

Title	石川県を中心とした雪害による道路途絶時の代替輸送について
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## Abstract

In Ishikawa Prefecture, truck transportation is a very important means of transportation. This is because trucks account for more than 99% of the total transportation in Ishikawa Prefecture on a tonnage basis. However, in recent years, perhaps due to climate change, major roads connecting the Hokuriku region to other regions have frequently been disrupted by heavy snowfall. For example, in February 2018 and January 2021, large scale vehicle hold-ups occurred on National Route 8, the Hokuriku Expressway, and the Tokai-Hokuriku Expressway . Furthermore, when large scale vehicle congestion occurred, supermarkets and convenience stores in Ishikawa and Fukui prefectures experienced shortages of goods and products. In order to prevent food shortages in the Hokuriku region in the event of snow damage, it is important to first understand where food is supplied to Ishikawa Prefecture under normal conditions, and to consider the risk of heavy snowfall in advance. However, the production bases and distribution routes of foodstuffs are often not recognized at present, and in Ishikawa Prefecture, specific quantities are not disclosed and unknown. Therefore, it is also unknown how much the food supply would be affected if a certain road were disrupted. In order to prevent food supply disruptions to Ishikawa Prefecture, it is very important to know which items are supplied from where under normal circumstances, and to take into account the different food supply under normal circumstances when roads are disrupted.

The purpose of this study is to show the possibility of preventing food shortages in Ishikawa Prefecture by alternative transportation when roads are disrupted due to snow damage. Although the prefectural government and road management companies are taking measures to cope with snow damage, the current measures are not sufficient to deal with the impact on food supplies, as convenience stores and supermarkets are experiencing shortages and shortages of products. In this study, we consider the possibility of providing food supplies through alternative transportation from prefectures that are not affected by road disruptions, which is different from the normal situation. In this case, we will target items that are in relatively high demand during disasters due to time constraints. Although there have been no specific surveys or studies on which items were in short supply and to what extent due to road disruptions in Ishikawa and other prefectures, there were many reports in newspapers and other media of shortages of bread and noodles. Therefore, in addition to bread and noodles, the target items are beverages that are essential to sustain life for 2-3 days until the roads are restored due to the snow damage.

In this study, first, the effects of road disruption caused by snow damage and the resulting food supply were investigated from newspaper articles and prefectural survey reports at the time of the snow damage. Next, based on the Freight Census and the location of food manufacturing plants, we examined which prefectures Ishikawa Prefecture imports food from. Then, based on the Traffic Census and other data, we considered alternative roads that could replace the disrupted roads in the event of road disruption due to snow damage. Finally, the concept of potential was introduced to the food supply, and a study was conducted on the possible alternative transportation routes from which prefectures could be used in an emergency.

The results of this study focused on the impact on food supply due to road disruptions caused by snow damage mainly in Ishikawa Prefecture, and showed that in February 2018 and January 2021, when National Route 8, Hokuriku Expressway, Tokai-Hokuriku Expressway, and other roads in Fukui Prefecture were closed for a few days, processed food products were sold out in supermarkets and convenience stores and were not available in convenience stores. In particular, shortages occurred at supermarkets and convenience stores. In particular, many processed foods such as rice balls, boxed lunches, bread, ham, etc., as well as fresh foods were out of stock or in short supply.

Next, we discuss the relationship between the disruption of National Route 8 and the Hokuriku Expressway and the food supply to Ishikawa Prefecture, particularly processed food products. Ishikawa Prefecture does not have a large-scale production base for processed food products, and it is thought that many processed food products are transferred from other prefectures, with a high percentage of these coming from the Kinki and Chubu regions. The roads connecting Ishikawa Prefecture with the Kinki and Chubu regions are National Route 8 and the Hokuriku Expressway, and it is thought that these roads were cut off, resulting in inadequate food supplies. The beverages were imported from Hyogo, Aichi, Shizuoka, Gifu, and other Chubu prefectures, as well as Toyama Prefecture.

Alternative routes to Route 8 and the Hokuriku Expressway are the Tokai-Hokuriku Expressway and Route 41. Even when alternative routes existed, the actual food supply was affected, indicating the need for alternative transportation from regions different from those under normal conditions. However, it is considered difficult to arrange transportation from different areas immediately after the disaster. In preparation for road disruptions, it is necessary to secure multiple suppliers at normal times and to consider supply routes in advance in case of road

disruptions.

The concept of potential is introduced to food supply. The analysis was conducted using the OD matrices between prefectures for "Other Food Industrial Products" and "Beverages" from the "Inter-Prefecture Flow Volume - Weight -" of the Freight Census. The values of "inter-Prefecture Flow Volume - Weight" were not consistent, possibly due to the fact that the values varied considerably from year to year. It is considered that the possibility of alternative transportation from any of the prefectures should be considered in the future.