STAMP Incident Investigation: Control Structures as a Tool to Intervene

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Our goals today

- **To show you our use of STAMP *during* incident investigation**
- **To share with you**
  - the results so far
  - our recommendations

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Questions you migth have

1. Who is NEDTRAIN?
2. What is NEDTRAIN's 'traditional way' of incident investigation?

3. Why did you introduce STAMP?

4. How did you apply STAMP?
5. Can you show us an example?

6. What are the results of using STAMP till now?
7. What would you recommend us?

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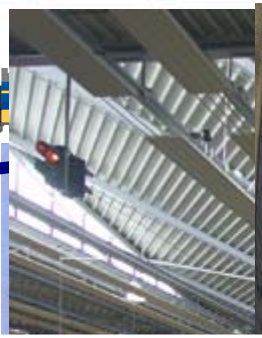
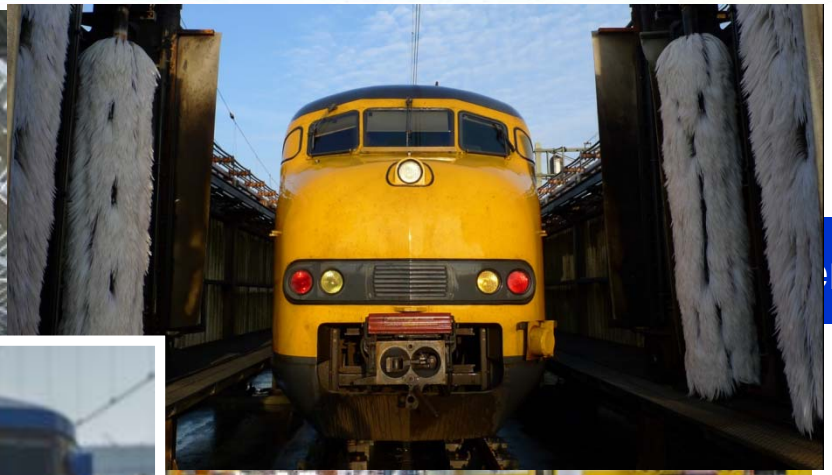
1. NedTrain & NS

Amsterdam

Onnen
Maastricht
Amsterdam
Leidschendam





2. NEDTRAIN's incident investigation

Incidents & near misses:

- **Railtraffic (shunting),**
- **Occupational health**
- **Train safety**

Approx. 100 investigations/yr

Proces:

- **Interviews**
- **Data analysis**
- **Multi Timeline & animation**
- **Analysis & conclusions**
- **Check & suggestions; by presenting to all involved**
- **Measures & management learning; by presenting to management**
- **New: STAMP analysis to improve last step**

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3. Reasons for introducing STAMP

- **Nancy's lecture on STAMP in Amsterdam 2014**
- **Desire to include systems thinking in incident investigation**
- **Desire to include mental models in incident investigation**
- **Desire to change thinking of management**
  - they did it wrong → why did it make sense?
  - It's up to the workfloor → I have a stake!

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4. Application of STAMP: context

- **Little experience in applying STAMP during incident investigation**
  - at NEDTRAIN: none
  - in the Netherlands: limited, mainly Dutch Safety Board
- **No handbook**
- **No training courses**

- **Solution: hands-on coaching by experienced user, just start!**

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4. Application of STAMP: STEPS

1. **Consider the added value of STAMP**
2. **Define the undesired event and relevant hazards**
3. **Identify relevant components in the system**
4. **Specify for each component:**
   - Responsibilities relevant for controlling the hazards
   - Control actions (constraints given to other components)
   - Feedback
5. **Evaluate the control structure**
   - Control/feedback: absent, wrong, missing, too late, ineffective?
   - System: how effective is it in controlling the hazards?

