

Safety Management and Certification on Singapore Longest Road Tunnel - Kallang and Paya Lebar Expressway (KPE)

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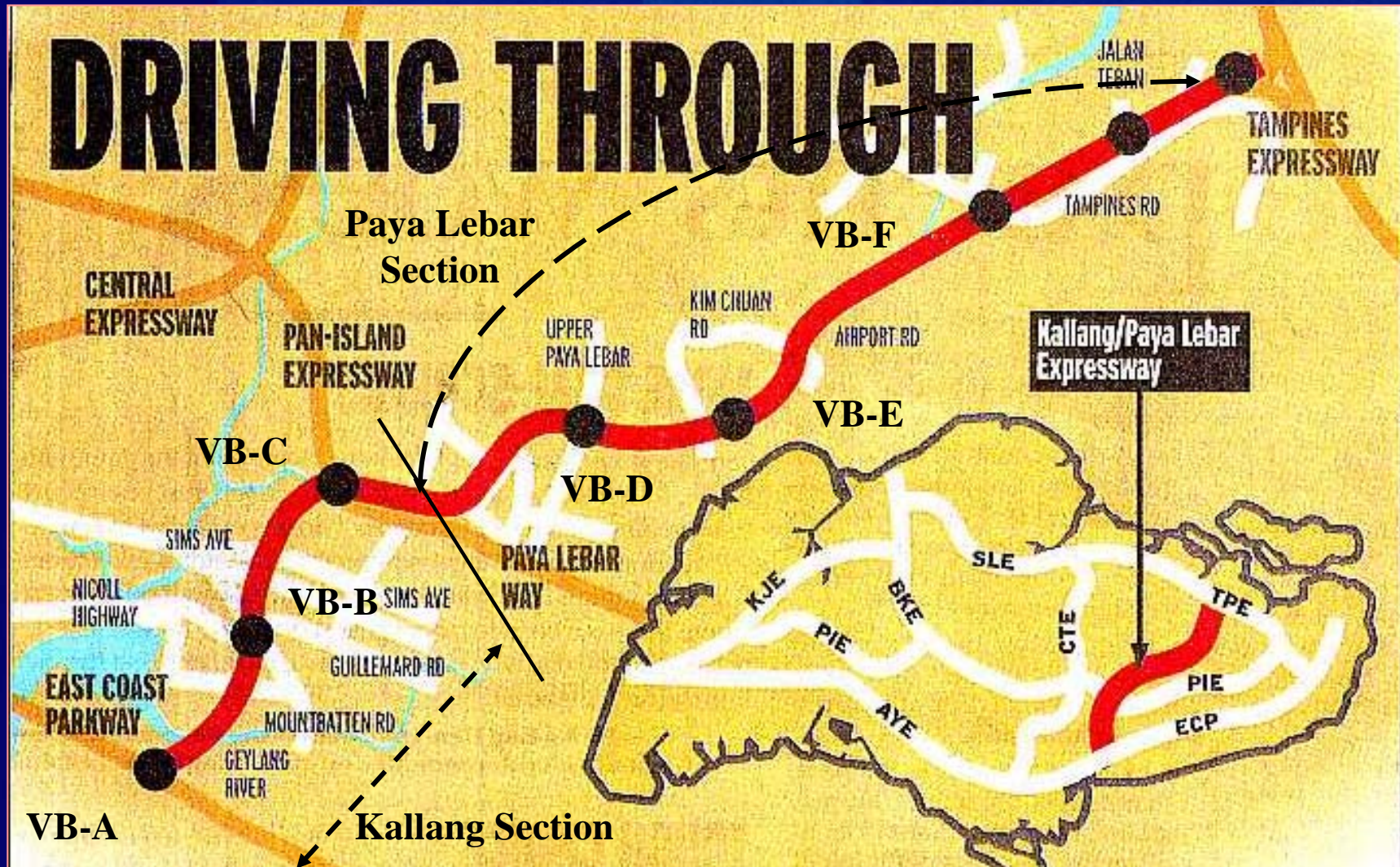
Presentation Outline

- Project Overview
- LTA Safety Certification Process for Road Projects
- KPE Safety Objectives & Management.
- Challenges of Implementing Safety Management
- Benefits Derived from KPE Safety Management
- Conclusion

KPE Project Overview

- KPE Route Map
- E&M Systems
- Environmental Measures
- Operation Measures

KPE Route Map



E&M Systems

- Tunnel Ventilation & Environmental Control System (TV&ECS)
- Fire Protection System (FPS)
- High and Low Voltage Electrical Distribution Systems (ES)
- Integrated Traffic and Plant Monitoring Systems (ITPMS)
- Communications System (CS)
- Lifts and Hoist Systems (L&HS)

