Safety Management for Expressway Maintenance in Japan

July 16, 2019
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West Nippon Expressway Co. Ltd.
Corporate Profile

- Company name: West Nippon Expressway Company Limited
- Representative: Kazuhiro Sakai (President, CEO)
- Date of establishment: October 1\textsuperscript{st}, 2005
- Toll road operation: 3,513km (As of April 2018)
- Number of Traffic: 2.86 million per day (Average in FY2017)
- Shareholders’ equity: 430 million USD
- Toll Revenue: 7,115 million USD (FY2018)
- Associated revenue: 306 million USD (FY2018)
- Employees: 2,431 (As of March 2018)
- Head office: Osaka, Japan
• West Nippon Expressway Co. Ltd. (NEXCO-West) is a successor of the former Japan Highway Public Corporation (JH) which had been a government-backed organisation.

• Since JH was established in 1956, it had been contributing to develop expressway network in Japan for more than 60 years.

• In October 2005, JH was privatised and divided into three private companies. NEXCO-West was one of them, and has been constructing and operating the expressways in western Japan.
Serious Accident Risk Management

● Concept of serious accident risk management

- In NEXCO-West, based on the awareness that “construction cannot be completed without securing safety” and “owners and contractors work together to enhance the construction safety”, Serious Accident Risk Management System has been established and operated to achieve our common goal of “contribute to society by completing construction on time with safety and quality” and become a company trusted by the society.

- Accidents with high frequency but small negative social impact are mainly prevented by contractor’s own safety and health management, on the other hand, the ones with low frequency but huge negative social impact are eliminated by both owner (NEXCO-West) and contractors.
**Scheme of Serious Accident Risk Management**

- **Efforts for improving construction safety**
  - **NEXCO-West (owner)**
  - **Construction company (contractors)**
  - Construction contract
  - Develop construction and safety management plans
  - Extract serious accident risks during construction

- **<Serious Accident Risk Assessment>**
  - Based on construction plan developed by contractors, items below are confirmed and discussed between NEXCO-West and contractors:
    - Items shown in construction and safety management plans are confirmed in document
    - Extracted risks are confirmed in document and at site
    - Necessity of preventive or corrective actions is discussed as required

- **<Strengthening safety conference activity>**
  - Activities in safety conference between NEXCO-West and contractors are strengthened by safety patrols which mainly checks extracted risks in each construction site.

- **Achieve our common goal of “contribute to society by completing construction on time with safety and quality”**
Contents

• Safety management by contractors
  – Operation manual
  – Safety construction cycle

• Safety management by NEXCO-West and contractors
  – Serious accident risk assessment
  – Safety patrol
  – Safety education for NEXCO-West and contractors

• Applying and developing products for accident prevention
Operation manual is regarded as a guide for workers to achieve their work during construction.

The manual must satisfy the requirements below;

- Accidents and disasters never occur as long as following the manual.
- The operation should be safe, correct, fast, and not hard.
- Without waste, unevenness, and unreasonable, it should be effective to improve work efficiency and ensure the quality.
- Every workers can perform the operation with the manual.
- Past lessons such as accidents and disasters should be reflected.

The manual should be specific, simple, and easy to understand and operate. It should be performed by workers with good understanding.
### An Example of Good Construction Operation Manual

<table>
<thead>
<tr>
<th>Step</th>
<th>Not good</th>
<th>Better</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Call a crane</td>
<td>• In understandable way</td>
<td>One worker gives a signal with big motion</td>
</tr>
<tr>
<td>2. Do slinging work</td>
<td>• Not to lose a load balance • Surely</td>
<td>Confirm the load balance from two directions and keep the angle between two slings from 30° to 60°</td>
</tr>
<tr>
<td>3. Lift the load and confirm sling fixing condition</td>
<td>• Not to collapse it</td>
<td>Set support slings to prevent the load from swinging</td>
</tr>
<tr>
<td>4. Lift the load up</td>
<td>• Gradually • Slowly</td>
<td>Separate workers 3m from the load and operate in slow lift up mode</td>
</tr>
<tr>
<td>5. Move the load</td>
<td>• Confirming safety</td>
<td>Follow the lead of support slings</td>
</tr>
</tbody>
</table>
Safety Construction Cycle

● Safety construction cycle is an activity which aims to eradicate worker’s accidents during construction by integrating operation and safety on work site, after combing supervision by prime contractor and independent safety activities by safety and health manager and workers to daily operation work.

