A Framework of Economic Loss Estimation due to Transportation Network Disruptions

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Recently, socio-economic impact of a disaster is enormous hitting urban areas in which population and asset are accumulated. Thus, we need to build up effective
integrated disaster risk management strategies for reducing economic losses. To this end, it is necessary to establish an analytical framework for estimating
indirect economic losses induced by disruption of transportation networks or dysfunction of other infrastructure.
Comprehensive economic modeling framework such as input-output analysis and computable general equilibrium (CGE) model is widely used to accomplish the above purpose. The spatial CGE model (SCGE model), which is extended from CGE model into multi-regional framework, is such a promising one that it can entail not only inter-industry relationship but also inter-regional commodity flow. However, it still remains some challenges: e.g. description of intra-regional transportation flows and traffic congestion in a disaster. In order to solve the problem, this research aims at showing a framework which integrates SCGE model and traffic assignment on transportation networks, and at applying a suggested framework for economic loss estimation due to transportation disruption scenarios from a great earthquake scenario.
An idea of the research is as follows. SCGE analysis provides interregional commodity flow as one of outputs. It can be regarded as traffic demand (OD traffic volume), and we convert figures in an appropriate manner, decomposing a region in SCGE into several zones in traffic assignment. After preparing OD traffic volume based on the inter-regional commodity flow, traffic assignment is carried out by user equilibrium concept. As a consequence, we will obtain inter-zonal travel time.
Aggregating into inter-regional transport time for the SCGE model, it is used as an input for the SCGE analysis. An economic equilibrium is calculated under a new
input value, providing again a set of interregional commodity flow. Continuing this cyclic process, the equilibrium state will finally be found in this integrated model.