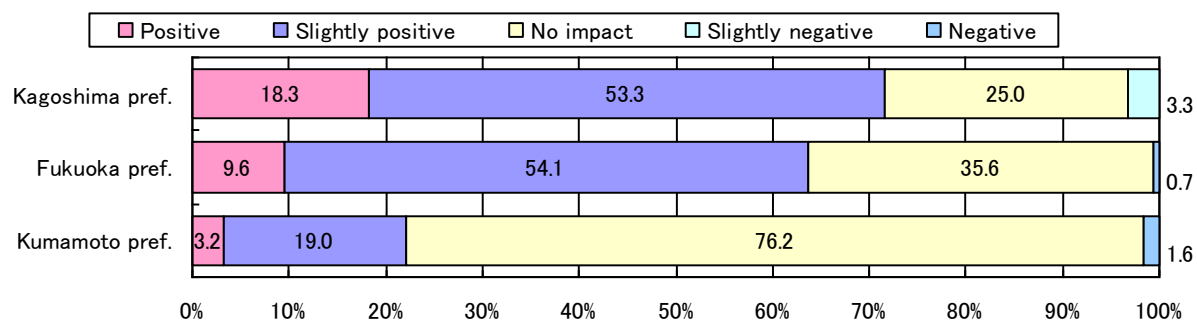


**Figure 16** – Expanded range of travel destinations after the Shinkansen line developed

Source: Questionnaire survey (in Oct. 2008) by JR TT

*4-3-2 Impact on business activities*

According to the "questionnaire survey on partly-opened Kyushu Shinkansen line" given by Kyushu Economic Research Center addressed to branch offices and publicly-listed local companies located in prefectures where the conventional line called Kagoshima Main Line runs through, 72 percent of respondent companies in Kagoshima prefecture, 64 percent in Fukuoka prefecture, and 22 percent in Kumamoto prefecture answered that the new rail service has given a positive impact. Major impacts include "reduction of travel cost for business trips", "expanded range of business and sales activities", and "easier access to information to be collected."



**Figure 17** – Impact by partly-opened Shinkansen service on business activities

Source: Monthly Research Bulletin of Kyushu Economy

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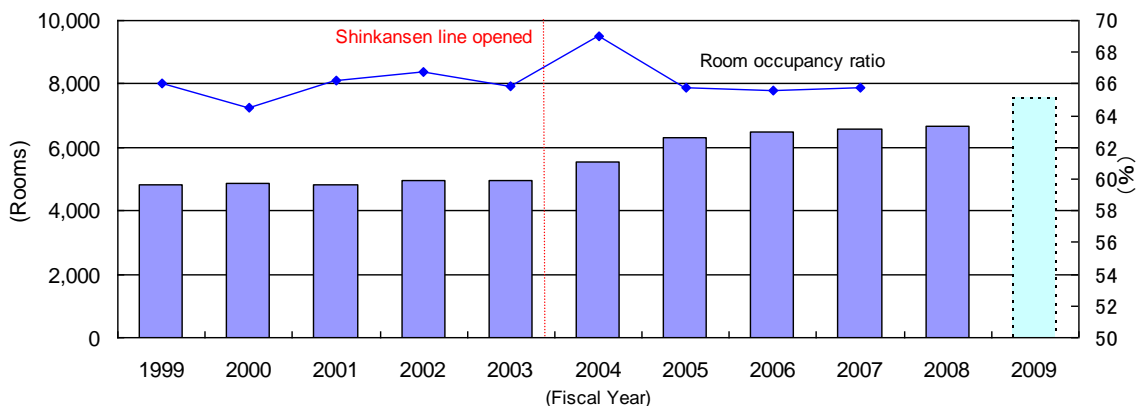
The possible arrival time at the cities of Fukuoka, Kumamoto and others from the city of Kagoshima was never earlier than 10 am before the opening of the Kyushu Shinkansen line. Since the line opened and shortened the journey time, a passenger from the city of Kagoshima is now able to arrive at these cities before 9 am. The shortened journey time has made it possible for the passengers who need to attend a morning meeting to leave home on the same morning. Workers used to live close to workplace away from their families can now also commute from their home with families.

Additionally, the number of conventions held in the city of Kagoshima and their participants are both on the increase after the launch of the line. As explained above, the launch of the high-speed rail service is considered to have contributed to vitalization of business activities and more active interaction.

