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Using the New Integrated Traffic-Accident and Road Database

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1. Introduction

The ‘Integrated Traffic-Accident and Road Database’ — which combines traffic-accident statistical data with road and traffic data — has long been used to streamline the identification of locations on national and prefectural roads where the road or traffic environment requires the implementation of traffic-safety measures. However, it is difficult to say whether locations requiring traffic-safety measures on municipal roads and similar routes are being sufficiently identified using accident data.

In this paper, we present an overview of the Integrated Traffic-Accident and Road Database for general roads, which was newly developed by ITARDA in 2024, and show how it can be used to identify locations on municipal roads that require traffic-safety measures.

2. What is the Integrated Traffic-Accident and Road Database?

The Integrated Traffic-Accident and Road Database (hereinafter, ‘Integrated Road Database’) combines traffic-accident statistical data with road and traffic data, was developed by the Institute for Traffic Accident Research and Data Analysis (ITARDA), and is

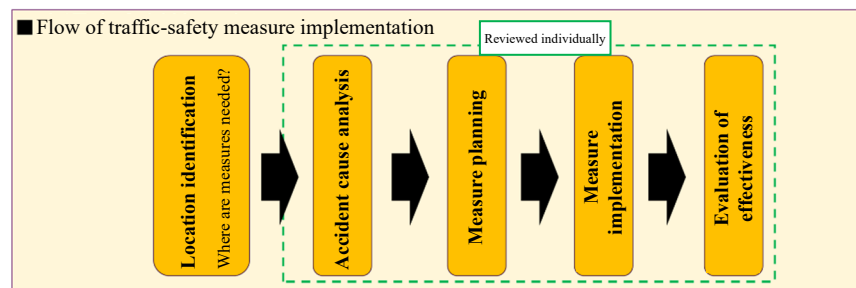


Figure 1. Basic flow of traffic-safety measure implementation

provided to road managers for use in performing traffic-safety work. The database enables analysis of relationships between conditions under which traffic accidents occur and road and traffic conditions. In particular, it is expected to help in ‘location identification’, which is the process for identifying locations in the Traffic-Safety Measure Implementation Flow (Figure 1). It also includes multi-year traffic-accident occurrence data that can be used to evaluate the effectiveness of traffic-safety measures implemented at individual locations.

3. Overview of the New Integrated Road Database

Figure 2 shows the data structure of the new integrated road database.

Because location identification on municipal roads has been insufficient, it was considered advisable to identify locations in line with the traffic-safety countermeasure methods to be implemented. To support this, ITARDA has newly prepared area-based data that include accidents on municipal roads, as well as ITARDA’s accident-cluster intersection data.

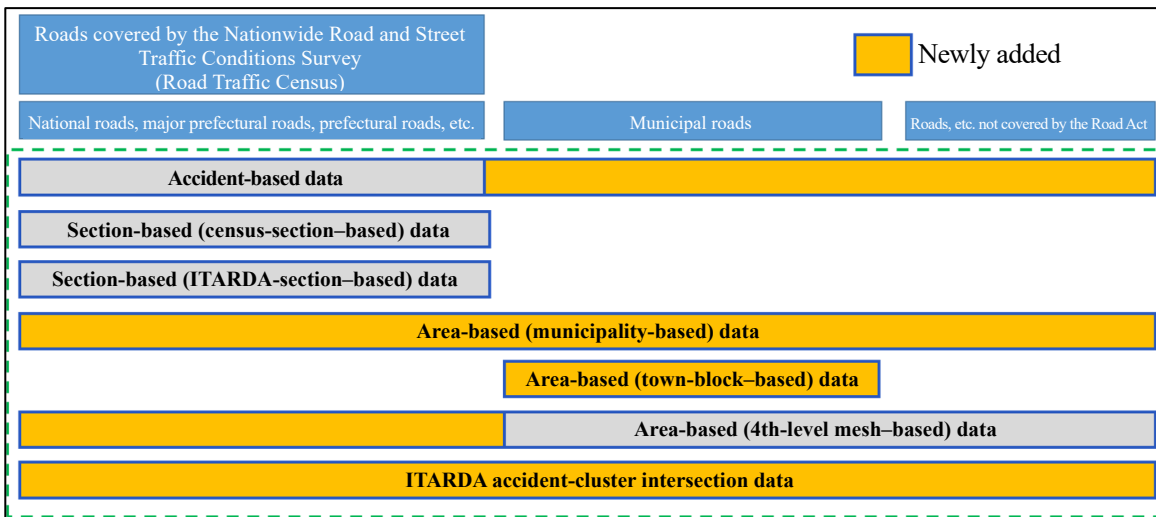


Figure 2. Data structure in a new integrated road database

4. Using the New Integrated Road Database

In this paper, municipal roads with a road width of less than 5.5 m are classified as ‘local roads’, while those with a road width of 5.5 m or greater are classified as ‘municipal roads with two or more lanes’. ITARDA’s location-identification method using the Integrated Road Database is outlined for each of these road categories.

