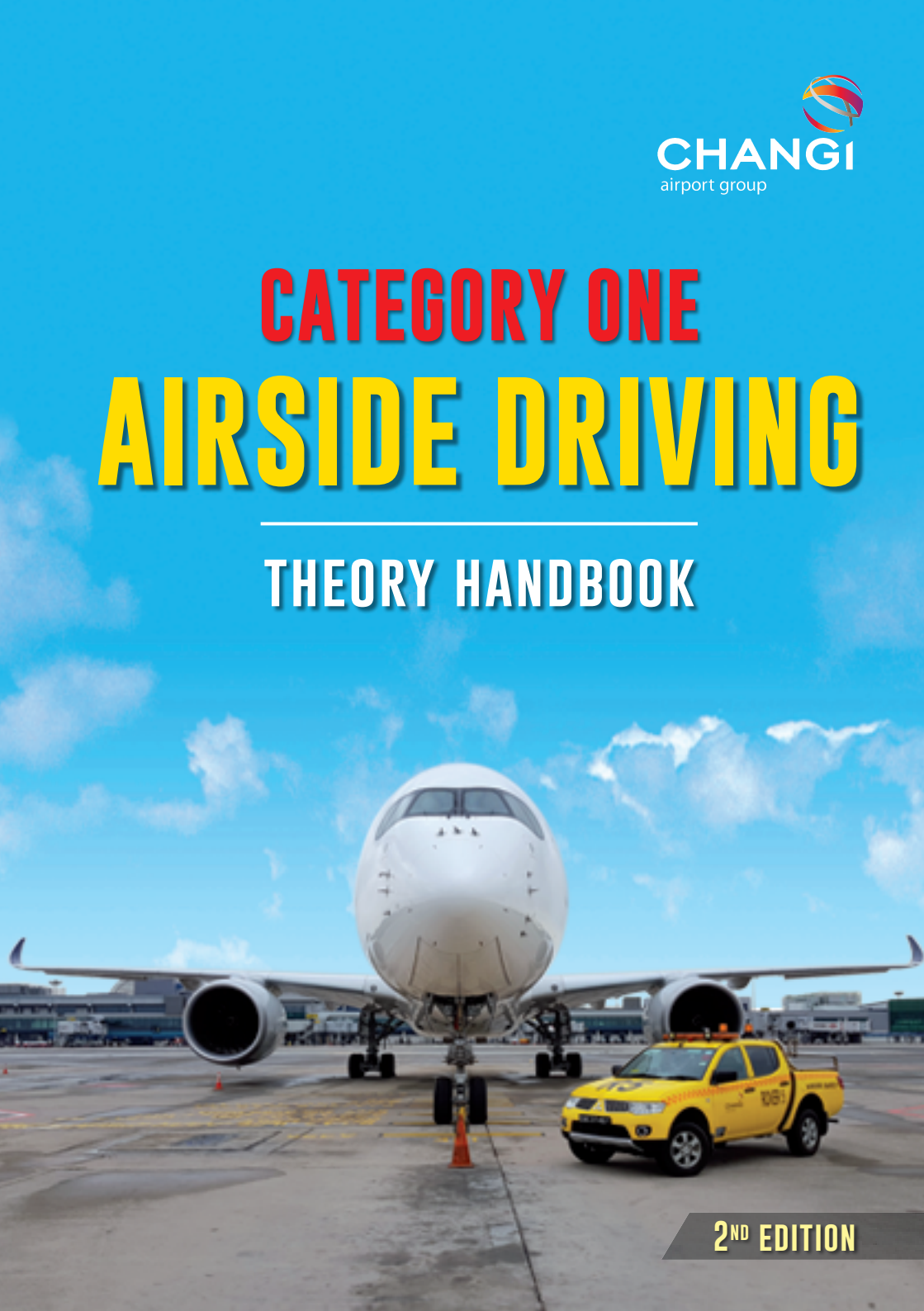
CHANGI
airport group

CATEGORY ONE
AIRSIDE DRIVING

THEORY HANDBOOK



2ND EDITION

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CONTENTS

1 INTRODUCTION

1.1. Purpose

All drivers operating in the manoeuvring area must do so in a safe and competent manner. The CAT1 Airside Driving Theory Handbook (ADTH) sets out the requirements, rules and regulations, and standard operating procedures governing driving in the manoeuvring area of Changi airside. The CAT1 ADTH also sets out the requirements for all vehicles operating in the manoeuvring area.

The manoeuvring area is shared with aircraft, and therefore driving in this area requires a stricter standard of driving competency, familiarity with the airfield, communications techniques, and knowledge of standard operating procedures. Hence, all manoeuvring area drivers shall be competent, vigilant, and strictly adhere with all rules and regulations and standard operating procedures described in this handbook to ensure the safety of passengers, airside workers, aircraft and vehicles.

The contents of the CAT1 ADTH shall be read in conjunction with the CAT1 theory training, which is a classroom-based training course covering training material required for CAT1 driving.

1.2. Review and Revision of Contents

The contents of this handbook will be reviewed on an as-required basis. Any supplement or revision to the contents of this handbook can be found on the Changi Airport Group website.

CAG ADC Website: https://tinyurl.com/ycqbn4lq or https://www.changiairport.com/content/dam/cacorp/documents/airsidedrivingcentre/Changi%20Category%201%20Airside%20Driving%20Theory%20Handbook.pdf

An Airside Operations Notice (AON) and Airside Safety Notice (ASN) will also be published to inform the airside community of any supplement or revision.

Drivers shall comply with all rules and regulations including any supplement or revision.

1.3. Legislation

All personnel operating in the airside are governed by the following rules and regulations including any subsequent amendments.

1.3.1. **The Civil Aviation Authority of Singapore Act 2009.**
1.3.2. **The Civil Aviation Authority of Singapore (Changi Airport) By-Laws 2009.**
1.3.3. **Civil Aviation Authority of Singapore (Composition of Offences) Regulations 2009.**
1.3.4. Protected Areas and Protected Places Act (Chapter 256) (Note: In addition, the Penal Code is applicable in certain traffic accidents determined by State Police).
1.3.5. Workplace Safety and Health Act.

1.4. Related Reference Documents

1.4.1. ICAO Annex 10 – Aeronautical Telecommunications – Vol. 2 (Communications Procedures Including those with PANS status).
1.4.2. ICAO Annex 14 – Aerodromes.
1.4.3. ICAO Document 9432 – Manual of Radiotelephony.
1.4.4. ICAO Document 9870 – Manual on the Prevention of Runway Incursions.
1.4.5. Changi Aerodrome Manual (CAM).
1.4.6. Low Visibility CATII ILS Operations in Changi Airport (by CAAS).

1.5. Jurisdiction

All vehicles and handling operations at the airside, apron, and designated roadways are under the control and jurisdiction of Changi Airport Group (S) Pte Ltd ("CAG"), the airport licensee.

The control of aircraft taxiing from runways to aircraft stands and vice versa by Changi Tower is under the control and jurisdiction of the Civil Aviation Authority of Singapore (CAAS).

1.6. Traffic Control

All drivers entering the airside shall present their valid Airfield Driving Permit (ADP), and display their valid Airfield Vehicle Permit (AVP) on the windshield or a conspicuous location to the Auxiliary Police Officer at the entry point without request.

1.7. Suspension or Cancellation of Airfield Driving Permits

CAG may suspend or cancel an ADP if:

(a) there has been a contravention of any condition of the permit;
(b) the person to whom the permit has been issued is not competent to drive the relevant vehicle; or
(c) it would not be in the interest of public safety for him to hold a driving permit.

CAG may at any time in its discretion cancel any AVP or ADP without assigning any reason therefore under By-Law 79 and 80 or the CAAS (Changi Airport) By-Laws 2009.

1.8. Surrender of Airfield Driving Permits

The ADP holder must return the ADP to CAG Airside Driving Center (ADC) upon cessation of driving duties for his employer. The vehicle operator must also ensure that the ADP holder complies with this clause.

1.9. Notice Of Offence (NOO)

Any person who contravenes the CAAS (Changi Airport) By-Laws 2009 or fails to comply with the conditions of any permit or pass issued under the CAAS (Changi Airport) By-Laws 2009 will be issued a Notice of Offence. The regulations do not restrict CAG from suspending an ADP when it is deemed necessary.

2 ABBREVIATIONS AND DEFINITIONS

ACC	means Airside Control Centre.
Accident	means an occurrence associated with the operation or handling of an aircraft in which a person is fatally or seriously injured, or the aircraft sustains damage (adapted from the definition in ICAO Annex 13).
ABL	means Apron Boundary Line.
ADC	means Changi Airport Group (S) Pte Ltd Airside Driving Centre.
ADP or Airfield Driving Permit	means an airfield driving permit issued by the airport licensee.
Aerodrome	means the Changi Aerodrome managed by the Authority and includes any road or uncovered area which is within the limits of the aerodrome, but does not include any road or uncovered area to which the public has access.
AES	means Airport Emergency Service.
Aircraft Stand	means an area on an apron for parking of aircraft.
Airside	means the movement area of the airport and the adjacent terrain and buildings or parts thereof, access to which is controlled, but does not include the cargo handling area.
AMC	means Airside Management Centre.
APD	means Airport Police Division.
Apron	means the part of the airport, other than the manoeuvring area, to be used for accommodating aircraft for the purposes of embarkation or disembarkation of passengers, loading or unloading of mail or cargo, or fuelling, parking or maintenance of aircraft.
ARRRC	means Airfield Rules and Regulations Refresher Course.

