

Disaster Risk Reduction in Road Transportation of Petroleum Products in Nigeria

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Nigeria: Present Challenges



Road Tanker Accidents & Explosion in Nigeria



**Ibadan Tanker Explosion,
Saturday, 7th Sept 2024: 4
Cars burnt, houses
destroyed.**

**Minna, Niger State, Tanker
Explosion, Sunday 8th Sept
2024: 37 fatalities, 50 cows
destroyed, several people
injured & vehicles
destroyed**



Majia Tanker Explosion, Jigawa State 15th Oct 2024



**Tanker Rollover & Explosion:
over 209 fatalities, 124
persons injured.**



Tanker Disasters have not abated in 2025



**Dikko Junction, near Suleja,
Niger State, Tanker Explosion,
Saturday 18th January 2025:
over 100 fatalities, 69 injured,
destroyed houses & at least
20 nearby shops**

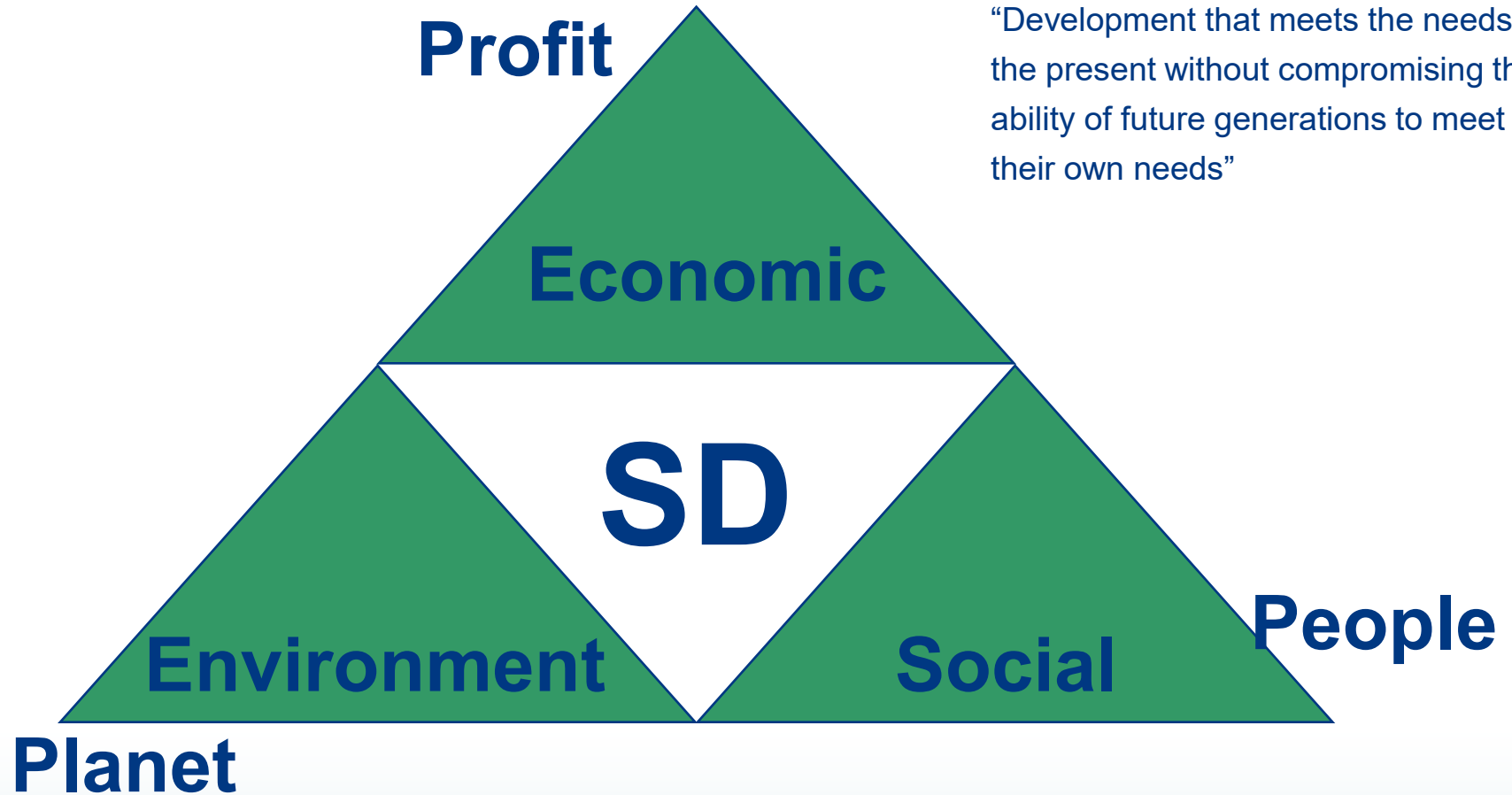
**Karu Bridge, FCT, Wednesday,
19th March 2025: Over 30
fatalities, 20 hospitalised, 18
vehicles burnt**



The Case for Action

The Triple Bottom Line of Sustainable Development

“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”



The 3 Pillars of SD: People, Planet & Profit

Disasters destroy the 3 Pillars

Sachangwan-Kenya Memorial for 2009 Disaster Victims



31st January 2009, a petroleum road tanker rolled over in Sachangwan-Kenya, resulting in PMS leaks followed by explosion & fire, which killed 120 persons, and several others injured. The Govt investigated the incident, set up NTSA, etc. & built a monument at the location, with the mass grave. A commitment !

The Cost of Accidents

Minor Accidents

£1

INSURED COSTS

. Covering injury, ill health, damage.

