TRANSPORTATION SAFETY MANAGEMENT USING TRANSPORTATION BIG DATA

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Korea Transportation Safety Authority(TS) has various transportation data. This session introduces various data held by TS . We will also introduce some of the results of the research using this data, and discuss opinions on future traffic safety management methods using data.

1. Study on the Development of Safety Grade Model for Roads in Korea Using Digital Tachograph and Traffic Accident Data

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A Digital Tachograph (DTG) attached to a business vehicle is a device that stores vehicle driving record in real time. The DTG can record the vehicle's GPS position, driving speed, revolutions per minute (RPM), vehicle status, brake signal, azimuth, and acceleration. Korea Traffic Safety Authority (KTSA) collects DTG data and uses the collected DTG data to generate eleven dangerous driving behaviors such as speeding, rapid acceleration, rapid deceleration, sudden lane changing, and sudden turning. The number of eleven dangerous driving behaviors can be used to identify the driver's driving behaviors. Therefore, it is expected that the number of dangerous driving behaviors will be matched with the road segment and it will be able to identify the dangerous driving behavior occurring in a specific road section.

The purpose of this study is to construct road safety performance functions based on eleven hazardous driving behaviors and traffic accident data in order to establish safety grade model of roads in Korea.

The time range of the study is for 2015. Spatial coverage targets all roads managed in national standard node-link system. The national standard node-link system is a map created by the National ITS Center to provide integrated traffic information for domestic traffic information on it.

To construct the SPF, eleven hazardous driving behaviors, AADT, section length, lane number, and traffic accident severity data were processed through the spatial operation on the basis of big-data analysis. For AADT, this study utilized the traffic data provided in the ViewT which is developed by the Korea Transport Research Institute. In addition, geometric features that can not be grasped by existing geometric data are reflected by using eleven dangerous driving behavior data. The SPF was constructed through Poisson and negative binomial regression analysis. In the models, the section length and the AADT are shifted out of the exponent as an exposure.

$$EPDO_{predicted} = AADT^{\beta_1} \times Segment\ Length^{\beta_2} \times e^{(\alpha+\beta_3 X_t)}$$

Where,

$EPDO_{predicted}$= the predicted traffic accident severity

AADT= annual average traffic volume

Segment Length = length of the segment

X_t= other independent variables

Based on the constructed SPF, the road safety grade model was constructed. The road safety grade is a method of classifying road safety by grade. The road safety grade is determined by comparing the number of actual traffic accidents with the grade created using the average number of traffic accidents and its standard deviation.

In this study, four grades A to D are presented based on the above equations. It is expected that the calculated road safety grade for each road section can be utilized to conduct road safety diagnosis, traffic safety analysis, etc.

2. Develop safety surrogate measure for evaluating motor carrier Companies and drivers

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The risk of accidents of commercial vehicles is higher than that of ordinary vehicles. Traffic fatalities per registered vehicles are 3.8 times higher than in commercial vehicles than ordinary vehicles in 2016. Because of the high severity of accidents, there should be a lot of effort to reduce accidents and manage traffic safety of motor carrier companies. So far, safety assessments for commercial vehicles have been evaluated according to the frequency and the severity of accidents. This approach has several problems. First, the accident can not be preemptively prevented because it is based on the post evaluation of the accident. Second, it is difficult to provide consulting or action guidelines because it is impossible to determine what factors caused traffic accidents. With the recent development of data collection technology, not only traffic accident information, but also the various characteristics of motor carrier companies and drivers such as vehicle driving record, dangerous driving behavior, law violation information are collected. Therefore, this study aims to develop a new safety surrogate measure based on various characteristics of motor carrier companies and drivers. Safety measure of motor carrier companies was calculated based on the risk driving behavior collected by digital tachograph (DTG). The factor analysis and the regression model were used to investigate the relationship between the risk driving behaviors and traffic accidents. Finally, we derived the risk driving behavior score by each company. In the case of drivers, the correlation between socio-demographic factors such as violation of taffic laws, frequency of turnover, age, and career was analyzed, and a safety surrogate measure was calculated based on the correlation. The results of the study show that it is possible to extract various characterstics of companies and drivers which are related to traffic accident. Based on those relationships, the study suggest possibilites to manage the safety of motor carrier companies and employees.

3. Analysis on Taxi Operation Using Digital Tachograph and Meter Data in Korea

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The purpose of this study is to analyze the taxi operation data from Digital Tachograph (DTG) and taxi meter and to provide a support for the government policy decision and taxi company operation. Data from DTG include speed, acceleration, direction, GPS coordinates, engine condition, etc. From taxi meter, meter on-off information and real-time fare data are collected automatically. By combining these two types of data, we can perform 1) demand-supply analysis, 2) driving pattern analysis and 3) illegal operation analysis. For this study, one day data from 2,263 taxis in City of Daejeon are used.

4. Prediction for Danger Zone of Gyeongbu Expressway using Digital Tacho Graph data

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In Korea, especially at Seoul Metropolitan area, there are many wide area bus traveling on expressway. Traffic accidents caused by wide-area buses traveling on expressways are very damaging to people.

In this study, to prevent large-scale accident by wide area bus, we analyzed the driving behaviors of them running on expressways. And we developed a risk prediction model to evaluate the risk of each expressway section.

For Modeling, we use the Digital Tacho-graph Data which has a driving behavior record of wide area bus. And we use traffic accident data, travel speed data, traffic volume data for 5 years on Gyeongbu expressway.

Using deep learning and machine learning, We analyzed the driving behavior and extracted the segments showing the specific driving behavior. Rapid acceleration and deceleration were found to be highly correlated with traffic accidents, and the sections where such driving behavior frequently occurred were classified as dangerous sections.

The purpose of this study is to predict the risk of each road segment by applying the model developed in this study and to induce safe driving and to prevent traffic accidents by providing this information to the driver.