INTERNATIONAL RAILWAY SAFETY COUNCIL 2022

IRSC Spain

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INTERNATIONAL RAILWAY
SAFETY COUNCIL

SEVILLA, OCTOBER 16-21, 2022

KORAIL
KOREA RAILROAD

EUROPEAN UNION AGENCY FOR RAILWAYS

AESF AGENCIA ESTATAL DE SEGURIDAD FERROVIARIA

adif

RYU, JEONG HYEON

Safety General HQ / KORAIL

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INTERNATIONAL RAILWAY SAFETY COUNCIL
SEVILLA, OCTOBER 16-21, 2022

Strengthening the Safety of Track workers

Using Train Access Alert App and Management Information System

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CHAPTER 1

About KORAIL

1.1 About KORAIL

- KORAIL operates the overall railway business in Korea(105 routes, 4,127.7km) with 31,024 employees

Transportation

KTX 10.2 mil pax / day

Conventional Trains
11.6 mil pax / day

Metro 240 mil pax/day

Logistics
72,000tons / day

Operating 3,385times per day ▶ 261mil Passengers 7,2000tons Logistics (Sales of 6.4 billion won per day)

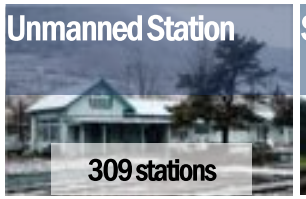
(As of December 2021)

Business Development

Rolling Stock Maintenance

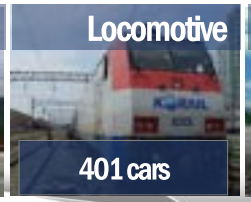
Track Maintenance

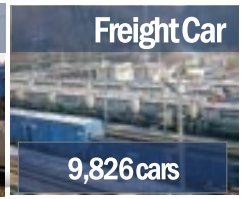
687 stations : 337 ordinary stations(80 Management Stations)



※ 60 High Speed Railway Stations

15,787 Rolling Stocks





(Unit : km)

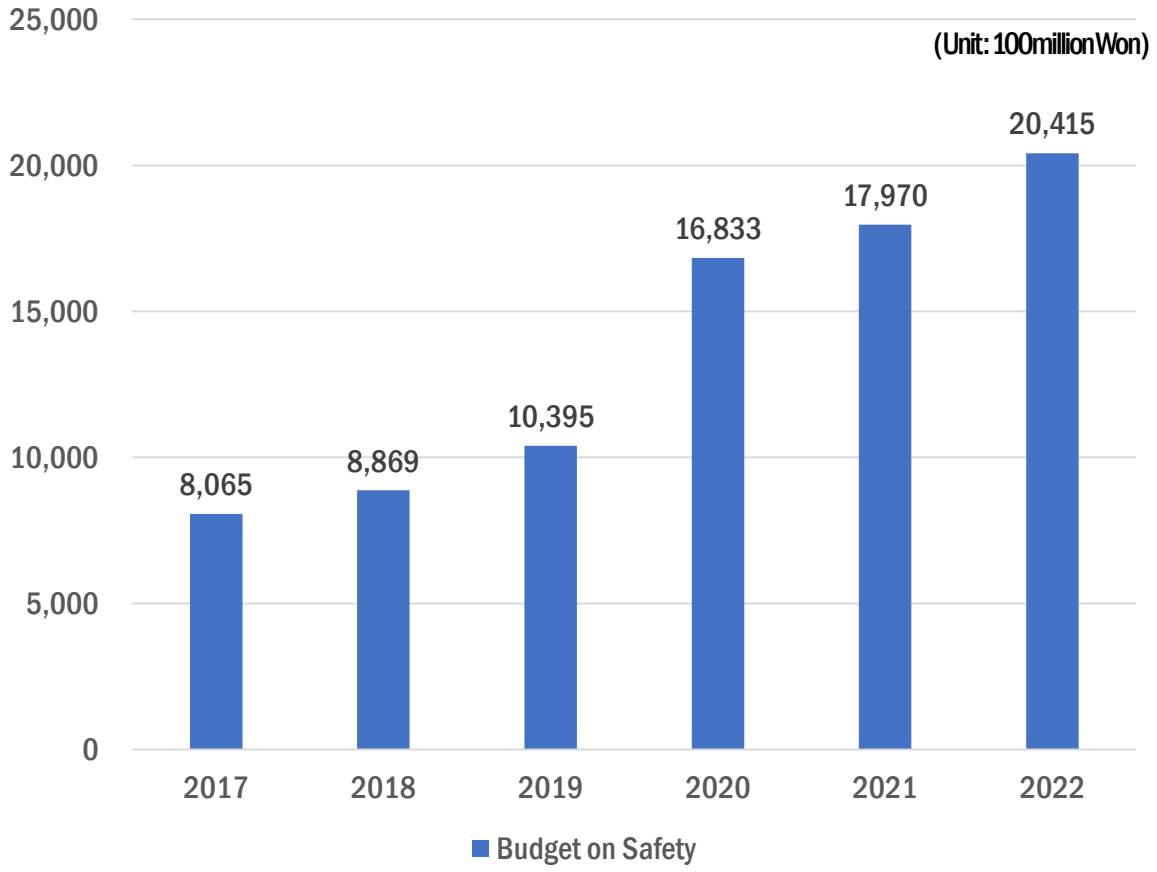
Total Routes	Total Rail Distance	Operating Distance			Double Track Distance		Metro Distance	
		Passenger	Logistics	Metro	Distance	Ratio	Distance	Ratio
105	4,127.7	3,862.8	3,103.6	643.9	2,882.6	69.8%	3,212.6	77.8%

