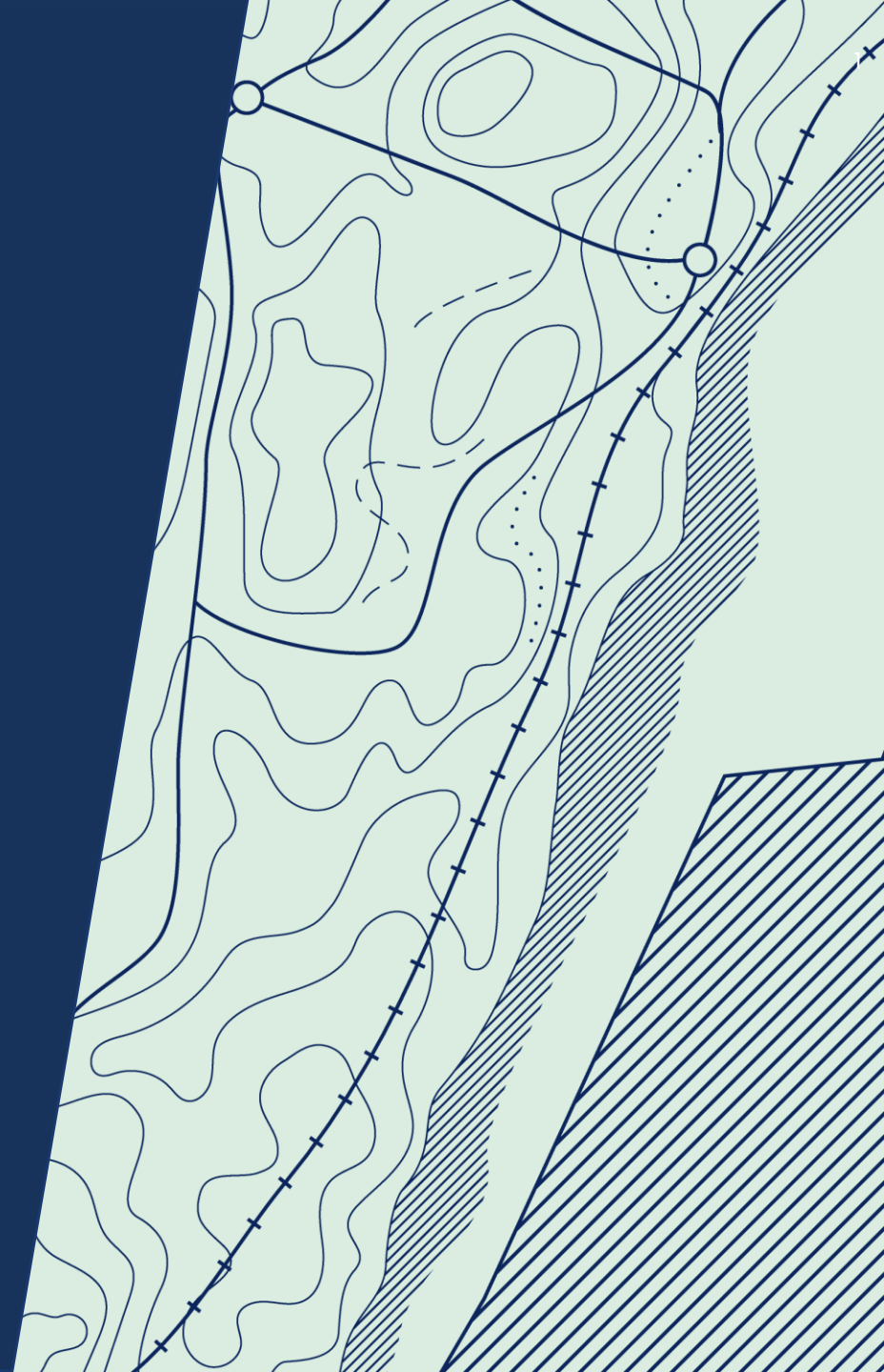


Derailment with Airport Express train

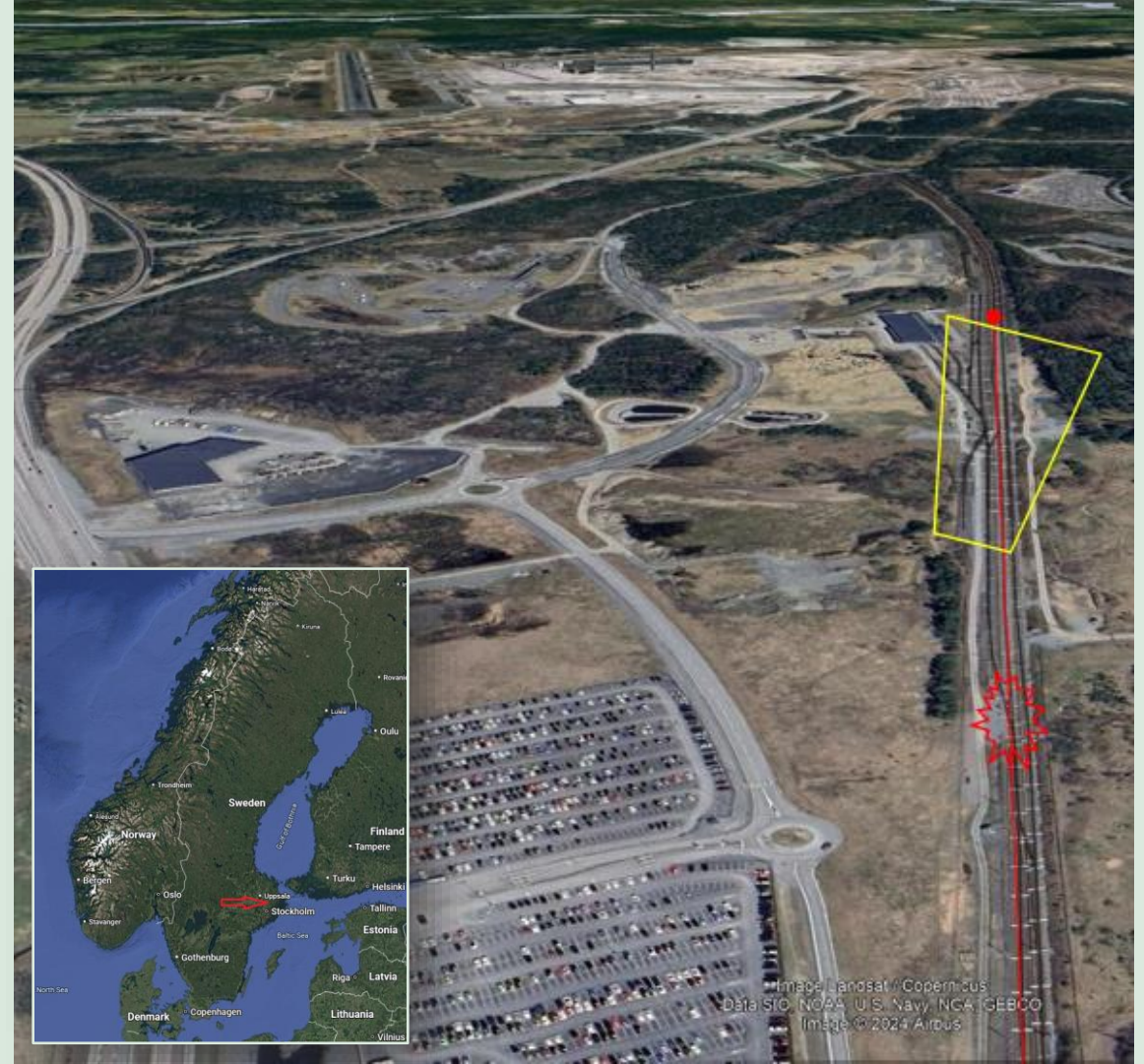
RAIF Taiwan 21 – 24 October 2025

Mikael Hillbo, Senior Investigator Rail
Swedish Accident Investigation Authority



The accident

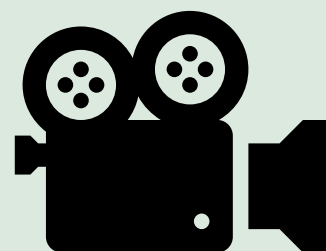
- May 27, 2023, at 4:35 AM
- At Blackvreten on A-Train AB's infrastructure
- The mornings first Arlanda Express train from Stockholm towards Arlanda airport
- 67 passengers onboard
- Driver and train attendant
- The train derailed at 178 km/h (110 mph)
- 900 meters before the train stopped
- One passenger suffered serious injuries



