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# SC 2023

INTERNATIONAL RAILWAY  
SAFETY COUNCIL

“Reshaping Railways in an Uncertain World”

CAPE TOWN, OCTOBER 1 - 6, 2023

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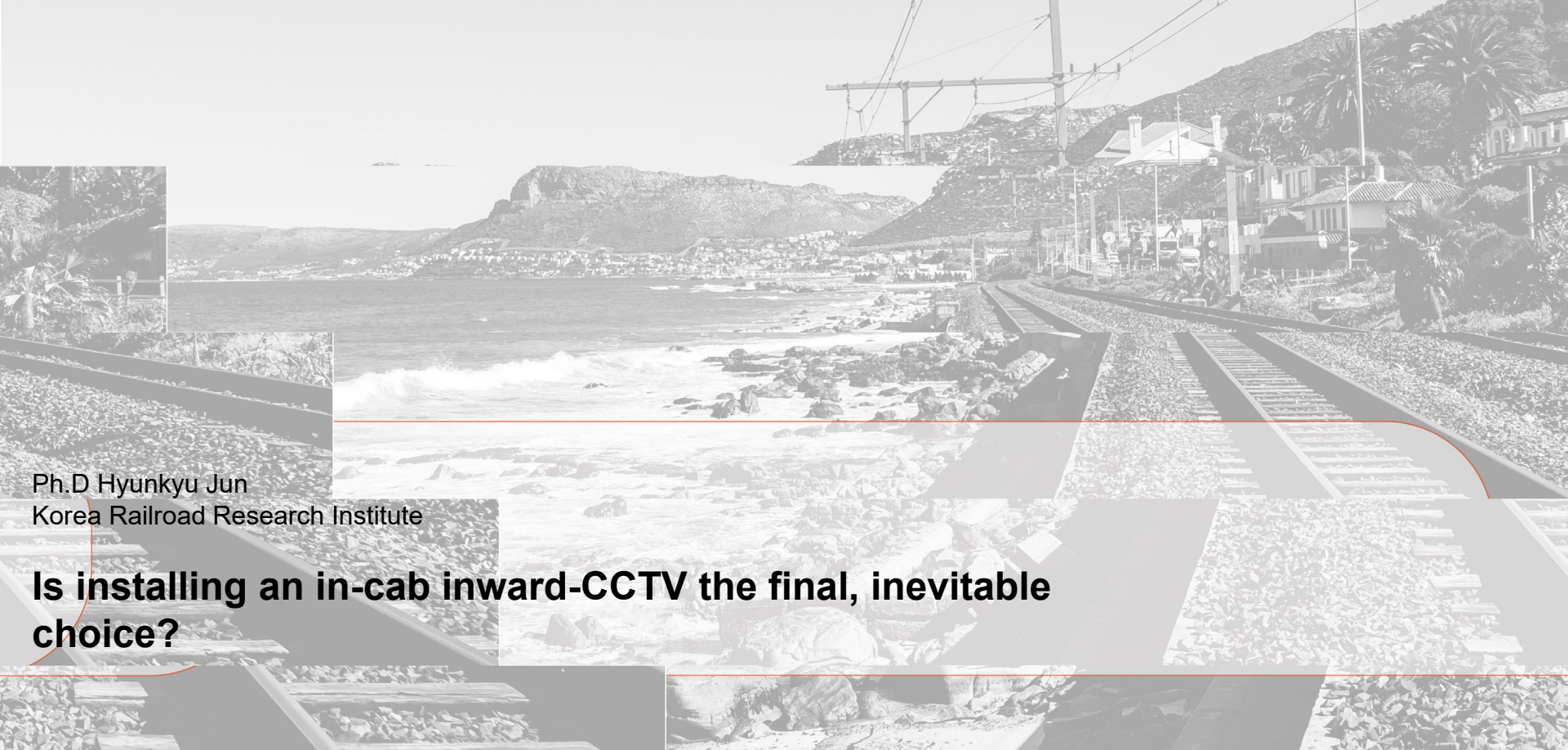


RAILWAY  
SAFETY



RAILWAY  
REGULATOR

RAIL SAFETY ON THE RIGHT TRACK



Ph.D Hyunkyu Jun  
Korea Railroad Research Institute

# Is installing an in-cab inward-CCTV the final, inevitable choice?

# Contents

- 1 Background and Issues
- 2 Expect opinions about installing the in-cab inward CCTV(A survey)
- 3 Degree of distraction from safe driving according the level of automation
- 4 Conclusion and Discussion

# 1. Background & Issues

- CCTV have been widely used everywhere in society **for the early detection of risks**
  - Public transport systems such as buses, taxis, etc., **have increased the use of CCTVs**
  - Although the concerns about **human rights**, it is already **spread all the train coach**
    - ※ 100% CCTV installed in passenger coach(KTX, ITX-Train, Subway etc.)