ATC	means CAAS Air Traffic Control.
Authorised Person	means: (a) any other officer or employee of the airport licensee; or (b) any person duly authorised by the airport licensee to act on its behalf.
AVP or Airfield Vehicle Permit	means an airfield vehicle permit issued by the airport authority.
CAAS	means Civil Aviation Authority of Singapore.
CAG	means Changi Airport Group (S) Pte Ltd.
Category One Airfield Driving Permit	is the airfield driving permit which allows the holder to enter the taxiways, subject to approval from ATC.
Category 1R Airfield Driving Permit	is the airfield driving permit which allows the driver to enter the runways and taxiways, subject to approval from ATC.
Category One Airfield Vehicle Permit	is the vehicle permit which allows the vehicle to enter the runways and taxiways, subject to approval from Changi Tower.
Driver	means: (a) in relation to any towed object, includes a driver of a vehicle by which the towed object is drawn; (b) where a separate person acts as a steersman of a vehicle, includes that person as well as any other person engaged in the driving of the vehicle; and the word "drive" shall be construed accordingly.
EPA	means Equipment Parking Area.
ERA	means Equipment Restraint Area.
ESA	means Equipment Staging Area.
"Follow Me" Vehicle	means a vehicle used to guide aircraft or other vehicles.
FOD	means Foreign Object Debris.

GP	means Glide Path.
Incident	means an occurrence, other than an accident as described above, associated with the operation or handling of an aircraft, which affects or could affect the safety of operations.
ILS	means Instrument Landing System.
Keep Clear Zone	means zones in aircraft stands that are marked with white hatched lines and "No Parking" signs painted on the ground. These zones shall be kept clear of personnel, vehicles, and equipment prior to arrival of aircraft and after departure of aircraft.
Manoeuvring Area	means the part of the airport to be used for the taking off, landing and taxiing of aircraft, but does not include areas set aside to accommodate aircraft, for the embarkation and disembarkation of passengers, for the loading or unloading of mail or cargo, or for fuelling, parking or maintenance of aircraft (i.e. the **Apron**).
Movement Area	means the part of the airport that includes both the **Apron** and **Manoeuvring Area**.
NOO	means Notice Of Offence, referring to Notice of Composition of Offences, which is a report of any violations of the **Civil Aviation Authority of Singapore (Composition of Offences) Regulations 2009**.
Perimeter Roadway	means roadways within the airside that allow vehicles to move around the airport clear of the **Apron** and **Manoeuvring Area**.
PLB	means Passenger Loading Bridge.
Primary Roadway	means roadways in front of all aircraft parking stands and baggage handling areas meant for movement of vehicles and equipment.
Runway	means a defined rectangular area prepared for the landing and taking-off of aircraft.

Runway Strip	means a defined area, including the runway and stopway, if provided, that is intended to reduce the risk of damage to aircraft running off a runway; and to protect aircraft flying over the area during take-off and landing operations.
Secondary Roadway	means roadways behind all aircraft parking stands meant for movement of vehicles and equipment that are not allowed to use the primary roadways or unable to access the primary roadways due to height limit restrictions.
Taxiway	means a defined path established for the taxiing of aircraft and to provide a link between one part of the aerodrome and another, including: (a) **aircraft stand taxi-lane**, where a portion of the apron designated as a taxiway and to provide access to aircraft stands only; (b) **apron taxiway**, where a portion of the taxiway system located on the apron for the purposes of providing a through taxi route across the apron; (c) **parallel taxiway**, where a portion of the taxiway system used for the purposes of providing a through taxi route to other parts of the aerodrome; (d) **exit taxiway**, where a taxiway is connected to a runway for the purposes of providing a through taxi route into the runway; and (e) **rapid exit taxiway**, where a taxiway is connected to a runway at an acute angle and is designed to allow landing aircraft to turn off at higher speeds than may be achieved on other exit taxiways, thereby minimising runway occupancy times.
TEP	means Temporary Entry Permit.

USEFUL CONTACT DETAILS

CHANGI AIRPORT GROUP (S) PTE LTD

Airside Control Centre (ACC)	6541 2257 / 6541 2258
Airside Management Centre (AMC)	6541 2275
Airport Emergency Service (AES)	6541 2525

AIRPORT ORGANISATIONS

Medical Emergency Hotline	6543 2223
Airport Police Division (APD)	6546 0000
Changi Airport Fuel Hydrant Installation (CAFHI)	6546 4316

3 QUALIFYING REQUIREMENTS FOR MANOEUVRING AREA DRIVING

3.1. Requirements for Drivers

3.1.1. Eligibility for Manoeuvring Area Driving

Personnel who are required to drive in the manoeuvring area shall:

(a) possess a valid seasonal Airport Pass from Airport Police Division for access to the airside;

(b) possess a valid Class 3 Driving License issued by the Singapore Traffic Police (TP) or state licensing authority (outside Singapore), or an International Driving Permit equivalent to Class 3.

Licenses and supporting documents not in English shall be supported by translation from recognised authorities; and

(c) possess a Category 1 or Category 1R Airfield Driving Permit (ADP) issued by Changi Airport Group (CAG) Airside Driving Centre (ADC). The Category 1 ADP allows drivers to drive in taxiways only. The Category 1R ADP allows drivers to drive in taxiways and live runways.

The process to qualify for a Category 1 or Category 1R ADP is described in the following sections.

3.1.2. Access Zones

A Category 1 ADP holder is allowed to drive on all airside roadways, aircraft stands, and taxiways. A category 1R ADP holder is allowed to drive on all of the above, including live runways. Access to the manoeuvring area is subject to permission by air traffic control (ATC) obtained via radiotelephony communication.

3.1.3. Qualifying for Category One/Category 1R ADP

Operating in the manoeuvring area presents unique challenges compared to driving in the apron, and thus demands a higher degree of driving competency and knowledge of the airfield. Operating in the manoeuvring area involves:

- strict adherence to manoeuvring area standard operating procedures and safety regulations;
- the need to understand manoeuvring area features such as signs, markings, lights, and navigational aids;
- the need to anticipate aircraft movements and to give way at all times; and
- competency in radiotelephony communications.

It is a prerequisite to hold an ADP before applying for a Category One/Category 1R ADP. For details on the ADP, refer to the Airside Driving Theory Handbook. To obtain a Category One ADP, an airside driver must:

(a) have held an ADP for at least 3 months;
(b) have not been issued any NOO for the past 1 year;
(c) have a valid reason to operate in the taxiways; and
(d) successfully complete the Category One ADP qualification process.

To obtain a Category 1R ADP, an airside driver must:

(a) possess a valid Category One ADP for at least 3 months;
(b) have a valid reason to operate in live runways; and
(c) successfully complete the Category 1R ADP qualification process.

3.1.4. Category One Airfield Driving Permit (ADP) Application Process

To obtain a Category One ADP, drivers must first have a valid reason for operating in the manoeuvring area, be pre-approved by ADC, and then proceed to complete the qualification process.

The general qualification process is described below:

* For details on documentation required, refer to **Application for Category One Airfield Driving Permit** form available on CAG website, or in hardcopy at CAG Airside Driving Centre (ADC).

Details of the process are described in the sections below.

(a) Category One ADP Theory Training

After obtaining approval to apply for a Category One ADP, applicants shall study the contents of this CAT1 ADTH, and shall attend a theory training course at ADC. The course will introduce applicants to manoeuvring area driving, rules and regulations, and standard operating procedures.

(b) Category One ADP Theory Test

The Category One ADP Theory Test assesses applicants' knowledge of the requirements, rules and regulations, and standard operating procedures governing driving in the manoeuvring area of Changi airside.

(c) Category One ADP Simulator Training

The Simulator provides a safe environment for drivers to experience hands-on training in adherence to manoeuvring area SOP, radio-telephony procedures, and exception handling.

(d) Category One ADP Practical Training

The practical training is a structured program during which applicants will be paired with a practical trainer. During the course, the applicants will be familiarised with the airfield and develop and demonstrate the required skills for driving in the taxiways.

Applicants must successfully complete all practical training modules to progress to the practical test.

(e) Category One Practical Test

The practical test assesses applicants' driving competency and adherence to airside driving safety and regulations, and taxiway standard operating procedures.

(f) English Language Proficiency (ELP) Test

All CAT1 drivers must be competent in communicating with ATC using a combination of standard ICAO RT words/phrases and plain (everyday) language.

After passing the Category One Practical Test, drivers must take an ELP test administered by SEAMEO RELC. The test ensures that drivers are able to communicate effectively with ATC in English, in an aviation context. Drivers shall contact RELC at enquiries@relc.org.sg to arrange for the test and make payment as necessary. Drivers must attain at least Level 4.

After completing the above, drivers must submit evidence of completion to ADC to be issued the CAT1 ADP.

3.1.5. Issuance of ADP

Upon completing the process described above, drivers will receive the CAT1 ADP. This allows drivers to drive in the taxiways only. **CAT1 ADP holders are not allowed to enter live runways.**

In addition, within three (3) months of being issued the CAT1 ADP, drivers must complete the following:

(a) CAT1 ADP On-Job-Training (OJT)

Drivers shall complete a minimum of three (3) entries into open taxiways in the course of their regular work under the supervision of an OJT Mentor. The CAT1 ADP OJT Checklist is issued to drivers along with the CAT1 ADP.

3.1.6. Validity of CAT1/CAT1R ADP and Renewal Process

(a) ADP Validity Period

Scenario 1 - Non-CAT1/CAT1R ADP Expires Before CAT1/ CAT1R ADP

- On 1 Jan 2019, driver obtains ADP with a validity of 2 years (expiry on 31 Dec 2020).
- On 1 Jun 2020, driver obtains CAT1/CAT1R ADP.
- Thus, driver's ADP still expires on 31 Dec 2020. Driver must renew ADP within 3 months of the expiry date (before 31 Dec 2020).
- If driver does not renew ADP by the expiry date (31 Dec 2020), both ADP and CAT1/CAT1R ADP will be voided.

