Commissioned Project on Survey on Environmental Improvement for Practical Use of Transport Services by Automated Driving in the New Town Area, shown in Automated Driving (System and Services' Expansion) in 2nd Period, Strategic Innovation Promotion Programs (SIP)

Report Outline

April 30, 2019

Outsourcing Contractor: Nippon Koei., Co., Ltd.

NIPPON KOEI

Background of Survey

- The Newtown constructed in the period of 1965-1975 has the characteristics below:

  - ➢ The population amassed.

  - ➢ The short-distance drive on the level of normal life occurred with high frequency.

  - ➢ The aging of population increased rapidly and entirely.

  （In most of case, the same generation moved into the Newtown at the beginning of development. After that, several years have passed.)

- Assumed the increase of the short-distance drive more than ever in the future by the progression of the aging of population.

⇩
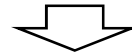
Expected the potential demand of the mobility service of automated driving.

Purpose of Survey

- Objective: Midorigaoka – Aoyama district (Miki city, Hyogo prefecture) centered independent housings.

- Consider the transportation service of automated driving for solving the problem of the Newtown.

- Implement the experiment assumed the steps to realize the transportation service supporting the mobility inside the area.

- Implement the verification of validity and availability about the problem and the way of solving.

- In addition, consider the strategy of development toward the actual implementation to the society based on these verifications.

Outline of Area

- Miki City is located about 50 mins by car and 60 mins by train from Sannomiya, Kobe City.
- Midorigaoka Neo-police and Matsugaoka Neo-police in Midorigaoka - Aoyama district are independent housing complex of suburban style as a bedroom suburbs of Kobe City or Osaka City.

第3期開発

第2期開発

第1期開発

Third term of the development
Matsugaoka Neo-police land readjustment project
A=181 ha 2,000 plots
Land formation: 1983 - 1988
Start sale in plots: 1985

Second term of the development
Midorigaoka housing complex project
A=20 ha 450 plots
Land formation: 1975 - 1976
Start sale in plots: 1975

First term of the development
Midorigaoka Neo-police land readjustment project
A=106 ha 3,000 plots
Land formation: 1969 - 1972
Start sale in plots: 1971

Problems of Area

- The progression of the aging of population

  （Midorigaoka district is the one of the corresponding area progressing the aging in Miki City.

  The ratio of the aging of population is 40%）

- Rugged terrain （The maximum height different is approximate 50m.)
- Slackness of zonal circulated bus（Number of user is less than 1 person/bus)

Direction aimed

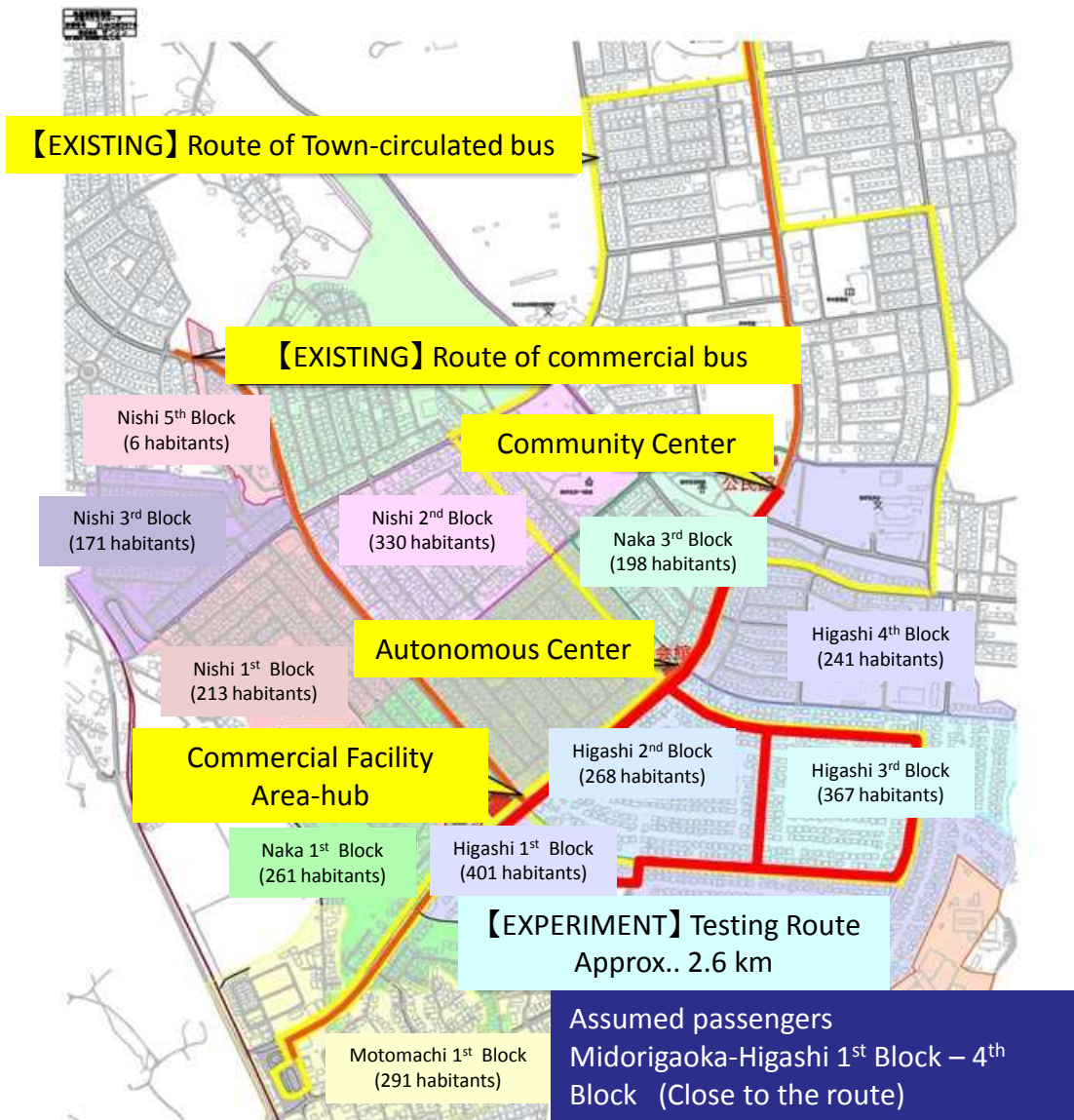◆ **Automatic driving service in the future**

