Summary of SIP-adus Project (FY2016)

Name of the project	Research on the speediness and the safety of the Advanced Rapid Transit
Responsible Organization	Pacific Consultants Co., Ltd.

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Object of the Project

The basic requirements of an on-board bus unit and the system configuration of PTPS using 700MHz band vehicle-to-infrastructure communication to improve its efficiency (Advanced PTPS) have been studied under SIP-adus.
Based on the requirements of an on-board equipment for PTPS clarified last fiscal year, this research evaluated the prioritization methods for ART vehicles coming to the same intersection and their influence using a traffic simulation. This research also developed trial design of the PTPS on-board equipment assuming that it would be used for the demonstration experiments from next fiscal year onwards. Furthermore, a study on application of the system to other cities across the country was conducted.

Project Summary

【Study contents in FY 2015】
(1) Simulation evaluation of ART prioritization methods and their influence
(2) Simulation evaluation and feasibility study of the effects of combination of the ART priority control method with advanced PTPS, road structures and regional regulations
(3) Trial design of on-board equipment for ART
(4) Research for market introduction of ART

【Results】
・When two or more ART vehicles approach an intersection, an ART vehicle to travel preferentially is selected and granted priority over other ART vehicles. This prioritization is realized with the additional function of PTPS on-board equipment that enables the vehicle to judge the priority level of itself and to discriminate between priority request yes and no states.
・The PTPS on-board equipment compares the index of the vehicle (e.g., derived from the delay from schedule diagram of the vehicle, and/or ridership) against thresholds specified for enabling/disabling a priority request. Only if priority request is judged to be enabled, the equipment sets priority request to “yes” and uplinks the request to the PTPS roadside equipment. This threshold can be either static (the value preset in the on-board equipment) or dynamic. In the case of dynamic thresholding, the ART information center (also studied in SIP-adus) joins the process, so that the threshold is changed dynamically based on the status of multiple ART vehicles running in the specific area.
⇒Under the conditions set for the simulation, the average travel time of ART vehicles has been verified to be shortened with the introduction of advanced PTPS. It has also been indicated that the average delay time and maximum delay time may be reduced when priority is granted as compared with when it is not granted. As for methods of granting priority, the variation of delay time during simulation cases is shown to be smaller with dynamic thresholding (where priority request is judged in conjunction with the ART information center) than with static thresholding (where priority request is judged by on-board equipment alone).
・A trial design of hardware and software of the PTPS on-board equipment including the function of priority judgement has been developed.
・To explore the feasibility of applying ART to various cities across Japan, we carried out simulation evaluations for implementing advanced PTPS under different conditions including use of ART dedicated lane and the various positions of the dedicated lane (both sides or center of the road) under various road conditions and regulations.
⇒On roads with four or more lanes, combined implementation of ART dedicated lane and advanced PTPS leads to the high speediness and punctuality of ART. Therefore, it is desirable to explore implementation in this combination, while considering also the impacts on general vehicles and measures to deal with rat-running roads.
・As a research toward introducing ART to market, we conducted interviews with related organizations (municipalities, bus companies, etc.).

Future plan

・Fabrication of the on-board equipment and conduct of demonstration experiment on roads to verify the feasibility of the functions of the on-board equipment and the effect of its implementation.
・Study the method in terms of the content and display means from viewpoints of effectiveness and safety by conducting hearings with bus companies and experiments for providing information to a bus driver.
・As a feasibility study toward the introduction of ART to market, continuing to grasp the trends of cities, while sharing information with related organizations.
⇒Using the evaluation methodology we have built, quantifying the effects of ART implementation and proposing appropriate priority control methods in specific cities likely to introduce ART.