Surveillance camera

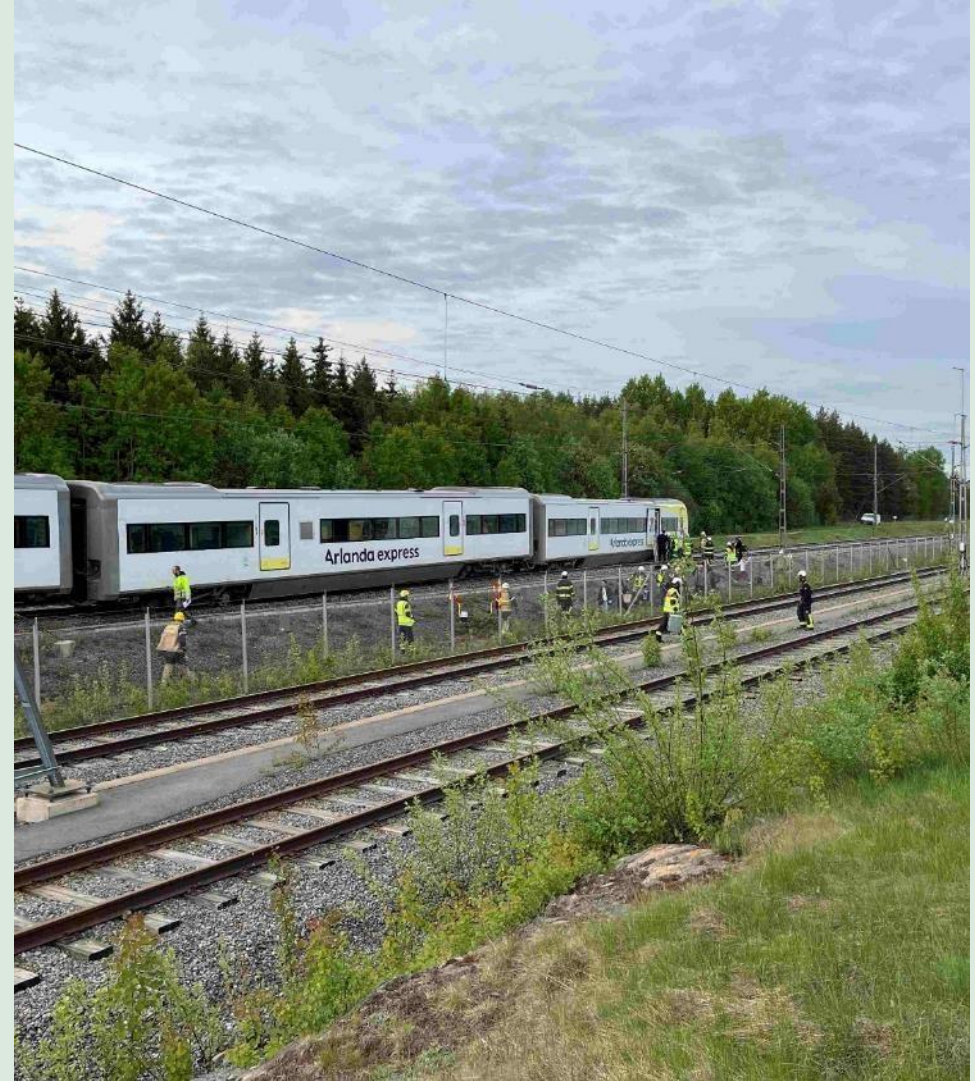
- A surveillance camera recorded the passing train
- Derailment occurred from axle seven
- Heavy smoke development from crushed ballast and concrete
- The derailed vehicles bounced over the subsequent switches





