

SUPPORT SERVICE FOR PROVIDING INFORMATION CONCERNING DRIVING SNOWY ROADS DURING WINTER

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ABSTRACT

NEXCO East is a company which constructs and manages the expressways from Tokyo to Hokkaido, which encompasses roughly the east half of the Japanese Islands. The characteristics of the weather during winter within our administration area differ greatly. It snows frequently in northern Japan, but it seldom snows in the capital city area. Therefore, many drivers use normal tires even in winter in the capital city area. When these drivers drive in periods of snow fall, the traffic network is paralyzed because of closures for sliding accidents. This is one of our main issues. In response to this, we launched a website called “Drive Traffic,” which provides traffic information and weather information to a location off-site, in cooperation with ZENRIN DATA COM Co., Ltd. From the numbers of hits, we think the website is gathering a certain appreciation for valuable information. We report the function and the effect of “Drive Traffic” including examples of utility at this site during winter.

1. TASKS FOR SAFETY DRIVING DURING WINTER

1.1 Tasks For Safety Driving On Snowy Roads

1-1-1 Risks of driving with normal tires

In northern regions of Japan which experiences heavy snow, each driver switches normal tires to studless tires when the first snow occurs in winter.

On the other hand, since there are many sunny days even in winter, most drivers in the capital city area keep using normal tires throughout the year, except the drivers of business trucks, buses, and taxis. Therefore, drivers encounter risks on snowy roads in the following cases.

1) When driving from the capital city area to the countryside with normal tires, drivers may have checked the weather at their destination, but they may come across snow in the mountain area on the way, because of a sudden change of the weather, etc.

2) When they experience snow in the capital city area several times a year, drivers may have to drive in the snow by necessity.

1-1-2 Risks of driving under bad weather conditions

Not only drivers in the capital city area, who don't use studless tires, but all drivers are at risk if the road surface condition is suddenly changed because of the deterioration of the weather.

If the road surface condition quickly worsened because of snow, a sudden speed reduction will occur. Therefore, if a driver doesn't notice the speed reduction of the car ahead, the risk of collision will be higher for sudden change in steering or sudden breaking.

Table 1 clearly shows the risk mentioned above as the accident rate (case / 100 million cars · km (the number of accidents per the number of passing cars (100million cars) × length (km)), and the length of closure (km · hr (length (km) × duration (hr))). (#1)

(#1) The amount of closure includes all the closure lengths for accidents, bad weather etc. Compared with the data in other seasons, the values both of accident rates and length of closure are 1.7 times more.

	Winter	Summer	winter/summer
Accident rate (case/100million cars · km)	72.3	42.1	1.72
Length of closure (km · hr)	1,266.3	745.9	1.70

“Table 1 - Comparison of the accident rates and length of closure (monthly average) in winter and in other seasons in 2012 “

1-2 Public awareness for safety driving during winter, which our company conducts

We recognize that to reduce the accident rate and closure during winter is one of the important tasks of ours.

As a countermeasure for these issues, we have conducted an on-site public awareness campaign to use studless tires using two methods.

1-2-1 Public awareness by advising drivers directly

We check if studless tires are used or not at the toll gate in heavy snow areas. And our staff requests drivers, who don't use studless tires, to switch directly to using studless tires. (ETC lanes are not covered because they are non-stopping lanes.)



“Figure 1 - Pictures of studless tire research
 (Left : The Sign at the front, Right : Spot check by the staff) ”

1-2-2 Public awareness by providing information through various media

We urge drivers to use studless tires with signboards, posters, etc.

We also conduct caution alert streaming for snow on the road with signboards.



“Figure 2 - Public awareness for using studless tires with signboards (Left) and the posters (Right) ”

As shown above, we have conducted an on-site awareness and information streaming campaign thus far. However, for traffic disorders from the sudden change in weather etc., the needs of off-site information streaming, which can be accessed from anywhere to obtain traffic information and weather information even before starting driving, are more and more coming into demand by drivers.