£8 - £11

UNINSURED COSTS (some 10x higher)

- . Product and material damage
- . Plant and building damage
- . Tool and equipment damage
- . Legal costs
- . Expenditure on emergency supplies
- . Clearing site
- . Production delays
- . Overtime working and temporary labour
- . Investigation time
- . Supervisors time diverted
- . Clerical effort
- . Fines
- . Loss of expertise / experience

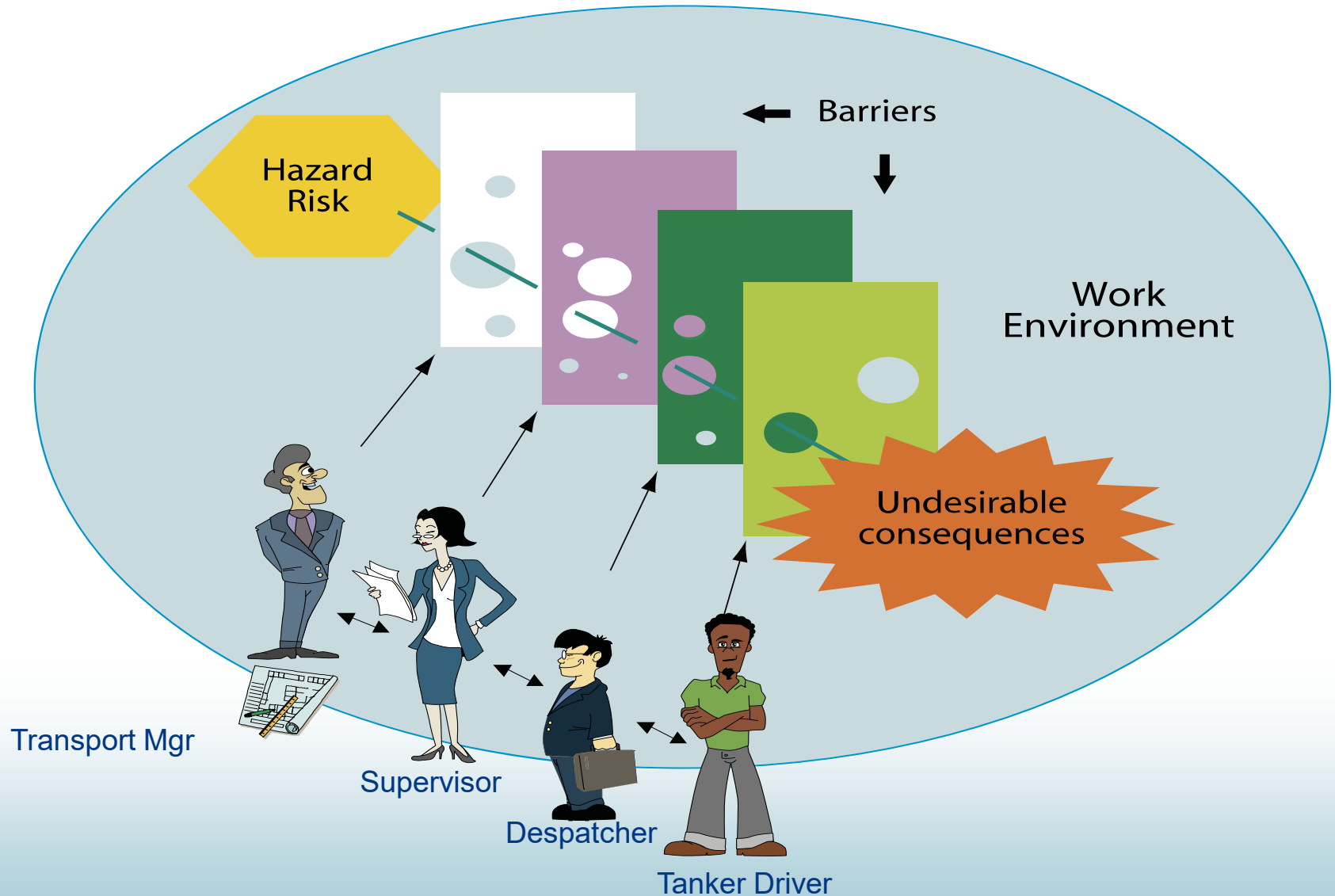
Road Safety Strategy

6-Point Focus Area:

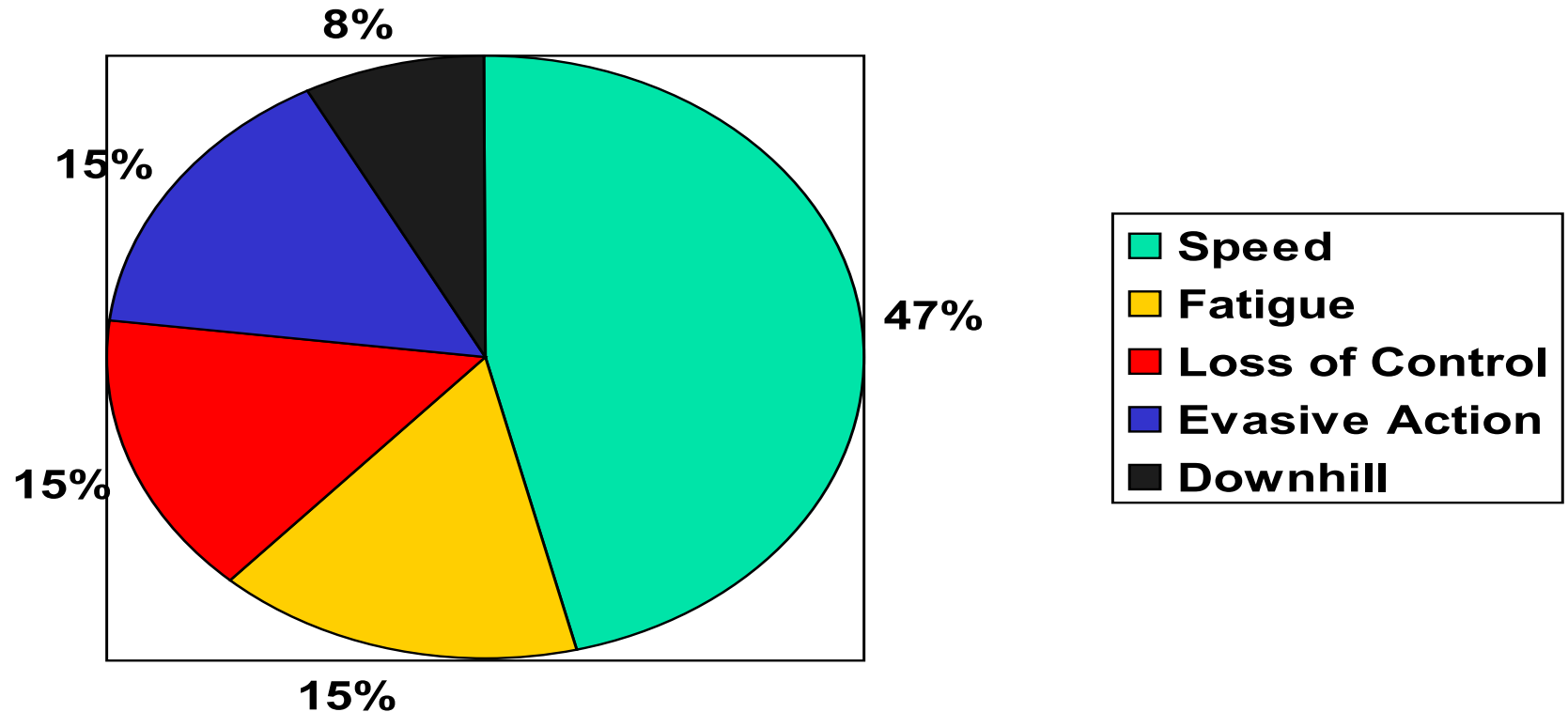
- **People:** Suitability/Recruitment of Drivers, Training/Certification; Dispatchers/Journey Managers, Supervisors, etc.
- **Vehicle:** Vehicle Specifications/Standards; Rules/Checks for Safe Vehicles, OBC/IVMS, etc.
- **Procedures:** Journey Management; “Authorisation to Drive” Procedures; Rest Periods (Fatigue Management); etc.
- **Driver Management:** Driver's Professionalism; Mentoring, Best-Practice sharing
- **Roads:** Hazard Route Mapping/Reporting
- **Other Stakeholders:** Govt/Regulators/Agencies to improve awareness (FRSC, Red Cross, Police, Industry), Other Road Users, School Curriculum