*4-3-3 Changes in accommodation facilities*

In terms of changes in the number of hotels in the city of Kagoshima, construction of hotels starts to grow in about five years before the Shinkansen line opened. The number of hotels increased to 73 in 2006, up by 16 compared to 1999. The number of guest rooms grew to 6,581, increased by 1,756 rooms. One of the possible factors of the increase is opening of hotels assuming a growth of tourists and other guests led by the launch of the high-speed rail service. On the other hand, three hotels were closed in 2007 due to intensified competition. A further growth of tourists is expected in coming years, since the high-speed rail service is going to stretch to Hakata in 2011. A hotel (100 guest rooms) and five hotels (approx. 900 guest rooms) are opened or planned to be opened in the fiscal year 2008 and 2009, respectively.

An average occupancy ratio of the 9 hotel facilities located in the city of Kagoshima once dropped after the opening of the Shinkansen; however, remained the same level thereafter despite the fact that the number of guest rooms has largely increased.



**Figure 18** – *Number of guest rooms and occupancy ratio of hotels in the city of Kagoshima*

Source: Kagoshima Regional Economic Information (website), Report on Public Health Administration and Services (website)

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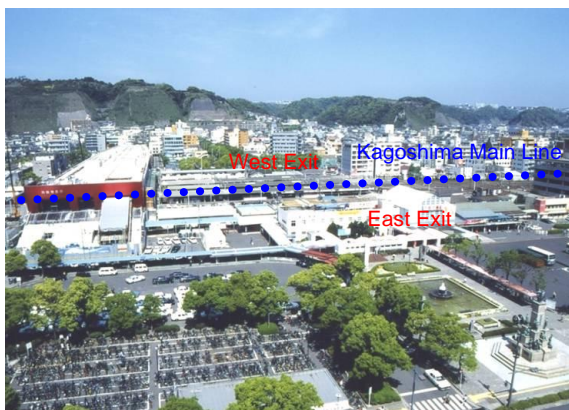
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4-3-4 Development around station

Kagoshima-Chuo station of the Shinkansen line was built to be directly connected with the conventional railway station. Along with the construction of the new line, the station plaza was also developed for improvements. At the east station plaza, a streetcar track and the stop were pulled into the plaza from the center of the street in front of the station. The changes provided better traveller convenience in terms of easier transfer and improved safety without requiring the passengers to cross over the street.

At the west station plaza, some bus stops in a roundabout, taxi stands, and car parking spaces were additionally established. Other facilities including economy hotels were constructed around the west exit area.

Before Shinkansen line was opened



After opening



**Figure 19** – Photo of Kagoshima-Chuo station  
(before and after the Shinkansen line was opened)

Other stations also had renovation projects for station front areas, including construction of new station building for conventional line, bus stops, and car parking spaces, in time for the launch of the Shinkansen service. New tourist information centers and gift and souvenir centers have been established in the station facilities, and hotels and condominiums have been constructed around them. As seen from the above findings, Shinkansen stations are expected to take a role as a gateway to the community and a hub for local transportation.

4-4 Effect and impact on sightseeing businesses

Kagoshima prefecture has one of the most famous hot spring resort areas in Japan, having nationally-known Kirishima Onsen and Ibusuki Onsen resorts. It also has various tourist sites, including Mt. Sakurajima which is famous as an active volcano and Yakushima Island which was designated as one of World Natural Heritage sites.



**Figure 18** – Major tourist sites in southern part of the Kyushu region

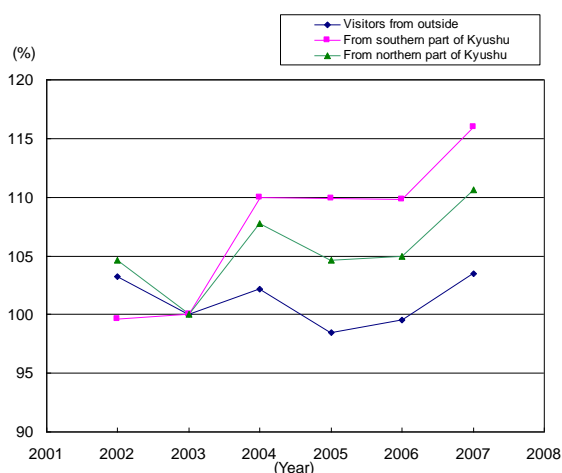
12<sup>th</sup> WCTR, July 11-15, 2010 – Lisbon, Portugal

