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Cloncurry Airport Concept Design

Concept Design Report

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Cloncurry Airport Concept Design
Concept Design Report

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Description	**Concept Design Report**

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Contents

Executive Summary

Cloncurry Shire Council has received financial aid from the *Preparing Australian Communities Program* for the development of a Master Plan and subsequent Concept Design for Cloncurry Airport.

At present, Cloncurry Airport primarily caters to passenger traffic largely for the mining industry, General Aviation (GA) traffic including recreational flying and traffic for the mustering industry. Although the current traffic at Cloncurry is deemed as low, the airport has ample growth opportunities given its unique location along with the existence of two cross runways. Growth sectors include but are not limited to chartered flights, Unmanned Aerial Systems (UASs), freight and GA.

However, this *lifeline* to the town of Cloncurry is currently facing a number of infrastructure issues i.e., deteriorating pavements, site-wide flooding, and an unreliable electrical system.

Ramboll has been engaged as a *Consultant* by Cloncurry Shire Council to assist in:

- Preparation of a 20-year *Master Plan*, where three scenarios were developed and evaluated using a multi-criteria analysis.
- *Concept Design* development, which includes rehabilitation works for the existing infrastructure and design advancement of the new on-site infrastructure envisioned as part of the 20-year master plan. The key infrastructure items include:
    - Aircraft pavements – geometric and pavement design
    - Airside and landside drainage infrastructure
    - Aerodrome visual and navigational aids, including lighting
    - Airfield pavement paint markings

As part of this concept design, the main change to the infrastructure layout has been the new GA area, keeping in line with the expected growth in this sector. This has namely been a new apron and new hangar facilities along with a system of taxiways and taxilanes to connect the infrastructure to the runway and other existing infrastructure. With the key issues on-site being deteriorating pavement and site-wide flooding, rehabilitation of existing pavements and upgrading the drainage to be flood resilient has been the majority of the design work undertaken. Further to this, design of AGL, floodlighting and paint markings have also been undertaken to ensure compliance with *Civil Aviation Safety Authority (CASA) – Part 139 (Aerodromes) Manual of Standards 2019.*

Moreover, an investment budget estimate has been prepared to reflect the CAPEX associated to the infrastructure design development as per the scope of this concept design.

The overall purpose of the concept design is to develop the design to a level such that it can be used as the basis for further development as a detailed design package of work or for design and build (EPC) subject to the preferences of Cloncurry Shire Council.

1. Introduction

Ramboll has been engaged as a *Consultant* by Cloncurry Shire Council for the ***Cloncurry Airport – Master Plan and Concept Design*** project.

1.1 Purpose

This report has been prepared to document the changes proposed to be made to the infrastructure at Cloncurry Airport, as part of WP4 Concept Design. This design package includes the design for the rehabilitation of deteriorating/ non-compliant infrastructure as well as the development of design for new infrastructure which would primarily support the predicted growth in the GA sector at the airport.

1.2 Scope of Work

The Concept Design of Cloncurry Airport focuses on the following disciplines:

- Geometric Design
- Pavement Design
- Drainage Design
- Visual and Navigational Aids (Navaids) Design (including lighting)
- Pavement Paint Markings

Additionally, based on this design an indicative cost estimate (+/- 40%) has been prepared.

1.3 Background Information

The general information basis to the concept design has been the preceding work packages within the project which include the following:

- WP1 – Airport Compliance Assessment based on visual site inspection and stakeholder interviews/ consultations.
- WP2 – On-Site Investigations, including topographical survey, pavement & geotechnical investigations.
- WP3 – Project Assessment Framework which involved the preparation of a 20-year Master Plan, where three scenarios were developed, and one chosen via a multi-criterion analysis.

1.4 Design Development

In the chapters that follow, the development of the design for the disciplines mentioned in Section 1.2 has been elaborated on. Each discipline expands upon the design development of various infrastructure elements from the existing infrastructure to the new and improved infrastructure, along with the basis, limitations and assumptions followed for design.

The general layout of the existing infrastructure is shown in Figure 1, whereas the layout of the new and improved infrastructure is shown in Figure 2. The major difference in the layout is the development of new GA infrastructure, namely a new apron and new hangar facilities along with a system of taxiways and taxilanes to connect the infrastructure to the runway and other existing infrastructure.

