Re-design of Jerusalem Airport "Qalandia"

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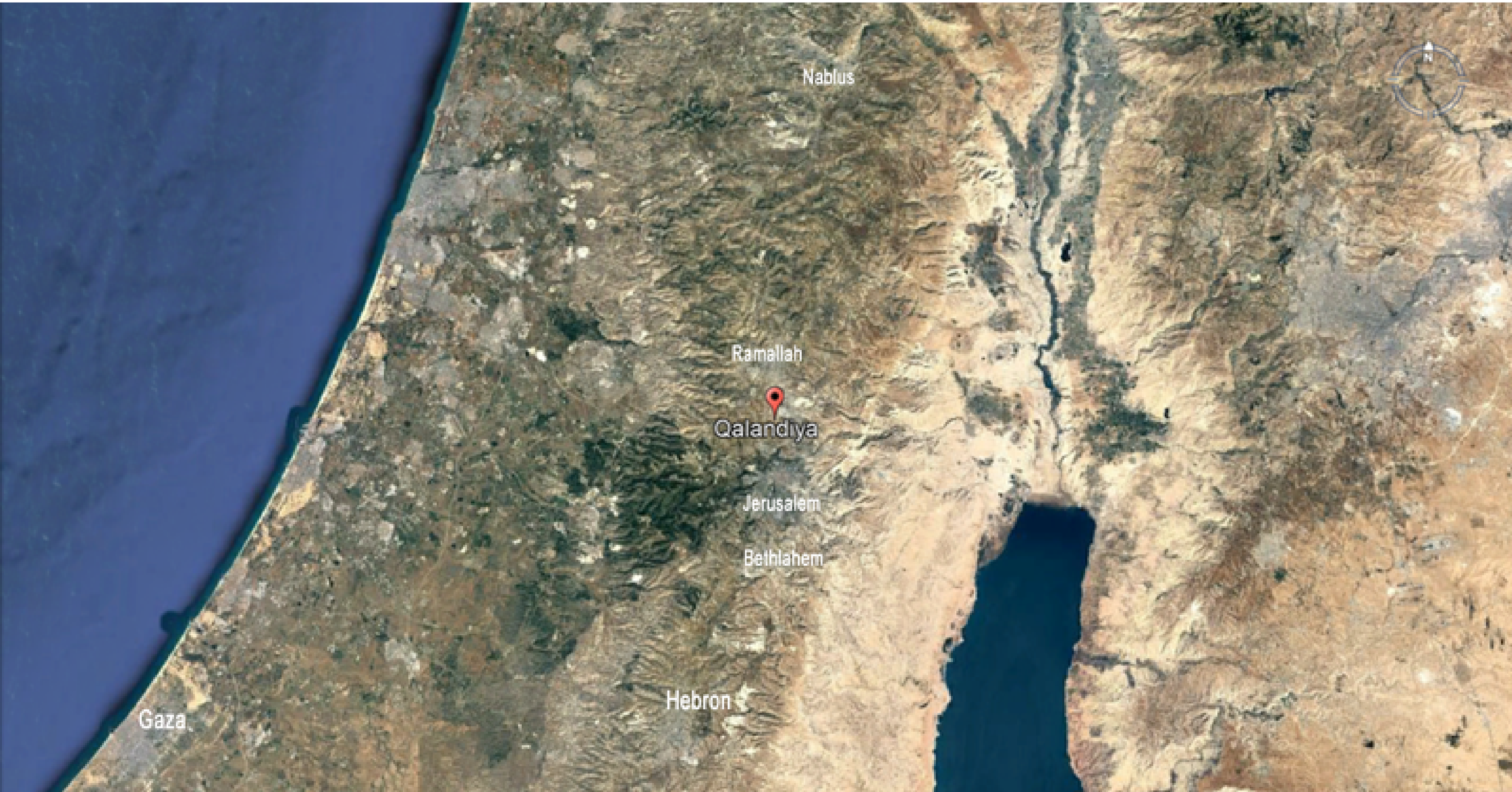
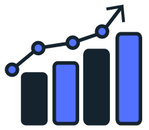
Jerusalem Airport
LUMION


Nablus
Ramallah
Qalandiya
Jerusalem
Bethlahem
Hebron
Gaza

Significance Of The Project

Serve the state's capital, Jerusalem.

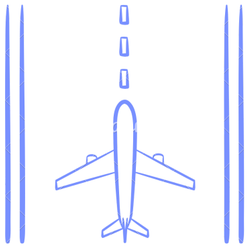
Assist link Palestine with the outside world.



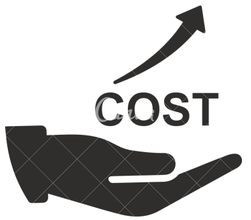
Stimulate tourism and the economy.

Outcomes of the project

Forecast Air Passengers



Airfield Geometric Design

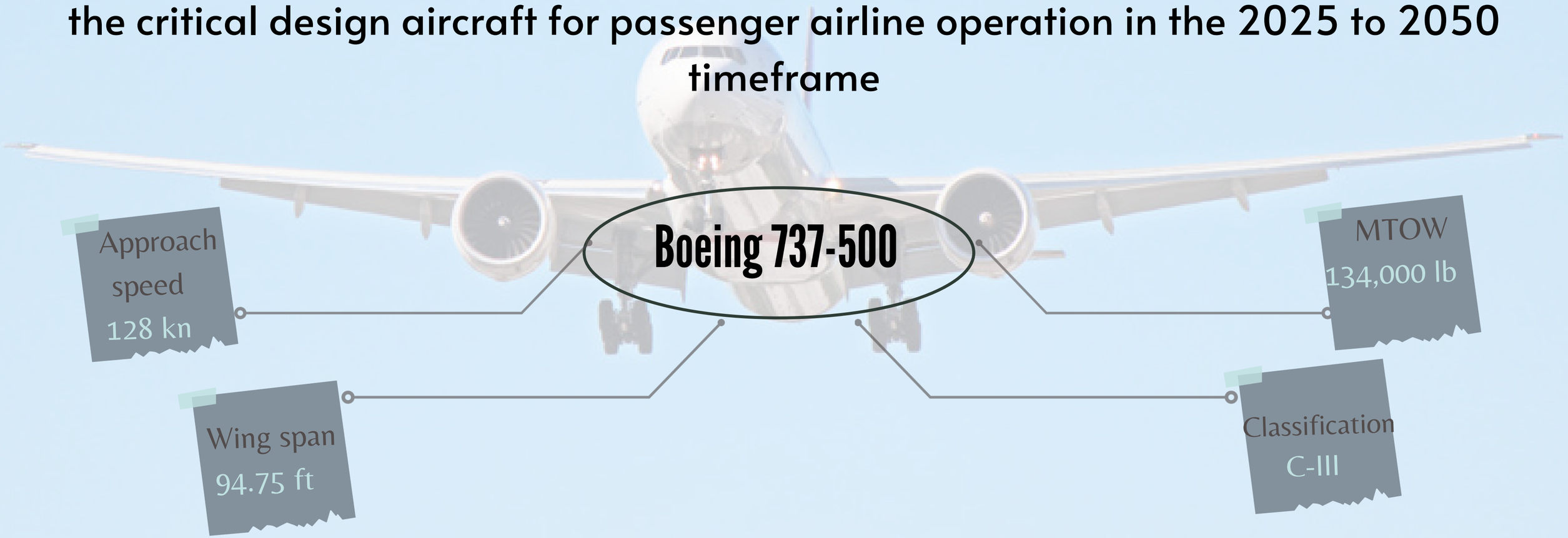


Cost And Quantities Estimation

	PHASE I	PHASE II	PHASE III
MI	21-50	21-50	21-50
HOURLY CAPCITY	57	57	57
ANNUAL SERVICES OPERATIONS PER YEAR	195,000	195,000	195,000
ANNUAL OPERATIONS DEMAND	37,000	69,000	95,000
RUNWAY CONFIGURATION	Single	Single	Single

Critical Design Airplane

the Aviation Demand Forecasts indicate that the Boeing 737-500 will become the critical design aircraft for passenger airline operation in the 2025 to 2050 timeframe

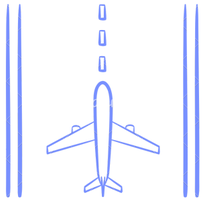


Result For The First Stage :

Between Jerusalem and Ramallah

phase I : 3M
phase II : 5.7M
phase III : 7.9M

Boeing 737-500



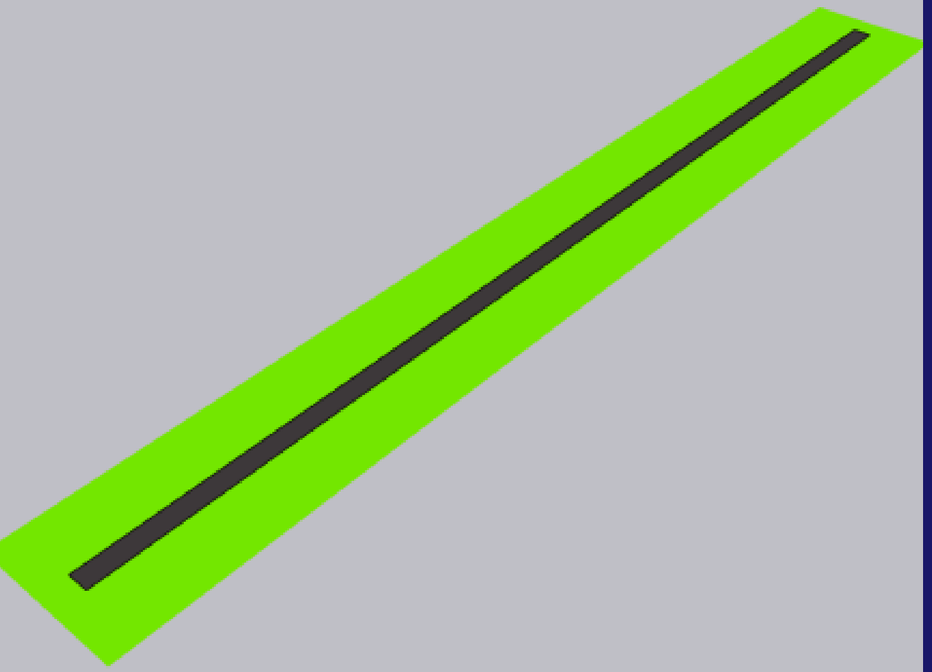
One runway
Length : 2470m

3 phases:
2025-2035
2036-2045
2046-2050

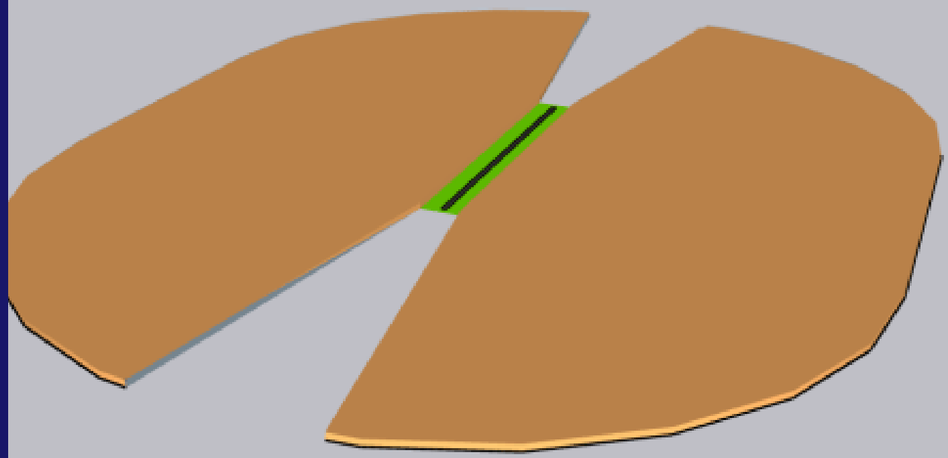
Airport Classfication
C-III

Airport Obstacles Surfaces

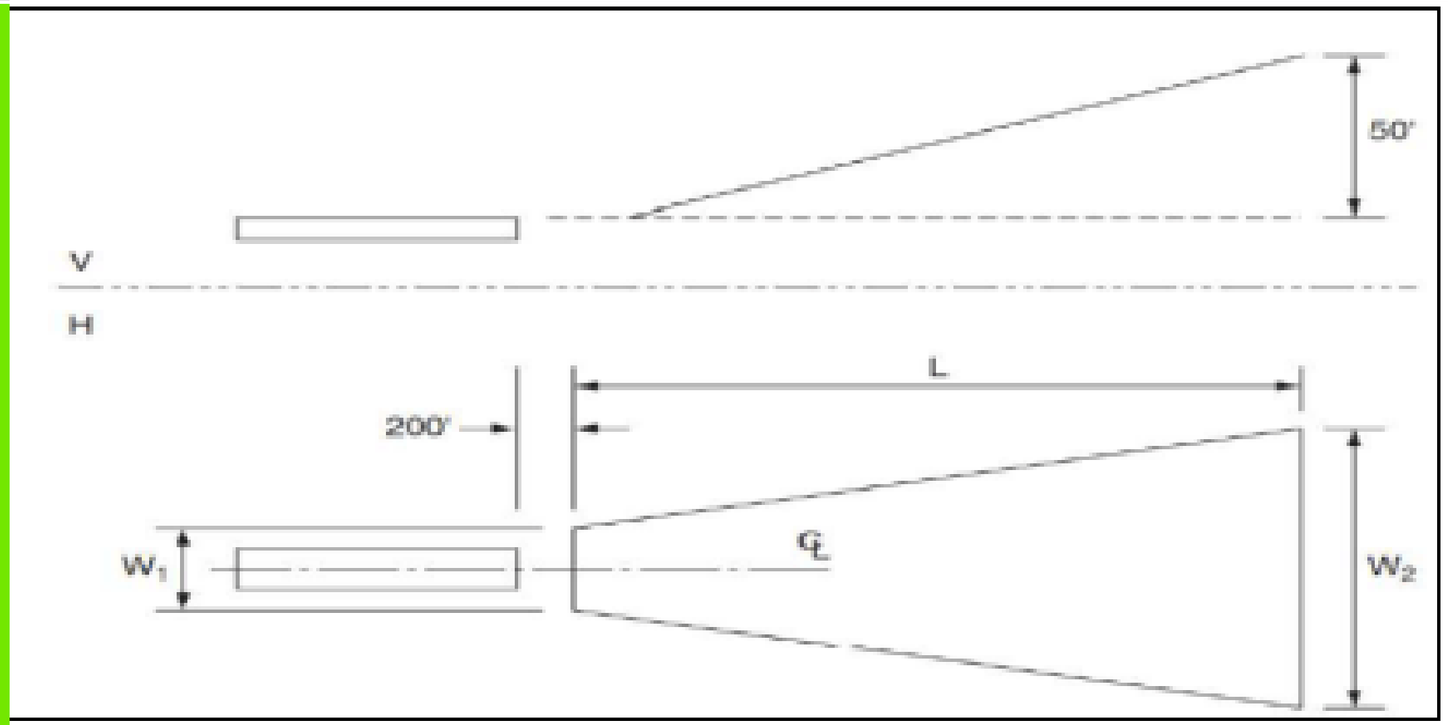
- Primary Surface
- Horizontal surface
- Approach surface
- Transitional surface
- Conical surface



