IMPALA
Member of the Implats Group

Improvements on winch signalling systems

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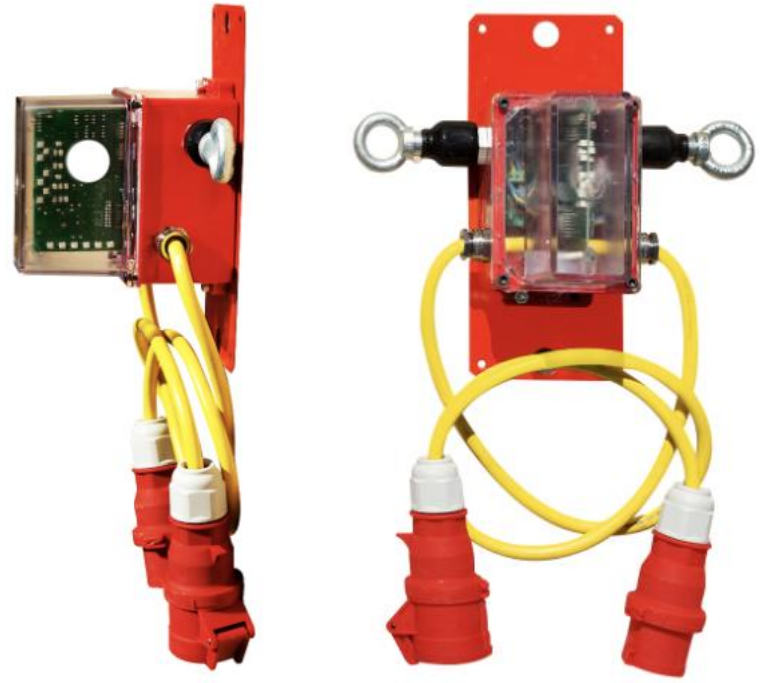
Winch singalling system optimization

Layout of presentation

- Background
- Issues experienced to date
- Proposed methodology to determine root cause
- Findings to date
- Plans to rectify findings
- The importance of MOC



Winch singalling system optimization - Background

- Electronic winch signalling systems introduced 14 years ago
- Intended to replace the use of air whistles for singalling due to the following safety issues:
  - Not suitable for long gulley lengths
  - Bell wire gets tangled in the workings of the gulley's
  - No pre-start warning
  - No ability to trip the winch
  - Single point of singalling
  - Reliant on compressed air

- Electronic winch signalling is currently in use in all the centre gulley’s and diagonals at Impala

Winch singalling system optimization - Background

- Electronic winch singalling introduced for the following safety benefits
  - Detection of electronic winch signalling system required to start the winch
  - Magnetic key required to start the winch - only issued to winch drivers
  - Pre-start warning (audible and visual) emitted along the length of the scraper path
  - Visual indication of the winches operational status for the length of the scraper path
  - Reduces total length of each bell wire – easier to signal and less chance of fowling
  - Provides personnel with the ability to trip the winch
  - Enables voice communications from anywhere along the scraper path to the winch driver

Safe to enter

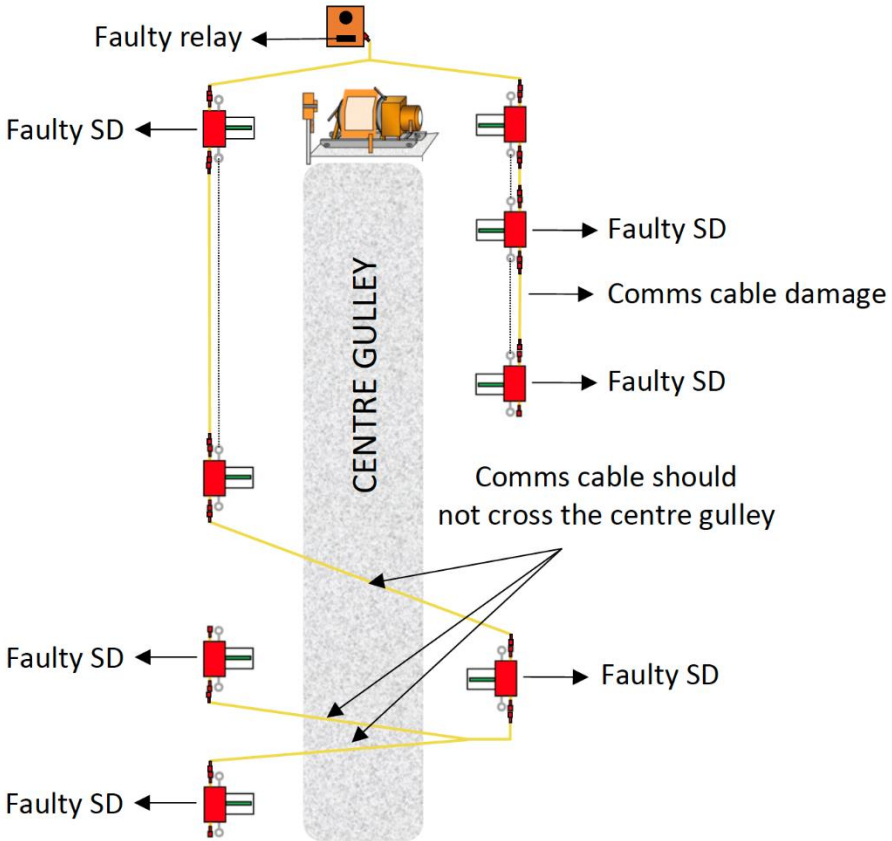
Do not enter

Signal

Winch singalling system optimization - Issues

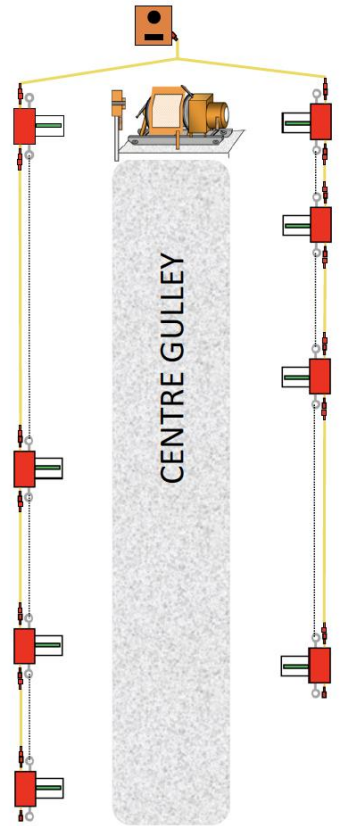
- Auditing of existing systems revealed many installations below standard

