
A study on the practical deployment and promotion of safe and ecological roundabouts

1. Background and goals

Countless accidents involving head-on collisions and vehicles turning against traffic occur at road intersections, regardless of whether traffic signals are in place. Even when installed as a safety measure, traffic signals do not always prevent accidents from occurring when the signals change or when drivers ignore them. Therefore, in some cases, signalization does not provide a fundamental solution to the problem. When installed at intersections with low traffic volume, traffic signals can even cause problems such as delays and increased environmental load. To search for solutions to these issues, the current project aims toward the practical deployment of modern roundabouts in Japan. As part of these efforts, the H188 Project was launched in 2009, with the following goals.

- 1) To conduct field operational tests in cooperation with government organizations, thereby collecting a variety of empirical data associated with introducing roundabouts to Japan and preparing an environment for their full-scale introduction.
- 2) To collect data on user behavior before and after the introduction of roundabouts at intersections, thereby accumulating empirical data for the advancement of technical findings related to the planning and design of roundabouts in Japan. Furthermore, to conduct quantitative evaluation of the effects of roundabouts by comparison of data before and after their introduction.
- 3) To perform ongoing promotional activities such as workshops and seminars for the implementation of roundabouts.
- 4) To propose specific plans, designs and technologies related to roundabouts, and to participate in technical planning of field operational tests. Through this, to accumulate and summarize experience with cases of roundabout conversion.

2. Research content

2-1. Analysis of user behavior through a mock roundabout on testing grounds

In the H188 Project of 2009, a mock modern roundabout was established at the Tomakomai Test Track of the Civil Engineering Research Institute for Cold Region, and technical empirical data were collected on user behavior related to designs and operational methods such as structural geometries, road signs, and markings. These data were then used to perform analysis of safety and efficiency, enabling the

acquisition of structural and operational knowledge.

2-2. Field operational road test at a roundabout in Azuma-cho, Iida City

In the H2292 project, the project team cooperated with Iida City in Nagano Prefecture and installed road markings and various safety devices in an existing rotary intersection in the Azuma-cho district, without changing the intersection's physical structure. Over the 42 days between November 1 and December 12, 2010, a field operational test was performed to verify the effects of structural improvements to an actual roundabout incorporating the latest design ideas (Fig. 1). There was a high degree of support from local authorities and residents regarding the structure and operation of the modern roundabout developed on the basis of the most recent technical knowledge. This furthermore allowed for verification of the safety and traffic-smoothing features of modern roundabouts on actual Japanese roads.



Figure 1. The roundabout on which field operational tests were performed in 2010; Azuma-cho, Iida City, Nagano Prefecture

2-3. Field operational test of a pedestrian detection system implementing light-emitting road studs in Azuma-cho

Because the 2010 field operational test was evaluated highly, Iida City decided not to revert the roundabout to its previous layout for the next year, and the roundabout was left in generally the same condition as in the field operational test. In 2011, various improvements to the intersection were made, such

as modifying the location of crosswalks and installing structures at corners where semi-permanent road cones had been previously installed during the field operational test. Immediate relocation of some crosswalks was difficult for a variety of reasons, and as a result in some locations the distance between the circulatory roadway and crosswalks increased. For these locations in particular there were concerns about pedestrian safety. Therefore, with the cooperation of Iida City and the ITS Laboratory at the National Institute for Land and Infrastructure Management, the H2303 project was conducted. In this project, a system of light-emitting road studs was installed at the crosswalks of roundabout entries/exits for pedestrian detection in Azuma-cho, and an experiment was performed to verify the system's safety and functionality. The results confirmed that there was improved pedestrian safety during road crossing, and the system received many positive evaluations from users.

2-4. Japan's first conversion of a signalized intersection to a modern roundabout in Towa-cho, Iida City

As a result of the various field operational tests regarding the proposals and verifications performed in "A study on the practical deployment and promotion of safe and ecological roundabouts (H188/H2292/H2303)," conducted between 2009 and 2011 in cooperation with related government agencies and local residents, in 2012 a signalized intersection in the Towa-cho district in Iida City was converted to a modern roundabout (Fig. 2). This was a groundbreaking initiative that marked the first time that traffic signals had been removed and an intersection converted into a roundabout in Japan, making it an extremely valuable case study. In the H2420 project "A study on social implementation and promotion of roundabouts," which started in 2012, a technical investigation of this conversion was performed, and data from before the conversion were collected. Furthermore, methods were investigated for converting intersections into roundabouts while still allowing traffic in operation, and experiences during the construction and operation were recorded. On March 24, 2013, a modern roundabout that incorporated the latest technologies investigated and proposed by this project was finally opened in Towa-cho. The

