



# Illogical smart highway management policy in Japan

Yoshiyasu Takefuji

Faculty of Environment and Information Studies, Keio University, 5322 Endo, Fujisawa 252-0882, Japan



## ARTICLE INFO

### Keywords:

Smart highway management  
Weather policy  
Weather forecast

## ABSTRACT

This paper reports an illogical policy on smart highway management in Japan. Heavy snow in Japan on Dec. 17 in 2020 revealed the failed link in the current policy between the smart highway management and weather forecast. Weather forecast information is supposed to be used in controlling the gates in highway for mitigating stranded vehicles by heavy snowfalls, blizzards, freezing rain or sleet, dense fog, high winds, and other weather-related phenomena respectively. However, more than several thousand vehicles were stranded every winter on the smart highway in Japan. This paper examines what is wrong and what should be fixed in the current highway policy in Japan.

## 1. Introduction

On December 17 in 2020, more than 1100 vehicles were stranded on a Kanetsu expressway by heavy snow [1]. It took two days to clear all vehicles that had remained stranded on a long stretch of expressway north of Tokyo [2]. Members of the ground self-defense force and others shoveled snow accumulated on the road, where as many as 2100 vehicles had been stranded [2]. The Kanetsu expressway is managed by NEXCO managing a smart highway system using the latest weather forecast with 400 weather sensor stations every 10 km and 1760 CCTV (Closed circuit TV) cameras every 2 km on the highway [3]. Many other highways in Japan have been managed by the similar smart highway system. Although the Kanetsu expressway has been controlled under the state-of-the-art smart highway system, 1100 vehicles were stranded by heavy snow. Based on weather forecast on December 15 and 16, heavy snow was predicted and expected. NEXCO did not close the gates on the highway on Dec. 17 in 2020.

In the UK, a highway authority is under a duty to ensure, so far as is reasonably practicable, that safe passage along a highway is not endangered by snow or ice [4].

In the US, removal or prevention of snow and ice accumulation on the roadway is a top priority and will generally take precedence over other non-emergency maintenance functions [5].

Samuel et al. surveyed existing research and knowledge on the vulnerability of transportation systems to climate change and extreme weather events [6].

Oliver et al. provided a comprehensive review of big data initiatives as examples of smart road traffic information applications [7].

Traffic flow prediction is performed using meteorological information for road traffic using deep learning technology, which has made remarkable progress in recent years [8].

There are two methods for avoiding stranded vehicles on the highway against heavy snow: 1. removal of snow and ice accumulation on the roadway, 2. closure of the gates. In Japan every winter, many vehicles were stranded on the highway by heavy snow. This paper examines what causing snow stranded problems in Japan.

## 2. Snow stranded cases

In order to understand what causes snow stranded problems on the highway in Japan, the past 3 years snow stranded cases on the highways were investigated in this paper.

On 2020, nearly 700 cars still stranded in heavy snow in central Japan [9].

About 680 cars remained stranded on a snow-covered road Wednesday night in Fukui prefecture in central Japan, with ground self-defense force personnel struggling to clear the thoroughfare [10].

On Feb.6 2018, hundreds of vehicles trapped on highway by thick snow in Japan's Fukui prefecture [11].

On Jan. 24 2017, more than 300 vehicles stranded in western Japan [12].

The investigated stranded result in the last 3 years shows that the critical link between weather forecast and smart highway management failed. Although NEXCO managing all highways in Japan reported to the Japanese government about the smart highway management using the latest weather forecast [3], the policy to control the gates entering the highways is inconsistent. In other words, the NEXCO policy on highway management is vulnerable and weak against the heavy snow.

## 3. Discussion

The detailed policy of NEXCO for controlling the gates of the highway is not disclosed in Japan. However, every heavy snow season in

E-mail address: [takefuji@keio.jp](mailto:takefuji@keio.jp)

<https://doi.org/10.1016/j.treng.2021.100051>

Received 28 December 2020; Received in revised form 25 January 2021; Accepted 28 January 2021

2666-691X/© 2021 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

the last 3 years, smart highways have consistently stranded many vehicles on highways in Japan so that we may be able to assume that the weather-activated-gate policy is not properly implemented.

According to the committee document in Japan [13], of course, the Japanese road administration also considers vehicle stagnation to be a problem and is trying to make effective use of weather forecast information in order to reduce the occurrence of vehicle stagnation and restore traffic as soon as possible. The following is a general discussion of the environment surrounding road traffic during the winter months as summarized in the Committee document:

- (1) In recent years, the amount of 24-hour snowfall in Japan has been increasing, and heavy snowfalls that cause large-scale vehicle stagnation occur somewhere in Japan every year. On the other hand, with the development of road networks, the car-oriented society, logistics, etc., it has become the responsibility of road administrators to ensure automobile traffic even during heavy snowfall. Thus, as snowfall conditions change and the need to cope with severe snowfall increases, road administrators are required to use weather information in a smart way.
- (2) Japan has taken a step-by-step approach to snowfall in order to secure road traffic: speed limits, chain restrictions, and road closures. However, there is no publicly available data on each of these decisions.
- (3) Committee pointed out that heavy trucks without chains have a significant impact on the occurrence of vehicle stagnation. It is true that the direct cause of the vehicle stagnation may be the drivers who wandered onto the highway, but the road administrators could have prevented the drivers from entering the highway in advance by looking at the weather forecast and local observations.