Sub-standard installation



Audit and rectify

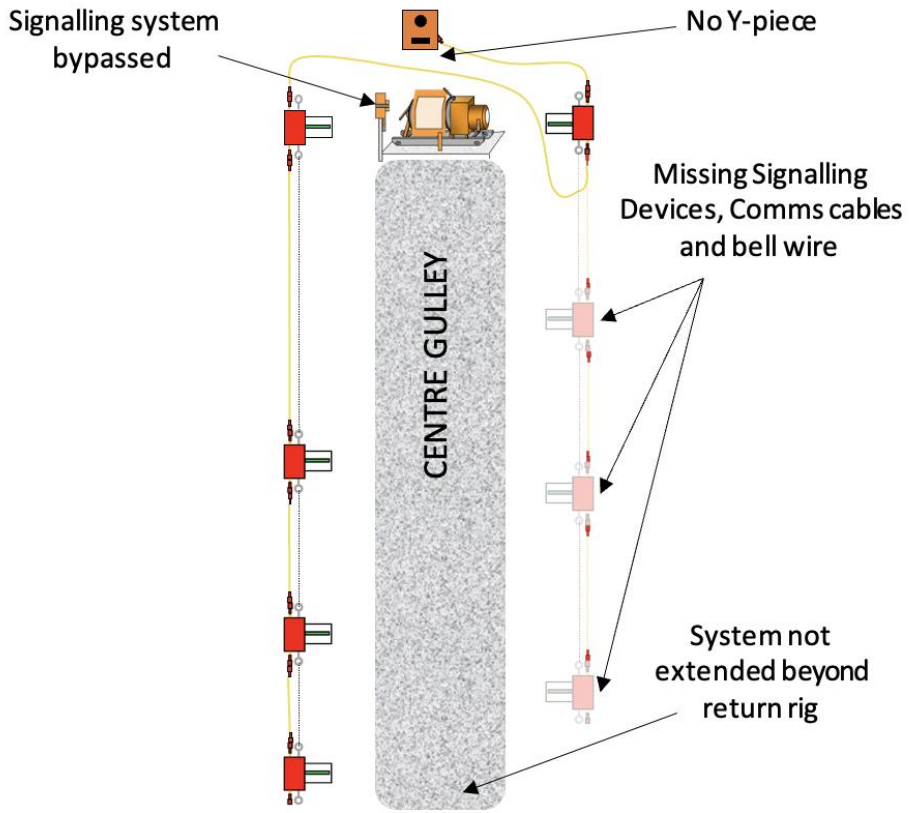
Corrected installation



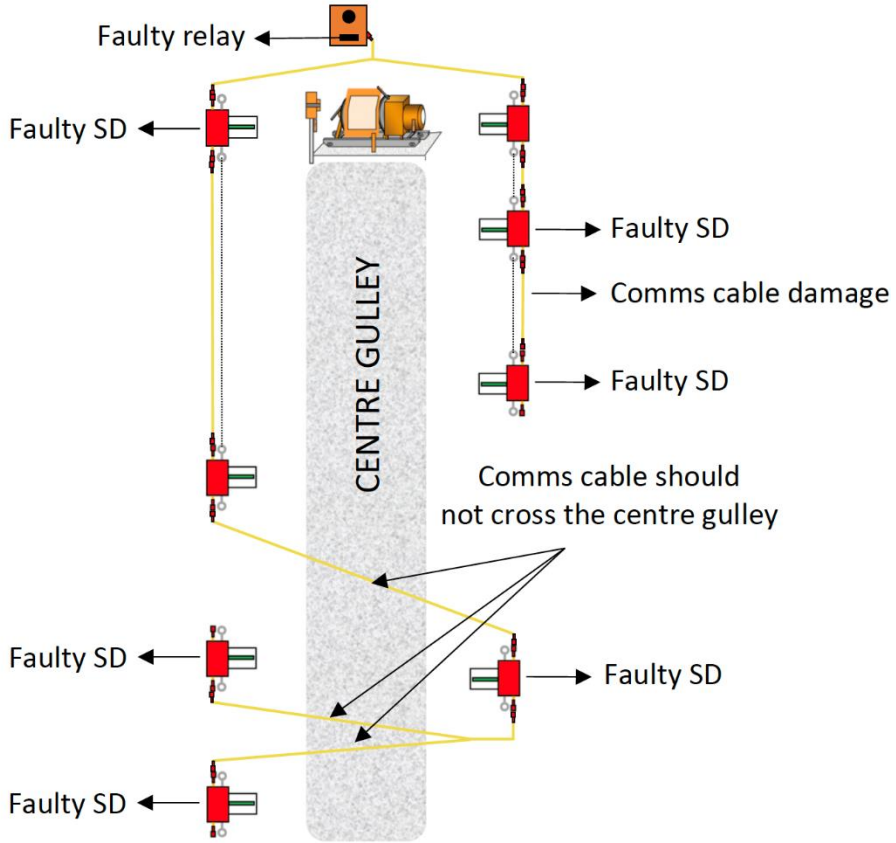
Winch singalling system optimization - Issues

- This led us to the following question - why are installations sub-standard?