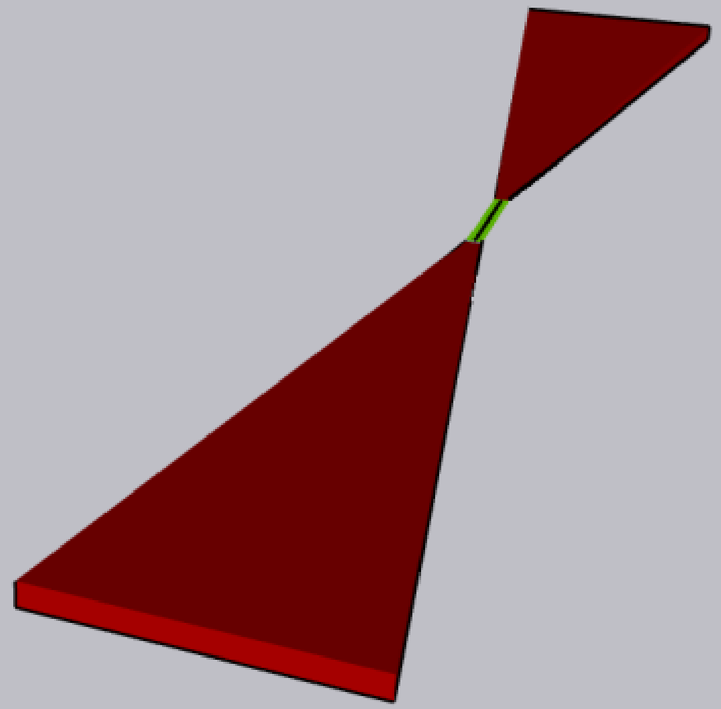
Runway protection zone



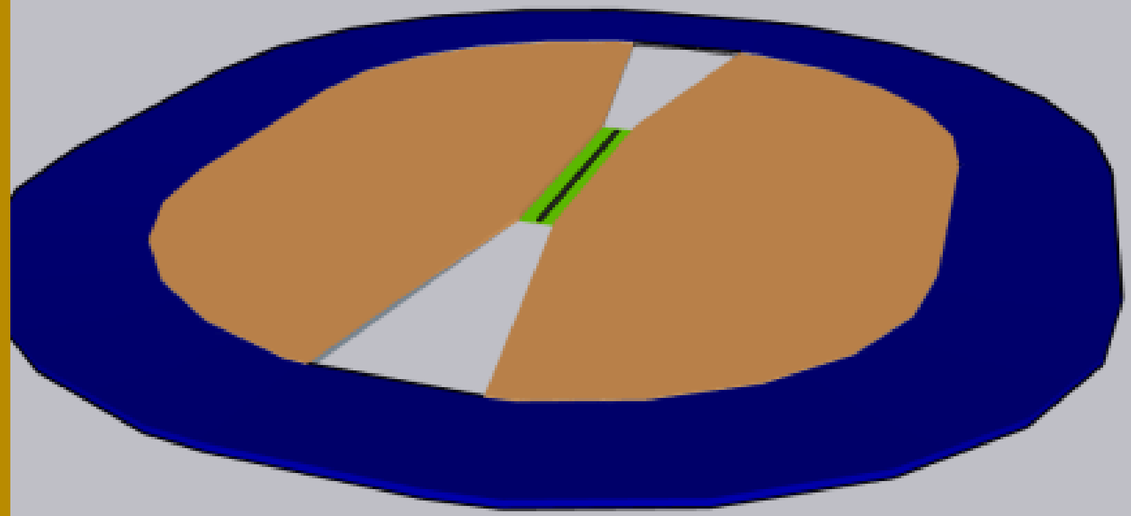
Primary Surface



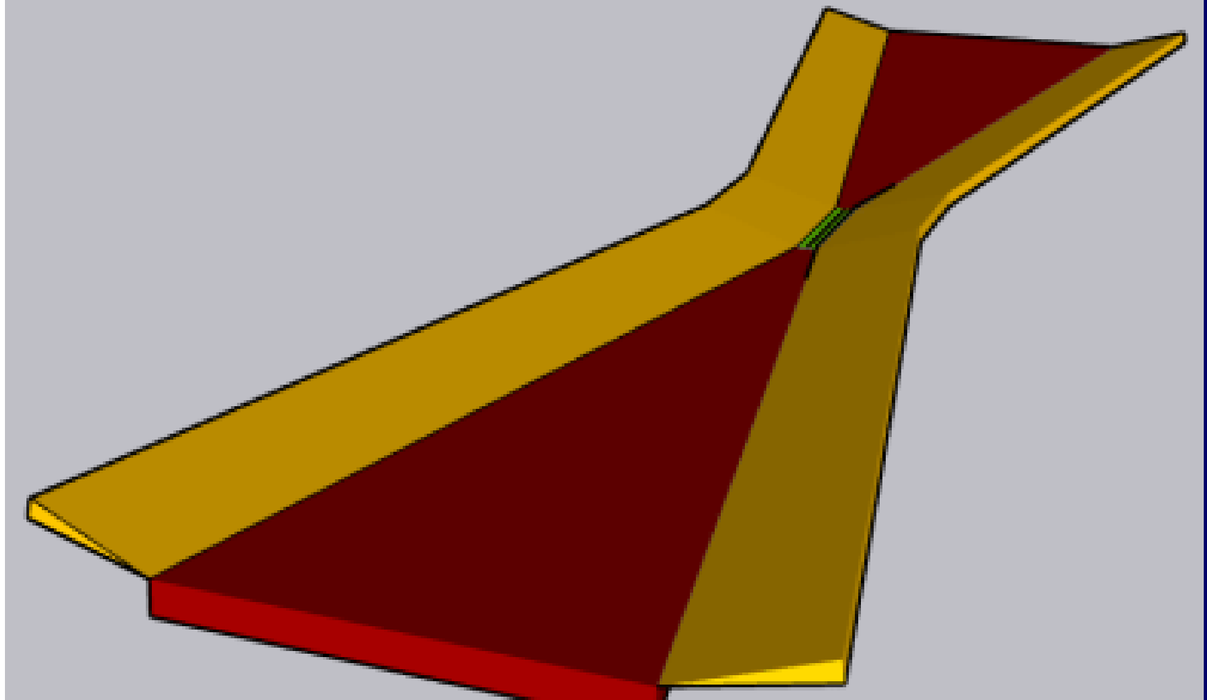
Horizontal surface



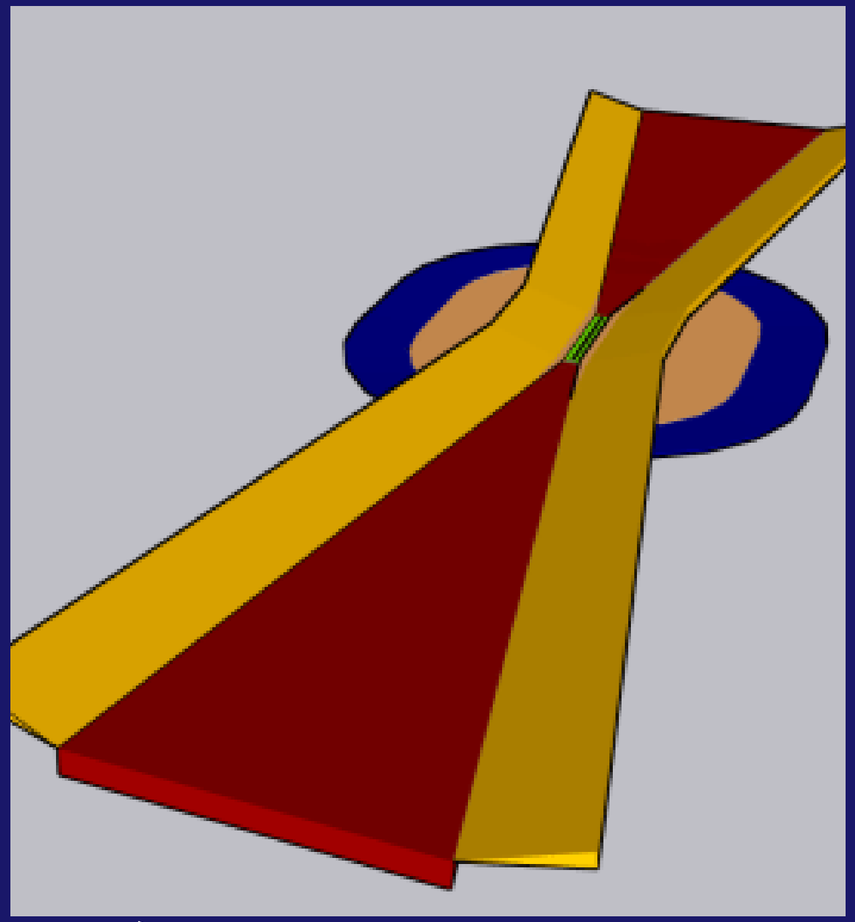
Transitional surface



Approach surface

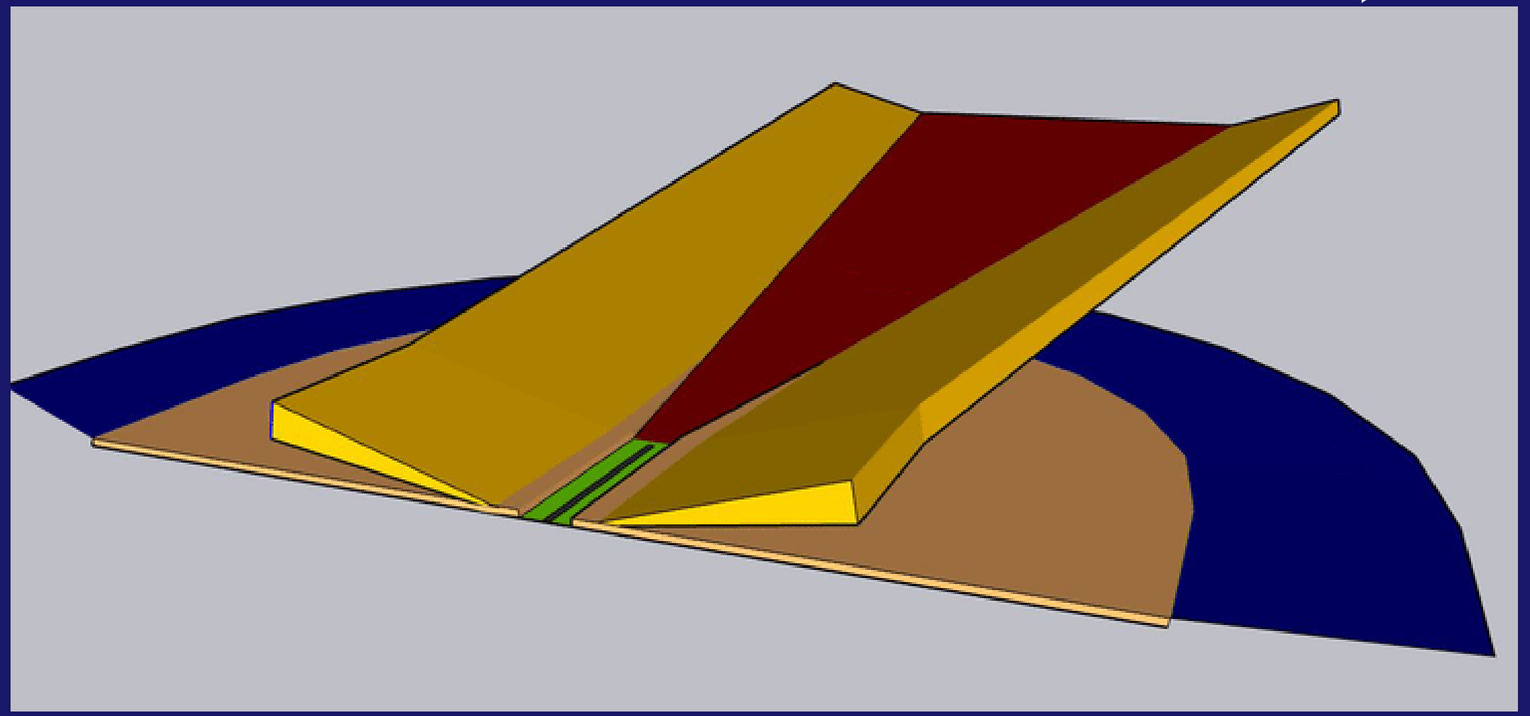


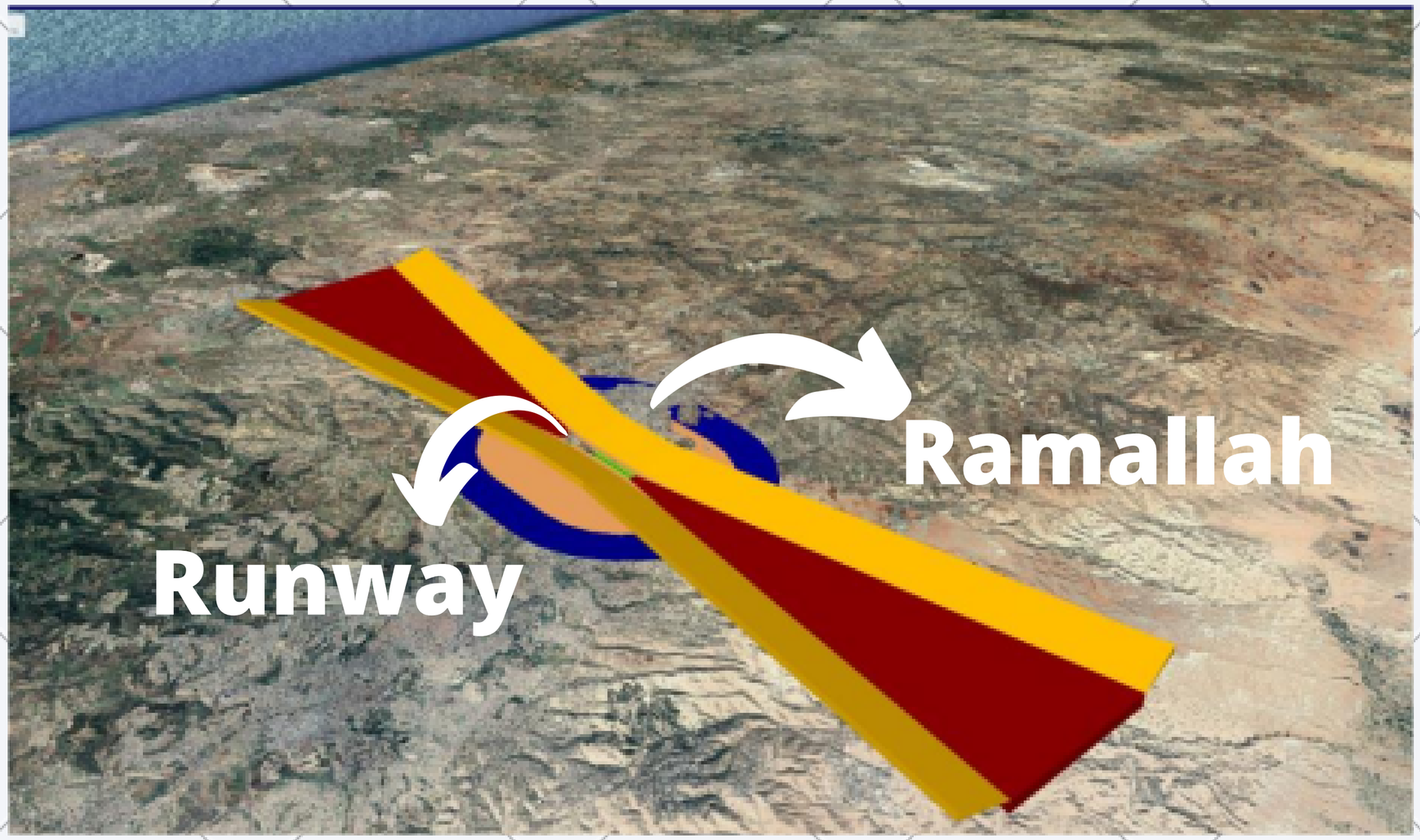
Conical surface



All the imaginary surfaces of the Jerusalem airport runway

schematic cross-section of the runway imaginary surfaces





OBSTACLE ANALYSIS RESULTS

Geometric design of the airfield

- Runway Design
- Taxiways And Taxilanes
- Exit Taxiway

GEOMETRIC DESIGN OF THE RUNWAY

RUNWAY DIMENSIONS

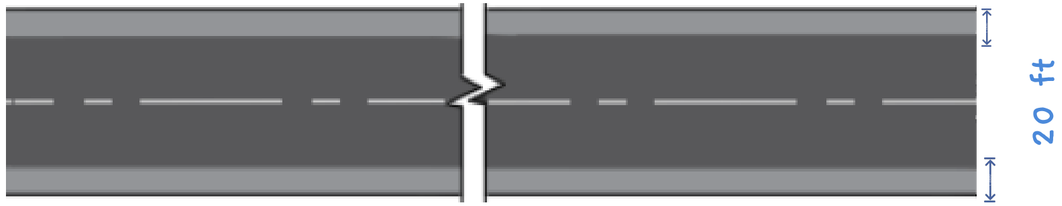
VERTICAL ALIGNMENT

TRANSVERSE SLOPES

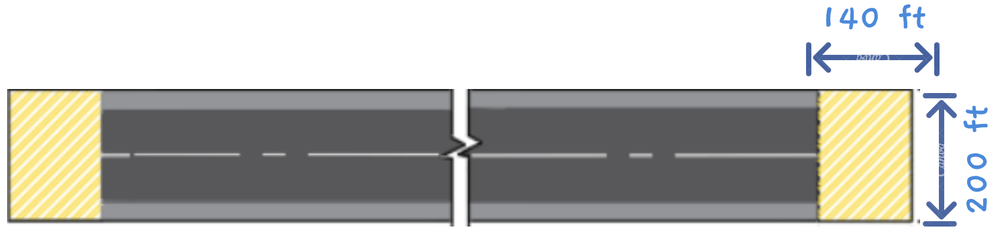
Runway System Component

RUNWAY WIDTH

RUNWAY SHOULDER



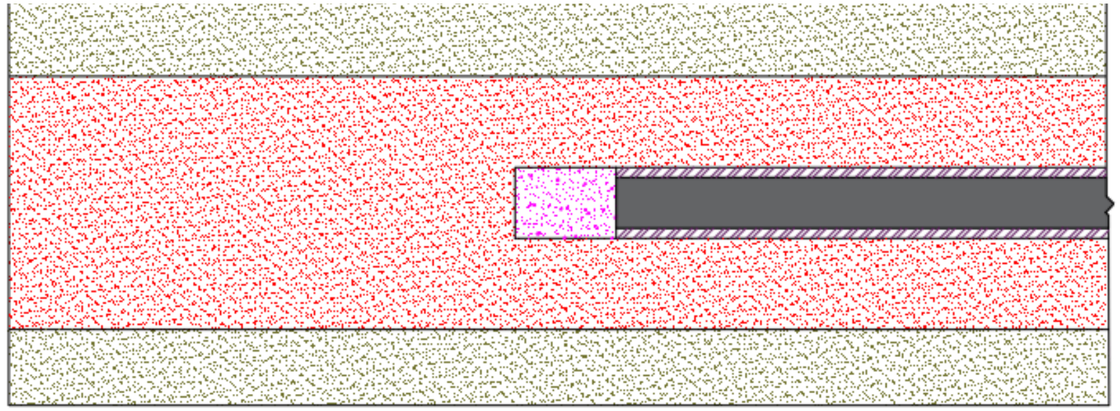
BLAST PAD



Critical aircraft with type C-III

	Airplane Design Group					
	I	II	III	IV	V	VI
Runway width	100	100	100[a]	150	150	200
Shoulder[b] width	10	10	20[a]	25	35	40
Blast pad						
Width	120	120	140[a]	200	220	280
Length	100	150	200	200	400	400

Runway System Component



- Runway
- Shoulder
- Blast Pad
- Safety Area
- Object-free Area

GEOMETRIC DESIGN OF THE TAXIWAY&TAXILANE

	Airplane Design Group					