Control Structure

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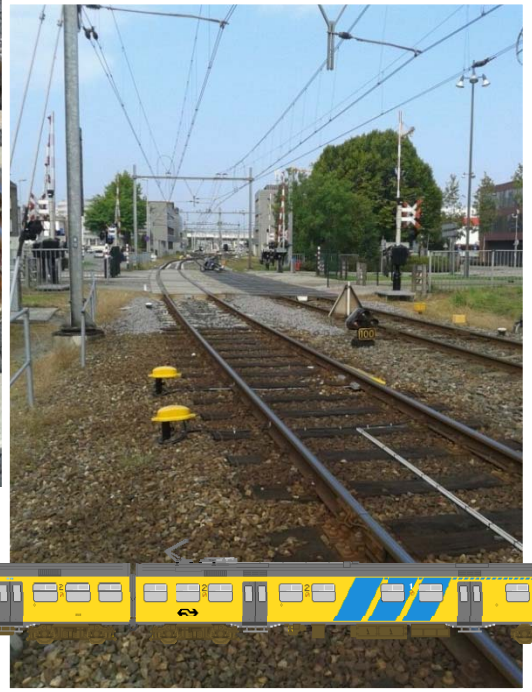
5. Example: Train on track available for other train

Near miss caused by SPAD at Heerlen, Netherlands, 29-8-2014, 19:28



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5. Example: high potential!

Amsterdam Singelgracht, april 21 2012:
1 passenger killed, 190 injured
Right train passed signal at danger

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5. Example: Investigation

Focus on understanding:

- **What happened?**
- **How did it happen?**
- **Why did it make sense?**

- **Interviews**
  - individually
  - based on *MEDA* (Boeing)
  - focus on Human Factors
- **Analysis of**
  - onboard datarecorder
  - traffic control data
  - voice logging

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Timeline

august 29

19:11 19:17 19:22 19:27 19:28

37 years of experience, 14 years as shunting driver. Last late shift in row of 5. Fit but a sandwich didn't fall well (several visits to bathroom)

Starts shift at 14:00. No work till 16:00.

Waits for train NSR 6959 at platform 1/2. Train arrives on schedule at 19:11

Train arrives, driver NSR leaves. Driver NedTrain checks if train is empty and gets in. His job: shunt empty train to platform track 205

Gets blinking yellow signal to leave for track 211. Stops 44 meters past signal 100. Changes sides

Drives to signal 100, sees that it shows red

Brakes very late and speed exceeds speedlimit in ATP system wich is activated. Driver sees this as a malfunction of ATP

Overrides ATP VV by unconsiously pressing reset button twice within 3 seconds in stead of once to reset