Disaster Risk Reduction in Road Transport

The Swiss Cheese Model of Accident Causation



What are the causes of tanker rollover?



- All tanker rollovers are preventable
- Rollovers are mainly caused by human errors
- The tanker driver is the last barrier to prevention

Rollover Awareness/Prevention: Human Factors

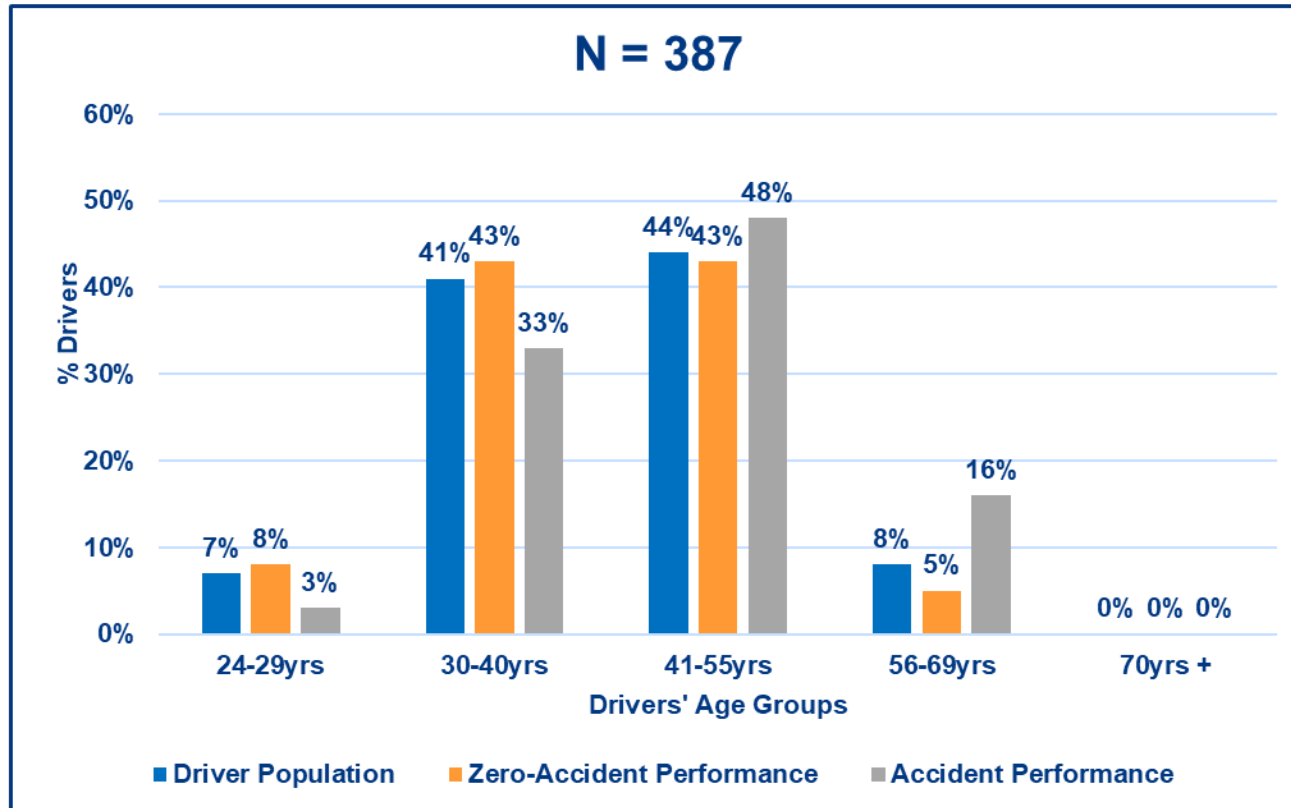
- **Excessive Speed**
- **Fatigue**
- **Driver inexperience or poor awareness of sloshing effect while transporting bulk liquid loads**
- **Drifting off the road or onto a soft verge and then quickly counter-steering**
- **Entering a bend, round-about or a ramp too fast**
- **Driving downhill/steep slope with inappropriate gear engagement**