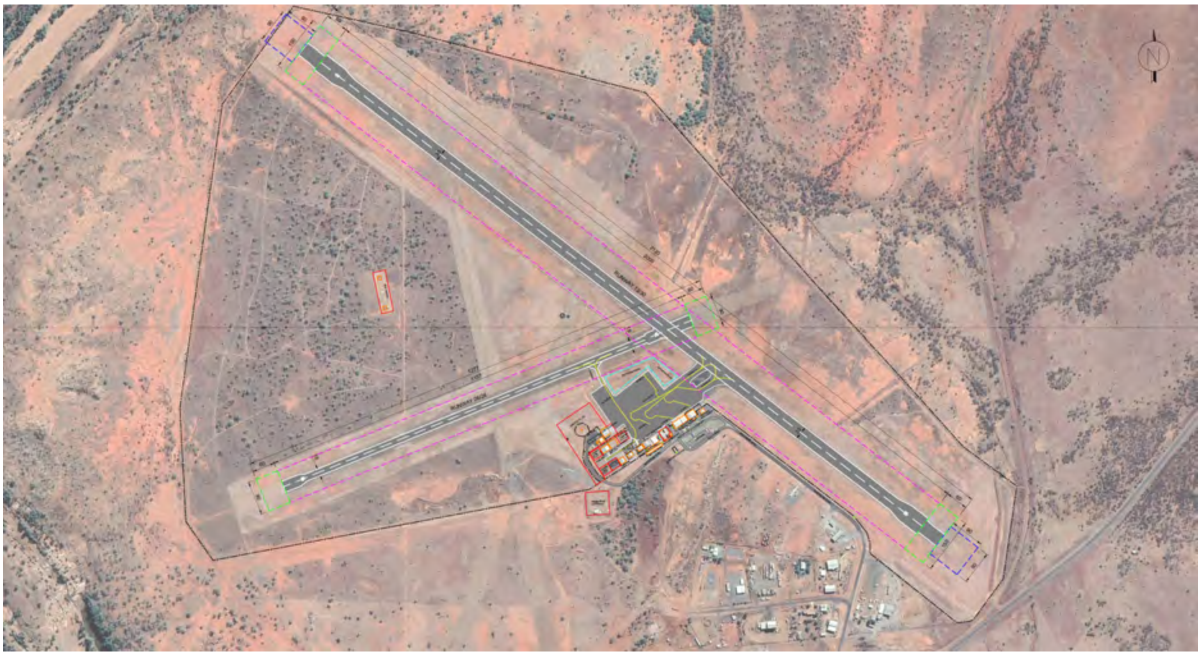

Figure 1 Existing Infrastructure Layout

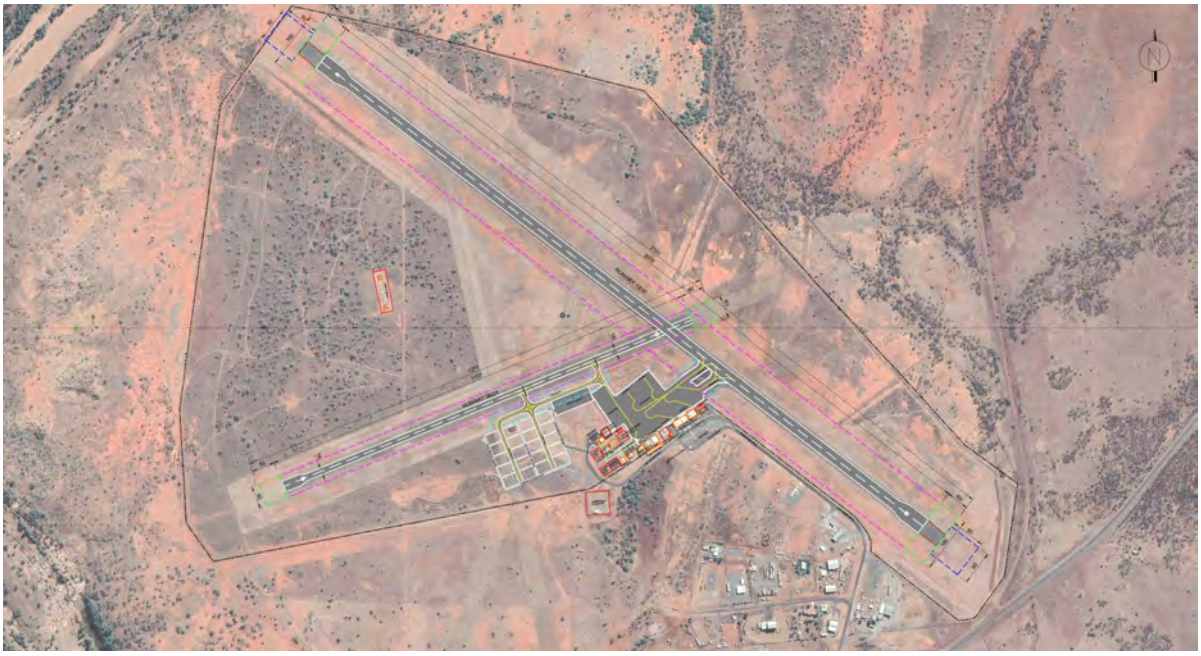

Figure 2 New and Improved Infrastructure Layout

For reference to the various airside components, the existing infrastructure drawings *CNJ-CD-GL-DW-1-100* and *CNJ-CD-GL-DW-1-111* can be found in Appendix 1. The general arrangement drawings *CNJ-CD-GM-DW-1-100* and *CNJ-CD-GM-DW-1-111* can be found in Appendix 2.

2. Geometric Design

2.1 Background Information

The following is the information basis for the geometrical design:

- **Topographical Survey** conducted as part of the on-site investigations, which shows the extent and the levels of the on-site infrastructure as well as the surrounding terrain.
- **Master Plan Report and Drawings** providing an abstract layout to guide the future growth and development of on-site infrastructure.

2.2 Assumptions and Limitations

One of the primary limitations of the design has been the on-site existing terrain level. In response to this the grading of the new airside elements such as taxiways, aprons etc. have been such that the longitudinal and/or transverse slopes follow the natural gradient of the ground, to the extent possible given the requirements of aviation design standards, to minimise the cut and fill earthwork quantities required, whilst ensuring proper drainage.

2.3 Design Standards

The design standards followed are:

- *Civil Aviation Safety Authority (CASA) – Part 139 (Aerodromes) Manual of Standards 2019.*
- *ICAO Annex 14 Aerodromes – Volume I Aerodrome Design and Operations (to be used where referred to in CASA Part 139 MoS and/or where clear guidance is not provided in CASA Part 139 MoS)*
- *ICAO Document 9157, Aerodrome Design Manual, Part 1 - Runways*
- *ICAO Document 9157, Aerodrome Design Manual, Part 2 – Taxiways and Aprons*

2.4 Design Aircraft Types

The design of the different airside components is dependent on the aircraft types they would cater to at present and in the future. There are two groups of design aircraft types, dependent on the traffic segment. They are as follows:

- General Aviation (GA) Traffic
    - Code A aircraft types (e.g., Cessna 172, Piper Seneca, etc.)
    - Small to medium sized Code B aircraft types (future)
- Passenger Traffic
    - Code C aircraft types
        - Dash-8 Q400
        - Embraer 190
        - Fokker 70
        - Fokker 100
        - Airbus 320 (future)
        - Boeing 737-800/ MAX (future)

2.5 Horizontal Geometry Design

This section elaborates upon the design development of the horizontal geometry for the various existing and new airside infrastructure elements. The general layout of the focal area for the existing infrastructure is shown in Figure 3, whereas the layout of the core area for the new and improved infrastructure is shown in Figure 4.

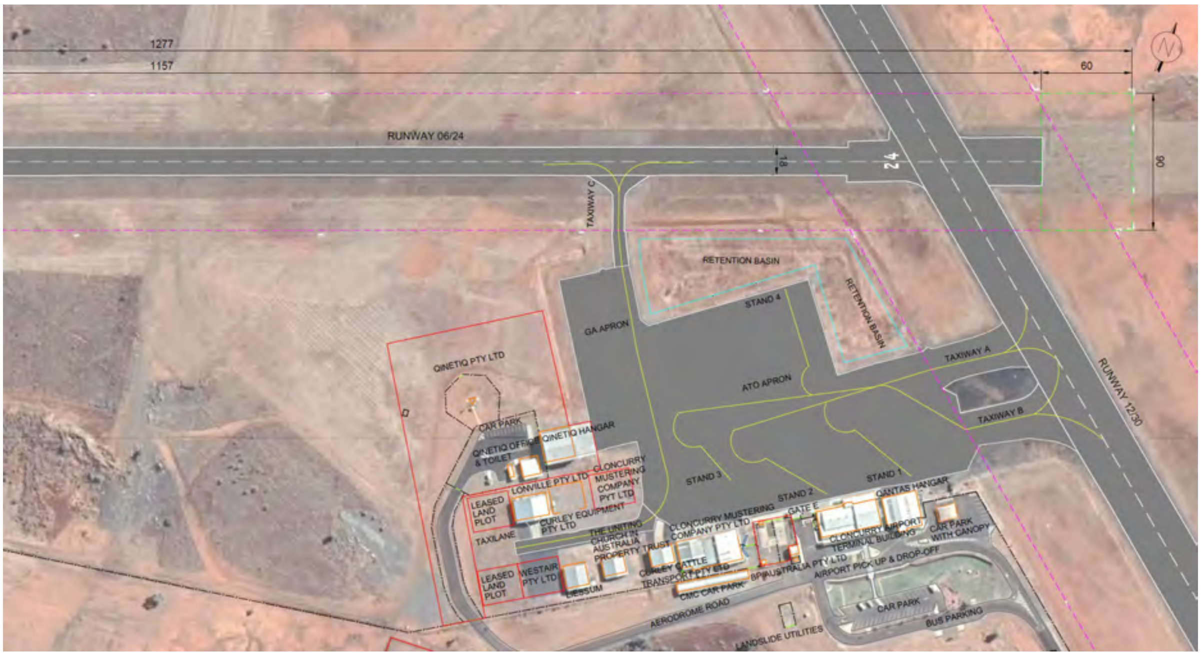

Figure 3 Existing Infrastructure Layout (Focal Area)

