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Study on evaluation of road friction characteristics on ordinary roads

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The safety of road traffic has depended on the driver, and the emergency avoidance and braking behavior have depended on the experience value so far. However, the ordinary driver has relatively few opportunities to experience such situations and has little opportunity to gain experience. In order to ensure the safety of self-driving cars, which are expected to spread in the next generation, it is necessary for the controller itself to acquire information on the road ahead. Moreover, even with ADAS that supports drivers in emergencies, it is extremely difficult to prevent accidents if accurate information such as road surface friction cannot be obtained on snowy and icy roads. Currently, ABS is obligatory for vehicles in Japan, so even in an emergency braking situation such as obstacle avoidance, it is considered possible to brake using the state close to the optimum in the road surface friction. While such systems can achieve optimal braking on current road surfaces, however, obstacle avoidance is dependent on the value of the road's coefficient of friction. Therefore, as information for improving traffic safety in the future, to construct a estimation system for forward road friction will be important. We have been studying the construction of the database used in this new system. This study is carried out from such a point of view, and improved the measurement system constructed so far, and conduct experiments for road friction measurement on the proving ground.

In this study, two types of experiments are conducted on the same paved road surface, but different condition between dry and wet. The running speed during the experiment is carried out at five levels of 5km/h, 20km/h, 40km/h, 60km/h and 80km/h, and the effect of speed is confirmed. Three different slip ratios are realized with three measurement tires, and the friction coefficients under these conditions are used for identification by the Magic Formula presented by Prof. Pacejka. Fig.1 shows the three types of friction coefficients obtained in the experiment versus speed. Results at this condition show that the effect of speed on the coefficient of friction is relatively small and does not show any distinctive trend. Similarly, the friction coefficient results on wet road surface are measured. Fig. 2 shows the different μ-s characteristics for dry and wet roads obtained from these results. It can be seen that this trend clearly represents the μ-s characteristics of dry and wet road surfaces that have been recognized so far. Finally, Fig. 3 shows the effects of changes in road surface conditions and speed.

From this figure, it can be seen that the value of the peak μ is largely independent of velocity. Many previous studies have shown that the road surface friction coefficient is highly dependent on speed, and it has been considered an important factor when considering the friction coefficient. The main reason for this is that the main evaluation value of road surface friction has been dependent on the coefficient of sliding friction. Therefore, it was shown that the road friction characteristic that should be provided to current vehicles is not sliding friction but peak μ.

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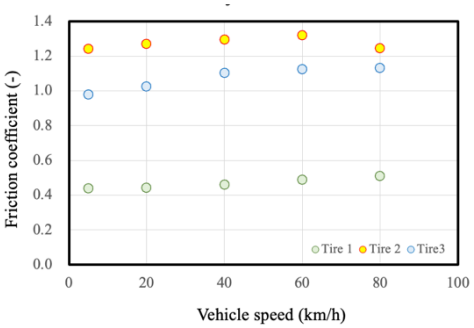
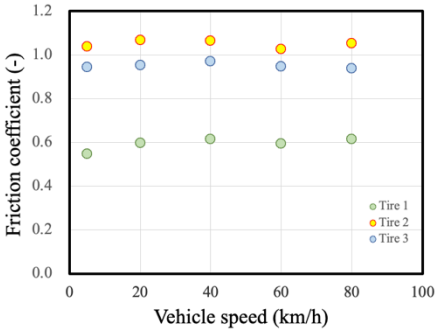


a) Dry condition



b) Wet condition

Fig.1 Road friction coefficient at each speed

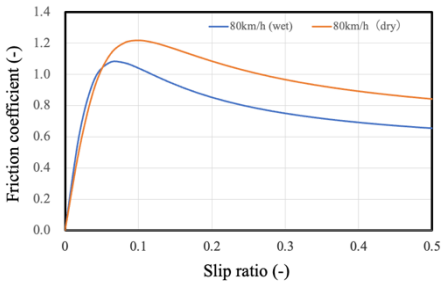


Fig.2 Differences in μ-s characteristics under two types of road surface conditions

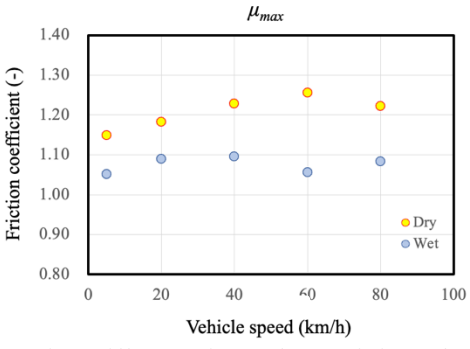


Fig.3 Differences in μ-s characteristics under two types of road surface at each speed