Physical Characteristics

Physical Characteristics

This course will focus on:

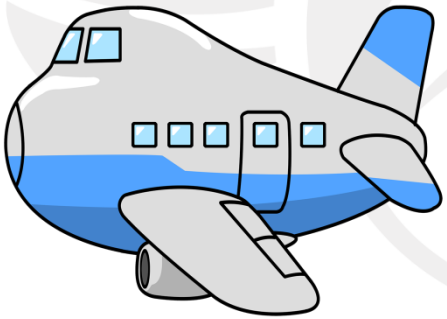
- Aerodrome Reference Codes
- Runway
- Runway Strip
- Clear and Graded Area
- Runway End Safety Area
- Stopway
- Clearway
- Taxiway
- Apron

Physical Characteristics

Aerodrome Reference Code

CAR Part IX (Appendix 7) defines how the Aerodrome Reference Code (ARC) is calculated.

An aerodrome reference code — code **number** and **letter** — which is selected for aerodrome planning purposes determined in accordance with the characteristics of the aeroplane for which an aerodrome facility is intended.



Physical Characteristics

Aerodrome Reference Code (ARC)

CAR PART IX, APPENDIX 7

Table App 7-1

Aerodrome Reference Code

Code element 1			Code element 2	
Code number (1)	Aeroplane reference field length (2)	Code letter (3)	Wingspan (4)	Outer main gear wheel span[a] (5)
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1 200 m	B	15 m up to but not including 24 m	4.5 m up to but not including 6 m
3	1 200 m up to but not including 1 800 m	C	24 m up to but not including 36 m	6 m up to but not including 9 m
4	1 800 m and over	D	36 m up to but not including 52 m	9 m up to but not including 14 m
		E	52 m up to but not including 65 m	9 m up to but not including 14 m
		F	65 m up to but not including 80 m	14 m up to but not including 16 m

[a] *Distance* between *the outside edges of the main gear wheels.*

Note: Guidance on planning for aeroplanes with wingspans greater than 80 m is given in the ICAO Aerodrome Design Manual (Doc 9157), Parts 1 and 2.

Physical Characteristics

Aerodrome Reference Code (examples)

A/C Type	ARFL	WS	OMGWS	ARC
B777-200	2,500 m	60.9 m	12.8 m	4E

Physical Characteristics

Aerodrome Reference Code (examples)

A/C Type	ARFL	WS	OMGWS	ARC
EMB-145	1,500 m	20 m	4.8 m	

Physical Characteristics

Aerodrome Reference Code (examples)

A/C Type	ARFL	WS	OMGWS	ARC
A320-200	2,058 m	33.9 m	8.7 m	

Physical Characteristics

Aerodrome Reference Code (examples)

Aerodrome Reference Code	Aircraft	Cargo Aircraft
Code 4F	Airbus 380 B747-800	Antonov 124
Code 4E	B747-400 A330/340 B777	Same aircraft converted for cargo
Code 4D	B767 MD 11 B707	Same aircraft converted for cargo
Code 4C	B737 A319/320 DC9-80/MD80	Same aircraft converted for cargo
Code 2B	Beechcraft 1900 Embraer 110	Same aircraft converted for cargo
Code 1A	Cessna 172 Beechcraft 100	

Physical Characteristics

Runways

Courchevel Airport - France

Gustaf III Airport – St. Barthelemy

Gibraltar International Airport

Madiera Airport - Portugal

Physical Characteristics

Runway CAR IX Definition

Runway. A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

Physical Characteristics

THREE TYPES OF RUNWAY

1. **NON-INSTRUMENT RUNWAY.** A runway intended for the operation of aircraft using visual approach procedures.
2. **NON-PRECISION APPROACH RUNWAY.** An instrument runway served by visual aids and a non visual aid providing at least directional guidance adequate for straight-in approach.

3. **PRECISION APPROACH RUNWAY.** An instrument runway served by ILS and/or MLS and visual aids intended for operations:

- **CATEGORY I**

  Decision Height (DH) not lower than 60m (200ft).
  Visibility not less than 800m.
  RVR not less than 550m.

Physical Characteristics

THREE TYPES OF RUNWAY

- **CATEGORY II**

  DH lower than 60m (200ft) but not lower than 30m (100ft)
  RVR not less than 300m.

- **CATEGORY III**

  - **CAT III A –** DH lower than 30m (100ft), or no DH.
    RVR not less than 200m.

  - **CAT III B –** DH lower than 15m (50ft), or no DH.
    RVR less than 200m but not less than 50m.

  - **CAT III C –** no DH and no RVR limitations.

Physical Characteristics

Width of Runways

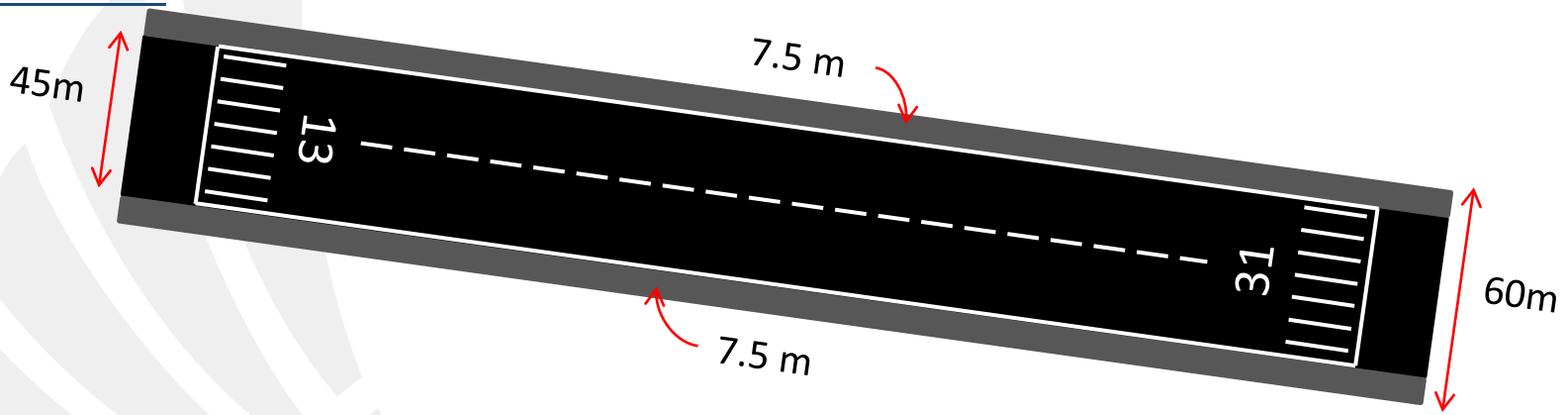
	Code Letter					
Code Number	**A**	**B**	**C**	**D** *	**E** *	**F** *
1	18m	18m	23m	---	---	---
2	23m	23m	30m	---	---	---
3	30m	30m	30m	45m	---	---
4	---	---	45m	45m	45m	60m