	I	II	III	IV	V	VI
Width	25	35	50[a]	75	75	100
Edge safety margin[b]	5	7.5	10[c]	15	15	20
Shoulder width	10	10	20	25	35[d]	40[d]
Safety area width[e]	49	79	118	171	214	262
Object-free area width						
Taxiway[f]	89	131	186	259	320	386
Taxilane[g]	79	115	162	225	276	334
Separations						
Taxiway centerline to taxiway centerline[h]	69	105	152	215	267	324
fixed or movable object[i]	44.5	62.5	93	129.5	160	193
Taxilane centerline to taxilane centerline[j]	64	97	140	198	245	298
fixed or movable object[k]	39.5	57.5	81	112.5	138	167

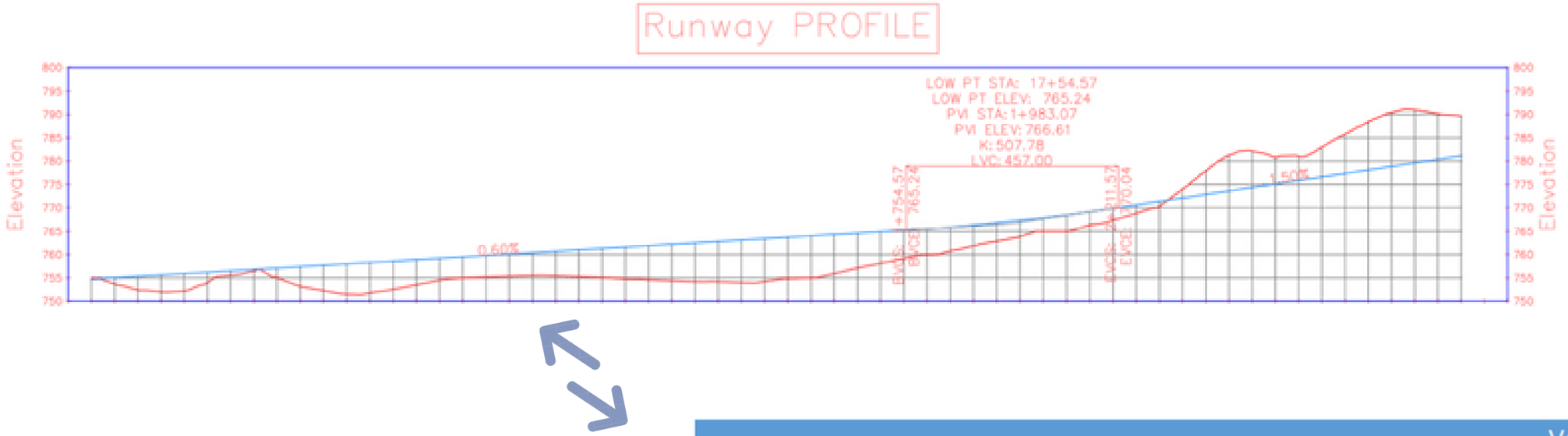
Item	TDG							
	1A	1B	2A	2B	3	4	5	6
Taxiway/Taxilane Width [1]	25 ft (7.6 m)	25 ft (7.6 m)	35 ft (10.7 m)	35 ft (10.7 m)	50 ft (15.2 m)	50 ft (15.2 m)	75 ft (22.9 m)	75 ft (22.9 m)
Taxiway Edge Safety Margin [1]	5 ft (1.5 m)	5 ft (1.5 m)	7.5 ft (2.3 m)	7.5 ft (2.3 m)	10 ft (3 m)	10 ft (3 m)	14 ft (4.3 m)	14 ft (4.3 m)
Taxiway Shoulder Width [2]	10 ft (3 m)	10 ft (3 m)	15 ft (4.6 m)	15 ft (4.6 m)	20 ft (6.1 m)	20 ft (6.1 m)	30 ft (9.1 m)	30 ft (9.1 m)

LAYOUT OF VERTICAL ALIGNMENT

Critical aircraft with type C-III

- Maximum Longitudinal Gradient for runway and taxiway is 1.5%
- Maximum Change in Longitudinal Gradient for runway is 1.5% and for taxiway is 3%
- No grade changes at the 1st and last quarter of the runway.