Environmental Measures

Key areas of environmental concerns are:

- Land use
- Air & Water Quality
- Noise & Vibration
- Visual Impacts

Operation Measures

- Regulations on Prohibitions
- Restrictions in Tunnel
- Public Education

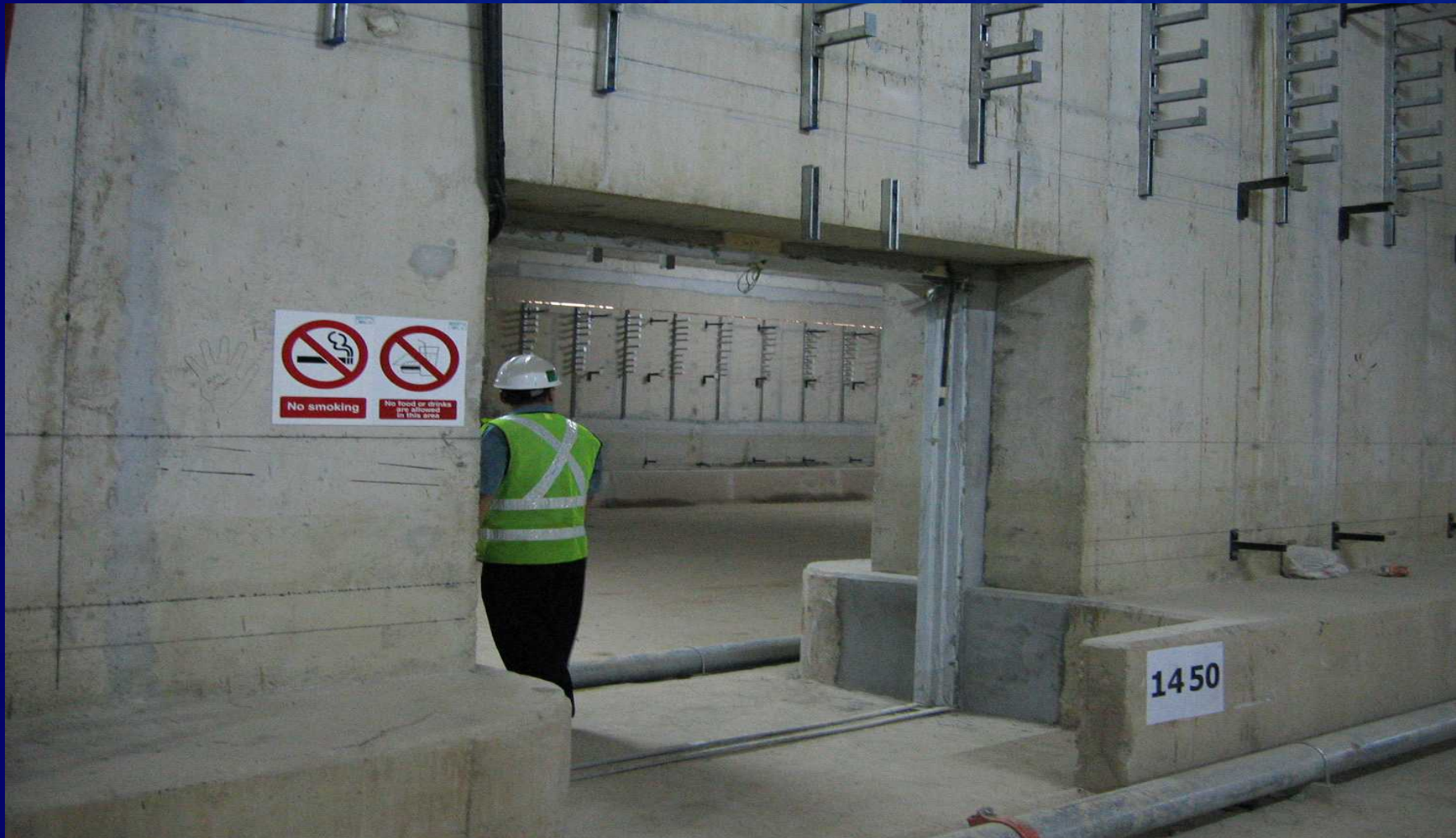
Tunnel with Base Lighting Installed



Cross Section Showing Ventilation Ducting



Passenger Cross Passage Without Door



Passenger Cross Passage



Vehicle Cross Passage



LTA Safety Certification Process for Road Projects

- Role of LTA and Its Safety Goal
- Purpose of LTA Project Safety Review (PSR) Process
- What is in the PSR Process for Roads?
- Types of Safety Submission
- Roles/Parties in PSR

Role of LTA

- Management agency for Ministry of Transport (MOT) on land transport infrastructure and systems.
- Responsible for the design, construction, operation and maintenance of the public road structures.