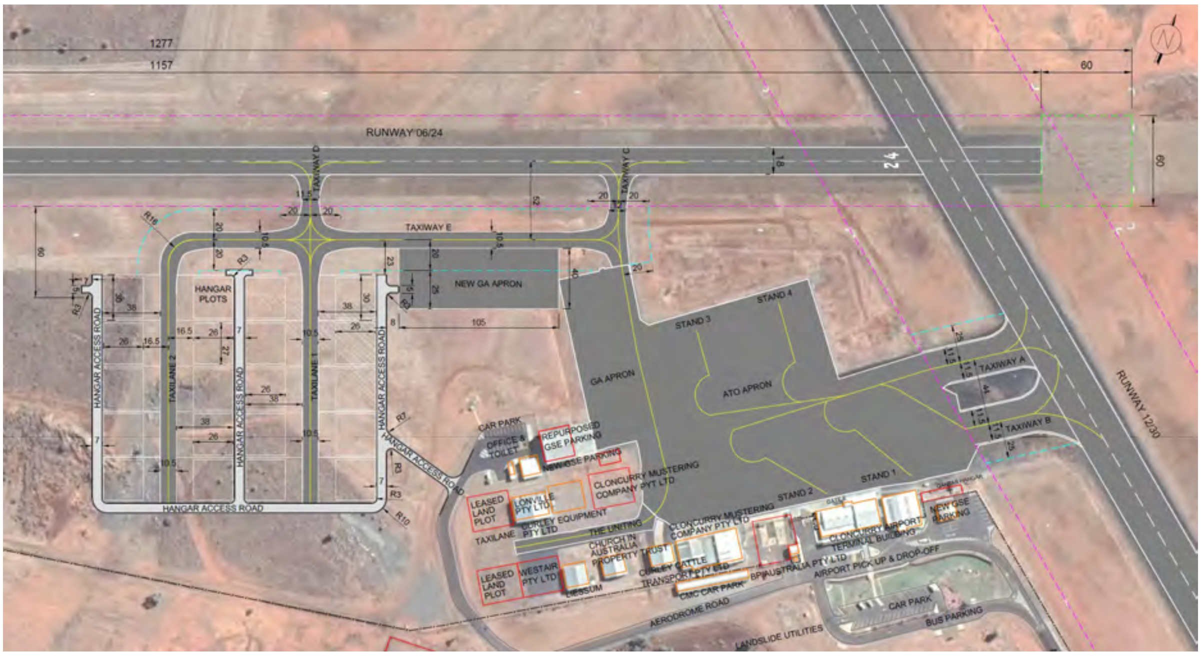

Figure 4 New and Improved Infrastructure Layout (Focal Area)

2.5.1 Existing Infrastructure

Runways – Primary Runway 12/30 & Secondary Runway 06/24

The primary runway, RWY 12/30 - 2,000m x 30m - at Cloncurry airport is classified as Code 3C, where the design aircraft types are Code C passenger aircraft. The secondary runway, RWY 06/24 – 1,157m x 18m – is classified as Code 1B and caters to Code A and small-to-medium sized Code

B GA aircraft. The dimensions and the category of both, RWY 12/30 and RWY 06/24 have been retained as part of this design as the length and width of the runways are adequate as per the design standards[1] for the expected traffic segment. Additionally, the size of the turn pads on both the runways are maintained, as they too are sufficient for the expected traffic.

Along the length of RWY 12/30, there exists additional pavement of approximately 3m width on each side. This excess paved area is not required and amounts to about 10,000 sqm. To eliminate the CAPEX and OPEX associated to retaining non-essential pavement, this has been excluded. It is proposed to remove the extra pavement by milling off the surface layer and then covering the area with grass to avoid the risk of Foreign Object Debris (FOD) on airside.

Similarly, for RWY 06/24, there exists a considerable area of excess pavement where this runway meets the main runway. For reasons stated above, this additional pavement is also excluded and proposed to be removed.

Runway Strips – Primary Runway 12/30 & Secondary Runway 06/24

For RWY 12/30, the existing total runway strip width of 150m is to be maintained instead of any modification for achieving compliance as Cloncurry Airport already holds a dispensation from CASA for the same and any modification would require major infrastructure changes which are not deemed feasible.

For RWY 06/24, the total runway strip width is to be reduced from 90m to the minimum requirement of 60m. Doing so, would significantly reduce the runway strip area that needs to be graded and maintained. Additionally, as the Obstacle Limitation Surfaces (OLS) of a runway is associated to the edge of the runway strip, reduction in runway strip width would lessen the expanse of the OLS thereby making the airspace less restrictive. This is particularly beneficial to avoid penetration of the OLS by the apron flood lights.

Taxiway Widths – Taxiway A & B

At present, existing TWY A and TWY B have been classified as Code C and Code D taxiways respectively. Given that the design aircraft types are limited to Code C aircraft, TWY B is reclassified as a Code C taxiway. The dimensions of both taxiways are adjusted, so as to maintain the minimum width of the straight portion as 23m and the minimum width with the shoulder as 25m.

Taxiway Width – Taxiway C

Currently, TWY C is classified as a Code A taxiway used by GA aircraft only. In the future with the expected growth in GA traffic, Cloncurry Airport is expected to witness Code B GA aircraft operations as well. Therefore, the GA infrastructure needs to be upgraded from Code A to Code B. In line with the afore mentioned, the width of TWY C is expanded from 7.5m to 10.5 m.

Taxiway Fillets – Taxiway A, B & C

To maintain the taxiway edge safety margin on taxiway curves and intersections, the taxiway pavement fillet design has been undertaken using Transoft's AviPLAN Airside Pro 4. For TWY A and TWY B intersection with RWY 12/30 it is observed that the fillets need a slight expansion to accommodate the aircraft turns while maintain the edge safety margin for the design Code C aircraft types. TWY C width expansion would be supplemented with fillet design for where this taxiway

[1] CASA has accepted advice from Transport Canada that the Dash-8 400 series aircraft is certified to operate fro2m a standard ICAO 3C category aerodrome which consists for a 30m wide runway.

connects to a runway, other taxiways, and aprons, where small-to-medium sized Code B aircraft types have been considered for design.

Apron – ATO Apron Stands Reconfiguration

Although the existing ATO Apron is large enough to accommodate parking four Code C aircraft simultaneously, it is rarely executed due to the peculiar placements and orientation of the different stands. Figure 5 below indicates the ATO Apron stands layout as it is on-site today, along with the aircraft safety clearance required at each stand.