Strong belief on  
the prevention of Crime

Human rights



Sub-theme: 6 Integration of human factors in rail



# 1. Background & Issues

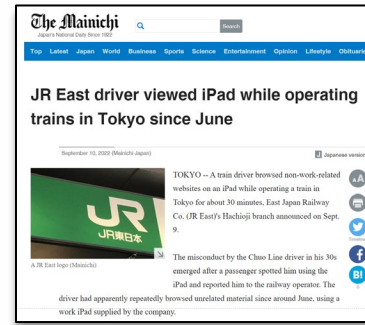
- Train accident due to **mobile phone using** while train driving is **increasing**
  - Korea: Train collision due to train driver messaging with mobile phone(2014.7)
  - Russia: Train collision due to using mobile phone(2019.10)
  - Japan: iPad watching while train driving(2022.9)
  - German: Commuter train collision due to train driver mobile gaming(2016.4)



Korea (2014.7)



Russia(2019.10)



Japan(2022.9)



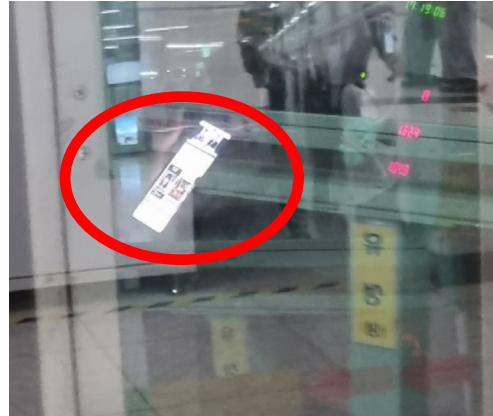
German(2016.4)

# 1. Background & Issues

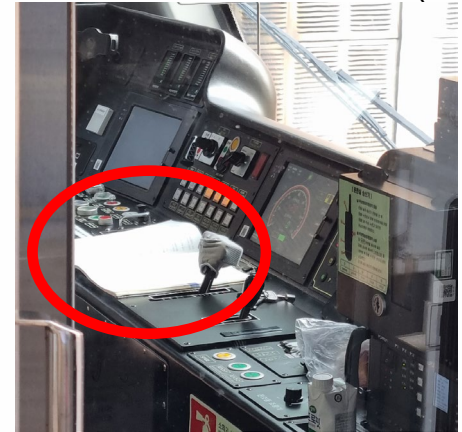
- In Korea, the regulator have been considered the installation of in-cab inward camera
  - **Installation of in-cab inward-CCTV was regulated** in Railway Safety Law in Korea('16)
  - But, make an exemption in case of an on-board driving data recording system installed, due to the **strong opposition of union**('17)
  - But with the recent increment of mobile device use by driver, the installation of CCTV is **reissued** ('23)



Railway Safety Law(Korea, 2016)



Mobile phone using(2023.5)



Book reading(2023.6)

# 1. Background & Issues

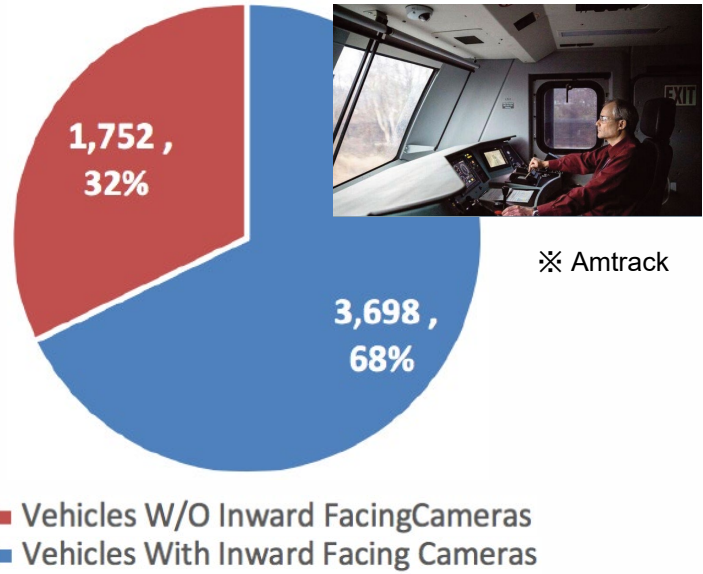
- Several countries have been tried to **regulate** the installation of in-cab CCTV
- Many railway operating companies are running inward CCTV **regardless of regulation**