For these reasons, we released the website “Drive Traffic.” We introduce the support service for drivers which we have conducted on the website in the following section.

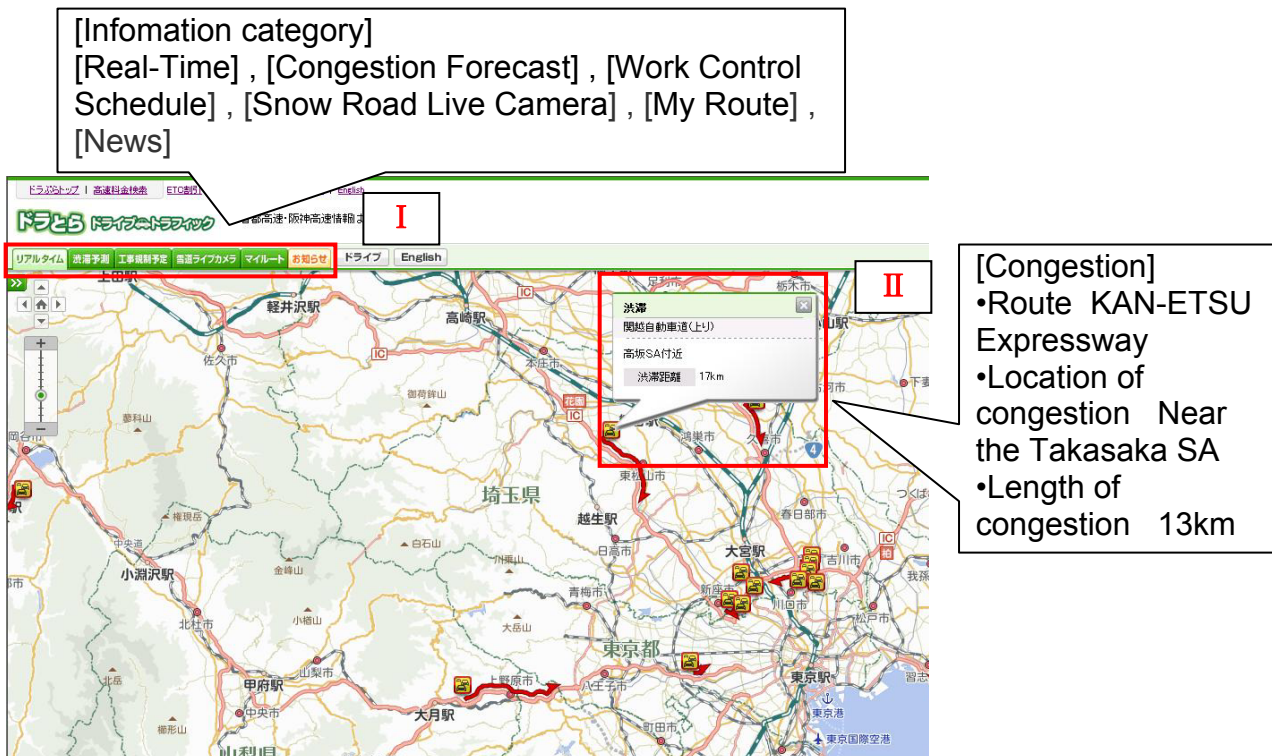
2. THE WEBSITE “DRIVE TRAFFIC”

2-1 Outline of the website

“Drive Traffic” was released in 2009 as a website which provides general traffic information, such as road traffic control and congestion on the expressway. It was only for PC versions and cellphone versions, when it was first released. However, because of the quick spread of smartphones, we have started a smartphone version in 2011.

2-2 The structure of the website

Figure 3 shows the top page of “Drive Traffic (PC version).”



“Figure 3 - The top page of “Drive Traffic (PC version)”

If you access the PC version of “Drive Traffic,” “the real-time traffic information,” which is most requested by drivers, will be displayed as the top page.