The Human Factor: Tanker Drivers

Tanker Driver Survey

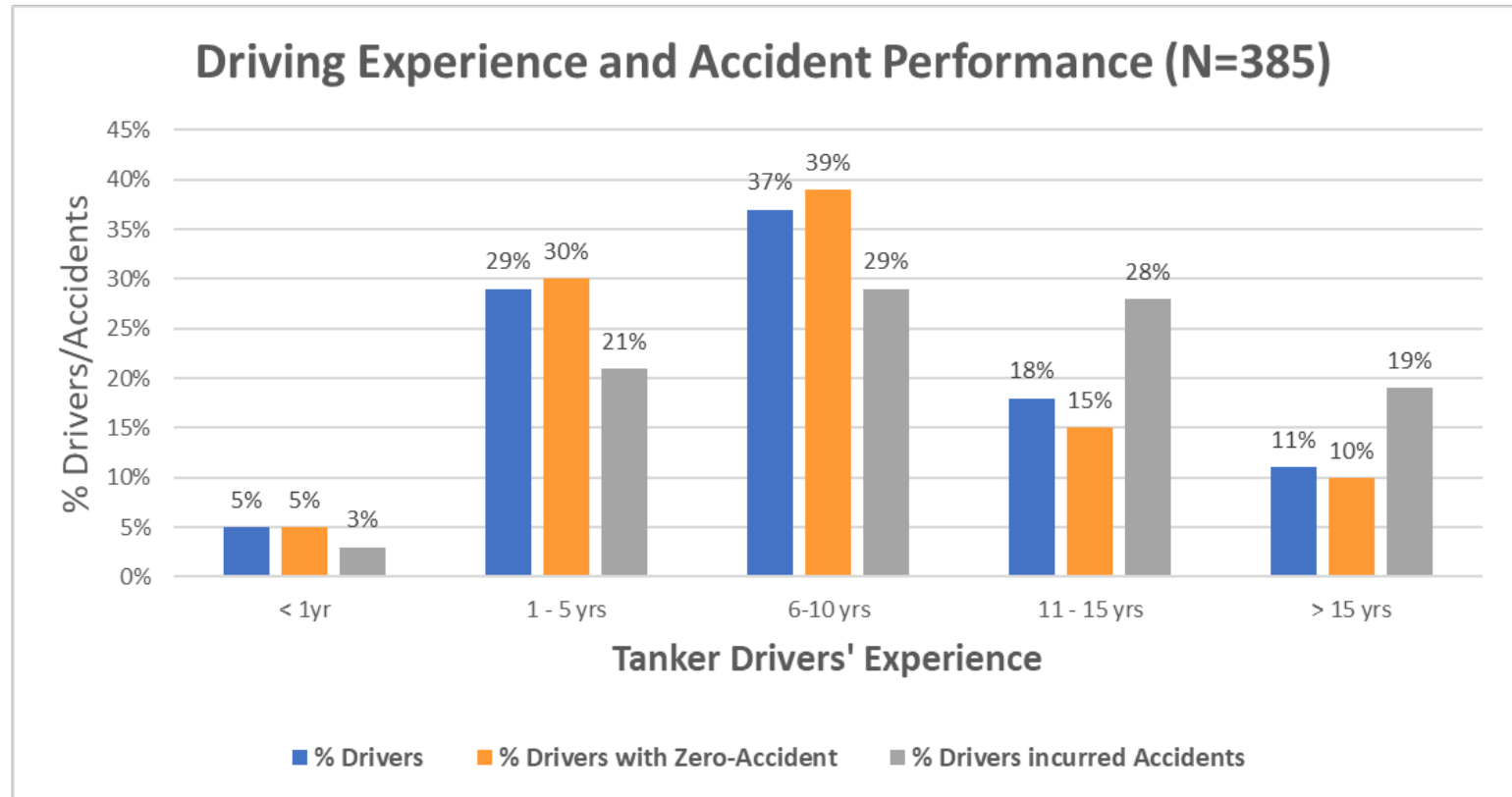
- Over 400 drivers participated in the survey, from different transporters, using simple random sampling
- Demographic characteristics of respondents included age, educational level, driving experience, monthly salary, category of transporters, etc.
- Data obtained: accidents incurred, injuries, spills, compliance with driving rules, engagement with supervisors, safety meetings frequency, etc.

Tanker Drivers' Accident Performance based on Age



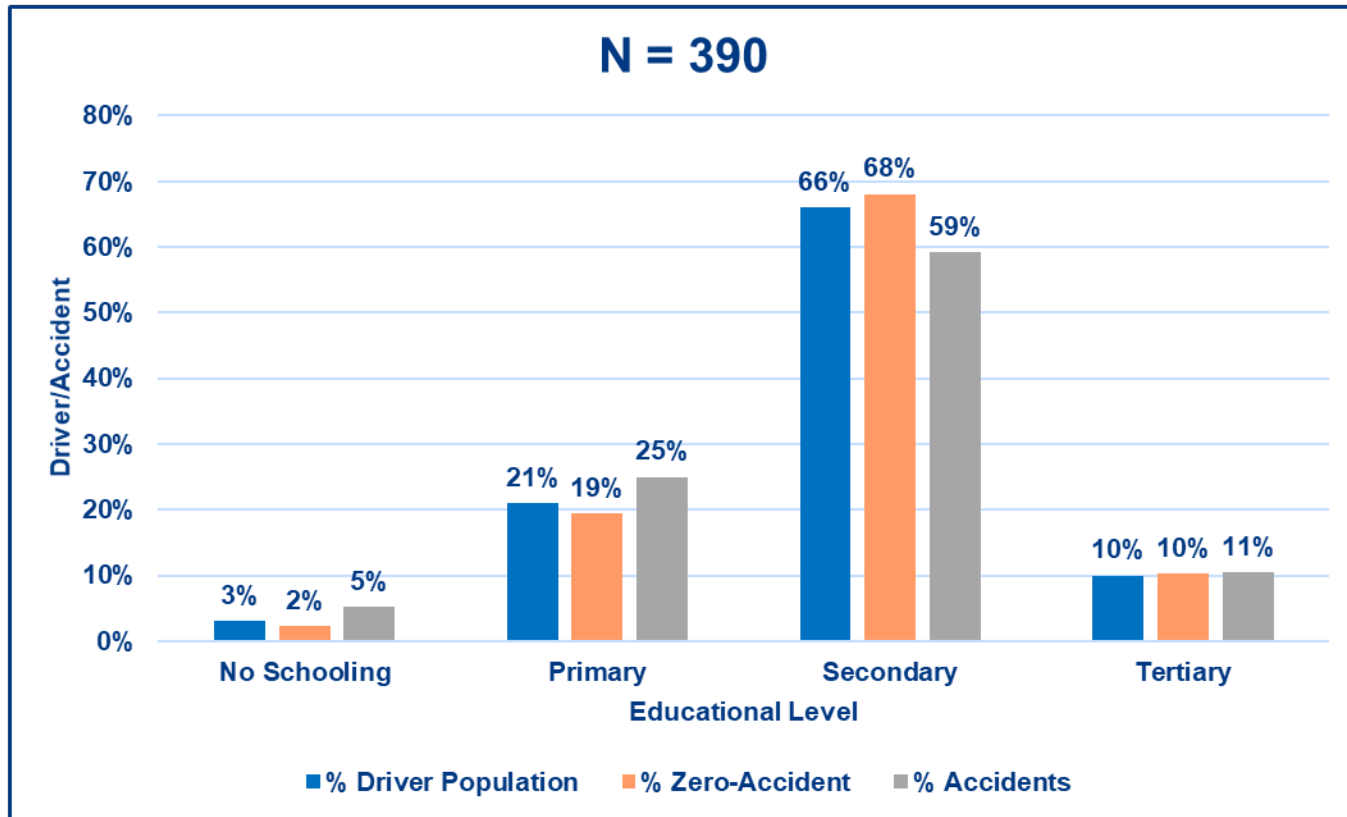
- Drivers in 30 – 40yrs age group had best performance: higher contribution to zero-accident
- This group of drivers had proportionally lowest contribution to accidents: 33% vs 41% size
- Research has shown driver's age could be a predictor of accidents (Hordofar et al 2018)