LTA's Safety Goals

- Strive for the highest standards of safety consistent with international best practices.
- Believes that every accident is avoidable.
- Aims to achieve zero accidents for all its projects.

Purpose of Project Safety Review (PSR) Process

To provide a staged, systematic and robust check and balance process on safety management and assurance of new road projects throughout their project lifecycles

What is in the PSR Process for Roads?

1. Four-stage safety certification process - concept/preliminary, design, handover/post-construction and operation readiness.
2. Emphasis on safety -roads design safety, Electrical & Mechanical (E&M) systems safety and operation safety.
3. Hazard Identification and Management.
4. A Project Safety Assurance Committee (PSAC).
5. Safety Submissions - Proof of Safety at Each Stage.

Types of Safety Submission

1. Roads Design Aspects

- Preliminary Design Safety Submissions (PDSS)
- Detailed Design Safety Submission (DDSS)
- Temporary Traffic Control Safety Submission (TTCSS applicable for construction phase)
- Post Construction Safety Submission (PCSS)

Types of Safety Submission

2. E&M Aspects

- Concept Safety Submission (CSS)
- Design Safety Submission (DSS)
- Handover Safety Submission (HSS)

3. Operation Readiness Aspects

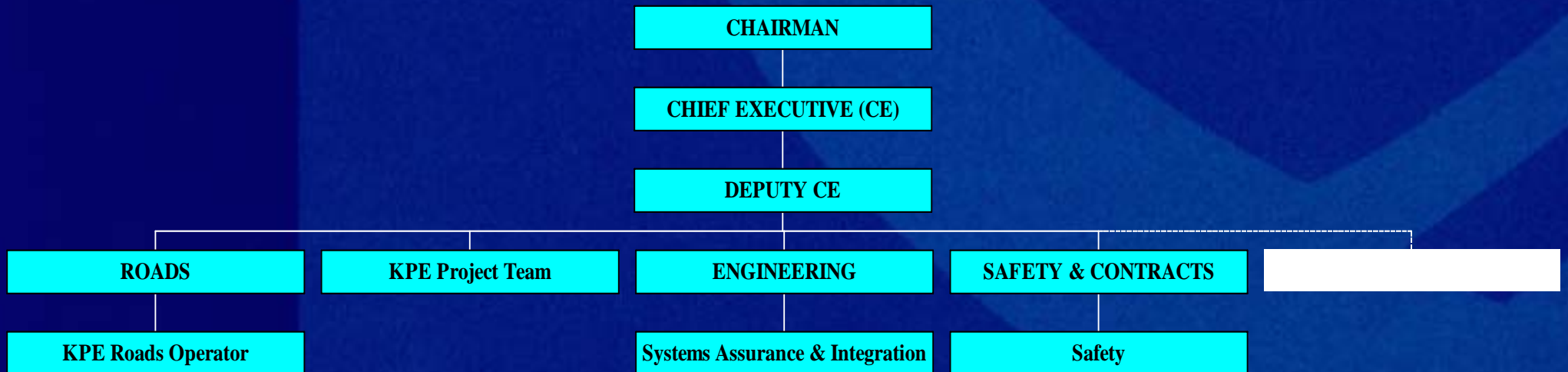
- Operation Safety Submissions (OSS)