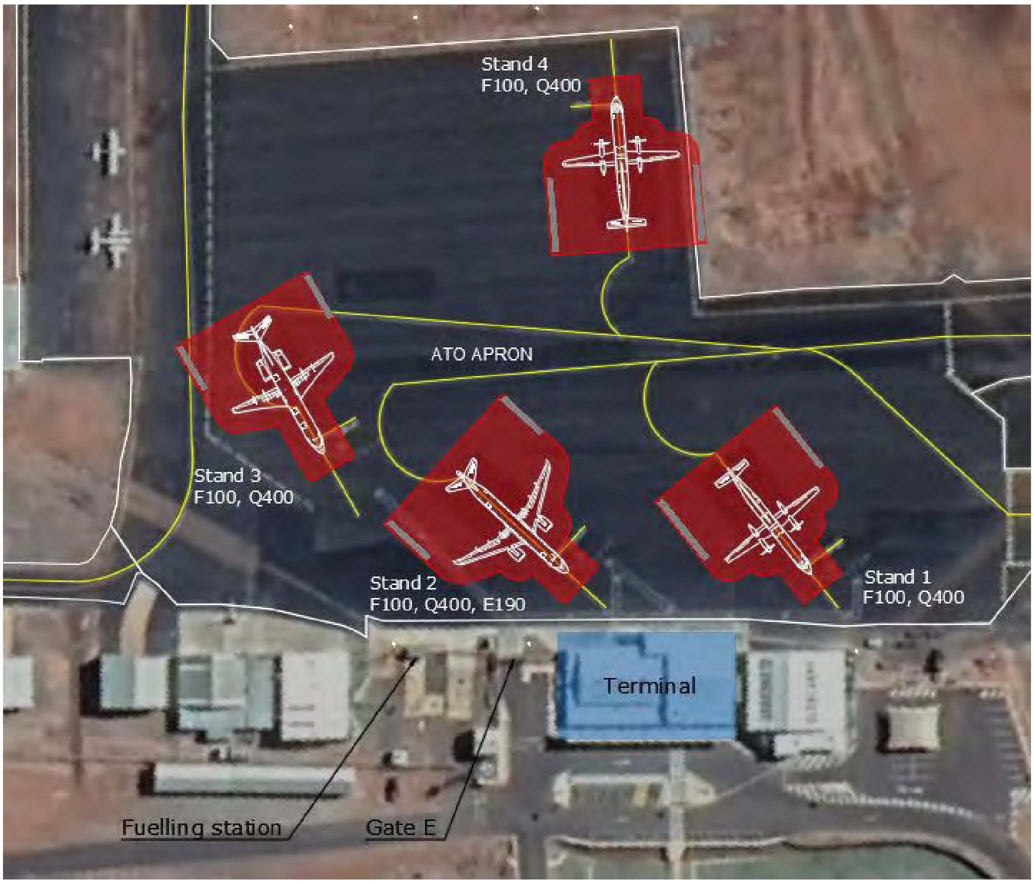

Figure 5 Existing ATO Apron Stands Configuration

While Stand 3 has sufficient aircraft clearance from adjacent Stand 2, it is almost never used (especially when Stand 2 is occupied) due to the pilot’s perceived impression of limited clearance. Moreover, if Stand 3 is in use, the parked aircraft makes it challenging for the GA aircraft to taxi along the GA Hangar Taxiway (in the North-South direction) to access the Fuel Station. On the other hand, Stand 4 does not have enough clearance from the edge of the pavement towards the east for service vehicles to get around.

Given the ample unused area to the northern side of the ATO Apron, Stand 3 has been relocated here. Additionally, Stand 4 has been shifted westwards towards the new Stand 3 position to accommodate a service passage on the eastern side. The new stands configuration is illustrated in Figure 6 below.

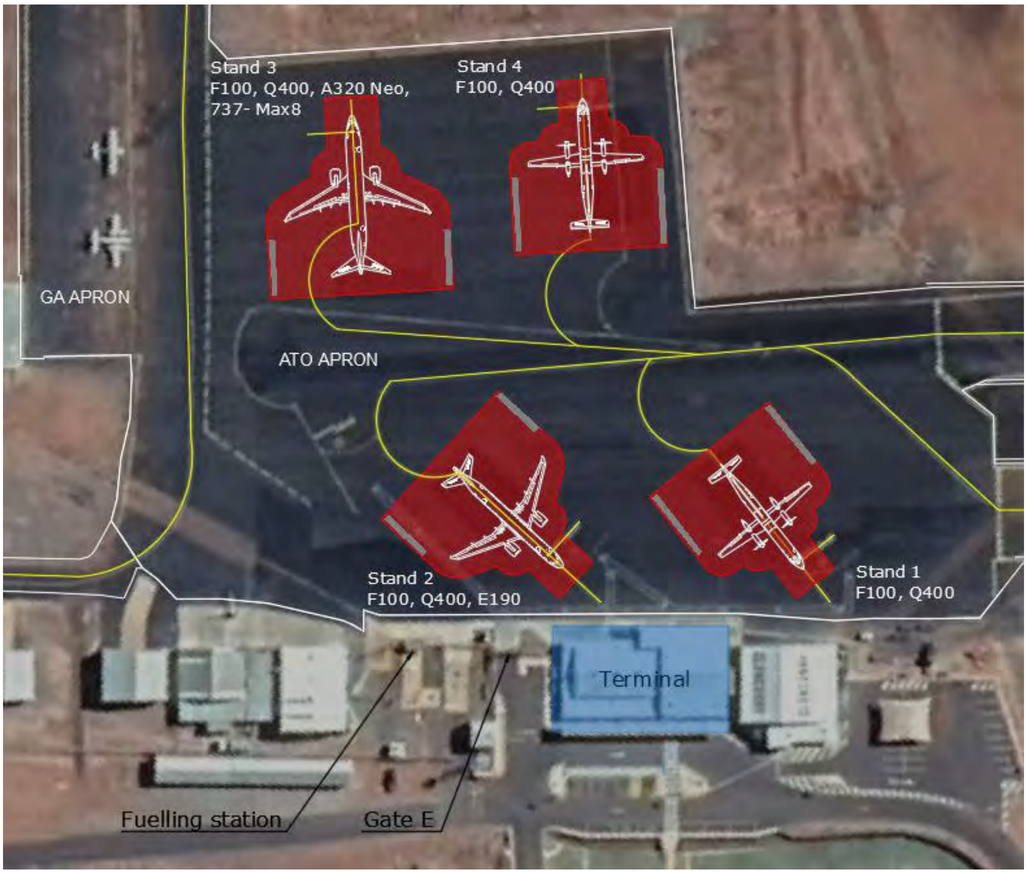

Figure 6 New ATO Apron Stands Configuration

No changes have been made to the location of Stand 1 & Stand 2, as the angled orientation ensures sufficient clearance from taxiing aircraft at the back of stand and the aircraft tail being under the OLS levels.

When designing the placement of the different stands the following aircraft parking clearances and minimum separation distances have been observed:

- Aircraft stand clearance of 4.5m for Code C aircraft types (Clause 6.58)
- Taxilane centreline to object clearance of 16.5m for Code B aircraft types using GA Hangar Taxiway (Clause 6.53)
- Taxilane centreline to object clearance of 22.5m for Code C aircraft types using ATO Apron Taxilanes (Clause 6.53)

Furthermore, to safeguard that the aircraft movements on the ATO Apron can continue as per the operations today, aircraft simulations were carried out in Transoft's AviPLAN Airside Pro 4. The taxi-in and taxi-out aircraft simulations for each stand ensures adequate separation distances to be maintained at all times between the moving aircraft and, any parked aircraft or any fixed objects such as high mast lights. It should be noted that when an aircraft taxi's out from Stand 3 and Stand 4, the aircraft shall be making a complete U-turn before taxiing out of the ATO Apron.

Table 1 tabulates the changes that have been made to the layout of the existing infrastructure in accordance with the relevant CASA clauses as part of this concept design.

Table 1 Existing Infrastructure Layout Changes

Design Element	Infrastructure	Existing Dimensions	New Dimensions	CASA MoS Part 139
Runway Strip Width	Runway 06/24	90m	60m	Clause 6.17
Taxiway Width	Taxiway A Taxiway B Taxiway C	21m 23m 7.m	23m 23m 10.5m	Clause 6.37
Taxiway Width with Shoulder	Taxiway A Taxiway B	27m 29m	25m 25m	Clause 6.45

2.5.2 New Infrastructure

Taxiway and Taxilane Widths – Taxiway D & E; Taxilane 1 & 2

The new taxiways and taxilanes are designed such as to provide connections between the existing and the new GA infrastructure and facilities. It entails connecting RWY 06/24, TWY C, GA Apron, New GA Apron, Hangar Plots and Fuel Station, to each other, while ensuring that the minimum clearance distances are maintained. Figure 7 below illustrates these connections.