Runway's Longitudinal Profile



Curve	PVI Station (m)	PVI Elevation (m)	Grade in	Grade out	Grade change (A)	Vertical cuve length (m)	Curve type
1	1+983.07	764.626	0.60%	1.50%	0.9%	457	Sag

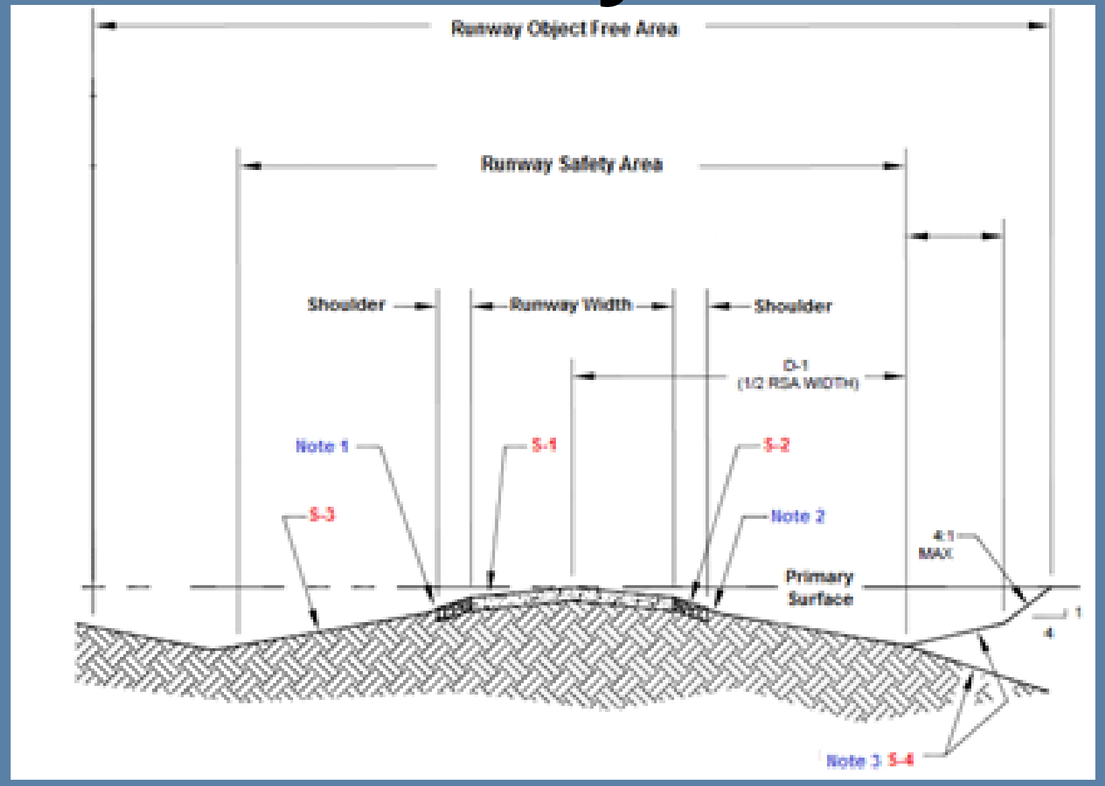
Taxiway Longitudinal Profile

Curve	PVI station (m)	PVI elevation (m)	Grade in	Grade out	Change in grade (A)	Profile curve length (m)	Profile curve type
1	1+335.55	757.944	0.40%	1.26%	0.86%	457.00	Sag
2	2+435.57	771.786	1.26%	1.5%	0.24%	500.00	Sag

Curve	Distance between VPI Stations (m)
Curve 1 – Curve 2	1100.02

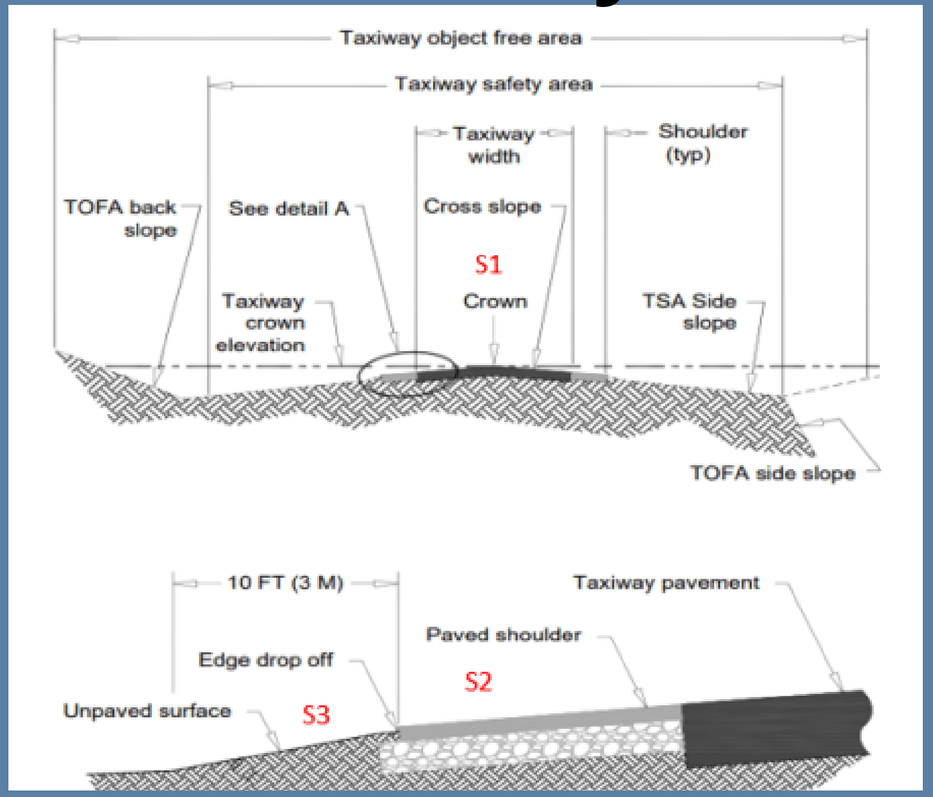
TRANSVERSE SLOPES

Runway



- S-1 = 1.5 %
- S-2=(1.5 -5 %)
- S-3= (1.5-3 %)

Taxiway



- S-1 = (1-2 %)
- S-2=(1.5 -5 %)
- S-3= (1.5-5 %)

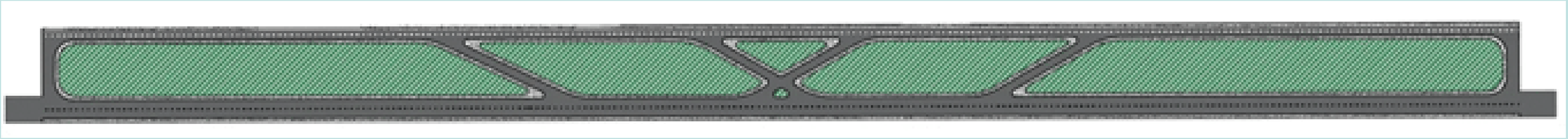
Types of Exit Taxiway

RIGHT ANGLE EXIT

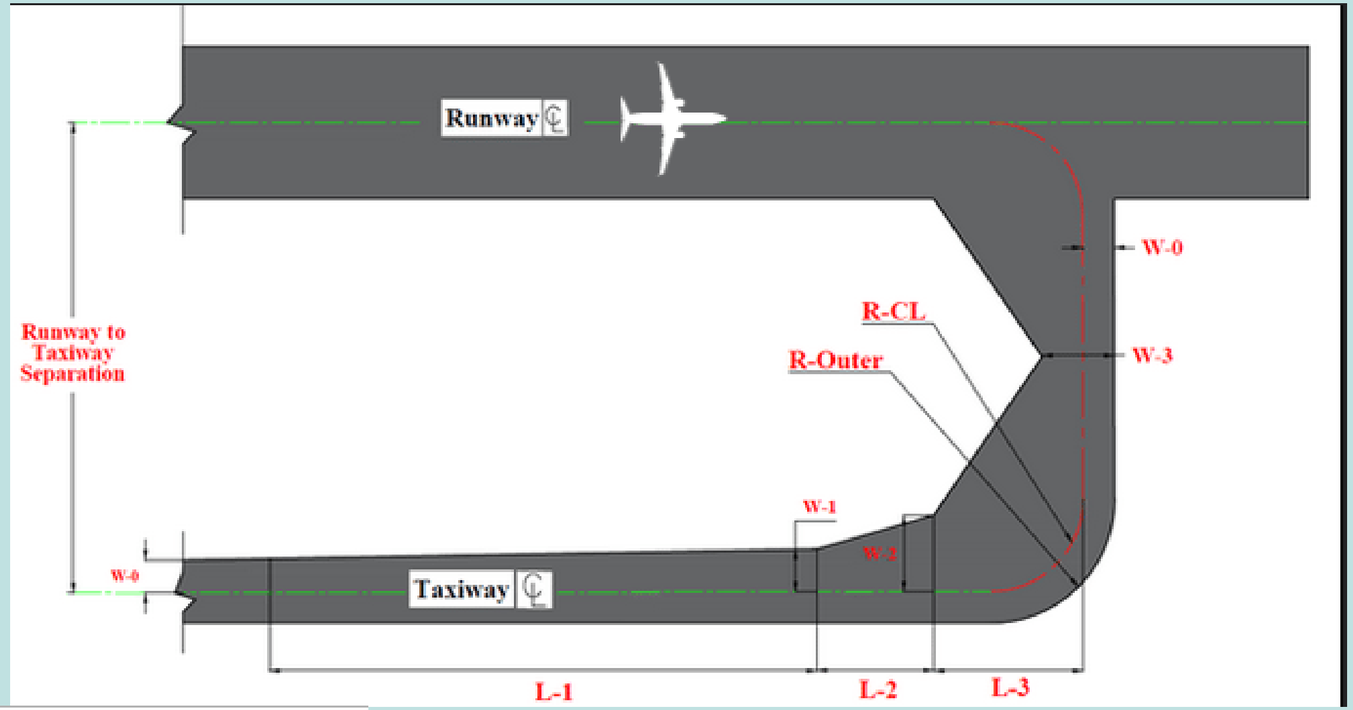
- Turning angle = 90
- Exit speed is 15 mph

HIGH SPEED EXIT

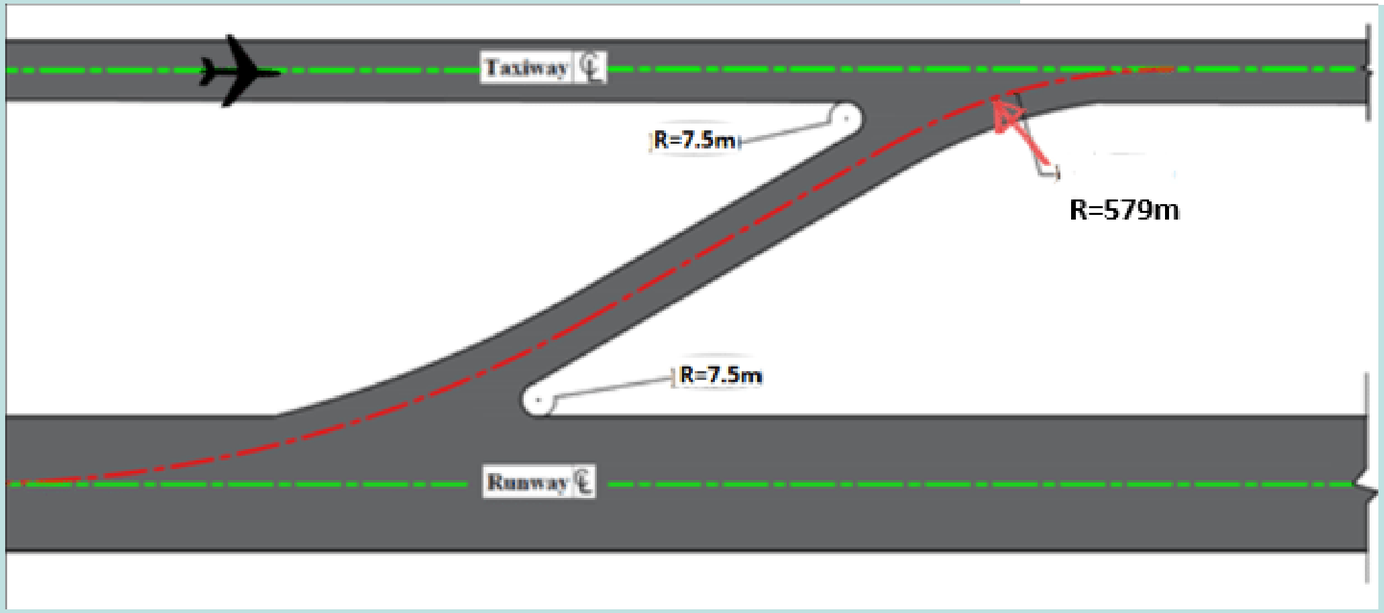
- 30-degree angle of intersection
- Exit speed is 60 mph