Automated driving car sharing service managed by the organization to promote the housing complex renovation (Provisional)

- Aim at the town to keep living in the community without the opportunity to go out by considering the way of transportation which is more convenient than bus and cheaper than taxi or own car.

- The management of the transportation service is assumed by Miki City the Furtherance of Active Community in the Lifetime Agency which is the organization to promote the housing complex renovation.

◆ **Expected effects by installing the automatic driving service**

1）Create effective way of mobility inside the area.

2）Activate the community of the area

- ✓ The health enhancement by the increase of the opportunity to go out.

- ✓ Create the space for gathering residents by using the area-hub as a transportation-hub.
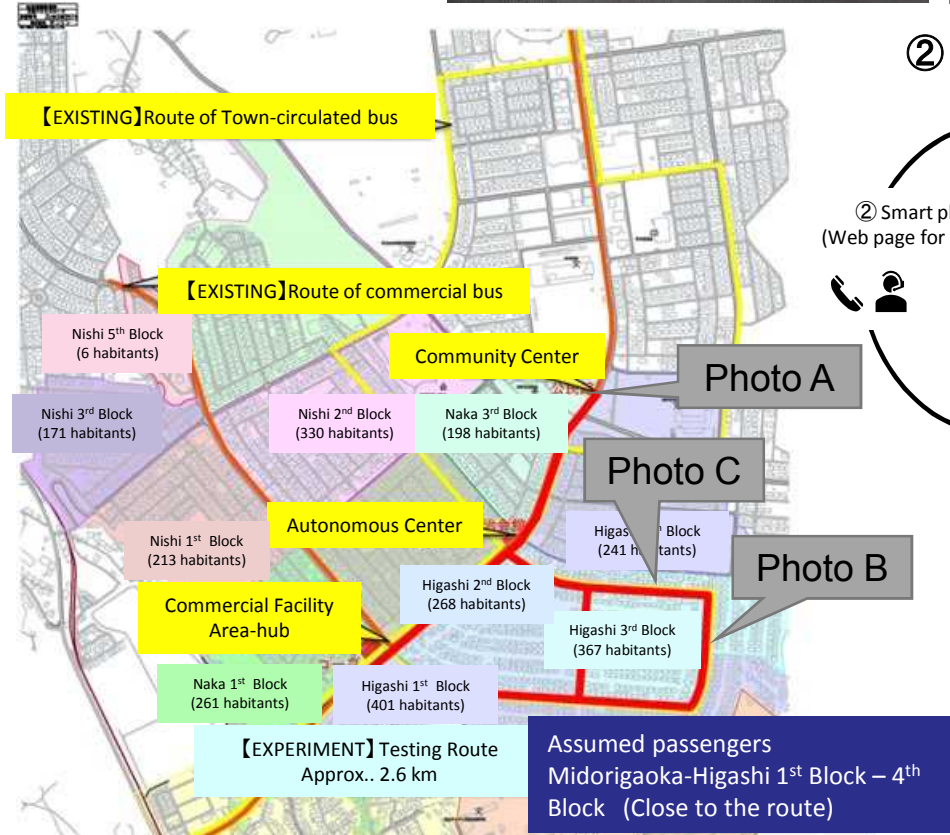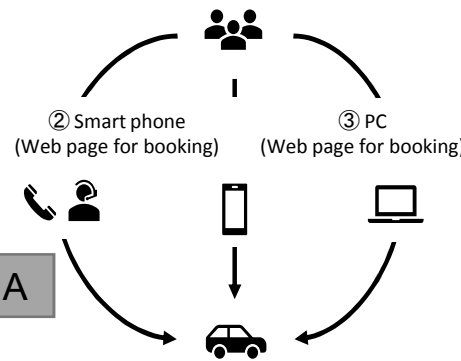
Experiment Plan

【EXISTING】Route of Town-circulated bus

【EXISTING】Route of commercial bus

Nishi 5th Block
(6 habitants)

Community Center

Nishi 3rd Block
(171 habitants)

Nishi 2nd Block
(330 habitants)

Naka 3rd Block
(198 habitants)

Higashi 4th Block
(241 habitants)

Autonomous Center

Nishi 1st Block
(213 habitants)

Commercial Facility
Area-hub

Higashi 2nd Block
(268 habitants)

Higashi 3rd Block
(367 habitants)

Naka 1st Block
(261 habitants)