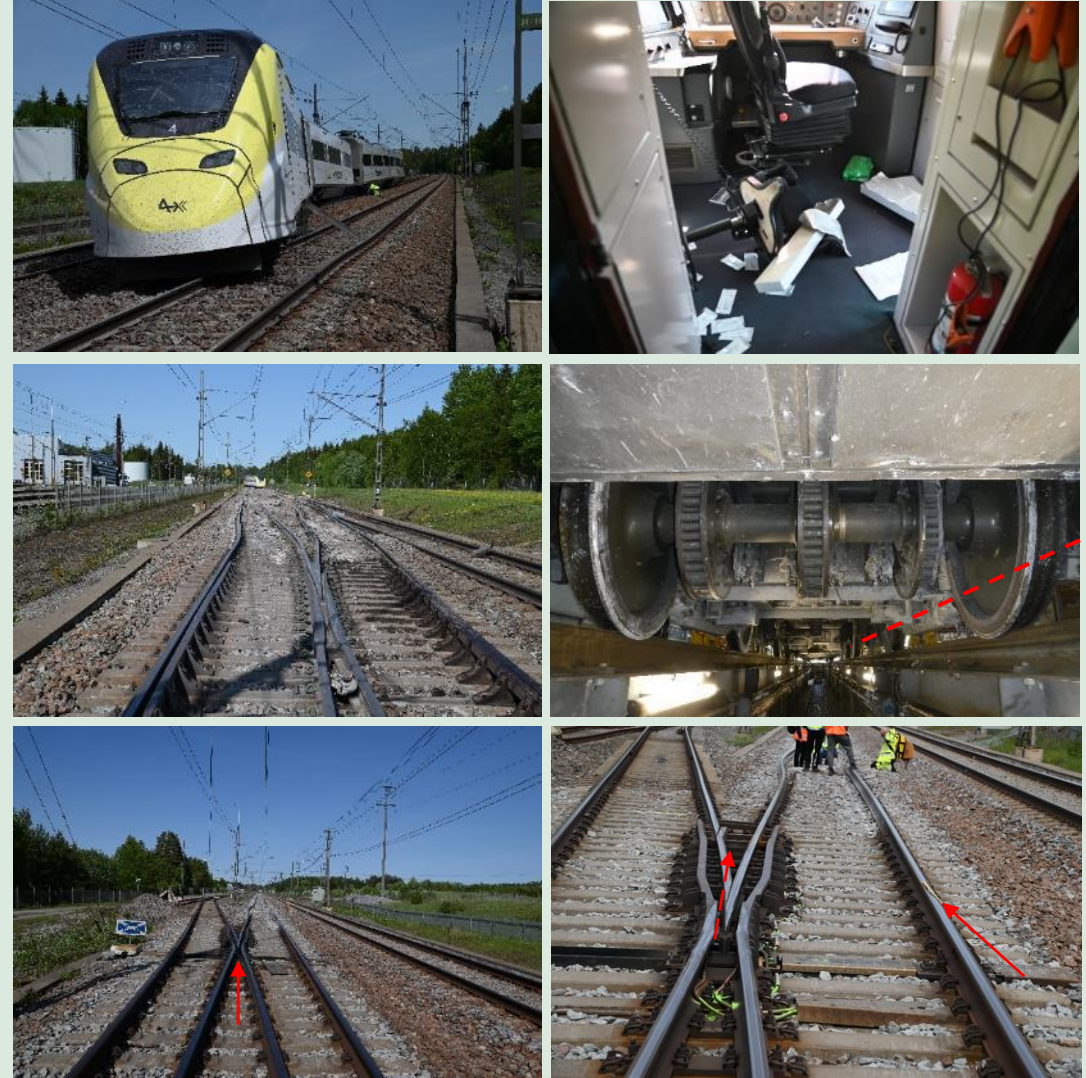
Rescue operation

- The derailment occurred at 04:35 AM
- Call to emergency call service at 04:39
- Initially unclear location for the rescue services
- The first unit arrived at the gates of the adjacent depot at 04:53
- The rescue operation started at 05:05
- The serious injured person was transported by air ambulance
- The rescue operation was concluded at 06:26



Accident Site Investigation

- Major damage to the derailed vehicles, but none that caused the derailment
- Significant damage to 900 meters of track and switches
- Bogie design guided the left rail
- In switch 106 – with movable crossing point – the crossing tip was in a middle position
- Marks parallel to the crossing where the right wheels had left the right rail