Geometric Design of Right- Angle Exit



vi



Geometric Design of High-Speed Exit

Location of Exit Taxiway

$$De = \frac{(Vtd^2 - Ve^2)}{2a}$$

$$D = Dtd + Dexit$$

High exit speed

Boeing 737-500 → D → 1,764

Cessna-675 → D → 1,206

Regular or right-angle Exit

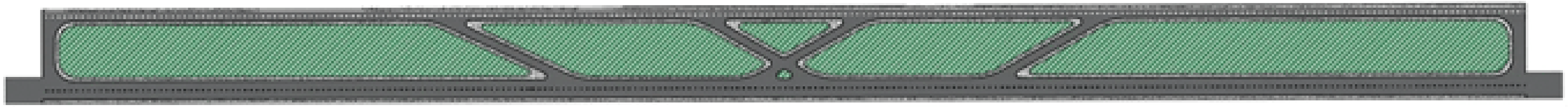
Boeing 737-500 → D → 1,764

Cessna-675 → D → 1,206

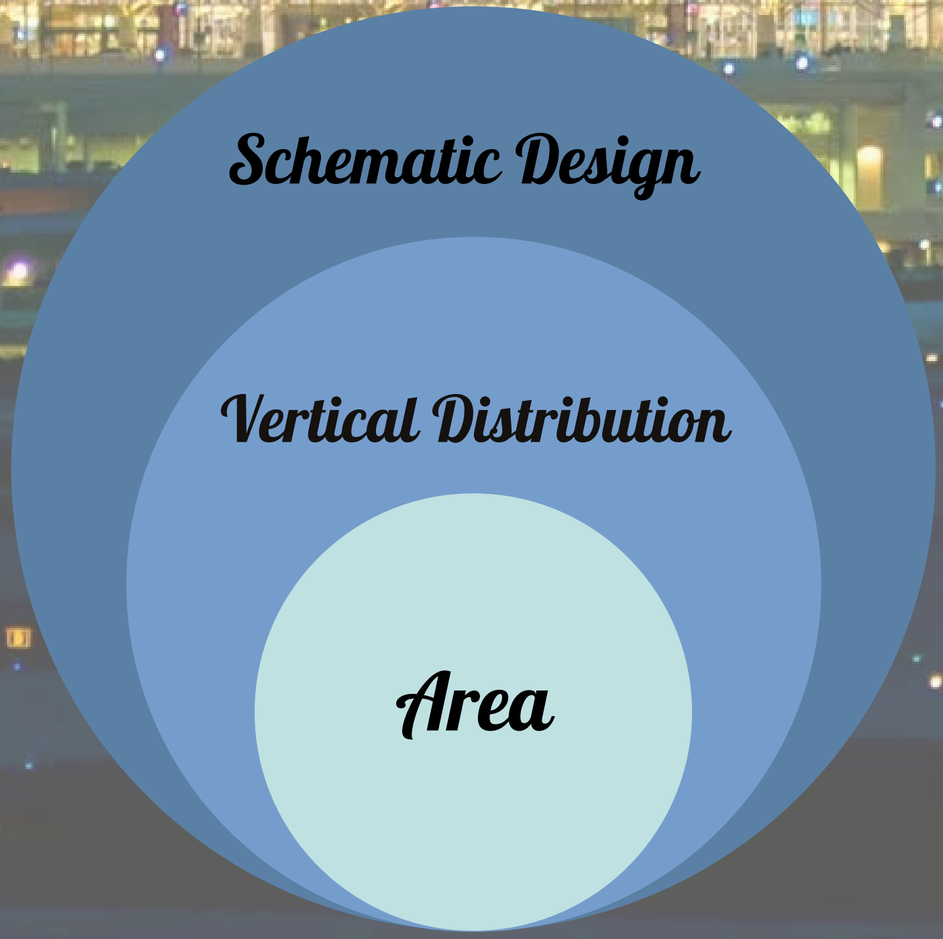
Location of Exit Taxiway

Final Locations Of Exit Taxiways

Exit	Exit Type	Point of Curvature Location (m)
E-1	30°	1,200
E-2	30°	1,600
E-3	90°	2,500



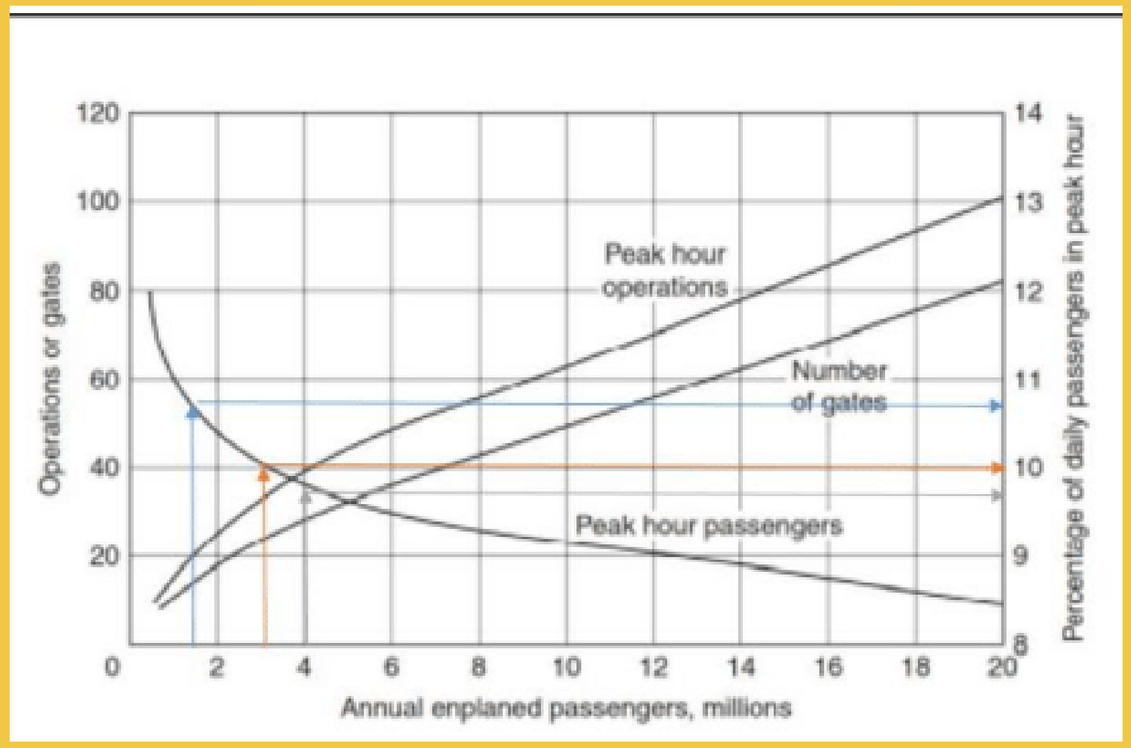
Terminal Building



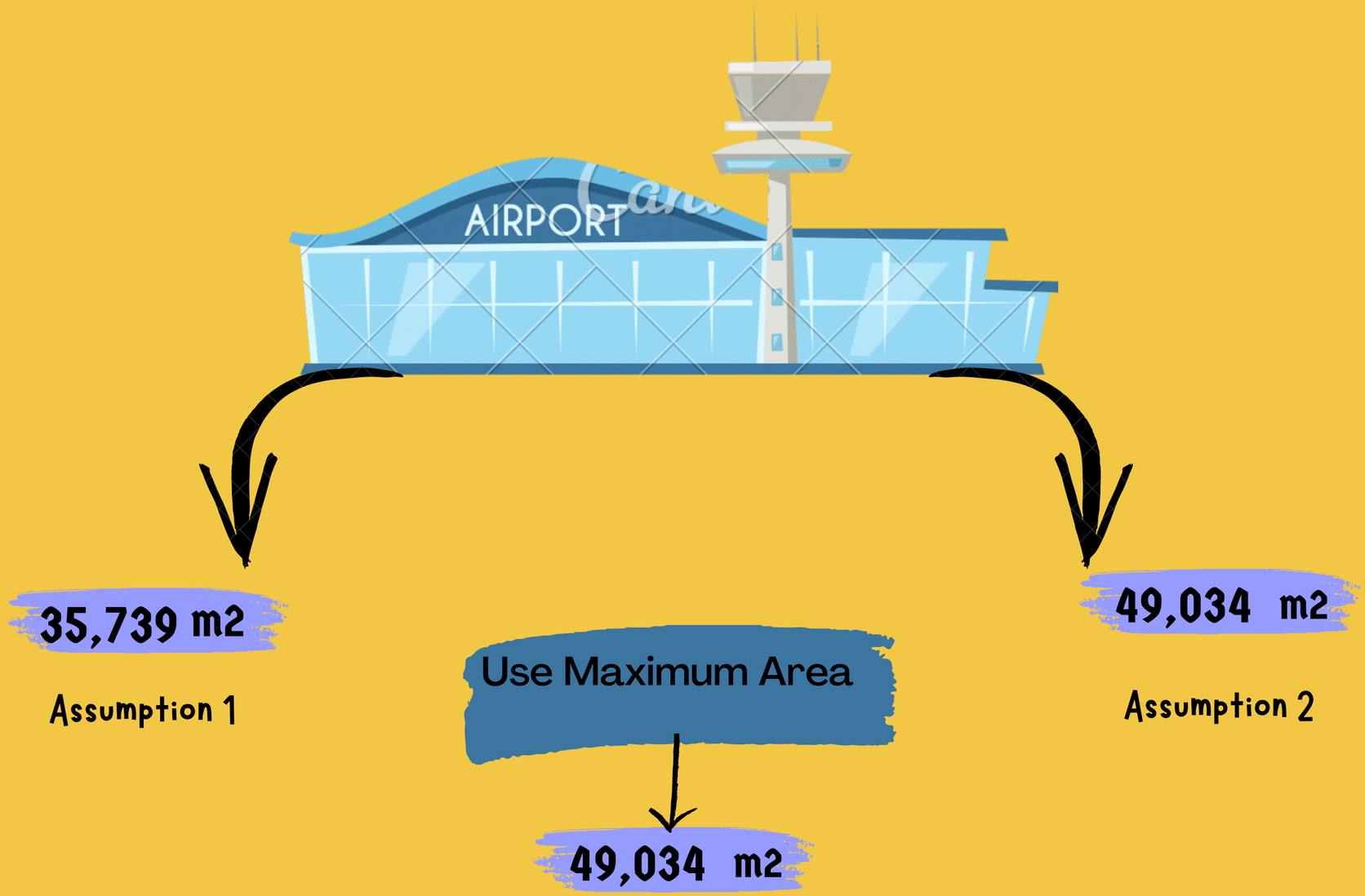

First Assumption
Add more sub-Gross terminal area : (0.007-0.011 m^2) per annual enplaned passenger
Gross terminal area
Second Assumption
Gross terminal area : 14 m^2 per design hour passenger

Assumption 2

Gross area = 14 m2 per design hour passenger

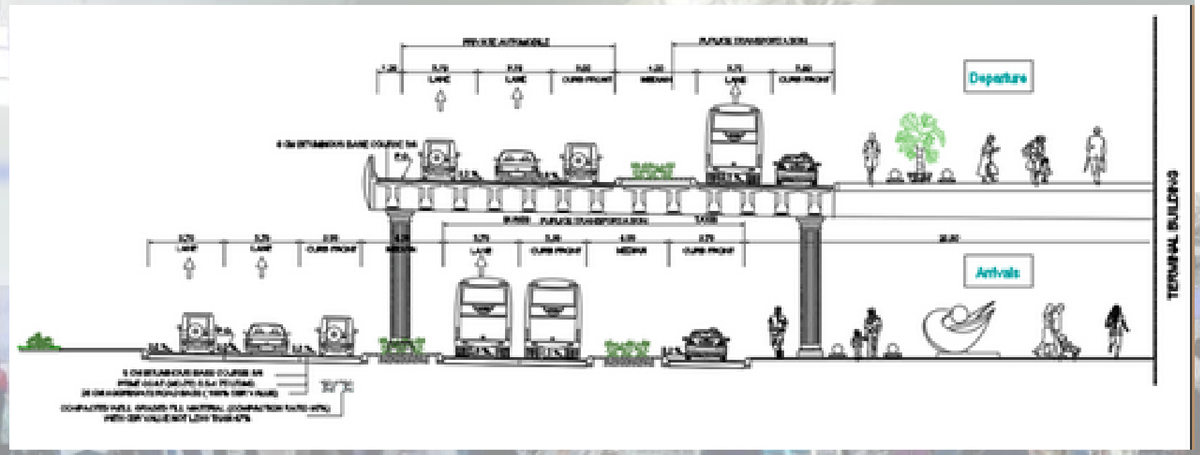


Phase	Peak Hour Passengers	Gross Terminal Building Area (m^2)
2025-2035	1,497	20,950
2036-2045	2,606	36,484
2046-2050	3,503	49,034

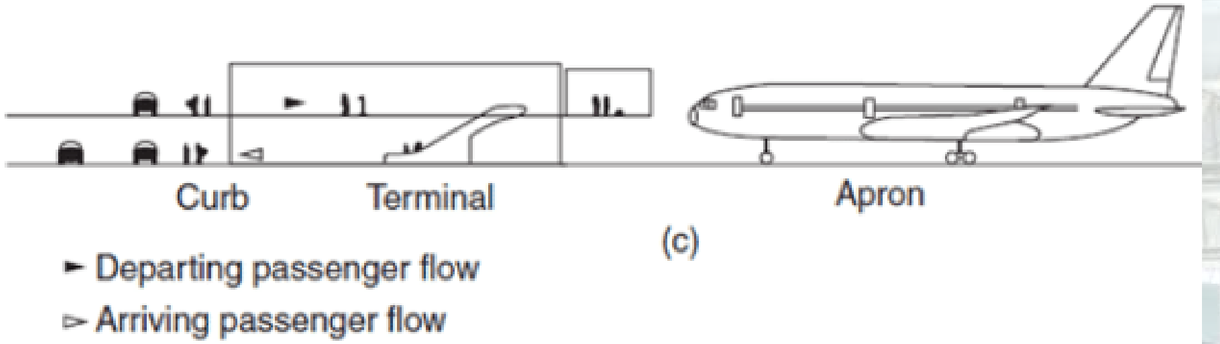


- Assume that the terminal building consists of two floors with an area of 50,000 m2 (eachfloor with area 25,000 m2)