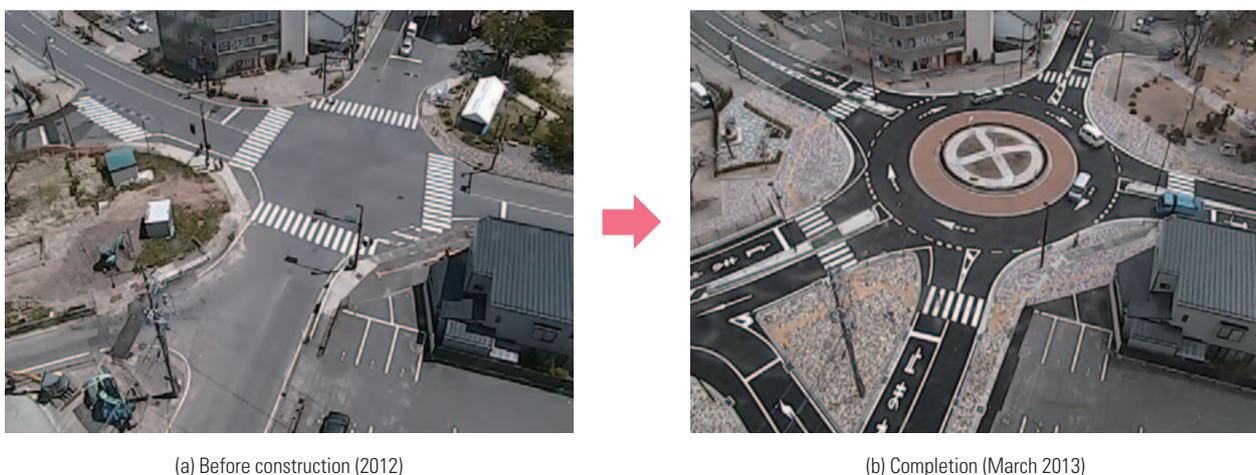


Figure 2. Conversion of a signalized intersection to a modern roundabout; Towa-cho, Iida City, Nagano Prefecture
(Photo by Iida Cable Television)

roundabout featured a central island with a stepped apron construction, splitter islands at entries/exits, and a two-stage crosswalk, all Japan firsts.

2-5. Pre- and post-conversion comparison of the roundabout in Towa-cho

In the H2534 project, user behavior was compared before and after the conversion of the Towa-cho intersection to a modern roundabout. The results confirmed significant reductions in average vehicle delays and average pedestrian travel times following the conversion to a roundabout. When the intersection was signalized, intersection entry speeds and vehicle pass-through speeds were high and varied greatly, but following the conversion to a roundabout, entry speeds were verified to be lower and more stable. A much lower level of danger was verified for collisions between vehicles, especially those turning against traffic.

2-6. Roundabout planning, technical proposals for field operational tests, and roundabout promotion

Since its start, this project has continued to work toward the planning and design of roundabout conversions throughout Japan, as well as toward proposals, support, and promotion for further field operational tests. In the process, the project has attempted to grasp both citizens' needs and practical business needs, and as a result was selected by the Ministry of Land, Infrastructure, Transport and Tourism to perform further operational tests in Karuizawa-cho in Nagano Prefecture, Yaizu City in Shizuoka Prefecture, and Moriyama City in Shiga Prefecture. Roundabout conversions were successfully implemented through these operational tests and large effects were verified. During the fiscal year ending in March 2015, additional roundabouts will be implemented at unsignalized intersections in the cities of Suzaka and Azumino in Nagano Prefecture. We have continued to conduct seminars throughout Japan to deepen understanding of roundabouts, and in particular drew many attendees and much attention to our "Roundabout Summit" at Iida City in January, 2014. At that summit, formation of a "Roundabout Promotion Council" was declared, comprising the heads of seven regional governments.

3. Conclusions

While at first it took a long time to obtain understanding of roundabouts in Japan, the present research and activities have helped widely position roundabouts as a vital part of safe city planning among government agencies, engineers, and area residents. This has led to serious consideration of the introduction of roundabouts throughout the country, and with the amendments to the Road Traffic Law in June 2013, there has been no small amount of attention brought to the national level. In the future it will be necessary to continue on with these efforts to promote the dissemination of appropriate technologies and to continue the collection and analysis of data related to the currently ongoing cases.