● The activity of “Safety Construction Cycle” is set as routine work such as daily, weekly, and monthly, and implemented continuously by improving and enhancing.
Process of Safety Construction Cycle (Daily)

Morning assembly (entire) → Safety meetings (each work group) → Inspections before work → Patrons by overall safety and health manager

Cleaning on work site → Work preparation for next day → Supervision during construction work → Safety schedule meetings
Process of Safety Construction Cycle (As Required)

Pre-meeting with new entry workers

Safety training for new entry workers

Notification of equipment etc.
Serious Accident Risk Assessment

Process of serious accident risk assessment

1. Develop construction and safety management plans
2. Extract serious accident risks and examine safety measures
3. Estimate timing when serious accident risk will occur
4. Verify the extracted risk in document based and at the site
5. Develop preventive or corrective actions as required

Start construction work
Serious Accident Risk Assessment

- Visualization of serious accident risks

1. Fall of elevating scaffold
2. Fall of workers

(Risk on a road in front of abutment 1)
- Fall of elevating scaffold
- Fall of brackets for bridge fall prevention

(Risk on a road in front of abutment 2)
- Fall of brackets for bridge fall prevention
- Loads collide with and cut lightning cables attached on bridge balustrade during unloading work from Hanwa expressway
- Brackets for bridge fall prevention collide with and damage water pipes or communication cables during its installation.

(Risk during disassembling scaffold)
- Crane loads collide with workers

(Risk on the expressway)
- Crane falling on adjacent traffic lanes
### Extract serious accident risks by contractors

<table>
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<tr>
<th><strong>Extracted serious accident risks</strong></th>
<th><strong>Required safety measures</strong></th>
<th><strong>Inspection Item</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane falling down</td>
<td>Ensure required width of stretched outrigger</td>
<td>Work group leader confirms that width of stretched outrigger satisfies required size</td>
</tr>
<tr>
<td></td>
<td>Display rated load according to width of stretched outrigger</td>
<td>Work group leader confirms the weight of load before lifting</td>
</tr>
<tr>
<td>Crane loads contact with workers</td>
<td>Prohibit entry within the radius of crane working area</td>
<td>Work group leader confirms installation of safety cone and caution sign for the entry prohibition</td>
</tr>
<tr>
<td></td>
<td>Prevent crane loads from swinging</td>
<td>Crane loads are fixed by safety (support) sling</td>
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● Estimate timing when serious accident risks will occur

When the risk will occur? By when safety measures should be prepared?
Verify serious accident risks between NEXCO-West and contractors

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Possible risk is newly add based on the checks

Fall of brackets for bridge fall prevention to road under the expressway

Regulate traffic on road under the expressway during unloading

Enforce traffic regulation
Safety Patrol between NEXCO-West and contractors

- Safety patrol by NEXCO-West and contractors together
  - Safety patrol is an activity for accident prevention that eliminates apparent or potential accident risks at work site.
  - Safety patrol examines especially site where serious accident risks are suspected, and implementation and effects of safety measures are confirmed too.

- Result report of safety patrol
  - Risks pointed out in safety patrol are shared between NEXCO-West and contractors.
  - Contractors submit corrective reports to NEXCO-West after implementing additional safety measures against the risks.

<table>
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<th>Opening in work place</th>
<th>Filling in the opening</th>
</tr>
</thead>
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<tr>
<td>Before</td>
<td>After</td>
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● Sharing information pointed out in safety patrol

Points to check prohibition of entry

- **chunks of dust, debris, etc.**
  - Ensure the safety zone is free from dust, debris, etc.
  - Maintain cleanliness in the safety zone.

- **inuse equipment, etc.**
  - Ensure all equipment is in use.
  - Check that all equipment is operational.