As the red box in the picture left-above shows, the website consists of the following: “congestion forecast,” “planned road traffic control,” “Snowy road web-cam,” “My Route (#2),” and “information.” (The smartphone version and cellphone version have the same contents.)

(#2) Refer 3-2-4 for a further explanation of “My Route.”

We introduce the outline of the main contents in the next section of this report.

2-2-1 Real-time traffic information

“Real-time traffic information” is a system to display the latest traffic information, such as closure and congestion, every 5 minutes.

If you click the icon of congestion information, the detailed information will be displayed. (See the red box II in Figure 3)

2-2-2 Congestion forecast

“Congestion forecast” distributes the predicted traffic congestion on the expressways all over Japan (except the Urban Expressways) for the next 6 months, which is predicted with data from the past.

If you input the date and area of expressway, the predicted congestion length and time slots, the time duration which is required to travel will be displayed.



“Figure 4 - Congestion forecast on “Drive Traffic (PC version)”

2-2-3 Snowy road webcam

The “web-cam” provides road images at 90 spots within our administration area and weather information at the 320 observation spots (about 1 spot for one IC, weather information provided every 3 hours a day in advance).



“Figure 5 - The page of Snowy road web-cam on “Drive Traffic” (left) and the picture from the web-cam (right)”

The pictures from the camera and the weather observation data are provided from our original data, which we use for road management. For better use of this data, we provide them to drivers through “Drive Traffic.”

Since the observation spots are on the expressway, our company can provide users with original data, thus we have the following advantages in comparison with other companies.

- 1) We can provide a pin-point weather information on the driving route which the drivers require.
- 2) We can provide snow information at the weather changing points in the mountain areas such as local severe snow events, which are very hard to ascertain with the general weather forecasting system.

The following is an example of the “Snowy road web-cam” as a smartphone version.

Since pictures from the web-cam or hourly weather information at each observation spot, such as weather, road surface, amount of snow, are available, it can be considered that this is an efficient method to provide information for drivers.



“Figure 6 - A picture from the web-cam (left) and the weather information (right) (smartphone version)”

2-2-4 My Route

“My Route is a distribution service for registered users via email. If you register the route which you use most often, you can receive closure information or closure lifting information on the route with emails.

2-3 Examples of the utilization of “Drive Traffic” (On January 14, 2013, when it snowed in the capital city area)

We introduce some examples of how each function of “Drive Traffic” is used. The following are the actual examples on January 14, 2013 (Monday, National Holiday), on which it snowed heavily in the capital city area, based on the actual weather and road conditions.

2-3-1 General situation of heavy snow

On January 14, the low pressure moved to the north east on the south coast of Japan growing rapidly and it brought snow on the Pacific Ocean side mainly in the Kanto region. Especially in the capital city area, the snow started before noon and it continued falling heavily until midnight. Because of this snow, the transportation including expressways were disrupted greatly.

2-3-2 The closure situation in the capital city area (within our administration)

The closure occurred on some areas in the capital city area around noon on January 14. As you see from the map below, the closure occurred in a wide area when the closure length peaked around 18:00 on Jan.14.



“Figure 7 - closure situation in the capital city area on January 14, 2013”

2-3-3 The scenes in which “Drive Traffic” was used according to the situation

We examined the uses of “Drive Traffic” before and after start driving by comparing the length of closure and the number of accesses every hour, as the figure below shows.

2-3-3-1 Before starting driving (In the morning on January 14)

Since no closures occurred in the morning, we assumed that there were many users who wanted to obtain the current and future congestion situation of the expressway and weather information to arrive at the destination before the weather turns bad.

Also, the need to receive the closure information of the route which they were going to use would increase.

Under these conditions, the entire function of “Drive Traffic,” such as “Real-time,” “Congestion forecast,” and “Snowy road web-cam,” started to be accessed.

2-3-3-2 After starting driving (Afternoon to evening on January 14)

The weather turned bad and closure for snow occurred in some areas. The need to grasp the latest traffic situation and weather information to make a detour on the route which is less affected from bad weather increased from motorists who were using the highway.

