

A Review on the Classification and Grading Criteria of Road Transport Natural Disasters

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Abstract: This review summarizes and analyzes the basic information of various types of road transport natural disaster emergencies, refers to various types of road transport emergency plans, and combines the actual needs of road transport emergency rescue with national emergency related laws. It also proposes the classification criteria and grading standard for the emergencies of road transport natural disasters based on the classification and grading standard of the regulations, which provide a basis to take reasonable and effective disposal measures in the emergency response of road transport emergencies under natural disaster conditions.

Keywords: *road transport; emergencies; classification criteria; grading standard; natural disasters*

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0 Overview

China is one of those countries in the world which experiences serious natural disasters. There are numerous natural disasters which are widely distributed and occur frequently. They are characterized by multiple disasters, mass, and concentrated outbreaks. In the recent years, some rare natural disasters have also occurred frequently resulting in continued increase in disaster losses and seriously affecting economic development and improvement of people's livelihood. In China, the average number of people affected by various types of natural disasters in the recent decades has reached hundreds of millions of people each year. In addition, the number of emergency resettlement

personnel has exceeded 10 million, and tens of thousands of houses have been collapsed.

While natural disasters are experienced, the road transport emergency and emergency transportation support provide timely and effective emergency rescue work and provide all kinds of materials urgently needed for the people in the disaster areas to save lives and reduce casualties. It also plays an important role in the preventing loss of property, prevention of disasters, and ensuring social stability in the disaster areas. However, the road transport emergency response capabilities of China are not as advanced as that of the developed countries. Therefore, there is a need to further improve the emergency response and disposal capabilities of road transport emergencies under natural disasters in China. A detailed classification criteria and grading standard for road transport natural disasters under the overall national emergency rules and regulations are necessary to enhance the response and disposal capacity of road transport natural disasters. The classification and grading of disaster-related emergencies which are in line with the actual situation of the industry are compatible with the national overall emergency classification standard and aid in taking reasonable and effective measures for emergency response of road transport emergencies under natural disaster conditions.

1 Classification of emergency events in road transport natural disasters

Analyze the unexpected road traffic incidents caused by natural disasters in recent years and their countermeasures through statistics, and research and analysis of emergency response plans for industries of

passenger transport, freight transport and urban road transport. Based on the classification of natural disasters in the country, the classification and analyses of road traffic emergencies was carried out. The classification of events^[1,2] has been based on the classification of natural disasters in the country and classified research on road transport emergencies. According to the two disaster types of meteorological disasters and natural disasters and their subcategories, this classification has two major categories and seven subcategories of natural disasters: Floods, snow, earthquakes, landslides, mudslides, caves (groundwater), stuffed lakes, detailed classification, and typical damage caused by them as shown in Table 1^[3].

2 Grading of emergency events in road transport natural disasters

In the National Emergency Response Plan for Public Emergencies, the emergencies are graded from I to IV, according to their severity, nature, and scope of the emergency, and are graded as extraordinarily serious emergencies (Level I), serious emergencies (Level II), comparatively serious emergencies (Level III), and general emergencies (Level IV)^[1,4]. Based on the national Levels I-IV emergencies, this paper grades the actual situation of road transport emergencies according to the above grading criteria for road transport natural disasters. Similarly, in road transport, the general emergency (Level IV) accounts for a relatively higher

proportion, while the country's grading of general emergencies (Level IV) is relatively macroscopic. Therefore, this article considered whether natural disasters cause casualties as the basic standard and referred to other relevant influencing factors, for general emergencies (Level IV), road transport disasters, and subdivided the emergency events into two sublevels, namely Level IV-1 and Level IV-2.

2.1 Extraordinarily serious emergencies

Road transport natural disasters can be one of the following situations, which is particularly an extraordinarily serious emergency (Level I):

1. More than 30 deaths (including disappearances) caused by extreme weather, such as heavy rain, heavy snow, dust storms, strong winds, and haze, or more than 1000 people transferred, or economic losses of more than 50 million yuan;
2. More than 30 deaths (including missing persons) due to geological disasters, or more than 1000 people transferred, or direct economic losses of more than 10 million yuan.

2.2 Serious emergencies

Road transport natural disasters can be one of the following situations, which are a serious emergency (Level II):

1. Causing continuous interruption of transportation for more than 24 h;

Table 1: Classification of road transport natural disaster emergencies

Classification	Subclass	Typical damage
Meteorological disaster	Flood	Road: Fouling, burial, levee, damage, etc. Bridges and culverts: Displacement, collapse, etc. Tunnel: Water damage at the hole, collapse of the hole, water inrush, etc.
	Ice and snow	Road: Burying, shifting, supporting, structural damage, melting snow, sinking, etc. Bridges and culverts: Overturning, collapse, displacement, etc. Tunnel: Collapse, water damage, etc.
	Earthquake	Road: Subsidence, cracking, slipping, twisting, collapse, side shift, water damage, etc. Bridges and culverts: Damage, collapse, displacement, falling beams, fractures, cover beams, subsidence, etc. Tunnel: Collapse, instability, sinking, cracking, seepage, staggering, tilting, etc.
Geological disaster	Landslide	Road: Burying, supporting, structural damage, etc. Bridges and culverts: Burying, shifting, staggering, collapsing, etc. Tunnel: Hole rushing, blocking, etc.
	Debris flow	Road: Collapse, burial, protection, structural damage, etc. Bridges and culverts: Silt, displacement, collapse of the pier foundation, damage, etc. Tunnel: Hole and wall collapse, blockage, etc.
	Cave (groundwater)	Road: Water damage, burial, immersion, etc. Tunnel: Inverted sinking, collapse, water damage, etc.
	Stuffed lake	Road: Water damage, burial, immersion, etc.

2. Deaths of 10 or more people (including missing persons) caused by extreme weather and other extreme weather conditions such as heavy rain, heavy snow, dust storms, strong winds, and haze, or the number of people to be transferred is <500 and <1000, or 10 million or more and 50 million economic loss below the yuan;
3. Death of 10 or more people (including missing persons) due to geological disasters, or the number of people to be transferred is <500 and <1000, or direct economic losses of more than 5 million yuan and more than 10 million yuan.

2.3 Comparatively serious emergencies

Road transport natural disasters are one of the following situations, which are a comparatively serious emergency (Level III):

1. Causing continuous interruption of transportation for >6 h and <24 h;
2. Three or more deaths (including missing persons) caused by natural disasters, or the number of people to be transferred is between 200 and 500.

2.4 General emergencies

Road transport natural disasters are one of the following situations, which is a general emergency (Level IV-1):

1. Causing continuous interruption of transportation for more than 30 min and <6 h, or the capacity is reduced by more than 50%;
2. One or more deaths (including missing persons) caused by natural disasters, or the number of people to be transferred is <50 and <200.

Road transport natural disasters are one of the following situations, which is a general emergency (Level IV-2):

1. Causing the transportation to be continuously

interrupted for 30 min or less, or the capacity is reduced by 30% or more and 50% or less;

2. Personnel injured due to natural disasters, or the number of people to be transferred is <50.

3 Conclusion

This article attempts to summarize the classification and grading of various types of road transport emergencies based on the relevant rules and regulations and emergency plans for national road transport emergencies. Based on the national emergency classification criteria and the road transport natural disasters, the emergencies were subdivided. On the basis of national levels of emergencies and the grading of road transport natural disaster-like emergencies, the corresponding grading was carried out, and the most frequent occurrence of general emergencies (Level IV) was subdivided into two sublevels according to the standard of causing casualties which has certain guiding significance for the emergency response and disposal of road transport natural disaster emergencies.

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