Discussion on the System Structure and Capacity Building of Highway Emergency Management in China

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Abstract. The highway development in China is in the ascendant, but its operation time is shorter than the operation time of western developed countries, especially for highway emergency management, which is lagging no matter in practice or in experience. The most important reason should be attributed to lack of a set of effective emergency management system. The system is a combination of hardware and software, namely it is the embodiment of system framework and ability. The paper points out “four-supporting mechanism” from the perspective of hardware and comes up with “six-capacity mechanism” from the perspective of software.

Introduction

China only has operated the highway for more than 20 years since from the operation of the first highway, thus it has a little experience in operation and management of the highway and it still has a larger difference by comparing with the highway in developed countries, especially for emergency management, which still has lots of shortcomings. The key problem is the imperfection of the emergency management system. If there is no perfect emergency management system supporting emergencies, the entire emergency management will be extremely blind, thus high efficiency and timeliness can’t be safeguarded. Once there are emergencies, the proportion of casualties and economic losses will be enlarged with it [1].

The Highway Emergency Management System

From the perspective of system theory, a system refers to an organic whole with specific functions and it is composed of some systems associated by some things or consciousnesses mutually. The system generally includes two aspects: One is the mutually-related system, and the other one is the organism with specific functions. It is just like the hardware and software in a computer. System structure is equal to hardware configuration, which should be supported by capacity building (namely software), if it wants to operate well. On the other hand, software realizes functions based on the hardware. Hardware is controlled by software. Thus, in order to perfect highway emergency management in China, it is necessary to combine software with hardware, namely it must build perfect crisis management structure and promote unification of various abilities.

System Structure—“Four-Supporting Mechanism”

The system structure of the highway emergency management includes four aspects: namely “four-supporting mechanism”: macroscopic external legal environment and information technology; internal operation mechanism in various organizations, microcosmic basic personnel and troops, etc.

Capacity Building—“Six-Capacity Mechanism”

The system structure of the highway emergency management should be supported by software, namely it requires for construction of “six-capacity mechanism”, including organizational capacity of mutual adjustment and unification between multiple subjects; management capacity of every
subject; team capacity of individuals; service capacity provided by subjects; science and technology capability to master and apply technology; and executive capacity to implement in practice.

The System Structure of the Highway Emergency Management—“Four-Supporting Mechanism”

Operation Mechanism

According to the working process of emergency management, the operation mechanism of the highway emergency management can be summarized into the five parts as follows: emergency warning system, emergency response system, emergency command and disposal system, emergency management information system and emergency mobilization and safeguard system. In these five systems, emergency command and disposal system should be regarded as the core status and is responsible for unifying a command and scheduling; Emergency mobilization and safeguard system should ensure that various related resources can be applied in time when emergencies take place; Emergency management information system provide a data information support and sharing platform for the emergency command and disposal system; Emergency warning system integrates various inspection and monitoring devices and related information departments, predicts, discovers and analyzes time, place, scale and development tendency of highway emergencies in time, and offers a reliable basis on the emergency response decisions and commands; Emergency response system is a hardware system that serves for effective implementation of emergency response program.

At present, efficiency of emergency disposal is restrained by the imperfect operation mechanism of emergency management in China. Thus it is urgent to further improve the emergency management system of existing transportation security, expand functions and increase the emergency management capacity of transportation security emergencies. All of these have already been crucial.

Legal Environment

The construction of legal and regulation system is the foundation and safeguard of the highway emergency management and also is the basis of executing emergency management. Laws and regulations of major emergency rescue management in China can be divided into several different levels in line with different legislative body. According to actual demands, legislations of major emergency rescue management in China should include laws, administrative laws and departmental rules and local laws and regulations.

From the perspective of laws, macro guidance and standard are basic work of the highway emergency management in China. Administrative laws and departmental rules should define special tasks of various functional departments in the emergency management process and define allocation of commands and functions in accordance with national institution setting situations. Departmental rules mean that national comprehensive emergency management departments and professional rescue management departments formulate normative documents about emergency management for related emergencies within their extent of competence in accordance with relevant laws and administrative rules. The content of these rules should further subdivide specific management system and measure and explain rules of implementation in details. From the perspective of local rules, it is necessary to formulate corresponding local rules by combining with physical truth of local resources and to propose specific regulations and requirements for emergency preparation, emergency and emergency recovery of emergencies.

Basic Troops

Nowadays, basic troops of the highway emergency management system should mainly include highway traffic police, highway department, rescue, fire department, and hospital, etc. Emergency staff in different departments stay in diverse posts, thus their work pressure, workload and business level vary considerably. It is hard for different departments to deeply know about functions of other
posts. For example, monitors don’t know how to deal with emergencies. Traffic police may know little about rescue expenses. Moreover, it is difficult for road administration to control traffic flow.

Therefore, it is necessary to perfect basic troops of the highway management system, to establish an emergency management mode based on the whole government and the whole society, to cooperate with training, learning and social mobilization mechanism, to establish an emergency troop including governments, troops, social organizations, enterprise and volunteers, etc., in line with the cooperative mode between the government and the society; to construct a library filled with professionals and emergency experts for direct participation in the highway emergency warning, disposal and emergency consulting; and to reinforce schedule and cooperation of emergency personnel in different sections of the highway. Furthermore, business in different departments should be learned and practiced mutually.