* *shall be provided with runway shoulders.*

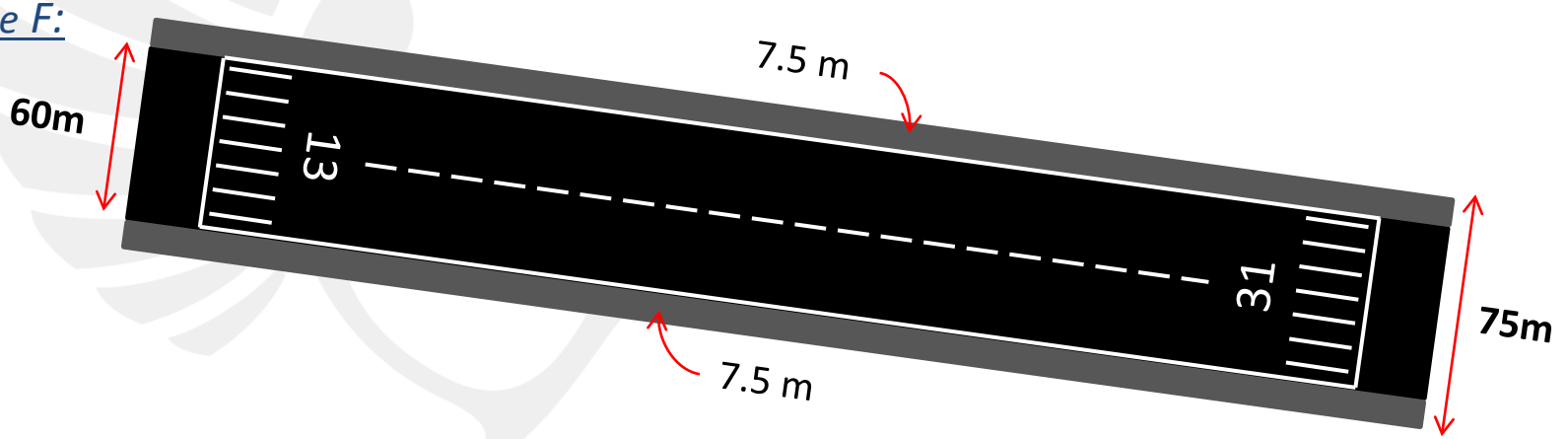
Physical Characteristics

Runway Shoulders

Code D and E:



Code F:



Physical Characteristics

Runway Strip CAR IX Definition

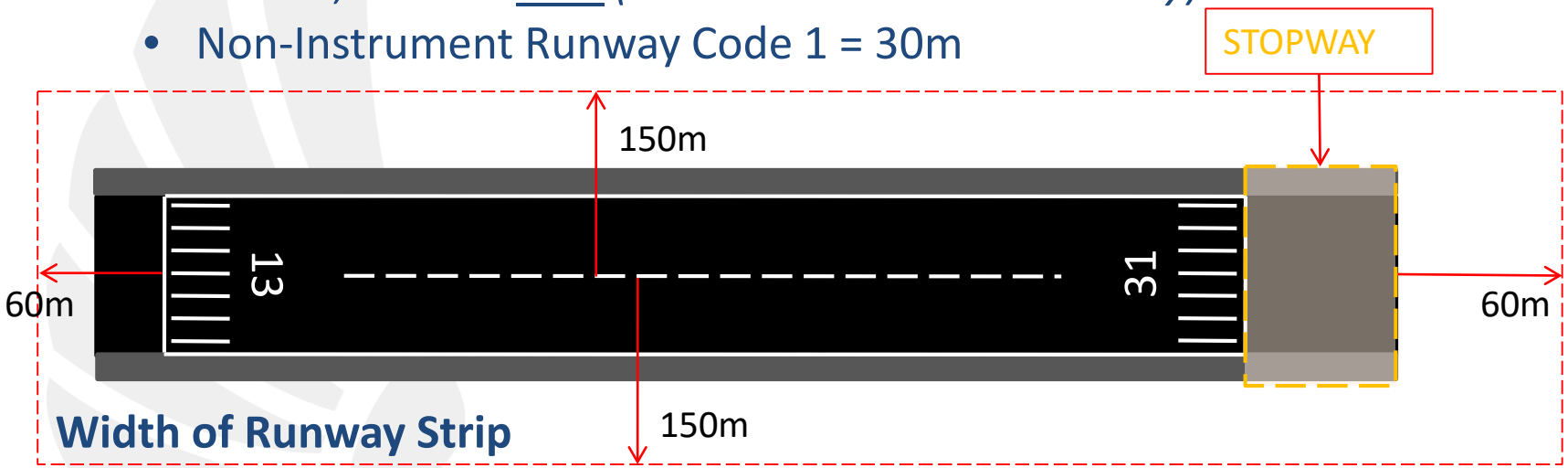
Runway Strip. A defined area including the runway and stopway, if provided, intended:

a) To reduce the risk of damage to aircraft running off a runway.
b) To protect aircraft flying over it during take off or landing operations.

Physical Characteristics

Length of Runway Strip

- Code 2, 3 or 4 = 60m *(Code 1 - Instrument Runway)*
- Non-Instrument Runway Code 1 = 30m



Width of Runway Strip

- Precision Approach and Non-Precision Approach Runway
  - Code 3 or 4 = 150m; Code 1 or 2 = 75m
- Non-Instrument Runway
  - Code 3 or 4 = 75m; Code 2 = 40m; Code 1 = 30m

Physical Characteristics

Clear and Graded Area CAR IX Definition

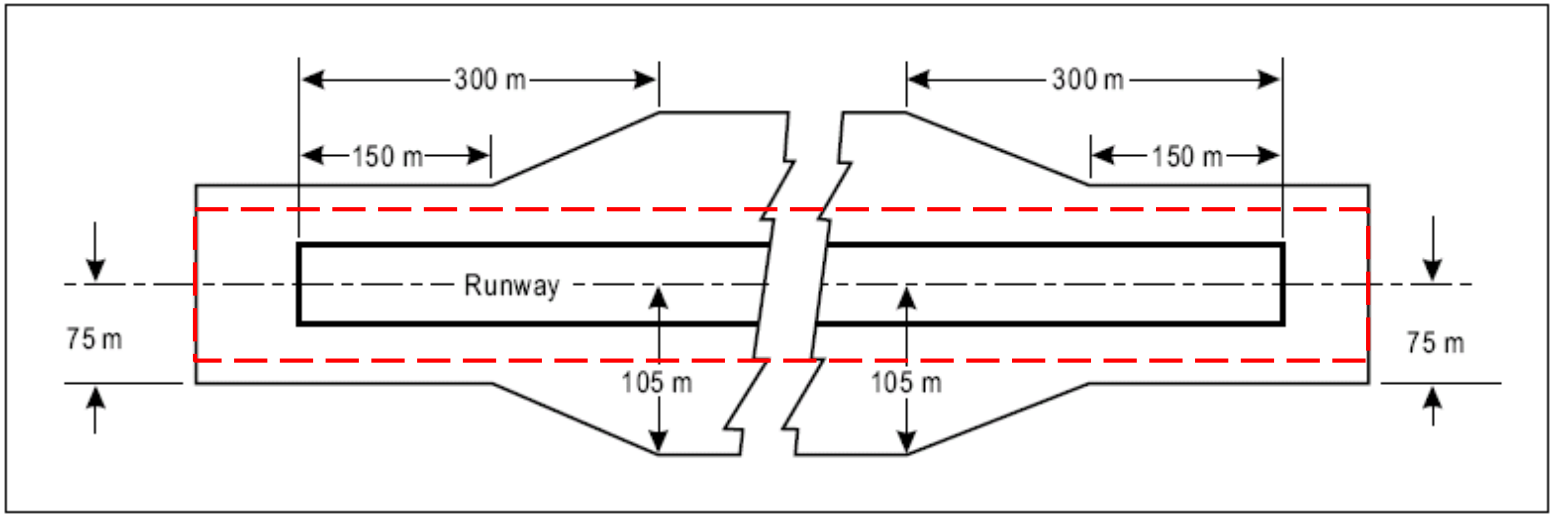
Cleared and Graded Area. That part of the Runway Strip cleared of all obstacles except for minor specified items and graded, intended to reduce the risk of damage to an aircraft running off the runway.

