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GREENER SKIES, SAFER AIRPORTS

STRATEGIC EV PREPAREDNESS & FIRE SAFETY AT MALAYSIA AIRPORTS

"Towards High Performance Aviation Rescue & Firefighting Service"

MUHAMMAD HIDAYAT BIN ISMAIL, IAP, GIFireE
General Manager AFRS Malaysia Airports
8th October 2025

MUHAMMAD HIDAYAT BIN ISMAIL, IAP, GIFireE

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Master
Emergency Response & Planning
Universiti Putra Malaysia

Degree
Information Technology
Universiti Kebangsaan Malaysia

Diploma
Fire Science
Akademi Bomba & Penyelamat Malaysia

KUL

BKI

MLE

HQ

MATC

ACI | APEX AIRPORT EXCELLENCE IN SAFETY

Advisor Member
ICAO Emergency Response Planning Expert Group

Task Force Member
ACI Emergency Preparedness & Contingency Planning

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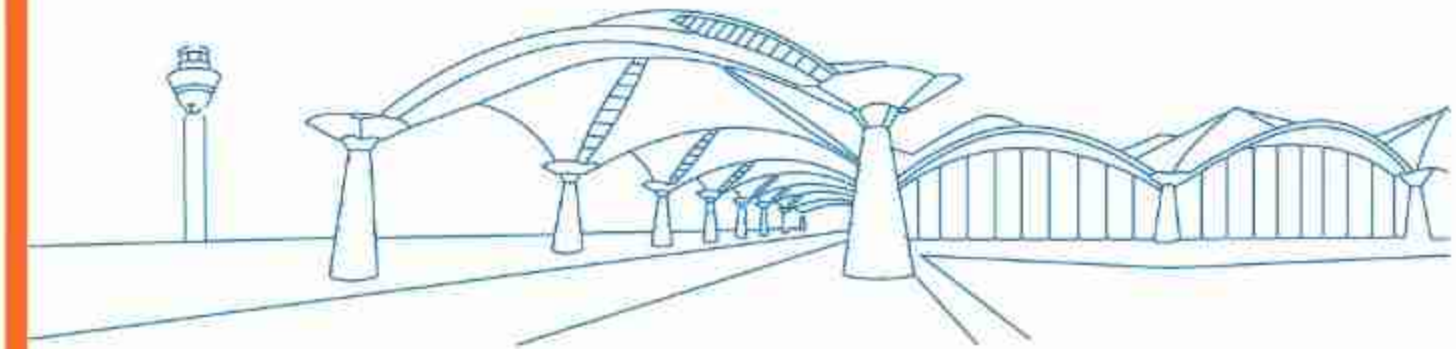
CONTENT



CONTENT

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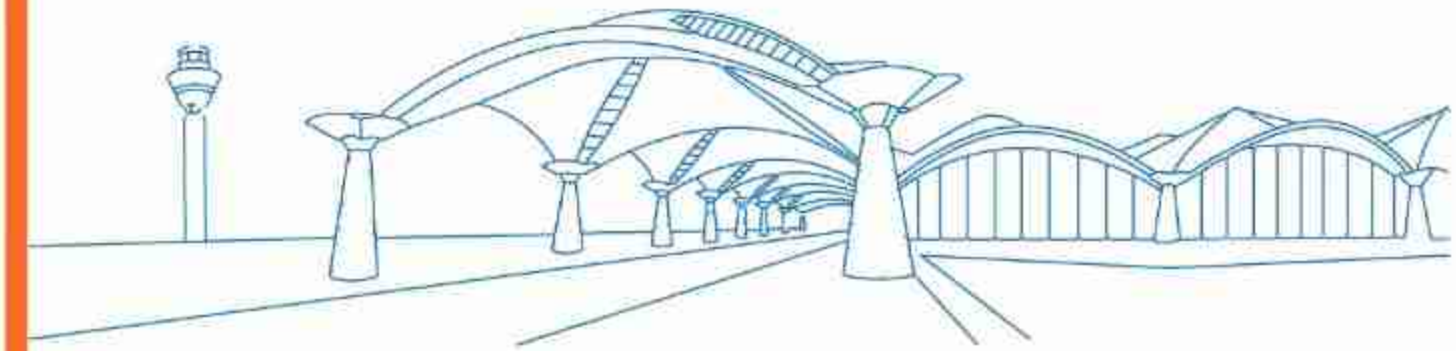
IAFPAC 2025

INTRODUCTION TO MALAYSIA AIRPORTS

- Regulatory Framework
- AFRS@Malaysia Airports
- AFRS Organization Chart



REGULATORY FRAMEWORK – RESCUE & FIREFIGHTING

Annex 14 Aerodromes Vol I	**Civil Aviation Act 1969**	**Civil Aviation (Aerodrome Operations) Regulations 2016**	**Civil Aviation Directive 14 Vol I**
9.2.1 Rescue and firefighting equipment and services shall be provided at an aerodrome when serving commercial air transport operations.	24A. Power of Minister to grant a license to provide airport and aviation services in an airport. License granted to MA (Sepang) & MASB by Minister of Transport Condition 7 – Fire Fighting and Rescue Services and Equipment	33. (1) An aerodrome operator shall establish and provide rescue and fire fighting facilities in the aerodrome in accordance with any requirements as may be determined by the Chief Executive Officer.	9.2.1 Rescue and firefighting equipment and services shall be provided at an aerodrome when serving commercial air transport operations.

