# Progress of HD Map Development and Future expansion

DYNAMIC MAP PLATFORM

# Our mission

## Modeling the Earth

Our company supports innovation in a variety of industries by providing a high-precision HD data platform that replicates the real world in digital space

# Company Overview

## General Information

**Established**

June 2016

**Employees**

230 (1)

As of May 2002

**Total Fundraising**

JPY44.4Bn

As of Apr 2022

**Partnerships**

woven planet, AIRMOBILITY, SoftBank, NEDO, 内閣府 Cabinet Office, 飯山市 IIYAMA CITY, Valeo, ANA, TOKYO METROPOLITAN GOVERNMENT

## Group Organization

Acquired US HD map (2) supplier, Ushr, in 2019

DYNAMIC MAP PLATFORM → Ushr A DMP Group Company

## Unique Shareholder Base

As of Apr 2022

| Financial Sponsors/ Strategic Players | Japan Major Carmaker OEMs (2) | Map Developers | Companies w/ Positioning Tech |
|---|---|---|---|
| INCJ | TOYOTA | ZENRIN | Satellite positioning |
| JII | NISSAN | | MITSUBISHI ELECTRIC Changes for the Better |
| MITSUI & CO. | DAIHATSU | mapmaster | Ground Positioning |
| SBI Investment | SUBARU | | AISAN TECHNOLOGY CO.,LTD. |
| JOIN | SUZUKI | GeoTechnologies | PASCO World's Leading Geospatial Group |
| TGVEST | MITSUBISHI MOTORS | | |
| MUFG | ISUZU | | |
| MIZUHO Mizuho Capital | HONDA | | |
| ヒューリック株式会社 | HINO | | |
| | mazda | | |

**Notes:**
1. Number of employees on a consolidated basis
2. HD map: high definition map, OEM: original equipment manufacturer

# History

| | |
|---|---|
| Jun. 2016 | Established as Dynamic Map Platform Planning Co. |
| 2017 | GM's "Super Cruise™" First to Use Ushr Inc.'s HD Maps |
| Jun. 2017 | Company name changed to Dynamic Map Platform Co. |
| Mar. 2019 | Completed data conversion of 29,205 km of up and down Japanese expressways and freeways |
| Apr. 2019 | Completed the acquisition of Ushr Inc. |
| Sep. 2019 | Nissan Motor Co., Ltd. adopts our high-precision 3D map data (HD Map) for the first time in "ProPILOT 2.0". |
| Mar. 2021 | Our HD maps are used in Honda SENSING Elite, the world's first Level 3 automated driving system from Honda Motor Co. |
| Mar. 2021 | Our HD maps are used in "Toyota Teammate Advanced Drive" by Toyota Motor Corporation |
| Jul. 2022 | Selected for NEDO Green Innovation Fund Project "Building a Smart Mobility Society” |
| Aug. 2022 | Contracted by the Digital Agency to conduct "Research and Study on Digital Twin Construction” |

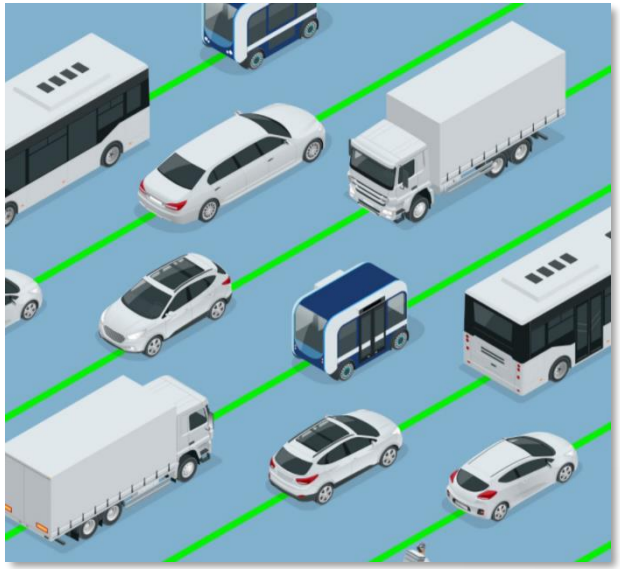
# Our Advantages

## Gathering the wisdom of All-Japan to expand globally

### Unparalleled accuracy of "cm-class" data

HD maps created by combining the most advanced and sophisticated technologies to achieve cm-level absolute accuracy.

### Specifications to meet automakers' requirements



HD Map, which consolidates the requirements of 10 companies, is highly evaluated by many customers.

### Global Business Expansion

Together with our group company Ushr Inc. Expansion to more countries in the future

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# Provided data

**Generated by extracting specific geographic features from point cloud data acquired by MMS (Mobile Mapping System) and vectorizing them.**

## HD Map Production Process

©MITSUBISHI ELECTRIC CORPORATION

### ① Satellite positioning

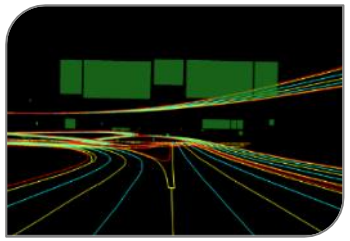
Location correction technology using Multi-GNSS