Sub-standard installation #1



Sub-standard installation #2



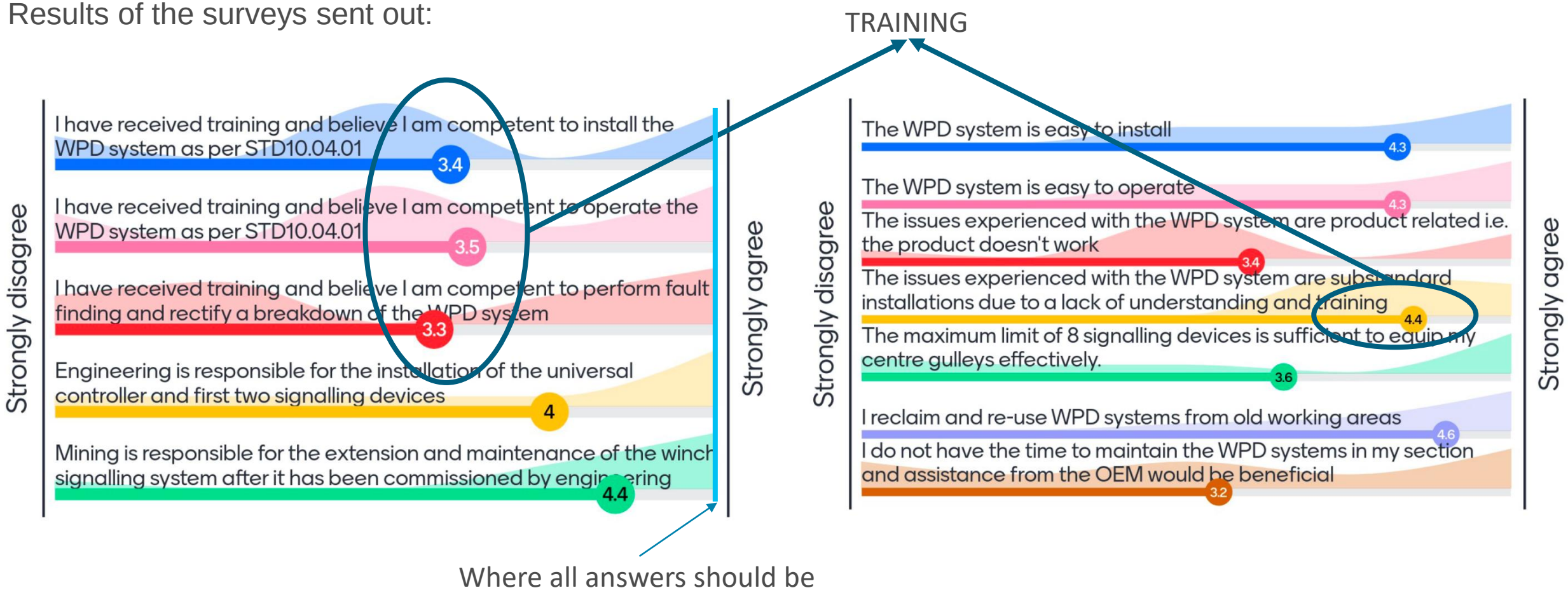
Winch singalling system optimization – Methodology

The following methodology was applied in collaboration with the OEM in order to determine the root cause of the issues faced with the electronic winch singalling system.

- Surveys sent out to several key personnel across all shafts
  - Mine Overseers, Shift Bosses, Engineers, Electrical Forman and Electricians
- Rectified mock-ups installed at various shafts
  - Provides a permanent example which can always be referenced for the correct installation methodology
- OEM provided detailed training to the relevant personnel managing the winch singalling systems
  - Performed a pre-test and post-test
    - Revealed current gaps in the work forces competency
    - Highlighted which aspects were not adequately addressed during training
  - Asked the work force to highlight the top 3 issues causing substandard installations

Winch singalling system optimization – Surveys

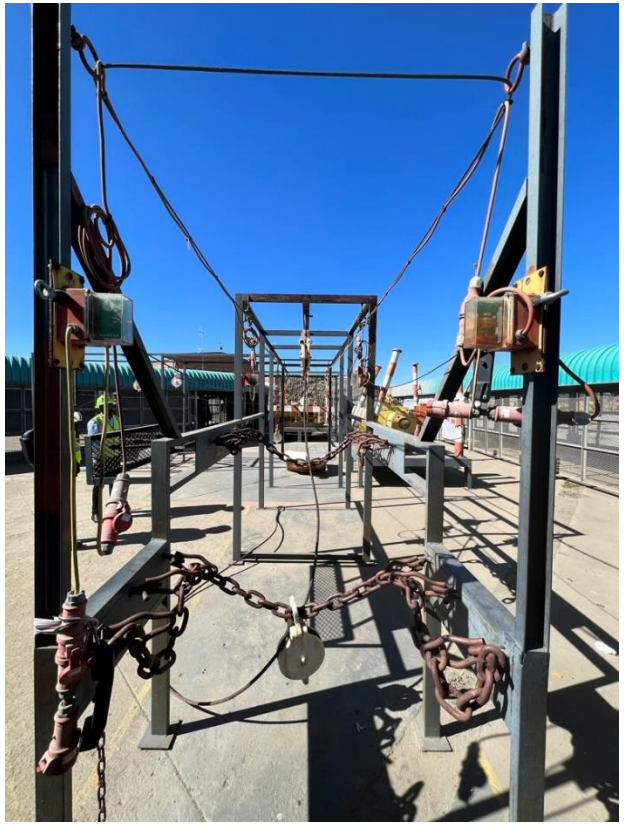
Results of the surveys sent out:



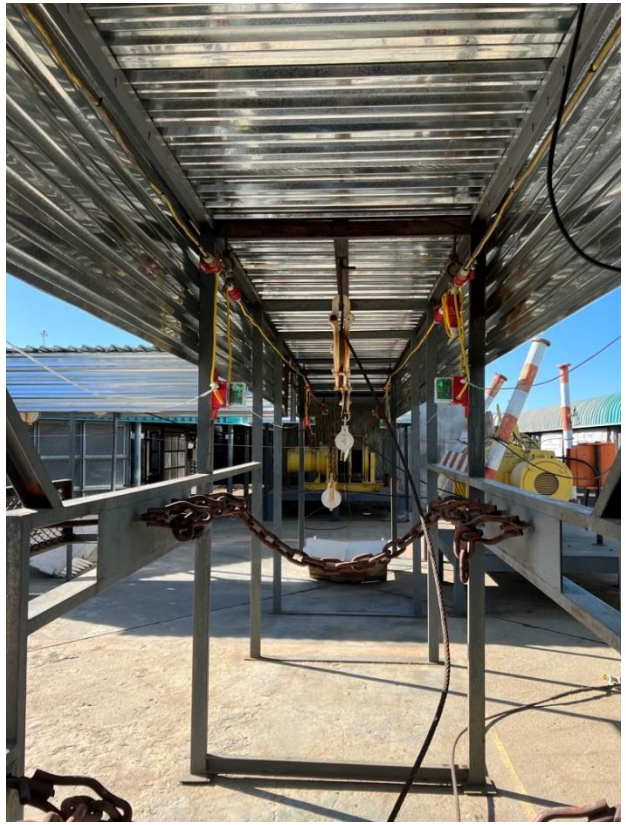
Winch singalling system optimization – Mock-ups

It was clear from the surveys that training is one of the leading factors which is resulting in sub-standard installations. Therefore, we ensured that all mock-ups were operational and began to provide training to critical managerial personnel.