※ Total Rail Distance : 4,127.7km(High Speed Rail: 596.3km, Conventional Rail: 3,531.4km)

※ Operating Distance : Exclude industrial tracks near the depots and others not used for passengers/logistics

1.2 KORAIL's Investment in Safety

- The investment is continuously increased and KORAIL spent 2trillion won in 2022 (2.5 times compared to 2017)



[Major Invest Plans for Safety in 2022]

① Policy Improvement and On-Site Capability Securement (1 billion won)

Promote international treaties,
Enhance self-reporting system and publicize excellent safety cases

② Rail Workers' Safety Ability Empowerment (21.7 billion won)

Supplement safety facilities to prevent from falling and conduction
KOSHA Certification
Outsource training session and nurture key talents by fields

③ Rolling Stock Management Systematization (1.957 trillion won)

Purchase rolling stock cars and parts, rolling stock safety diagnosis, etc.

④ Expansion and Improvement of Safety Facilities (896.1 billion won)

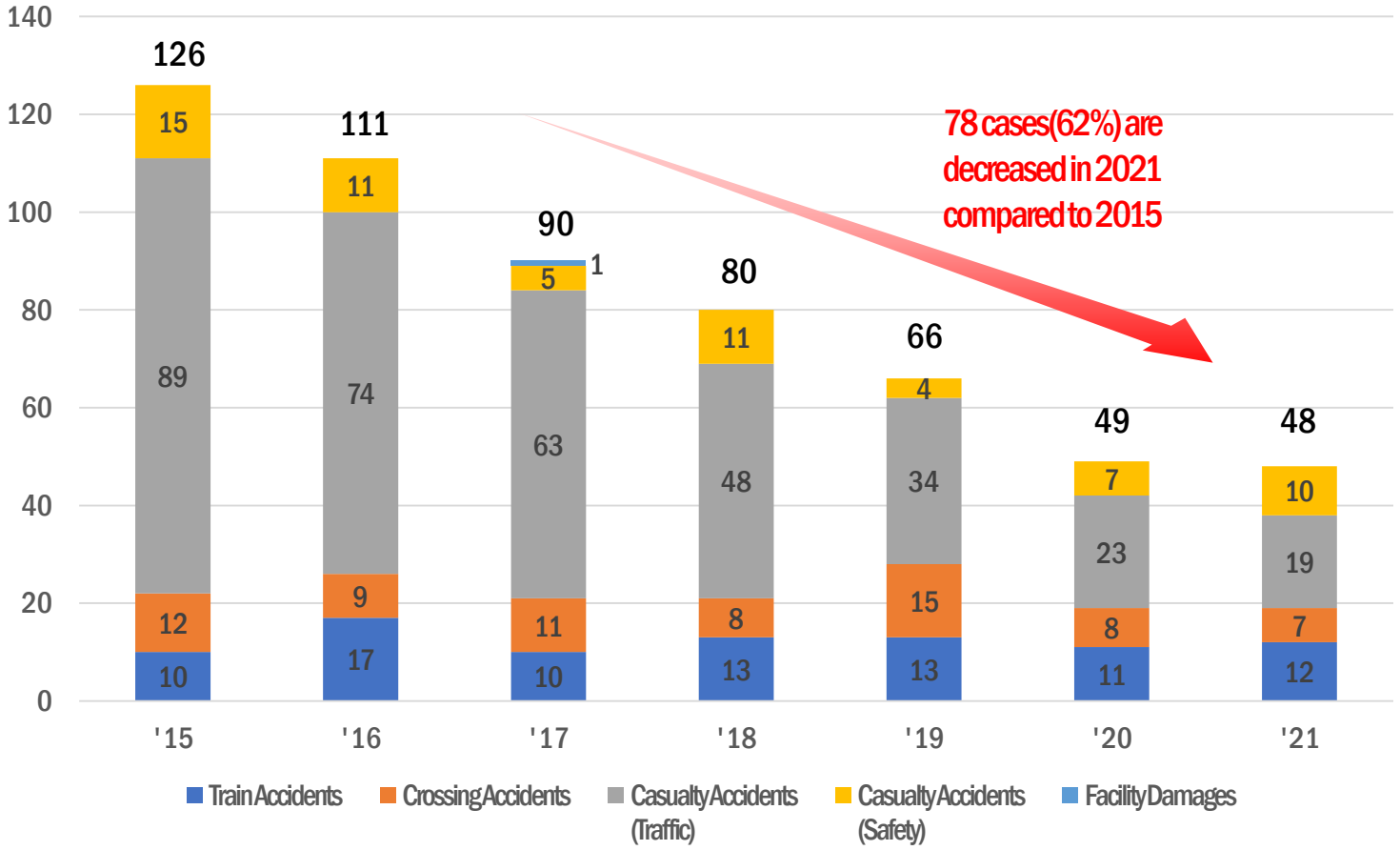
Improve old facilities including stations, depots, accommodations
Improve old tracks, equipment, electric installation

⑤ Reinforcement of Railway Safety Research (24.2 billion won)

Boost technology R&D for foreign dependent parts (braking pads, reduction gear, etc.)