Scenario 2 - Non-CAT1/CAT1R ADP Expires After CAT1/ CAT1R ADP

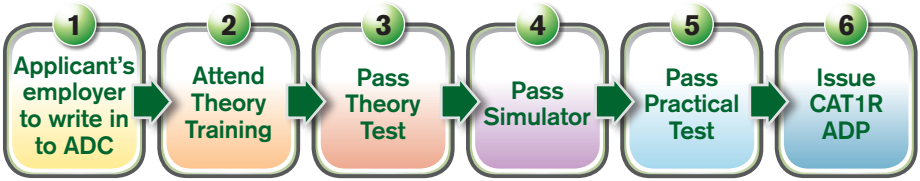
- On 1 Jan 2019, driver obtains ADP with a validity of 2 years (expiry on 31 Dec 2020).
- On 1 Jun 2019, driver obtains CAT1 ADP with a validity of 1 year (expiry on 1 Jun 2020). Note that the new expiry date is now earlier than the original expiry date.
- Thus, driver's ADP now expires on 1 Jun 2020. Driver must renew ADP within 3 months of the expiry date (before 1 Jun 2020).
- If driver does not renew ADP by the expiry date (31 Dec 2020), both ADP and CAT1/CAT1R ADP will be voided.

3.1.7. Category 1R ADP Application Process

Drivers who are required to enter live runways must possess a valid CAT1R ADP. To obtain a Category 1R ADP, drivers must first have a valid reason for operating in live runways, be pre-approved by ADC, and then proceed to complete the qualification process.

Note: Drivers who are required to enter runways under escort, or when the runways are closed, do not require a CAT1R ADP.

The general qualification process is described below:



Details of the process are described in the sections below.

(a) Category 1R ADP Theory Training

After obtaining approval to apply for a Category 1R ADP, applicants shall study the contents of this CAT1 ADTH, and shall attend a theory training course at ADC. The course will introduce applicants to runway operations, rules and regulations, and standard operating procedures.

(b) Category 1R ADP Theory Test

The Category One ADP Theory Test assesses applicants' knowledge of the requirements, rules and regulations, and standard operating procedures governing operating in the runways.

(c) Category 1R ADP Simulator Training

The Simulator provides a safe environment for drivers to experience hands-on training in adherence to runway SOP, radio-telephony procedures, and exception handling.

(d) Category 1R ADP Practical Test

The practical test assesses applicants' driving competency and adherence to standard operating procedures for entering, operating in, and vacating live runways.

3.1.8. Upon completion of the process described above, drivers will receive the CAT1R sticker which will be affixed to their CAT1 ADP.

In addition, within three (3) months of being issued the CAT1R ADP, drivers must complete the following:

(a) CAT1R ADP On-Job-Training (OJT)

Drivers shall complete a minimum of three (3) entries into open runways in the course of their regular work under the supervision of an OJT Mentor. The CAT1R ADP OJT Checklist is issued to drivers along with the CAT1R ADP.

3.1.9. Refresher Training and Renewal of CAT1/CAT1R ADP

All CAT1 drivers must attend the CAT1 ADP Refresher Course, Simulator and Practical Test (in that order) in order to renew their CAT1/CAT1R ADP. Drivers may refer to the online booking system to book available time slots for each module.

An example of the renewal process is as follows:

(f) Change of Employment

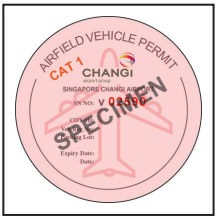
i. The ADP is not transferable. Upon leaving his employer, the driver shall return his ADP to CAG ADC either personally or through his employer. Failure to do so is a violation of CAAS By-Laws.

ii. If the driver is required to drive in the airside by his new employer, he shall proceed to CAG ADC and produce a proof-of-employment letter from his new employer together with a supporting document from the respective CAG project officer as supporting documents to have his ADP details updated.

3.2. Requirements for Vehicles

3.2.1. Category One Airfield Vehicle Permit (AVP)

Vehicles operating in the manoeuvring area must be issued a CAT1 AVP.



3.2.2. CAT1 AVP Application and Vehicle Requirements

(a) CAT1 AVP Application

To register for a new CAT1 AVP or renew an existing CAT1 AVP, an application form along with all necessary documentation shall be submitted at CAG ADC.

For full details on application requirements, please refer to the **Application for Category One Airfield Vehicle Permit** form available on the CAG website or in hardcopy at CAG ADC.

(b) Vehicle Requirements

To be issued with a CAT1 AVP, vehicles shall comply with the requirements below.

i. Vehicle Examination

Vehicles shall undergo physical examination at the LTA authorised inspection centers (e.g. VICOM and STA) and produce a copy of the inspection form/certificate.

ii. Designated Parking Area

The designated vehicle parking area shall be clearly stated in the application form.

iii. Obstacle Light

An ICAO-compliant obstacle light shall be installed on the highest point of the vehicle. This light shall be switched on at all times when the vehicle is in operation. The light shall meet the following specifications (refer to **Application for Category One Airfield Vehicle Permit** form for full details):

Light Type	Colour	Signal Type/ Flash Rate	Peak Intensity (CD) at Given Background Luminance			Light Distribution Table			
			Day (>500cd/ m^2)	Twilight (50 to 500cd/ m^2)	Night (<50cd/ m^2)	Minimum Intensity	Maximum Intensity	Vertical Beam Spread	
								Minimum Beam Spread	Intensity
Low-Intensity, Type C (Mobile Obstacle)	Yellow	Flashing 60-90 flashes per minute	N/A	40 400 max	40 400 max	40cd	400cd	12°	20cd

iv. Radiotelephony (RT) Set

The radiotelephony set is used for communication with ATC. RT set tuned to appropriate frequencies shall be installed by CAAS appointed contractor.

v. ADS-B Transponder

The ADS-B vehicle transponder broadcasts a vehicle's location and allows ATC to track all vehicular movements in the manoeuvring area. Transponder shall be installed by CAAS appointed contractor.

vi. Runway Incursion Pre-Warning Prevention Location Equipment (RIPPLE)

RIPPLE helps mitigate the risk of runway incursions by providing a visual and audio warning to drivers when the vehicle approaches the runway. RIPPLE shall be installed by CAG appointed contractor. Drivers shall ensure that RIPPLE is in serviceable condition before operating any CAT1 vehicles. Should the RIPPLE not be in serviceable condition, immediately contact the appointed maintenance contractor for servicing.

vii. Latest Aerodrome Chart

The latest aerodrome chart issued by CAAS Aeronautical Information Publication (AIP) website shall be located in the vehicle. This chart serves as a map to help drivers determine their location in the airfield. Subscribe to the website to receive alerts on the latest updates. The latest aerodrome chart may be downloaded here:
https://aim-sg.caas.gov.sg/eaip.html

viii. Vehicle Markings

The entire vehicle shall be painted yellow, except AES vehicles. Vehicle callsign shall be painted in black, with each alphanumeric character no smaller than 60cm (Height) on vehicle roof or bonnet; and no smaller than 20cm (Height) on left and right sides of the vehicle.

ix. Signage

- 'No Smoking' and speed limit signs shall be displayed in the vehicle.
- Warning sign shall be displayed on the dashboard (or any position conspicuous to the driver of the vehicle) bearing

the following words: **NO ENTRY INTO RUNWAY/TAXIWAY WITHOUT PERMISSION FROM CHANGI TOWER.**

- Changi Tower's contact number shall be displayed in the vehicle: **CHANGI TOWER (6541 2416 / 6541 2417).**

x. Insurance

All vehicles operating in the airside shall have insurance coverage for activities conducted in Changi airside. Insurance policy number shall be indicated in the application form.

xi. Registration

All vehicles operating in the airside shall be registered with the Land Transport Authority of Singapore (LTA). Vehicle registration number shall be indicated in the application form.

xii. Seat Belts

Unless exempted by the airport licensee, all vehicles shall be installed with seat belts for the driver and front seat passenger.

xiii. In-Vehicle Camera

Front-facing in-vehicle camera with audio and video recording capabilities shall be installed. The camera shall have sufficient storage capacity to allow minimum two (2) hours' of footage.

(c) Fire Safety

All vehicles operating in the airside shall comply with fire safety rules as stipulated below.

i. Flame Proofing of Petrol Engine

- Exhaust pipe explosions shall not occur when throttle is suddenly closed.
- Carburetor shall be fitted with flame trap/arrestor. A standard automotive-type oil bath air cleaner shall be used. Alternatives shall be approved by CAG Airport Emergency Service (AES).
- Gasket between induction manifold and cylinder block shall have gas-tight seal.

ii. Exhaust System

- Exhaust manifold and adjacent section of exhaust pipe shall be covered with metal to prevent petrol/oil/other combustible material from coming into contact with them. Otherwise, drip tray shall be provided under the carburetor, with a pipe to drain waste petrol from the manifold and exhaust pipe.
- Exhaust pipe of petrol engine vehicle without catalytic converter shall be fitted with approved spark arrestor. Screen-type arrestors shall be serviced regularly to ensure no carbon build-up.

iii. Electrical System

- Spark plugs shall be covered and protected.
- Vehicle battery shall be ventilated. Terminals shall be covered.
- Fuse box shall be enclosed and protected by cover.
- Wiring connections shall not be loose. Wiring insulation shall not be cracked or damaged.

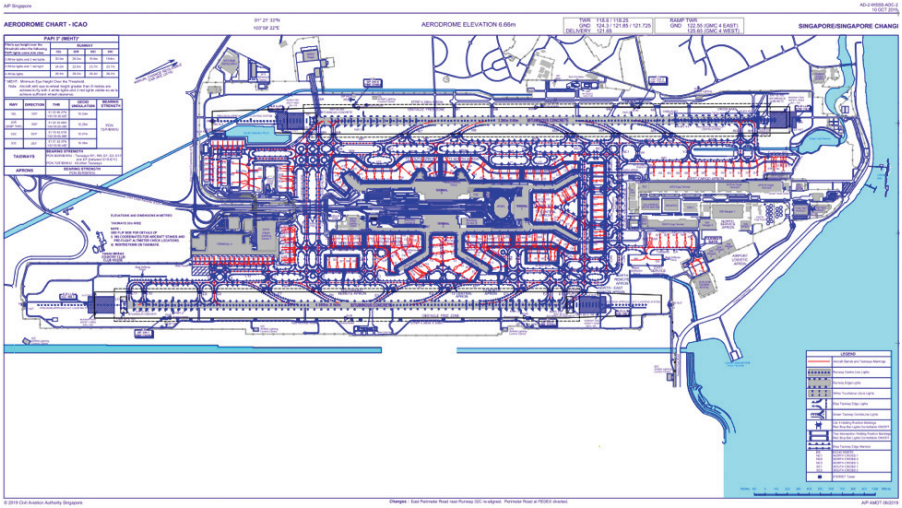
iv. Fire Extinguishers

- All vehicles operating in the airside shall carry at least one 1kg ABC Dry Powder Extinguisher fitted in an easily accessible location.
- All Airfield Refueling Vehicles shall carry at least two 9kg ABC Dry Powder Extinguishers fitted in easily accessible locations.
- All fire extinguishers shall be checked for correct working pressure, servicing period validity, and overall serviceability.