Mandatory(Canada, 2022)



Recommendation(USA, 2021)



Sub-theme: 6 Integration of human factors in rail

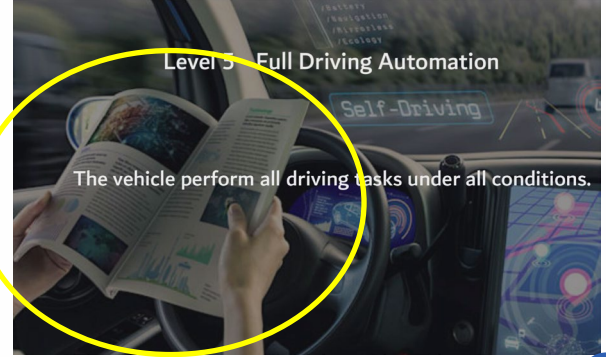
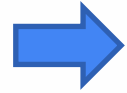


# 1. Background & Issues

What will happen to the present and future according to the **development of science and technology?**

(Automotive Industry) The role of driver shifts according to the **level of automation**

- Level 3: Conditional Driving Automation
- Level 4: High Driving Automation
- Level 5: **Full Driving Automation**



(Railway Industry) **What is the vision** in train driving ?

	Grade of Automation	Type of train operation	Setting the train in motion	Stopping train	Door closure	Operation in event of Disruption
	<b>GoA 0</b>	Driver	Driver	Driver	Driver	Driver
	<b>GoA 1</b>	ATP with driver	Driver	Driver	Driver	Driver
	<b>GoA 2</b>	ATP+ATO with driver	Automatic	Automatic	Driver	Driver
	<b>GoA 3</b>	Driverless	Automatic	Automatic	Train attendant	Train attendant
	<b>GoA 4</b>	Unattended train operation (UTO)	Automatic	Automatic	Automatic	Automatic



※ Reference: BS EN 62290-1

Sub-theme: 6 Integration of human factors in rail

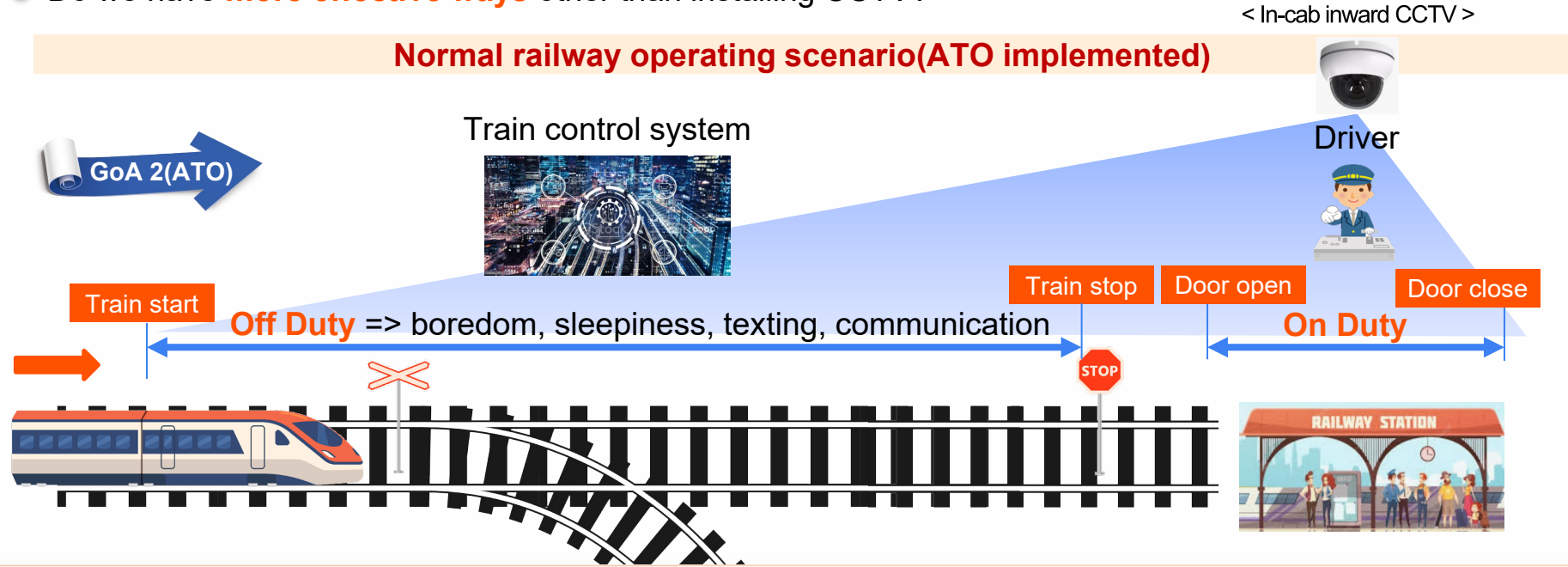




# 1. Background & Issues

- **Repeated and low workload** brings boredom, sleepiness, communication and lost mind etc.
- To prevent this distraction, Just **installing CCTV** can solve the problems?
- Do we have **more effective ways** other than installing CCTV?