Tanker Drivers' Accident Performance based on Experience



- Drivers with 1-5yrs & 6-10yrs experience had good performance: higher contribution to zero-accident & lower accidents compared with population sizes of 29% and 37% respectively. However, drivers with 6-10yrs had marginally better performance on zero-accident.
- It has been highlighted that inexperienced drivers contribute to road tanker accidents (Shileche, 2012)

Tanker Drivers' Accident Performance based on Education



- Drivers with secondary school educational level had best performance; being the only group that contributed higher to lower accident performance (59%) compared with its population size (66%)
- Drivers with no formal education incurred higher accident rate (5% compared with population of 3%)
- Researchers have shown that education plays crucial role as a factor in road accidents (Lofti, et al, 2019)

Conclusions, based on study findings

Tanker Drivers:

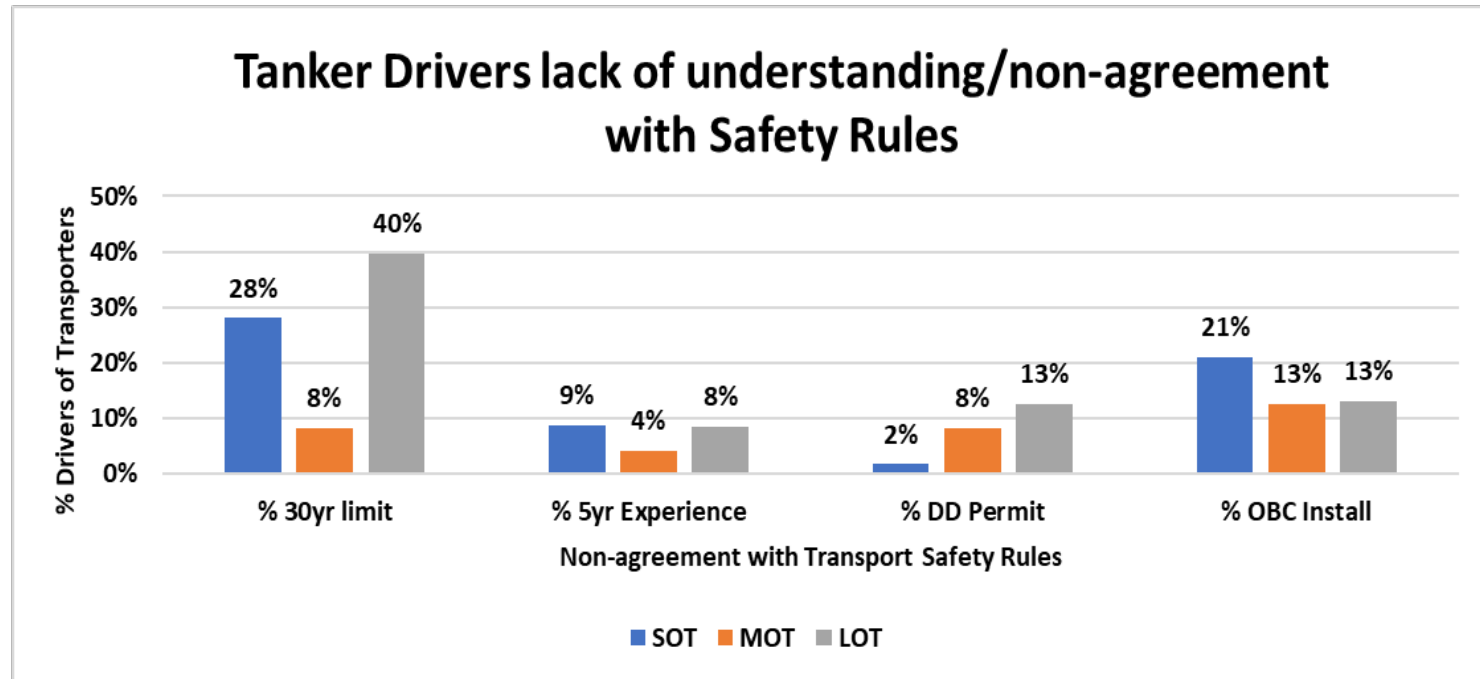
To reduce risks of disasters during road transportation of petroleum products, transporters should give preference to recruitment of tanker drivers with:

- Minimum age: 30yrs, preferably between 30 - 40yrs
- Minimum driving experience: 6yrs
- Minimum educational level: Secondary Education

FRSC should establish recruitment standards & certification for tanker drivers

The Human Factor: Supervisors & Organisation

Breakdown of tanker drivers' non-compliance with safety rules



- LOT had highest percentage of drivers (40%), who disagreed with 30yr age limit for drivers
- LOT had the highest percentage of drivers (13%) that disagreed with Defensive Driving Training and issuance of Permit-to-Drive (Defensive Driving Permit)
- Research has shown importance of pre-licensing program/training (Uzundu, 2018)

Legend:

SOT: Small Transporters (1 to 9 Tankers in the fleet)

MOT: Medium Transporters (10 – 49 Tankers)

LOT: Large Transporters (50 Tankers and above)

Root Causes of Disasters in Road Transport

The research identified two root causes of disasters:

- **Non-compliance:** The study revealed transporters with high level of non-compliance also had high rate of accidents and oil spill. Conversely, compliance with rules and procedures result in lower accident rate.
- **Ineffective Management (Organisation):** The study identified lapses within transporter's organization contributed to incidents; these included inadequate supervision and lack of enforcement of safe behavior. There was a general lack of management support for tanker drivers, leading to poor safety awareness. Drivers are the last barrier in the prevention of accidents.