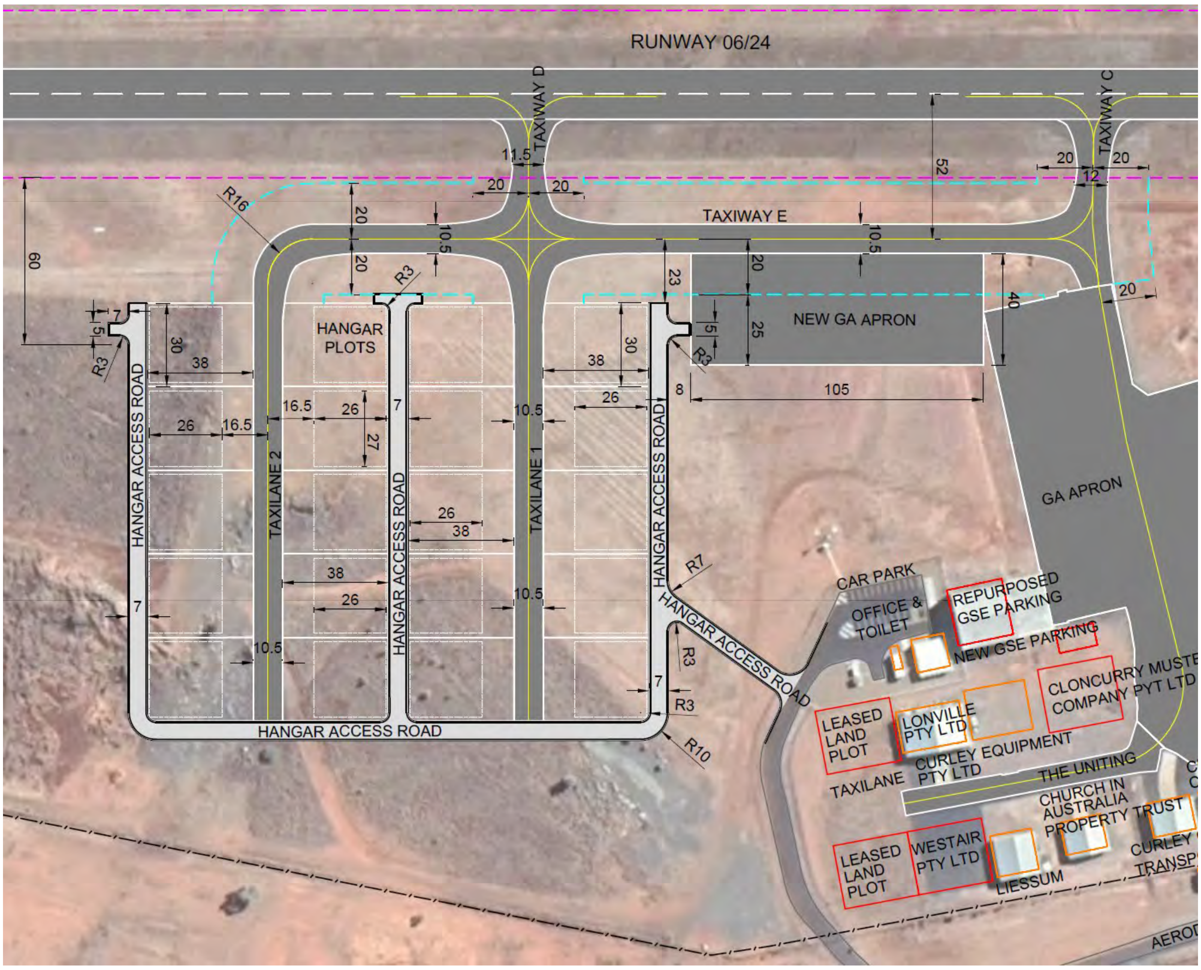

Figure 7 Existing and New GA Infrastructure

As these taxiways and taxilanes are dedicated to GA traffic use, they have been classified as Code B and have a minimum width of 10.5m in the straight portions.

Taxiway and Taxilane Fillets - Taxiway D & E; Taxilane 1 & 2

Just as for the existing taxiways, to maintain the taxiway edge safety margin on taxiway curves and intersections, the taxiway pavement fillet design has been undertaken using Transoft's AviPLAN Airside Pro 4, where small-to-medium sized Code B aircraft types have been considered for design.

Apron – New GA Apron

As shown in Figure 7, the New GA Apron has been placed adjacent to TWY E for easy access by an aircraft along the length of the new apron. This apron is designed to be 105m x 40m. The frontage of 105m allows for 6-8 Code A and small-to-medium Code B to be parked. The depth of 40m is accommodating of small to medium sized Code B aircraft types, which could be parked straight or skewed to maintain the required 20m clearance from TWY E centreline to object.

Hangar Plots

Based on the predicted GA traffic growth and demand of hangar facilities at Cloncurry Airport, 20 Hangar Plots have been placed on site. As illustrated in Figure 7, 10 Hangar Plots are serviced by a single taxilane, with 5 plots on each side of this taxilane. Each Hangar Plot is dimensioned to be 38m x 30m, which ensures that a hangar big enough to house an aircraft up to 24m long and 24 m wide can be built while maintaining a clearance of minimum 16.5 m from taxilane centreline to the assumed edge of the hangar building.

Furthermore, the placement of the Hangar Plots closest to RWY 06/24 considers the OLS levels. The maximum height of the hangar building is envisaged as 10m at the highest point of the roof ridge which is assumed to align with the centre of the Hangar Plot. This could easily house an aircraft with a tail heigh of up to 8m. This height does not interfere with the OLS when the first hangar building's assumed centre is placed at a distance of 60m from edge of the strip for RWY 06/24.

Hangar Access Roads

Hangar Access Roads are an extension of the existing airside access road. These roads have been planned to allow future GA Hangar Users to access the back of hangars. These roads are designed to have two lanes, with a total width of 7m. Additionally, the road's turning radii and hammer head dimensions are a result of vehicle simulations and follow the vehicle manoeuvring requirements. An SUV such as a Toyota Landcruiser Amazon has been used for the simulations.

Table 2 tabulates the layout design of the new infrastructure in accordance with the relevant CASA clauses as part of this concept design.

Table 2 New Infrastructure Layout

Design Element	Infrastructure	New Dimensions	CASA MoS Part 139
Taxiway/ Taxilane Width	Taxiway D Taxiway E Taxilane 1 Taxilane 2	10.5m 10.5m 10.5m 10.5m	Clause 6.37

2.6 Vertical Geometry Design

This section expands upon the design approach to the vertical geometry of the various airside infrastructure element.

As the scope of the project includes the rehabilitation of existing airside pavements, the existing pavement levels and site conditions have been used as a basis as well as a constraint for design. The existing final pavement/ ground levels have been retained to the extent possible and only changed where necessary to achieving complaint slopes and ensuring proper drainage.

For new airside infrastructure, the slopes have been designed so as to follow the natural gradient of the ground, to the extent possible given the requirements of aviation design standards, to minimise the cut and fill earthwork quantities required, whilst ensuring proper drainage.

The overall proposed levels on-site can be seen in greater details in the general levels plan *CNJ-CD-GM-DW-2-100*, which can also be found in Appendix 3

Runway 12/30

The longitudinal slopes for the rehabilitated RWY 12/30 are designed to match the existing runway's longitudinal slope as they are compliant as per CASA standards and they do not inhibit the flow of surface runoff away from the runway. Between the threshold-to-threshold limit, the maximum longitudinal slope has been maintained as 0.53% while the minimum has been maintained as 0.00% at the taxiway intersections. Beyond the threshold limits at the jet blast pad, the longitudinal slopes are maintained at 0.49% and 0.86%. The distance between the point of intersection of two successive longitudinal slope changes have been achieved as a minimum of 45m by obtaining the sum of the absolute numerical values of the corresponding slope changes multiplied by 15,000m or 45m, whichever is greater. Also, the transition of one slope to another has been accomplished by introducing a curve with a minimum radius of 15,000m. Figure 8 below shows the longitudinal profile of the main runway between st. 300.000m and 680.000m, where the design level closely follows the ground level.

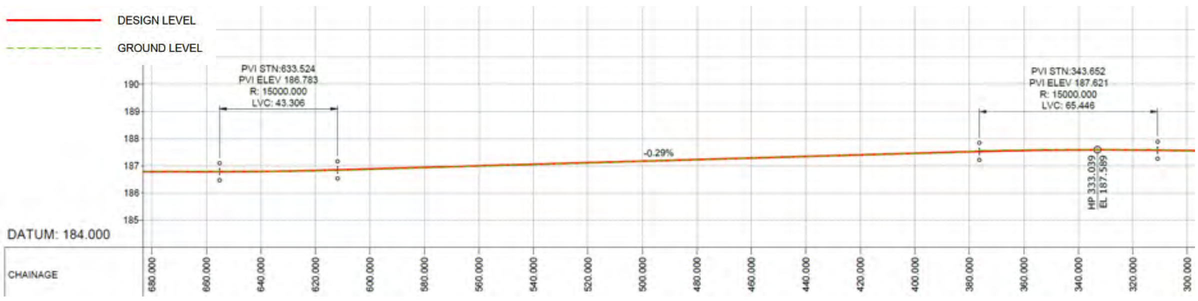

Figure 8 Runway 12/30 Longitudinal Profile (st. 300.000m - 680.000m)

Furthermore, the transverse slopes for the runway and runway strip have been maintained to match the existing slopes except for a few locations on the runway and strip to the west of the centreline. Where the runway and strip is observed to have a transverse slope of less than 0.3%, it has been graded to have a minimum transverse slope of 0.3% to facilitate proper drainage.

