

Acoustic Wave Propagation Analysis for Studying Possibilities of Detecting Vehicles Outside the Field of View

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To reduce the number of serious accidents, it will be effective to detect vehicles outside the field of view by sound. Its detection ability has already been confirmed by us in experiments at several intersections. In this study, we conducted basic research on how to estimate the existence and position of vehicles outside the field of view approaching an intersection from the data measured by a microphone alone or a microphone array. As a result, the following useful results were obtained. The FDTD method was used to numerically simulate how the sound waves emitted by a vehicle outside the field of view propagate near an intersection. (Fig.1)

1. At the intersection of certain typical acoustic conditions, it was found that the sound waves emitted from a vehicle outside the field of view were incident on the microphone array in the following order in time. 1st: Sound diffracted from the corner of the intersection, 2nd: Sound reflected by the wall near the microphone array, 3rd: Sound reflected by the wall near the sound source.(Fig.2 and 3)

2. A method of calculating the position of a vehicle outside the field of view, which is a sound source, from the arrival time difference information and the geometric information of the intersection obtained by electromagnetic wave sensors.(Fig.4)

This analysis will be able to accelerate the development of a system that reduce accidents at intersections.

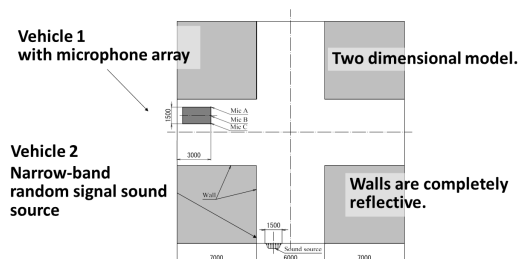


Fig.1 Geometry of an intersection model

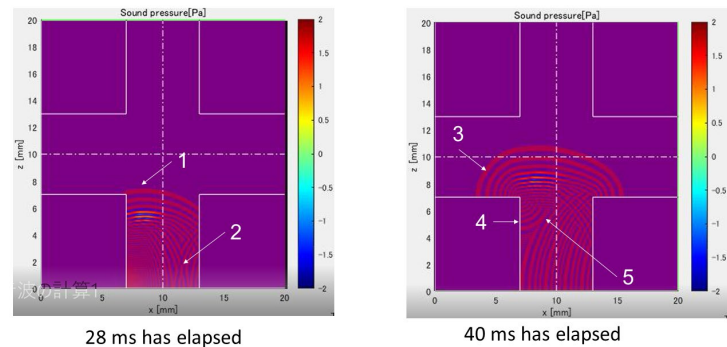


Fig.2 An example of the calculated wavefront movement

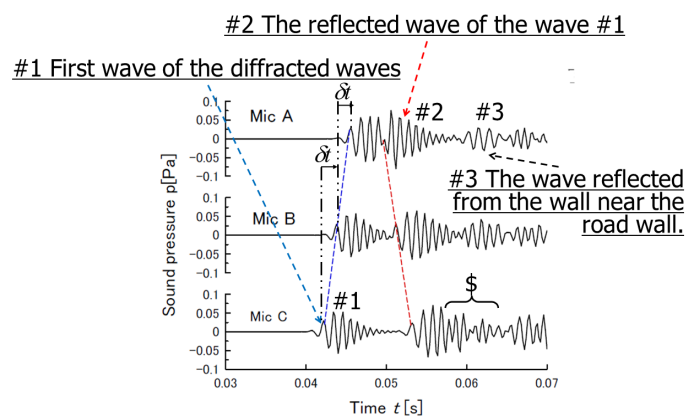


Fig.3 Calculated sound pressure waveforms at the microphone A, B and C.

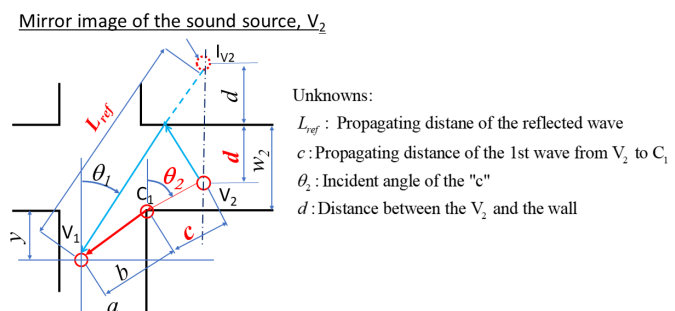


Fig. 4 Estimation of the sound source position