4 INTRODUCTION TO THE MANOEUVRING AREA

4.1. Aerodrome Chart

The aerodrome chart is a regularly updated map that is published by CAAS AIP and available to the public. This chart contains information about the Changi Aerodrome, and is primarily used by drivers and pilots for navigation and wayfinding. An example is shown below:



The key features shown in the aerodrome chart are: Runways, taxiways, aircraft stands, terminals, and roadways.

A current aerodrome chart must be located in all CAT1 vehicles at all times.

4.2. Giving Way to Aircraft

CAT1 vehicles commonly operate in live taxiways, where aircraft may be present. These aircraft may be taxiing, being pushed back from aircraft stands, or being towed by aircraft tow tugs. Therefore, drivers must always be vigilant and look out for aircraft.

Drivers shall always give way to aircraft by using a combination of safe driving, airfield knowledge, route planning, adaptive manoeuvres and situational awareness. Situational awareness includes visually looking out for aircraft, listening out to radio communications on the RT set, aircraft recognition and knowing which aircraft are allocated to specific

terminals. Additionally, drivers shall only enter taxiways and runways if they have a valid operational reason to do so. Drivers shall keep to primary and perimeter roadways as far as practicable. **Drivers shall not use taxiways as a means of quicker travel**, unless they have a valid operational reason to do so (e.g. responding to an emergency / wildlife dispersal / FOD retrieval / etc.)

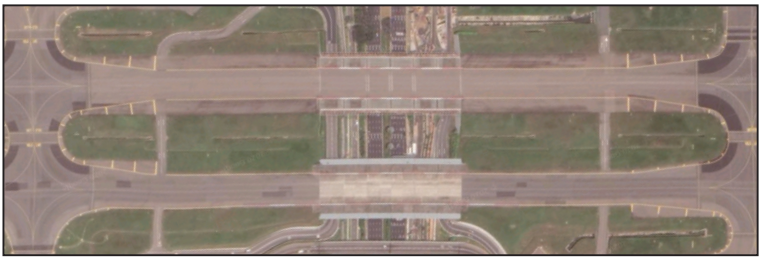
General Principles for Giving Way to Aircraft:

- Look out for aircraft being pushed back by looking out for the presence of safety cones; aircraft anti-collision light; whether tow tug/PLB is connected; and whether ground support equipment have been removed from the aircraft stand.

- After spotting an aircraft that could cross your path, take measures to safely seek shelter in a nearby aircraft stand or alter your course.

4.2.1. Terrain

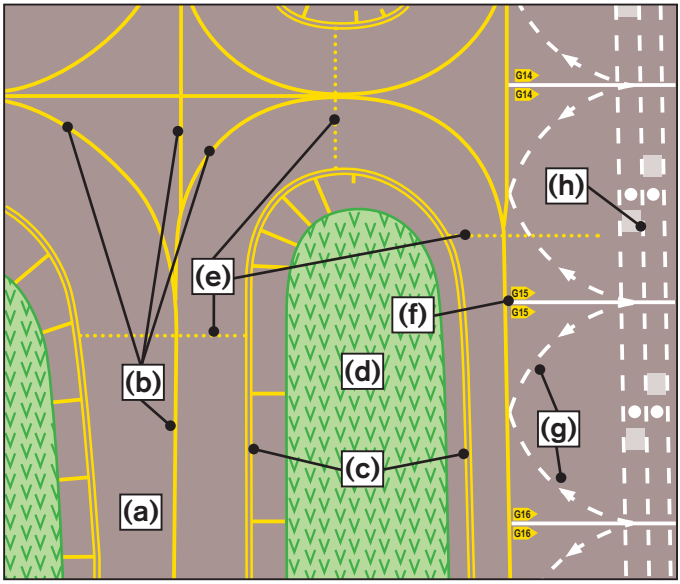
Drivers must be aware of unique terrain features which exist around the airfield, which affects their situational awareness. One example is the south cross-field taxiways between Terminal 3 and Terminal 2. While most of the airfield is flat, which allows drivers to look out over long distances, the south cross-field taxiways are sloped. This means that when a vehicle and aircraft are on opposite ends of the taxiways moving toward each other, drivers may not be able to see the entire body of the aircraft.



4.3. Taxiway Features

The majority of the driving surface in the manoeuvring area is made up of taxiways. Being familiar with taxiway features will enable drivers to navigate more effectively. Taxiways have markings and lights with unique purposes. Taxiway features are explained in the following pages.

4.3.1. Markings



(a) Taxiway

Taxiways are specially constructed pavement that connect the runways to aprons, hangars, terminals, and other airside facilities. They enable aircraft to traverse, or taxi, between these areas. Drivers will drive on taxiways while operating in the manoeuvring area. Taxiways are generally named using an alpha-numeric format, for example, A1 (pronounced 'alpha-one').

(b) Taxiway Centerline

The taxiway centerline is a continuous yellow line that marks the center of a taxiway.

(c) Taxiway Edge Line

The taxiway edge line is a pair of continuous yellow lines that mark the edge of the taxiway. Near turns, 90-degree notches extend from the edge lines toward the taxiway shoulder.

(d) Grass

Grass within the airfield is carefully maintained to minimize the presence of wildlife, which is a hazard to vehicles and aircraft. Drivers shall not drive over grass as doing so will disturb the grass and soil, which may attract wildlife looking for food or a place to rest.

(e) Intermediate Holding Position

The intermediate holding position is a dashed white or yellow line marked across the taxiway, located near taxiway intersections. It is a designated position intended for traffic control at which taxiing aircraft and vehicles shall stop and hold until further cleared to proceed by air traffic control. When instructed to hold short of a taxiway ahead, drivers shall come to a complete stop before this line.

(f) Stand Indicator

The stand indicator points the way to nearby aircraft stands. It has a yellow background with the stand designation marked in black.

(g) Pushback guidance line

The pushback guidance line is a dashed white line that serves as a guide for aircraft tow tractors to push back aircraft.

(h) Secondary Roadway

The secondary roadway runs behind aircraft stands and is meant for vehicles and equipment exceeding the height limit on the primary roadway.

4.3.2. Lights

Lights help pilots and drivers navigate in hours of darkness, and provide visual guidance on the boundaries of taxiways. They are commonly turned on between evening and morning, or during taxiway inspections, where functionality of the lights is checked.

(a) Taxiway Centerline Lights

Taxiway centerline lights are steady green in-pavement lights located along the taxiway centerline.

(b) Taxiway Edge Lights

Taxiway edge lights are steady blue elevated lights (compared to in-pavement centerline lights) and are used to outline the taxiway boundary. Care shall be taken to not drive over and cause damage to these lights.

4.3.3. Signs

Directional signs and mandatory signs are located all around the airfield for wayfinding purposes.

(a) Taxiway Location/Direction Signs (Directional Signs)

Yellow-on-black taxiway **location signs** indicate the taxiway that the driver is currently on. In the above picture, the yellow letters 'W' on the black background means that the driver is currently travelling on taxiway W.

Black-on-yellow taxiway **direction signs** indicate the taxiways that the driver would be on if he or she turns in the direction indicated after passing the sign. In the above picture, the black letters 'W2' on the yellow background means that if the driver turns right after passing the sign, he or she would be travelling on taxiway W2. Similarly, if the driver turns left after passing the sign, he or she would be travelling on taxiway V2.

(b) Mandatory Signs

White-on-red **mandatory signs** are located at runway holding positions (explained in a later section). These signs warn drivers and aircraft that the runway indicated on the sign is ahead; drivers shall exercise caution so as not to inadvertently enter the runway and cause a runway incursion. Drivers shall obtain permission from Singapore Tower to proceed beyond the runway holding position and enter the runway ahead.

The picture above shows a combination of a taxiway location sign and a mandatory sign. The driver is currently on taxiway W3 (yellow 'W3' on black background). The white letters

'02L – 20R' on the red background indicates that this is also a runway holding position, with runway 02L/20R ahead.

4.4. Runway Holding Position

Runway holding positions are designated positions where vehicles must hold and seek clearance from ATC before proceeding into the runway. They are located at all taxiways connected to runways. This is a protective measure to guard against runway incursions. A runway incursion is defined as the incorrect presence of an aircraft, vehicle or person on the runway.

Below shows an aerial view of actual runway holding positions at W10, W9 and W8 (left to right) leading to the 02L approach (notice the '02L' marked on the runway) of runway 02L/20R. The separation between the taxiway side and runway side are clearly demarcated by the horizontal yellow lines across each taxiway:

Runway holding positions have several distinctive features that serve to mitigate the risk of runway incursions:

4.4.1. Enhanced Runway Ahead Markings/Enhanced Taxiway Centreline

The Enhanced Runway Ahead Markings, also known as the Enhanced Taxiway Centreline, are additional dashed yellow lines on each side of the regular solid yellow taxiway centerline. The dashed yellow lines extend for about 50m from the runway holding position. The additional dashed lines provide additional visual indication that drivers are approaching a runway.

4.4.2. Runway Designator Marking

The runway designator marking contains the designation of the runway ahead.