Roles/ Parties in PSR

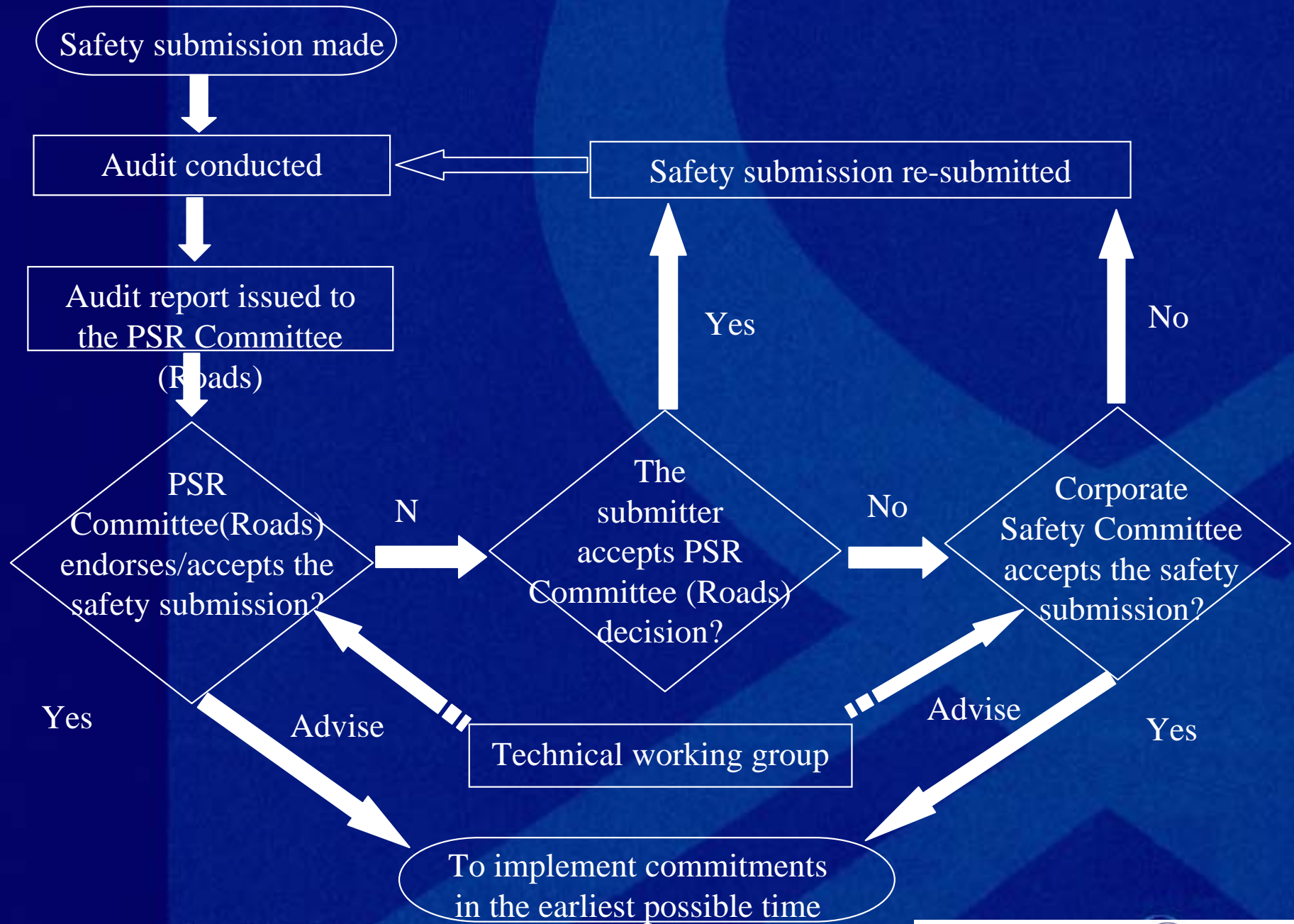
Four Main Roles:

- Reviewer - LTA Project Team
- Submitter - Roads - LTA Project Team
 - E&M - SAI Department
 - Operation - Operator
- Auditor - Safety Department (SD)
- Arbitrator/Endorser -PSR Committee (Roads) and Corporate Safety Committee (CSC)