Sees blinking white lamps aside service crossing and closing of level crossing

Sees a member of public crossing closed level crossing right in front of him

Starts driving past red signal. Doesn't see it is still red

Sees switch 93 is in the wrong direction and applies emergency brakes

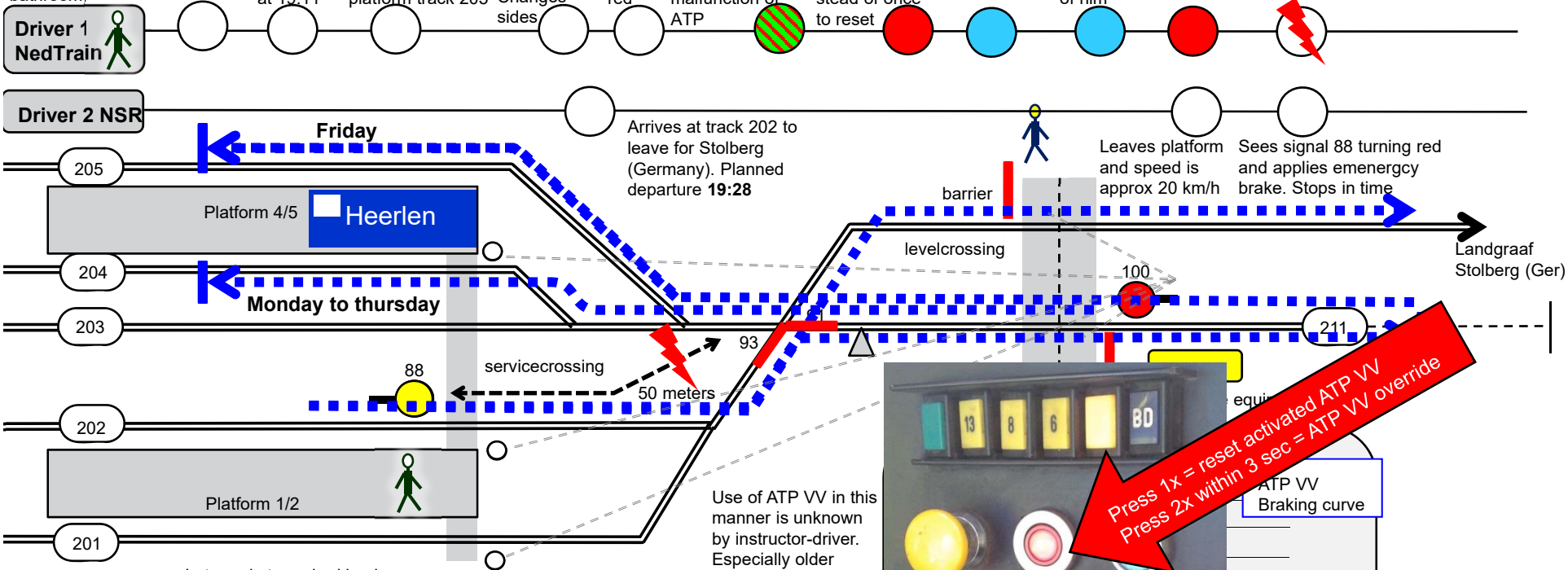
Driver 1 NedTrain

Driver 2 NSR

Arrives at track 202 to leave for Stolberg (Germany). Planned departure **19:28**

Leaves platform and speed is approx 20 km/h

Sees signal 88 turning red and applies emenergcy brake. Stops in time



Late and strong braking is normal for shunting drivers (uncomfortable, but never passengers on board and fastest way of working)

Shunting drivers hardly ever drive in area's covered with ATP. They drive on yards around stations and workshops. ATP VV is relatively new and braking by ATP VV isn't expected.

Use of ATP VV in this manner is unknown by instructor-driver. Especially older drivers and around workshop Maastricht use it this way due to frequently shunting trains with defects

Panel in dashboard train cockpit. Traindesign is of 1960's, ATP added in 1980's, ATP VV added 2010

Mgt & organisation

Not acc. expectation
Missed signal
Trigger or contributing factor

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5. Example: Could this have happened to others?

Human Factors:

- Experience: ATP VV system override common practice
- Confirmation bias: several signals triggering standard script
- Distraction: members of public passing closed barriers

Contributing factors:

- Knowledge of ATP VV
- Friday - different route & timing

Check with other drivers: This could happen to me too!

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5. Example: STAMP Steps

1. **Consider the added value of STAMP**
2. **Define the undesired event and relevant hazards**
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Control Structure

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5. Example: STAMP Steps 1-3

1. **Added value: to include responsibility at higher levels, systems thinking**
2. **Undesired event & relevant hazards:**
   1. Undesired event = collision of two trains
   2. Hazard = train on track, given available for another train
   3. Systems goal = to run multiple trains on infra
3. **Relevant components in the system:**
   1. Infrastructure
   2. Drivers
   3. Trains
   4. Systems in the train (train controls,ATP), in the infra
   5. frontline manager
   6. driver -instructor
   7. site-manager