Higashi 1st Block
(401 habitants)

【EXPERIMENT】Testing Route
Approx.. 2.6 km

Assumed passengers
Midorigaoka-Higashi 1st Block – 4th
Block (Close to the route)

Motomachi 1st Block
(291 habitants)

Driving Pattern ／Route extension	B：Short-distance drive (approx. 1 to 2 km) as feeder mode, extension of the transport-service routes around the area-hub facilities or stations: approx. 2.6 km
Driving Type / Route	Driving on a reservation basis: Getting on/off places are set at the house, area-hub, commercial facilities, autonomous center, and community center
Test Period	9:00 to 17:00 from Feb. 17th (Sun.) to 22nd (Fri.)
Passengers	Limited to the residents along the test routes: Prior entry is necessary
Vehicles	Vehicle type: Minivan, 1 vehicle, 2 fixed number
Driving system	-Possible to reserve the services up until 30 minutes of the desired departure - Use of a reservation system with the on-demand traffic system introduced in the past - Acceptance of the reservations by Telephone / Web
Level of automatic driving	Driving operated by driver's seat: level 2 (Driving technic of the vehicle is adjusted to the equivalent level 3)

Actual condition of the experiment

The situation of automatic driving

A. Community center

B. Getting on vehicle

C. Leading Car and Automatic driving car

D. Inside vehicle

【EXISTING】Route of Town-circulated bus

【EXISTING】Route of commercial bus

Nishi 5th Block (6 habitants)

Nishi 3rd Block (171 habitants)

Nishi 2nd Block (330 habitants)

Naka 3rd Block (198 habitants)

Community Center

Photo A

Nishi 1st Block (213 habitants)

Autonomous Center

Photo C

Higashi ... Block (241 habitants)

Commercial Facility Area-hub

Higashi 2nd Block (268 habitants)

Higashi 3rd Block (367 habitants)

Photo B

Naka 1st Block (261 habitants)

Higashi 1st Block (401 habitants)

【EXPERIMENT】Testing Route Approx.. 2.6 km

Assumed passengers Midorigaoka-Higashi 1st Block – 4th Block (Close to the route)

② How to book

② Smart phone (Web page for booking)

③ PC (Web page for booking)

Enter the place getting on in Booking Apps

Show the time to use

Web page for Administrator of driving
The view of the list of booking

The view of the list of Place to get on/off Passenger Time to get on/off

Trend analysis of passengers

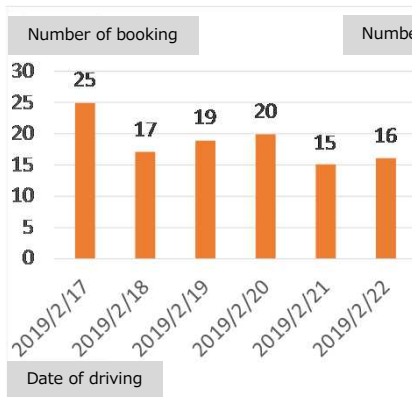## ① Characteristic of monitors　31 monitors