Delethalisation. Below ground ramping to buried vertical face of construction designed to reduce risk of damage to aircraft running on cleared and graded area of strip.

Physical Characteristics

Clear and Graded Area

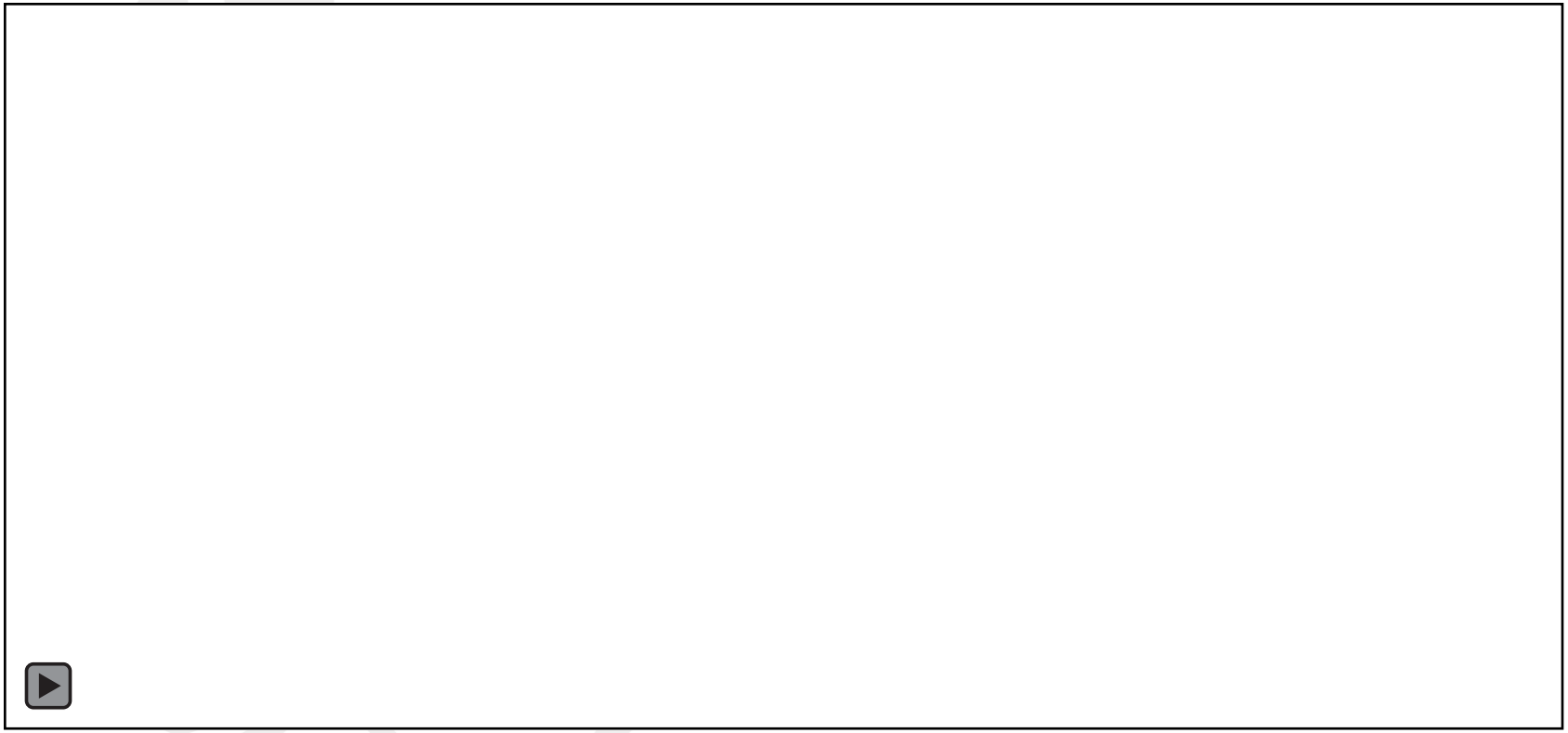
Precision Approach Runway Code 3 or 4 = 105m



- *Instrument Runway*
  - *Code 1 or 2 = 40m*
- *Non-Instrument Runway*
  - *Code 3 or 4 = 75m*
  - *Code 2 = 40m*
  - *Code 1 = 30m*

Physical Characteristics

Gustaf III Airport – Saint Barthelemy



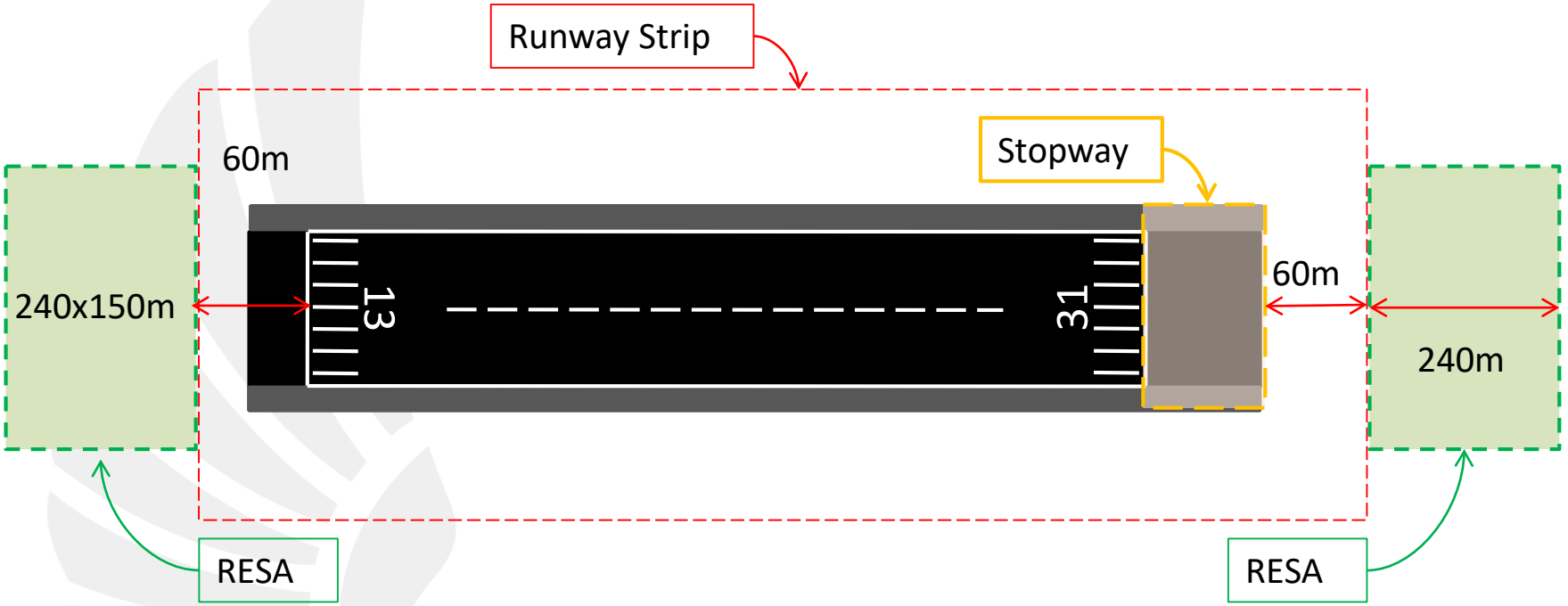
Physical Characteristics

Runway End Safety Area (RESA) CAR IX Definition

Runway End Safety Area (RESA). An area symmetrical about the extended runway center line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway.

Physical Characteristics

Runway End Safety Area (RESA) CAR IX



RESA shall extend from the end of the runway strip to a distance of at least:

i. 240m Code 3 or 4;

ii. 120m Code 1 or 2.