1.3 KORAIL's Outcome in Safety

- Railway Accidents are decreasing in 62% since 2015, maintaining a continuous decline



[Railway Accidents]

- (Train Accidents) Derailment, crashing into something or each other of rolling stocks
- (Crossing Accidents) Crashing accidents among a horse, human or other transportation machinery of a train or a rolling stock at a railroad crossing
- (Casualty Accidents: Traffic) Accidents in which a person killed or injured except for train accidents
- (Casualty Accidents: Safety) Accidents in which a person killed or injured due to a falling, conduction in a railroad facility such as a waiting room, platform or track without fire or damaging accidents
- (Facility Damages) Damaging accidents in a railroad facility such as bridges, tunnels, tracks and equipment for signaling, electricity and communication

1.3 KORAIL's Outcome in Safety

- Compared with the global safety level, Korea secures the 2nd highest safety level in the world as of 2020 (based on ERA)

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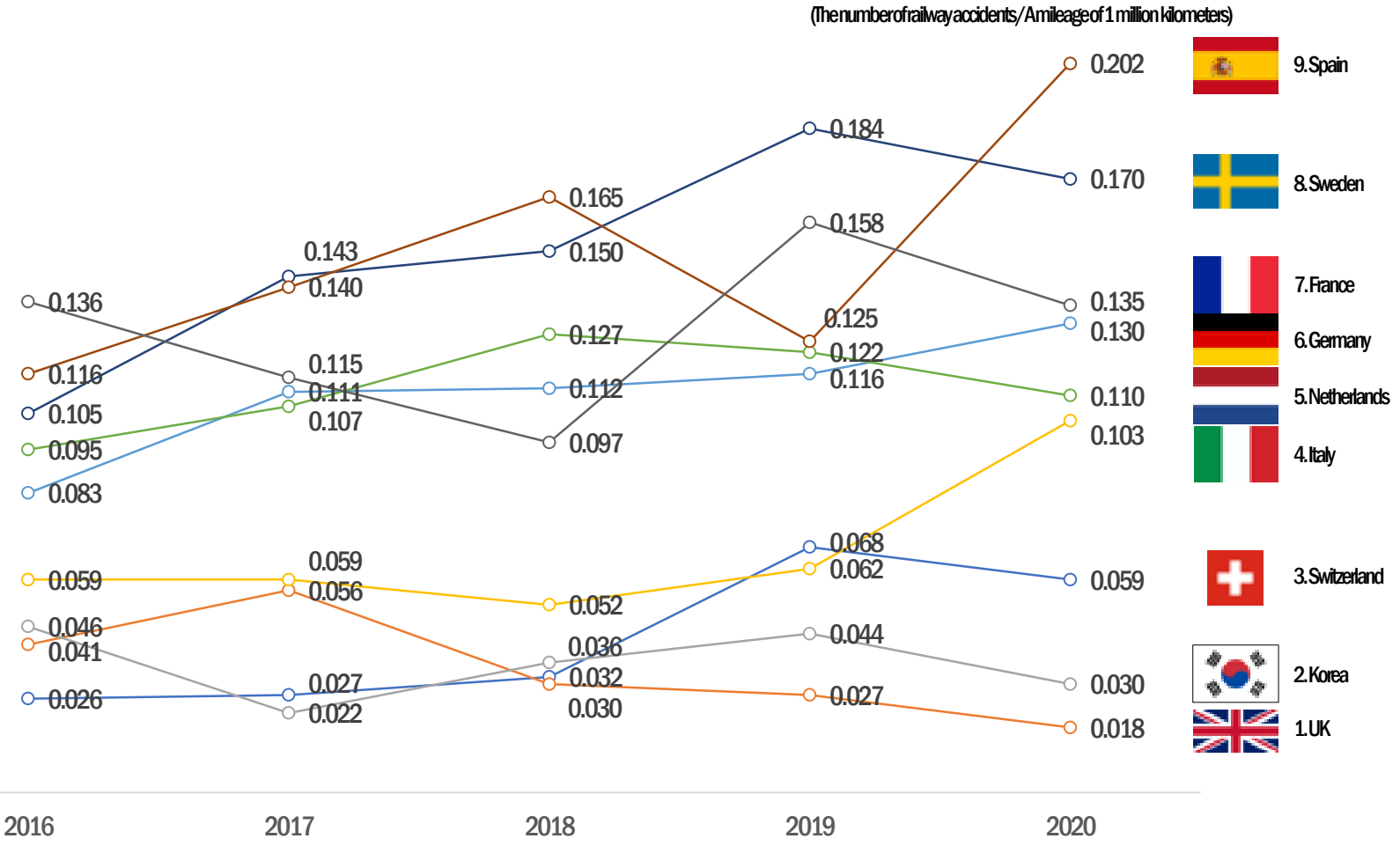