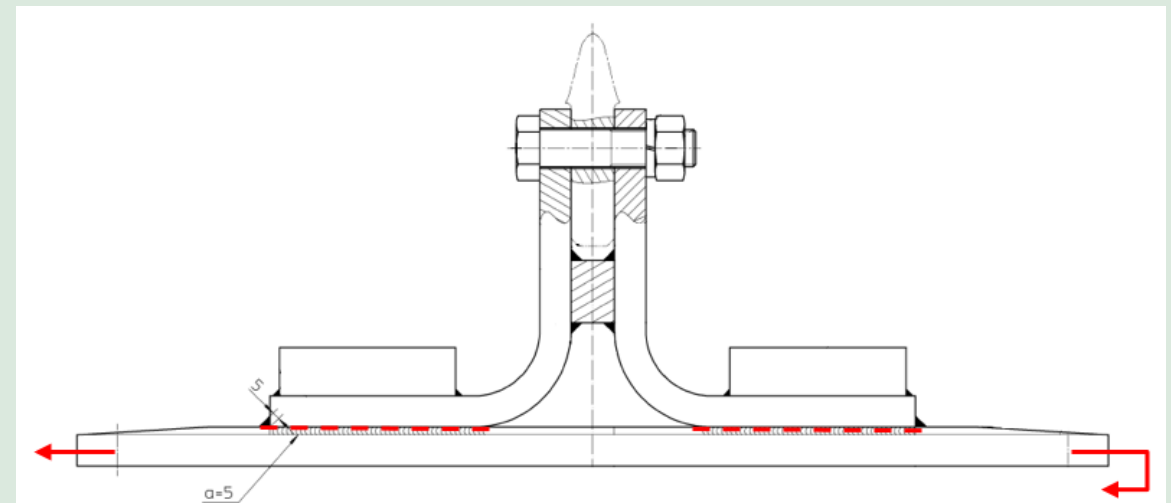
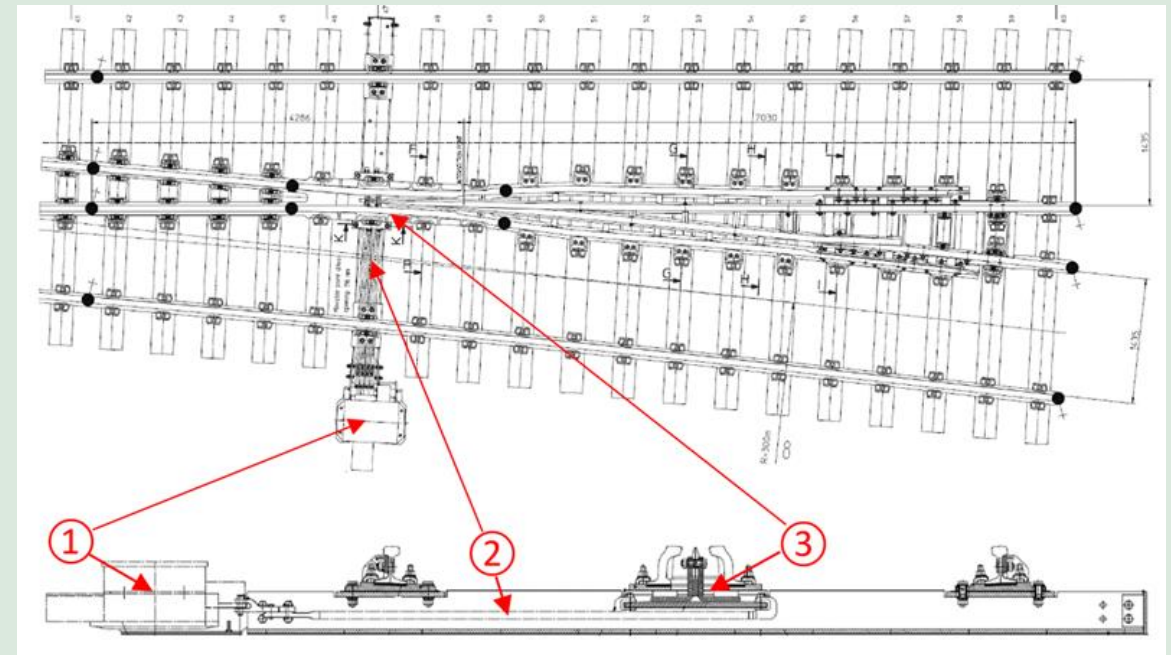


The drive connection plate beneath the moving crossing had broken



Drive connection plate

- A plate with two 90-degree brackets
- The brackets are welded to the plate
- Transfers force from the switch motor and pull rods to the movable crossing point
- Safety-critical function



A serious fault!