AFRS @ MALAYSIA AIRPORTS

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5 International Airports

17 Domestic Airports

17 STOLports

RFF Level of Protection **3-10**

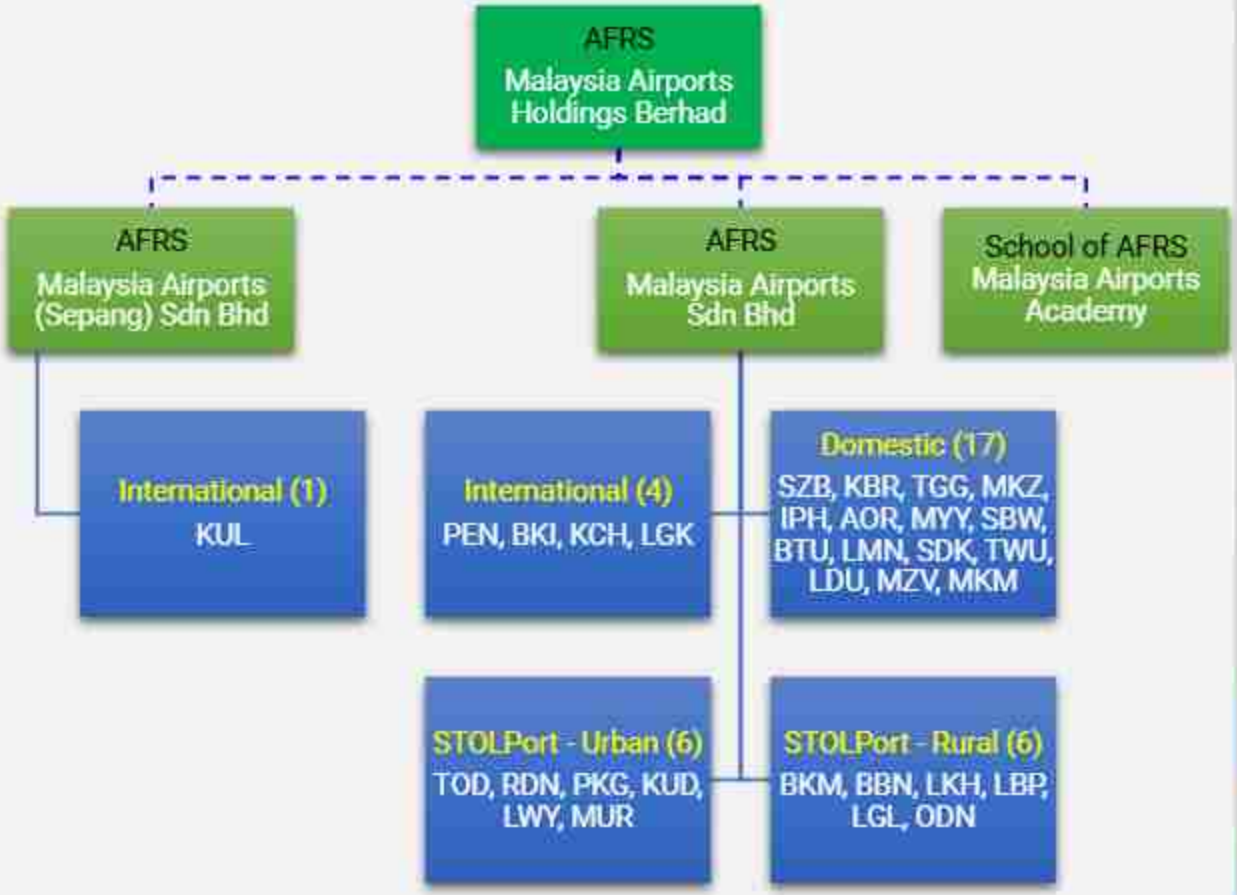
Fire Station **4+22**

RFF Vehicle **74**

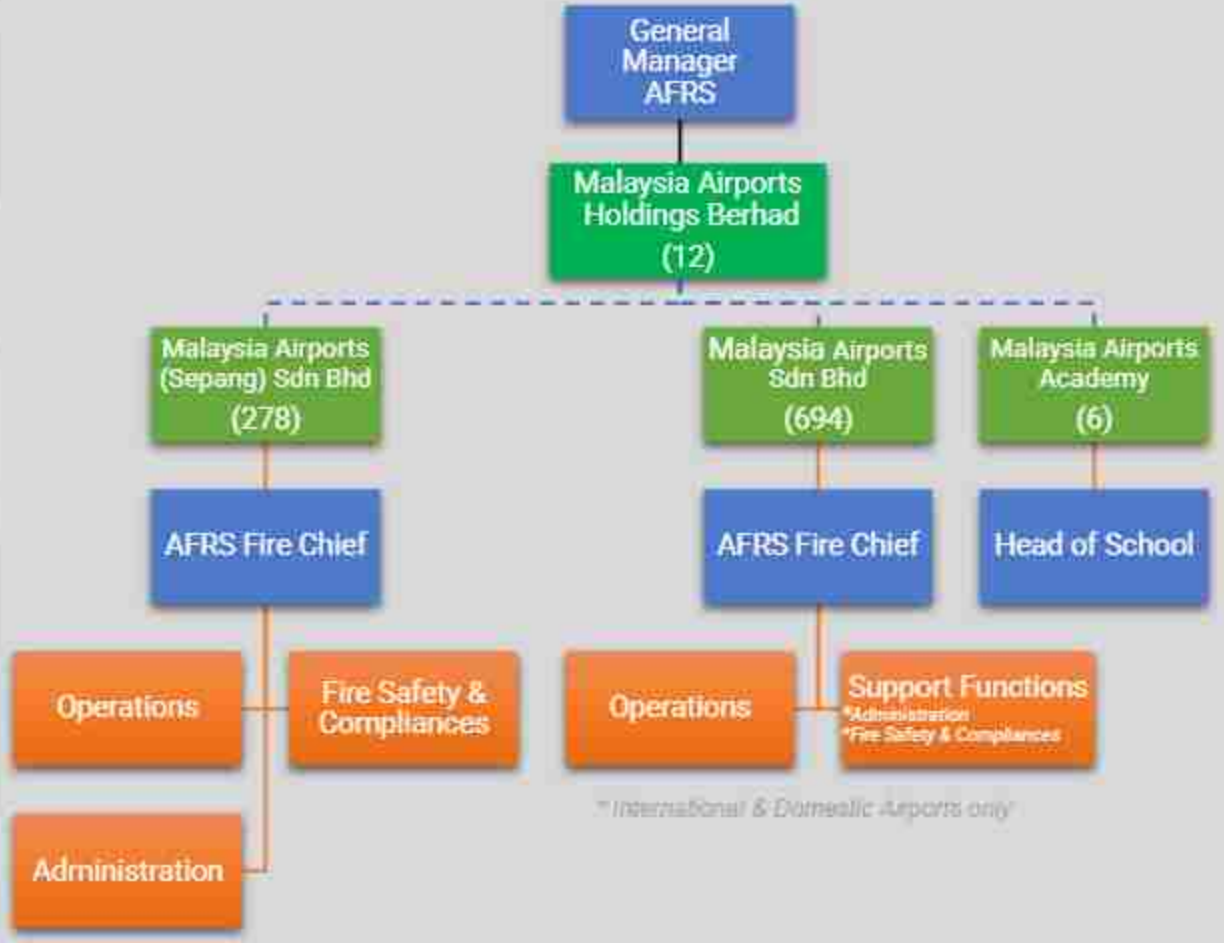
Trained Personnel **972**/990

AFRS ORGANIZATION CHART

Organization Chart by Subsidiary - Airport



Organization Chart by Subsidiary - Manpower



INTRODUCTION TO ELECTRIC VEHICLES IN MALAYSIA

- What is EV?
- Benefit EV vs ICE
- Low Carbon Mobility Blueprint 2021-2030
- National Automotive Policy 2020
- First EV Models in Malaysia
- eGSE at the Airside

WHAT IS ELECTRIC VEHICLE?

BEV 🔋	HEV ⚡	PHEV 🔌
BATTERY ELECTRIC VEHICLE	HYBRID ELECTRIC VEHICLE	PLUG-IN HYBRID ELECTRIC VEHICLE
		
➡ Fully powered by battery ➡ Charged with electricity ➡ No petrol engine	➡ Combines petrol engine + electric motor ➡ Self-charging while driving ➡ Lower fuel use & emissions	➡ Hybrid with plug-in charging ➡ Can run on electricity only (limited range) ➡ Flexible – electric + petrol

BENEFIT ELECTRICAL VEHICLE (EV) VS INTERNAL COMBUSTION ENGINE (ICE)

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01

Reduce Noise Pollution

Electric motors operate quietly, reducing noise pollution in urban environments and providing a more peaceful driving experience for passengers and pedestrians alike.

02

Environmental Friendly

EVs generate significantly less air pollution compared to petrol or diesel cars, emitting no exhaust air pollutants

06

Convenience

EV owners enjoy the convenience of charging their vehicles at home, eliminating the need to visit gas stations and providing flexibility in charging schedules..

03

Cost Saving

Running costs for fuel, maintenance, and car tax are substantially lower for EVs, leading to significant savings over time.

05

Performance Experience

Electric motors deliver instant torque, providing smooth and responsive acceleration, enhancing the overall driving experience.

04

Reduced Greenhouse Gas Emissions

EVs help mitigate climate change by emitting fewer greenhouse gases compared to conventional vehicles, especially when charged with renewable energy sources like solar or wind power.

LOW CARBON MOBILITY BLUEPRINT 2021-2030

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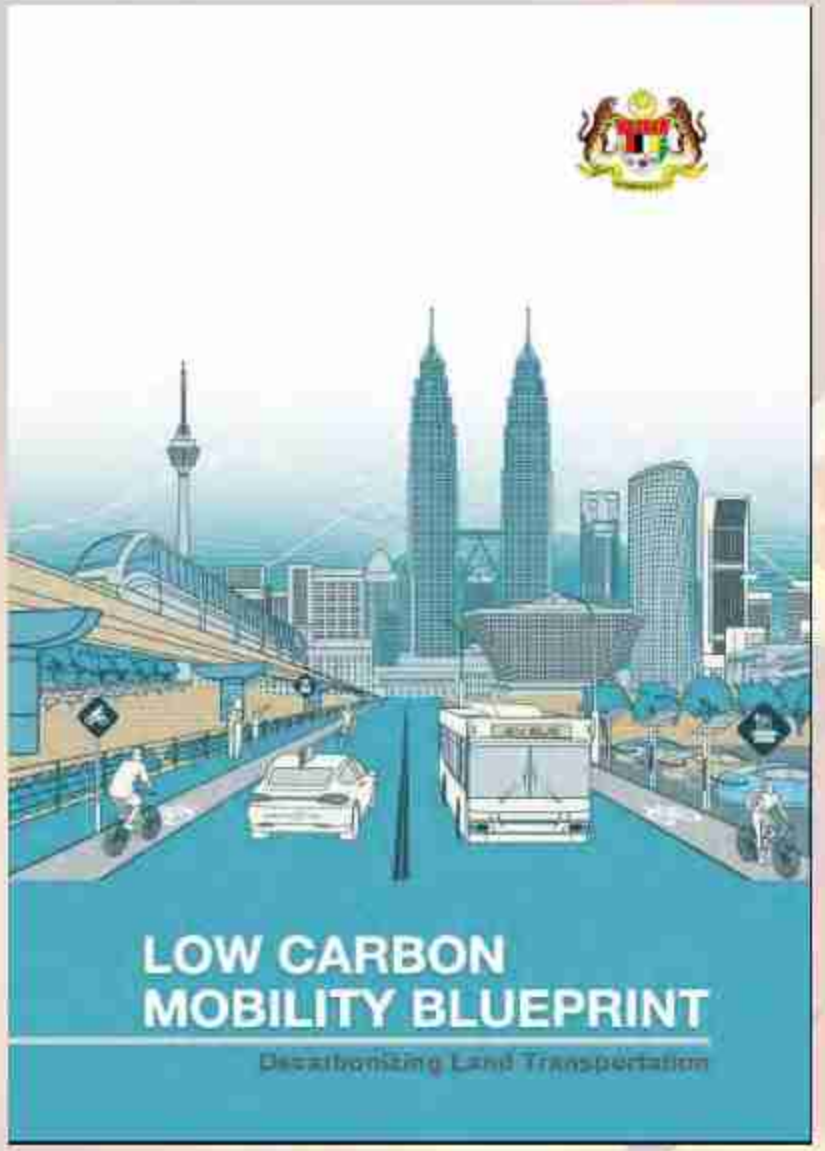

Realising Low Carbon Mobility for the Land Transport Sector Through Reducing Greenhouse Gas Emissions and Energy Comsumption by 2030

6 Strategic Actions

1. Strengthening institutional framework
2. Government-led initiatives
3. Facilitating conducive economic instruments
4. R&D, Technology nurturing and commercialisation
5. Capacity, skills and knowledge development
6. Consumer communication

Focus Areas

A – Improving Vehicle Energy Efficiency

2 Strategies

10 Action Plans

Emission rating for VTA, Vehicle End-of-Life, Eco-driving & Green Logistics

B – Electric Mobility Adoption

1 Strategy

13 Action Plans

Electric vehicles, electric buses & electric motorcycles

C – Alternative Fuel Adoption

2 Strategies

5 Action Plans

Biodiesel & Industrial Ecosystem Growth

D – Mode Shift

5 Strategies

17 Action Plans

Public Transport, TOD, Traffic Flow, Active and Micro Mobility & Rail for Freight Transport