## Normal railway operating scenario(ATO implemented)



# 1. Background & Issues

## Questions

1	<p>How much the CCTV information <b>help accident investigation</b>?</p> <ul style="list-style-type: none"><li>- Does it have essential data cannot obtain from other devices, if then what it is?</li></ul>
2	<ul style="list-style-type: none"><li>• Is the installing CCTV truly shows <b>substantial safety improvement</b>?</li><li>- Is it <b>not enough</b> on-board driving data recording system with forwarding cameras for accident investigation.</li><li>• Installing an in-cab inward facing CCTV <b>the only effective way</b> for prevention a driver distraction?</li><li>- Regardless of the advance of automation technology, the train driver always requested not loose focusing on driving?</li></ul>
3	<p><b>How much train driver distracted</b> from safe driving <b>in high level of automation</b>?</p> <ul style="list-style-type: none"><li>- In ATP/ATO system, how affect the texting and music listening for safe driving?</li></ul>



## 2. Expect opinions about installing the in-cab inward CCTV(A survey)

- A questionnaire composed of 8 main items proceeded.

### Accident investigation(3)

- With On-board driving recording system data, additional in-cab CCTV footage necessary?
- CCTV footage truly helpful, how much?
- What range of the information necessary?

### Prevent driver's distraction(3) & Human right

- The most effective way to prevent driver's distraction?
- Which is more important, human right or public safety?
- With CCTV, the safety of train truly expect to be enhanced ?

### Automation tech.(2)

- To relieve the boredom from low stressed work, which methods are appropriate?
- Allow to use device other than for driving in high automation level?



## 2. Expect opinions about installing the in-cab inward CCTV(A survey)

### Accident investigation(3)

- ❶ With On-board driving recording system data, additional in-cab CCTV footage necessary?
  1. Necessary
  2. Unnecessary
  
- ❷ CCTV footage truly helpful, how much?
  1. Somewhat helpful
  2. Very helpful
  3. Absolute helpful
  
- ❸ What range of the information necessary?
  1. Hand
  2. Hand and Face
  3. Devices
  4. Whole cabin

### Expert opinions

#### (1) CCTV footage is necessary for accident cause analysis

(Although, on-board driving and voice recording, forward camera give many information, in-cab inward CCTV also gives other clues for accident investigation)

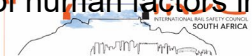
\* Error in electronic devices, Error in recording device, Unusual operation events etc.

#### (2,3) CCTV footage gives a lot and absolute help on unusual accident case

(CCTV footage is judged to be helpful in setting the initial direction of accident cause analysis and reconfirming the process and results of accidents.)

#### (4) Whole driver's cabin information(include device and driver)

(For the true understand of accident cause, whole driver's cabin information include device reading and driver operation are appropriate)





## 2. Expect opinions about installing the in-cab inward CCTV(A survey)

### Prevent driver's distraction(3) & Human right

❶ The most effective way to prevent driver's distraction?

1. Penalty by company
2. Penalty by government
3. Indirect monitoring(record)
4. Direct monitoring(CCTV)

❷ Which is more important, public interest or human right?

1. Public interest
2. Human rights

❸ With CCTV, the safety of train truly expect to be enhanced ?

1. Disrupt safety
2. No difference
3. Highly enhance

### Expert opinions

#### (2, 3) Enhance the penalty by government

(2 and 3 are preferable, because the driver's distraction is the only a few people problem. So it is not right for installing CCTV only for surveillance)

#### (1, 2) Public interest and Human rights both important

(Although, CCTV may good for accident investigation, but the safety improvements are not expected at the expense of human rights)

- ✘ (1): Public, Operating company, Accident investigation
- (2): Operating company, Instructor, Driver Union

#### (1, 3) Safety will be disrupted and enhanced

(Safety will be disrupted due to the driver's stress, on the other hand Safety will be enhanced such as proof of legitimate driving for device malfunction)

- ✘ Do we have any proof of driver's stress and proof of safety disrupt or enhancement ?