CHAPTER 2

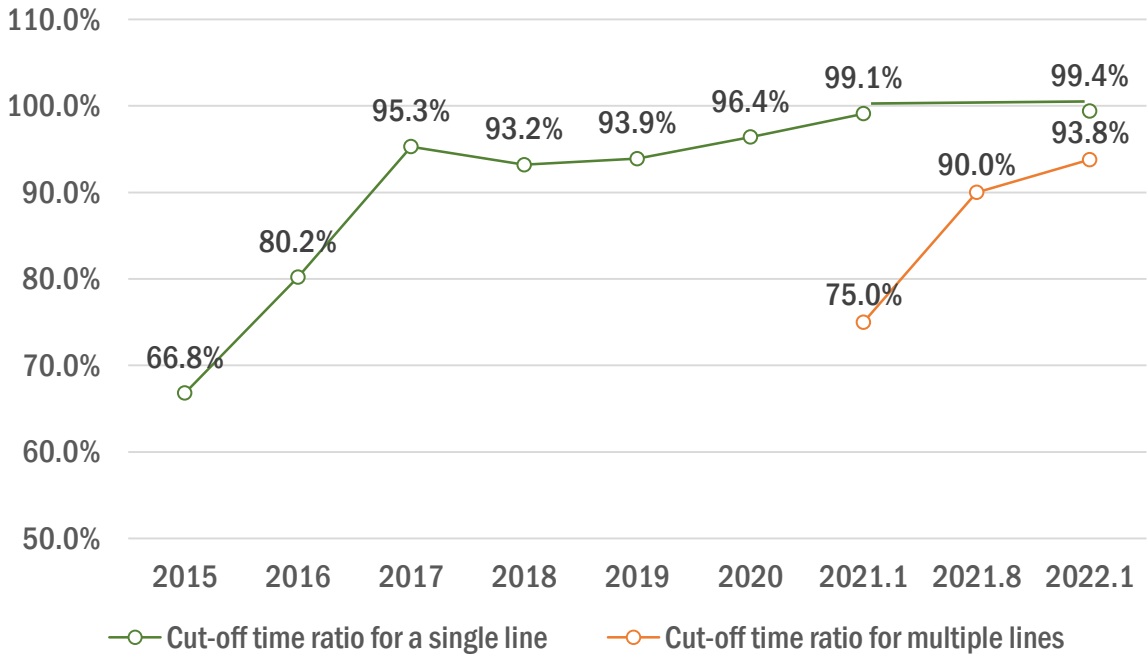
Safety Measures for Track Workers

2.1 The Risk of Track Works

- It is safest not to carry out track works on the operating lines when trains are in service
- KORAIL continuously strives to set aside 3.5 to 4 hours as minimum working hours
  - In addition to the basic working hours, KORAIL constantly tries to provide extra cut-off time for preparation and cleanup for safety

✓ Preparation: Transport materials and tools, move from door to the work site, install short circuit wires and grounding hangers, etc.

✓ Cleanup: Remove short circuit wires and temporary signals, transport waste and tools, check and carry feeders, etc.



※ The ratio indicates track sections that secure cut-off hours (when trains are not running) of more than 3.5 hours

3.5 to 4 hours as minimum cut-off hours is essential for track work safety

2.2 Safety Measures for Track Workers

- It is impossible to carry out all works in a cut-off way in case of unusual situations such as track inspection or natural disasters
- KORAIL places train guards for every work on operation lines and uses the in-house developed Train Access Alert Application
  - Train guards are placed on both sides to monitor train access
  - Train guards alert the worker of the train access to evacuate to a safe place
  - Train drivers can notice the obstacles so that safe train operation is guaranteed
  - The train operation is immediately stopped if there is any disruption

[The Criteria for Placing Train Guards]

- ✓ In a double track, block one and place train guards on both sides when the other one is in operation
- ✓ In a double track, place train guards on both sides when both lines are under construction
- ✓ In a single track, place train guards on both sides
- ✓ Increase train guards where trains are frequently running or along curvy lines