Vertical Distribution Concept



Vertical Distribution Concept at Terminal Building - landside



Vertical Distribution Concept at Terminal Building - Airside

Schematic Design

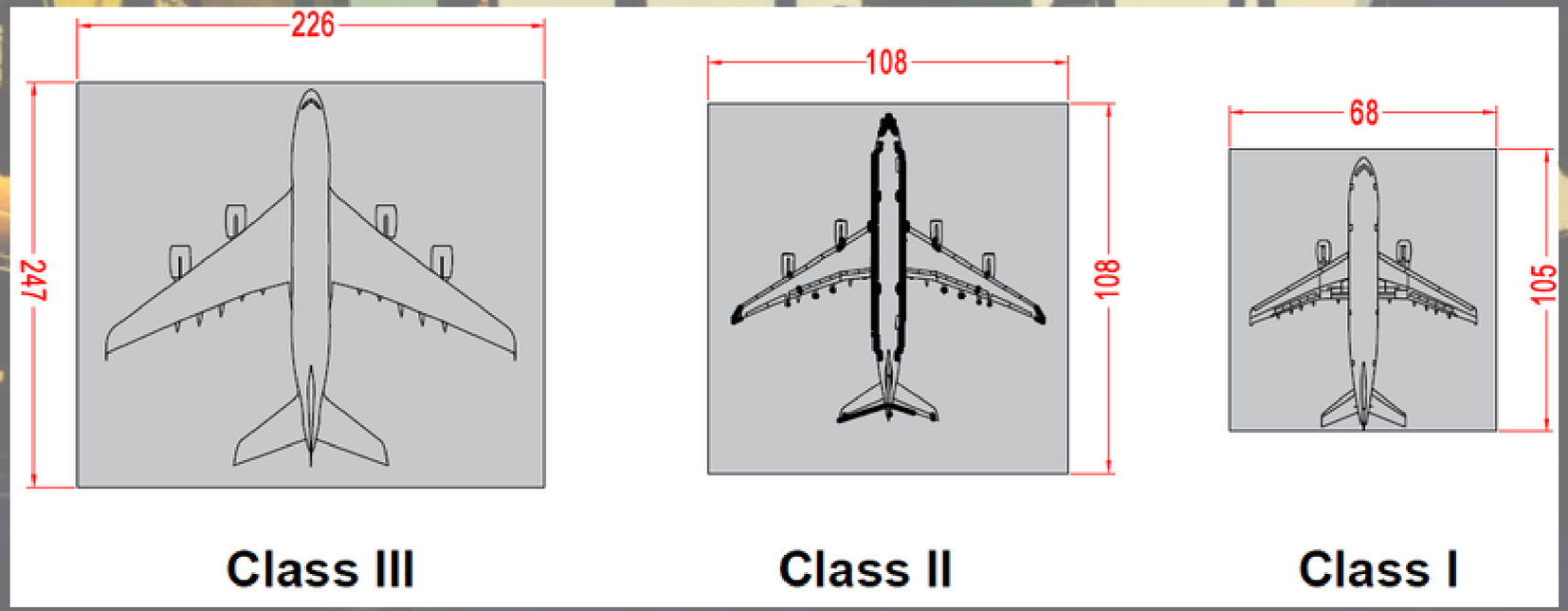
Terminal Gates :

μK NK ⩾ E (Tg) Cg → Number Of Gates : 28

Terminal Gates Dimensions

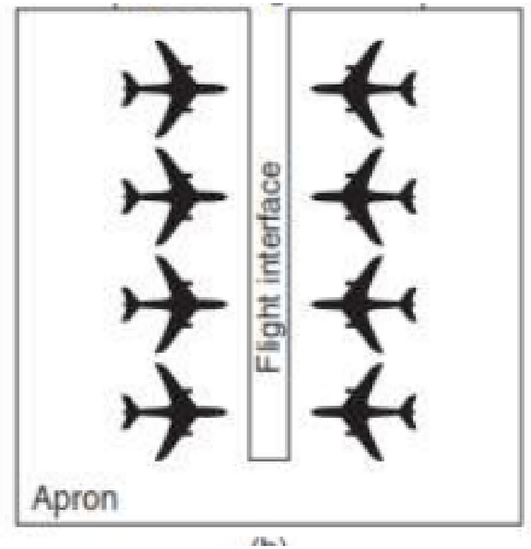
✓ Y=length of aircraft+ clearance

✓ X= (1.1*wingspan) +10

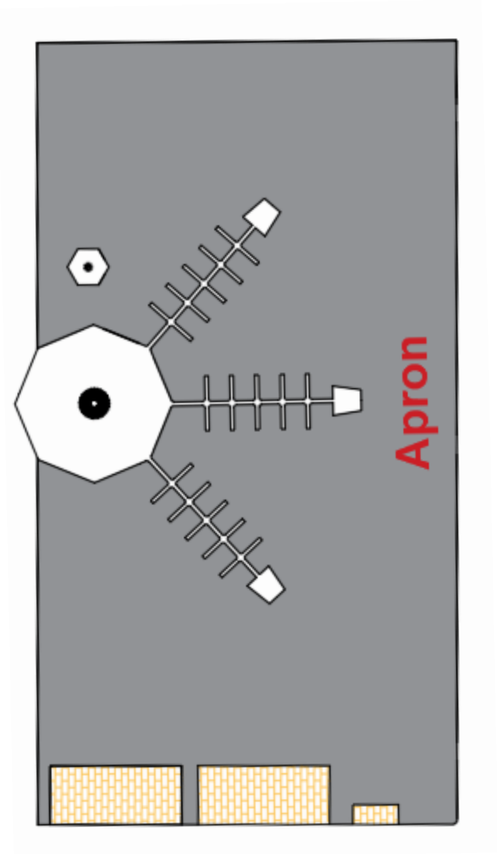


Design Of Apron

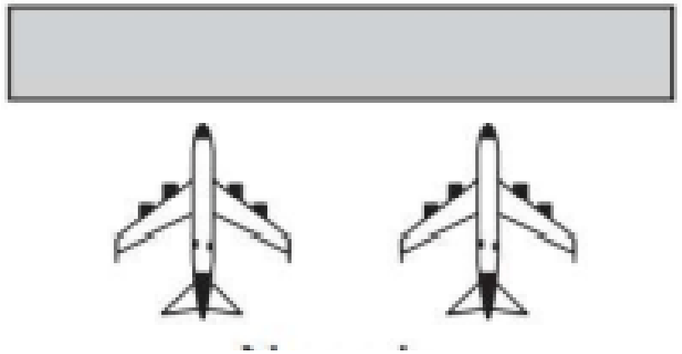
Apron Concepts



pier concept

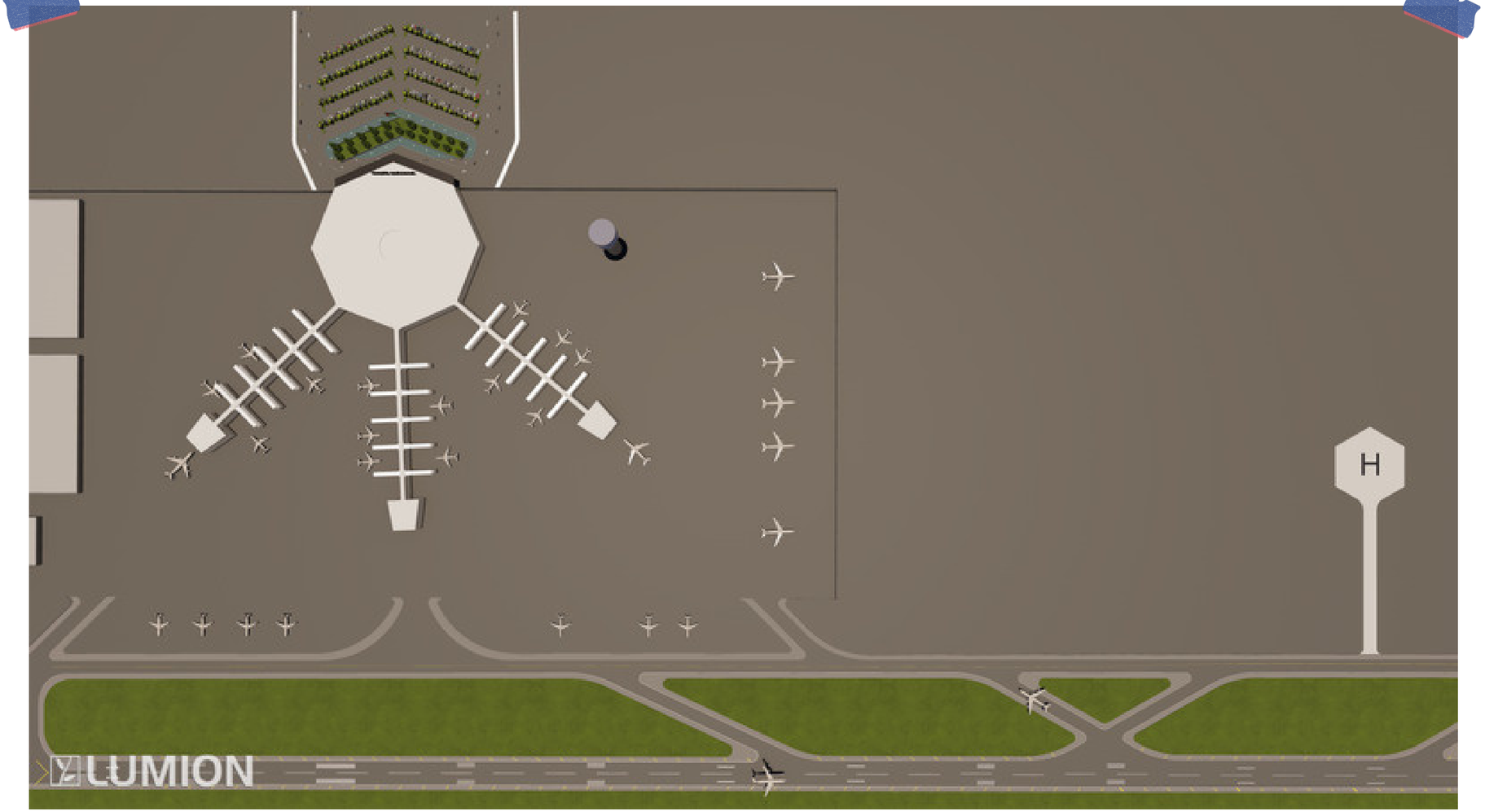


Parking Type



Nose In

Final Layout



Design Of Pavemet

Rigid Pavement

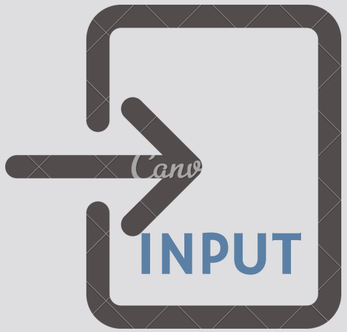
Apron Area

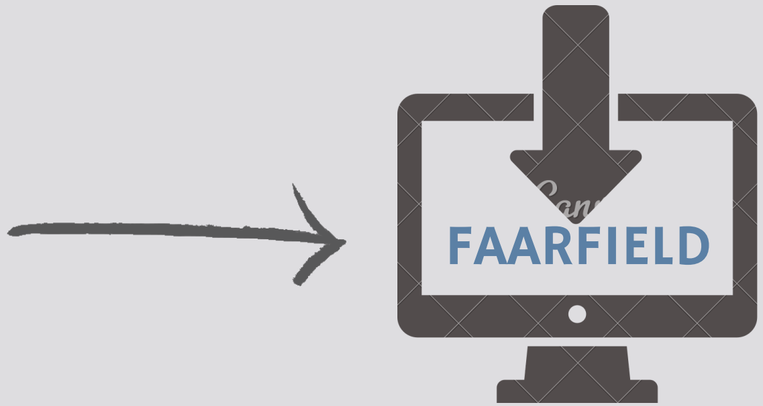
Flexible Pavement

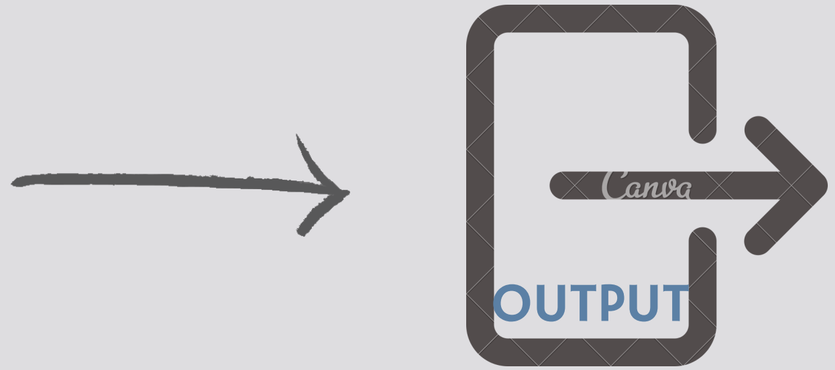
Runway
Taxiway
Exit

CBR : 7

Design of Flexible Pavement

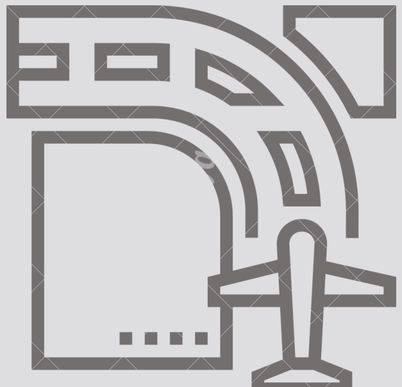






CBR Value=7

Annual Departure



Pavement structure, with total thickness of 565 mm, and design life of 20 years.