4.4.3. Runway Holding Position Markings

Runway holding position markings contain two solid and two dashed yellow lines across the width of the taxiway. The solid side is closer to the taxiway, while the dashed side is closer to the runway.

Drivers must stop before the solid yellow lines and request permission from ATC to cross them and enter the runway. Crossing the solid yellow lines without obtaining permission from ATC is a runway incursion, which is a serious violation and poses a danger to both aircraft and vehicles.

When vacating the runway (crossing from runway to taxiway side), vehicles are not required to stop before the dashed lines and are not required to obtain permission from ATC. However, after vacating the runway, drivers must still report to ATC that they have vacated.

4.4.4. Microwave Barrier Detector (MBD)

Microwave barrier detectors are located on each side of runway holding positions. These protect the runway by detecting unauthorised crossing of the runway holding position markings (runway incursion). In the event of an unauthorised crossing, an alert is sent to ATC.

4.4.5. Runway Holding Position Lights

Runway holding positions are accompanied by steady red stopbar lights and alternating flashing amber runway guard lights.

(a) Stopbar Lights

Steady red stopbar lights are in-pavement, unidirectional lights that run along the solid side (taxiway side) of the runway holding position markings. Lit red stopbar lights shall not be crossed at all times.

Even if permission is granted by air traffic control to enter the runway, if the red stopbar lights remain on, drivers shall inform ATC and request for the lights to be turned off before proceeding across.

Remember, **NEVER CROSS RED**.

(b) Runway Guard Lights

Runway guard lights are alternating flashing amber lights located at each side of the runway holding position. They provide additional visual indication to drivers that a runway is ahead.

4.5. Entering the Manoeuvring Area

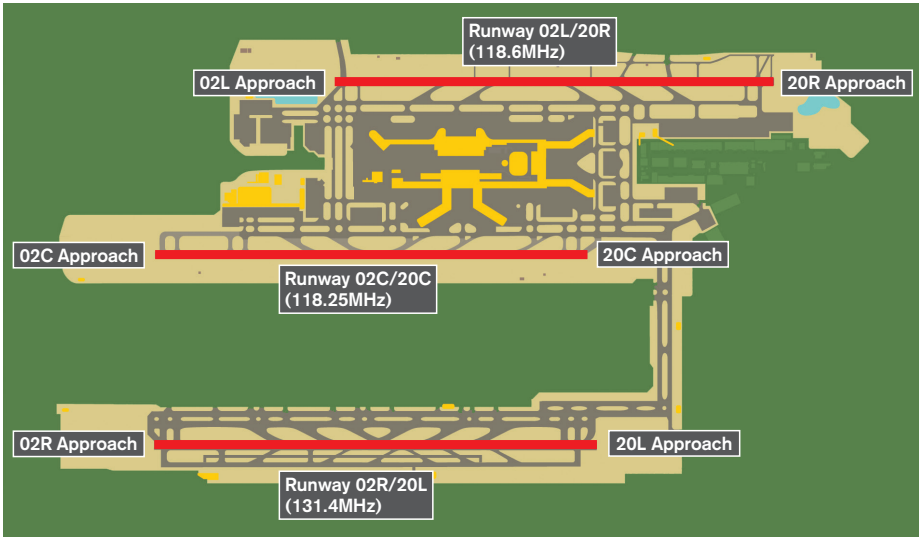
Drivers must follow standard operating procedures and standard radiotelephony phraseology when entering the manoeuvring area. This involves entering the taxiway system from adjacent roadways or aircraft stands. To enter the taxiway system, drivers must contact ATC using

the appropriate apron frequency. Radiotelephony is described in a later section.

Step 1	Position vehicle safely in aircraft stand adjacent to taxiway.
Step 2	On apron frequency, request permission to enter the taxiway from Changi Tower using the correct RT phraseology.
Step 3	Obtain clearance from Changi Tower to enter the taxiway and perform readback.
Step 4	Check for safety and enter the taxiway.

Even after being granted permission by Changi Tower to enter the taxiway, it is the responsibility of the driver to check and ensure that it is safe to do so.

4.6. Runways



Changi Airport has three runways: Runway 02L/20R, Runway 02C/20C, and Runway 02R/20L. These runways are colloquially known as Runway 1, Runway 2, and Runway 3, respectively.

When runways are open/occupied, aircraft movement and vehicular traffic under air traffic control may occur. When runways are closed, aircraft movements are suspended (no take-offs and landings), and vehicles shall enter the runways via Runway Entry Points (REP) using

the appropriate REP procedures. Vehicles commonly enter runways during runway closure for routine maintenance works. When runways are not closed, drivers must possess a valid CAT1R ADP to enter the runway, subject to positive control by ATC.

Except for emergencies, runways must only be entered from designated runway holding positions on the opposite end of the runway in use. This provides drivers with a larger safety distance from aircraft that are landing or taking off. For example, if Runway 20R is being used for take-off or landing, vehicles must enter Runway 02L/20R from the designated runway holding position at the 02L end, i.e. W10. Conversely, if Runway 02L is being used for take-off or landing, vehicles must enter Runway 02L/20R at the 20R end, i.e. W1.

Each runway has a dedicated RT frequency on which CAT1R drivers must seek clearance from ATC before entry:

Runway	Radio Frequency
02L/20R (Runway 1)	118.6MHz
02C/20C (Runway 2)	118.25MHz
02R/20L (Runway 3)	131.4MHz

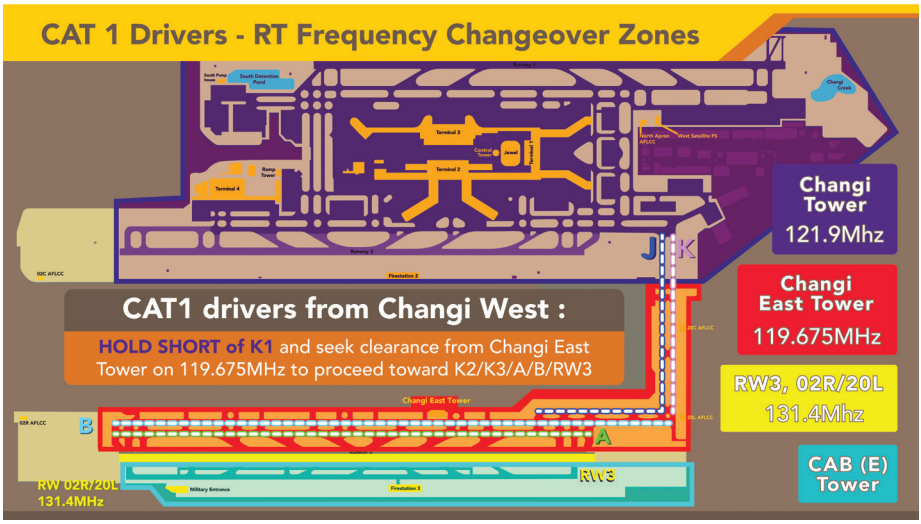
Drivers must follow the correct radiotelephony (RT) procedures and use the correct frequency when entering and operating on runways. Radiotelephony is described in a later section.

4.6.1. Access to Restricted Military Taxiways

Military taxiways adjacent to Runway 1 (M4 to M7) and Runway 3 (MY1 to MY10) are restricted-access only. Drivers required to perform maintenance works or any other works require an airfield permit issued by Changi Air Base (CAB), subject to positive control by CAB via RT communication. Except for military airside users, East Hawk Lane (the service roadway adjacent to Runway 3 which crosses military taxiways MY2 through MY9) usage is strictly restricted to CAT1 ADP holders driving vehicles with CAT1 AVP. Only authorised CAT1 ADP holders who are involved in wildlife, FOD, emergency response and maintenance activities are allowed to access East Hawk Lane.

For more details on the airfield permit, please contact RSAF 208 SQN Ops Centre at 6424 5666.

4.6.2. Access from Changi West to Changi East via North Loop (J & K Taxiways)



Drivers heading to Changi East via North Loop taxiways shall hold short of taxiway K1 and seek clearance from Changi East Tower on 119.675MHz. An example of the associated RT procedures is given in Section 5.

4.6.3. Entering Open/Occupied Runways

The standard operating procedure for entering open/occupied runways for non-emergency purposes (for example, routine runway inspections) is as follows:

Step 1	Proceed to appropriate designated runway holding position and stop before the runway holding position markings. Park facing aircraft take-off/ landing direction.

Step 2	On the appropriate apron frequency, request permission from Changi Tower to enter the runway using the correct RT phraseology. Changi Tower will request for the vehicle to switch to the appropriate runway frequency (depending on which runway is being entered) and wait for Singapore Tower to call.
Step 3	Switch to the appropriate runway frequency and standby for Singapore Tower to call.
Step 4	Obtain clearance from Singapore Tower to enter the runway and perform readback.
Step 5	Ensure that the red stopbar lights along the runway holding position markings are switched off. **NEVER CROSS ILLUMINATED STOPBAR LIGHTS, EVEN IF PERMISSION HAS BEEN GRANTED BY SINGAPORE TOWER TO ENTER THE RUNWAY.**
Step 6	Check for safety and enter the runway.

Even after being granted permission by Singapore Tower to enter the runway, it is the responsibility of the driver to check and ensure that it is safe to do so.

4.6.4. Entering Closed Runways

When the runways are closed, control of the runway is handed over from ATC to CAG. Entry to the respective runways shall be via the designated Runway Entry Points (REP) only. Each runway has one designated REP. Runway Entry Points are designated access roads connecting the perimeter roadways to each runway. Such entry points are recognised by the presence of red and white striped REP huts as shown in the picture below.

Generally, vehicles enter the runway during runway closure to carry out routine maintenance

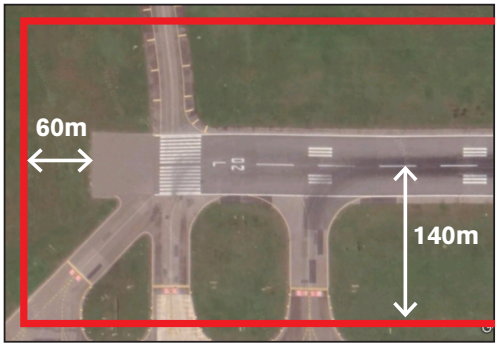
works. Before commencement of such works, all drivers are to be briefed, and boundaries will be set up within the closed runway to prevent drivers from straying off the runway onto the connecting taxiways.