NATIONAL AUTOMOTIVE POLICY 2020

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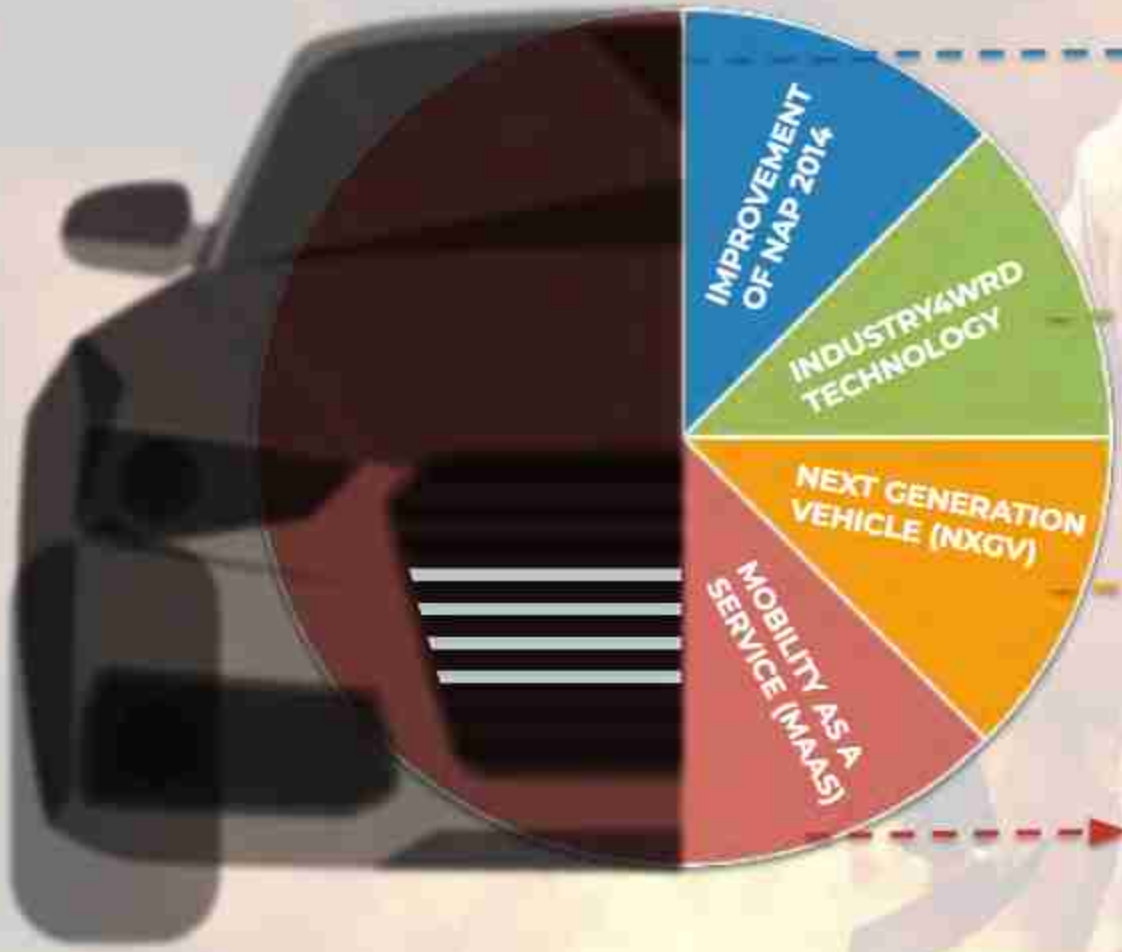

Strengthening vendor development in the manufacture of components and parts and improving export performance

Full implementation of Industry Forward technology for the purpose of transformation in the automotive sector.

Promoting local content usage and Next Generation Vehicle (NxGV) market penetration in Malaysia.

The creation of a new ecosystem known as Mobility as a Service (MaaS) to further strengthen and improve the automotive industry.

ELECTRIC VEHICLE MODELS IN MALAYSIA

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BMW	Mercedes-Benz	BYD	Tesla	PROTON	HONDA
					
I3 & I8	EQS 500 4MATIC	ATTO 3	MODEL Y	E.MAS 7	E:N1
2015	2022	2022	2023	2024	2025
KUALA LUMPUR					

GROUND SERVICE EQUIPMENT (eGSE) AT AIRSIDE

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TCR	GTR A SATS COMPANY		mag malaysia aviation group		AeroDarat
CHARLATTE AMERICA	HANGCHA	TCF	ITW GSE		mototok easy moving
					
Electric Belt Loader	Electric Baggage Tractor	Electric Pushback	Ground Power Unit	Electric Vehicle	Remote Control Pushback
2021	2024	2024	2025	2025	2025

*As of September 2025

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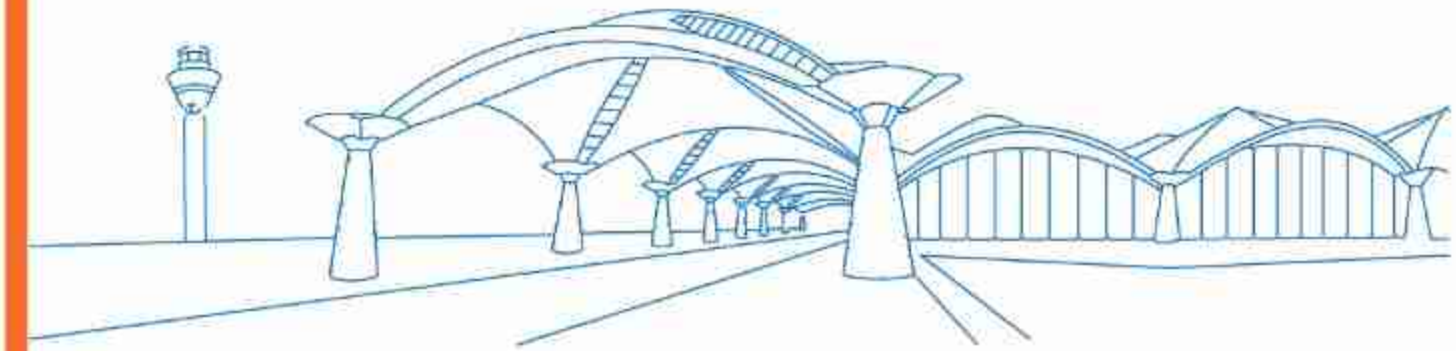
EV FIRE INCIDENTS & CASE STUDIES

- What is Thermal Runaway (TR)
- Case Study
- Challenges in EV Batteries



WHAT IS THERMAL RUNAWAY?

NFPA 855 3.3.20 Thermal Runaway: The condition when an electrochemical cell increases its temperature through self-heating in an uncontrollable fashion and progresses when the cell's heat generation is at a higher rate than it can dissipate, potentially leading to off-gassing, fire, or explosion.

COMMON CAUSES OF EV FIRES (THERMAL RUNAWAY) INCLUDE

- Overcharging
- Overheating
- Manufacturing Defects

CASE STUDY: ELECTRIC VEHICLE FIRE INCIDENTS IN MALAYSIA

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Neta V catches fire after hitting lorry tyre on PLUS

In Cars, Local News, Neta, Videos / By Jonathan James Tan / 9 November 2024 7:56 pm / 31 comments

Tesla Model Y seen burning in Puchong last night – first recorded case of EV fire in Malaysia?

In Cars, Local News / By Paul Tan / 17 October 2023 8:12 am / 61 comments

Neta V fire incident: No product defect, occured after impact with lorry tyre debris

Malaysia records 27 EV and hybrid car fire cases since 2023, says deputy minister

Big Fire Destroys EV Battery and E-Waste Facility in Melaka

Published by Meehan on 7 Feb 2025

Mercedes-Benz EQB catches fire at dealership charger in Johor, cause of fire still under investigation

In Cars, Local News, Mercedes-Benz / By Paul Tan / 1 January 2024 2:53 pm / 36 comments

CASE STUDIES: ELECTRIC VEHICLE FIRE INCIDENTS AT AIRPORTS

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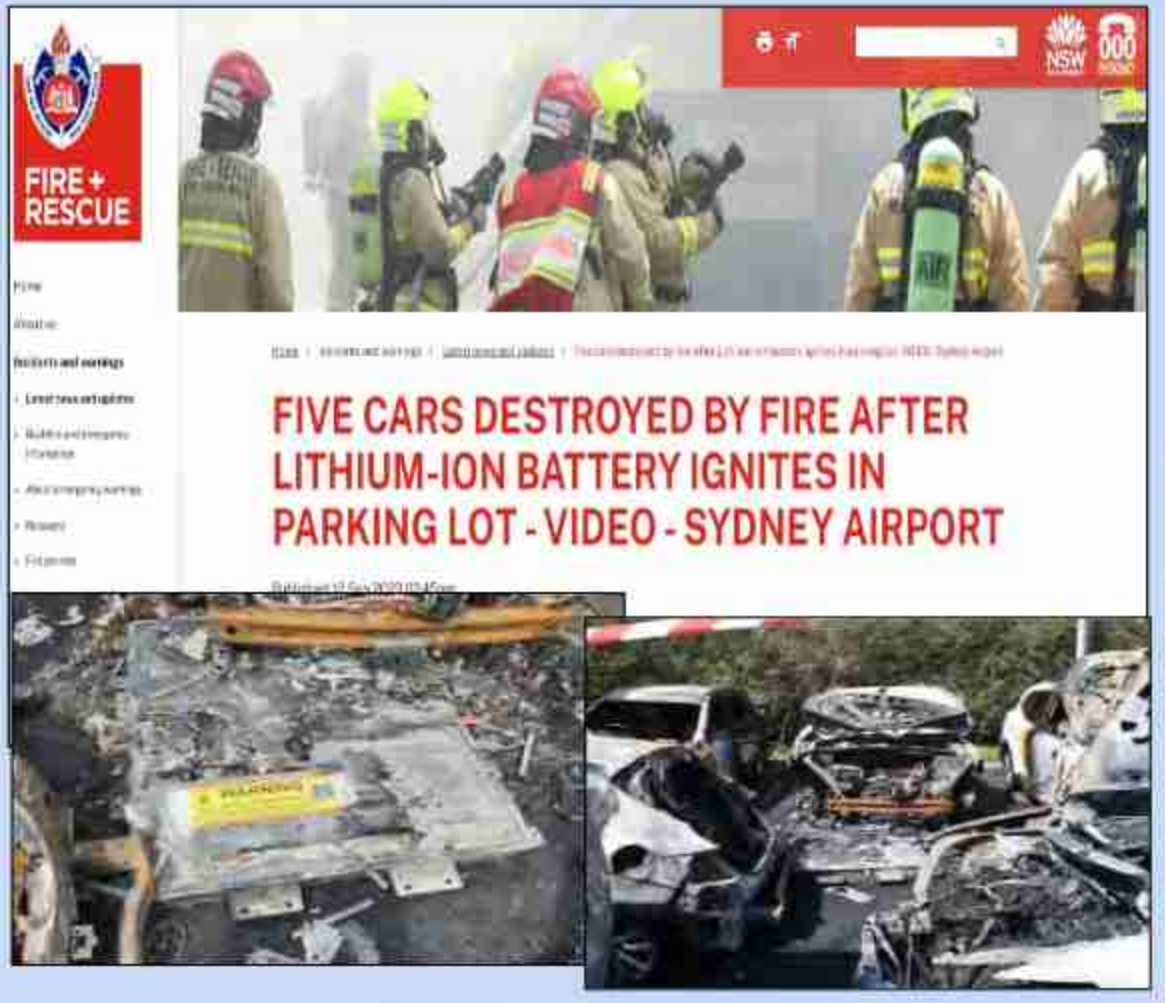
Sydney Airport, Australia 2023