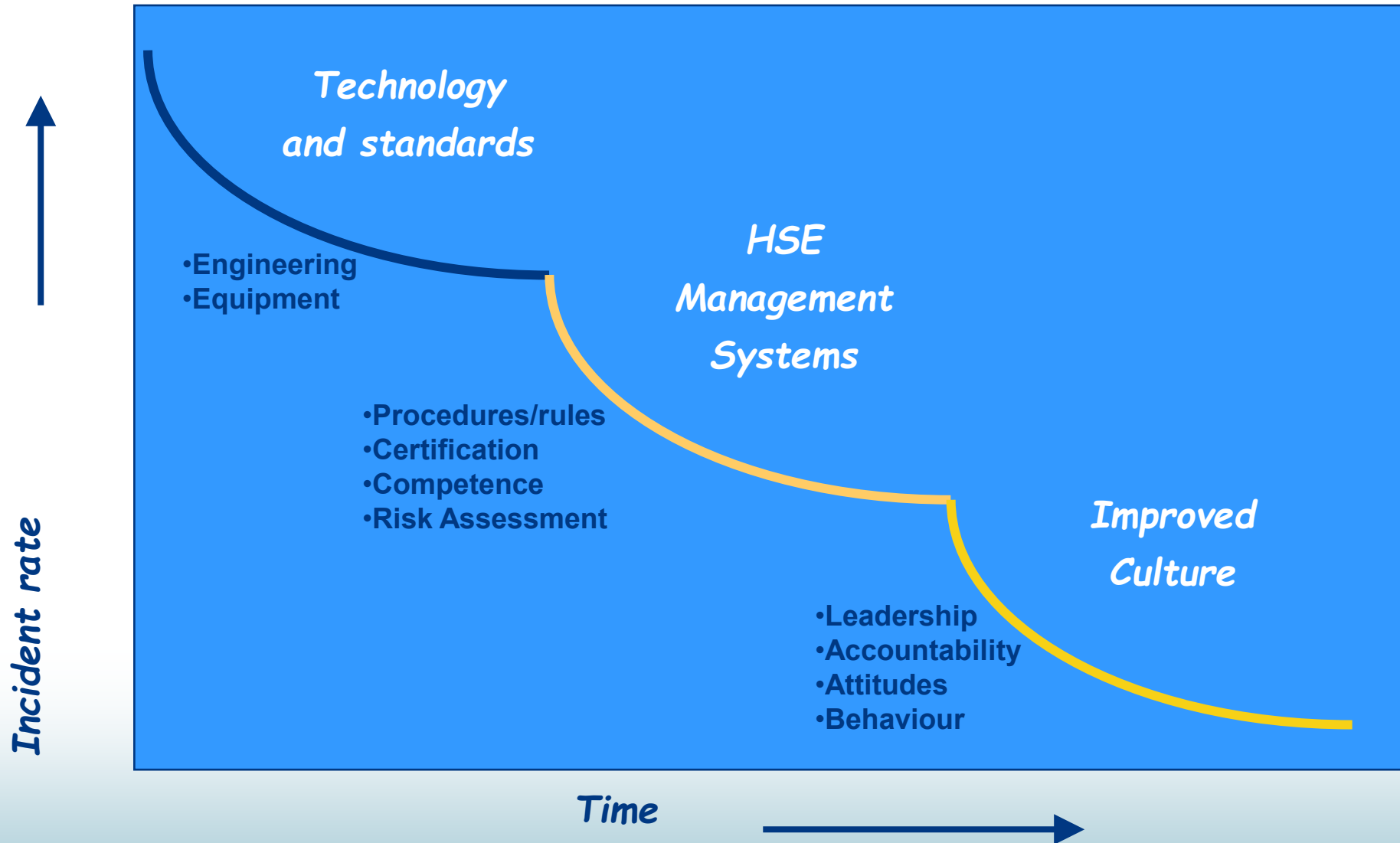
**How do we address these human factor issues:
tanker drivers & the organisation ?**

Behavioural Safety:

The Hearts & Minds Approach

The Case for Hearts & Minds

Safety Performance over Time



Why Hearts & Minds (H&M) ?