Rate of gender composition

Male
48%

Female
52%

N=31

Rate of age composition

Teenage
3%

Forties
6%

Eighties
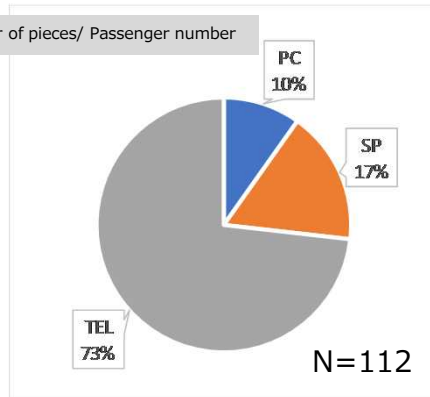19%

Fifties
10%

Seventies
36%

Sixties
26%

N=31
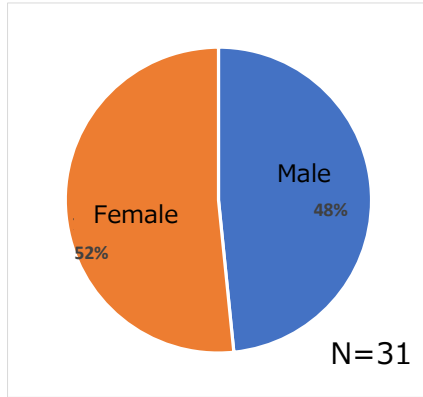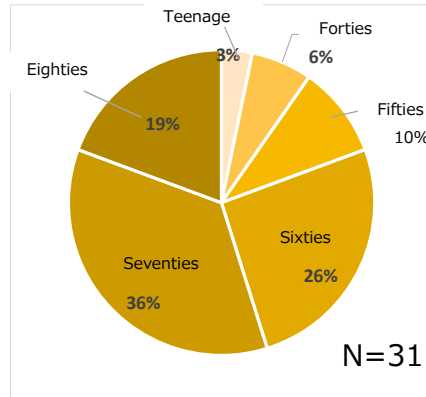
② Characteristic of use　112 bookings, 110 cases of actual use（2 cases are canceled without notice. ）
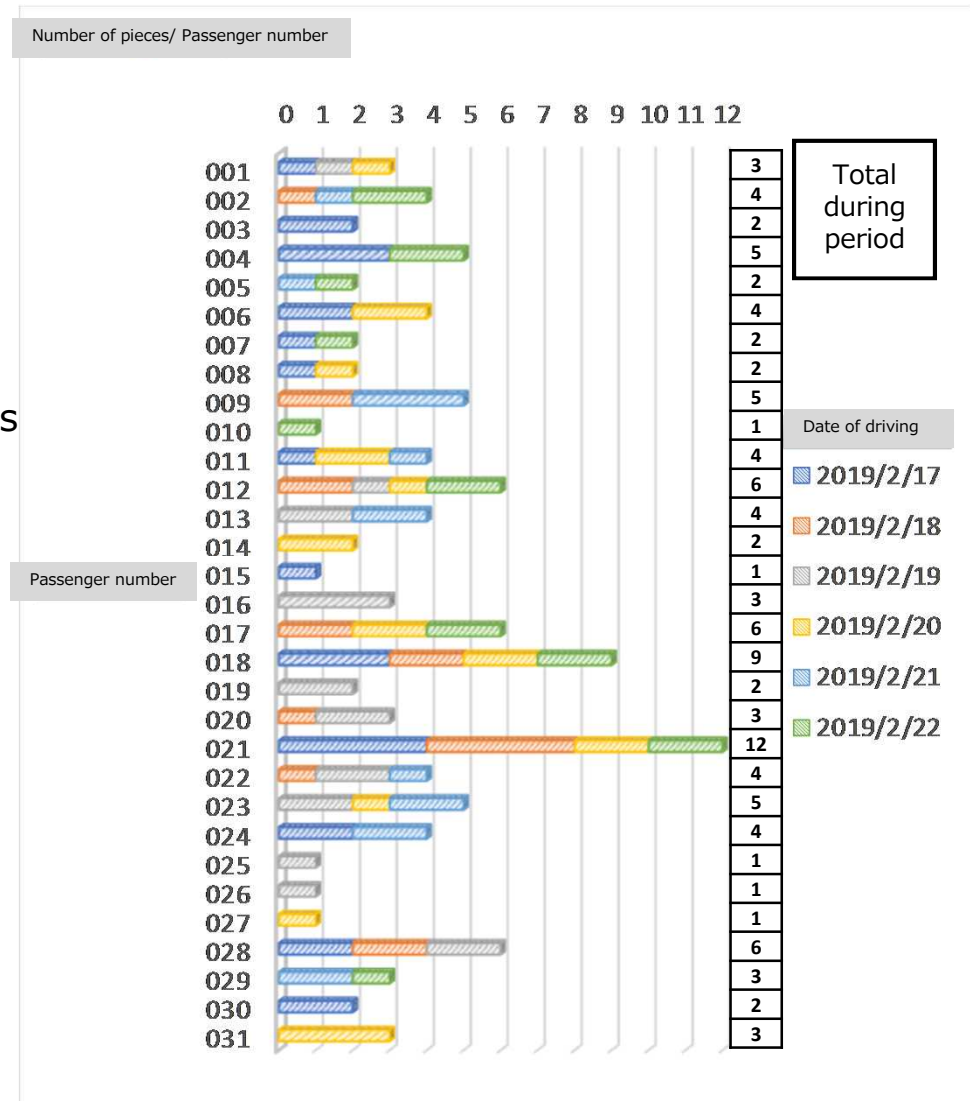
Number of booking by date

Number of booking

30	25
25	
20	17　19　20　15　16

2019/2/17　2019/2/18　2019/2/19　2019/2/20　2019/2/21　2019/2/22

Date of driving

Rate of way of booking composition

Number of pieces/ Passenger number

PC
10%

SP
17%

TEL
73%

N=112

Occurred 2 cases of cancel without notice on Feb. 17

（Booking system log）

③Number of booking by date and monitor （Booking system log）

Number of pieces/ Passenger number

0　1　2　3　4　5　6　7　8　9　10 11 12

Passenger number

Monitor	Total during period
001	3
002	4
003	2
004	5
005	2
006	4
007	2
008	2
009	5
010	1
011	4
012	6
013	4
014	2
015	1
016	3
017	6
018	9
019	2
020	3
021	12
022	4
023	5
024	4
025	1
026	1
027	1
028	6
029	3
030	2
031	3