Design of Flexible Pavement

Aircraft Mix	% Aircraft	Annual Departure for each aircraft
Cessna-441	16%	7,600
Cessna-675	16%	7,600
F-28-3000	16%	7,600
ATR-72	8%	3,800
F-28-2000	8%	3,800
EMB 190-E2	8%	3,800
BAC One-Eleven 500	8%	3,800
Boeing 737-200C	4%	1,900
Boeing 737-500	8%	3,800
EMB 175-E2	8%	3,800
Total Annual Departure		47,500

INPUT

Job Name: Runway pavement

Thickness Design

Run

Section Name: New Section 1

Include in Summary Report

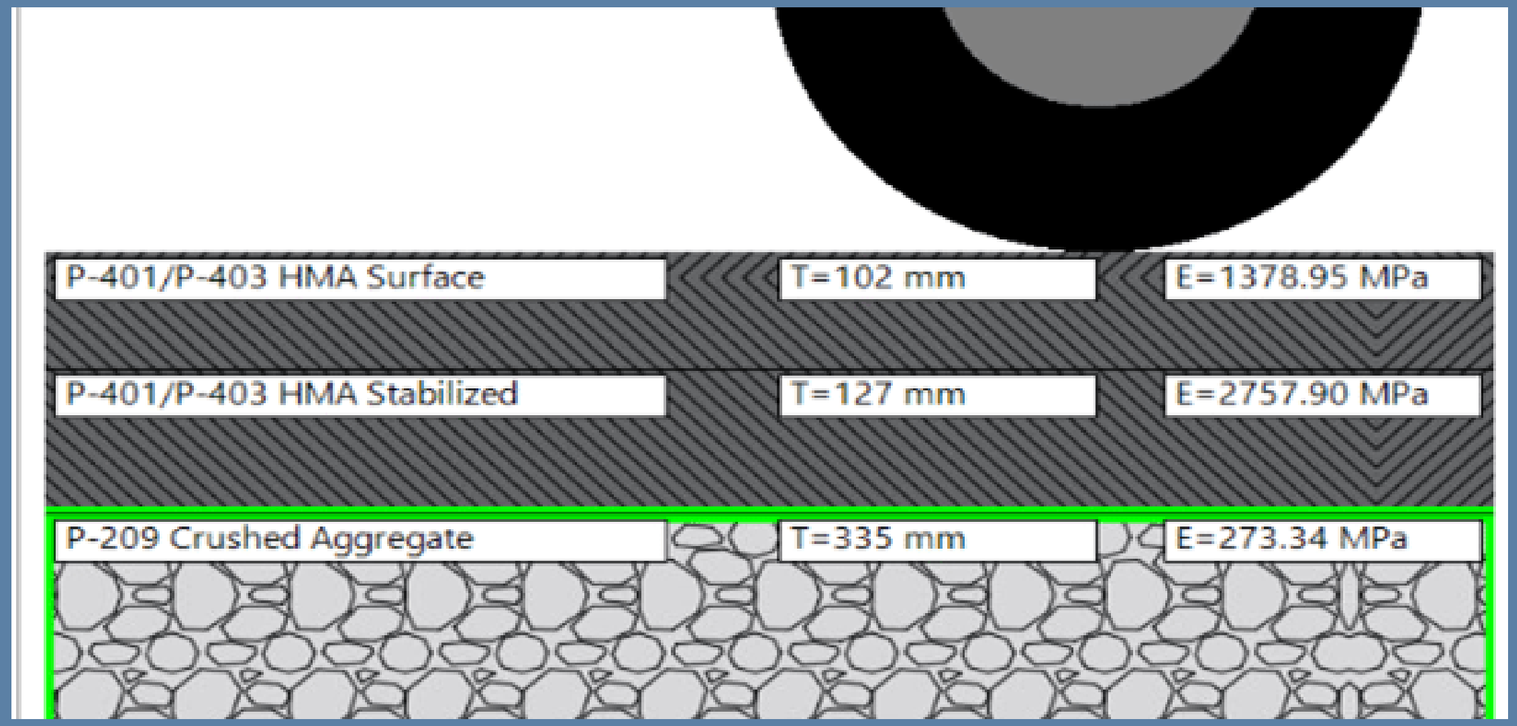
Add To Batch

Pavement Layers

Pavement Type: New Flexible

	Material	Thickness (mm)	E (MPa)	CBR
	P-401/P-403 HMA Surface	102	1378.95	
	P-401/P-403 HMA Stabilized	127	2757.90	
-->	P-209 Crushed Aggregate	335	273.34	
	Subgrade		72.39	7

Design of Flexible Pavement



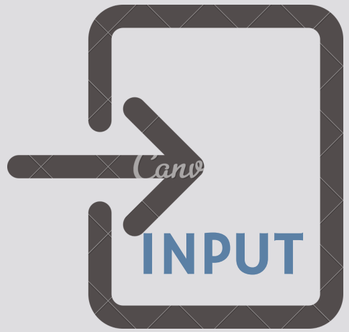
- Item P-401 is to be used as the surface course for pavements serving aircraft weighing more than 12,500 pounds (5,670 kg).

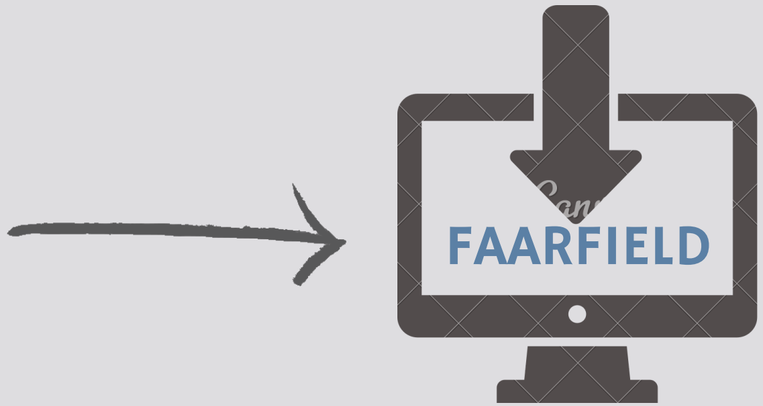
- If aircraft in the design traffic mix have gross loads of 100,000 pounds (45,359 kg) or more then the use of a stabilized base is required.

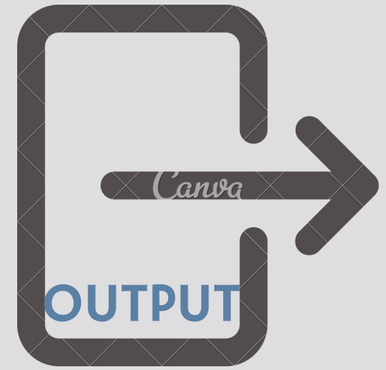
- P-209, Crushed AggregateBase Course.

OUTPUT

Design of Rigid Pavement

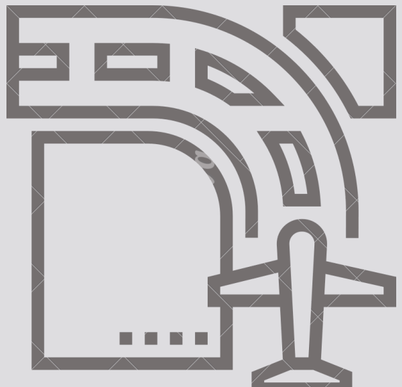






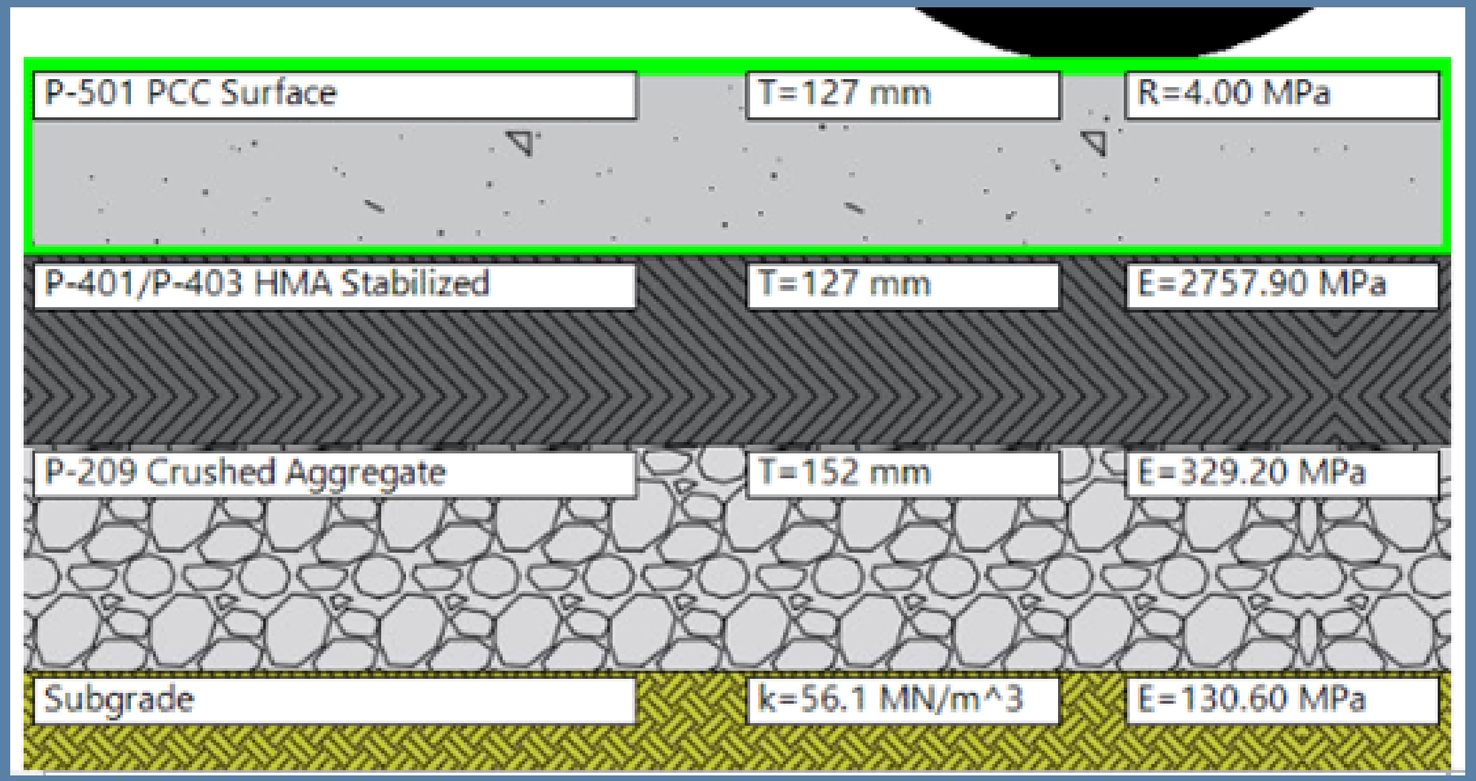
Modulus of Subgrade Reaction, K= 354.5 MN/m3

Annual Departure



Pavement structure, with total thickness of 406 mm, and design life of 20 years..

Design of Rigid Pavement



- Item P-401 is to be used as the surface course for pavements serving aircraft weighing more than 12,500 pounds (5,670 kg).

- If aircraft in the design traffic mix have gross loads of 100,000 pounds (45,359 kg) or more then the use of a stabilized base is required.

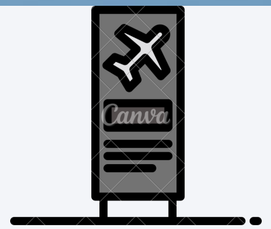
- P-209, Crushed AggregateBase Course.