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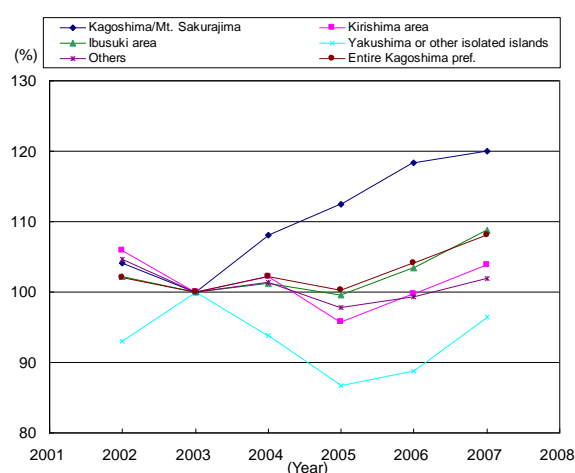
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**4-4-1 Changes in number of visitors**

The number of visitors to the entire Kagoshima prefecture in 2004, the year Shinkansen line started its operation, increased by approx. 2 percent over the previous year. The number then declined in 2005 to the 2003 level and showed a steady growth in the years 2006 and 2007. As to the number of the visitors coming from outside the prefecture and staying over, visitors from the southern part of the Kyushu region (Kumamoto and Miyazaki prefectures) in 2007 increased to approx. 115 percent and those from the northern part increased to approx. 110 percent. These figures are higher than those from outside the Kyushu region. This shows that beneficial information such as improved traveller convenience and better images were conveyed faster to the areas close to the Kyushu Shinkansen line.



**Figure 21** – Number of visitors stayed in Kagoshima pref. who came from outside



**Figure 22** – Number of visitors for sightseeing

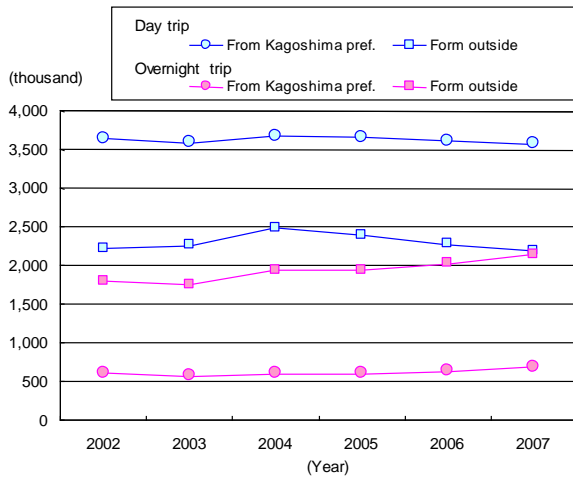
Source: Tourism statistics of Kagoshima prefecture (website)

Next, the changes in the number of visitors for sightseeing per tourist site show an increase in 2004, when the Shinkansen line opened, over the previous year in the Kagoshima prefecture except isolated islands such as Yakushima Island. It is considered that the increase was supported by the opening of the Shinkansen line. Especially in the Kagoshima/Mt. Sakurajima area, where the terminal station is located, has a notable growth. The number of visitors to the city of Kagoshima does not show a large difference between before and after the launch of the Shinkansen service, as well as any tendency to make their itinerary shorter to one day trip. In fact, the number of visitors staying at the city is on the rise after the opening of the Shinkansen line.

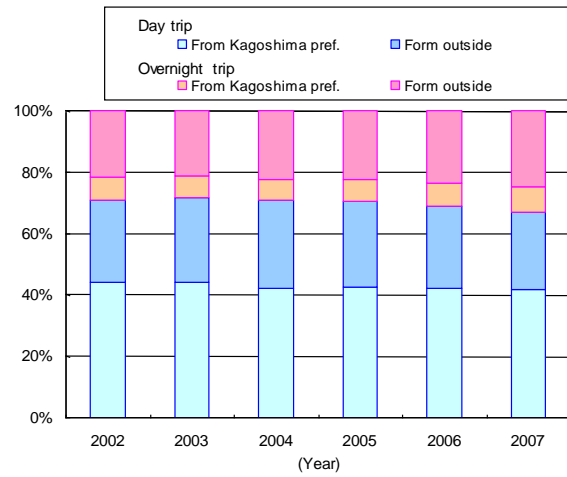


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**Figure 23 – Changes in Visitors to the City**  
[number of visitors]



**Figure 24 – Changes in Visitors to the City**  
[proportions]

Source: Tourism statistics of Kagoshima City (website)

Results of surveys on sightseeing trend related to opening of the Kyushu Shinkansen shows a relationship between a place to visit and place to stay at night indicating that approx. 75 percent of the tourists who visited the Kagoshima area stayed at the other area. As the above case illustrates, it is likely that the more tourists visit the areas along Shinkansen line, the more will visit other areas.