## 2. Expect opinions about installing the in-cab inward CCTV(A survey)

### Automation technology(2)

- To relieve the boredom from low stressed work, which methods are appropriate?
  1. Finger pointing
  2. Driving aids
  3. Music device
  4. Communication device
  5. Video device
- Allow to use device other than for driving in high automation level?
  1. Not allowed
  2. Allowed, level of automation

### Expert opinions

#### (2) Adapting driving aids preferable

(Finger pointing is good but it takes away the driving device operating time, 3, 4, 5 are not allowed even though considering current and future technology development)

#### (1) Not allowed

(Even though automation technology advancement, as a driver, he/she must keep on only driving)

# 2. Expect opinions about installing the in-cab inward CCTV(A survey)

**Questionnaire**

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□ Background of this study

- Owing to the introduction of numerous sensors and high-speed communication networks, abnormal signals generated during train operation are recorded in train operation recorders and used to analyze the causes of accidents and failures, but **human factors by drivers are not recorded, resulting in safety blind spots.**
- Also, due to train automation, the frequency and attention required for train operation is gradually decreasing, and as the use of voice and video devices such as smartphones becomes more common, **cases in which imaging devices other than for operation are used in cabs to relieve boredom and drowsiness\* are often reported.**  
 \* i.e., voice communication and video devices including mobile phones, books, and others
- These technical (analysis of the causes of train accidents and breakdowns) and social (prevention of prohibited behaviors in the cab) issues **call for the placement of CCTV camera with voice recording in cabs.**

**< Preliminary question >**

1. Do you have any regulation regarding the installation of in-cab inward CCTV in your country? If yes then let me know the current status

- Any comments or information:

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2. Do you have any railroad operating company installing the in-cab inward CCTV regardless of regulation? If yes then let me know the current status

- Any comments or information:

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※ If it is OK to contact regarding this issue further then leave your personal information

Name of workplace: \_\_\_\_\_ /Country \_\_\_\_\_

Email: \_\_\_\_\_ Name: \_\_\_\_\_

한국철도기술연구원 | 16105 경기도 의왕시 철도특별경로 176(철도동) TEL : 031-460-5100 FAX : 031-460-5109 www.kriiro.kr  
 Korea Railroad Research Institute | 176, Cheoldo bangnulgwan-ro, Uiwang, Gyeonggi-do, 16105, Korea TEL : +82-31-460-5100 FAX : +82-31-460-5109

This QR code will be updated at the conference

Put QR Code



# 3. Degree of distraction from safe driving according to the level of automation?

How much the train safety affected without alarming by the system?

## Abnormal railway operating scenario(Car collision accident)

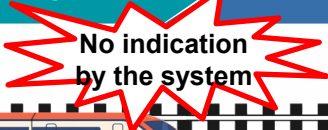
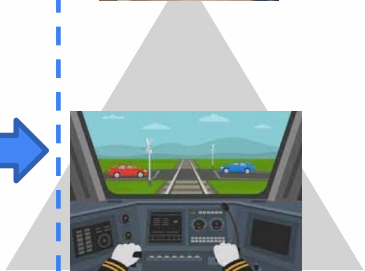
- 1. Full focusing
- 2. Texting



< on-board train recording >



(Important for accident investigation)



Sub-theme: 6 Integration of human factors in rail





# 3. Degree of distraction from safe driving according to the level of automation?

- The 4 driving scenario were prepared
  - Full focusing and texting and only light and both light and sound alarming signal case scenarios

		Alarming signal	
		Only Light	Light & Sound
Distract action	Full focusing	Case A1	Case A2
	While texting	Case B1	Case B2

## Full functional driving simulator



# 3. Degree of distraction from safe driving according to the level of automation?

No of signal miss, action delay were checked(Currently undergoing)

Distract action

Only light

Light and sound

Full focusing

Signal miss:  
Action delay:

Signal miss:  
Action delay:

Texting

This slide will be updated with up to date results

## 4. Conclusion and Discussion

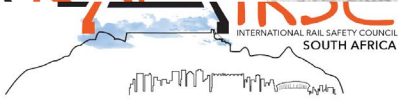
- ➊ Summarizing the expert opinions, the installation of **in-cab CCTV is the only way** at this moment to improve the accuracy of accident investigation and to prevent the driver's distraction.
- ➋ Based on the simulation, the risks posed by cell phone use are highly increased especially **without sound alarming system installed train**
- ➌ **To lead and maintain full focusing**, a driver assistance systems such as navigation or infotainment system have a value to be considered according to the level of automation.
- ➍ Currently, **What is you and your country's position?**

**Kindly ask you to write a survey and submit to my colleagues !!!**





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