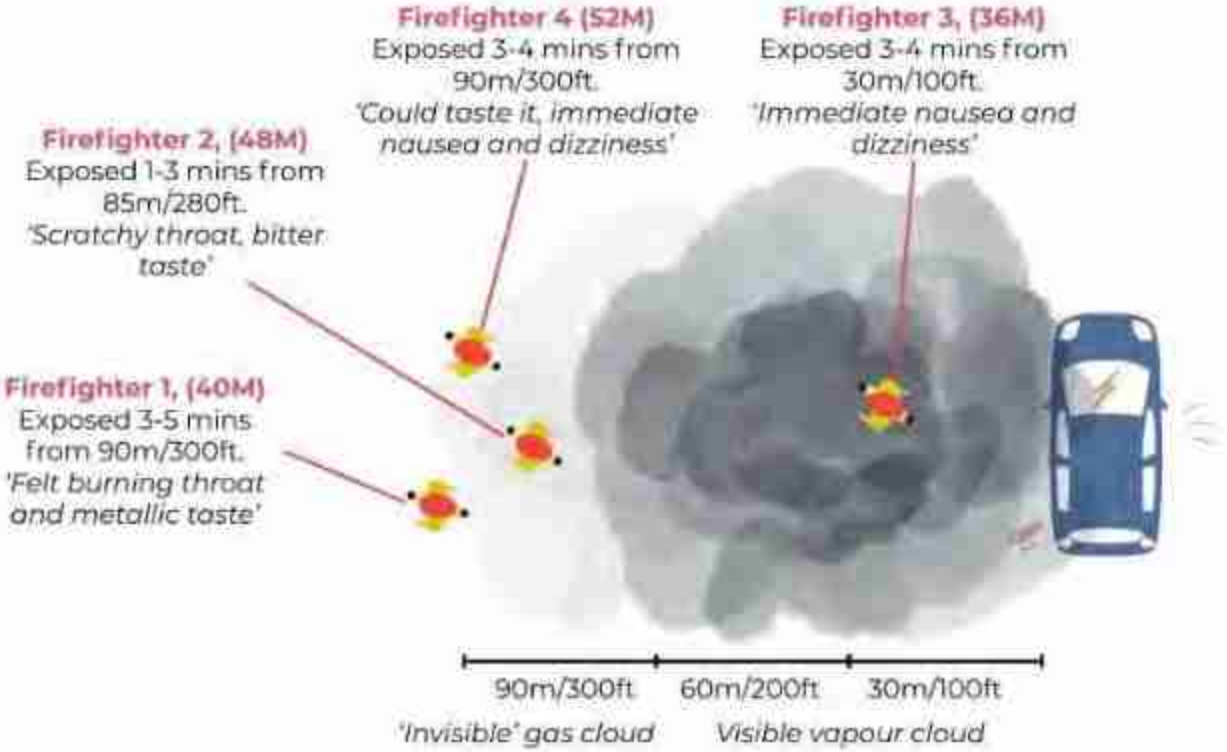


Incheon Airport, Korea 2024

CASE STUDY: EV COLLISION AND OFF-GASSING EXPOSURE

ELECTRIC VEHICLE COLLISION AND OFF-GASSING CAUSING RESPIRATORY INJURIES TO FIREFIGHTERS

Electric vehicle high speed collision with tree, no thermal runaway at time of incident, battery began off-gassing quickly and unexpectedly during recovery operations while being loaded onto tow truck. Five firefighters were exposed to vapours; all were hospitalised, with only one back on duty.



Incident occurred on 11th April 2025, all firefighters showed symptoms immediately and were hospitalised within 1 hour of exposure.

As of 28th September 2025, firefighter ongoing symptoms include:

- Reduced lung function (<82%)
- Sinus infection
- Elevated heart rate & tachycardia
- Mouth blisters turned into lesions
- Renal problems
- High concentrations of sulfur, phosphorus & lithium in blood tests

Source: Sacramento Fire Department
Prepared by evfiresafe.com and evfiresafe.training

THERMAL RUNAWAY AND FIRE SUPPRESSION CHALLENGES IN EV BATTERIES

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LONGER BURN DURATION

EV fires take hours to fully extinguish.

TOXIC GASES

Off-gassing releases harmful vapours.

HIGH WATER DEMAND

Requires large amounts of water to cool battery cells.

HIGH HEAT RELEASE

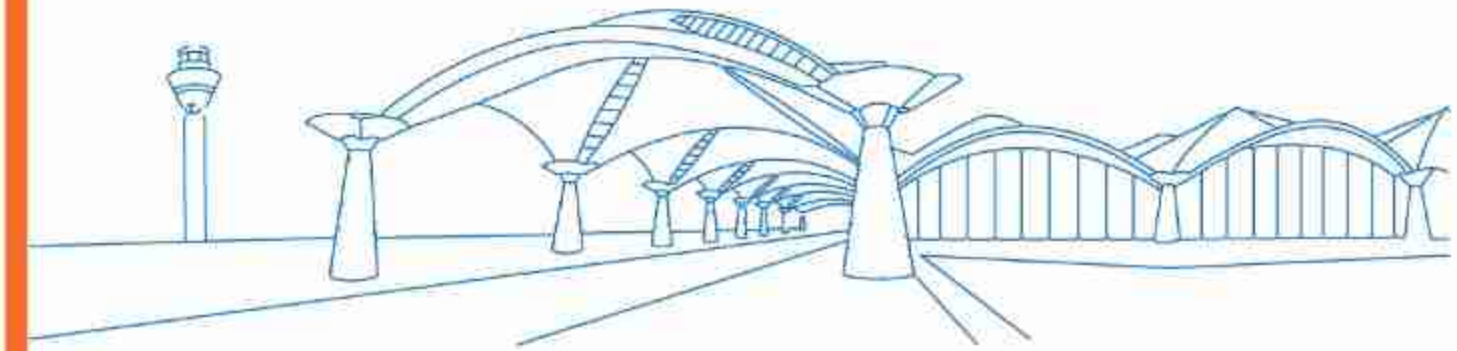
Extreme temperatures, difficult to control.

RE-IGNITION RISK

Batteries can reignite after suppression.

METHODS OF SUPPRESSING EV FIRES

- Vehicle Fire Blanket (VFB)
- EV Fire Extinguisher (EVFE)
- Cutting Tools
- Underbody Sprays
- EV Fire Isolation Pool



VEHICLE FIRE BLANKET & PORTABLE FIRE EXTINGUISHER

Large thermal fire blanket that is placed over an EV to contain flames

PROS	CONS
• Contains flames & prevents spread (if used early) • Can protect nearby exposures • Can stay on EV during removal (with caution of vapor cloud risk)	• Heavy (±25kg) → needs 2 firefighters w/ BA • Does not stop thermal runaway • Runaway may persist, only slowed • Off-gassing/vapour cloud continues • Limited independent testing on safety & effectiveness

INCREASED RISK	FOR RESPONDERS
• Gas build-up under blanket may cause vapour cloud explosion if lifted • No standard decontamination → multi-use blankets unsafe to reuse	• Use with caution → risk of vapour cloud explosion • Best applied post-incident to contain possible re-ignition (thermal runaway often starts before arrival)

Any portable fire extinguisher marketed for use on metal fires or lithium

PROS	CONS
• Effective on individual cell fires in open spaces	• Cannot reach battery cells inside modules/pack (IP-rated) • Limited testing → safety & effectiveness not yet proven

Aqueous Vermiculite Dispersion (AVD)

INCREASED RISK	FOR RESPONDERS
• May create false sense of security • Puts responders close to toxic gases, flames & explosion risk	• No real-world cases of extinguishers successfully stopping EV battery fires

EV CUTTING TOOLS & UNDERBODY SPRAY

Tools that pierce, blast or punch into an EV battery pack to apply cooling water directly to the battery cells

PROS	CONS
• Direct water to cells → controls thermal runaway within minutes (per initial tests)	• No manufacturer supports cutting/piercing packs • Tools are heavy & costly, not truck-friendly • Limited testing → safety & effectiveness uncertain

Cold Cut System

INCREASED RISK	FOR RESPONDERS
• Close proximity exposes responders to jet flames & explosions • Electrocution risk (400–800V cars, >1000V buses/trucks) • Cutting a stable pack can trigger thermal runaway	• Require trained personnel and specialist tools. • Must have specified protective measures: electrical isolation assumptions, arc/ballistic protection, hoselines. • Use only when alternative cooling/suppression is impractical or has failed

A 'sprinkler' type system that [illegible] EV to provide cooling water directly to the [illegible]

PROS	CONS
• Keeps firefighters safe → no close contact with EV in runaway • Wide water spray may help contain fire spread	• Cooling may prolong thermal runaway vs burn method • Units are expensive & bulky, hard to carry on truck

Turtle Fire System

Battery Extinguishing System Technology (BEST)

INCREASED RISK	FOR RESPONDERS
• No identified increased risks for responders	• Only if safe to slide under • Full PPE + SCBA, set exclusion zone • Monitor with thermal camera