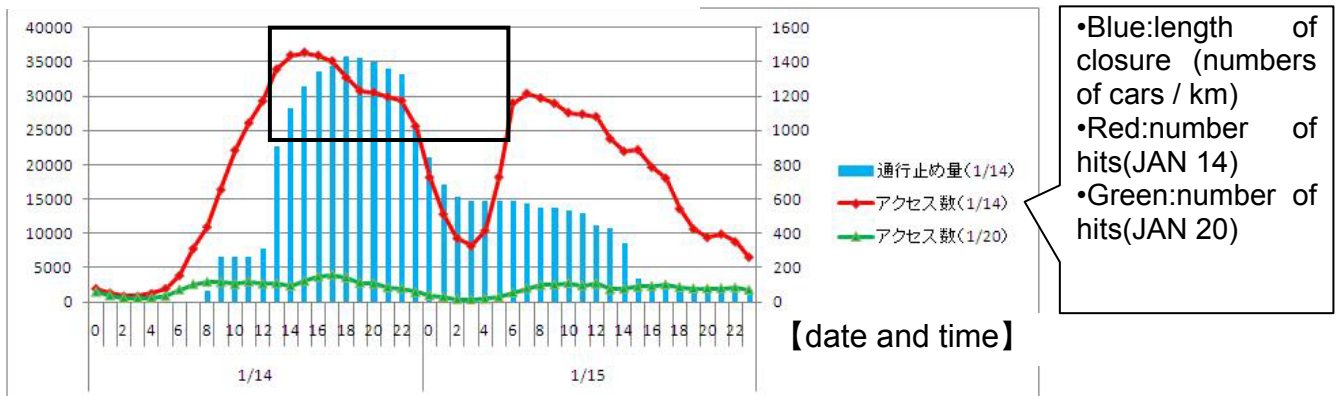
Therefore, the number of accesses to “Real-time” and “Snowy road web-cam” rapidly increased.

Because of the uses listed above, the access details of “Drive Traffic,” mainly the real-time traffic information and snowy road web-cam, from January 14 to January 15, 2013 were as follows. (see Figure 8)

In Figure 8, we have data on January 20 to 21, which was a week after the day concerned, as a sample of the access status in the normal period. The number of hits on January 14 to 15 was about 10 times more than the number of hits in the following week.

【Length of closure(number of cars · km)】

【number of hits】



“Figure 8 - Relation between the number of hits for “Drive Traffic” and the length of closure(number of cars – km)”

You can see the peak for the number of hits and the peak of the length of closure have a few hours time lag in Figure 8. (see the black □)

This is because drivers tried to obtain traffic information and weather information on “Drive Traffic” when the weather turned bad and driving became difficult.

We have examined the uses of “Drive Traffic” by drivers on the expressway on January 14 and 15, 2013, thus far. Now, let’s examine how the utilization of “Drive Traffic” changed the action of drivers specifically by taking the data on the KAN-ETSU Expressway as an example.

2-4 Changes of plan through using “Drive Traffic.”

2-4-1 Selecting a bypass to the national road because of closure

The KAN-ETSU Expressway is a highway which connects Tokyo and Niigata (see Figure 9). On January 14, the area between the Honjo Kodama IC and the starting point on the Tokyo side was closed from 13:00 to 23:15. (There was no closure on the KITA-KANTO Expressway, which could be used as a bypass to Tokyo)

Figure 10 shows the traffic flow when the closure occurred. The drivers from the Niigata side (pink) exited the expressway at Honjo Kodama IC, and made a detour to Route 17 (blue) to drive toward Tokyo.