### ② Measurement

Point cloud data generation by mobile mapping system

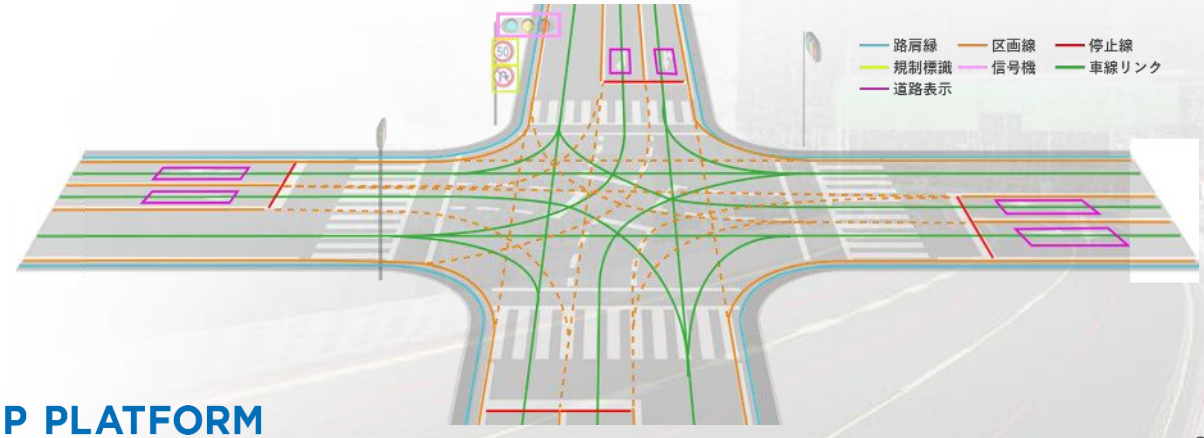
### ③ Mapping

Feature extraction from point cloud data



### ④ Integration

Data integration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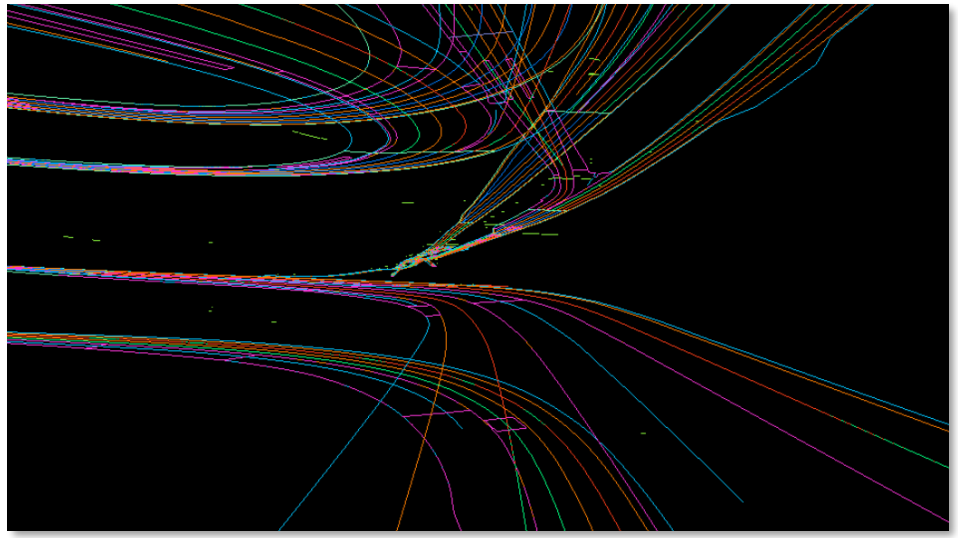
# Our Services

## High-precision 3D map data (HD map)

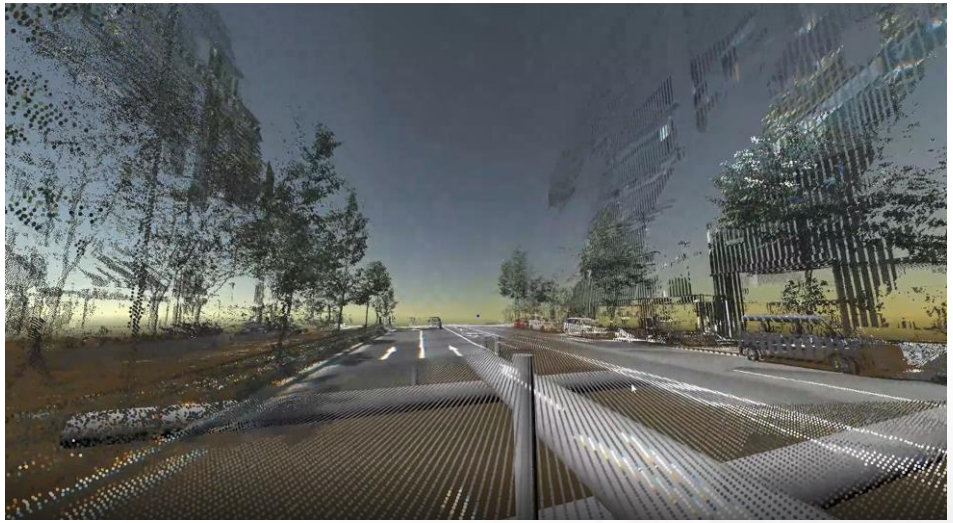
For automatic driving and advanced driver assistance systems for cars.



While meeting the requirements of 10 Japanese automobile manufacturers
Realization of absolute accuracy of cm class

## High-precision 3D point cloud data

Various applications such as social infrastructure development



Using the most advanced and sophisticated "measurement technology" in Japan
Measurement with mobile mapping system

# Role of HD Maps in Autonomous Driving and ADAS

**The HD map is closely related to the recognition part of automated driving technology, and optimizes vehicle control by matching information that cannot be detected by sensors with the results of sensor detection to increase the accuracy of the information.**

## Elements of Autonomous Driving System

**Recognition**

Identify vehicle situation through
a) Localizing vehicle position +
b) Detecting and recognizing surrounding objects

**Judgement**

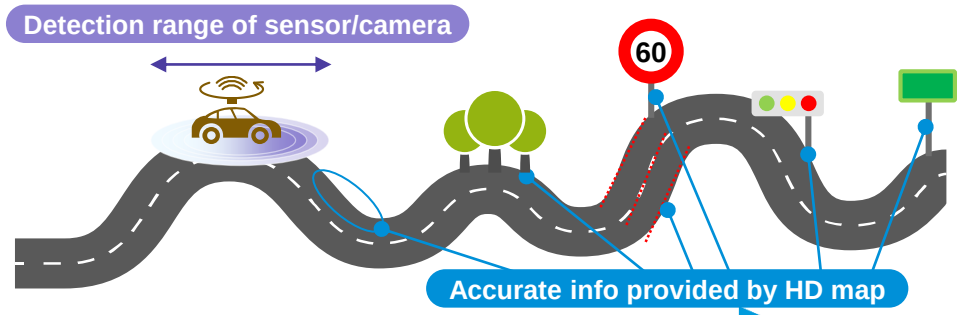
Draw up driving plans based on what vehicle recognized in the recognition phase

**Control & Operation**

Accurately control the vehicle as determined in the judgement phase

## How HD Map Supports "Recognition"

**Detection of surroundings** by sensor / camera + **HD accurate knowledge of nearby/distant road** provided by HD maps




## Navigation Map is not Sufficient Technology for AD

| | HD Maps | Navigation Maps (SD Map [1]) |
|---|---|---|
| Objectives | Vehicle Control | Navigation |
| Dimensions | HD | 2D |
| Information | Lane-by-Lane | Only road /No Lane-by-Lane info |
| Accuracy | Single-digit centimeters | Single-digit meters |

**Notes:**
1. SD map: standard map

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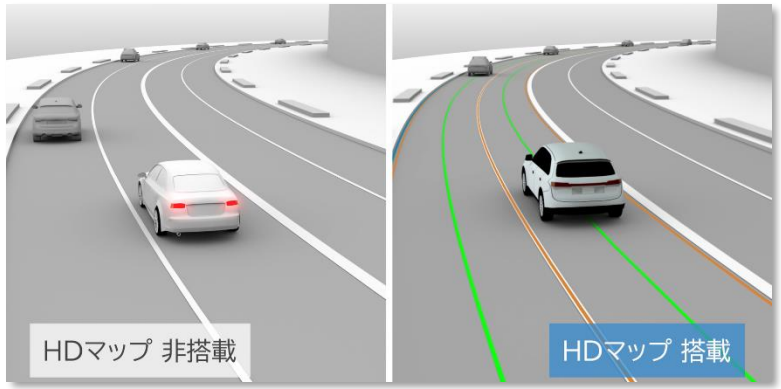
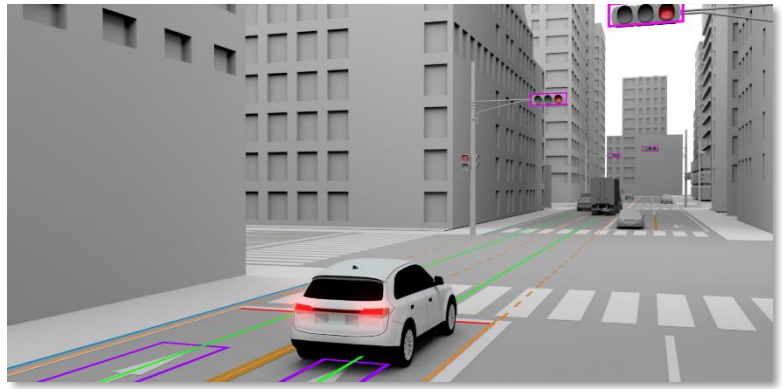
# Assumed Use Cases for HD Maps