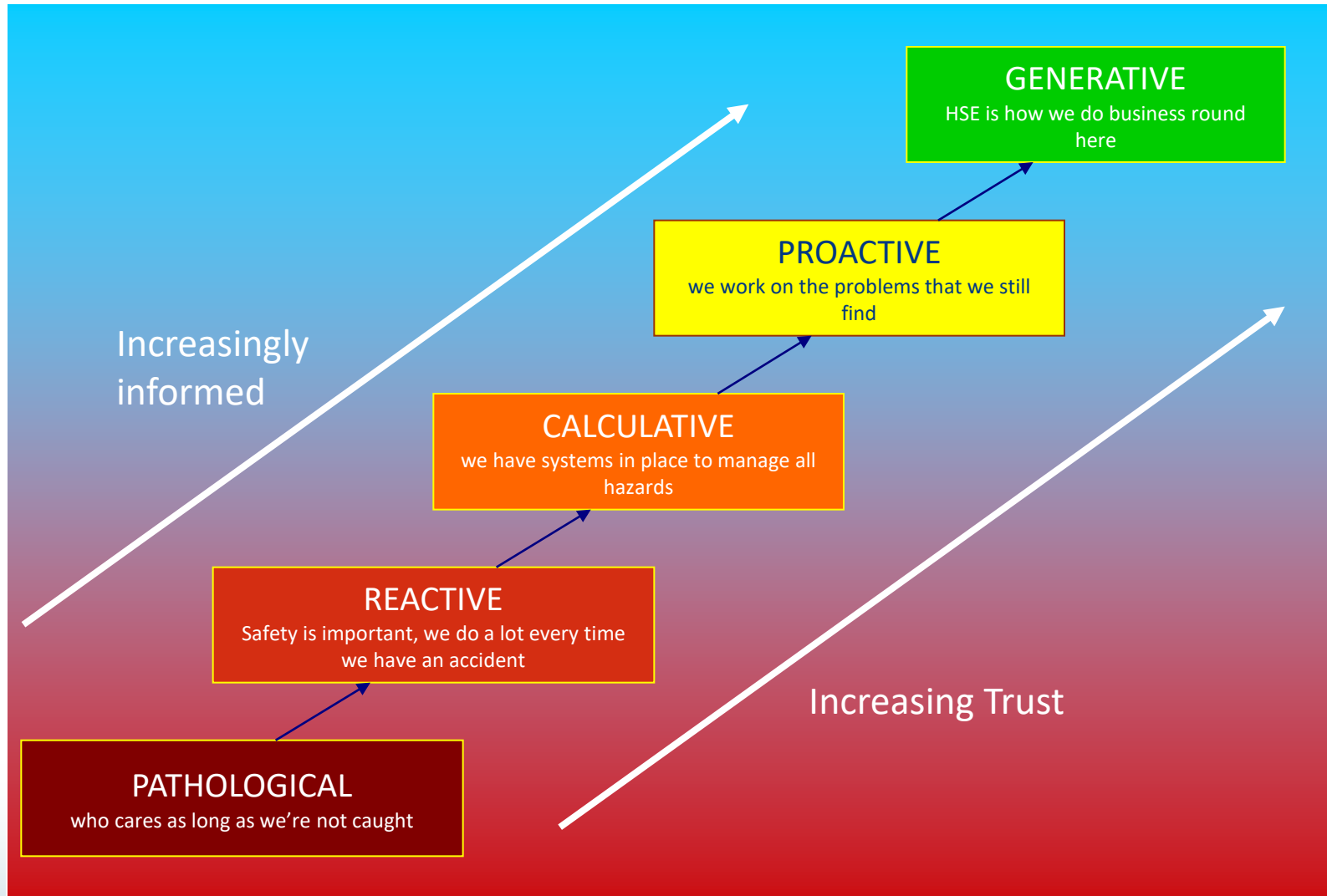
- H&M research was sponsored by Shell International Petroleum Company at both University of Manchester & Delft Technical University, Holland
- H&M tool now being coordinated worldwide by the Energy Institute (UK). To be run by only accredited personnel
- Tested & proven safety behavioural program; it has been well received in the oil industry by the majors & other industries
- H&M has a suite of tools that can be applied across all organizations, from senior leaders to shop-floor level
- The basic H&M tool, Understanding Your Safety Culture (UYC), facilitates assessment of organization's Culture and identifies the gaps
- H&M tools to address the gaps are identified; e.g. Driving for Excellence is directed at Road Transport Safety
- It facilitates the building of a high performance team to implement/support change

The Hearts & Minds Approach

The underlying aim

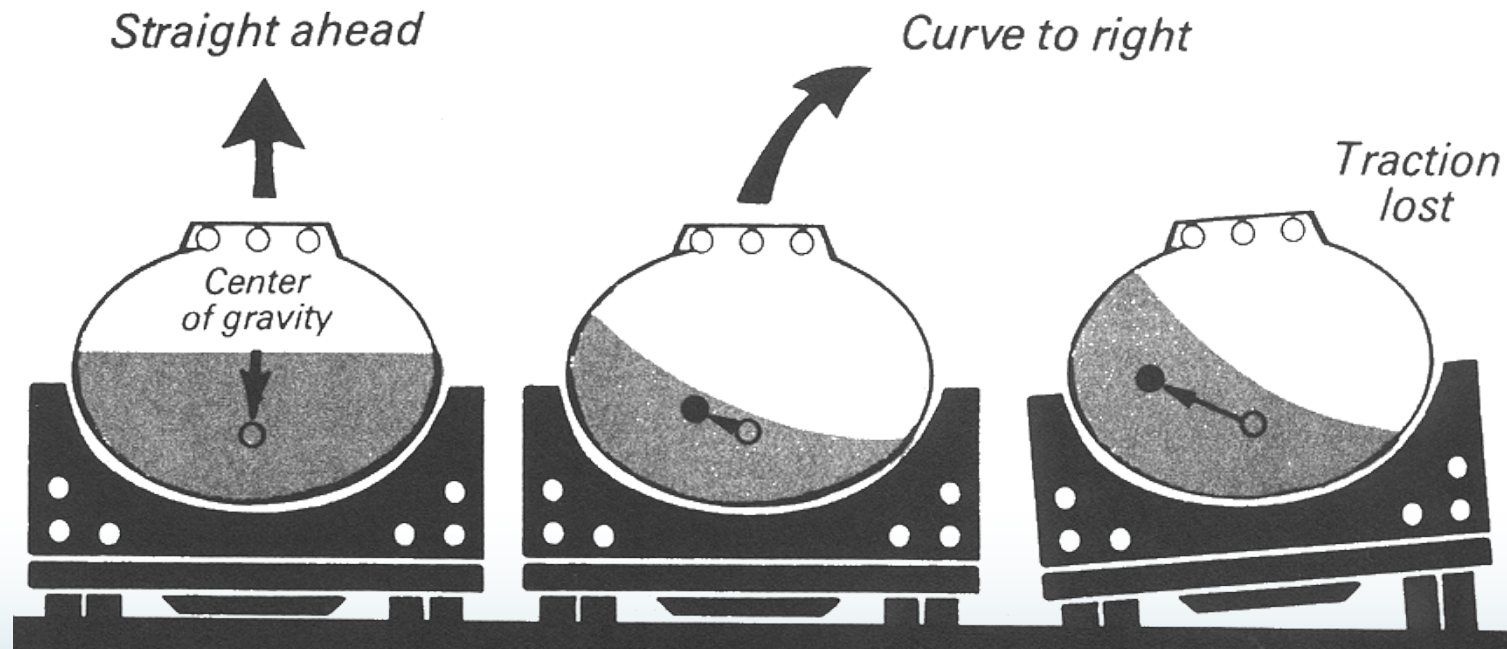
- To achieve world-class safety performance you need to go beyond the first two approaches
- This means addressing intangibles such as leadership, safety attitudes and communication – all of which are key to safety culture
- In practical terms, this means attempting to foster intrinsic motivation for safety right across the workforce
- In other words, winning the ‘hearts and minds’ of all employees