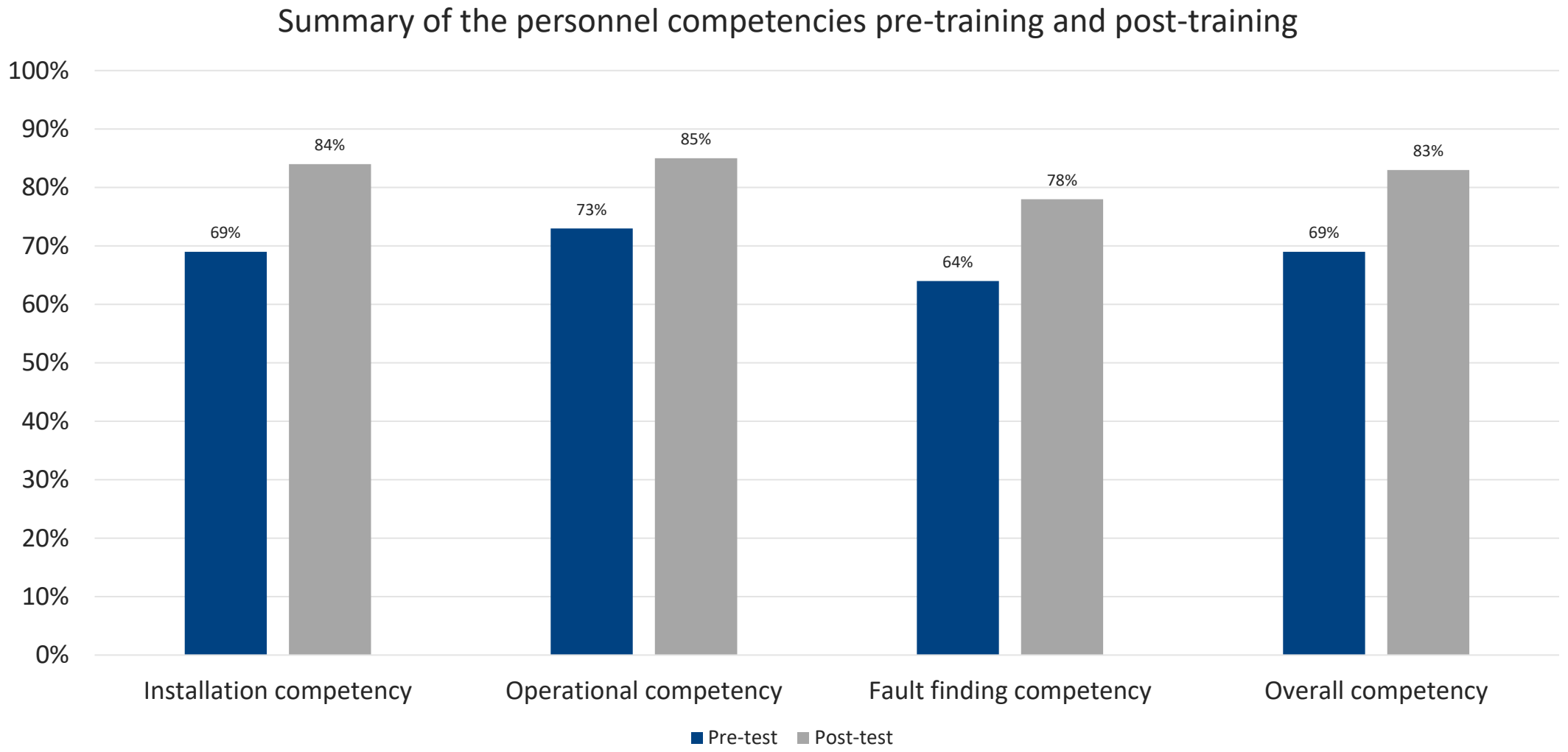
Before



After

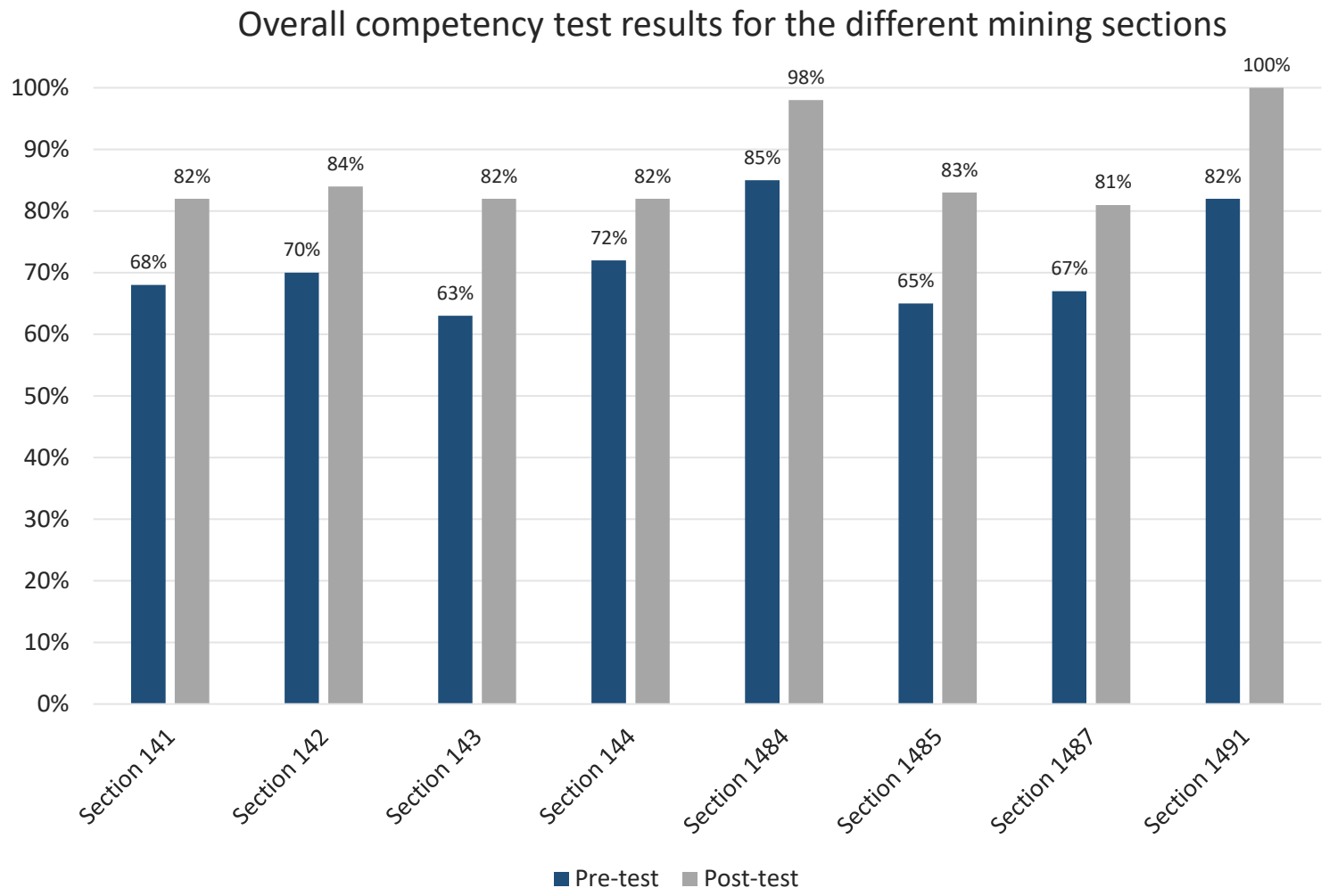


Winch singalling system optimization – Training results

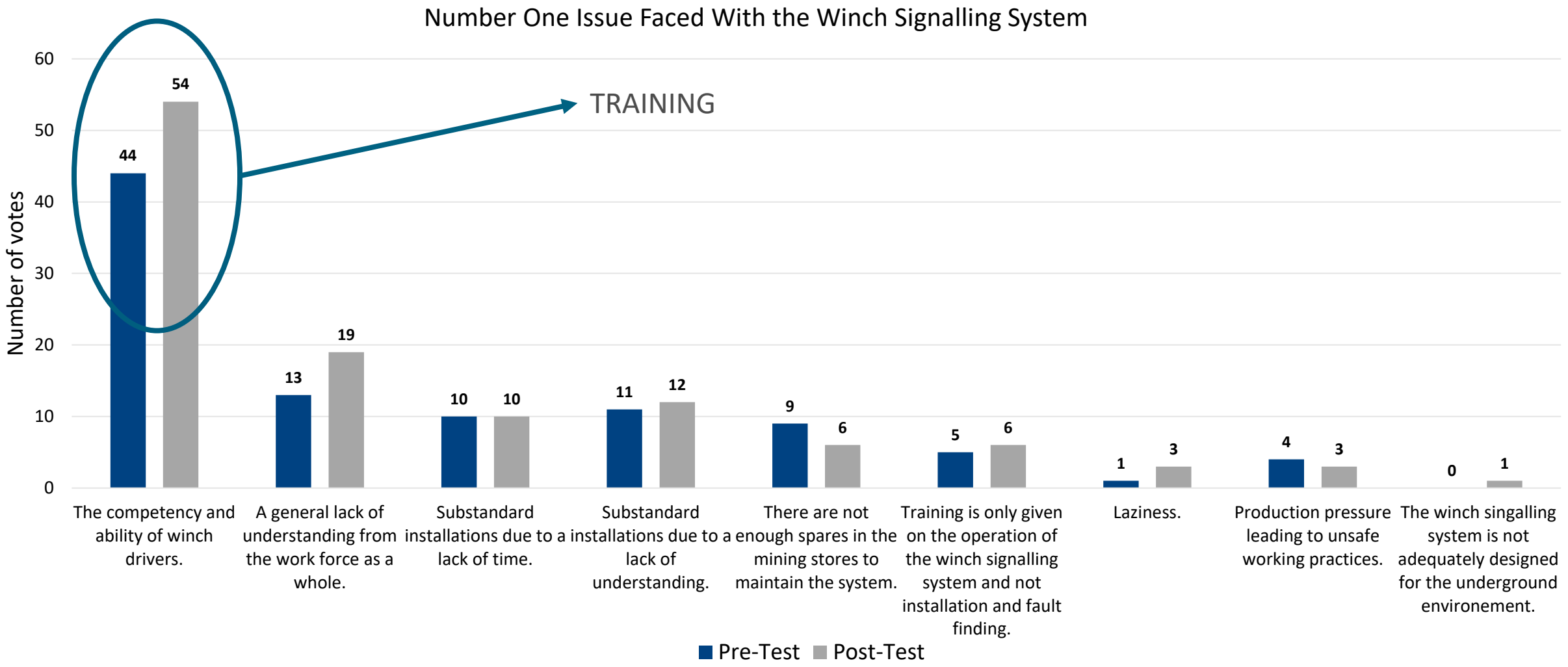


Winch singalling system optimization – Training results

