Article / Book Information

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Title(English)	Model development for enhancing airport operation in immediate disaster response
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論 文 要 旨

THESIS SUMMARY

専攻： International Development Engineering 専攻
Department of

申請学位（専攻分野）： 博士 (Philosophy)
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要旨（英文 800 語程度）
Thesis Summary （approx.800 English Words ）

Lessons learned from 2011 Great East Japan Earthquake highlight again about airport operation in immediate disaster response. Immediate disaster response airport operation includes transporting personnel and evacuees, loading and unloading aid goods, fueling and refueling, information collection, emergency medical care, and so on. Since such roles are executed in and through airports, airports are regarded as disaster response base. Regarding airport operation as disaster response base, Japanese government constructed a disaster management network in each region in order to prepare and respond to expected natural disasters such as earthquake and tsunamis after Great East Japan Earthquake. It is not only Japan that prepares disaster response planning with utilization existing airport infrastructures. However, there is only limited number of research in this area with framework development to assist decision making of airport operators and related stakeholders.

Therefore, this study develops mathematical models to enhance airport operation in immediate disaster response. Current challenges of an airport in immediate disaster response are identified and conceptual framework to present three dimensional bases for assisting airport disaster response planning. The purpose of dissertation is as the following: 1. To develop a model for diagramming procedure of disaster response base facilities in an airport 2. To develop a model for assessing waiting time of different operators' aircrafts in disaster response 3. To develop a model for cooperative response operation by assigning main disaster response roles to reduce mean and total disaster response time in plural airports.

In literature review, we developed conceptual framework for enhancing airport operation in terms of decision levels, what to manage and where the management takes place. In this section, we reviewed relevant literature reviews to build understanding on lessons learned from past natural disasters, current practices in airport operation, and cooperation issues. Methodological reviews were conducted on architectural approaches such as adjacency matrix, diagramming, schematic plan, and queuing approaches such as open Jackson network model. In addition, lessons learned from previous natural disasters were reviewed with careful attention

on current practices regarding airport as a disaster response in the world.

First, the first study focuses on a single airport operation dealing with limited space for sorting and staging relief goods and insufficient place for emergency worker's accommodation. It develops space planning methodology for diagramming procedure followed by calculation flow for base camp and staging area in a disaster response airport. The methodological procedure proposes a layout for a disaster response base within Shizuoka airport in Japan

The second focus of the study is to develop a model to estimate waiting time management of different airport operators with applying different queuing disciplines in an airport. The model is developed based on Jackson network queuing theory and considers various disaster response activities in an airport. The result suggests hybrid queuing discipline shows acceptable waiting time for higher priority operators. Also, the estimated data is compared with observed data regarding each airport's waiting time in Great East Japan Earthquake. Even though, there are some discrepancies in exactness of the model, tendency is found among three airports. We examined the same topology through comparing observed and estimated data and improved model accuracy by increase in transition probability from response activities to fueling.

Lastly, the study develops a model to estimate mean disaster response time of airports through cooperative plural airports operation scheme by an open Jackson network. The model is motivated by extension of previous chapter into plural airports network and the result reveals that cooperative role assignment among airport network in disaster response is effective in reducing mean waiting time of an aircraft in each airport.

The study concludes by summarizing its findings as in the last part. The study also shows effect of how each airport can enhance its operation by reducing response time. It is important to note that a single airport operation regarding space and time management also affects the other neighboring airports operation so cooperative and collaborative operation framework should be built prior to large scale emergencies. The policy implication for airport operators, local government, as well as humanitarian organizations is that airports must be planned and equipped with guideline with flexibility in advance of disasters.