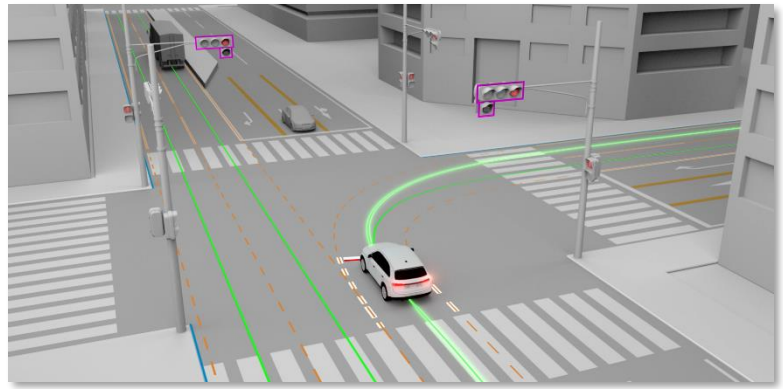

#01. Entering curves

Anticipate the path and enter the curve stably



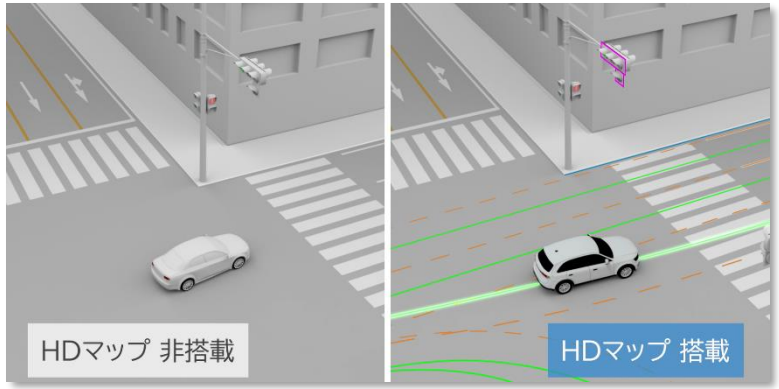
#02. Stop decision

Properly understand traffic light information to make a decision to stop



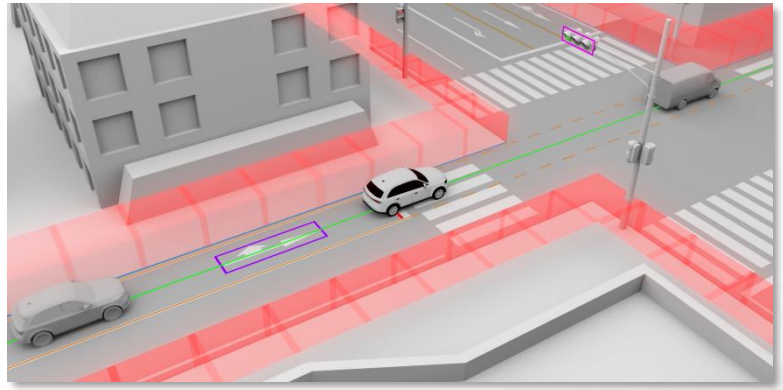
#03. Right turn at intersection

Can determine necessary information and make a right turn safely



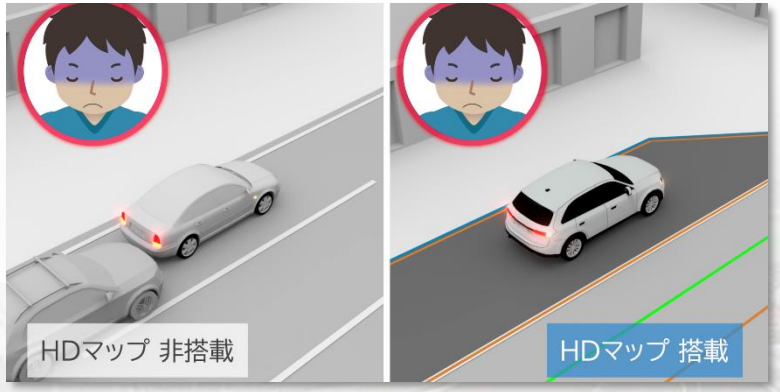

#04. Selection of travel lane

Can respond in advance to sudden road changes



#05. Recognition of areas where driving is not allowed

Prevent traffic accidents by always knowing where no-driving zones are




#06. Automatic stop in case of emergency

Automatic stop at a safe position in case of emergency

# Our HD map mounted results

**The system has been installed in mass-produced vehicles of Toyota Motor Corporation, Nissan Motor Co. and Honda Motor Co. in Japan, and GM and EV startup in the U.S. In the future, we will promote further OEM and installation of the system in new models.**

## Nissan

**Skyline**
2019/2020 models

**Ariya**
2021 model

## Honda

**Legend** Hybrid
EX 2021 model

## TOYOTA

**Lexus** LS & **MIRAI**
2021 model

## US EV Startup

## GM

**Cadillac**
CT6-2017 model

**Cadillac**
CT4-2021 model
**Cadillac**
CT5-2021 model

**Cadillac**
XT6-2021 model

**Cadillac**
Escalade
2021 model

**GMC Hummer**
EV Pickup
2022 model

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# Future data development policy

In addition to continuing the maintenance of the already maintained HD map (Gen1), the next generation HD map (Gen2), which extends coverage to general roads, will be introduced to enable the use of advanced ADAS systems in daily life.
Aiming to realize a safe, secure, and comfortable motorized society on more roads, in more countries, and with more vehicles.