LTA Organisation Chart



Endorsement/Acceptance Process for Safety Submission



KPE Safety Objectives & Management

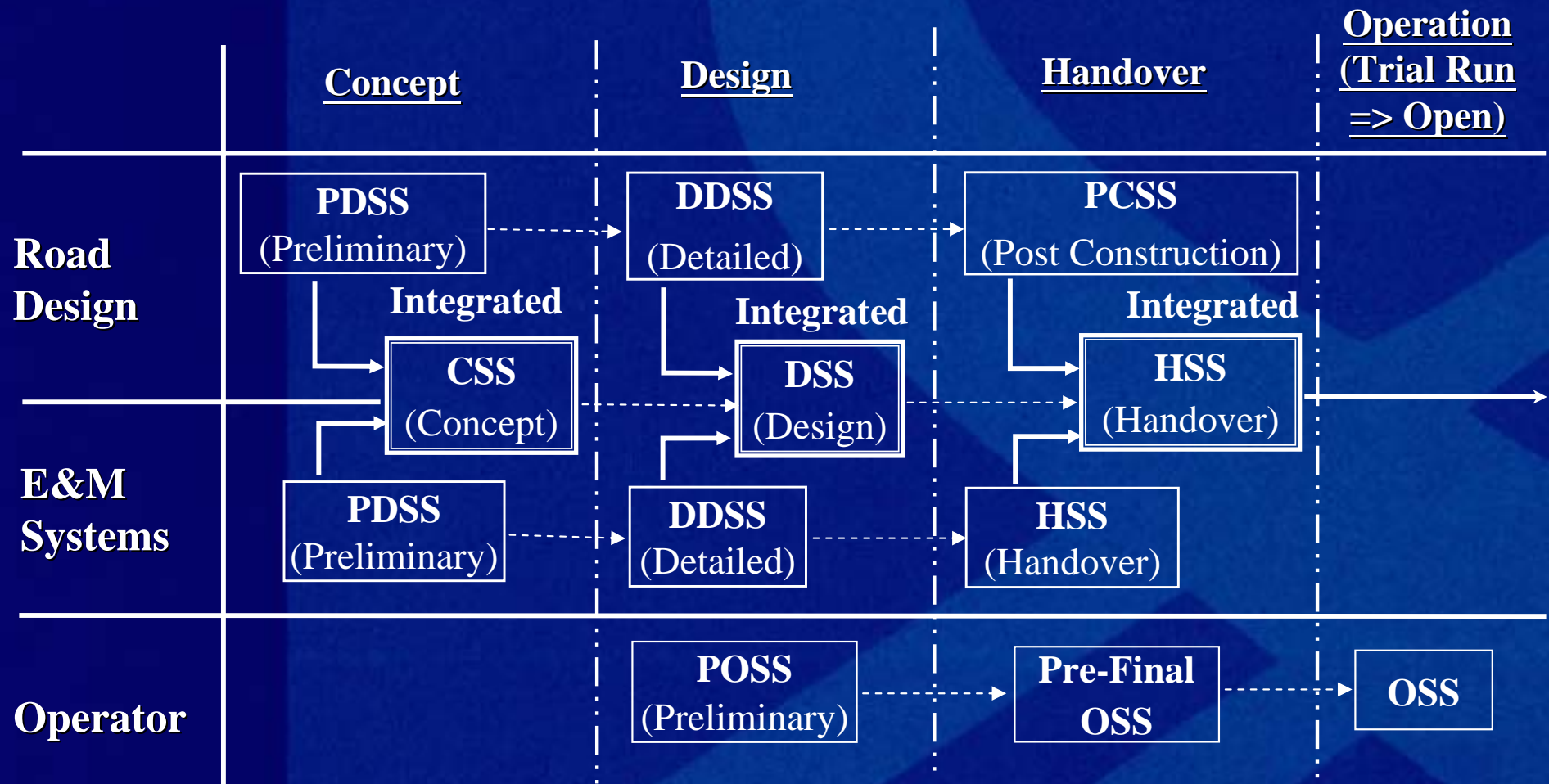
- Project Safety Objectives
- KPE Safety Management
- Overview of Safety Activities