The main runway strip has been designed such as to minimise the change in ground level but ensuring proper drainage. A maximum longitudinal slope of 0.86% and a maximum transverse slope of 2.5% is considered, keeping these slopes complaint as per the standards.

Runway 06/24

Similar to the main runway, the longitudinal slopes for the rehabilitated cross runway are designed to follow the existing runway's slopes. To ensure CASA compliance and surface runoff the maximum longitudinal slope has been maintained as 0.58% while the minimum has been maintained as 0.00%. The distance between the point of intersection of two successive longitudinal slope changes have been achieved as a minimum of 45m by obtaining the sum of the absolute numerical values of the corresponding slope changes multiplied by 5,000m or 45m, whichever is greater. Also, the transition of one slope to another has been accomplished by introducing a curve with a minimum radius of 7,500m. Figure 9 below shows the longitudinal profile of the main runway between st. 120.000m and 500.000m, where the design level closely follows the ground level.

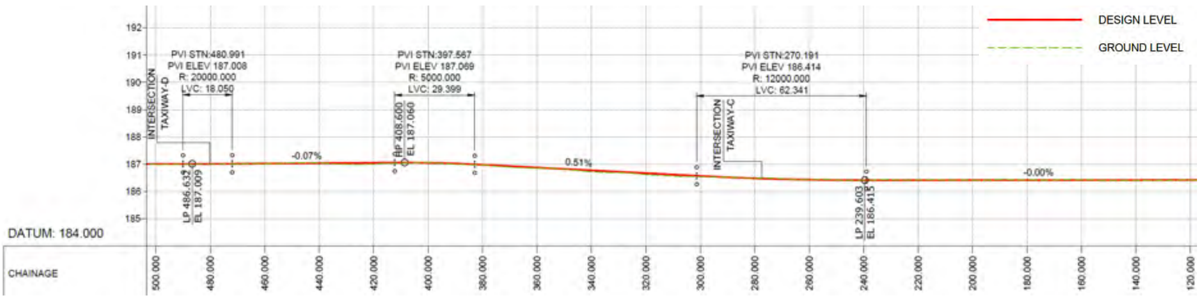

Figure 9 Runway 06/24 Longitudinal Profile (st. 120.000m - 500.000m)

The transverse slopes for the runway and runway strip have been maintained to match the existing slopes except for a few locations on the runway and strip to the west of the centreline. Where the runway and strip is observed to have a transverse slope of less than 0.3%, it has been graded to have a minimum transverse slope of 0.3% to facilitate proper drainage.

The cross-runway strip has been designed such as to minimise the change in ground level but ensuring proper drainage. A maximum longitudinal slope of 0.58% and a maximum transverse slope of 2.2% is considered, keeping these slopes complaint as per the standards. Furthermore, the portion of the graded strip to the south of the runway and between TWY C and TWY D (st. 290.000m – 570.000m), has been lowered such that the crossfall from the Taxiways are sloping towards the runway strip to facilitate drainage.

Taxiway A and Taxiway B

As previously mentioned, the existing final pavement/ ground levels have been retained to the extent possible and only changed where necessary to achieving complaint slopes and ensuring proper drainage. While the longitudinal design slope for TWY A follows the existing ground level slope, the same cannot be said for TWY B. In the case of TWY B, the existing longitudinal slope changes were observed to be non-compliant. Therefore, to achieve compliance the design longitudinal slope change was modified by the introduction of a curve with a 5292m radius. Figure 10 below shows the changes in the longitudinal profile of TWY B, from existing to design.

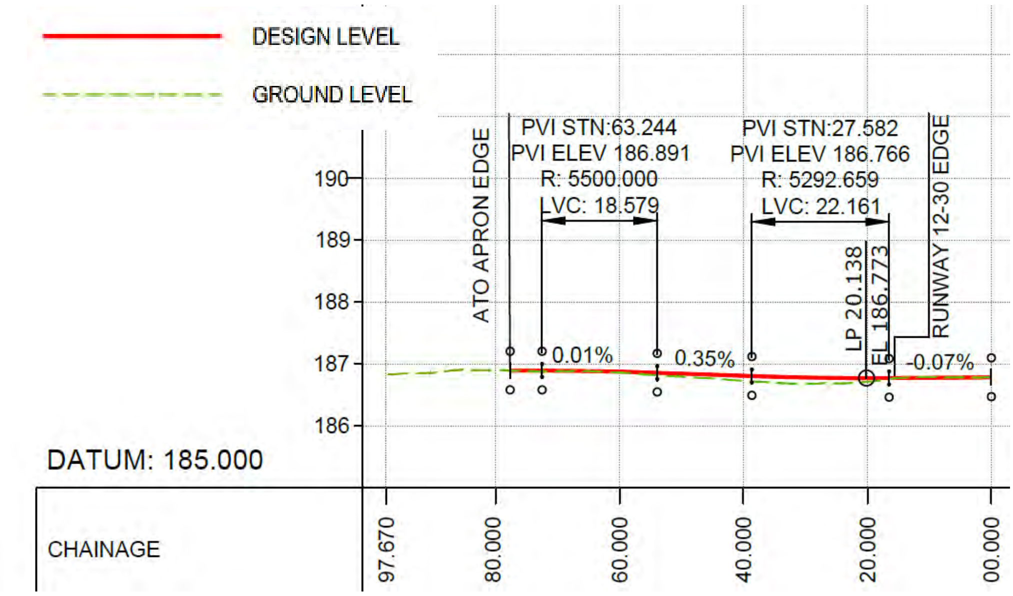

Figure 10 Taxiway B Longitudinal Profile

Taxiway C

Similar to TWY B, the longitudinal slope of TWY C was modified by the introduction of a curve of 5000m radius, to ensure that the slope changes along the taxiway centreline are smooth and compliant.

Taxiway D, Taxiway E, Taxilane 1 and Taxilane 2

The longitudinal and transverse slopes introduced for the new taxiways and taxilanes were such that the slopes followed the natural gradient of the ground to the extent possible given the requirements of aviation design standards, to minimise the cut and fill earthwork quantities required, whilst ensuring proper drainage. For example, Figure 11 below illustrates how the design level of the longitudinal slopes closely follows the ground level where possible, while compliance as per the CASA standards is maintained.