**Expanded coverage (Surface road)**

Extending advanced technology to familiar paths

**Cost performance improvement**

Bringing the future to every vehicles

**Global formatting**

Crossing Borders
Synchronize evolution

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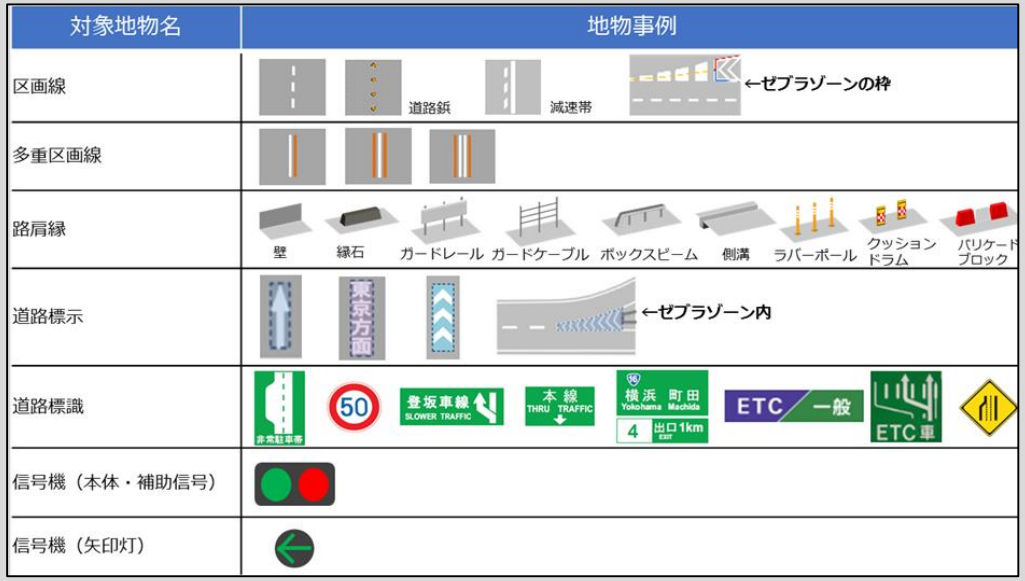
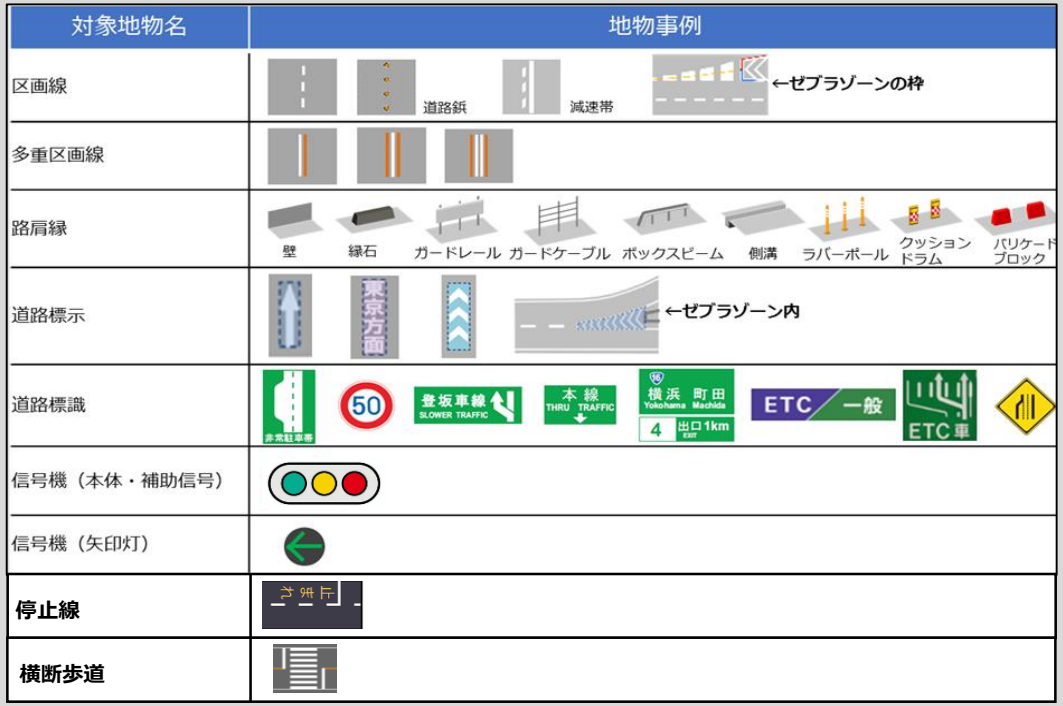
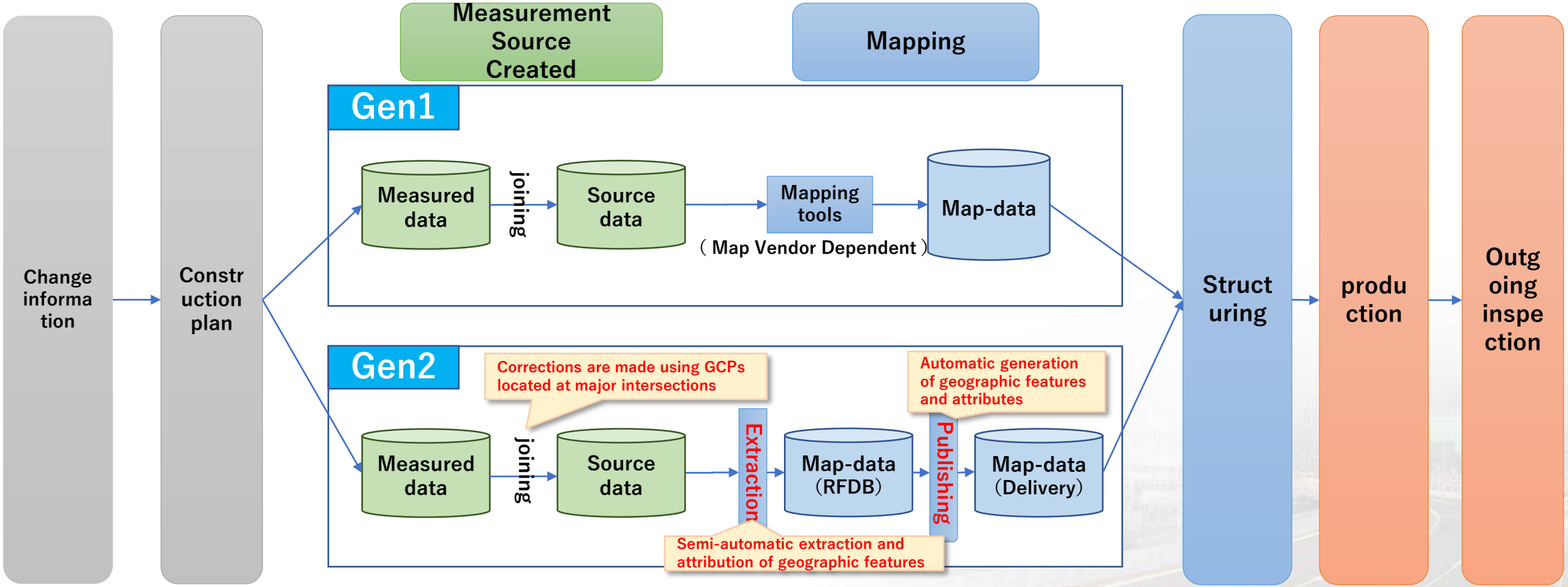
# Gen1/Gen2 Comparison (Overview)

**In Gen2, the contents maintained in Gen1 are added to those required for general roads, and a global common format is adopted, contributing to the global common development of automobile manufacturers.**

| | Gen1 | Gen2 |
|---|---|---|
| Target Area | Japan | Global |
| Coverage | Highway | Highway/Surface road |
| Format | Japanese original | Global Common |
| Contents |  |  |