2.3 The Train Access Alert App

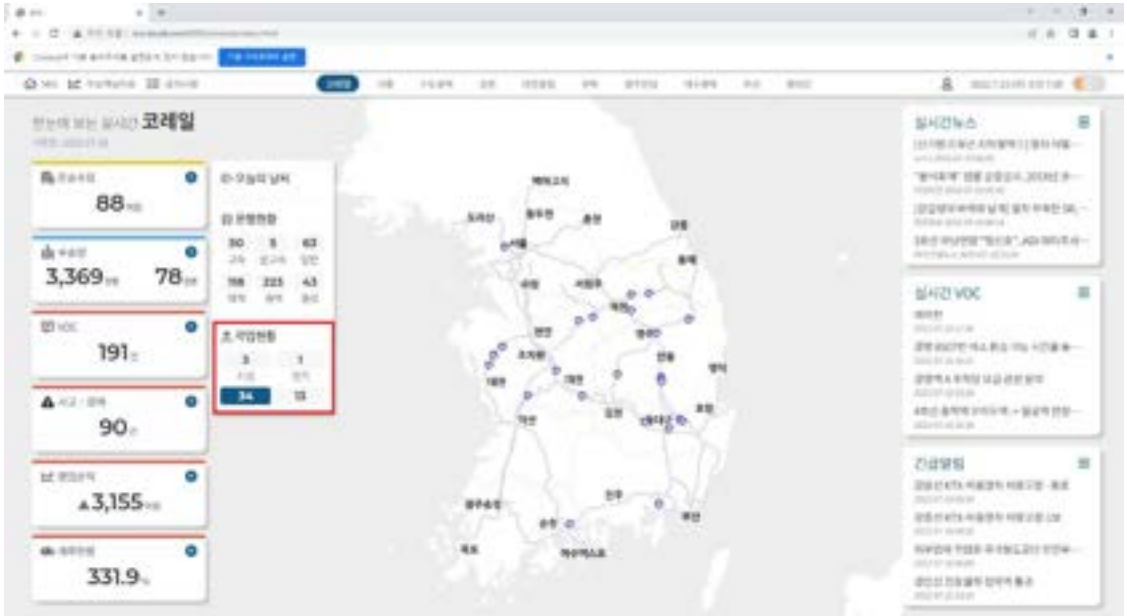
- In addition to the train guards, KORAIL manages the in-house developed Train Access Alert App to check trains approaching the worksite so that workers can evacuate in time
  - The Train Access Alert App sounds an alarm for the worker when the train approaches the worksite within 2 to 5 km, using the location information from the GPS system and train operation information from the CTC system
  - At the same time, the Navigation System in the locomotive warns the driver of the location of the worksite based on the GPS information from the App

✓ Drivers' Navigation System: It alerts the location of the worksite to train drivers to drive carefully

✓ Train Access Alert App: It sounds an alarm that enables the worker to evacuate when the train approaches

2.4 Monitoring Work Status via MIS System

- Once the Train Access App is activated its location information is displayed on the “Work Status” tab in the MIS system
  - The user can browse work status sorted by civil engineering work/electrical work, and the upper part of the screen shows the location of KORAIL workers and the bottom part shows the location of subcontractors
  - When clicking the icon of the location, detailed information appears
    - (KORAIL Workers) affiliates, phone numbers of the app
    - (Subcontractors) names of employer and contractor, project names, phone numbers of the app



[MIS – “Work Status” screen]

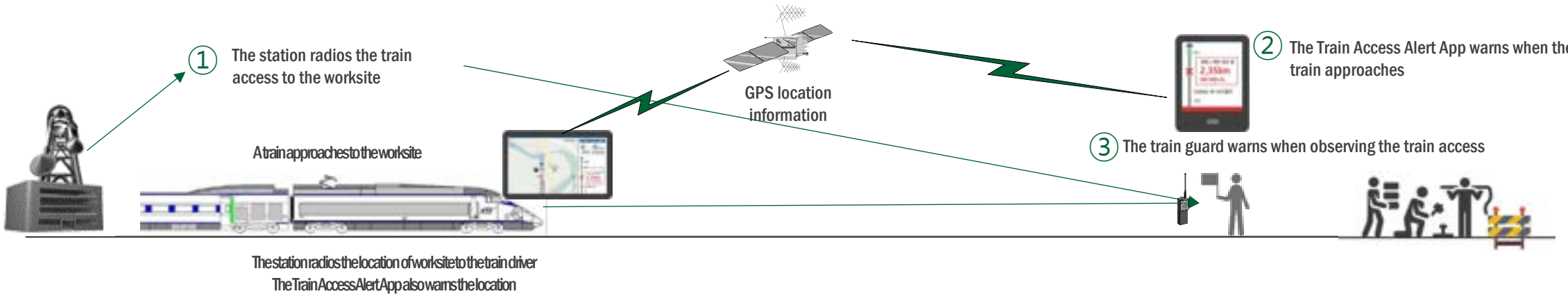
[Detailed information of KORAIL workers]