EV FIRE ISOLATION POOL

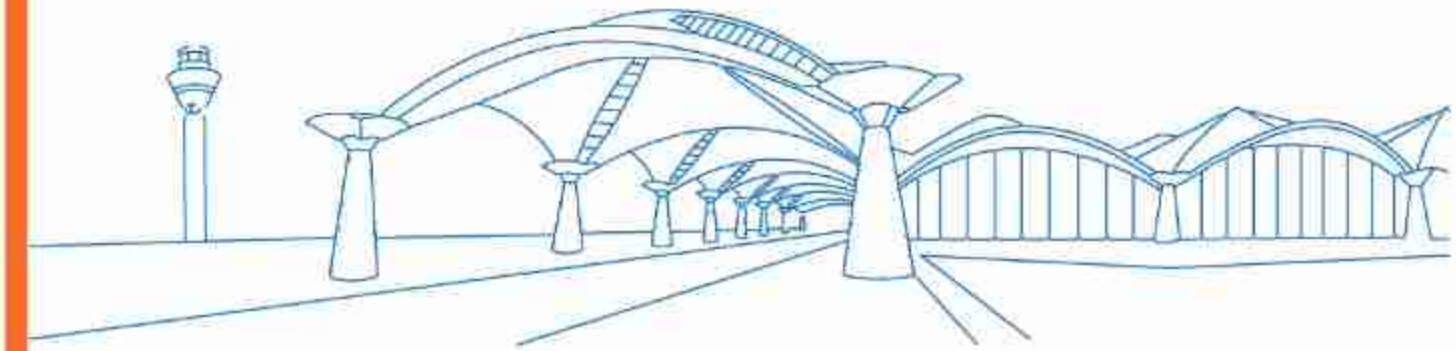
EV Fire Isolation Pool (used to submerge an EV to control thermal runaway)

PROS	CONS
• Effectively cools battery pack and suppresses thermal runaway • Reduces re-ignition risk by prolonged submersion • Suitable for containment of post-fire EVs • Can provide visual indication of off-gassing through bubbling	• Requires significant water volume (up to 8,000–10,000L per vehicle). • Logistical challenge to transport, fill, and dispose contaminated water.
INCREASED RISK	**FOR RESPONDERS**
• Risk of electrical hazard if submerged EV not properly isolated • Pool integrity failure (collapse or overflow) may spread contaminated water	• Ensure proper PPE and respiratory protection when near isolation pool. • Use only after confirming no live power source or charging cable attached

EV Fire Isolation Pool

EV EMERGENCY PREPAREDNESS AT MALAYSIA AIRPORTS

- Document Reference for EV at Malaysia
- EV Reference Guide - Malaysia Airports
- AFRS 3-Years EV Roadmap



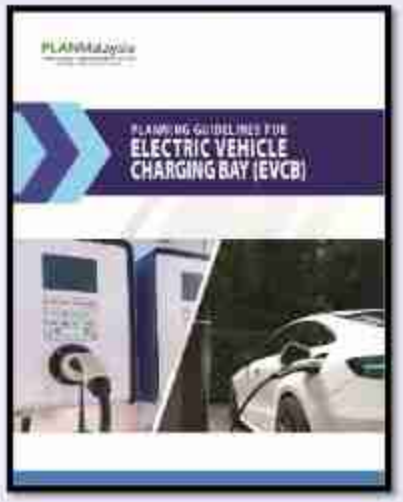
DOCUMENT REFERENCE FOR EV AT MALAYSIA

INTERNATIONAL

National Transportation Safety Board - Safety Risks To Emergency Responders From Lithium-Ion Battery Fires In Electric Vehicles -

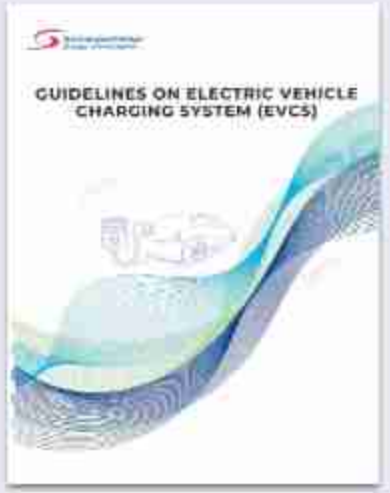
National Fire Protection & Association (NFPA)

MALAYSIA



Planning Guideline For Electric Vehicle Charging Bay (EVCB)- *PLANMalaysia*

Garis Panduan Keselamatan Kebakaran Bagi Electric Vehicle Charging Bay (EVCB) Di Premis, JBPM



Guidelines on Electric Vehicles Charging System, Energy Commission

EV REFERENCE GUIDE: MALAYSIA AIRPORTS

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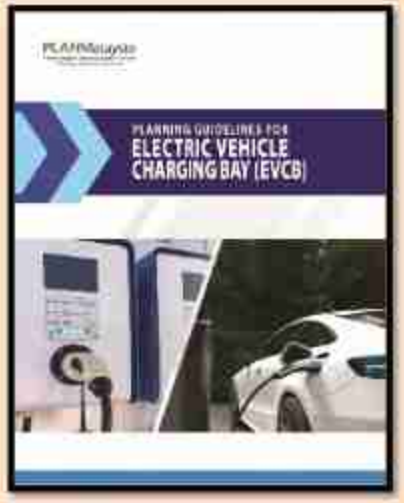
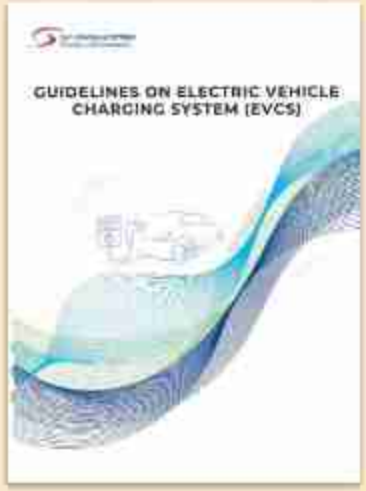
LANDSIDE AREA

Landside EVCBs, being publicly accessible, must strictly comply with guideline issued by the Ministry of Housing and Local Government, Energy Commission and the Fire and Rescue Department of Malaysia in order to ensure regulatory compliance and safeguard EV users and public.





LANDSIDE AREA

The airside will use the guidelines established by the Airport Fire & Rescue Service (AFRS), Malaysia Airports Holding Berhad (MAHB) for Electric Vehicles Emergency Preparedness at the Airside Guideline.

AFRS 3-YEAR EV ROADMAP – MALAYSIA AIRPORTS

2023

17 NOVEMBER 2023

- KSS on EV by JBPM
- VFB Demonstration
- Visit EVCB @ T1

20 NOVEMBER 2023

- HIRADC Meeting AFRS

28 NOVEMBER 2023

- HIRADC Meeting KUL
- Visit EGSE @ T1
- Visit EVCB @ T2
- Visit EGSE @ T2

CORE ENGAGEMENT

2024

23 - 30 APRIL 2024

- International Airport Fire Chiefs was assigned topic on EV Rescue Firefighting Strategy for MACA AFRS Practical Test

10.05.2024

- Procurement of EV Fire Blanket @ KUL
  5 unit @ AFRS & 1 unit @ STCP Block B

24-25 JULY 2024

- EV Safety Awareness @ BAuto Training School
  20 participants - (MAHB, MA (S) & MASB)

STRENGTHEN AWARENESS

2025

22 JANUARY 2025

- KSS On How To Use EV Fire Blanket For Airside Area at KUL

26 MARCH 2025

- EV RESPONDER Course at International Fire Training Centre, United Kingdom

5 JUNE 2025

- Enhancing Aerodrome Ground Services Workshop hosted by MAHB in support of the Ministry of Transport's (MOT)

17 JULY 2025

- Development of EV Emergency Preparedness at Airside Guideline

2 OCTOBER 2025

- Purchase EV Fire Isolation Pools for KUL

16 SEPTEMBER 2025

- EV Fire Blanket Training at KUL

30 OCTOBER 2025

- International Aviation Fire Protection Association Conference 2025

28 NOVEMBER 2025

- Presentation To Authority About Ev Emergency Preparedness At Airside Guideline

30 DECEMBER 2025

- Pilot training for International Airports

OPTIMIZE READINESS

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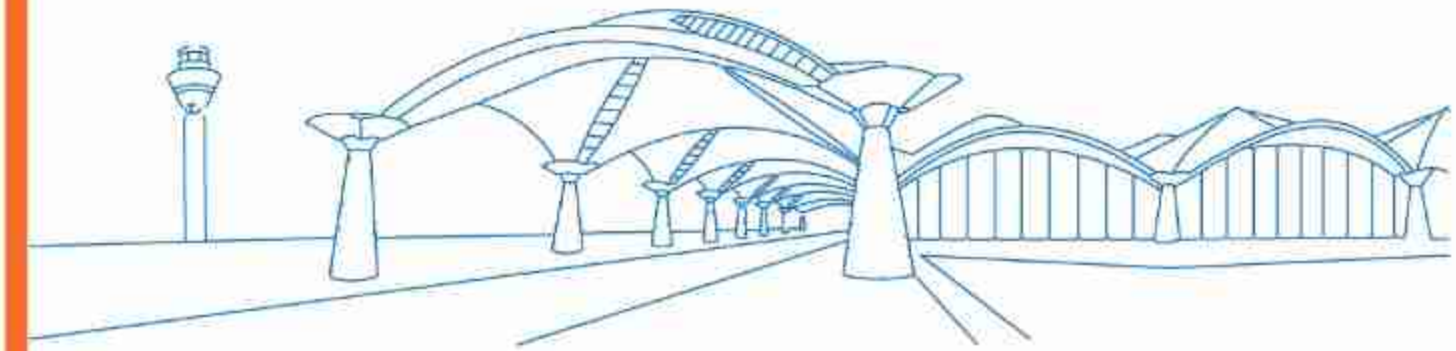
EV EMERGENCY PREPAREDNESS AT THE AIRSIDE GUIDELINE

- EV Guideline
- EV Risk Assessment
- Specification & Dimension of EVCB
- Charging Bay Size For Oversize Vehicles & Safety Setup
- Main Isolation Switch Requirements
- Safety Setup For Ev Charging Bays