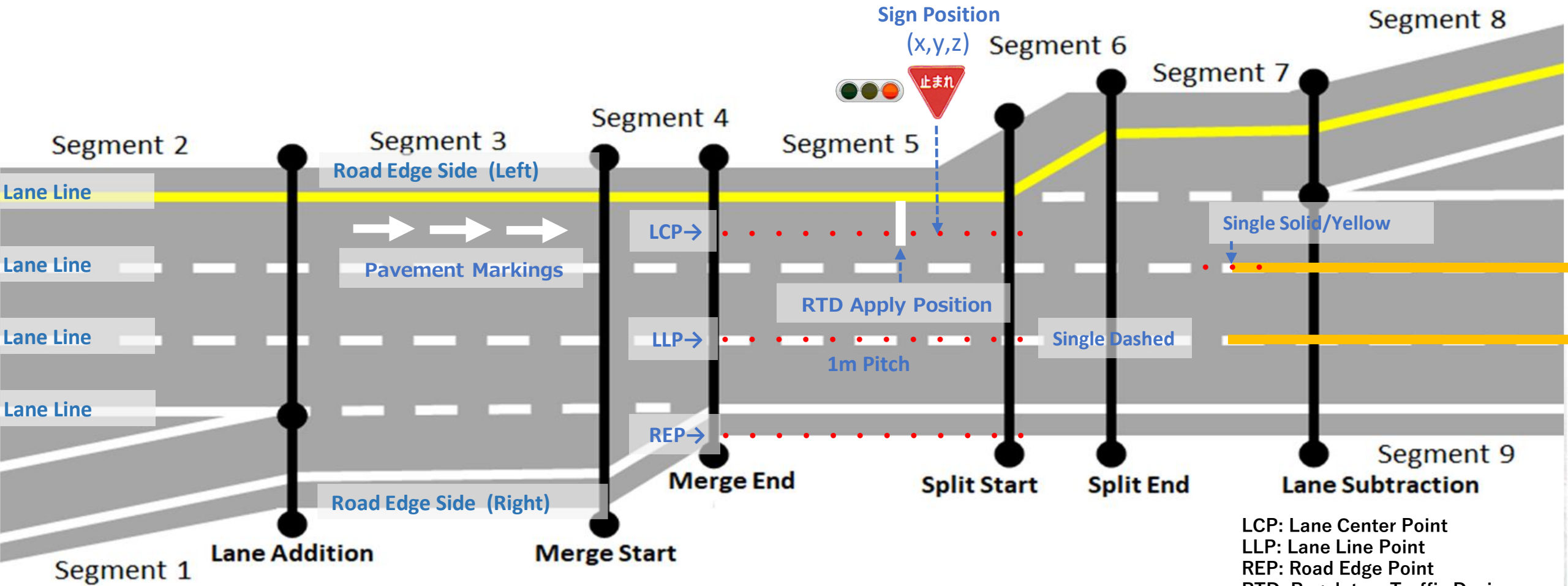
# Gen1/Gen2 comparison (process)

**Gen2 improves accuracy through "GCP correction" and "cost reduction through automation" to achieve a process that enables a wide range of HD map installations from luxury to mass-market vehicles.**



# Overview of Gen.2 data specifications

**Gen2 adopts road segmentation, which divides data by road structure, whereas Gen1 managed data by mesh data management units are minimized to improve flexibility when updating and converting data.**

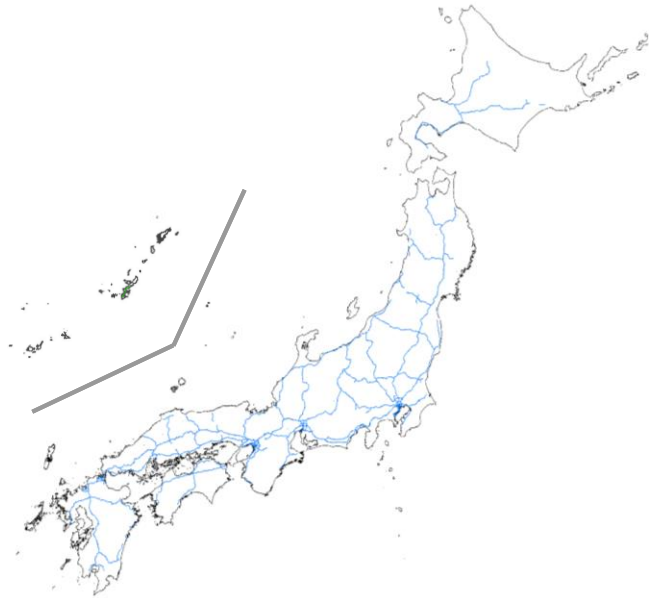



LCP: Lane Center Point
LLP: Lane Line Point
REP: Road Edge Point
RTD: Regulatory Traffic Device

# Data Expansion Plan (Japan)

**Executing general road maintenance in time for vehicle development in preparation for model change in FY2024 and beyond.**

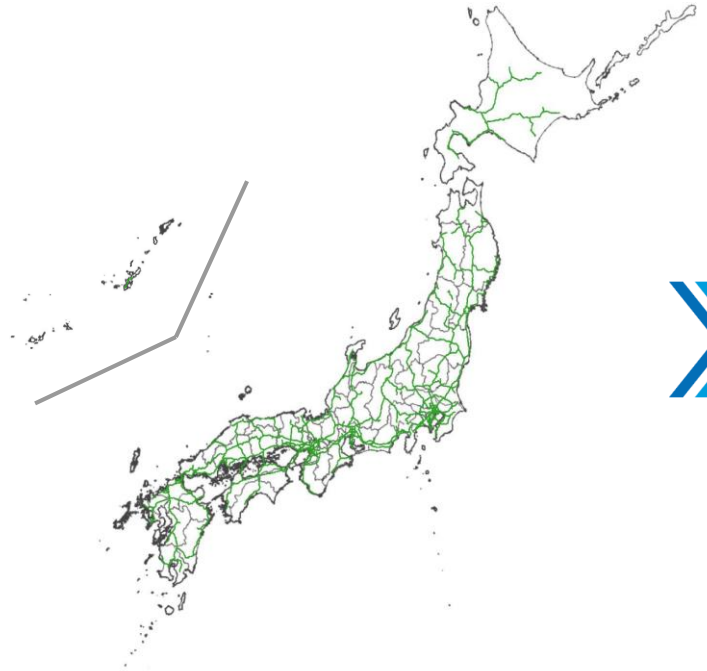
## FY2021



Highway(Gen1)