“Figure 9 - The location map of the KAN-ETSU Expressway (left)”

“Figure 10 - The bypass toward Tokyo when the southern route from the Honjo Kodama IC was closed(right)”

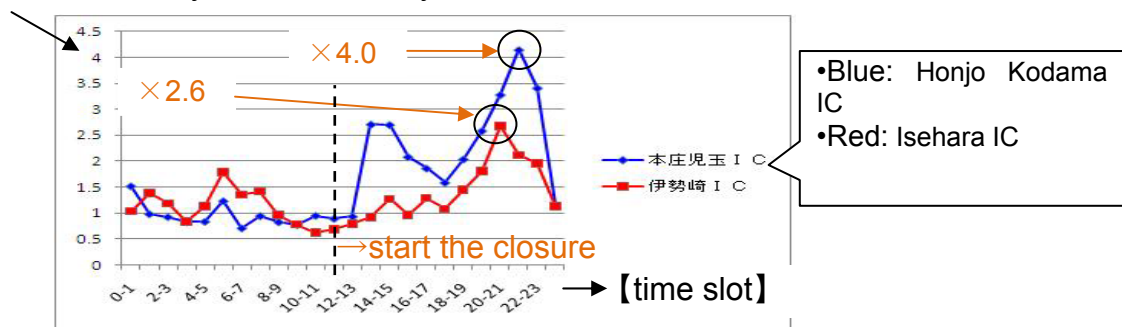
When the area from the Honjo Kodama IC to Tokyo was closed, the hourly amount of traffic at the exit of the Honjo Kodama IC became 4 times greater than usual (#3) between 21:00 to 22:00. (see Figure 11:I)

We assumed this was because there were many drivers who tried to travel as far possible on the expressway, since it is an IC for the drivers who drive from the Niigata side.

(#3) “Usual” means a Sunday with stable weather. In this research, we decided to include traffic data of the following week.

Also, the amount of traffic at the exit of the “Isezaki IC” on the KITA-KANTO Expressway, which has a convenient access to Route 17, kept increasing since the KAN-ETSU Expressway was closed, and the amount of traffic at peak (between 20:00 to 21:00) was 2.6 times more than usual. (see Figure 11:II)

【The ratio of January 14 and January 20】



“Figure 11 - The amount of traffic by every hour at the exit of the “Honjo Kodama IC” on the KAN-ETSU Expressway, at the exit of “Isezaki IC” on the KITA-KANTO Expressway (comparison of January 14, 2013 and January 20, 2013)”

“Drive Traffic” not only provides expressway information, but also is linked to the traffic information websites such as “national roads” which are connected to the expressway.

Therefore, we assume that the users of “Drive Traffic” grasped the congestion status around the Honjo Kodama IC on the KAN-ETSU Expressway and the traffic information of Route 17, and used the information to judge if they should exit the expressway at the Honjo Kodama IC or the Isezaki IC.

Since the road managers of Route 17 can access the Expressway information on “Drive Traffic” anytime, the website contributes to share information or collaboration for road managers.

Therefore, we assume that “Drive Traffic” is used practically by drivers as an efficient method to select a detour when the expressway was closed. We consider that the website had a positive effect on the smooth flow of traffic on the entire road system.

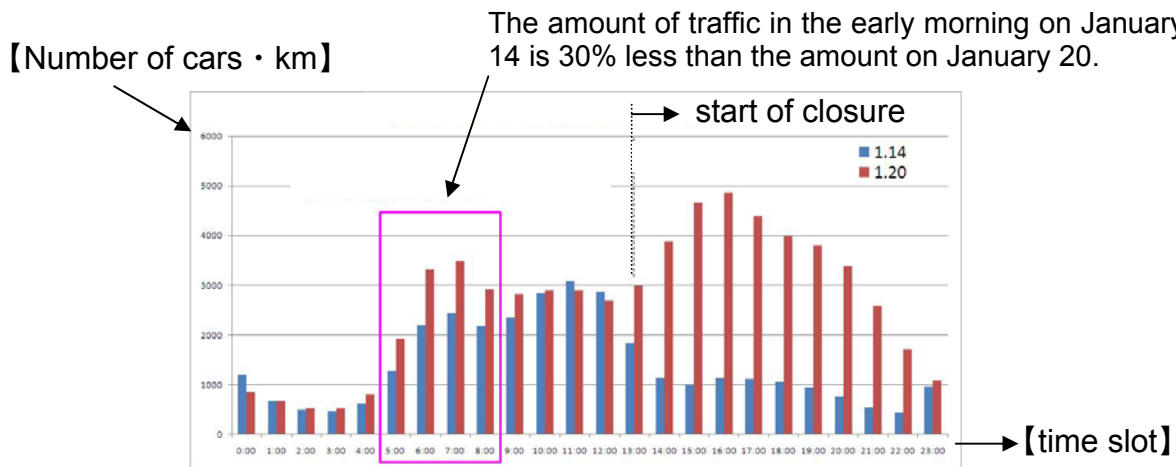
The advantage of these websites such as “Drive Traffic” is to be able to obtain road information anywhere as an invisible information streaming device. If you are away from the rest area on the expressway, where traffic information is available, you can access the information without any signboards or highway radio.