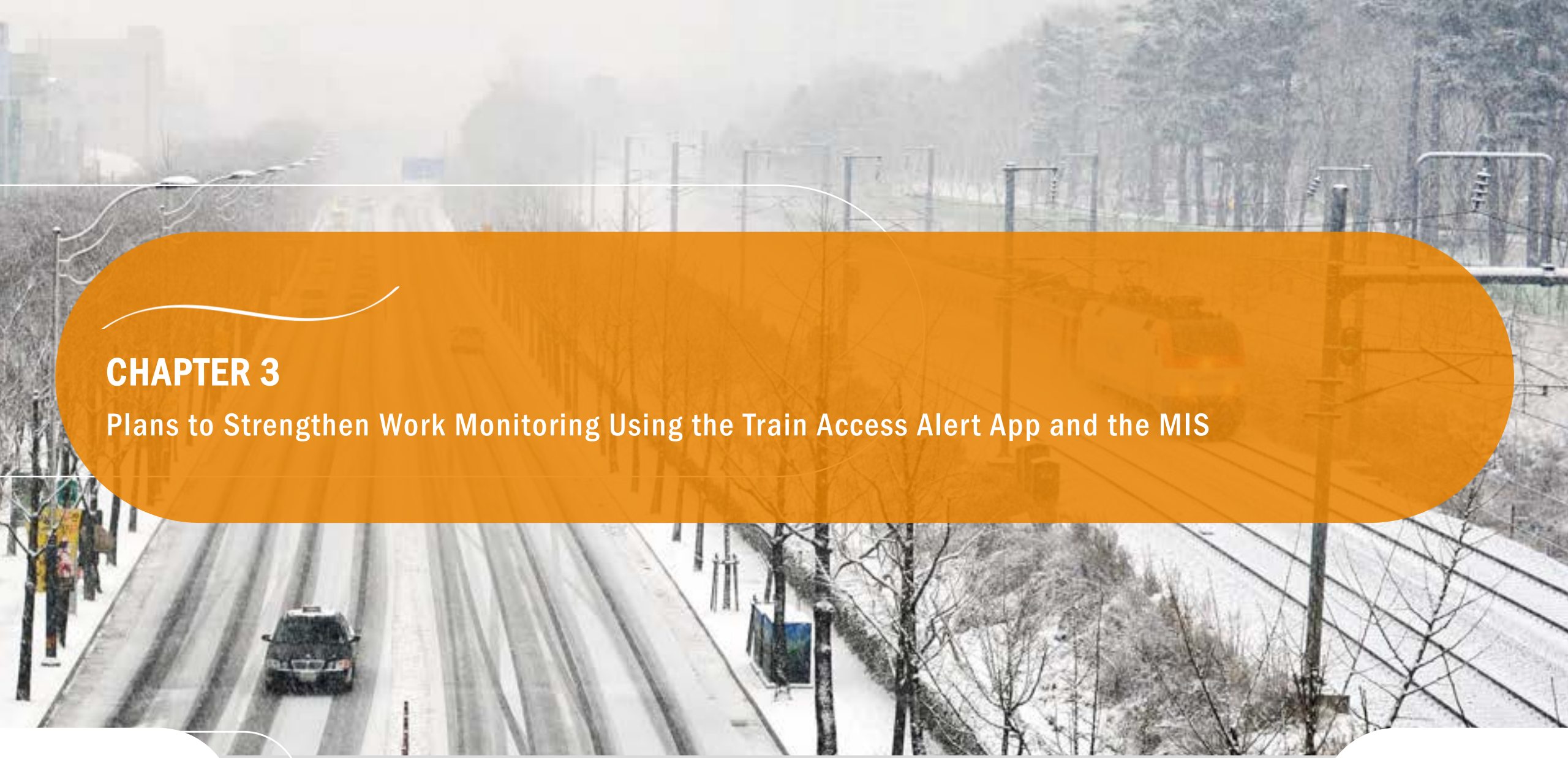
[Detailed information of subcontractors]

2.5 Considering Enhancement of Track Workers' Safety

- KORAIL manages multiple safety measures, but more definite method is needed to secure track workers' safety
  - If the worker doesn't hold or activate the app, train access alerts are made by humans such as the stations' radio communication or train guards and the location cannot be found in the navigation system or MIS (some workers don't use the app due to urgent work)
  - Even if using the app, it is difficult to check the work is in progress at a pre-negotiated section or time