Physical Characteristics

Runway End Safety Area (RESA)

Runway End Safety Areas (RESA) are a formal means to limit the consequences when aeroplanes overrun the end of a runway during a landing or a rejected take off, or undershoot the intended landing runway.

They are constructed to provide a cleared and graded area which is, as far as practicable, clear of all but frangible objects. It should have a surface which will enhance the deceleration of aircraft in the overrun case but should not be such as to hinder the movement of rescue and fire fighting vehicles or any other aspect of emergency response activity.

Physical Characteristics

Engineered Materials Arresting System (EMAS)

An EMAS uses a specially installed surface which quickly stops any aircraft that moves on it and is installed at the end of runways to reduce the extent, and associated risks, of any overrun off the end of a runway compared to the equivalent soft ground distance.

ICAO Position? There are currently no ICAO SARPs for EMAS.

Source: www.skybrary.aero 08 Feb 2015

FAA standards includes the planning, design and maintenance of EMAS.

Physical Characteristics

How many overruns/overshoots worldwide

Minor aircraft runway overruns and undershoots are a relatively frequent occurrence. Most data sources point to significant occurrences on average _____ and suggest that runway excursions overall are the **fourth** largest cause of airline fatalities.

once a week worldwide

www.skybrary.aero

It has been stated by the FAA Airport Design Division that approximately 90% of runway undershoot or overruns are contained within 300 metres of the runway end. The contribution which RESAs can make to a reduction in the consequences of such over-runs has frequently been demonstrated as has the avoidable hazardous outcomes where they have not been present.

Physical Characteristics

DECLARED DISTANCES	
TAKE OFF RUN AVAILABLE (TORA)	The length of runway declared and suitable ground run of an aircraft taking off.
TAKE OFF DISTANCE AVAILABLE (TODA)	The length of TORA + Clearway (if provided)
ACCELERATE STOP DISTANCE AVAILABLE (ASDA)	The length of TORA + Stopway (if provided)
LANDING DISTANCE AVAILABLE (LDA)	The length of runway which is declared available and suitable for ground run of an aircraft for landing.

Physical Characteristics

Declared Distances

Clearway. A defined rectangular area on the ground or water selected or prepared as a suitable area over which an aircraft may make a portion of its initial climb to a specified height.

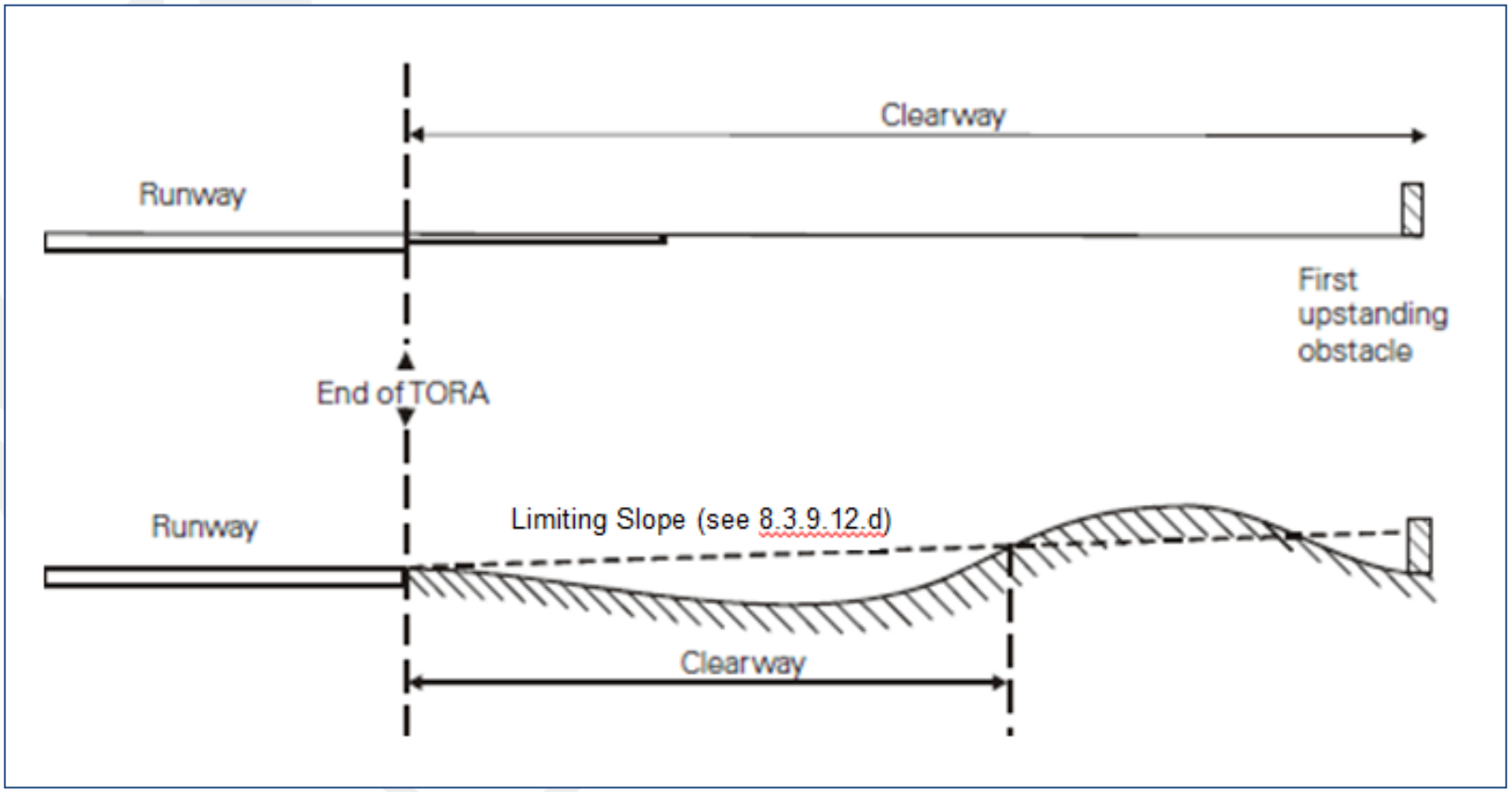
a. **Location of Clearways -** at the end of the TORA.

b. **Length of Clearways -** shall not exceed half the length of the TORA.

c. **Width of Clearways -** shall extend laterally to a distance of at least 75 m on each side of the extended centre line of the runway.