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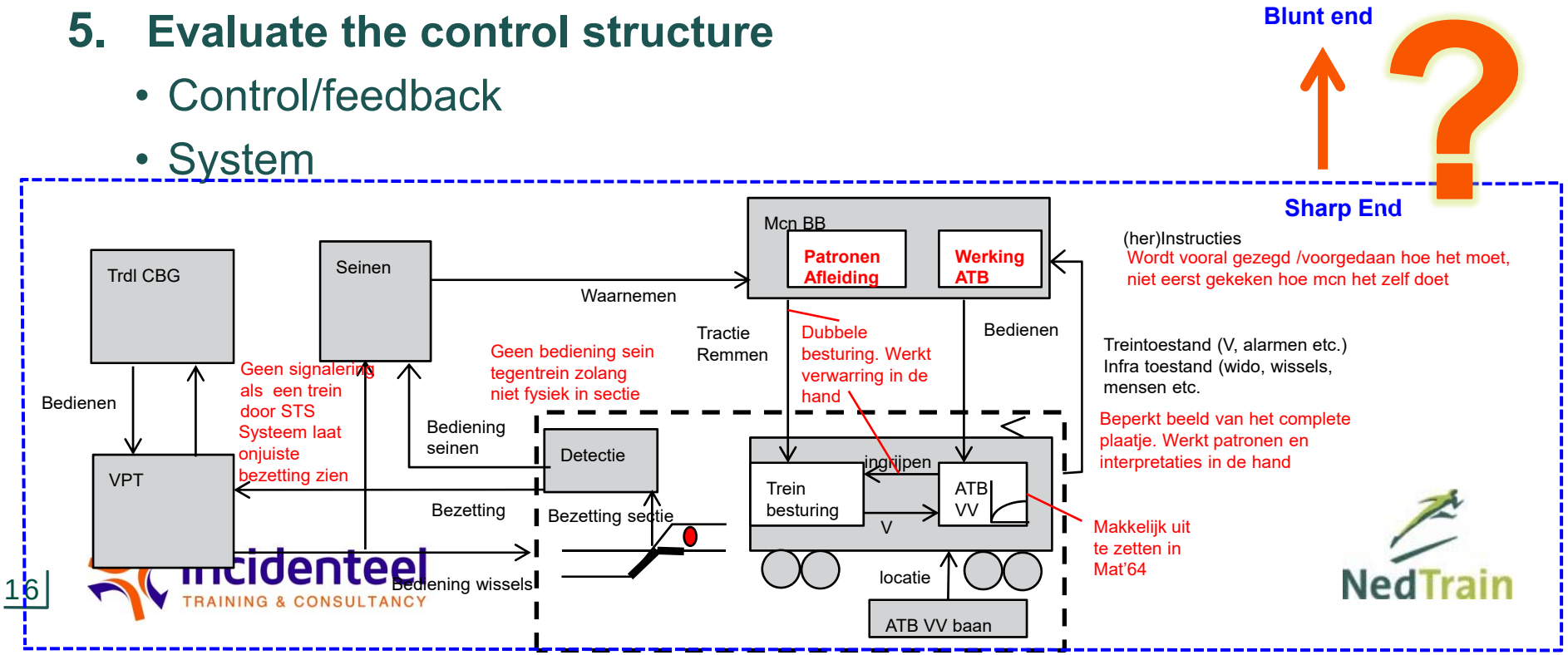