Parallel safety measures by humans and by the system





CHAPTER 3

Plans to Strengthen Work Monitoring Using the Train Access Alert App and the MIS

3.1 Deriving Ideas for Improvement

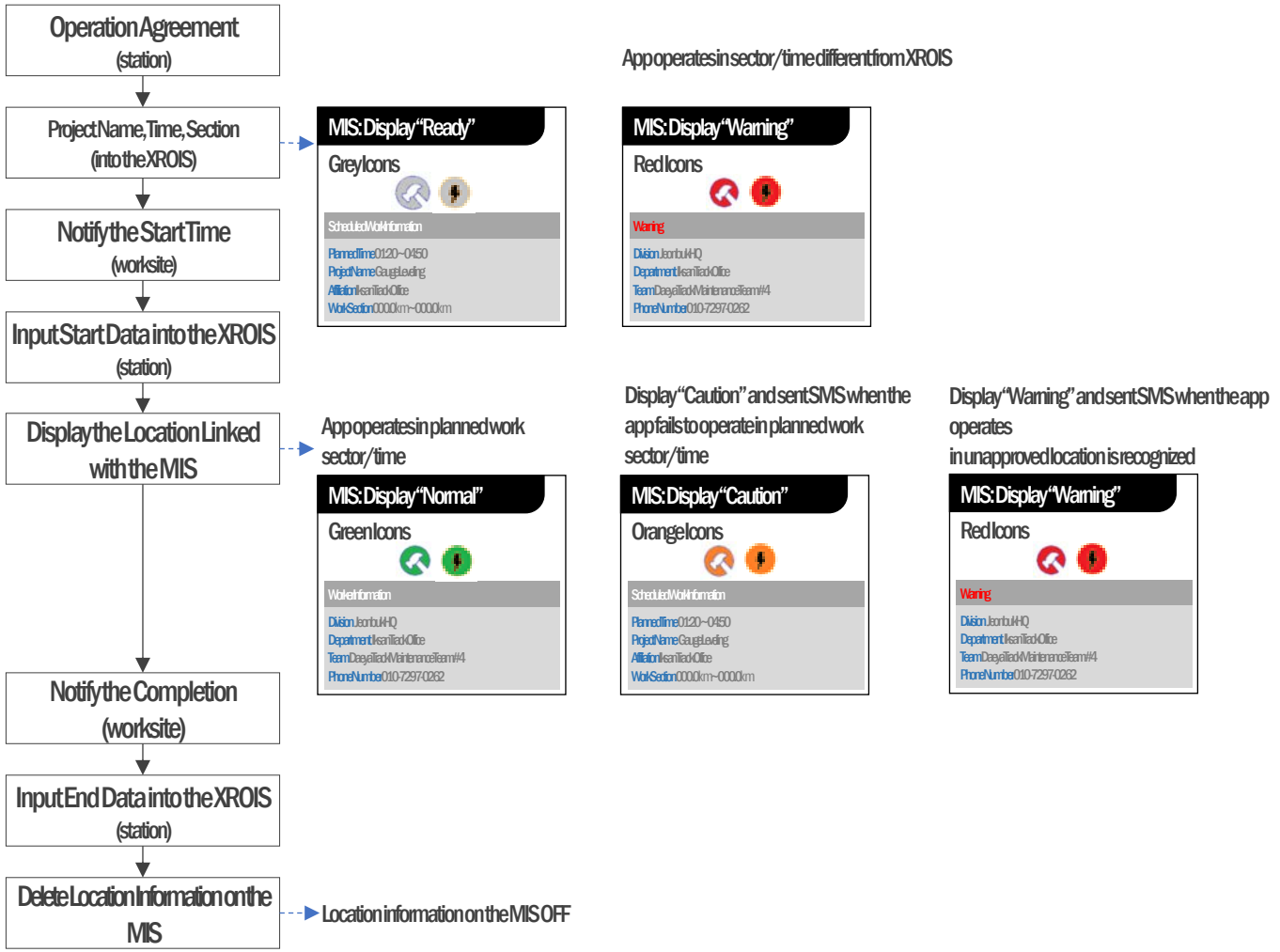
- How can we monitor the workers are using the Train Access Alert App at the worksite?
  - Consultations about the time, location, and objective are needed with the station near the worksite before all works around the railway
  - All stations take responsibility for approving the start of the task and being notified of the completion for safe operation

- How about upgrading the “Work Status” function in the MIS from a simple browsing page to a safe managing page?
  - If we mark the worksite approved by the station and link it with time/location information, we can monitor whether the app is being used or not
  - Therefore, we can establish a system that ensures safety at the worksite

Integrate monitoring tasks in the app and the safe operation agreement, which are separated before

3.2 Planning New Procedure

- Reinforce monitoring procedure by integrating the XROIS system, the Train Access Alert App, and the MIS system to link the Safe Operation Agreement, approved work schedule, and GPS information from the app
  - Once the Agreement with the station is completed, input the data including project name, section, time into the XROIS (the station or task manager)
  - The MIS displays planned work section based on the Agreement from the XROIS
  - When the station approve to start the scheduled work, change the status into the start mode in the XROIS
  - The MIS displays "Normal" or "Caution" based on the location information form the app
  - If unapproved location is recognized, the MIS displays "Warning"