Physical Characteristics

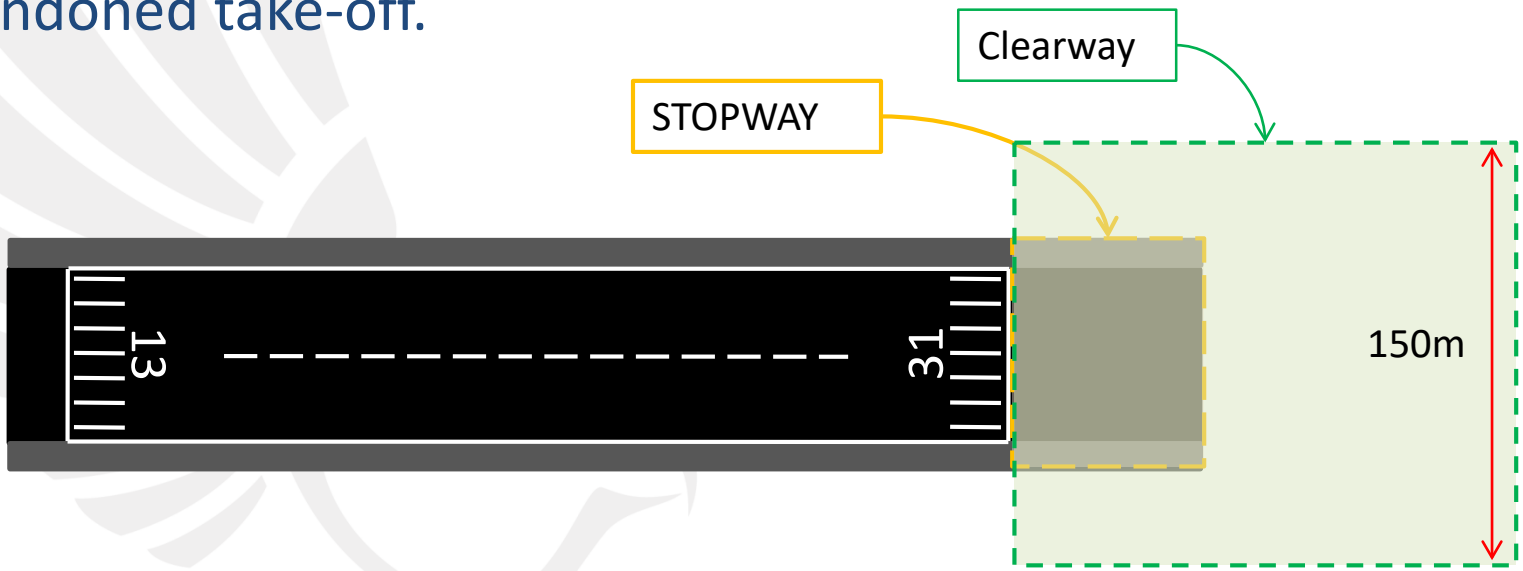
Declared Distances - Clearway



Physical Characteristics

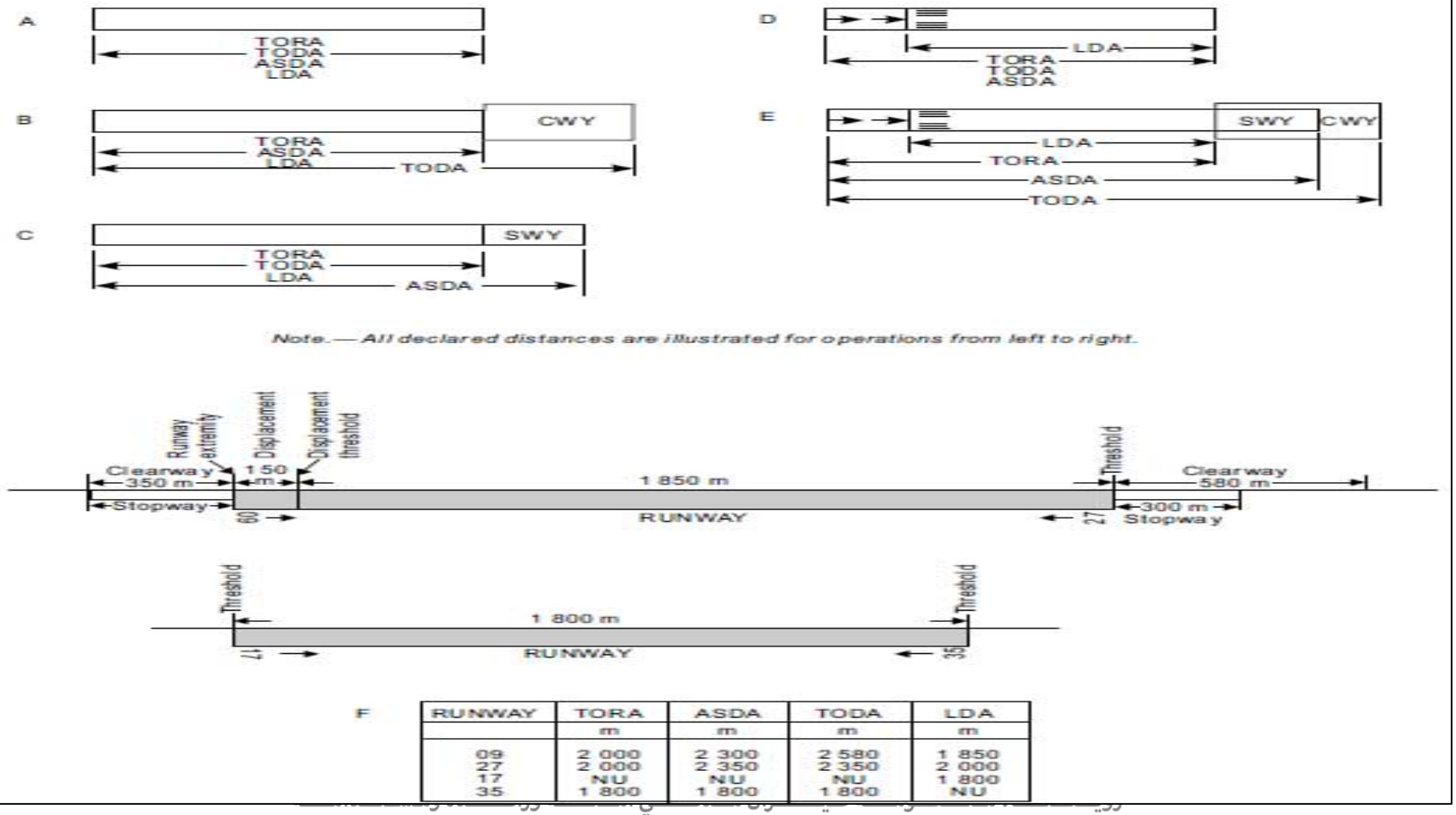
Declared Distances

Stopway. A defined rectangular braking action area on the ground at the end of take off run available prepared as a suitable area in which an aircraft can be stopped in the case of an abandoned take-off.



Physical Characteristics

Declared Distances



Note.— All declared distances are illustrated for operations from left to right.

F

RUNWAY	TORA	ASDA	TODA	LDA
	m	m	m	m
09	2 000	2 300	2 580	1 850
27	2 000	2 350	2 350	2 000
17	NU	NU	NU	1 800
35	1 800	1 800	1 800	NU

Taxiways

Taxiways

Types of Taxiways

- Taxiway
- Apron Taxiway?
- Aircraft Stand Taxi-lane
- Rapid Exit Taxiway

Taxiways

Taxiway

A defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another.