The weather-activated policy must be changed as soon as possible for mitigating the stranded vehicles on the highway in Japan. In order to build a robust policy for controlling a gate of the highway, the best threshold to open or close gates with predicted snowfall must be scientifically determined.

The weather-activated-gate-control policy should be implemented in order to avoid stranded vehicles on the highways in Japan. Weather forecast is supposed to be used for mitigating the stranded vehicles on the highway but the policy against heavy snow failed.

## Conclusion

In this paper the policy on the highway against heavy snow for controlling gates was examined. Based on this study, all snow-stranded vehicles on the highway were human-induced with inconsistent policy in

Japan. Smart highway management in Japan needs robust verifications for policy improvement. The policy on the highway must be properly implemented against heavy snowfalls, blizzards, freezing rain or sleet, dense fog, high winds, and other weather-related phenomena respectively for mitigating the stranded vehicles.

## Declaration of Competing Interest

This research has no fund. The author has no conflict of interest.

## References

- [1] Japan Times (2020a). Thousand vehicles stranded, 10,000 without electricity after heavy snowfall <https://www.japantimes.co.jp/news/2020/12/17/national/vehicles-stranded-japan-snowfall/>
- [2] Japan Times (2020b). All stranded cars cleared from snow-hit Japan expressway <https://www.japantimes.co.jp/news/2020/12/19/national/cars-snow-niigata/>
- [3] NEXCO eastHighway Management System and Weather Forecast, 2018 [https://www.soumu.go.jp/main\\_content/000557993.pdf](https://www.soumu.go.jp/main_content/000557993.pdf).
- [4] Devon County Council in UK, Road and transport, Winter Service and Emergency Plan 2020-2021 <https://www.devon.gov.uk/roadsandtransport/document/winter-service-and-emergency-plan-2020-2021/>
- [5] Highways in Washington State, Snow and ice control <https://www.dot.wa.gov/publications/manuals/fulltext/M51-01/Chapter7.pdf>
- [6] S.A. Markolf, et al., Transportation resilience to climate change and extreme weather events? Beyond risk and robustness, *Transp. Policy* Vol. 74 (2019) 174–186.
- [7] O. Lock, C. Pettit, Social media as passive geo-participation in transportation planning? How effective are topic modeling & sentiment analysis in comparison with citizen surveys? *Geo-spatial Inf. Sci.* 23 (4) (2020) 275–292 pages.
- [8] D. Zhang, M.R. Kabuka, Combining weather condition data to predict traffic flow: a GRU based deep learning approach, in: Proceedings of the 2017 IEEE 15th International Conference on Dependable, Autonomic and Secure Computing, 15th International Conference on Pervasive Intelligence and Computing, 3rd International Conference on Big Data Intelligence and Computing and Cyber Science and Technology Congress(DASC/PiCom/DataCom/CyberSciTech), Orlando, FL, 2017, pp. 1216–1219, doi:10.1109/DASC-PiCom-DataCom-CyberSciTec.194.2017.
- [9] Japan Times (2020c). Record-low snowfall puts Niigata city's plan to cool Tokyo Olympic venue in jeopardy. <https://www.japantimes.co.jp/news/2020/02/10/national/record-low-snowfall-niigata-cool-tokyo-olympic-venues/>
- [10] Kyodo News Nearly 700 Cars Still Stranded in Heavy Snow in Central Japan, 2018 <https://english.kyodonews.net/news/2018/02/0b60ed42aa1e-1400-cars-remain-stranded-after-heavy-snow-in-central-japan.html>.
- [11] Hundreds of Vehicles Trapped On Highway by Thick Snow in Japan's Fukui Prefecture. <https://www.heraldsun.com.au/news/national/hundreds-of-vehicles-trapped-on-highway-by-thick-snow-in-japans-fukui-prefecture/video/17127840fc0aee2cede288dab86b1633>
- [12] Mainichi Heavy Snow Leaves More Than 300 Vehicles Stranded in Western Japan, Jan. 2017 <https://mainichi.jp/english/articles/20170124/p2a/00m/0na/003000c>.
- [13] Committee to Study Measures to Ensure Winter Road Traffic (2018) Interim report on measures to secure road traffic during heavy snowfall. <https://www.mlit.go.jp/road/ir/ir-council/toukidourokanri/pdf/t02.pdf>