Date of driving

- 2019/2/17
- 2019/2/18
- 2019/2/19
- 2019/2/20
- 2019/2/21
- 2019/2/22

Trend analysis of passengers

④ Rate of composition of place to get off （Booking system log）

⑤ Breakdown of route using（Booking system log）

Higashi 4th block bus stop

COOP
30%

0%

Monitor's Home
34%

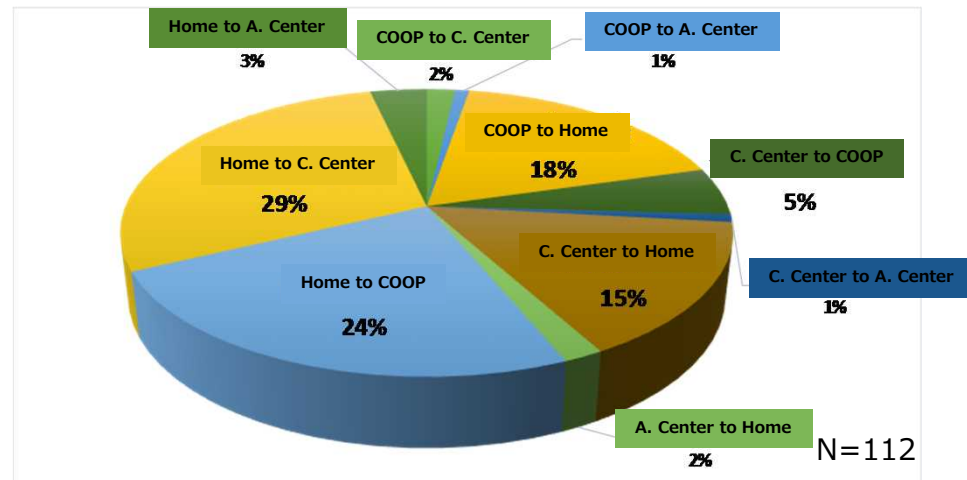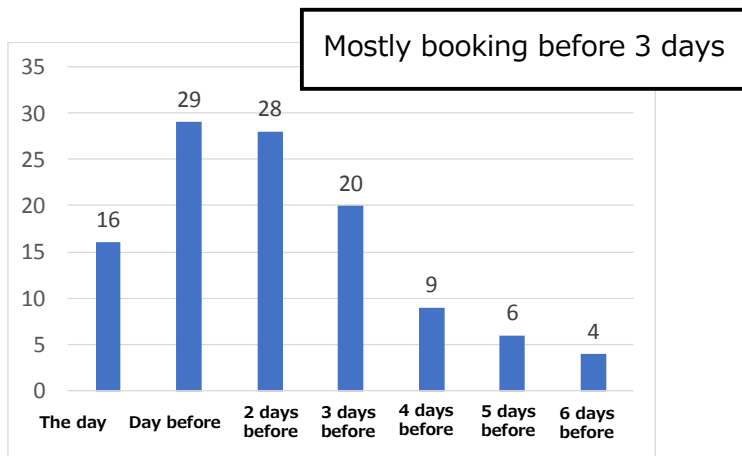Autonomous Center
5%

Community Center
31%

Higashi 1st block	8%
Higashi 2nd block	7%
Higashi 3rd block	14%
Higashi 4th block	5%

N=112

In most of case, used from Home to Community center or COOP

- COOP to C. Center: 2
- COOP to A. Center: 1
- COOP to Home: 20
- C. Center to COOP: 6
- C. Center to A. Center: 1
- C. Center to Home: 17
- A. Center to Home: 2
- Home to COOP: 27
- Home to C. Center: 32
- Home to A. Center: 4

⑥Time of booking（Booking system log）

Mostly booking before 3 days

- The day: 16
- Day before: 29
- 2 days before: 28
- 3 days before: 20
- 4 days before: 9
- 5 days before: 6
- 6 days before: 4

- Home to A. Center: 3%
- COOP to C. Center: 2%
- COOP to A. Center: 1%
- COOP to Home: 18%
- C. Center to COOP: 5%
- Home to C. Center: 29%
- C. Center to Home: 15%
- C. Center to A. Center: 1%
- Home to COOP: 24%
- A. Center to Home: 2%

N=112

Impressions of passengers

① Effectivity as a transportation service（Questionnaire after ride）

Usual transportation instead of this route

- First time to use this route **4%**
- Walk **22%**
- Bicycle **6%**
- Owned car **65%**

N=110
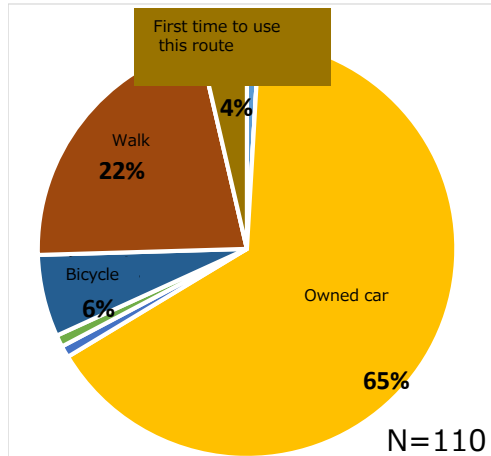
Is the amount of time increased or decreased compared to usual transportation?

- First time to use this route **5%**
- Shorter **18%**
- Longer **33%**
- The same **44%**

N=110
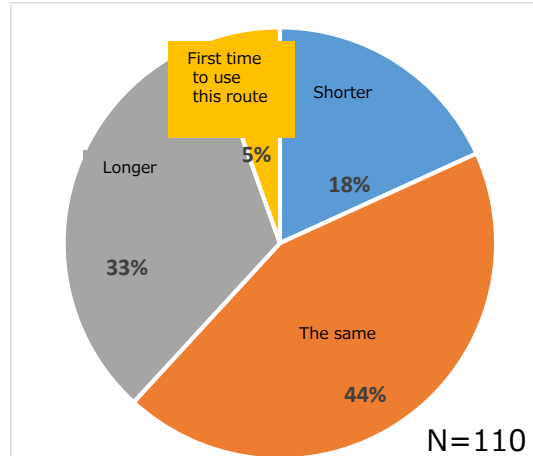
Is it more convenient or not compared to usual transportation?