Taxiways

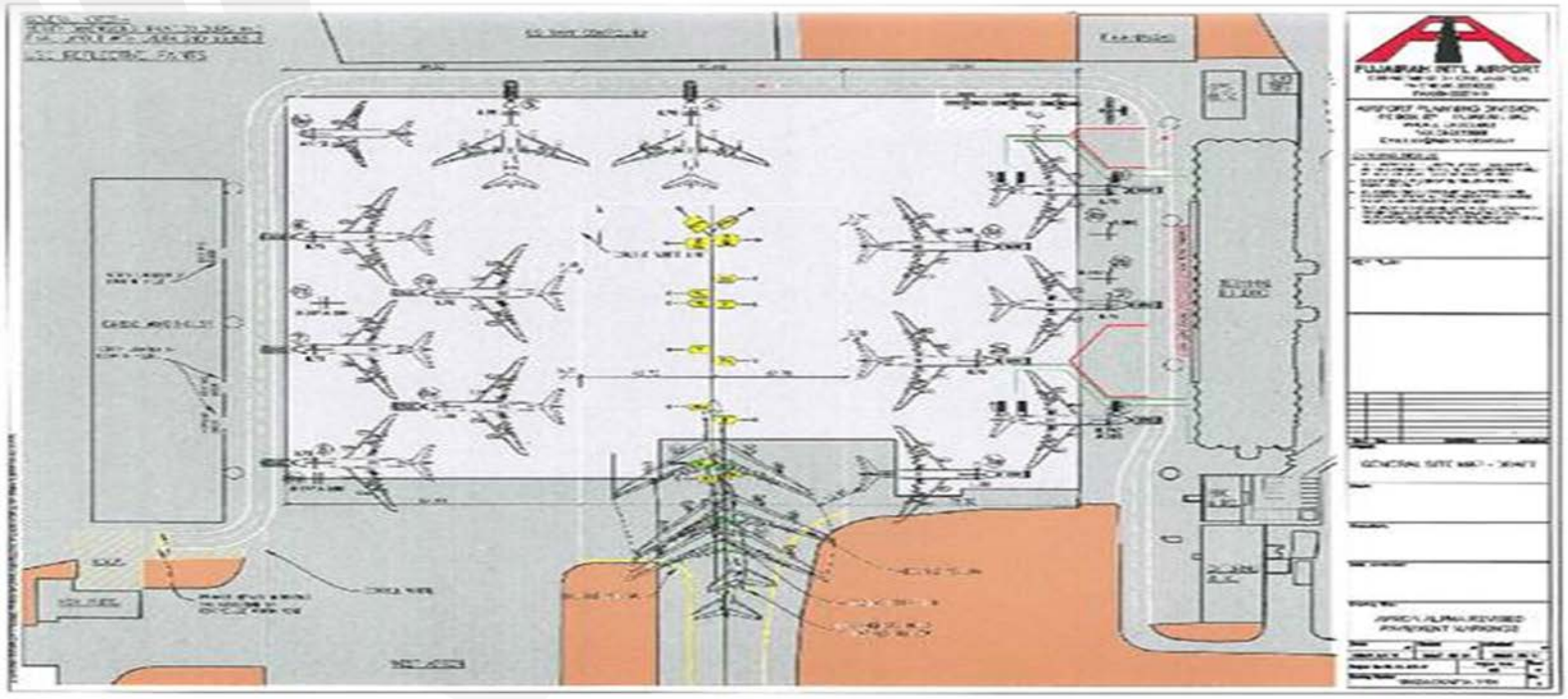
Apron Taxiway

A portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron:

Taxiways

Aircraft Stand Taxilane

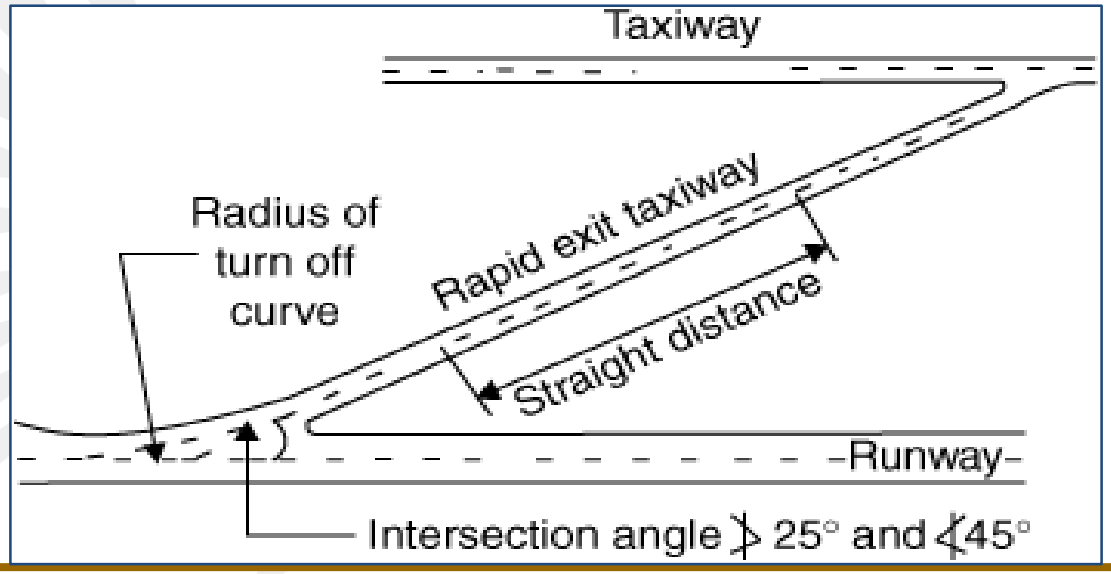
A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.



Taxiways

Rapid Exit Taxiway

A taxiway connected to a runway at an acute angle and designed to allow landing aircraft to turn off at higher speeds than are achieved on other exit taxiways thereby minimizing runway occupancy times.



Taxiways

Outer Edge Main Wheels to Edge of Taxiway

Taxiway Code	Distance
A	1.5m
B	2.25m
C	3m (wheelbase < 18m)
D, E, F	4.5m (wheelbase > 18m)

Taxiways

Width of Taxiways

Taxiway Code	Straight Portion Width	TWY Shoulders
A	7.5m	---
B	10.5m	---
C	15m *(wheel base < 18m)* 18m *(wheel base >= 18m)*	25m*
D	18m *(omg wheel span < 9m)* 23m *(omg wheel span > 9m)*	38m*
E	23m	44m*
F	25m	60m*

omg - outer main gear

** overall width of TWY on straight portion.*

Taxiways

Taxiway Strips & Graded Areas

Taxiway Code	Strip Width	Graded Width
A	32.5 m	22 m
B	43 m	25 m
C	52 m	25 m
D	81 m	38 m
E	95 m	44 m
F	115 m	60 m

Taxiways

Taxiway CL to Runway CL

Code	Instrument Runway Code				Non-Instrument Runway Code			
	1	2	3	4	1	2	3	4
A	82.5	82.5	---	---	37.5	47.5	---	---
B	87	87	---	---	42	52	---	---
C	---	---	168	---	---	---	93	---
D	---	---	176	176	---	---	101	101
E	---	---	---	182.5	---	---	---	107.5
F	---	---	---	190	---	---	---	115

Taxiways

Taxiway Minimum Separation Distances

Code	Taxiway Centerline to Taxiway Centerline (m)	Taxiway and Apron Taxiway Centerline to Object (m)	Aircraft Stand Taxilane Centerline to Object (m)
A	23	15.5	12
B	32	20	16.5
C	44	26	22.5
D	63	37	33.5
E	76	43.5	40
F	91	51	47.5