EV EMERGENCY PREPAREDNESS AT THE AIRSIDE GUIDELINE

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SPECIFICATION AND DIMENSION OF EV CHARGING BAY

THE SEPARATION BETWEEN EVCB AND NON-EV

WATER SOURCE DISTANCE FROM EVCB

DOCUMENT CLASSIFICATION
INTERNAL USE ONLY

MALAYSIA AIRPORTS

MALAYSIA AIRPORTS HOLDINGS BERHAD

GUIDELINE

AFRS DIVISION

DOCUMENT NO	:	MAHB/HDQ/GL/AF/01
TITLE	:	ELECTRIC VEHICLES EMERGENCY PREPAREDNESS AT THE AIRSIDE
EDITION	:	00
REVISION	:	01
EFFECTIVE DATE	:	01/07/2025

APPROVED BY	GENERAL MANAGER AFRS

MAIN ISOLATION SWITCH

FIREFIGHTING EQUIPMENT FOR EV

RISK ASSESSMENT

EV RISK ASSESSMENT – GROUND HANDLER, EVCB & RESPONDER

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ITEM	HAZARD	RISK
 GROUND HANDLER	a) Electrical Hazards	Electric shock or electrocution from high-voltage components
	b) Vehicle Movement and Traffic Management	Accidents involving moving vehicles or ground service equipment
	c) Training and Competency	Lack of knowledge leading to unsafe practices
	d) Emergency Preparedness	Inadequate response to accidents or emergencies
 EVCB	a) Electrical Risks: Overloading and Short Circuiting	Fires, damage to electrical equipment, and the risk of electric shock
	b) Overheating of Charging Equipment: Inadequate ventilation or prolonged charging can cause charger components to overheat	Risk of fire in the charger unit or the surrounding areas
	c) Electric Shock: Faulty equipment, exposed wires, or improper handling of charging cables	Electric shock to personnel or users
	d) Water Exposure: Charger points installed in outdoor areas or places with high humidity	Short circuits, electrical shock hazards, or corrosion of equipment
 RESPONDER	Firefighting on an electric vehicle (EV).	1. Inhalation of toxic gases. 2. Explosion of the battery. 3. Current flow. 4. Spreading of flames. 5. High temperature on fire.
	Rescue Casualty	1. Exposure to toxic gases 2. Electric shock from high-voltage parts 3. Burns from fire or hot components 4. Injury during extrication

SPECIFICATION AND DIMENSION OF EV CHARGING BAY

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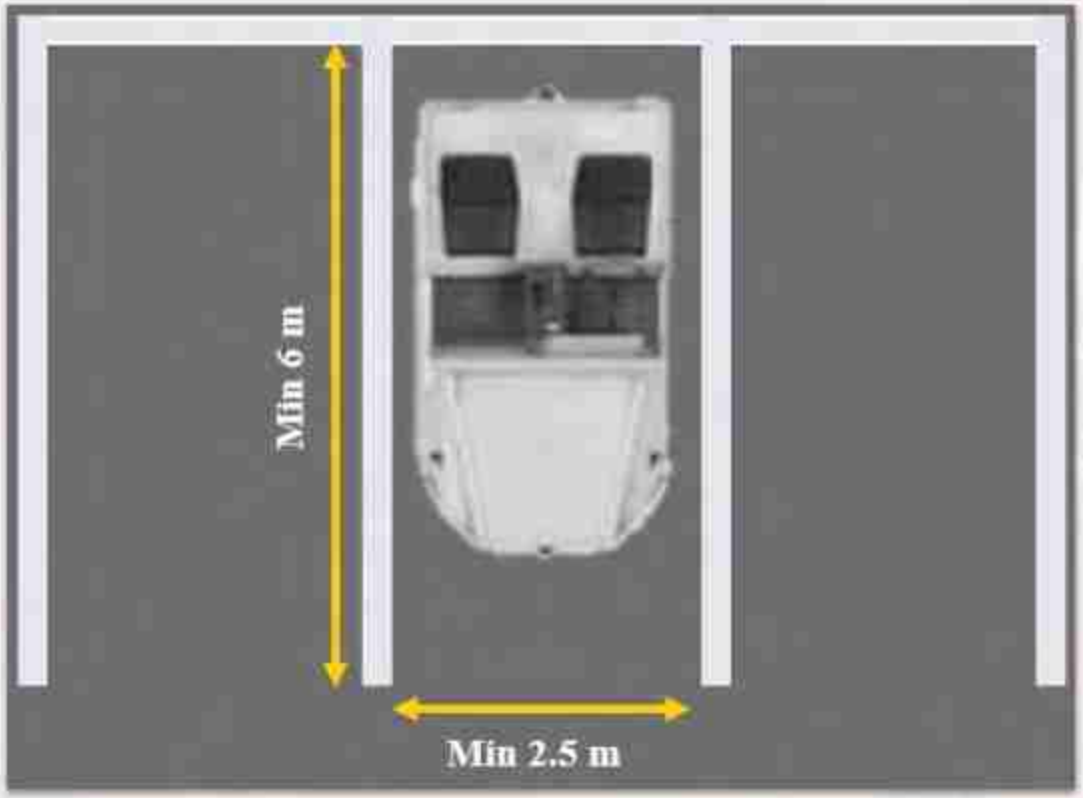
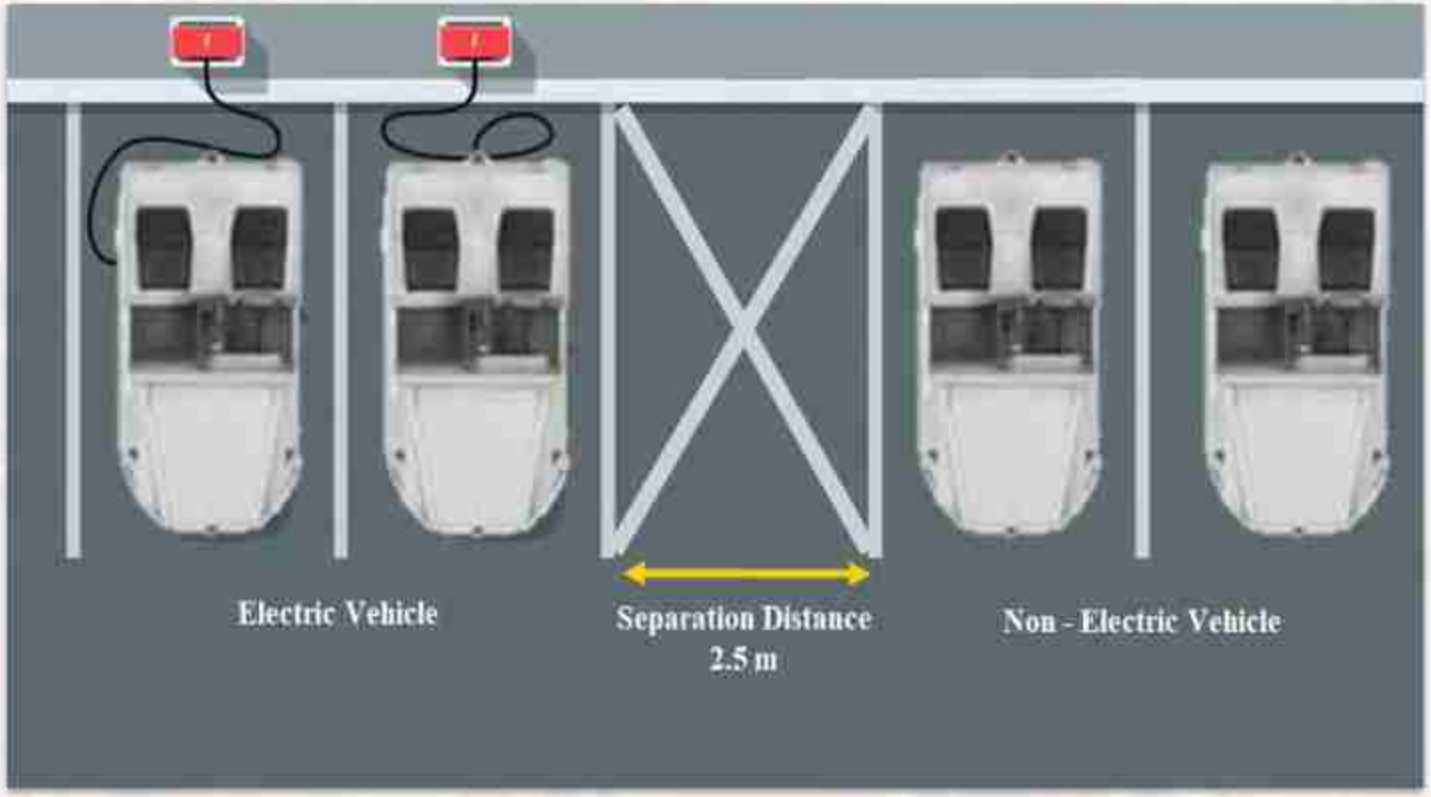
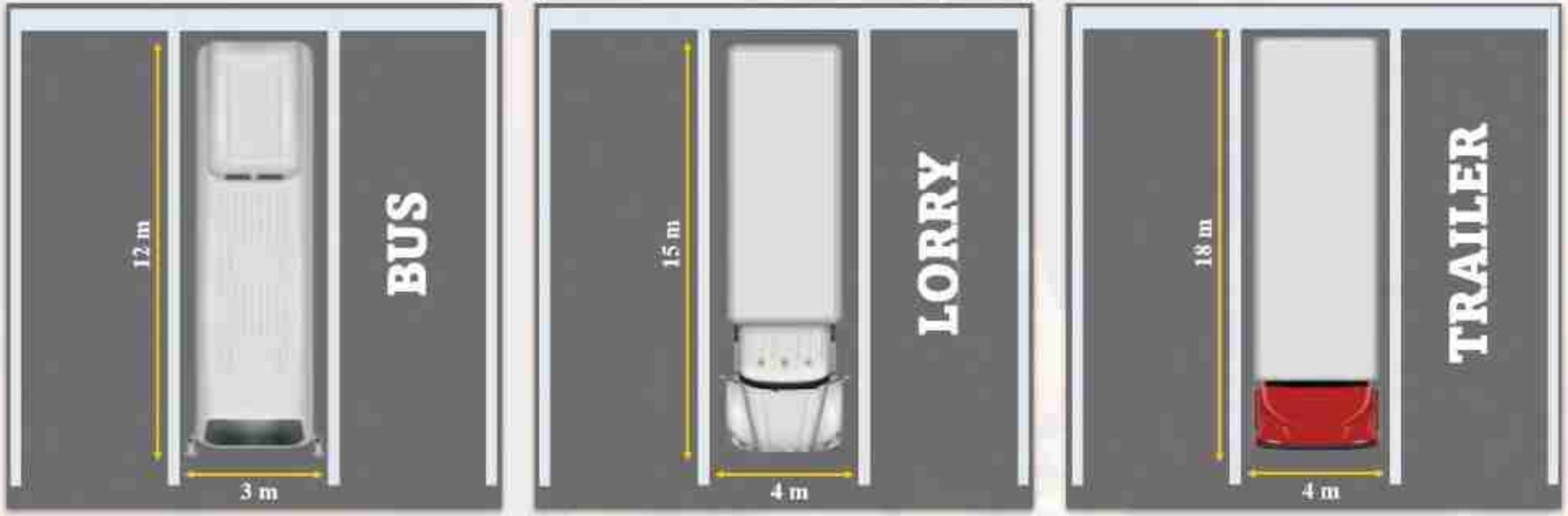