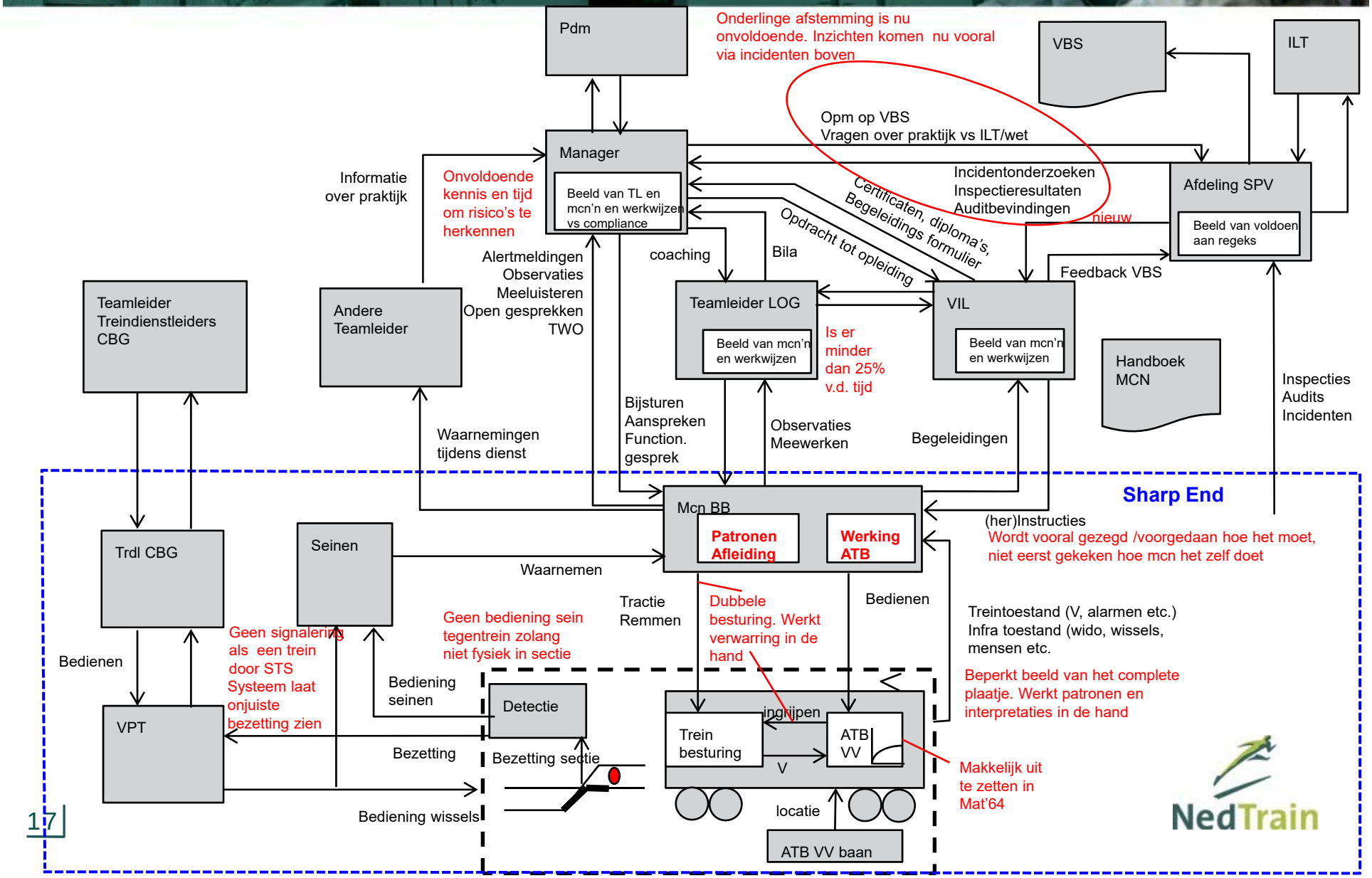
5. Example: STAMP Step 4 -5