約32,000km

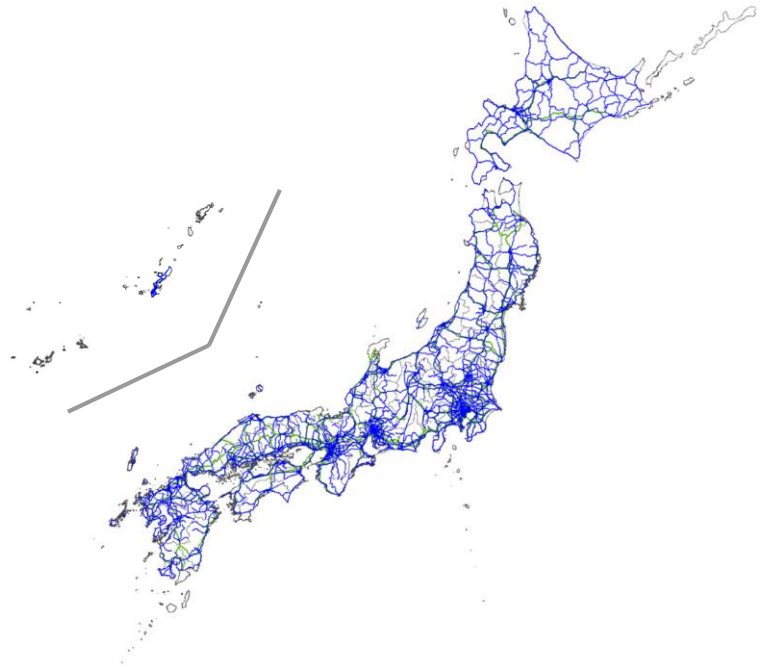
## FY2023



Highway(Gen1/2)・National roads(Gen2)

約80,000km

## FY2024～



Highway(Gen1/2)・Surface roads(Gen2)

約130,000km

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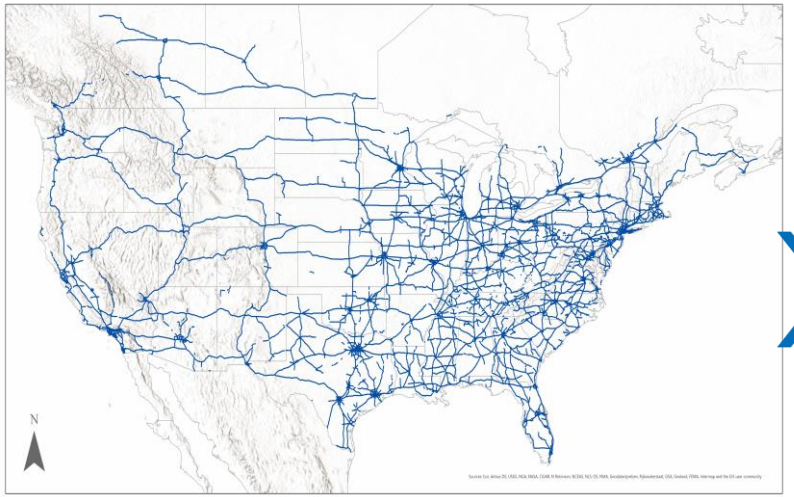
※ Images are for illustrative purposes only. The distances shown are the length of the upper and lower lines. The routes and distances are subject to change.

# Data Expansion Plan (North America)

## Expansion of maintenance roads to 400,000 miles for GM's Super Cruse

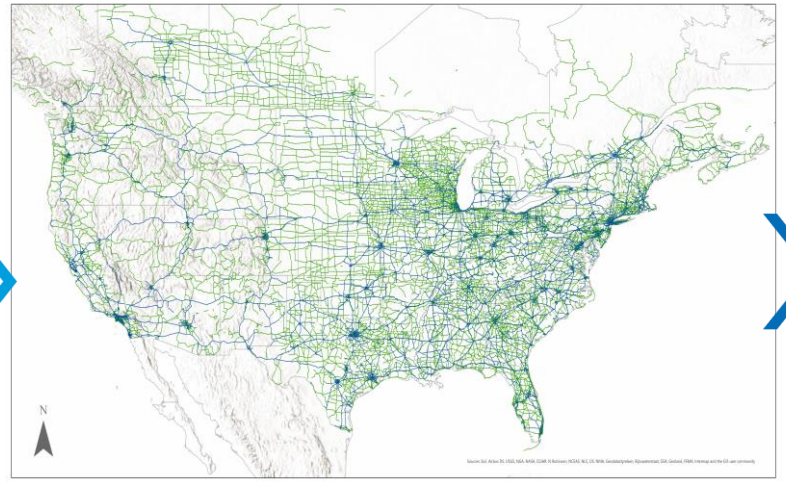
### FY2021



Motorway/Trunk

約200,000miles

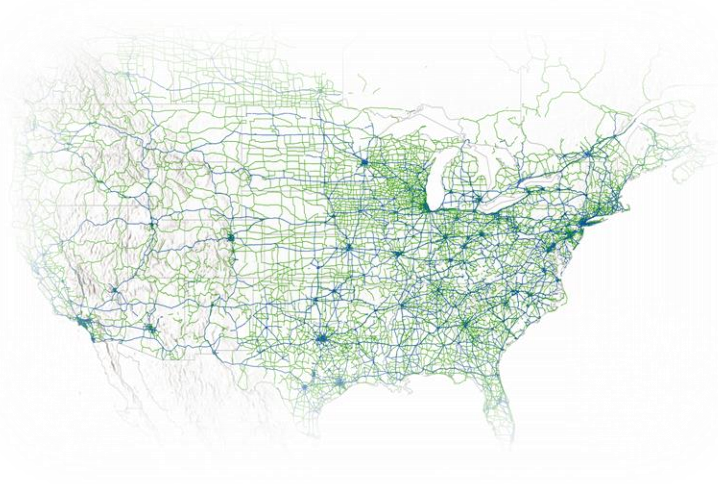
### FY2022



Motorway/Trunk/Primary

約400,000miles

### FY2025～



Motorway/Trunk/Primary and more

TBDmiles

Lane Geometry、 Road Edges、 Cross Slope & Along Slope、 Pavement Markings、 Implied Lane Line、 Smoothed Lane Centerlines
Lane Class (Toll, HOV, etc.)、 Intersections, Crossings、 Regulatory Traffic Devices、 Signs

※ Images are for illustrative purposes only. The distances shown are the length of the upper and lower lines. The routes and distances are subject to change.

# Versatile Business

**Expanding the use of high-precision 3D positional information in various industrial fields, as it is expected to be used in a variety of markets other than the automotive industry, and the market is expected to grow rapidly.**

# Initiatives for Versatile Business

## Business development through various partnering options

東京都

**Tokyo 5G**

- Promotion of AD/ADAS system within 5G network

飯山市 IIYAMA CITY

**Snow Removal**

- Creation of a system to support snow removal

三重県 Mie Prefectural Government

**Mie initiative demonstration support project**

- Provision of high-precision airspace map for accurate drone flight

NEDO 国立研究開発法人 新エネルギー・産業技術総合開発機構

**Green Innovation**

- Business Development regarding smart mobility society

内閣府 Cabinet Office

**SIP (1)**

- Development of infrastructure platform for mobility

NEXCO 東日本 NEXCO 中日本

**Road Management**

- Provision of HD map for highway management including advanced maintenance and traffic information

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Weather Data

Traffic Data

HD Map

Digital agency

Spatial ID

Probe Data

etc…

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# Green Innovation Project

**Linkage of HD maps and dynamic information contributes to highly accurate simulation models for CO2 reduction of logistics vehicles**