- First time to use this route **6%**
- unknown **2%**
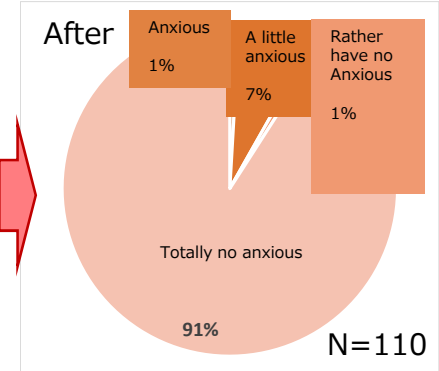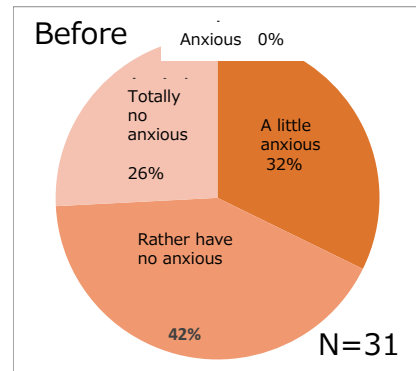- Less convenient **27%**
- More convenient **65%**

N=110
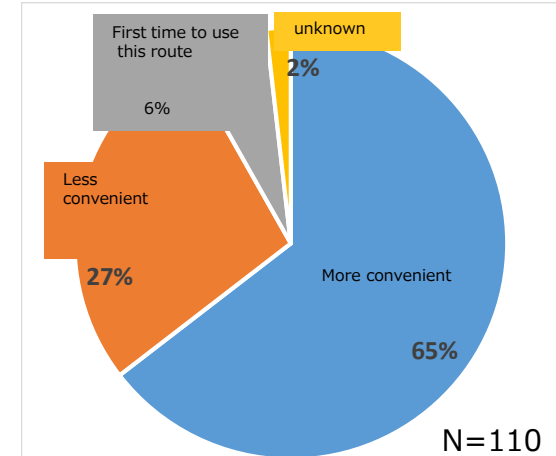
> 62% of passengers answered that took shorter time or the same, and 65% answered that it's more convenient than usual transportation.
> On the other hand, 33% answered that took longer, and 27% answered that it's less convenient than usual.

② Safety and ride comfort（Questionnaire before ride and after ride）

Concerns about safety

Before
- Anxious 0%
- Totally no anxious 19%
- A little anxious 39%
- Rather have no anxious 42%

N=31

After
- anxious 3%
- A little anxious 12%
- Rather have no Anxious 6%
- Totally no anxious 79%

N=110
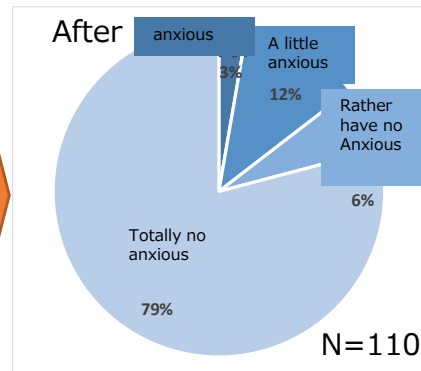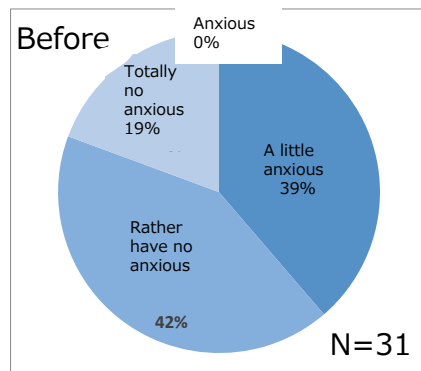
Concerns about ride comfort

Before
- Anxious 0%
- Totally no anxious 26%
- A little anxious 32%
- Rather have no anxious 42%