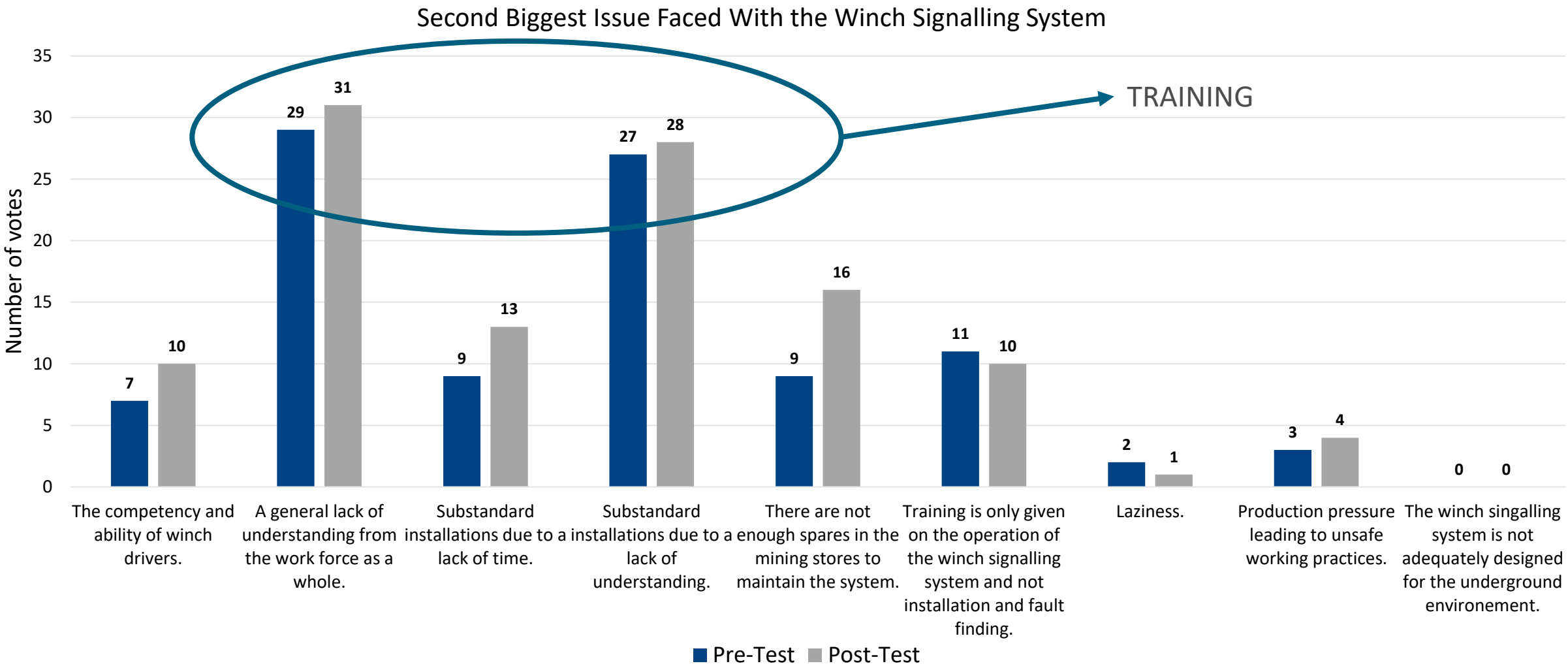
Section	Number of attendees
Section 141	29
Section 142	35
Section 143	11
Section 144	27
Section 1484	4
Section 1485	7
Section 1487	18
Section 1491	2
Total number of attendees	133