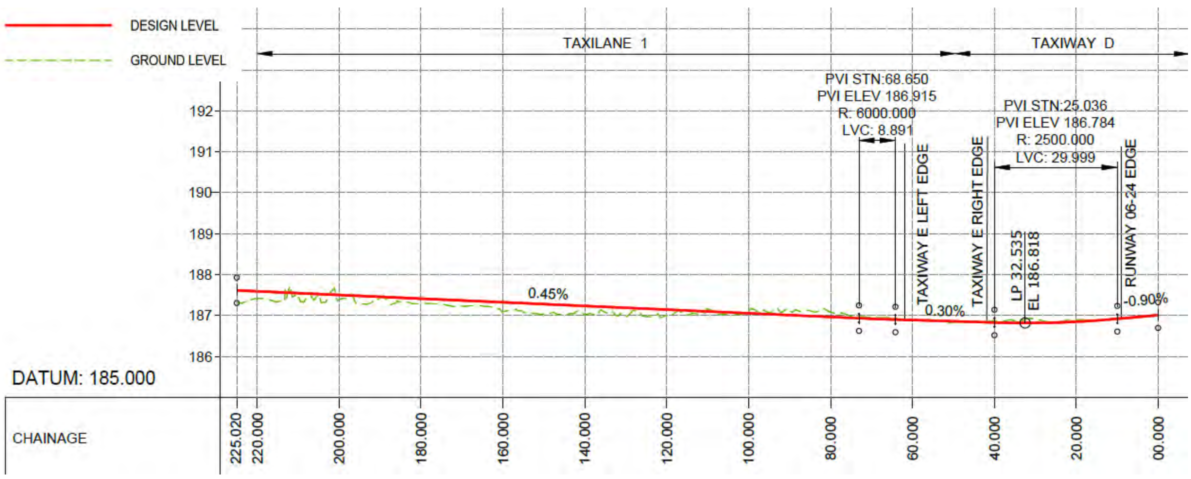

Figure 11 Taxiway D and Taxilane 1 Longitudinal Profile

The final longitudinal design slopes for all taxiways are observed to be within the 1.5% and 3.0% limit as is recommended by CASA (Clause 6.40) for Code C and Code B taxiways respectively. Furthermore, they all have a bi-directional transverse slope with a central crown except for TWY E, which has a unidirectional slope, which lowers towards the north, i.e. towards the drain running parallel to RWY 06/24. While the maximum designed cross slope is observed to fall within the design slope range as per CASA (Clause 6.41), the minimum designed cross slope falls below this range because of taxiway intersections with runways, other taxiways and aprons. However, this design ensures proper drainage even in the areas where the transverse design slope is below the minimum requirement.

New GA Apron

As the length of the New GA Apron is along TWY E, it follows the longitudinal slope of TWY E. Moreover, the southern edge of the New GA Apron has been raised to have the transverse slope falls towards the Taxiway E, to make sure all the surface runoff from the apron is collected the in designated drain.

Hangar Access Roads

The longitudinal slopes of the Hangar Access Roads follow those of TXL 1 and TXL 2, where they slope down towards TWY E as the surface runoff is to drain into the longitudinal drains running along TWY E.

3. Pavement Design

3.1 Background Information

The pavement design is as per the following background information:

- **Visual Site Inspection** of the pavement condition to identify pavement repair requirements from the surface conditions
- **Topographical Survey** conducted as part of the on-site investigations, which shows the extent and the existing pavement levels of the on-site paved infrastructure.
- **Pavement Investigations – Falling Weight Deflectometer (FWD) Testing** non-destructive testing that has been carried out to determine the structural capacity of the existing pavement on-site
- **Geotechnical Investigations** on-site investigations have been conducted, where 20 no. boreholes have been drilled to assess the existing pavement composition, field density of the site as well as the California Bearing Ratio (CBR)
- **Design Air Traffic Movement** the future design traffic mixture is a projection based on the historical information of air traffic movement shared by Cloncurry Airport

3.2 Design Standards

The design standards to be followed are:

- *Civil Aviation Safety Authority (CASA) – Part 139 (Aerodromes) Manual of Standards 2019.*
- *CASA Advisory Circular AC 139.C-07 v1.0 – Strength rating of aerodrome pavements February 2021.*
- *CASA Advisory Circular AC 139.C-06 v1.0 – Skid resistance of aerodrome pavements February 2021.*
- *ICAO Annex 14 Aerodromes – Volume I Aerodrome Design and Operations (to be used where referred to in CASA Part 139 MoS and/or where clear guidance is not provided in CASA Part 139 MoS)*
- *ICAO Document 9157, Aerodrome Design Manual, Part 1 - Runways*
- *ICAO Document 9157, Aerodrome Design Manual, Part 2 – Taxiways and Aprons*
- *Federal Aviation Administration (FAA) Advisory Circular Pavement Design 150/5320-6G, 2021.*
- *Federal Aviation Administration (FAA) Advisory Circular Pavement Strength 150/5335-5D, 2022.*

3.3 Design Elements

The pavement type and design life of the different paved areas to be achieved is as stated below in Table 3.

Table 3 Pavement Design Scope and Performance

	Design Elements	Design Performance
Existing Pavement	Runway 12/30 Runway 06/24 Taxiway A Taxiway B Taxiway C GA Hangar Taxiway ATO Apron GA Apron	Pavement type: Asphalt (flexible) Design life: 20 years
New Pavement	Taxiway D Taxiway E	Pavement type: Asphalt (flexible) Design life: 20 years

	Taxilane 1 Taxilane 2 New GA Apron	
	Access Road	Pavement type: Spray seal Design life: 20 years
	Outdoor GSE Parking	Pavement type: Asphalt (flexible) Design life: 20 years

3.4 Design Parameters

The pavement design would depend on the following parameters:

3.4.1 Type and CBR of subgrade

The soil at the site is primarily a sandy clay which is red in colour. Based on the geotechnical investigations, the CBR on site varies between 2% and 3% except at the southern end of runway 12/30, where the CBR is found to be about 13%. As this variance in CBR is isolated to a single borehole location, it is treated as an outlier.

To optimise the pavement design, stabilisation of the subgrade has been proposed where the pavement is to undergo reconstruction and new pavements are to be built. This would result in a higher CBR value of the subgrade, thereby assisting in the reduction of the pavement layers. A design CBR value of 8% is considered for pavement design of heavy traffic areas and 4% for low traffic areas.

3.4.2 Pavement Condition and Age

As the design life to be achieved for the existing flexible pavement is 20 years, it is key to determine the condition and the residual life of the standing pavement on site. This assessment is crucial to understand the kind of pavement repairs and rehabilitation works that are required to achieve the 20-year design life.

The modulus values and the subgrade CBR values collected via the FWD and geotechnical site investigations respectively, as well as the future air traffic movements were used as input parameters in FAARFIELD to calculate the residual life of the existing pavement. Furthermore, based on the calculated remaining life, an appropriate repair/ rehabilitation has been adopted. The result on the residual life and suggested repair/rehabilitation for the different paved areas has been presented in Table 4 below.

Table 4 Existing Pavement Residual Life

Existing Pavement	Residual Life (Years)	Repair / Rehabilitation
Runway 12/30	0	Reconstruction
Runway 06/24	0.2	Reconstruction
Taxiway A	More than 20	Functional Overlay
Taxiway B	0	Reconstruction
Taxiway C	4.8	Reconstruction
ATO APR-1	More than 20	Functional Overlay
ATO-APR-2	0.5	Reconstruction
GA Apron	5.8	Functional Overlay
GA Hangar Taxiway	More than 20	Functional Overlay

Although, Taxiway C has a remaining life of about 5 years, rutting of the pavement has been observed at the visual site inspection in conjunction to the surface roughness. Additionally, as Taxiway C is to undergo a width expansion, a pavement reconstruction has been proposed instead of an overlay repair.

The FAARFIELD section reports for the calculation of remaining life can be found in Appendix 4.

3.4.3 Air Traffic Movement Numbers and Type

This section elaborates on the methodology followed and the assumptions made in order to calculate the design air traffic movement on the various paved sections. The methodology followed is as listed below and further expanded upon in the sub-sections that follow:

- **Step 1: 20-Year Total Design Traffic Mix**
  Based on the 20-year forecast for GA traffic and passenger traffic as well as the present day split of the traffic by aircraft types, the total design traffic mix at Cloncurry Airport is estimated in total over the 20-year period by aircraft type.
- **Step 2: Annual Design Traffic Mix**
  In FAARFIELD, as one of the input parameters is the annual traffic, it is assumed that the 20-year total traffic is distributed equally over each of the 20 years.
- **Step 3: Annual Number of Aircraft Movements per Paved Area**
  Furthermore, as each paved area caters to a different mix of aircraft type and movement frequency numbers, calculations have been made on the number of aircraft movement for each of the paved areas. These calculations have been based on assumptions explained in Section 3.4.3.3.