N=31

After
- Anxious 1%
- A little anxious 7%
- Rather have no Anxious 1%
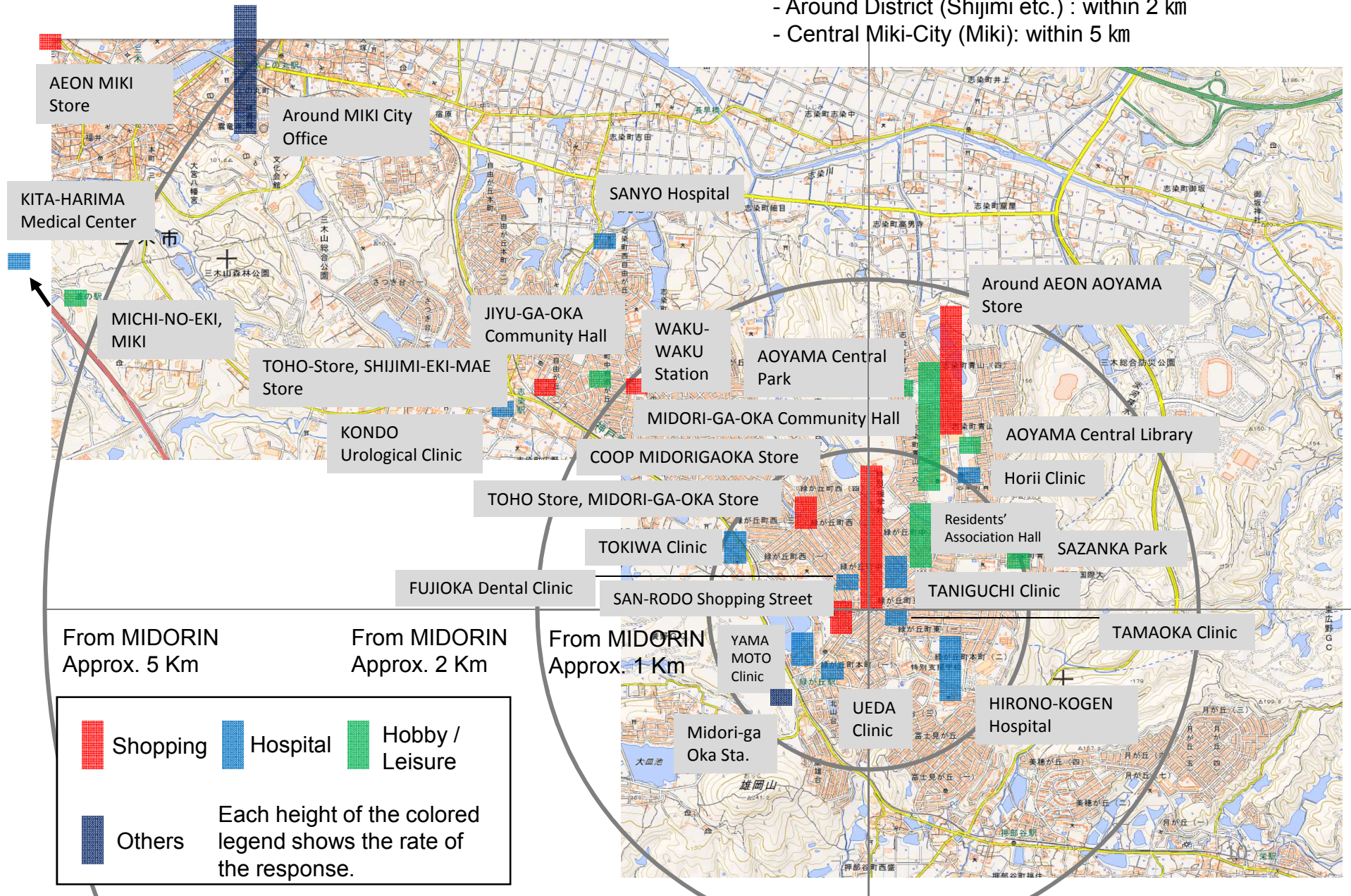- Totally no anxious 91%

N=110

9

Study for Actual Implementation to Society

① Test Participants' Daily-Life Range

【Distance from MIDOTIN】
- Inside District (Midori-Ga-Oka, Aoyama) : within 1 km
- Around District (Shijimi etc.) : within 2 km
- Central Miki-City (Miki): within 5 km

AEON MIKI Store

Around MIKI City Office

KITA-HARIMA Medical Center

SANYO Hospital

MICHI-NO-EKI, MIKI

Around AEON AOYAMA Store

JIYU-GA-OKA Community Hall

WAKU-WAKU Station

AOYAMA Central Park

TOHO-Store, SHIJIMI-EKI-MAE Store

MIDORI-GA-OKA Community Hall

AOYAMA Central Library

KONDO Urological Clinic

COOP MIDORIGAOKA Store

Horii Clinic

TOHO Store, MIDORI-GA-OKA Store

Residents' Association Hall

SAZANKA Park

TOKIWA Clinic

FUJIOKA Dental Clinic

SAN-RODO Shopping Street

TANIGUCHI Clinic

TAMAOKA Clinic

From MIDORIN Approx. 5 Km

From MIDORIN Approx. 2 Km

From MIDORIN Approx. 1 Km

YAMA MOTO Clinic

UEDA Clinic

HIRONO-KOGEN Hospital

Midori-ga Oka Sta.