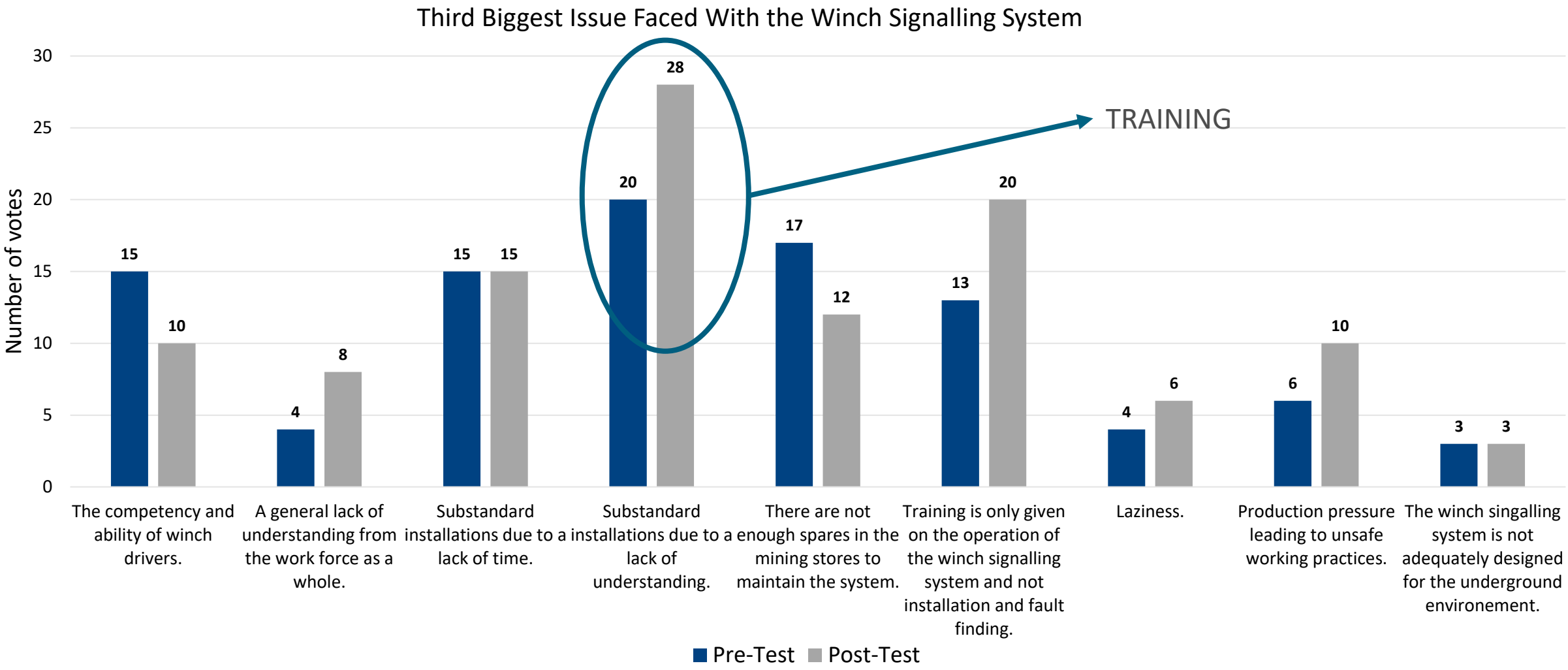
Winch singalling system optimization – Top 3 issues



Winch singalling system optimization – Top 3 issues



Winch singalling system optimization – Top 3 issues



Winch singalling system optimization – Installation competency

Installation competency

Question	Pre-Test		Post-Test	
	Agree	Disagree	Agree	Disagree
The winch signalling system must be switched off prior to adding or removing components from the system.	88%	12%	98%	2%
Two signalling devices must be installed on the two front poles of the winch barricade, connected to the Universal controller by the Y-Piece cable.	100%	0%	100%	0%
The maximum number of signalling devices which can be installed is 10.	71%	29%	6%	94%
Bell wire must only be installed on one side of the centre gulley.	13%	88%	26%	74%
All centre gulley's should be ledged and the yellow communications cable of the WPD system should be placed in the ledged sections, outside of the scraper path.	97%	4%	99%	1%
A signalling device from the raise winch must be installed at the bottom of the travelling way in the event that material is pulled up the travelling way using the raise winch.	83%	17%	61%	40%
A pull cable must be installed in each of the strike gulley's, such that personnel in the strike gulley can signal to the centre gulley winch driver.	98%	2%	94%	6%
The winch signalling system must be installed until 10m before the return rig.	61%	41%	25%	76%

Winch singalling system optimization – Operational competency

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Operational competency

Question	Pre-Test		Post-Test	
	Agree	Disagree	Agree	Disagree
All signalling devices should indicate a green light when the winch is not in operation if the WPD system is correctly installed.	95%	5%	98%	2%
A magnetic key should be permanently chained to the winch starter box such that it is always available.	26%	74%	3%	97%
The winch should be able to start without placing the magnetic key on the universal controller.	0%	100%	4%	96%
A 15 second audible and visual pre-start warning must be emitted by all the signalling devices after placing the magnetic key on the universal controller.	100%	0%	100%	0%
The winch can be started during the 15 second pre-start warning.	41%	59%	21%	79%
The yellow cable can be pulled to signal to the winch operator.	12%	88%	6%	94%
The Biza khuluma can only be installed at the first and last signalling device.	66%	34%	25%	75%
The Biza Khuluma can be used to signal the winch operator, tripping the winch and for voice communication.	87%	13%	100%	0%
A red light on the signalling device indicates that the winch is not running, and it is safe to enter the centre gulley.	4%	96%	2%	98%
Three short pulls on the bell wire will trip the winch.	25%	75%	18%	82%
The winch operator should inspect the winch signalling system installation for the entire length of the gully before he/she starts the winch at the start of the shift.	100%	0%	100%	0%
When a signal is given whilst the winch is in operation, the lights of the signalling device will remain red, and the green light will flash according to the given signal.	91%	9%	100%	0%