4-1. Use for local roads in urban residential areas

Local roads in urban residential areas see relatively high volumes of pedestrian and bicycle traffic, and improvements to the traffic environment are made to ensure the safety of those traffic participants. In response to these conditions, area-wide traffic-safety measures such as zoning measures^a have been implemented in recent years.

(1) **Data used:** Area-based (town-block-based) data

This data is organized by town blocks, which are units that further subdivide municipalities, and includes information such as accident occurrence conditions, population, and area.

(2) **Prior studies**

Kojima (2024) reported a location-identification method that uses the number of accidents per unit area for each town block at the 27th Presentation Session for Traffic Accident Investigations, Analysis, and Research. The main issues with this location-identification method, which uses the number of accidents per unit area as the identification indicator, are as follows.

- i. Even within the same prefecture, there is a tendency for areas with many mid-rise or higher residential buildings to be identified more easily.
- ii. There are large differences between prefectures, and areas with more advanced urbanization tend to be identified more easily.

^a Measures implemented to ensure the safety of an entire area and targeting areas surrounded by roads with two or more lanes, rivers, railways, etc. Within the zone, a maximum speed of 30 km/h is set, and physical devices such as speed bumps and road narrowings are combined as necessary. Such zones are designed to make drivers aware of differences in traffic and roadside environments both inside and outside the zone in order to alert them, reduce driving speeds, and minimize through traffic.

(3) Location-identification method

The ‘number of accidents per unit population’ is used here as the identification indicator in response to issue ‘i’ in (2) and the concept that ‘the occurrence of traffic accidents is influenced by the volume of automobile traffic and the population involved’. The indicator value is calculated using the population of each town block and the number of accidents on local roads recorded in the data, and is used to perform ranking and setting of priorities. To identify locations for specific countermeasures, separate thresholds for this indicator must be examined.

(4) Additional benefits of using number of accidents per unit population for identifying locations

i. It is possible to accurately identify areas that contain large-scale facilities

When using the ‘number of accidents per unit area’ as an indicator, town blocks (Figure 3) that contain large-scale facilities where traffic accidents cannot occur (e.g., substations) tend to have relatively large total areas. This causes the indicator value to be relatively small, making such areas difficult to identify. However, because this effect does not occur when using the ‘number of accidents per unit population’ as the indicator, areas with large facilities can be accurately identified.

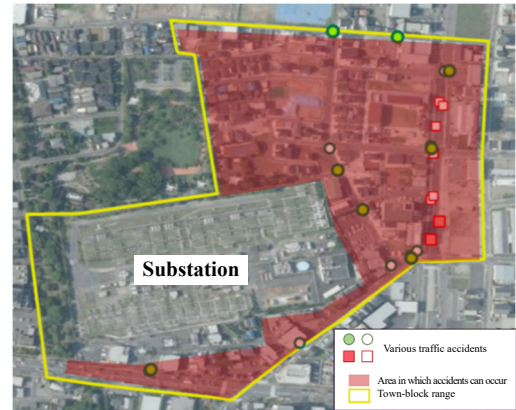


Figure 3. Town block with a large-scale facility

ii. It can address the problem of areas with more advanced urbanization tending to be identified more easily

Figure 4 shows the average values of the ‘number of accidents per unit area’ and the ‘number of accidents per unit population’ by prefecture.

When using the ‘number of accidents per unit area’ as the indicator, identification tended to concentrate in areas with advanced urbanization. However, when using the ‘number of accidents per unit population’ as the indicator, it was possible to identify not only highly urbanized areas but also relatively rural areas such as Kagawa Prefecture and Tokushima Prefecture, confirming that the problem was addressed.

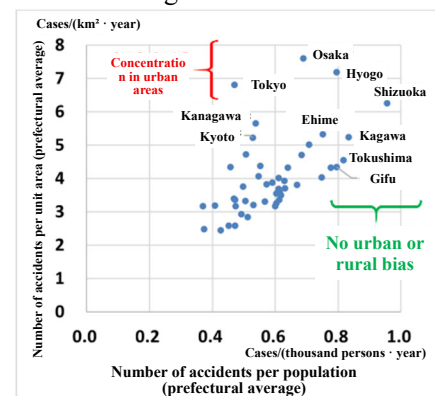


Figure 4. Prefecture-level average values for each indicator

(5) Considerations

When identifying locations using the above method, it is necessary to consider cases in which the boundaries of town blocks do not match the shape of the zoned area (i.e., areas surrounded by roads with two or more lanes, rivers, railways) (Figure 5). A possible approach that respects the identification results derived from the accident data would be setting the zoned area in accordance with the ‘targets of zoning measures’.