4. **Specify for each component:**
   - Responsibilities: safe operation within boudaries
   - Control actions: accelerate, break, switch on/off, etc
   - Feedback: position, speed, etc
5. **Evaluate the control structure**
   - Control/feedback
   - System



5. Example: STAMP control structure



5. Example: STAMP

Could we see this coming?

This incident was a combination of Expectations + self-learned optimizations + normal disturbances: *it was all there already*

STAMP

- **Explain: how does the system control the hazards that can lead to this type of incident**
- **Focus: how does the system control and monitor the drivers behaviours, expectations, self-learned patterns?**
- **Approach: dialogue with upper-management-levels on their roles**

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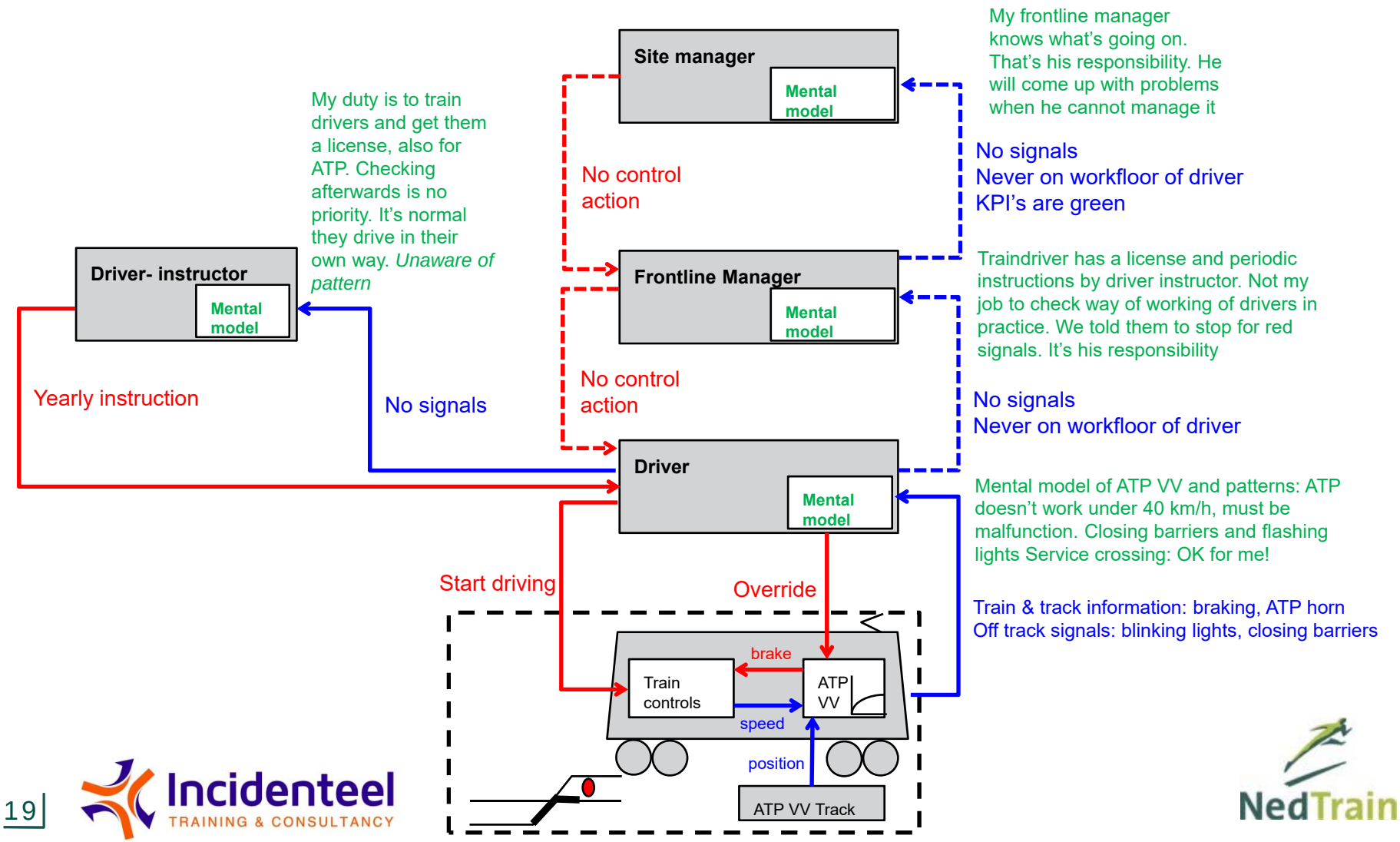
5. Example: STAMP control structure