	Shopping		Hospital		Hobby / Leisure

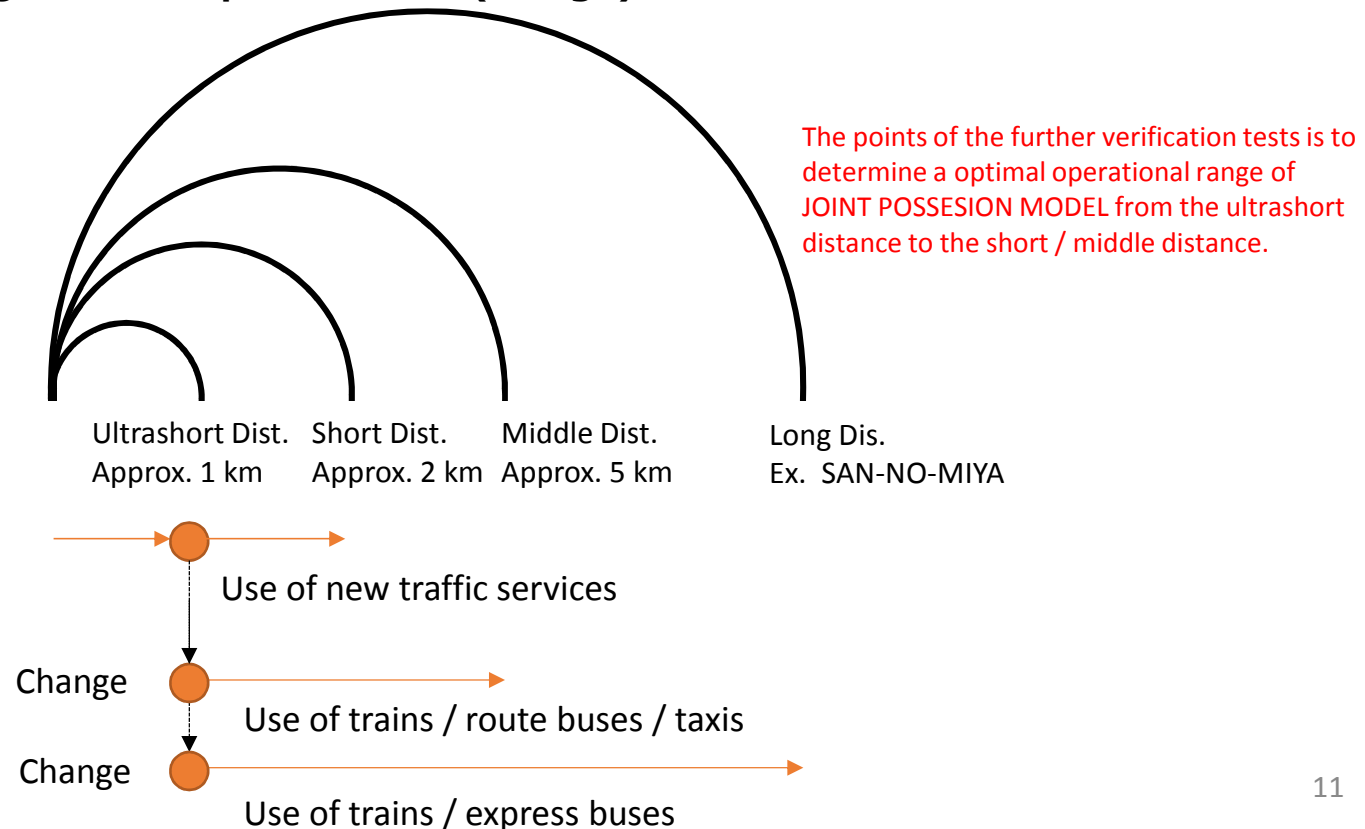Others — Each height of the colored legend shows the rate of the response.

Study for Actual Implementation to Society

② Services Image based on Verification-Test Results & Test Participants' Daily-Life Range

【Operation Contents】
・Cost burden per community: 1 vehicle per approx. 30 households（a range of certain mass） as a guide
・Automated driving vehicles with crews are operated according to the reservation status.
・Dep. / Arr. Place: Registered users only (approx. 3-5 places in MIDORI-GA-OKA / AOYAMA district, and domicile
　　　　　　　　　applicable）, and limited operational routes
・Ultrashort / Short distances are included, and changing buses / trains are used in middle / long distance.
・Vehicles that can drive automatically at the limited sections (assumed level 3 to 4): 3 to 4 fixed number
・Reserve system: Automated from reservation to vehicle allocation / route designation by using the improved
　　　　　　　　　vehicles after the verification test

Operation Range & Participants' Move (Image)

The points of the further verification tests is to determine a optimal operational range of JOINT POSSESION MODEL from the ultrashort distance to the short / middle distance.

Ultrashort Dist.
Approx. 1 km

Short Dist.
Approx. 2 km

Middle Dist.
Approx. 5 km

Long Dis.
Ex. SAN-NO-MIYA

Use of new traffic services

Change

Use of trains / route buses / taxis

Change

Use of trains / express buses

Study for Actual Implementation to Society

③ Further Verification Items

① Urban Space
- **Limited dep. /arr. places, Keeping vehicle garages in residential area, Establishing efficient operational routes**
- **Verifying the measures based on infrastructure support / reginal ruling to operate in the urban space**

Viewpoint		Item to be verified
Urban Space	**Set of Route, Dep/Arr. Place**	·Dep/Arr. place: registration system, and evaluation of validity and serviceability of the moderately limited routes
	Safe & Comfortable Running	·Verification of how to secure by road-side sensor ·Prohibit of running method or parking / stopping, study introduction of regional rules
	Management of Vehicles	·Operation by utilizing commercial parking spaces in the region ·Security in the garage, and measures to reassure in the commercial parking space

② Business Model
- **Study on desirable state of promoting going-out, approach of setting fare, and way of gaining profits through long verification or one for a fee**
- **Designating operational manager, and developing systems on users and running-service managers**

Viewpoint		Item to be verified
Business Model	**Business Feasibility**	·Determination of the optimal running range in 2 to 5 km and the optimal size of joint possession ·Verification on the effect to the life styles (e.g., going out) by the long verification ·Study on fare or gaining profits by running for a fee, and adjustment on the legal systems ·Addition of the measures for changing trains / buses ·Study on integrating the systems form reservation to vehicle allocation / route designation
	Potential Manager	·Securing the crews by the Promotion Organization ·Long running operation and business analysis by the Promotion Organization

③ Social Acceptability
- **Conduct of study sessions with the test participants in addition to verification test in order to judge feasibility of the joint possession**
- **Conduct of the survey on the interviews with the residents and the existing traffic systems in order to foster whole-district acceptability or feasibility with the existing traffic systems**

Viewpoint		Items to be verified
Social Acceptability	**Users' Acceptability**	·Continuous study sessions, grasping opinions on convenience / fare, and judge on feasibility of the joint possession
	Regional /Stakeholders Acceptability	·Providing opportunities to experience in other area ·Holding the study sessions in the whole district, and discussion on the automated driving cars ·Verification on the way of Promotion Organization involvement to enhance area acceptability ·Conduct of survey on the passing cars' responses or behaviors based on the fixed-point observation or the behavior data