Size of Electric Vehicle Charging Bay



Separation Distance for Non-EV Bay Parking

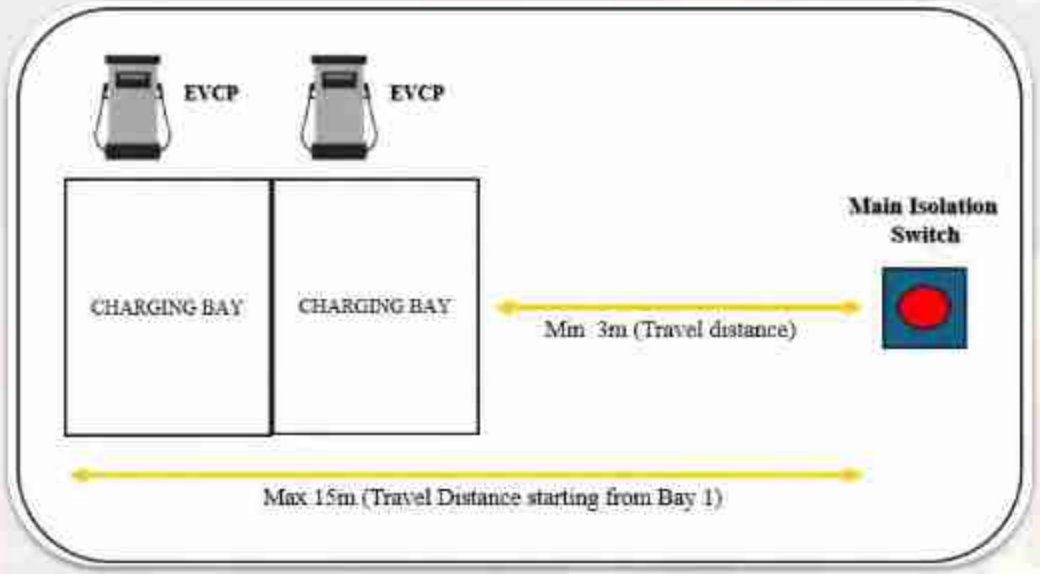
CHARGING BAY SIZE FOR OVERSIZE VEHICLES & SAFETY SETUP



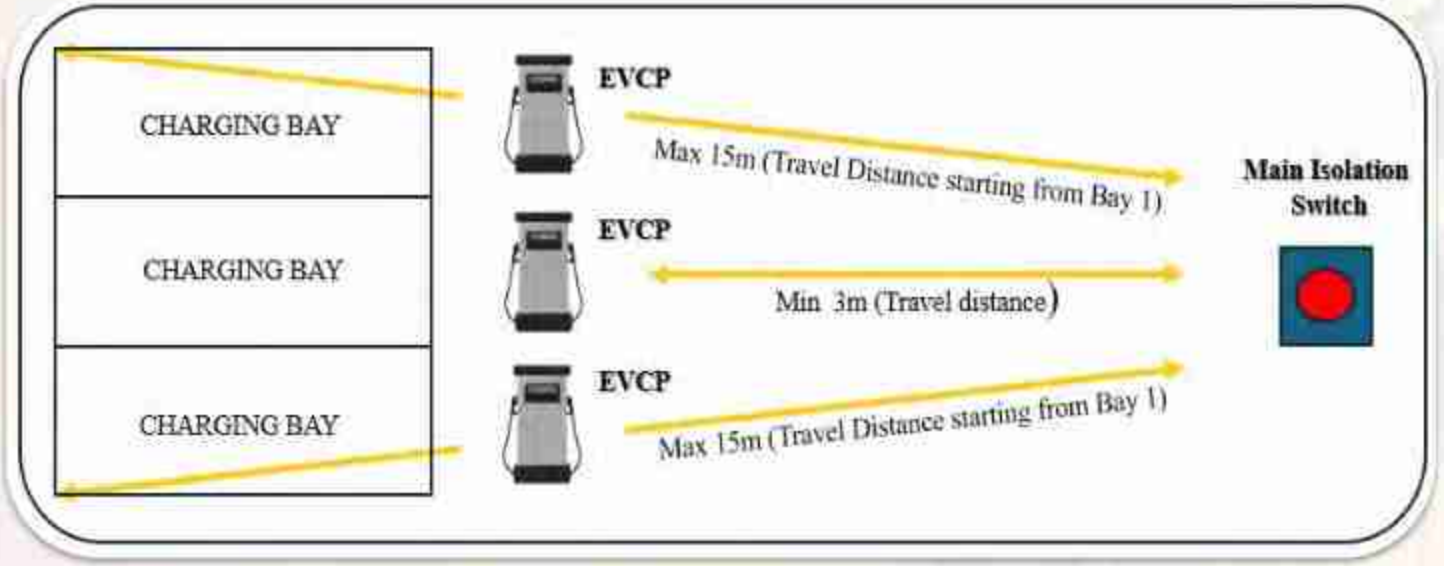
Size of Bus, Lorry and Trailer EVCB

Distance EVCB from Jet A1 Hydrant

MAIN ISOLATION SWITCH REQUIREMENTS

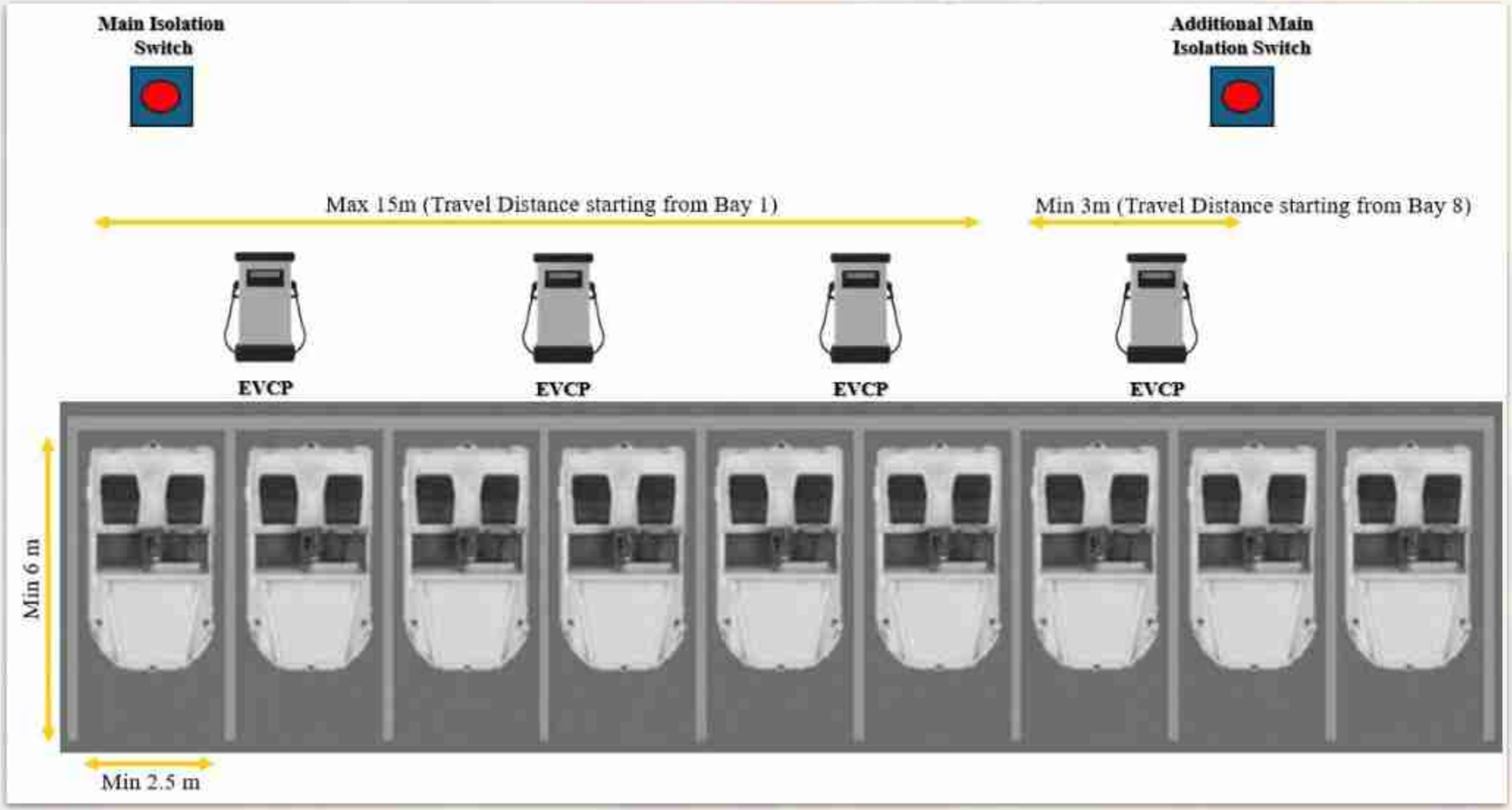


Main Isolation Switch Location



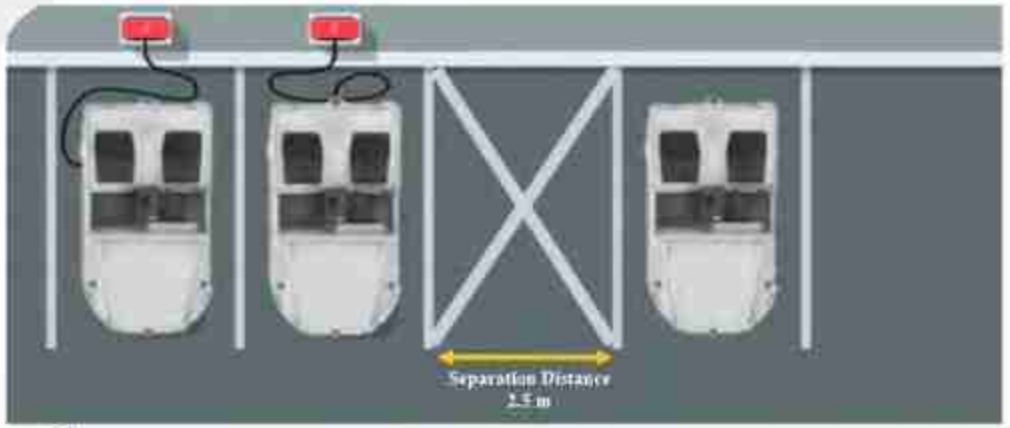
Sharing Main Isolation Switch

MAIN ISOLATION SWITCH REQUIREMENTS



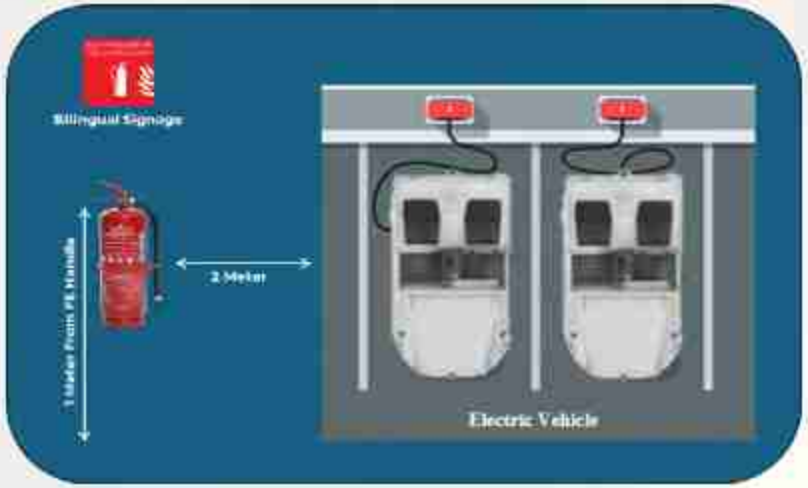
Additional Requirements For Main Isolation Switch

SAFETY SETUP FOR EV CHARGING BAYS

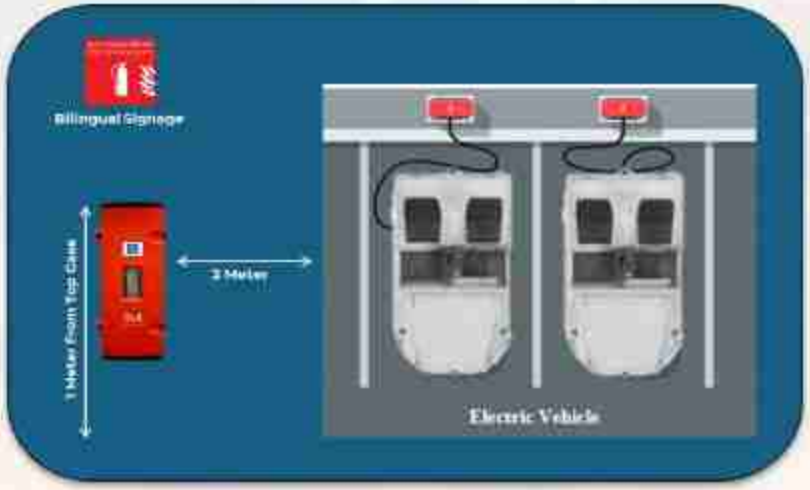


Travel distance from Bay 1 to Hydrant < 90 M

Distance of Fire Hydrant from EVCB



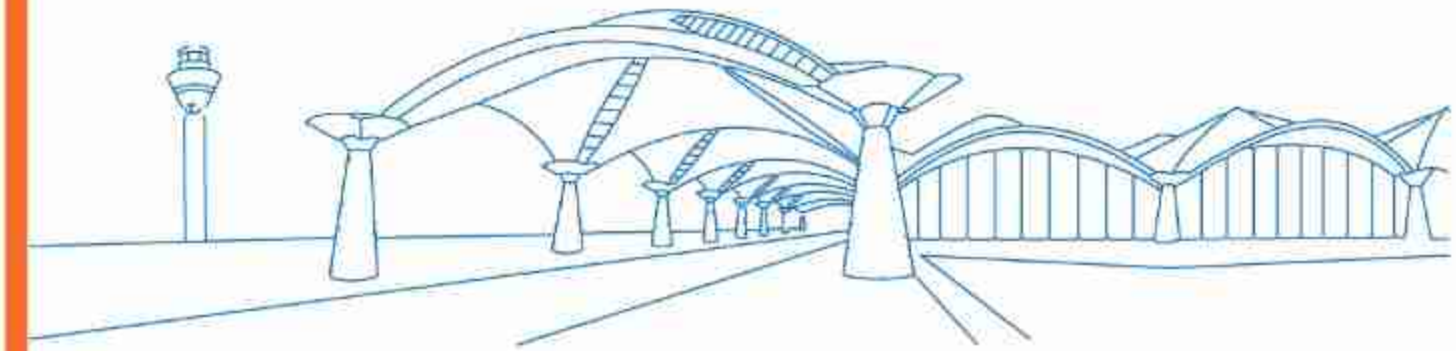
		
Number of EVCBs	Number of EVFB	Number of PFE
1	1	1
2 to 10	2	2
11 to 15	3	3



Vehicle Fire Blanket & Fire Extinguisher Placement at EVCB

EV FACILITIES AND FIREFIGHTING EQUIPMENT AT WMKK / KUL

- EV Fire Safety Equipment at The Airside
- EVCB at the Airside



EV FIRE SAFETY EQUIPMENT AT AIRSIDE

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Fire Station 1

Fire Station 2