OUTPUT

Airport visual Aids

Airport Ligthing

Airport Marking

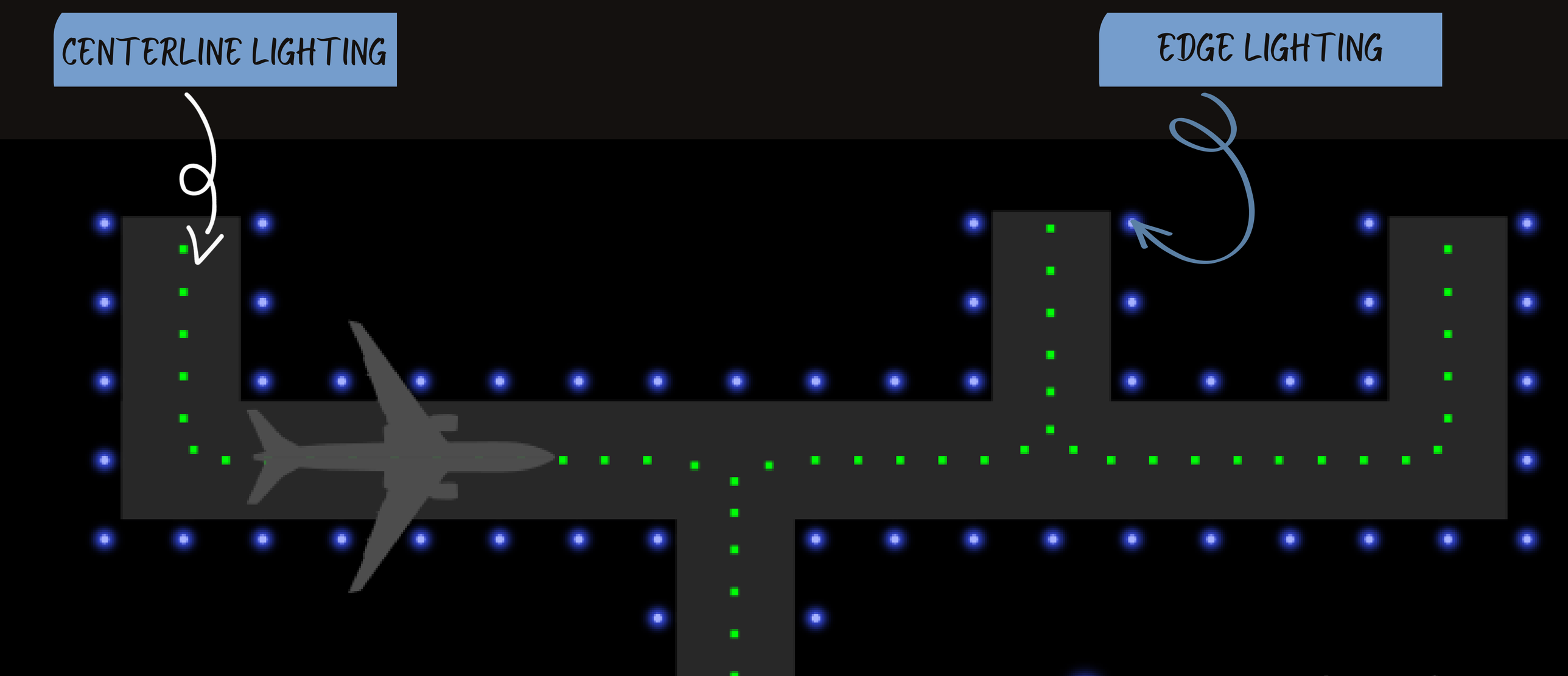


Airport Signage

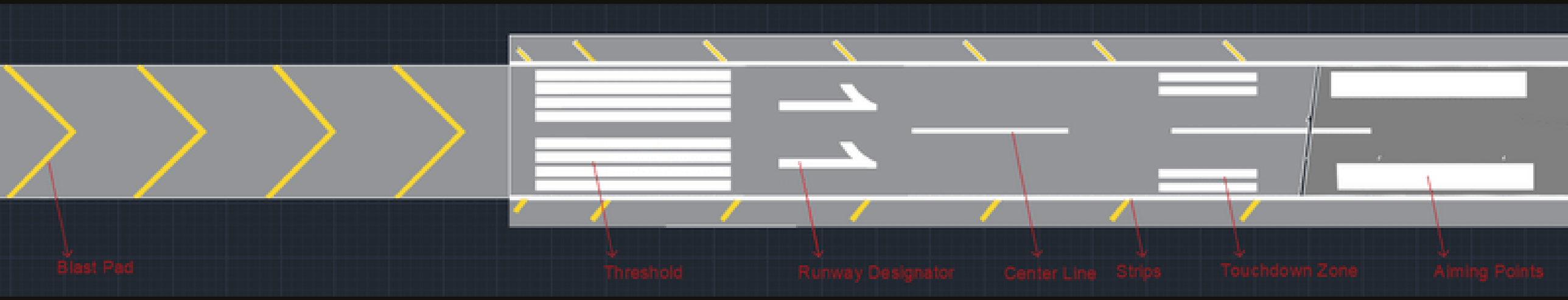

Runway Edge Lighting
Runway Lighting System
Centerline of the taxiway

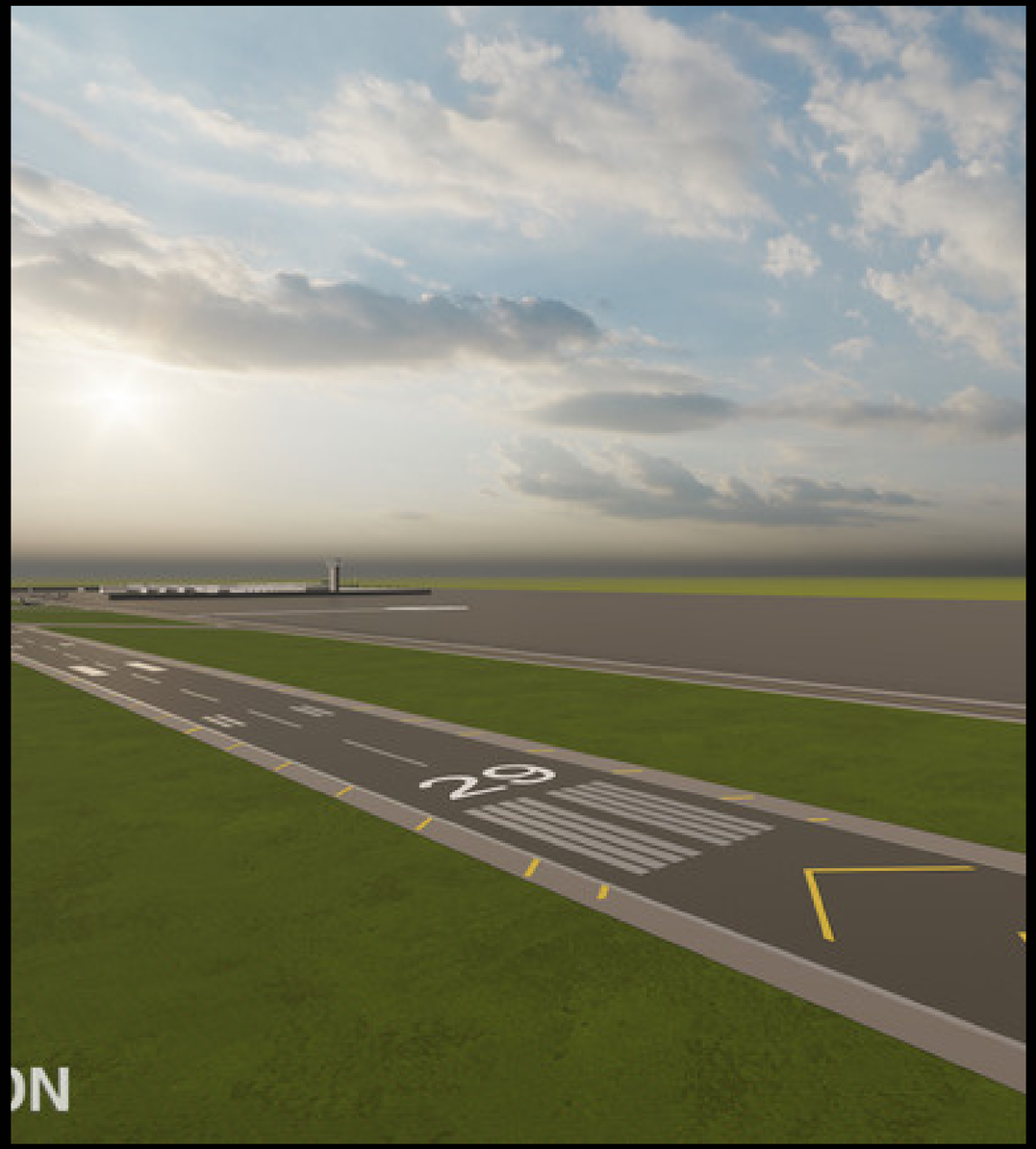

Runway End Lights
Runway Centreline Lights
Touchdown Zone Lights
Threshold Lights
Approach Lights
Taxiway Lights

Taxiway Lighting System

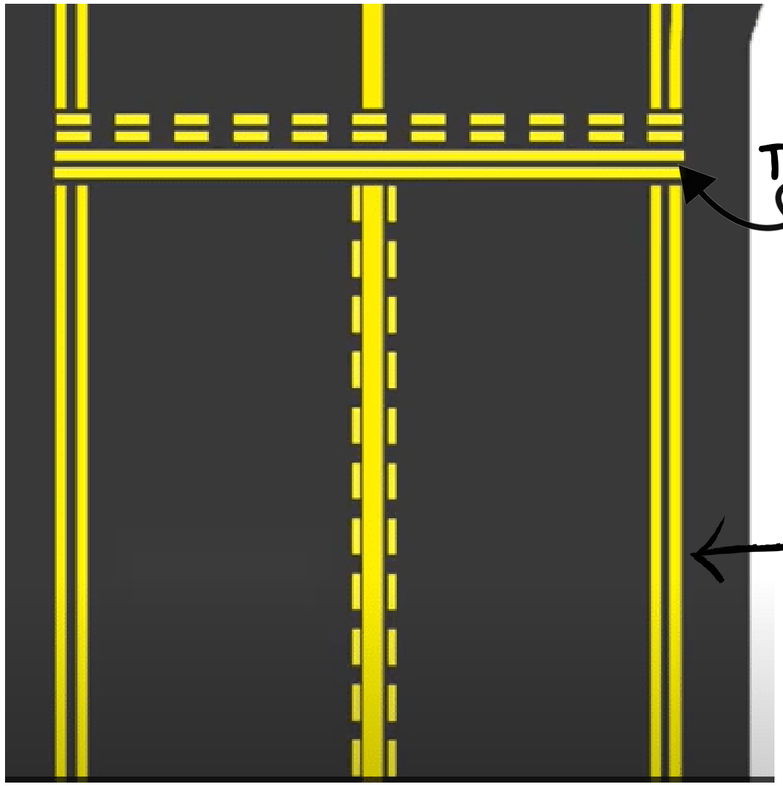


Marking Of The Runway




29
ON

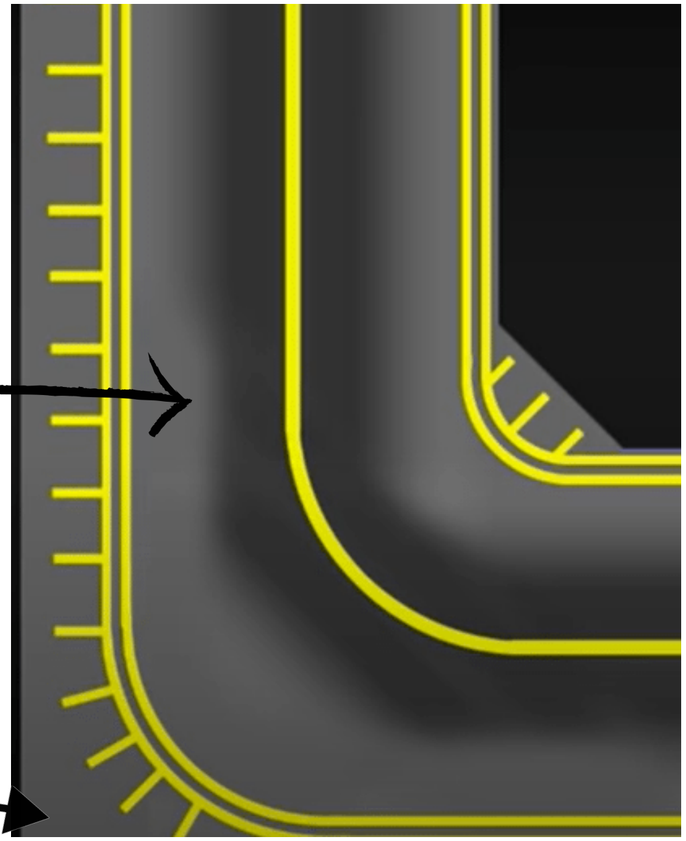
Taxiway Marking



Taxiway Hold Markings

Centerline

Edge Marking



Taxiway Shoulder Marking

Signage

Runway Distance Remaining Signs

Direction Signs

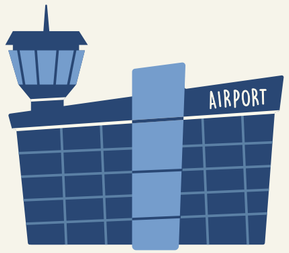
Location Signs

Destination Signs

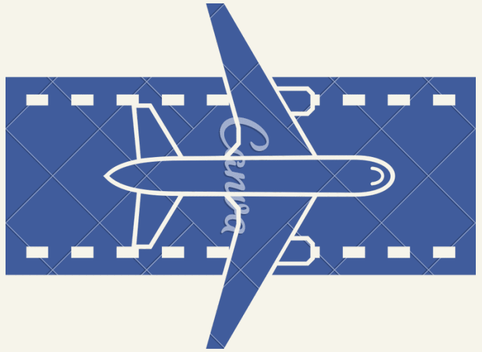
ILS Holding Position Sign

COST AND QUANTITIES ESTIMATION

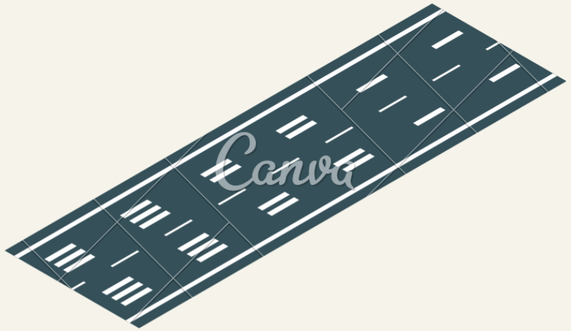
Item	Unit	Unit Cost $
Excavation (Cut)	m^3	4
Fill	m^3	6
HMA (d=25cm)	m^3	45
PCC (d = 35cm)	m^2	171
Base Course(15cm)	m^3	40
Terminal Building	m^2	800



Terminal Building
28,591,200$



Taxiway
1,986,000$



Runway
4,407,067$

Apron Area
35,404,204$

TOTAL

70,388,471$


Jerusalem Airport
LUMION