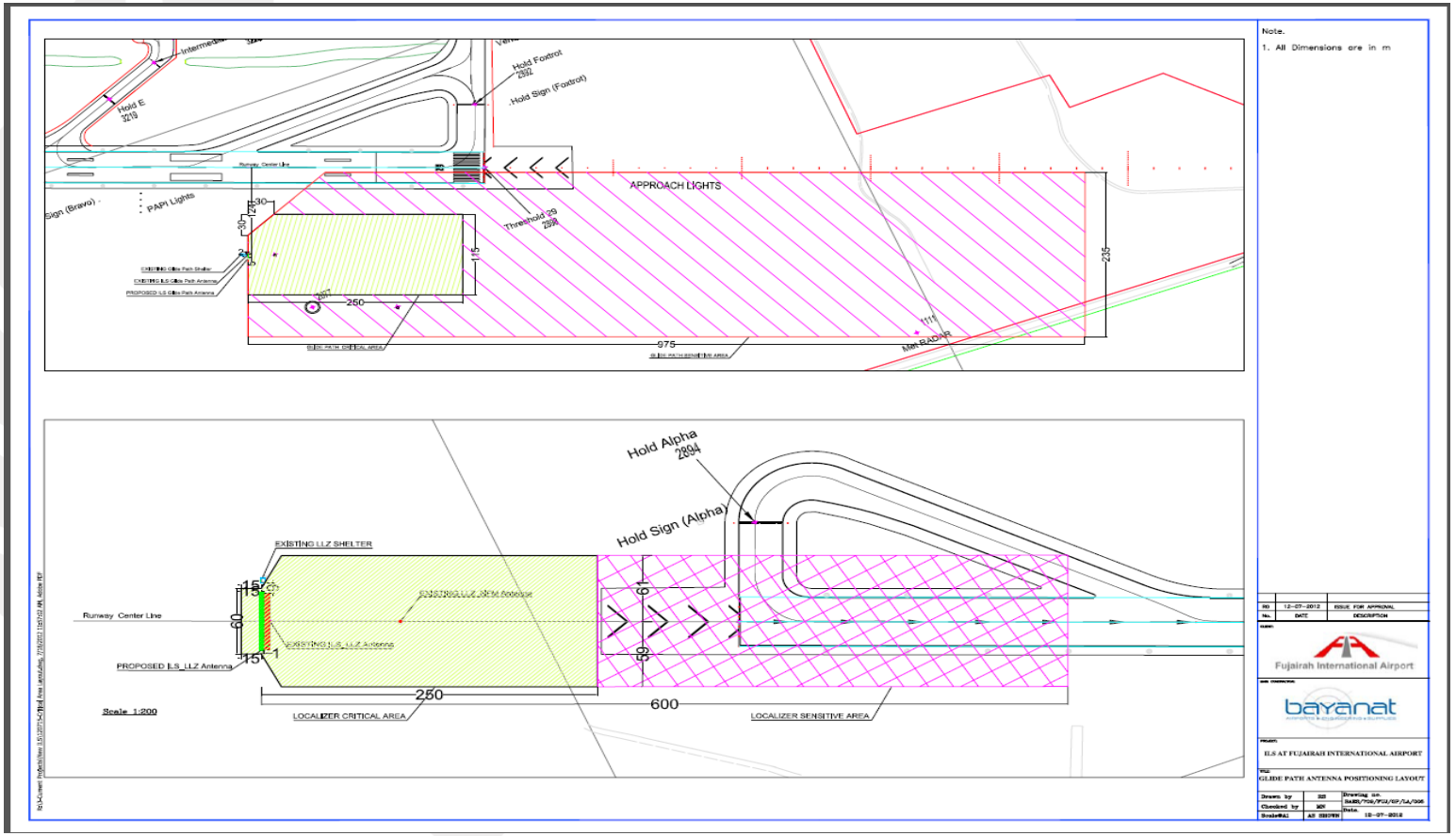
Taxiways

Taxiway Holding Bays and Positions

Type of Runway	Code Number			
	1	2	3	4
Non-Instrument	30m	40m	75m	75m
Non-Precision Approach	40m	40m	75m	75m
Precision Approach CAT I	60m	60m	90m	90m
CAT II & III	---	---	90m	90m
Take-off Runway	30m	40m	75m	75m

Taxiways

ILS Sensitive Area



Apron

Taxiways and Aprons

Apron

A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fuelling, parking or maintenance.

Taxiways and Aprons

General

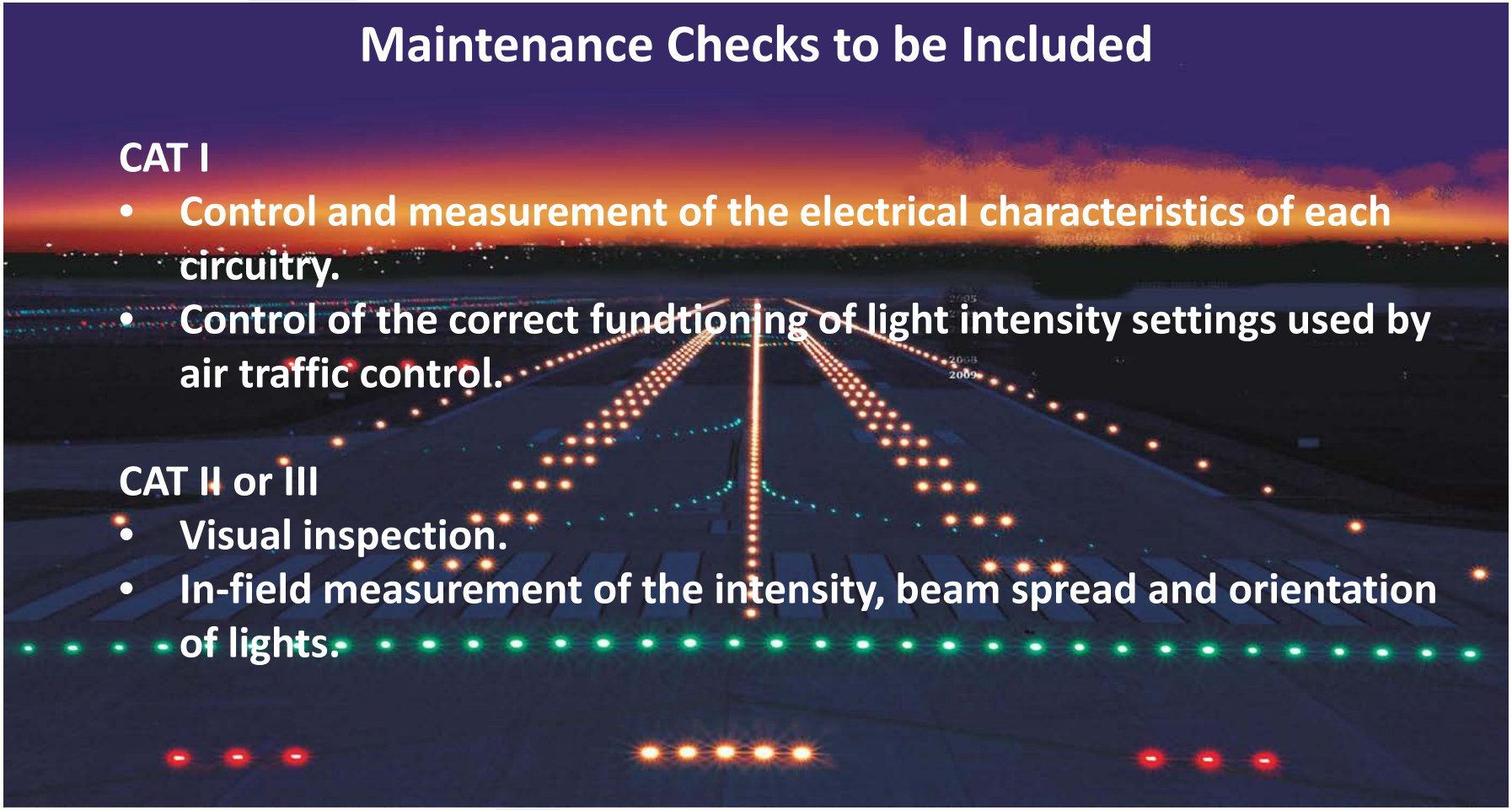
Aprons shall be provided to permit the on and off-loading of passengers, cargo or mail as well as the servicing of aircraft without interfering with aerodrome traffic.

Taxiways and Aprons

Clearance Distances on Aircraft Stands

Code Letter	Clearance (m)
A	3
B	3
C	4.5
D	7.5
E	7.5
F	7.5

Aeronautical Ground Lights (AGL)



Maintenance Checks to be Included

CAT I

- Control and measurement of the electrical characteristics of each circuitry.
- Control of the correct fundtioning of light intensity settings used by air traffic control.