- A similar construction used in 135 switches within the Swedish Transport Administration's infrastructure
- Risk of systemic failure
- The investigator called the NSA emergency line - decision to have a video meeting to present facts from the accident site
- The Swedish Transport Administration (largest Infrastructure Manager in Sweden) inspected all their corresponding drive connection plates



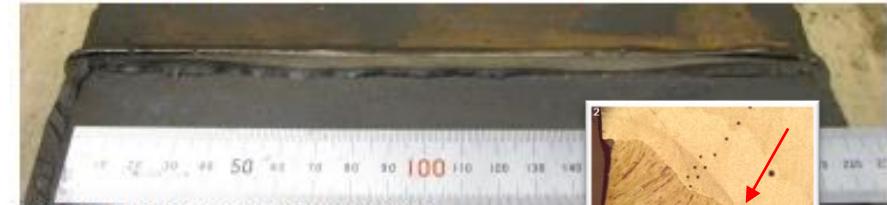
Metallurgical investigation



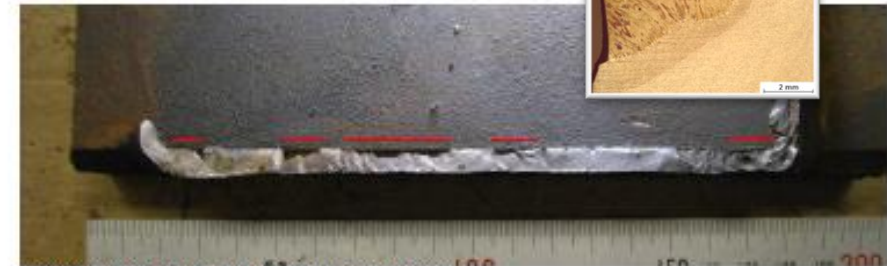
- The welds exhibited extensive fatigue cracks
- Final fracture in only half of the last weld
- Lack of fusion in the root of the four butt welds
- The welds were undersized compared to the drawing's specified 5 mm and did not meet the manufacturer's stated standard
- Lack of fusion also in the reference switch 103, but without signs of fatigue or cracks



Figur 4. Svets 1 i ankomstsblok, ljusgrå del av sprickytan bedöms som restbrott.



Figur 5. Svets 1 efter kapning och rengöring av plattan.

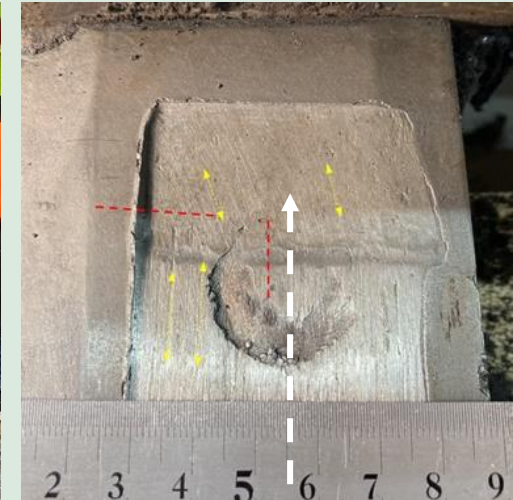


Figur 6. Svets 2, med de mest uppenbara rotfelen markerade.