## Measurement

**Measure up to the narrow streets in the demonstration area**

規制情報画像・渋滞情報画像　出典：中日本高速道路株式会社（https://www.c-nexco.co.jp/construction/）

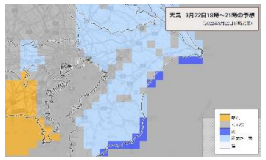
## Data fusion

Quasi-static and Quasi-dynamic information

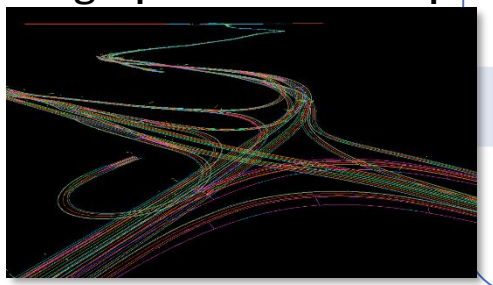
**Regulatory**

**Traffic**

**Weather**



**High-precision 3D maps**



**Data conversion**

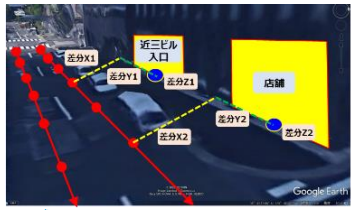
**Database**

**Data conversion**

**Establishment of data linkage specifications**

Static information

**POI**




**Height Limit**

**Slope**

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## Dynamic maps

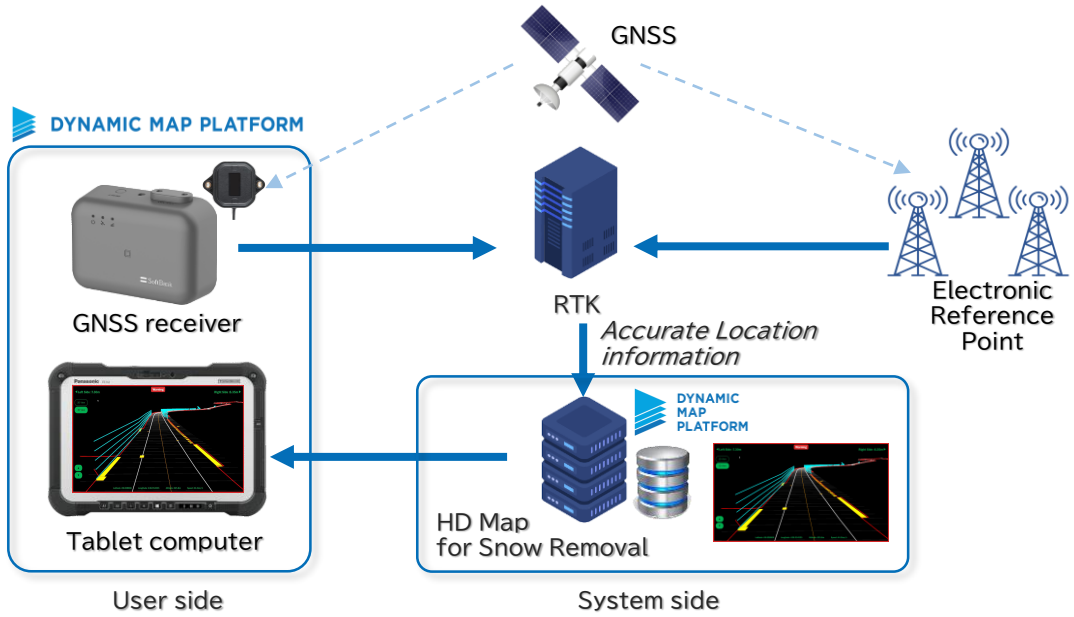
# Snow removal support

**High-precision map information visualizes road conditions under snow-covered roads and contributes to solving the problem of aging and shortage of snow removal workers.**

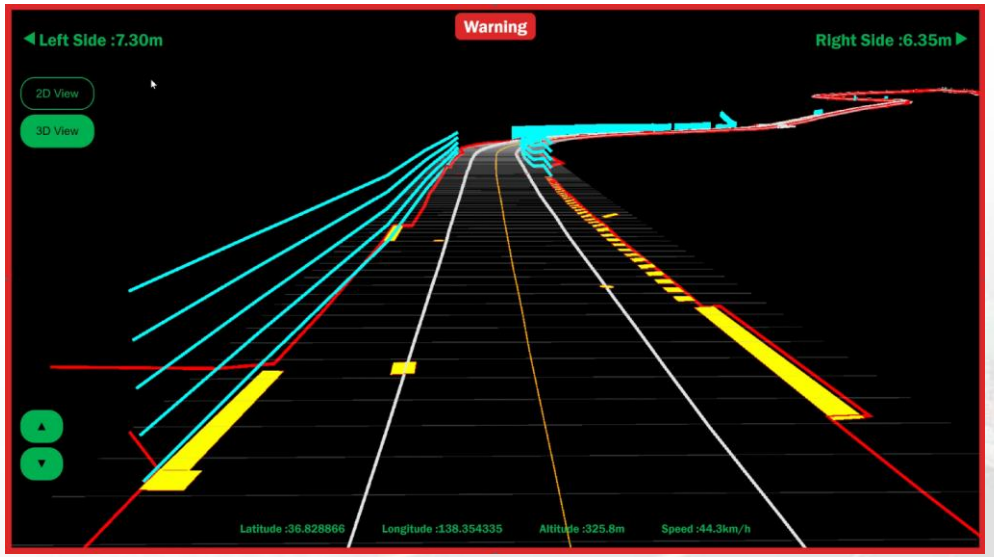
Snow removal activities to maintain lifelines in heavy snowfall areas, which account for approximately 50% of Japan's land area, rely on the experience and knowledge of workers to locate road structures (manhole covers, grating, bridge joints, shoulder edges, gutters, etc.) that are invisible due to snow.

To solve problems such as aging workers, road structures can be "visualized" using high-precision maps, contributing to safe snow removal activities that do not rely on knowledge and experience.

## ＜ System Conceptual Diagram ＞




## ＜ Screen image ＞

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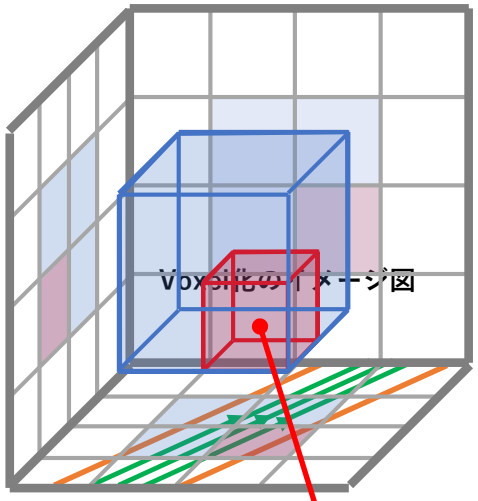
# Development of "Spatial ID”

## Developing a spatial ID architecture that integrates various types of information for the infrastructure of a "metaverse" synchronized with reality

Participating in a survey on 3D spatial information required for the construction of the digital twin promoted by the Digital Agency, as well as in the study of specifications and development of maintenance methods for the infrastructure system for the demonstration, and in the study of concrete use cases through the demonstration.