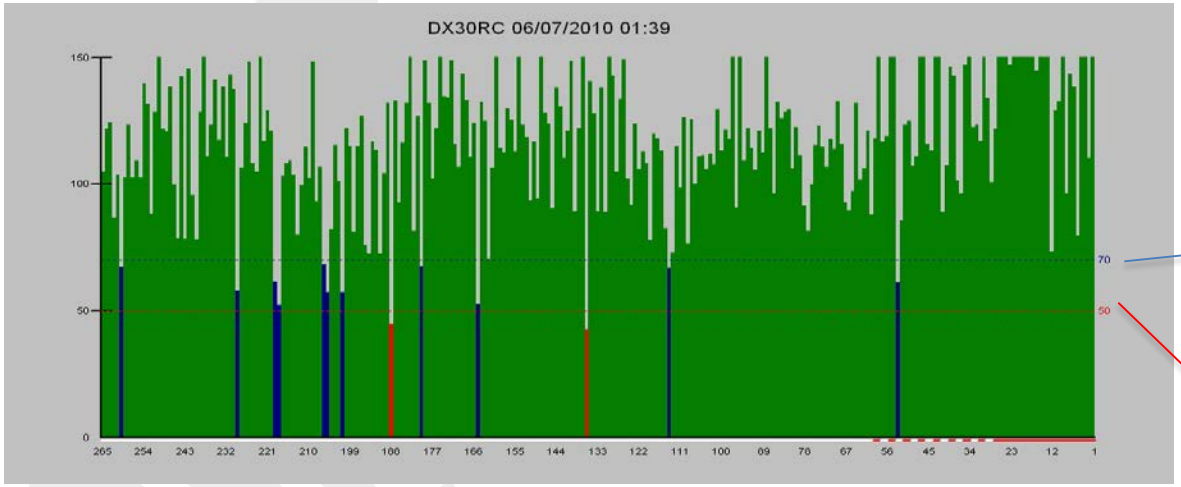
CAT II or III

- Visual inspection.
- In-field measurement of the intensity, beam spread and orientation of lights.

Aeronautical Ground Lights (AGL)

Photometric Trailer (Abu Dhabi International Airport)

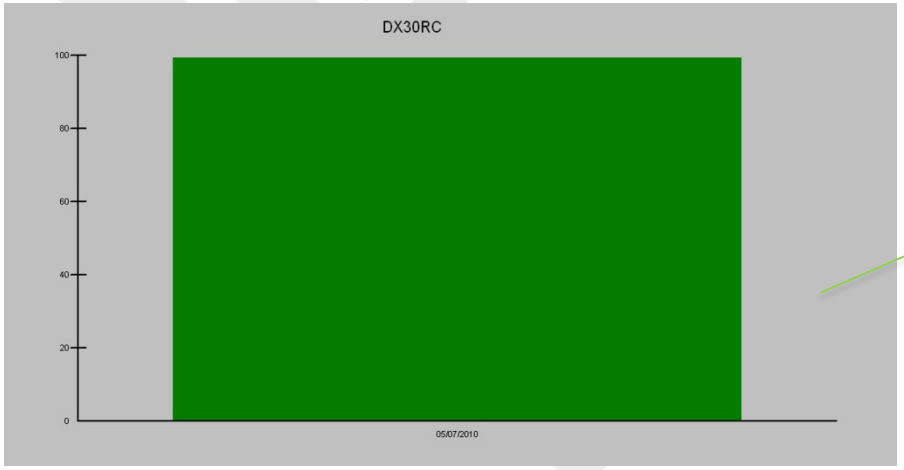
AGL Photometric Reports



Runway Centreline Lights Bar Chart

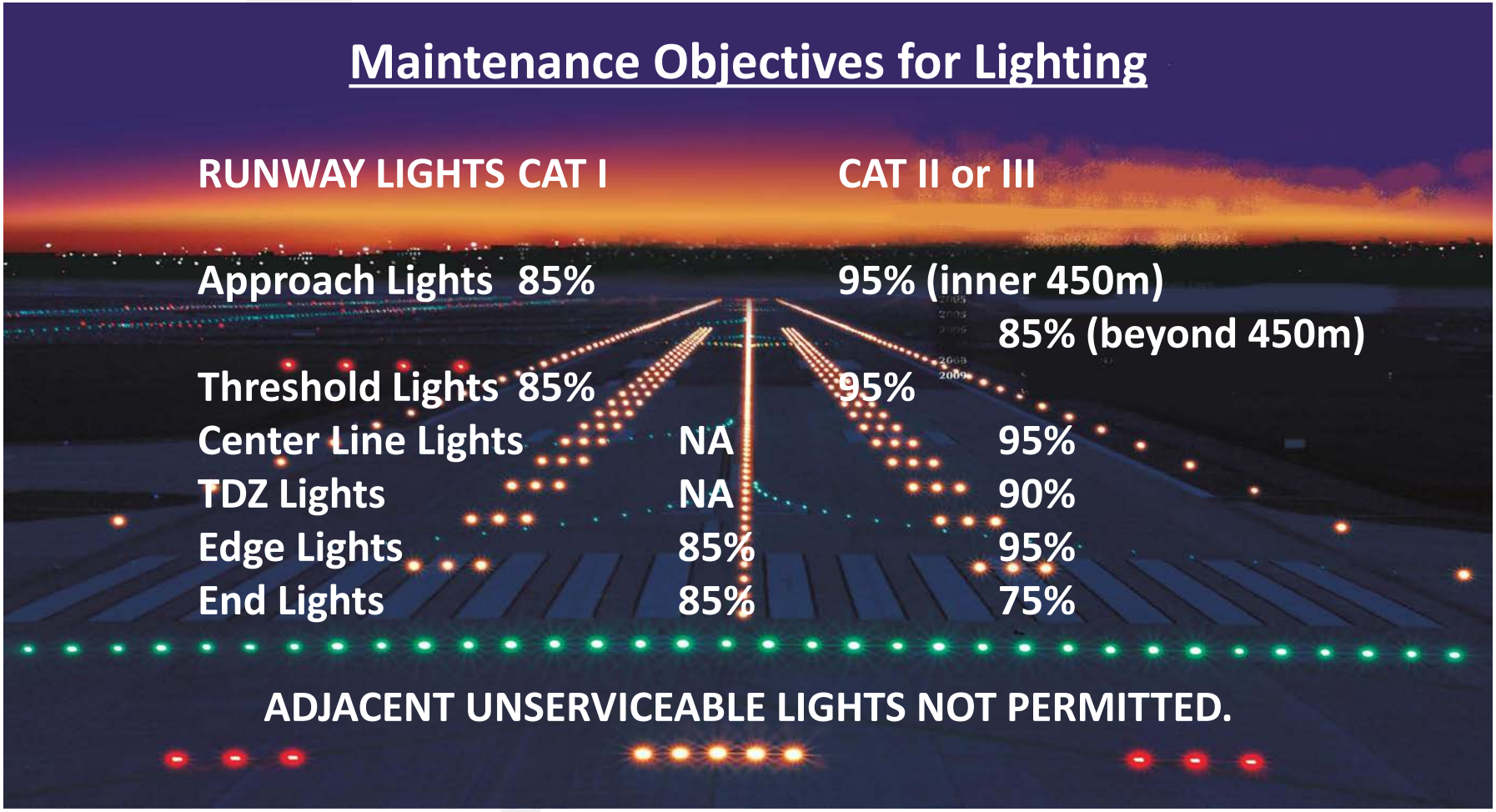
Maintenance Level

Serviceability below standard



Overall CATIII Serviceability (>95% lights meeting the standard)

Aeronautical Ground Lights (AGL)



Thank You