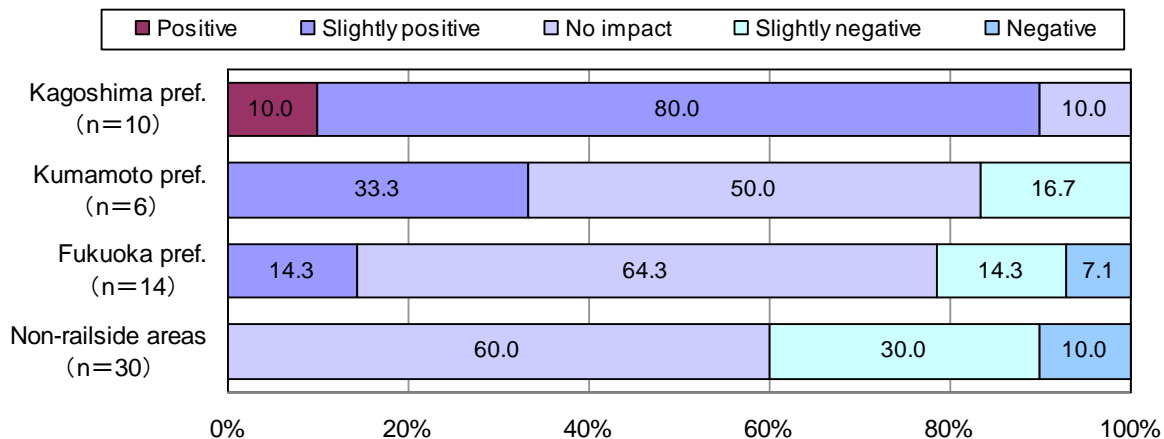
#### 4-4-2 Impact on sightseeing businesses

In the “Questionnaire Survey on Sightseeing and Leisure in the Kyushu Region” conducted by Kyushu Economic Research Center regarding the impact of the partly-opened Shinkansen service on sightseeing businesses, approx. 90 percent respondents engaged in tourists business in Kagoshima prefecture answered that the new line has given a positive impact on their facilities. Although the fact that the survey did not have enough number of samples due to limitation of respondents to major tourist facilities in each prefecture and was made in a short period of time 10 month after the opening must be taken into consideration, it is clear enough that the new high-speed rail service has given a notable impact on the sightseeing businesses. Even in Fukuoka prefecture, which is not located along the partly-opened Shinkansen section, approx. 15 percent of respondents answered that it posed a positive impact.

The impact on the sightseeing businesses are broken into direct factors such as “increased capacity to accept more tourists” and “improved transportation network” and indirect factors such as “enhanced image of the area”, which accounted for a large share.

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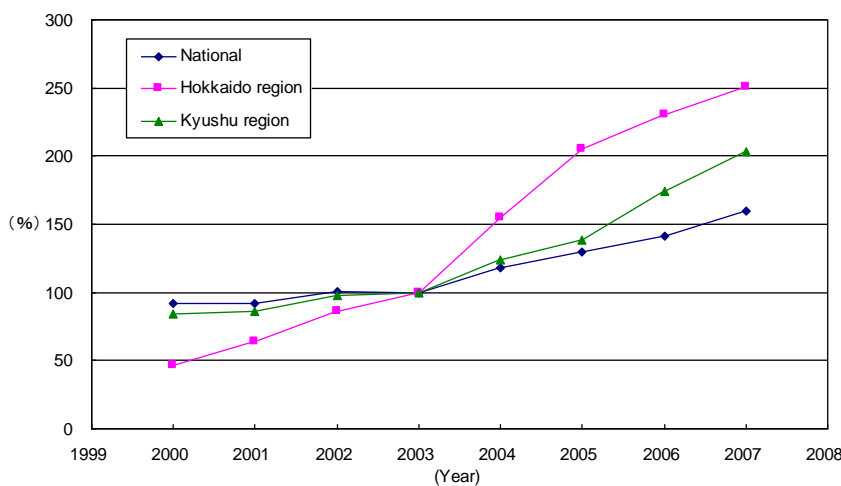
**Figure 25** – Impact of partly-opened Shinkansen on sightseeing businesses

Source: Monthly Research Bulletin of Kyushu Economy

Note: Non-railside areas refer to the prefectures in the Kyushu region except Fukuoka, Kumamoto, and Kagoshima pref.