Runway entry via REP is controlled by the REP Duty Officer stationed at the REP hut. Drivers shall adhere to REP procedures (briefed by duty officers or project officers) when entering the runways via REP. All REP are equipped with REP traffic lights. **Drivers shall not enter the runway when the traffic lights are red.**

4.6.5. Runway Features

It is important to be familiar with runway features for wayfinding purposes; drivers will be better prepared to know which part of the runway they are currently driving on if they are able to recognise features which are unique to specific parts of the runway. Additionally, knowledge of runway features allows drivers to identify irregularities, signs of damage, and other hazards, and report them to air traffic control and Airside Management Centre (AMC).

(a) Runway Strip



A defined area, including the runway and stopway if provided, that is intended to reduce the risk of damage to aircraft running off a runway, and to protect aircraft flying over the area during take-off or landing operations.

The runway strip surrounds the entire physical runway and extends 140m from each side of the runway centerline, and 60m from the runway ends.

(b) Stopway

An area beyond the runway which can be used for deceleration of aircraft in the event of a rejected take-off.

(c) Threshold and Displaced Threshold

Runway thresholds are white stripes across the runway that mark the beginning of the landing runway under non-emergency conditions.

Runway 20R has a displaced threshold, which is a threshold located a certain distance after the start of the physical runway. The area leading up to the displaced threshold is marked by white arrows. A displaced threshold is necessary because of the presence of obstacles such as water bodies or buildings in a landing aircraft's approach path.

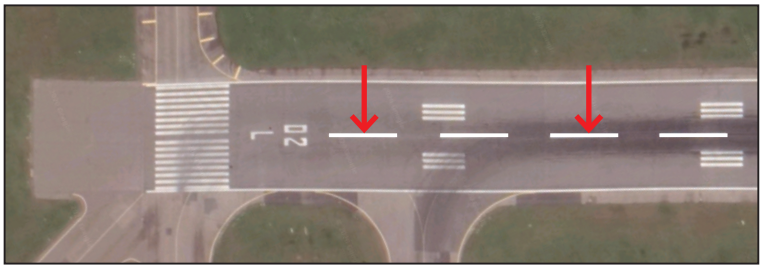
(d) Runway Designator

Runway designators are white markings painted on each end of the runway, indicating the compass heading of the runway centerline.

(e) Fixed Distance Markers and Aiming Point

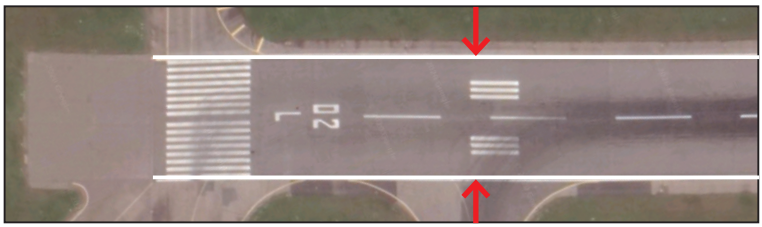
Fixed distance markers are white stripes painted on the left and right of the runway centerline at 150m intervals after the runway threshold. There are two sets of six stripes, followed by the aiming point, then one set of four stripes and finally two sets of two stripes. Together, the distance covered by these markings forms the touchdown zone.

(f) Runway Centerline



The runway centerline is a dashed white stripe along the center of the runway.

(g) Runway Edge Markings



Runway edge markings are continuous white stripes near the edges of the runway pavement.

4.7. Category II Instrument Landing System (ILS) Operations

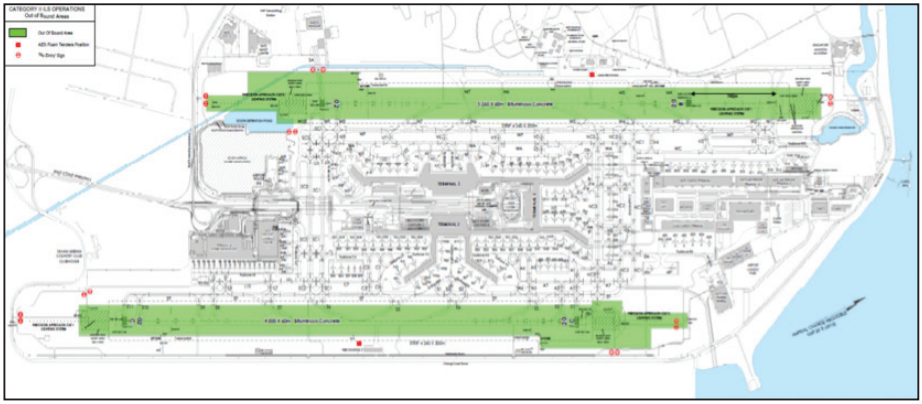
Instrument landing systems (ILS) are a set of navigation equipment installed near the runways. These equipment transmit radio signals containing information on distance, horizontal and vertical alignment to aircraft navigation systems. This enables aircraft to perform instrument landings in low visibility conditions (such as haze).

Changi Tower will declare the commencement/termination of CATII ILS operations when required.

4.7.1. ILS Critical Areas

ILS critical areas are demarcated by poles and rope surrounding ILS equipment. Presence of vehicles in the critical area **will** interfere with ILS signals, thus creating potential issues for aircraft using ILS.

4.7.2. ILS Sensitive Areas



ILS sensitive areas (shaded green above) have a larger footprint compared to ILS critical areas. Presence of vehicles in ILS sensitive areas **may** interfere with ILS signals. Vehicles must stay clear of ILS sensitive areas when CATII ILS operations are in force. Perimeter roads are still safe to travel.

4.8. Vehicle Breakdown in Manoeuvring Area

Vehicles should always be checked for serviceability before proceeding with duties in the manoeuvring area. However, unexpected breakdowns do occur.

Drivers must be aware of the procedures to remove the affected vehicle from the manoeuvring area as soon as possible to minimise impact to aircraft movements.

In the event of vehicle breakdown, drivers shall:

- notify Changi Tower immediately;
- notify Airside Management Centre; and
- contact company maintenance to tow vehicle out immediately.

4.9. Changi Tower Light Gun Signals

In the event of total failure of radio communications, Changi Tower may use light signals to communicate with drivers. The light signals used are as follows:

Colour and Type of Signal	Instruction to Vehicles
Steady Green	Cleared to cross / proceed / go
Steady Red	STOP
Flashing Red	Clear the taxiway / runway
Flashing White 	Return to starting point on airport
Alternating Red and Green 	Exercise extreme caution

4.10. Incident and Near-Miss Reporting

Safety is of the utmost importance when operating in the manoeuvring area.

All incidents (including near-misses; taxiway incursions; runway incursions, and failure to give way to aircraft) shall be **immediately** reported to Airside Management Centre.

5 RADIOTELEPHONY (RT) COMMUNICATIONS

5.1. Introduction to RT Communications

Drivers and ATC communicate using radio-telephony sets. All CAT1 vehicles must be equipped with Very High Frequency (VHF) radios to allow two-way communication between vehicles and ATC. Such communication must be clear, concise, unambiguous, and be constructed using a combination of standard RT phraseology and standard English.

RT phraseology is internationally standardized by the International Civil Aviation Organisation (ICAO) through Annex 10 – Aeronautical Telecommunications. This facilitates a common 'language' used by vehicles, air traffic controllers and pilots so that all parties have a common understanding of what is occurring.

All communications must use the 24-hr time format (for example, 1pm is denoted by 1300H).

Being competent in RT communications minimises the risk of miscommunication, misunderstanding of instructions, and incorrect relaying of information when operating in the manoeuvring area.

RT Communications generally use a standard format:

- Callsign of message recipient
- Your callsign
- Message or request

An example is as follows:

"Changi Tower, Rover One, request to enter taxiway C6 for maintenance works."

It is the responsibility of the driver, who has been trained during the course of obtaining the CAT1/CAT1R ADP, to ensure communication over the radio-telephony channel is clear and precise. Thus, only the driver, ie. **CAT1/CAT1R ADP holder, is allowed to operate the radio-telephony set** and communicate with Changi Tower for all matters relating to driving on the manoeuvring area. Any exception to this rule shall only be allowed if authorisation has been granted by CAG ADVL.

5.2. Phonetic Alphabet

5.2.1. Pronunciation of Letters

Letter	Word	Pronunciation
A	ALPHA	AL FAH
B	BRAVO	BRAH VOH
C	CHARLIE	CHAR LEE
D	DELTA	DELL TAH
E	ECHO	ECK OH
F	FOXTROT	FOKS TROT
G	GOLF	GOLF
H	HOTEL	HOH TELL
I	INDIA	IN DEE AH
J	JULIET	JEW LEE ETT
K	KILO	KEY LOH
L	LIMA	LEE MAH
M	MIKE	MIKE
N	NOVEMBER	NO VEM BER
O	OSCAR	OSS CAR
P	PAPA	PAH PAH
Q	QUEBEC	KEY BECK
R	ROMEO	ROW ME OH
S	SIERRA	SEE AIR RAH
T	TANGO	TANG GO
U	UNIFORM	YOU NEE FORM
V	VICTOR	VIK TAH
W	WHISKEY	WISS KEY
X	XRAY	ECKS RAY
Y	YANKEE	YANG KEY
Z	ZULU	ZOO LOO

5.2.2. Pronunciation of Numbers/Digits

Number	Pronunciation	Number	Pronunciation
0	ZEE-RO	5	FIFE
1	WUN	6	SIX
2	TOO	7	SEV-EN
3	TREE	8	AIT
4	FOW-ER	9	NIN-ER
. (DECIMAL)	DAY-SEE-MAL		

During RT communication, all digits shall be pronounced **separately**. For example, '34' is pronounced 'TREE-FOWER' and not 'THIRTY-FOWER'; and '10' is pronounced 'WUN-ZERO' and not 'TEN'. The decimal symbol '.' is also pronounced separately; '121.9' is pronounced 'WUN-TOO-WUN DAY-SEE-MAL NIN-ER', not 'WUN-TOO-WUN-POINT-NIN-ER'.