2-4-2 Inhibitory effect

Now, we examine if there are any users who were inhibited in their driving after using the “Snowy road web-cam” information.

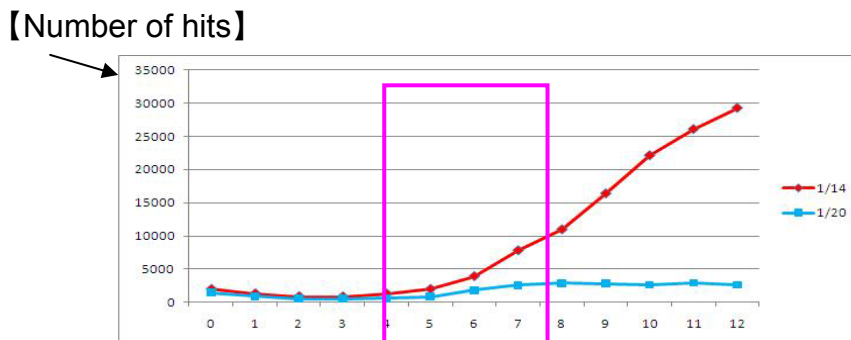
Taking the KAN-ETSU Expressway (the Kanto area) as an example, we compared the amount of traffic before the closure on January 14 to the amount of traffic at the same time slot on the following Sunday.

The amount of traffic in the early morning (between 5:00 to 8:00) on January 14 is 30% less than the amount on of January 20. (see Figure 12)
 This means that there were users who were inhibited driving on the expressway for various reasons.



“Figure 12 - Hourly amount of traffic on the KAN-ETSU Expressway (the Kanto area) (comparison of January 14 and January 20)”

On the other hand, reviewing the numbers of hits to “Drive Traffic” in the same time slot, the difference started at 5:00 in the morning.
 As a result, we assume that there are some drivers who were inhibited driving because they accessed “Drive Traffic” and obtained information. Therefore, we consider that the website was efficient as a method to obtain information before starting driving.



“Figure 13 - The number of hits to “Drive Traffic” in the morning (Comparison of Jan.14 and Jan.20) ”

3. CONCLUSION

Concerning driving on snowy roads during winter, we draw attention to the following two issues in the previous part of the article.

- 1) Risks of driving on snowy roads without using studless tires
 - 2) There are more accidents and closures during winter compared with the other seasons.
- With this in mine, providing fresh information, such as road images and weather forecasts, on “Drive Traffic” must influence drivers as follows.

- The website is used as one of the reasons for selecting a detour route on another expressway or national road, when there is closure.
- Since drivers, who don’t use studless tires or who are worried about driving in snow, inhibit driving when it snows, it has an effect to prevent traffic accidents.

From these results, we can expect a reduction in accidents, a reduction of closure for accidents, and a smoother traffic flow, if more users obtain traffic information from “Drive Traffic.”

We would like to improve the function of “Drive Traffic” as a method of extending our service with corresponding information technology innovation for the betterment of society.

4. DATA SOURCE

- All the data in this thesis (NEXCO East)