#### 4-4-3 Foreign tourists to Japan

The number of foreign tourists to Japan (foreigners who entered Japan) have been in upward trend nationwide, and so as in Kyushu region. Compared to the number of foreign visitors in 2003, right before the partial opening of the Kyushu Shinkansen, overall visitors to the country are on an upward trend, partly contributed by the launch of “Visit Japan” campaign activities in April 2003, and the visitors to Kyushu region in 2007 showed a more than two-fold increase, reaching to 204 percent of 2003 figure.



**Figure 26** – Change in number of foreign tourists

Source: Annual Report on Statistics on Legal Migrants

Although no statistical data on railway travel by foreign tourists has been well organized, sales of special train tickets issued for foreign travelers by JR Kyushu, which allow the purchasers an unlimited ride covering five prefectures in northern part of the Kyushu region

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for three days, has doubled in a three month period between January and March 2008 over the projected figure of the company.

*4-4-4 Effort of local communities and railway operators to improve sightseeing businesses*

Local governments promoted and implemented various measures for attracting more tourists to the prefectures including preparation of brochures to introduce some of the prominent tourist resources in the prefecture and discovering new tourist resources in time for the launch of the southern section of the line.

Local governments, communities, tourism industry, and transportation operators in southern Kyushu area are working together in a public-private partnership and continuing the effort to revitalize the areas and promote tourism by transmitting information about various event activities and branding the sightseeing in the region.

In time for the opening of the Kyushu Shinkansen, new connecting transportation have been developed, including new bus lines connected to the Shinkansen stations. Other local transportation to/from the stations of conventional railways have also been developed, including a new bus line running in some hot spring areas, bicycle rentals, and additional sightseeing taxis.

New interior design of the Shinkansen trains includes some traditional materials of Kyushu (e.g. Japanese cherry wood and rushes which is typically used to make Japanese tatami mats (straw mats)) to demonstrate an “identity of Kyushu region”. This is an approach to demonstrate geographical characteristics and culture of the region in a sophisticated manner as well as provide the best hospitality and relaxation and seek for excellence of universal functionality.



**Figure28** – Photo of Interior of Kyushu Shinkansen

**Left:** Wooden seats made of mountain cherry timber. **Center:** Roll-up shade made of mountain cheery timer.

**Right:** Short curtain made of rushes.

**4-5 Economic ripple effect**

Improvements in transportation services, including higher speed and frequency, achieved by the opening of the section between Shin-Yatsushiro and Kagoshima-Chuo stations of the Kyushu Shinkansen line bring some benefits in business activities, such as reduction of

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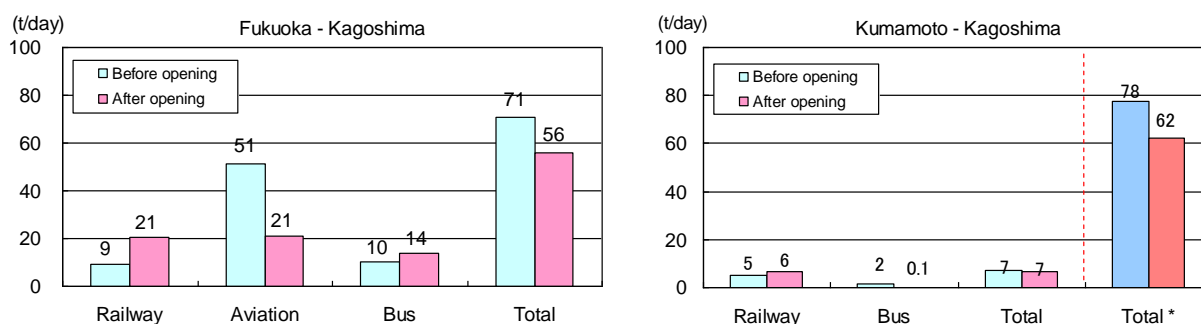
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business travel cost, expanded business and sales areas, more efficient collection of information, and improved efficiency in business activities due to easier access for meetings and business negotiations. Another impact is that advanced proximity among the local areas reduces communication cost and improves productivity of companies, leading to advantageous economic ripple effect.