KPE PROJECT SAFETY OBJECTIVES

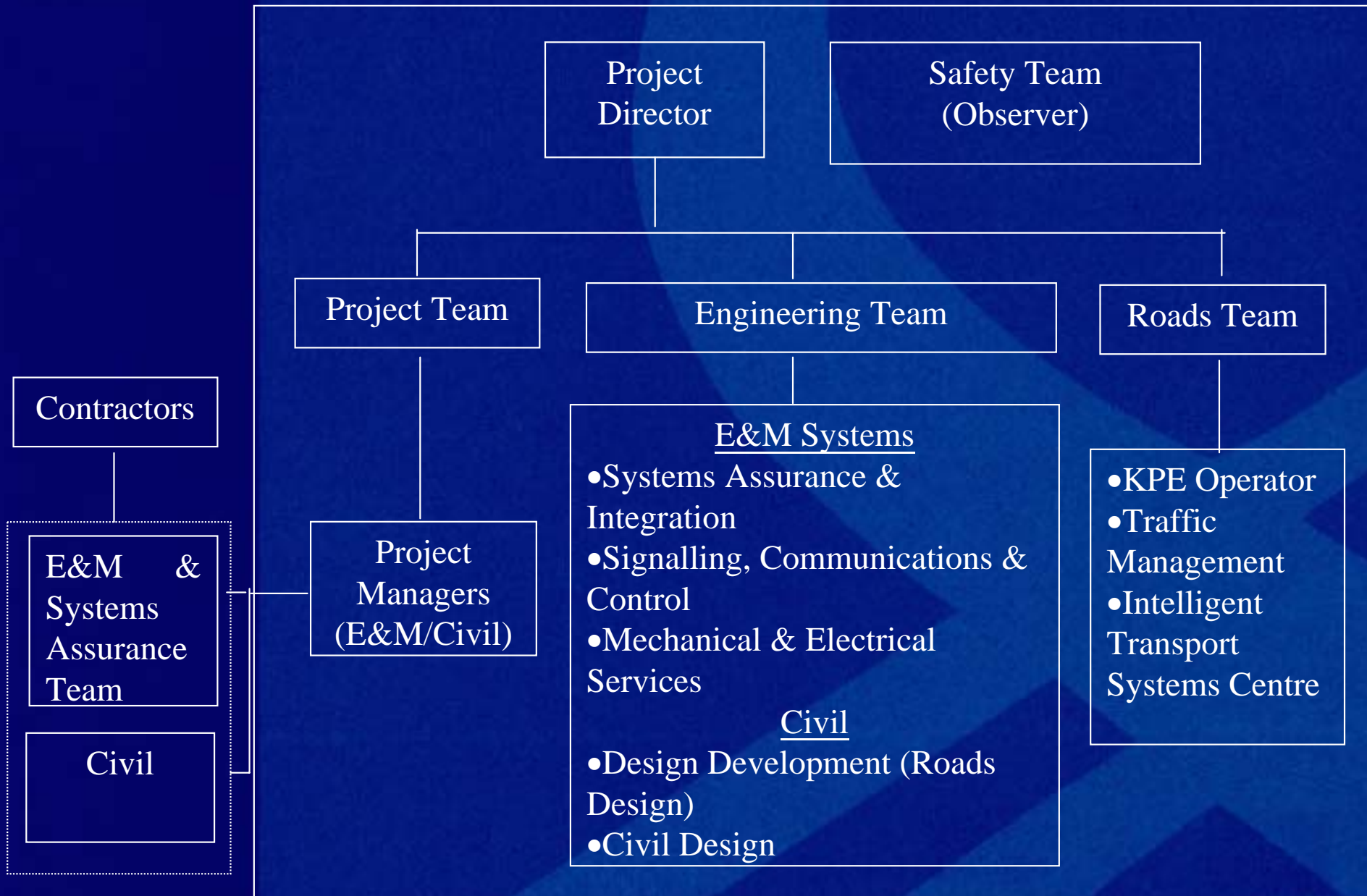
- Provide freedom from unacceptable risk for road users and that the levels of risk are acceptable in accordance with the KPE/LTA risk matrix.
- Meet or surpass relevant standards such as NFPA 502 and/or BD 78/99.
- Meet the requirements of Singapore statutory agencies. E.g. Fire Safety & Shelter Department (FSSD), Building & Construction Authority (BCA), Singapore Civil Defence Force (SCDF) and Traffic Police (TP).

KPE SAFETY MANAGEMENT

Safety Submissions for the KPE Project



LTA KPE Safety Committee (KSC)



Overview of Safety Activities

Contract Level Safety Activities

- Review of E&M contractors' submissions on systems assurance (HAZOP, hazard analyses, Fault Tree Analysis (FTA), Failure Modes and Effects Criticality Analysis (FMECA), etc).
Electromagnetic Compatibility (EMC), integrated test specification and plan,
- Validate Specifications via Tests.

System Level Safety Activities

- Deterministic Assessment
- HAZOP (HAZard and Operability) Study and Hazard Analyses (on system and interface level)
- Hazard Management and Hazard Register/Log
- Software Safety Assessment
- Inspections and Walkthroughs
- Integrated Testing and Commissioning (ITC)
- Operator's Trial Running.

Challenges of Implementing Safety Management

- Early Challenges with PSR Process
- Safety Integrity Level (SIL) and Software Safety
- Overall KPE System Risk Level
- Operation Safety and Readiness

Benefits Derived from KPE Safety Management

- Greater Safety Awareness and Risk Management
- Contract Specifications

CONCLUSION

- KPE - First Road Tunnels that Undergoes LTA Safety Management and Certification Process
- Safety Provisions, Measures and Management are Commensurable with International Standards and Best Practices.
- Experience Learnt enables LTA to Improve the PSR Process for Future Projects.

Thank You