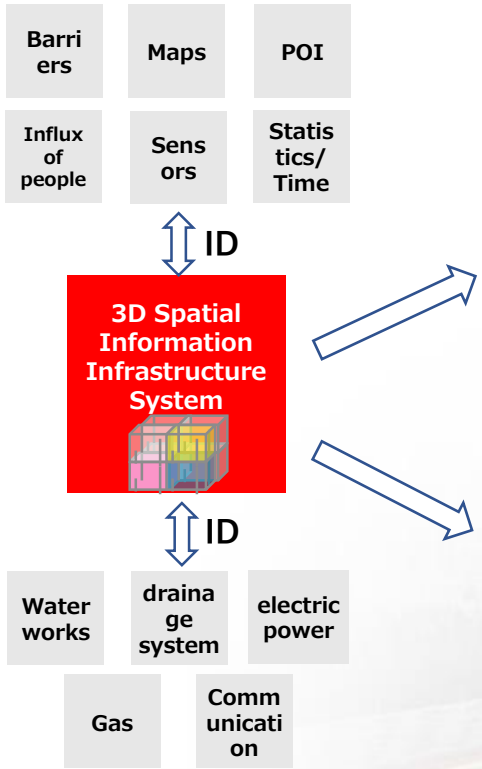
### Spatial ID



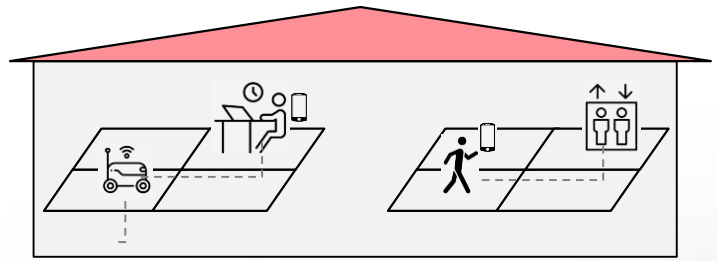

出所:
経済産業省:「Society 5.0 for SDGs国際展開のためのデジタル共創」, 2021年5月29日
内閣官房:「成長戦略フォローアップ案」, 2021年6月2日

Set a unique reference point (spatial ID) to spatial voxels in which 3D space is divided according to specifications that can be read by humans and autonomous mobility, and attach static and dynamic information to the voxels.

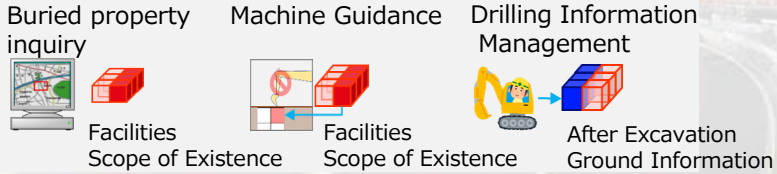
### Examples of use case demonstrations using spatial ID




**Indoor Space Navigation**



**Buried object inquiry and construction machine guidance**

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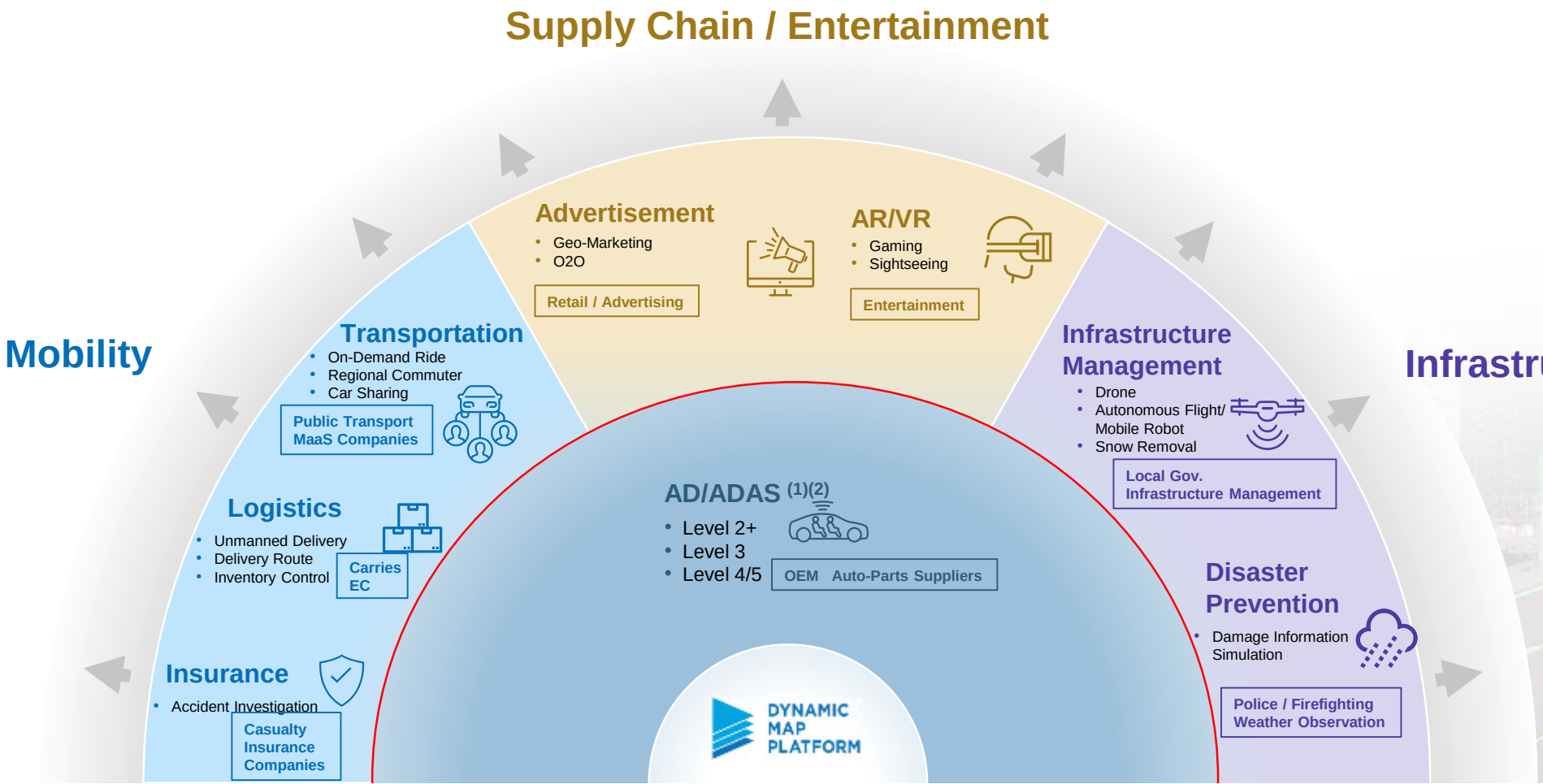
# Future Business Expansion

**In addition to the AD/ADAS market, which is expected to grow further, we will also target the mobility, supply chain/entertainment, and infrastructure management markets.**



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Modeling the Earth