Information Technology
At present, the “nonautomatic” detecting technology is mainly applied to detect the Chinese highway and it is based on the roadside emergency call, patrol of traffic police or road administrators to find out accidents. Such a conventional detecting technology undoubtedly will cause emergency delay from the perspective of difficult prediction and complexity of highway emergencies.

The applications of emergency information technology are mainly reflected in two aspects for the highway: supervision and communication. In terms of supervision, the realistic situation of China shows that it is economical and effective to apply closed-circuit television, emergency call, mutual aid system of drivers, and cruisers on the highway. Moreover, the latest supervision devices and detection modes can be introduced from western countries gradually. In terms of communication, it is necessary to set up a special information supervision center, maneuver, to advertise and predict emergencies at pre-stage, to inform related emergency departments during the emergencies rapidly, to give out traffic controlled signals in time, to coordinate with related work, to transmit development tendency and abnormal tendency of emergencies, and to analyze and summarize after emergencies.

The Capacity Building in the Highway Emergency Management System—“Six-Capacity Mechanism”

Organizational Capacity
The organization refers to a process that synthesizes various departments and coordinates the highway emergency management dynamically. The construction of organizational capacity should establish a uniform and special emergency management organization. All kinds of organizations and functional departments should construct the pre-arranged planning for coping with daily operation and emergency management of diverse emergencies. After the breakthrough of emergencies, all organizations and functional departments should coordinate and command emergency management for emergencies.

Management Capacity
Management involves in configuration and optimization of various resources, including manpower, financial resources, materials and services. In order to promote the highway emergency management, the following safeguards should be reinforced as follows: For manpower, personal configuration should live up to professionalize and standardize, to establish professional teams and backbone, to mobilize social organizations and volunteers to participate in rescue; and to increase international exchanges and cooperation; in terms of financial resources, it is necessary to safeguard emergency preparations and rescue funds for emergencies, to supervise and evaluate utilization and effects of emergency security funds, and to encourage private capital to contribute and rescue; as for materials, it is necessary to safeguard in-time supply of required materials and life articles and
reinforce supervision management, in-time supplement and update of reserved materials; for services, the department of health should be responsible for building emergency professional troops of medical treatment and public health and mobilizing some power, such as red cross, to participate in medical health rescue; emergency transportation should be arranged, scheduled and discharged preferentially. Under the emergencies, social transportation can be taken over for use; in addition; it is necessary to establish sound safeguard work system of emergency communication, broadcast and television and ensure smooth communication.

**Team Capacity**

The center of the highway emergency response system should be equipped with a team system with rapid response ability, professional rescue and full equipment. The team system is the multi-subject initiative entity with the core of the government. The main executor of the highway emergency management should be the government, but extensive traffic participators also should the participatory subjects of the emergency mechanism. As for capacity, all participatory subjects in the highway emergencies, especially for traffic police and armed police, should mast the most basic rescue knowledge, such as medical rescue and escape, except for basic skills of the major. In addition, it is necessary to pay attention to cultivating crisis prevention consciousness and coping capacity for traffic participators and brining emergency education of highway emergencies into the range of school education and adult education.

**Service Capacity**

In terms of the process of taking place highway emergencies, it can be divided into three stages, including pre-stage, mid-stage and post-stage. The pre-stage of emergencies emphasizes on providing public products with institutional forms. Public products with institutional forms refer to actions, rules, strategies and plans formulated by the government at different stages in different types of emergencies for guiding subjects of emergency management. Promotion of service capacity for institutional products requires for the government to establish a perfect emergency plan and emergency legal system for related emergencies. At the mid-stage, some public products with substance forms, such as emergency rescue, information publication and substance support should be provided, due to destroy of personal and property security. The post-stage should be the recovery reconstruction and experience summary. The main tasks refer to reconstructing public orders, recovering daily life and improving ability training of coping with similar events.

**Science and Technology Capacity**

It is necessary to establish the industry-university-research cooperation base for the highway emergency technology and management in China, to encourage and support enterprises to develop new products and technologies in the emergency fields, to promote industrialization of related emergency management technical products, to cultivate talents at all levels for Chinese demands, to promote establishment of the science and education supporting system for the highway emergency management comprehensively, to establish batches of technical-based organizations, to study and formulate the emergency management system, to reinforce emergency management technology and product research and development, application promotion of industrialization, and to form relatively perfect emergency supporting system of science and technology.

**Executive Capacity**

In order to improve executive capacity, it must establish uniform legal system and coordinating subjects for the highway emergency response and clearly define responsibilities and rights of every subject in crisis. From the perspective of subjects, first of all, it should cultivate responsibilities and enterprise of cultivators. Strength of responsibilities determines the degree of executive dynamics; enterprise strength decides good or bad executive effects. Emergency personnel in highway emergencies should regard “serve the people” as the guiding principle and insist in establishing the practical style.
Conclusions
China has insufficient experience in the highway emergency management no matter in practice and experience, due to short time of the highway development. It must sound the highway emergency management system in China, combine hardware with software, build complete emergency management system structure and promote various abilities, for the sake of solving the difficulty.

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