5.2.3. Standard Phraseology

Below is a list of standard words to be used during RT communications. To ensure uniform understanding of instructions by all parties, drivers shall not deviate from the standard phraseology where required, while the remainder of the message may be crafted freely using clear and concise language.

Word/Phrase	Meaning/Description
ACKNOWLEDGE	Let me know that you have received and understood the message.
AFFIRM	Yes.
APPROVED	Permission for requested action is granted.
CANCEL	Withdraw the previously transmitted clearance.
CONTACT	Establish radio contact with XXX.

Word/Phrase	Meaning/Description
CORRECTION	An error has been made in this transmission. The correct version is XXX.
ENTER	Permission granted to enter taxiway XXX / runway XXX.
GIVE WAY	Allow the mentioned aircraft to pass by.
HOLD SHORT	Stop at the point mentioned and do not enter the area ahead.
HOW DO YOU READ	What is the readability of my transmission?
MONITOR	Listen out on the frequency mentioned.
NEGATIVE	No / Permission not granted / That is not correct.
PROCEED	Clear to go to XXX (usually taxiway or holding point).
READ BACK	Repeat all, or the specified part, of this message back to me exactly as received.
REQUEST	I wish to know / obtain.
REPORT	Give me the mentioned information.
SAY AGAIN	Repeat all, or part, of your last transmission.
STANDBY	Wait and I will contact you. (Note: The word 'Standby' does not mean 'prepare' or 'be ready'.)
VACATE	Leave the manoeuvring area.

To ensure that RT communications are clear, drivers shall not use non-standard words during RT communication. Some examples are listed below:

- Copy
- Over
- Over and Out

5.3. Radio Set

Before setting off for the manoeuvring area, drivers shall ensure the following:

- RT set(s) switched on and in working order;
- volume set to optimum level, radio can be heard over background noise;
- no interference during transmission;
- set to correct frequency; and
- conduct radio check with Changi Apron (121.9MHz) before setting off.

Depending on the vehicle configuration, some vehicles may carry one RT set serving all frequencies, while others may carry an additional RT set serving only runway frequencies.

For runway frequencies, radio checks are not performed. However, drivers may tune to the appropriate runway frequencies and listen to transmissions to determine whether the RT set is in working order.

It is essential that the volume levels are set appropriately so that drivers can keep a listening watch on the respective frequencies for situational awareness.

5.3.1. Radio Frequencies

The following radio frequencies and corresponding callsigns (think of callsigns as names) are used in Changi Aerodrome:

Frequency	Callsign
121.9MHz	Changi Tower / Changi Apron
119.675MHz	Changi East Tower
118.6MHz	Singapore Tower (Runway frequency for runway 02L/20R)
118.25MHz	Singapore Tower (Runway frequency for runway 02C/20C)
131.4MHz	Singapore Tower (Runway frequency for runway 02R/20L)

Drivers shall ensure that the RT set(s) in the vehicle are switched on and tuned to the appropriate frequencies for his/her scope of work.

5.3.2. Radio Check

The standard procedure for a radio check using standard phraseology is illustrated below:

Remarks/Scenario	Changi Apron	Rover One
Rover One initiates contact with Changi Apron for radio check.		Changi Apron, Rover One.
	Rover One, Changi Apron.	
Rover One performs radio check for 121.9.		Changi Apron, Rover One. Radio check, 121.9.
Changi Apron responds with readability level.	Rover One, read you strength five.	

Remarks/Scenario	Changi Apron	Rover One
Rover One responds with readability level.		Changi Apron, read you strength five.

Transmission Readability:

Strength 1 (One) – Unreadable
Strength 2 (Two) – Readable now and then
Strength 3 (Three) – Readable, but with difficulty
Strength 4 (Four) – Readable
Strength 5 (Five) – Perfectly readable

Minimum of Strength 4 (Four) is required to operate in the manoeuvring area.

If readability level is 3 or below, perform another radio check with Changi Apron. If readability level remains at 3 or below, **do not use vehicle** and send RT set for servicing.

5.3.3. RT Example: Entry into Taxiway

Below is a sample RT scenario for maintenance vehicle Rover One, which needs to perform maintenance works at taxiway C2. Standard RT phraseology are indicated in **bold**.

Remarks/Scenario	Changi Tower	Rover One
Rover One initiates contact with Changi Tower to request permission to enter taxiway.		Changi Tower, Rover One.
	Rover One, Changi Tower.	
		Changi Tower, Rover One holding at Bay F50. **Request to proceed** to taxiway C2 for maintenance, duration 10 minutes.
Changi Tower grants permission to proceed to C2 via C6.	Rover One, **Proceed** to taxiway C2 via C6.	
Rover One is unsure of instruction given by Changi Tower, requests for confirmation from Changi Tower.		Changi Tower, Rover One. Please **confirm proceed** to taxiway C2 via C6.
Changi Tower confirms instruction.	**Affirm**, Rover One.	

Remarks/Scenario	Changi Tower	Rover One
Rover One does not hear Changi Tower's instruction, perhaps due to radio clipping, or requires a repeat of instructions.		Changi Tower, Rover One. **Say Again**.
	Rover One, **proceed** to taxiway C2 via C6.	
Rover One performs readback of instruction.		Changi Tower, Rover One **proceeding** to taxiway C2 via C3.
Changi Tower corrects an incorrect readback by Rover One.	Rover One, Changi Tower. **Negative**. Proceed to taxiway C2 via C6. **Acknowledge**.	
		Changi Tower, Rover One. **Affirm**. **Proceeding** to taxiway C2 via C6.
Changi Tower is not required to acknowledge a correct readback.		
After maintenance works are completed, Rover One returns to F50. Upon crossing over from taxiway C6 to F50, Rover One reports to Changi Tower that it has vacated the manoeuvring area.		Changi Tower, Rover One **vacated** taxiway C6 at F50.

5.3.4. RT Example: Entry into Runway and Vacating the Runway

Below is a sample RT scenario for maintenance vehicle Rover One, which needs to perform a runway inspection on runway 02L/20R. Currently runway 20R is in use. Key words used in Standard RT phraseology are indicated in **bold**.

Remarks/ Scenario	Changi Tower/ Singapore Tower (121.9MHz/ 118.6MHz)	Rover One
		Changi Tower, Rover One.
	Rover One, Changi Tower.	
		Changi Tower, Rover One holding at holding point W10. **Request to enter** runway 02L for runway inspection.
	Rover One, **monitor** Singapore Tower on 118.6.	
		Changi Tower, Rover One, **monitor** Singapore Tower on 118.6.
	Rover One, Singapore Tower. **Enter** runway 02L via W10.	
		Singapore Tower, Rover One. **Entering** runway 02L via W10.

Remarks/ Scenario	Changi Tower/ Singapore Tower (121.9MHz/ 118.6MHz)	Rover One
Rover One confirms that the red stopbar lights are switched off before proceeding into runway 02L.		
After inspection is completed, Rover One vacates (exits) runway 02L via taxiway W8. (Note: Vehicle must report vacated AFTER vacating the runway; not while it is still in the process of doing so. This helps eliminate uncertainty as to whether the vehicle is still on the runway or not.)		Singapore Tower, Rover One **vacated** runway 02L via W8.
As Rover One has vacated the runway, it must now monitor 121.9MHz.	Rover One, switch to 121.9 and listen out.	
		Singapore Tower, switching to 121.9, will listen out.

5.3.5. RT Example: Proceeding to Changi East (Runway 3 Area) via North Loop (J & K Taxiways)

Below is a sample RT scenario for maintenance vehicle Rover One, which needs to perform a runway inspection on runway 02R/20L. Currently runway 02R is in use. Standard RT phraseology are indicated in **bold**.

Remarks/ Scenario	Changi Tower/ Changi East Tower/ Singapore Tower (121.9MHz/ 119.675MHz/ 131.4MHz)	Rover One
Rover One driving east on taxiway K.		
Rover One holds short of taxiway K1 and switches radio frequency from 121.9MHz to 119.675MHz.		
		Changi East Tower, Rover One.
	Rover One, Changi East Tower.	
		Changi East Tower, Rover One holding at K1. Request to proceed to A1 for runway inspection.
	Rover One, proceed to A1.	
		Changi East Tower, Rover One, proceeding to A1.

Remarks/ Scenario	Changi Tower/ Changi East Tower/ Singapore Tower (121.9MHz/ 119.675MHz/ 131.4MHz)	Rover One
Rover One arrives at runway holding position A1.		
		Changi East Tower, Rover One.
	Rover One, Changi East Tower.	
		Changi East Tower, Rover One holding at holding point A1. Request to enter runway 20L for runway inspection.
	Rover One, **monitor** Singapore Tower on 131.4.	
		Changi Tower, Rover One, **monitor** Singapore Tower on 131.4.
Rover One switches frequency from 119.675MHz to 131.4MHz.		
	Rover One, Singapore Tower. **Enter** runway 20L via A1.	
		Singapore Tower, Rover One. **Entering** runway 20L via A1.

Remarks/ Scenario	Changi Tower/ Changi East Tower/ Singapore Tower (121.9MHz/ 119.675MHz/ 131.4MHz)	Rover One
Rover One confirms that the red stopbar lights are switched off before proceeding into runway 20L.		
After inspection is completed, Rover One vacates (exits) runway 20L via taxiway A4. (Note: Vehicle must report vacated AFTER vacating the runway; not while it is still in the process of doing so. This helps eliminate uncertainty as to whether the vehicle is still on the runway or not.)		Singapore Tower, Rover One **vacated** runway 20L via A4.
As Rover One has vacated the runway, it must now monitor 119.675MHz.	Rover One, switch to 119.675 and listen out.	
		Singapore Tower, switching to 119.675, will listen out.