An estimated economic ripple effect of the Kyushu Shinkansen operation using multi-regional macroeconomic models is approx. 25 billion yen (278million dollar) a year in the fifth year of the new high-speed rail service (the year 2008) and approx. 29 billion yen (322million dollar) a year in the tenth year (2013).

#### 4-6 Environmental impact

The following figures show estimated CO<sub>2</sub> emissions attributable to travels using public transportation between Fukuoka and Kagoshima prefectures and between Kumamoto and Kagoshima prefectures before and after the partial opening of the Shinkansen line, calculated based on the number of ODs (number of trains operated at the origin and destination of the section) between the target prefectures in the “Inter-Regional Travel Survey” of Ministry of Land, Infrastructure, Transport and Tourism (MLIT) for the years 2000 and 2005.



**Figure 29 – CO<sub>2</sub> emissions from public transportation**

Note: \*Total of Fukuoka – Kagoshima and Kumamoto - Kagoshima

**Table 1 – CO<sub>2</sub> emissions and consumption rates**

	Railways	Aviation	Bus	Private automobile
g-CO <sub>2</sub> / passenger-km	18	111	51	172
In case consumption rate of railroad equals 1.0	1.0	6.2	2.8	9.6

Source: Transportation, Traffic and Environment

The emissions from railway transportation increased because of the growth of train passengers due to the partly-opened Shinkansen service, while the emissions from the aviation service which has greater emission intensity have been on a decline. A total CO<sub>2</sub> emitted by the entire public transportation for both sections (between Fukuoka and Kagoshima prefectures and between Kumamoto and Kagoshima prefectures) have

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decreased to 80 percent (down by 16 tons/day), from 78 ton/day before the opening to 62 ton/day after the opening. These figures indicate that the development of the Shinkansen service has contributed to reduction of the environmental burden.

Although a shift from automobile users to railway passengers is anticipated, the above estimate did not take the shift into consideration for the calculation of CO<sub>2</sub> emissions, since the number of ODs in automobile segment had a sharp decrease in the Inter-Regional Travel Survey and assuming the entire decrease as the users who changed their transportation mode to railway service would be an overestimation.

Consequently, assuming that 24.9 percent of automobile users were shifted to Shinkansen passengers based on the results of the Shinkansen user questionnaire, it is estimated that the shift from automobile rides contributed to CO<sub>2</sub> reductions of approx. 49 ton/day and approx. 16 ton/day between Fukuoka and Kagoshima prefectures and between Kumamoto and Kagoshima prefectures, respectively. Combining these numbers into the above reductions by the public transportation, it is estimated that CO<sub>2</sub> reduction of approx. 81 ton/day was achieved.

## **5. SUMMARY**

The partly-opened Kyushu Shinkansen line has brought improved journey time to and traveller convenience, resulted in more than two-fold increase of passengers compared to the railway users before the opening, and more than tenfold growth in daily Shinkansen commuters to school or work. According to the findings from questionnaire surveys, approx. 18 percent is newly created demand. The opening has also posed a significant impact providing various benefits of high-speed transportation to the railway users and regional economy, such as expanded area of interaction, improved efficiency and increased area of business activities. It has given another impact on sightseeing businesses, including direct impact represented by increased number of visitors not only in the areas along the Shinkansen line but also other areas, as well as indirect impact such as improved image of tourist sites and attractions. In terms of an environment impact, CO<sub>2</sub> emissions attributable to travels using public transportation have been reduced by approx. 16 tons/day compared to before the development of the high-speed rail. This is demonstrating a notable environmental preservation effect.

Since further improved speed and traveller convenience are to be achieved by the full opening of the Kyushu Shinkansen line (between Hakata and Kagoshima-Chuo stations) in the fiscal year 2010, it is expected that a greater impact will be given on the communities and businesses than the partial opening of the line. Taking these into consideration, changes in the impact and effect by the full opening should be continuously followed and further investigated.

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