Winch singalling system optimization – Fault finding competency

Fault finding competency

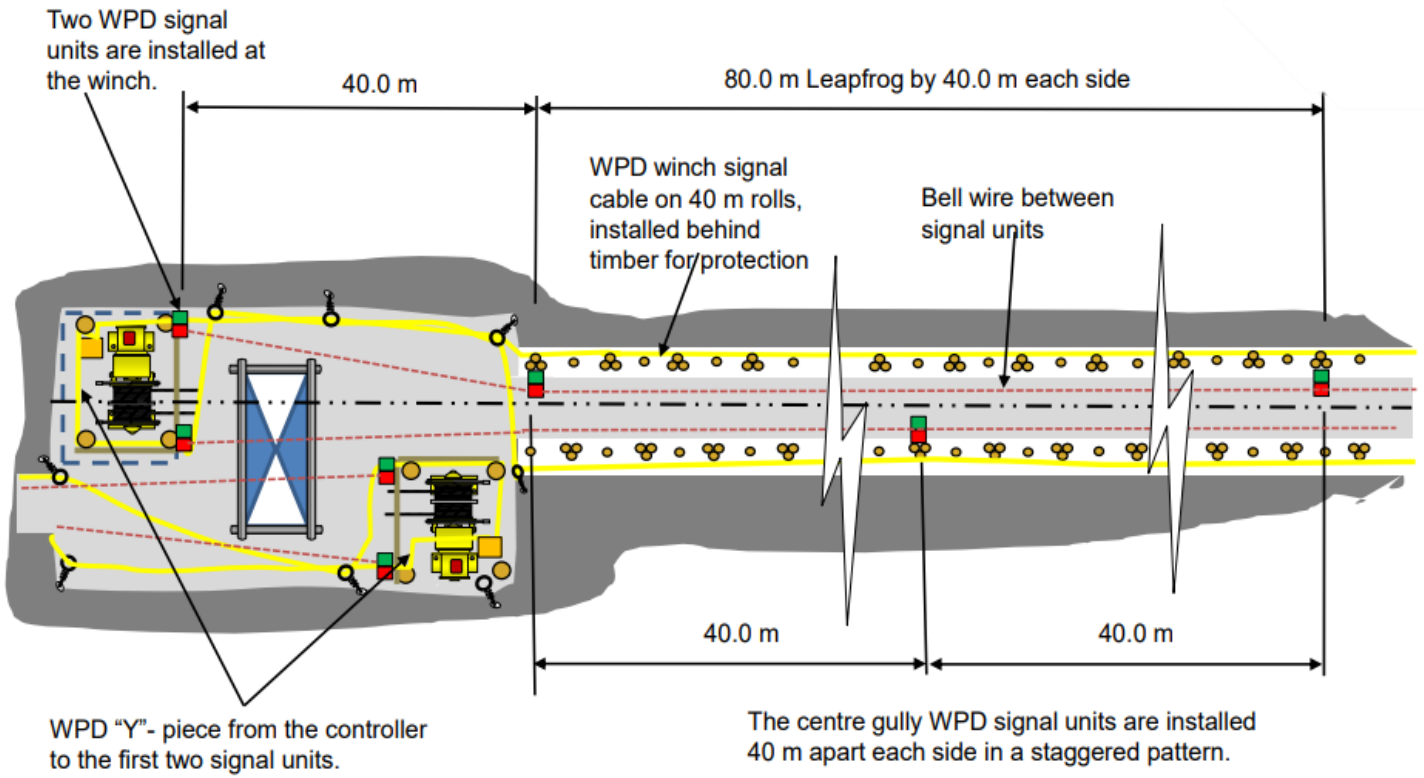
Question	Pre-Test		Post-Test	
	Agree	Disagree	Agree	Disagree
The system should be switched off at the universal controller prior to replacing a faulty signalling device or a damaged cable.	92%	8%	96%	4%
When fault finding on the system, the first step requires that that the system be shut-down and only the universal controller and first two signalling devices should remain connected and be tested.	85%	15%	95%	5%
If the winch signalling system is faulty it must be bridged out such that the winch can be used.	0%	100%	16%	84%
When a cable is damaged during underground operations it should be repaired using insulation tape and re-used.	24%	76%	7%	93%
If a signalling device does not emit a green or a red light, it is working correctly.	10%	90%	7%	93%
If a signalling device is suspected to be faulty it should be bypassed/skipped and then the system should be re-tested to check if the signalling device is in fact the issue.	43%	57%	64%	36%
If the relay has been replaced and the system still does not operate as expected, then the relay should be replaced again.	84%	16%	46%	54%

Issues raised by mining personnel during training

- Panel keys to open universal controller
- Tampering with Relays
- Relays falling out when blasting at the tip
- Relay damage due to substandard installations

Issues raised by mining personnel during training

- The centre gulley's only being ledged on one side, leading to communications cable running within the centre gulley and getting damaged.



Winch singalling system optimization – Plans to rectify training issues

- Revisit and rectify existing standards
  - Improve readability of standards
  - Include commission testing when handing over the system from Engineering to mining
- Rectification of training at training centres to cover the following:
  - Installation
  - Operation
  - Fault finding
- Create an awareness video to highlight critical items related to electronic winch signalling
- Include Electronic winch signalling competency in winch drivers licence process
- Onboarding of a team from the OEM to assist with installations, training and fault finding

Winch singalling system optimization – Adoption of a new system

- Implementation of a trial site with the legacy system
- Benefits of the legacy system
  - Removes the ability to tamper with the universal controller
  - Increased ruggedness of the system
  - The system can perform a self diagnosis to assist the winch operator with fault finding

Winch singalling system optimization – MOC

- Management of change is required to ensure a successful rollout of the new system

- Enabling / reinforcing leadership and management
  - Create personal incentives through recognition and reward

- Direct industry involvement
  - Create industry ownership through leadership

- Specialist secretariat support
  - Reduce complexity and enable effective industry involvement

- Peer group reviews
  - Identify and spread adoption of good practice

Winch singalling system optimization – MOC

- Demonstration projects
  - Facilitate emergence of adoptive behaviour

- Communities of practice
  - Facilitate widespread adoption

- Champions
  - Spearhead emergence of adoptive behaviour

- Facilitating structures and processes
  - Operational adoption of technology and best practice

- Quality communication throughout the process
  - All initiatives listed above must constitute quality communication to facilitate adoptive behaviours

The end

Questions?