- **instruct personnel**
  - Ensure personnel are trained.
  - Regularly conduct safety drills.

- **checklist for entry**
  - Ensure all equipment is accounted for.
  - Confirm that all personnel are accounted for.

Risks pointed out

- **checklist for entry**
  - Ensure all equipment is accounted for.
  - Confirm that all personnel are accounted for.

 Correction

- **safety zone**
  - Ensure the safety zone is free from dust, debris, etc.
  - Maintain cleanliness in the safety zone.

- **inuse equipment, etc.**
  - Ensure all equipment is in use.
  - Check that all equipment is operational.

- **instruct personnel**
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- **checklist for entry**
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Safety Education for NEXCO-West and Contractors

 Sharing information of accident examples

事故の概要

事故の型分類

建築・転落

工事

耐震補強工事

耐震補強工事に伴う構造物周辺に設置された柵子を作業員が通る途中で足を滑らせ、体をなすと転落したため

一般的な事故原因

柵子昇降に対する危険意識の欠如（3点支持しながら昇降する認識がなかった）

転落対策（安全ブロック等）が不十分

安全確認のポイント

新規入口時やKYO等で転落リスクを想定した安全教育が徹底されているか

柵子の昇降は、3点支持（両手・足の4点のうち、3点により身体を支えた状態）をとっているか

安全があると思われる施設を持って昇降しているか

必要に応じて転落を防止するための安全対策（安全ブロック等）を講じているか

関係法令等

安全確認のポイント

架空線等新規作業中は監視員が常時監視しているか

元請けは、監視員が作業を離れる場合の連絡体制、作業停止などの手順が明確に定まっていたか

安全確認のポイント

関係法令等

関係法令等

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Developing products for accident prevention

Traffic cone installing and removing vehicle: “Robo Cone”

- Robo cone is a maintenance vehicle to install and remove safety cones operated by only one driver, and it takes 8 min to install the cones in 2 km and 12 min to remove them.

- In conventional operation, 4 kg of cones were installed and removed manually that was a heavy burden for workers as well as extremely dangerous, because they had to lean out from cargo bed while other vehicles were passing on adjacent lanes. Therefore, Robo cone can improve workers safety and relieve their burden.
ロボコーン
標識搭載型ラバーコーン自動設置回収車
Developing products for accident prevention

Vehicle Stop Device: “Tomaruzo II”

- Tomaruzo II is a supplemental device installed at the traffic regulation start point to stop a vehicle safely which accidentally enters into the regulated zone in the shortest distance.
- After collision with the device, front tires of the vehicle are lifted on the arm of the device by principle of leverage, and with the weight of vehicle, friction resistance between special rubber under the device and road surface stops the vehicle forcibly in the shortest distance.
- Also, there is no huge impact on a driver because the device can stop a vehicle by sliding together.
とまるぞーⅡ（大型車両用）
とまるぞーⅡ 設置時
Emergency escape transmission helmet: “K・HO-MET”

- At construction sites in traffic regulation, accidents where workers are injured or killed due to careless driving vehicles entering a traffic regulated area have been continuously occurred.
- To escape promptly, emergency information has to be certainly transmitted to all workers.
- The purpose of this helmet is to ensure worker’s safety by transmitting a danger surely and urging prompt escape, using vibration which is hardly affected by

Each workers can send and receive emergency signal.

Emergency signal is transmitted through associated systems

- This is no effect on surrounding area, such as hearing difficulties, noise because it is not sound-based transmission
- In case using relay device, receiver may react twice with the signal from transmitter and one via relay device, but it is not fault in the equipment.
危険発生を振動でヘルメットに伝える！
K・HO-MET
手動ボタン式発信機
ヘルメット振動型受信機
Summary

• Contractors implement safety management below,
  – Operation manual
  – Safety construction cycle

• NEXCO-West promotes various measures for construction safety in collaboration with contractors below,
  – Serious accident risk assessment
  – Safety Patrol
  – Safety education for employee

• NEXCO-West applies and develops new products for accident prevention.