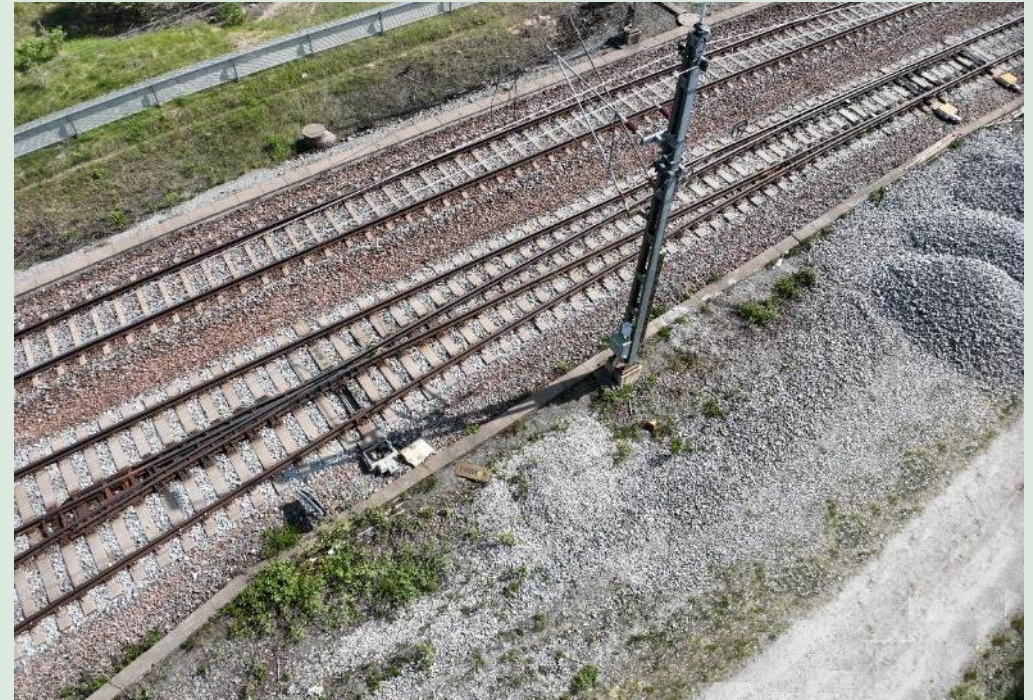
Supplementary site visit and in-depth investigation

- Review of the crossing section together with our appointed metallurgical expert and specialists from the Swedish Transport Administration
- In-depth investigation of the crossing section in our workshop
- Molding of the plates under the moving crossing for microscope examination
- Diagonal marks on the plates clearly indicates the presence of movement and dynamics in the moving crossing



Switch typ EVR-60E1-300-1:9

- Developed for the Arlanda Line between 2006 and 2008 to replace switches with high wear in fixed crossings
- Declaration that the switch met the applicable European standards for interoperability
- Approved for 200 km/h
- The drive connection plate was designed and dimensioned solely for static load and to last the entire lifetime of the switch
- Two switches delivered to A-Train AB, later nine switches to the Swedish Transport Administrations infrastructure



Maintenance

- Continuous high wear with moving crossing
- No track geometry faults outside applicable requirements
- Safety inspections six times per year and maintenance according to the Swedish Transport Administration's and manufacturer's instructions
- The drive connection plate and its welds were hidden under the crossing – no specific inspections was required
- Replacement of the drive connection plate in 2015 due to wear in the pull rod fastening holes
- Installation of bushings in the pull rod holes in 2017, re-bushing in 2020

KRAV
Säkerhetsbesiktning av fasta järnvägsanläggningar
TDOK 2014:0240
Version 11.0
2022-11-01