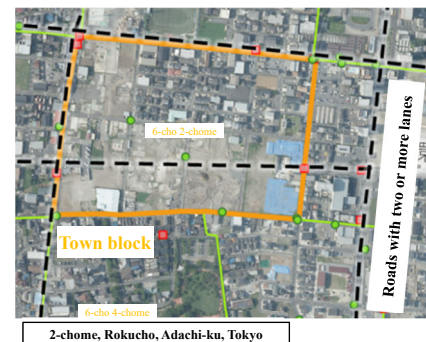


Figure 5. Town block that does not match the shape of the zoned area

4-2. Use for municipal roads with two or more lanes

Because traffic volume is relatively high on municipal roads with two or more lanes, traffic-safety measures are primarily implemented at intersections to prevent vehicle-to-vehicle accidents.

(1) Data used: ITARDA accident-cluster intersection data

This data defines intersections with an average of one or more accidents per year over the last four years as ‘ITARDA accident-cluster intersections’ and includes information such as accident-occurrence conditions for those intersections.

(2) Location-identification method

ITARDA accident-cluster intersections are selected based on accident totals, and because various types of intersections are mixed together, special consideration is required when setting priorities by comparing them directly. Therefore, these intersections are classified based on the concept that ‘the occurrence of traffic accidents is influenced by the volume of automobile traffic and the population involved’. Here, instead of traffic-volume and population data, two indicators^b considered to influence automobile traffic volume — ‘intersection road width’ and ‘urban / non-urban area’ — are used to classify intersections as shown in Figure 6. Accident counts and other factors are then compared within each classification, and priorities are set accordingly.

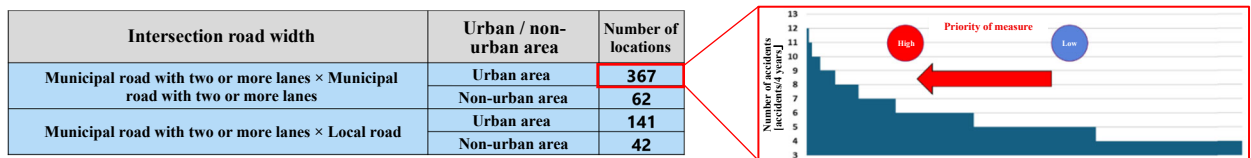


Figure 6. Priority setting (left: Intersection class, right: Priority setting for the same class)

(3) ITARDA Accident-Cluster Intersections

Shown below are examples of ITARDA accident-cluster intersections.

i. Municipal road with two or more lanes × Municipal road with two or more lanes (Non-urban area)

This four-way, unsignalized intersection has seen frequent crossing collisions between automobiles in the last four years (2020-2023: 13 out of 15 crossing collisions). However, as of October 2023, few measures other than stop signs have been implemented (Figure 7).



Figure 7. ITARDA accident-cluster intersection (Example 1)

At unsignalized intersections in non-urban areas where crossing collisions frequently occur, one possible measure is the installation of a roundabout, etc. Using ITARDA accident-cluster intersection data, it was confirmed that intersections with the

^b The ‘intersection road width’ is included in the information recorded in the ITARDA accident-cluster intersection data. Urban and non-urban areas are determined using a Geographic Information System (GIS), with intersections located within a Densely Inhabited District (DID) classified as being in an urban area, and those outside classified as being in a non-urban area.

potential for such measures had been selected.

ii. Municipal road with two or more lanes × Municipal road with two or more lanes (Urban area)

This three-way, unsignalized intersection near a train station sees relatively high volumes of pedestrian and bicycle traffic, and has been the site of many crossing collisions involving bicycles (2020–2023: 5 out of 11 crossing collisions) (Figure 8). When intersections are identified as having high numbers of bicycle accidents, such as in the case of this intersection, measures should include not only traffic-safety measures aimed at improving the road environment but also those designed to enhance safe bicycle use.

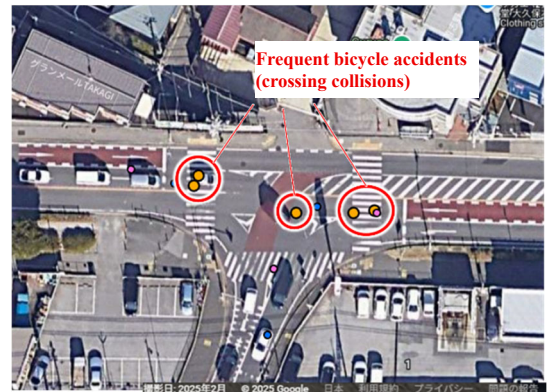


Figure 8. ITARDA accident-cluster intersection (Example 2)

5. Summary

In this paper, we presented an overview of the new Integrated Road Database and how ITARDA envisions its use. For each of the two road types — ‘local roads in urban residential areas’ and ‘municipal roads with two or more lanes’ — we presented the relationship with traffic-safety countermeasure methods, location-identification methods using the Integrated Road Database, and related findings.

We strongly hope that the new Integrated Road Database introduced in this paper can be used to reduce traffic accidents by enabling effective location identification and the implementation of appropriate traffic-safety measures.

[References/Sources]

- (1) Shumpei Kojima, 2024, Study on Methods for Identifying Accident-Prone Areas with an Urgent Need for Zoning Measures on Residential Roads, 27th Presentation Session for Traffic Accident Investigations, Analysis, and Research

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