Culture Ladder



Technical Considerations

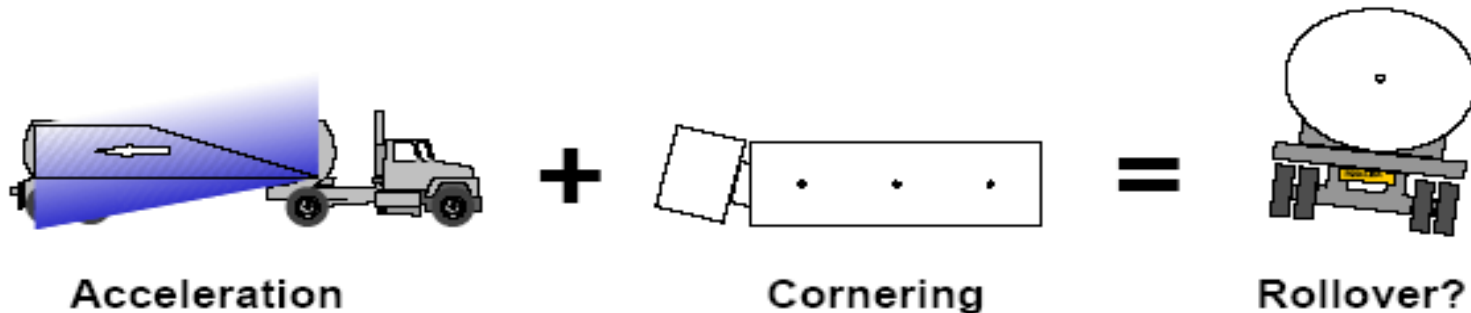
Rollover Awareness/Prevention: Understanding Centrifugal Force



Rollover Awareness/Prevention:

Combination of effects leading to rollover

It is when changing direction and speed simultaneously that the effects are most dramatic.



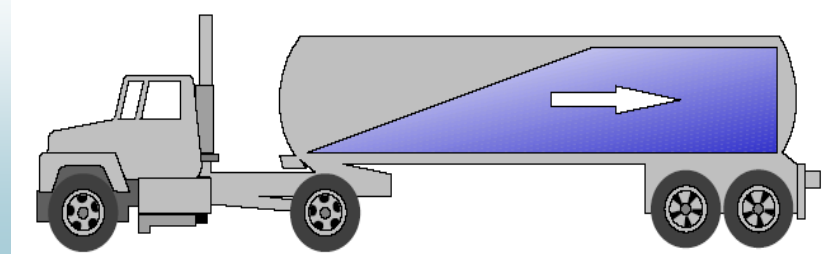
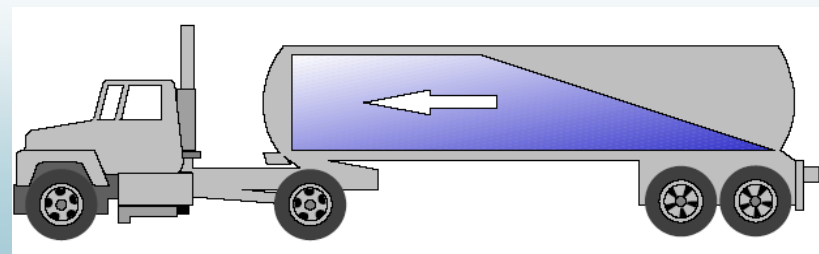
Load moves sideways, weight concentrated on outside semi-trailer wheels. Possibly results in rollover.

Technical Considerations for DRR

OBCs/IVMS: In-cabin OBCs/IVMS, including debrief/feedback after each round trip

Spill-proof Manholes on Road Tankers: Coaming with Spill-proof Manhole; Vandal-proof Valves on Tankers;

Registration of Fuel Tankers: Petroleum Tankers to be registered and inspected to ensure they meet industry specifications

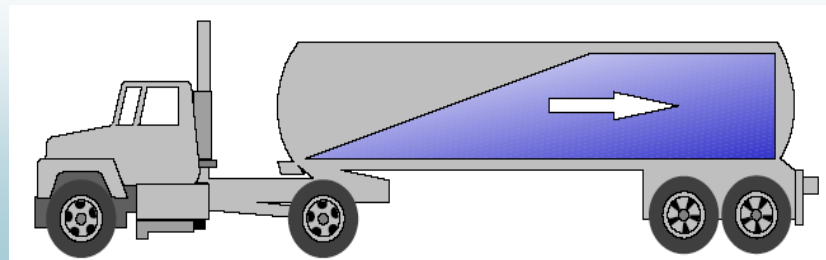
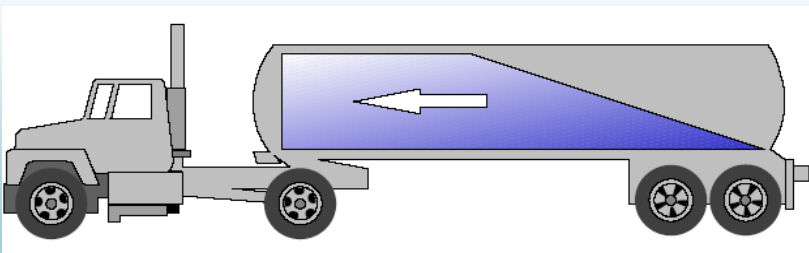


Other Considerations

Training & Defensive Driving: tanker drivers need to go through specific training to improve competence & skills

Society Safety Awareness: communication of product risks awareness across the country via TV/print media , e.g. ***“Don’t Fool with Fuel”, etc.***

Rails &/or Pipelines, in preference to road tankers for long distance haulage



Emerging Technology: what the future holds

Artificial Intelligence: Use of Autonomous Road Tankers for product deliveries; automated loading/offloading systems

Engineering/Specifications: Double-Skin Vessels; On-Board Cameras, in addition to OBCs



Way Forward: Recommendations

- Establish standards for recruitment of tanker drivers, training & certification (age, experience, education, etc.)
- Establish minimum technical standards for road tankers and registration for compliance (OBCs, Spill-proof manholes, vandal-proof valves, etc.)
- Regulate transportation of Petroleum Products, by using only registered transporters, whose tankers are approved
- Encourage transporters to roll out Hearts & Minds for world-class safety performance
- Through PPP, initiate public awareness campaign about the dangers of petroleum product pilferage

Thank you for listening

Q&A

THE END

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