Fire Station 3

EV Charging bay
4 @T1
2 @T2

Fire Extinguisher
10 @T1
5 @T2

EV Fire Blanket
3 @T1
2 @T2

Fire Hydrant
8 @T1
3 @T2

EV CHARGING BAY AT LANDSIDE

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Alternate Current (AC)

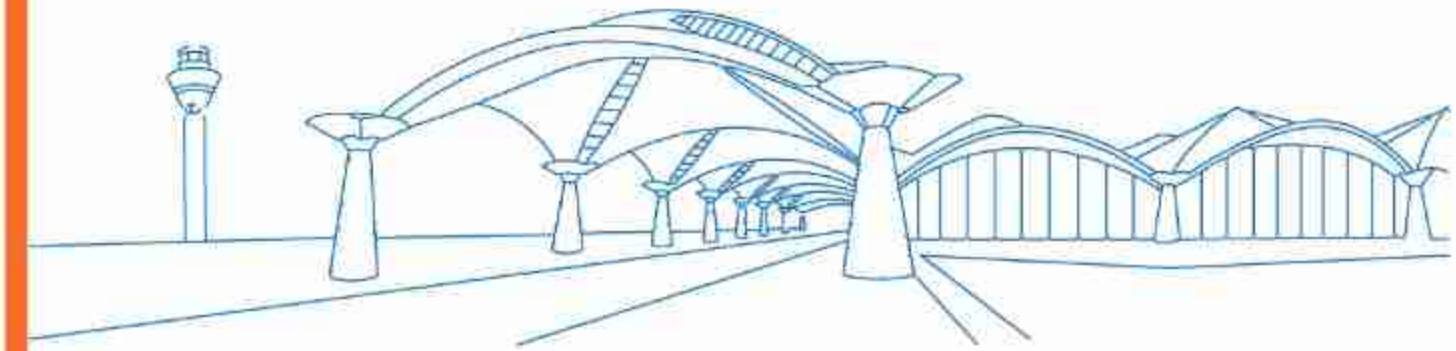

Isolation Switch


EV Fire Blanket


Sprinkler System

EV PREPAREDNESS MOVING FORWARD

- Move Forward



EV PREPAREDNESS MOVE FORWARD

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Awareness

- Malaysia Airports Staffs - Airside, Car Park
- Airport Community

Training

- Subject Matter Expert (SME)
- AFRS Personnel - KUL, SZB, PEN, BKI, KCH

Infrastructure

- Electric Fire Vehicle Charging Bay (EVCB)

EXCELLENT

EV

VIGILANT

Guideline

- EV Emergency Response Aide Memoire
- EV Emergency Response App
- Training Module

Equipment

- Vehicle Fire Blanket (VFB) - SZB, PEN, BKI, KCH
- EV Fire Extinguisher (EVFE) - - KUL, SZB, PEN, BKI, KCH
- EV Isolation Pool (EVIP) - KUL, SZB

Collaboration

- Airlines / Ground Handler - ADS, Pos Aviation, GTR
- EV Charging Vendor

MALAYSIA AIRPORTS

Hosting Joyful Connections

TERIMA KASIH

Muhammad Hidayat Ismail

Chief Hidayat Ismail

Muhammad Hidayat Ismail