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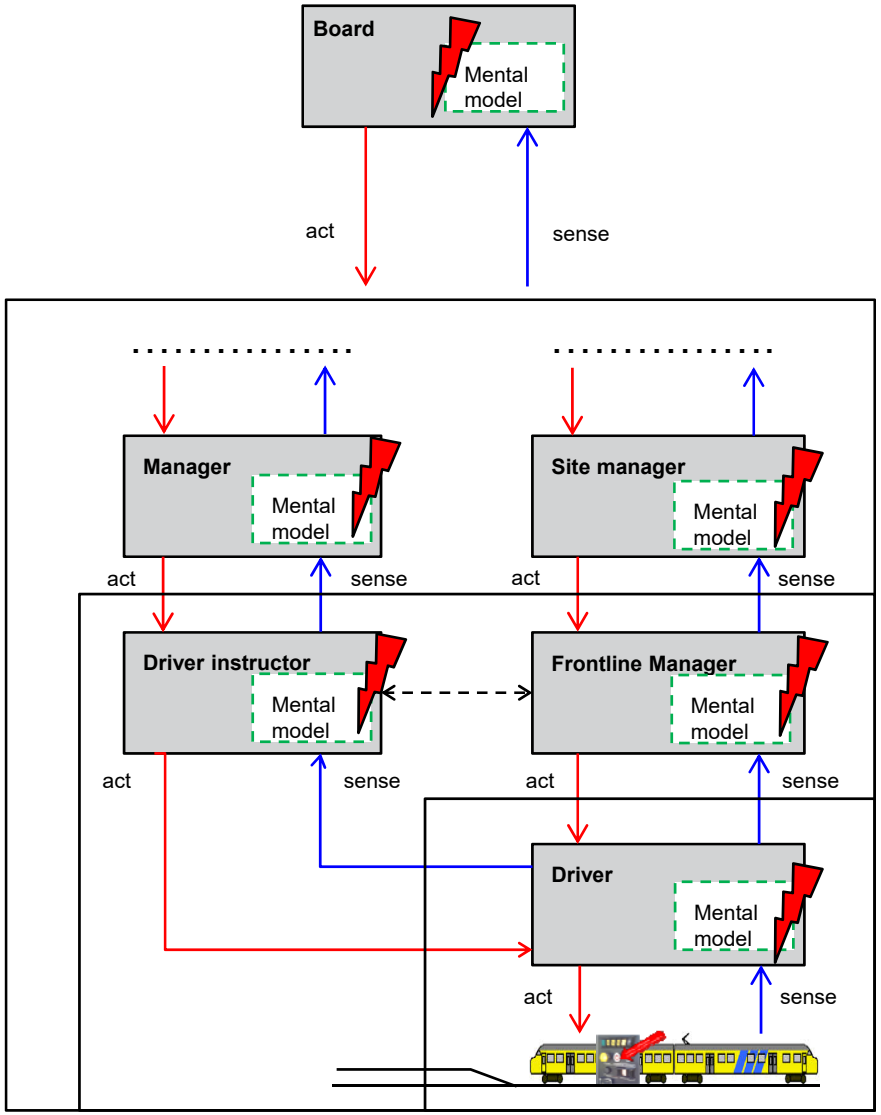
5. Example: Bottom line

Conclusion:

Management won't learn: will not see erosion & dangerous patterns

Future incidents will not be prevented



Not aware that managers are not aware of how things work in real world and accuse in stead of creating a climate to be open and learn

Not aware of these phenomena. Accusing the actions of the driver: we told you to stop for red signals!

Interpretation ATP VV
Incomplete script

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6. Results so far

Based on application in 10 cases

- **Management**
  - not aware of patterns and “work as done”
  - eyeopener! > more involved in incident investigation
  - starts to accept local rationality of people at sharp end
  - awareness of their own role grows
  - awareness that the red line (control) is leading and the blue line (sense) is under developed
  - starts to detect patterns and risks in their own processes
- **Notions:**
  - Incident investigation itself is a form of sensing…..
  - STAMP triggers thinking towards “*illusion of* control structure”

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6. Recommendations

1. **Use STAMP *during* your investigation when you are ready to exceed incident level**
2. **Use STAMP's control structure for a dialogue with higher level controllers:**
   - Did you know it worked this way on operational level?
   - What is your role and responsibility in this?
   - What information do you receive on how it works?
   - How do you steer on adequate performance?
3. **Focus on one level lower (not only the operational level)**
   - The role of a manager is to detect wether one level lower is detecting….
4. **Use colors and animations to build up the model**

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Learning from incidents

- **Level 1: taking measures on operator level:**
  - more instruction on ATP VV,
  - using this case in toolboxmeetings with operators to point at patterns

- **Level 2: enhancing the controlstructure to detect patterns and optimization of workmethods on forehand**
  - Investigate current control structure, supported bij STAMP
  - Discussions with management where and how to improve detection (and see limitations)…… *under construction at this moment!*

- **Level 3: being aware that our view on safety has to change**
  - Use cases like this on all levels to change from accusing and “find the culprit!” to “why did it make sense to do what they did?”
  - This is the basic requirement to start learning in stead of just managing measures

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Thank you for
your attention
SOTR
Questions?