TRAFIKVERKET

Felrapport id	Anmält datum	Beskrivning	Typ av fel	Anläggningsdel
FR02892206	2015-01-12	R-växel 106 (BVH) gick ur kontroll.	Ur kontroll	Bvr 106
FR02895626	2015-02-03	Växel 106 ej väntsläp. Överlämnat till Arlanda	Ur kontroll	Bvr 106
FR02897805	2016-05-15	växel 106 går inte om i vänsterläge. Överlämnat till Arlanda	Ur kontroll	Bvr 106
FR02898430	2016-06-11	vd 106 ej väntsläp	Ur kontroll	Bvr 106
FR028984780	2016-06-19	Växel 106 ej höger	Ur kontroll	Bvr 106
FR02101045	2016-11-09	vd 106 ej väntsläp. Ett annat företag som fixar vax därav prognos fredag	Ur kontroll	Bvr 106
FR02103249	2016-12-10	vd 106 ej väntsläp	Ur kontroll	Bvr 106
FR02102065	2017-01-04	Vxl 106 ej väntsläp (snö?)	Ur kontroll	Bvr 106
FR02102146	2017-01-08	vd 106 ej höger. tar även hand om vd 106.	Ur kontroll	Bvr 106
FR02151508	2018-10-28	Vxl 106 ej höger	Ur kontroll	Bvr 106
FR02169372	2019-01-28	vd 106 gick först inte i vänsterläge. felet försvann efter omläggning.	Ur kontroll	Bvr 106
FR02171920	2019-02-04	Växel 106, ej väntsläp	Ur kontroll	Bvr 106
FR02223652	2019-10-25	växel 106 var ur kontroll. felet försvann	Ur kontroll	Bvr 106
FR0223232	2019-10-29	R-växel 106 i Blackveten går ej i höger	Ur kontroll	Bvr 106
FR02197937	2020-12-27	Vxl 106 ur kontroll	Ur kontroll	Bvr 106
FR02300521	2021-01-11	Växel 106 ur kontroll efter ett tåg.	Ur kontroll	Bvr 106
FR02305951	2021-01-30	Vxl 106 ur kontroll	Ur kontroll	Bvr 106
FR02344025	2021-06-18	R-växel 106 går ej höger.	Ur kontroll	Bvr 106
FR02342350	2021-07-28	Växel 106 går ej i höger	Ur kontroll	Bvr 106
FR02370864	2021-12-22	Vxl 106 ur kontroll	Ur kontroll	Bvr 106
FR02174087	2022-01-08	Växel 106 klövad och ur kontroll	Ur kontroll	Bvr 106
FR02395029	2022-04-27	Växel 106 går ej höger. Växeln är nu klövad i vänsterläge.	Ur kontroll	Bvr 106
FR02395029	2022-04-27	Växel 106,337 går inte om i vänsterläge	Ur kontroll	Bvr 106
FR02395029	2022-04-27	Växel 106, ej väntsläp	Ur kontroll	Bvr 106

BANVERKET

Handbok
BVH 521.112
1907-05-13
Tills vidare

Handbok rörande Banverkets växeldriv
Växeldriv JEA 72 och JEA 73
Montage, underhåll och skötsel

Denna handbok ersätter och uppkriver följande SJTF:
573.0.106, 573.0.172 och 573.0.215.

Kommentar

2 om in på spets
gen. Påspets
avsett.

2
ng växlar 105,103,106
hela växeln
om skruv på växelns
ålgas
ändras
gröda, bit ur
omringning, ändras

20230317 133- 860 Hög@134 10mm långt 5m växel 107 Bvr samt växel 106

Conclusions and causes of the accident

- The direct cause of the derailment was the displacement of the movable crossing due to the failure of the weld joints on the drive connection plate
- Dynamic load cases from passing wheels and axles had caused fatigue cracks in the weld joints of the drive connection plate
- At the system level, the drive connection plate was not designed for the load cases and conditions present in switch 106
- Additionally, the rules and procedures for safety inspections and maintenance were not designed to identify and address deficiencies in the weld joints of the drive connection plate

Recommendations

A-Train AB:

- Given the previous high wear, maintenance and damage to the old types of switches: monitor wear and maintenance in the new type of switch to proactively identify potential deficiencies

Recommendations

Vossloh Switch Systems AB:

- Investigate whether weld joints in newly manufactured drive connection plates should be dimensioned for dynamic load cases to minimize the risk of fatigue cracks and fractures
- Review and follow up on rules and procedures to ensure that welding work meets requirements and standards

Recommendations

Swedish Transport Administration:

- Examine drive connection plates using volumetric testing to ensure that the weld joints meet established requirements and to detect any hidden defects in load-bearing welds
- Review governing documents to ensure that weld joints in drive connection plates for movable crossings within the Swedish Transport Administration's infrastructure are inspected to the required extent to minimize the risks of fatigue cracks and fractures

Recommendations

Swedish Transport Administration:

- In consultation with the Swedish emergency call service, develop a method to quickly determine the location of a railway accident. The work should focus on ensuring that the Swedish Transport Administration, in connection with the initial information about the accident, can provide and communicate a position that emergency resources can reference.