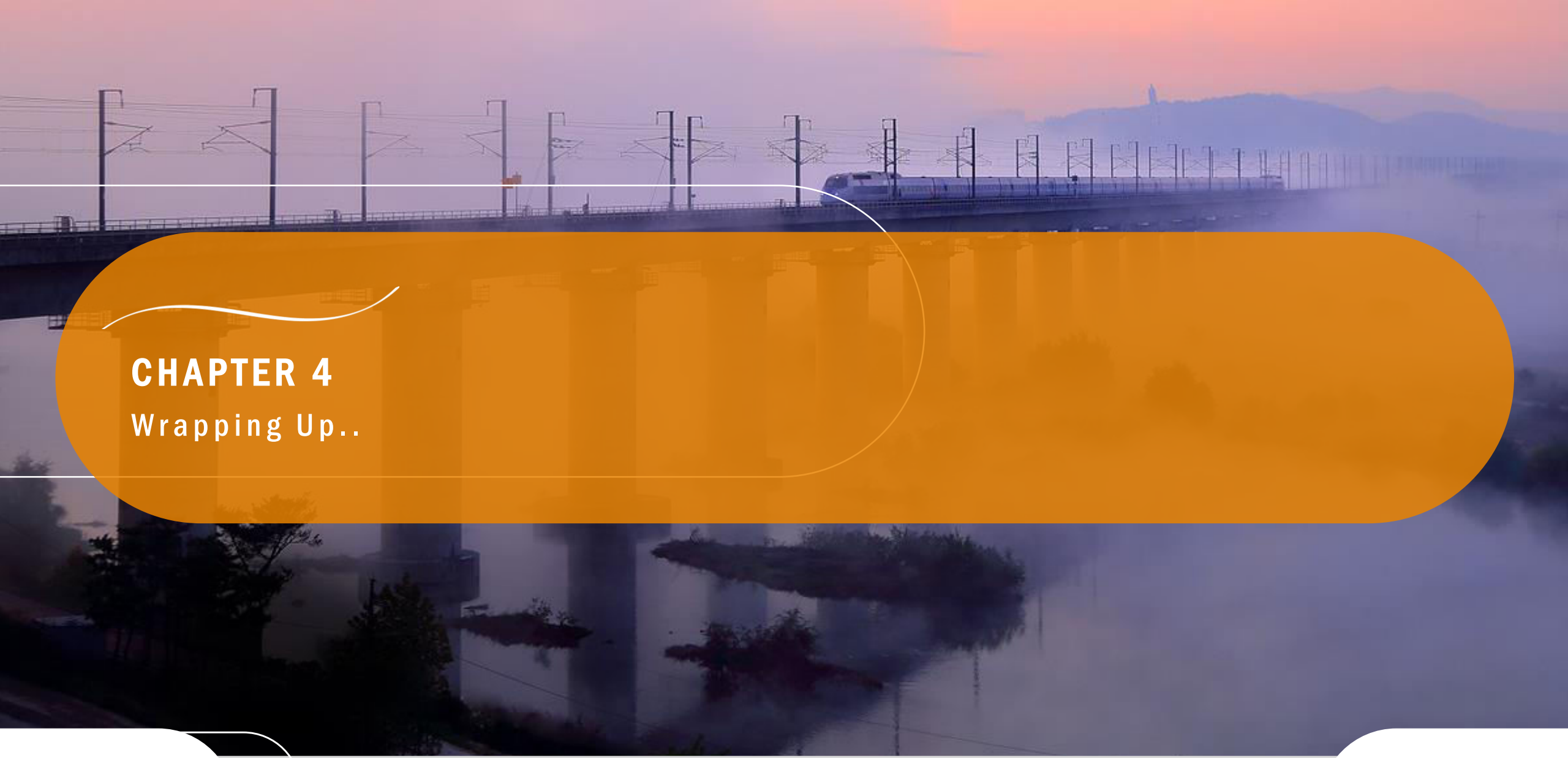
3.3 The Inquiry Screen on the MIS (Example)

- The location information will be marked on the map when the improvement is completed, and employees can monitor whether this systemic safety measure is working or not by easy inquiry on the MIS system
- The integrated system will be developed by 2022, will be commercialized by 2023 through a pilot operation

"Work Status" function in the MIS enables to check and process the worksites' safety

3.4 Additional Factors to Utilize the System

- It is difficult to use the app in multiple tracks section because of the mapping problem that the system fails to link coordinated information from GPS and km-based data
  - In Seoul and other metropolitan area, more than 3 tracks are installed so the app works in unrelated tracks
- It is impossible to notice unexpected entry into the unapproved sections
  - It is a serious offense and subject to punishment
- It is hard to assign the data input staff when the urgent work occurs
  - In normal cases, the task manager input the schedule into the XROIS which is already negotiated before the task starts
  - When the urgent maintenance work/inspection occurs and the task manager cannot input the data into the XROIS, the worker need to request the consultation/approval/input to the station
  - The precise criteria is needed to avoid missing data

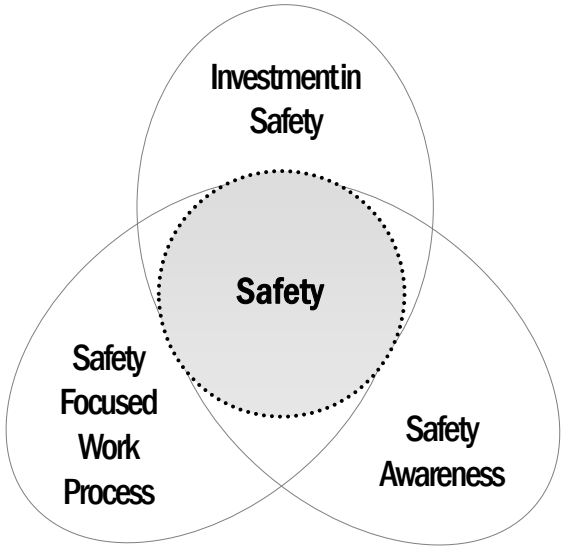


CHAPTER 4

Wrapping Up..

4. Wrap Up

- Safety is the essential value along with safe train operation, customer safety, employee safety
- To keep these safety values, we must pursue the following three elements
  - Safety facility and equipment: consistent investment in safety
  - Work process focused on safety: work manual and process
  - Employees' safety awareness: initiative and continuous safety education



The key elements of safety are proper investment, a work process focused on safety, workers' safety awareness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