5.3.6. Radio Failure

In the event of radio failure while operating in the manoeuvring area, the following SOP shall be adopted:

1. proceed as last instructed;
2. vacate the manoeuvring area as soon and as safely as possible; and
3. use another vehicle's RT set to contact Changi Tower or establish contact via mobile phone.

5.4. RT Do's and Don'ts

DO	DON'T
Listen out before transmitting.	Interrupt another transmission taking place.
Formulate a clear, concise message containing all necessary information. The 4 'W's' is a good guide. • Who are you calling? • Who are you? • Where are you? • Where are you going?	• Use poor pronunciation. • Use non-standard phraseology. • Speak too fast or too softly. • Formulate a message that is too long. • Say something that is not true.
Adopt a uniform distance between your mouth and the microphone.	• Blow into the microphone. • Flick the transmit switch. • Turn your head away from the microphone while talking.
Provide a full readback.	Assume an instruction that you are unclear of.

6 ESCORTING VEHICLES IN MANOEUVRING AREA

6.1. Objectives

Robust maintenance of the manoeuvring area is required to facilitate smooth airport operations. This includes maintenance and repair works for taxiway and runway lights, markings, and pavement, which may be carried out using vehicles without a valid CAT1 AVP, or by drivers who do not possess a valid CAT1/CAT1R ADP.

Therefore, these vehicles must be escorted by drivers with valid CAT1/CAT1R ADP in a separate vehicle with a valid CAT1 AVP. Only escort drivers briefed and endorsed by CAG Airside Driving Centre (ADC) may perform escort duties. CAT1 ADP holders are allowed to escort vehicles in taxiways. CAT1R ADP holders are allowed to escort vehicles in taxiways and live runways.

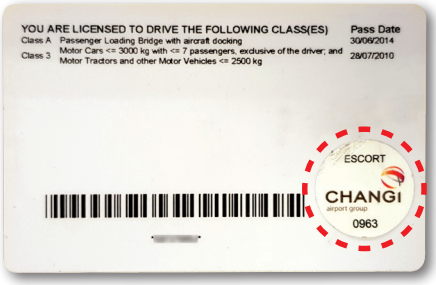
6.2. Requirements for CAT1 Escort Drivers

Briefings are conducted in English only. Attendees must sign up personally at the ADC with a valid CAT1/CAT1R ADP at least 15 minutes before commencement of the briefing.

To be able to perform escort duties, drivers shall:

- possess a valid CAT1/CAT1R ADP;
- successfully complete escort briefing by CAG ADC;
- be endorsed by CAG ADC; and
- vehicles of CAT1 escort drivers shall possess valid CAT1 AVP.

Upon endorsement by CAG ADC, drivers will have their CAT1/CAT1R ADP marked with a serialised 'Escort' sticker. This sticker shall be shown on demand by an authorised person.



6.2.1. Validity of Escort Certification

Validity of the escort endorsement is concurrent with the ADP. Upon renewal of the CAT1/CAT1R ADP, drivers shall re-attend the escort briefing to obtain escort re-endorsement.

6.3. General Roles & Responsibilities of CAT1 Escort Drivers/Drivers Under CAT1 Escort

Drivers are responsible for the following:

Escort Lead CAT1 Drivers	Drivers Being Escorted
Have a clear understanding of purpose of escort and number of vehicles being escorted. Inform ATC the purpose of escort and number of vehicles being escorted to seek clearance into the manoeuvring areas.	Never drive in the manoeuvring area without an Escort Lead CAT1/CAT1R Driver.
Brief the escorted drivers on: • route; • objective of task; • escort Procedures; • means of communication; • airside Rules and regulations; and • contingency procedures.	Comply with airside rules and regulations as briefed by the Escort Lead CAT1/CAT1R Driver.
Have mobile telephone number(s) of all escorted driver(s) prior to commencement of escort. Listen out on appropriate radio frequencies at all times. Be contactable at all times throughout duration of escort.	Have mobile number of Escort Lead CAT1/CAT1R Driver prior to commencement of escort. Perform a test call to ensure that communication can be established.

Escort Lead CAT1 Drivers	Drivers Being Escorted
Be in a separate vehicle with valid CAT1 AVP.	
Be responsible and liable for safe operations of the driver(s) and vehicle(s) under escort.	Do not overtake, drive ahead of Escort Lead Driver, or break away from convoy.
Each escort driver shall escort a maximum of two (2) vehicles at any time.	
Stay close to the escort convoy and observe operations closely.	Stay close to Escort Lead Driver at all times.
Should any escorted driver break away from the convoy, escort driver shall: • steer any remaining vehicle in the convoy to a designated approved holding/parking area; • contact the break-away driver immediately; and • report incident to Changi Tower and Airside Management Centre (6541 2275) by any means of communication.	In the event the driver breaks away from the convoy, flash vehicle headlights and sound vehicle horn to alert Escort Lead CAT1/CAT1R Driver.

6.4. Escorting Vehicles in the Manoeuvring Area

All escort vehicles shall possess a valid CAT1 AVP and be driven by a driver with a valid CAT1/CAT1R ADP with the serialised 'Escort' sticker. **Each** escort vehicle may escort **up to 2** vehicles with valid TEP or AVP, for example:

Number of Escort Vehicles (with CAT1 AVP)	Maximum Number of Escorted Vehicles (with TEP or AVP)
1	2

Vehicles without valid CAT1 AVP shall not be driven as lead escort, even if the driver possesses a valid CAT1/CAT1R ADP with serialised 'Escort' sticker.

7 COMMON COMMERCIAL AIRCRAFT

Narrow Body:

1. Airbus A319

2. Airbus A320

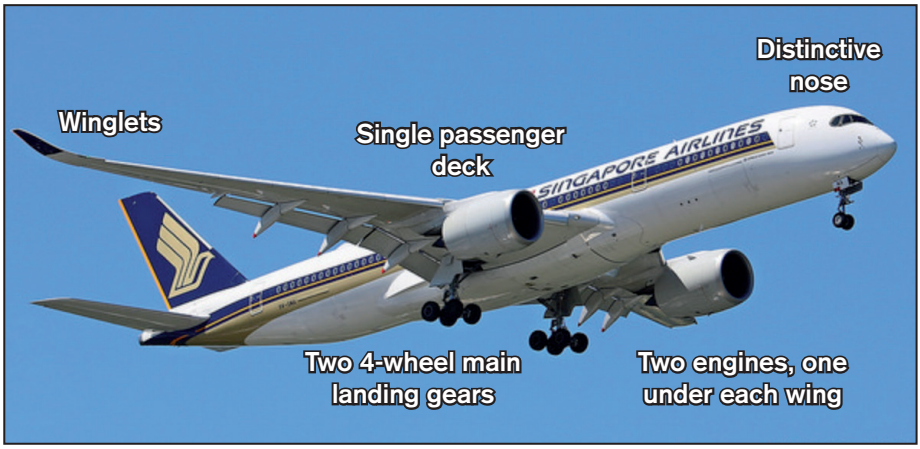
3. Boeing B737

4. ATR 72-500

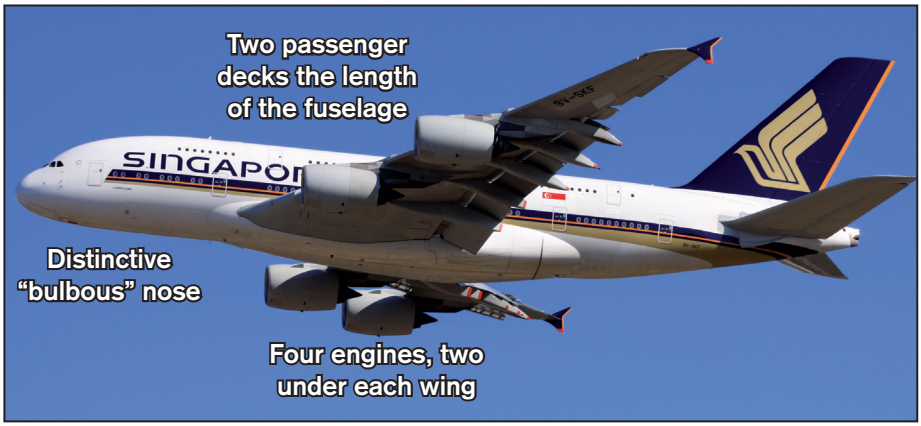
Wide Body:

1. Airbus A330

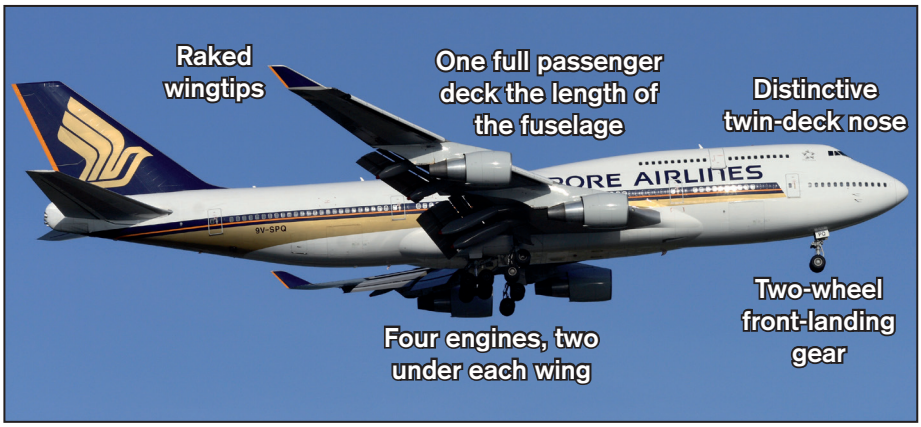
2. Airbus A350



3. Airbus A380



4. Boeing B747



5. Boeing B777

6. Boeing B787

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