3.4.3.1 20-Year Total Design Traffic Mix

As per the calculated traffic forecast, Table 5 shows the total design traffic mixture at Cloncurry Airport over the next 20 years.

Table 5 Total Design Traffic Mix Over 20-Year Period

Aircraft Code	Aircraft Type	No. of Departures	No. of Arrivals
Code A	Cessna 172	55479	55479
	Piper Seneca	55479	55479
Code B	Beechcraft 200	23777	23777
	King Air 350	23777	23777
Code C	Dash-8 Q400	15228	15228
	Embraer 190	2475	2475
	Fokker 70	2475	2475
	Fokker 100	17513	17513
	Boeing 737-800/ MAX	381	381

3.4.3.2 Annual Design Traffic Mix

Table 6 below shows the annual design traffic mix, where the annual count is assumed to be when the 20-year total traffic is distributed equally over each year in this period.

Table 6 Annual Design Traffic Mix

Aircraft Code	Aircraft Type	No. of Departures	No. of Arrivals
Code A	Cessna 172	2774	2774
	Piper Seneca	2774	2774
Code B	Beechcraft 200	1189	1189
	King Air 350	1189	1189

Code C	Dash-8 Q400	762	762
	Embraer 190	124	124
	Fokker 70	124	124
	Fokker 100	876	876
	Boeing 737-800/ MAX	20	20

3.4.3.3 Annual Number of Aircraft Movements per Paved Area

In the tables that follow, for each aircraft type the no. of movements (including departures and arrivals) in a single year have been noted for every paved section (existing & new), which would be henceforth used as an input for the pavement structure calculations. The numbers noted have been based on a conservative calculation of the no. of movements of each aircraft type, keeping in mind that future uncertainties and circumstances may force the usage of one paved area more than another. Therefore, the summation of the numbers noted in the tables below, do not correlate to the summation of the numbers in Table 6.

Noted below are the assumptions made to calculate the annual number of movements by different aircraft types on each paved section:

- The number of movements includes the movements to be undertaken by a specific aircraft during departure, as pavement designs only take into consideration the departures.
- The use of runway based on aircraft categories has been split as follows, based on current day operations which is assumed to continue in the future:

Aircraft Categories	Runway 12/30	Runway 06/24
Code A	70%	30%
Code B	70%	30%
Code C	100%	0%

- Based on the placement of the exit taxiways for both runways, the number of movements on the runway have been doubled up. This is because an aircraft typically needs to taxi to the end of the runway to initiate a 180 degree turn before take-off to be able to utilise the full length of the runway. Therefore, a single departure can require two aircraft movements on the runway.
- Taxiway A and Taxiway B are the only two Code C taxiways on site and will hence be used at all times by Code C aircraft to access the main runway. Additionally, Code A and Code B aircraft are presumed to use Taxiway A and Taxiway B when operating from the main runway. To keep with the conservative calculations each Code C taxiway has been assumed to be used 70% of the time instead of 50%.
- Taxiway C is a Code B taxiway dedicated to being used by Code A and Code B aircraft when accessing the cross runway. When new taxiways, Taxiway D and Taxiway E are constructed, they are assumed to be utilised similar to Taxiway C.
- Usage of Taxilane 1 and Taxilane 2 would be half of what is seen on Taxiway D or Taxiway E.
- GA Hangar Taxiway is Code A taxiway to be exclusively used by the present-day GA tenants to access their hangars. They would constitute a small percentage (approx. 30%) of the total GA tenants in the airport.
- It is assumed that 100% of the Code C aircraft use the ATO Apron, while only 40% of the Code A and Code B aircraft use the GA Apron and another 40% use the New GA Apron. The remaining GA aircraft are assumed to not use the aprons, as the aircraft would either use the hangars or visit the airport for refuelling purposes only.

Table 7 below notes the number of departure movements by each aircraft on an annual basis, on the existing paved areas in Cloncurry Airport.

Table 7 Number of Aircraft Movements Annually – Existing Pavement

Aircraft Type	Code C				Code B			
	Runway 12/30	Taxiway A	Taxiway B	ATO Apron	Runway 06/24	Taxiway C	GA Hangar Taxiway	GA Apron
Cessna 172	3884	1360	1360	0	1665	833	75	1110
Piper Seneca	3884	1360	1360	0	1665	833	75	1110
Beechcraft 200	1665	583	583	0	714	357	0	476
King Air 350	1665	583	583	0	714	357	0	476
Dash-8 Q400	1523	533	533	762	0	0	0	0
Embraer 190	248	87	87	124	0	0	0	0
Fokker 70	248	87	87	124	0	0	0	0
Fokker 100	1752	613	613	876	0	0	0	0
Boeing 737-800/ MAX	39	14	14	20	0	0	0	0

Table 8 below notes the number of departure movements by each aircraft on an annual basis, on the proposed new pavement at Cloncurry Airport. As the new infrastructure is to cater to GA traffic, only Code A and Code B aircraft types have been included.

Table 8 Number of Aircraft Movements Annually – New Pavement

Aircraft Type	Code B				
	Taxiway D	Taxiway E	Taxilane 1	Taxilane 2	New GA Apron
Cessna 172	833	833	417	417	1110
Piper Seneca	833	833	417	417	1110
Beechcraft 200	357	357	179	179	476
King Air 350	357	357	179	179	476

3.5 Pavement Design

Determination of Elastic Modulus

The elastic modulus is a fundamental property of an asphalt pavement and is associated to the thickness of each layer of a pavement. The results from the FWD investigations of the existing pavements were used to calculate the e-modulus values for the different pavement layers. This was achieved in accordance with clause C.16 of FAA AC 150/5320-6G.

The e-modulus value determined for each constituent layer of the existing pavement structure is used further for the design of the reconstructed pavement structure., keeping the e-modulus consistent with the respective layers.

Although the e-modulus is kept constant for a particular pavement layer, the thickness of the corresponding pavement layers in the as-built design and new construction design varies. And since the e-modulus of a pavement layer is associated to its thickness, the e-modulus is subject to change. This change will have to be established at the time of construction, as a new set of investigations would be required, with tests conducted on the newly laid pavement layers.

Structural Design – Airside Pavements
All airside pavements have been designed using FAARFIELD v2.0 and in accordance with FAA AC 150/5320-6G (specifically clauses 3.15 – design methodology and 3.12.11 – minimum layer thickness for flexible pavements). The design parameters and input used are as listed below:

- Flexible pavement with structural design life of 20-years
- Aircraft traffic data including aircraft types, operating weights and annual departures as stated in Section 3.4.3.3
- Pavement layers and material

Pavement layers	
As per AC 150/5320-6G	**As per Construction Practices**
P-401/P-403 HMA Surface	Surface course
P-401/P-403 HMA Stabilised	Stabilised Base Course
P-209 Crushed Aggregate	Crushed Aggregate Base Course
P-154 Uncrushed Aggregate	Subbase

- Subgrade CBR as documented below:

Pavements	Design CBR
Runway 12/30; Taxiway B; ATO-Apron 2	8%
Runway 06/24; Taxiway C, D & E; Taxilane 1 & 2; New GA Apron	4%
GSE Parking A and B	6%

Based on the considerations and parameters previously mentioned, the proposed design for reconstruction and new construction has been tabulated in Table 9.

Table 9 Summary of Full Pavement Design – Reconstruction & New Construction

Pavement Area	Flexible Pavement - Materials & Thicknesses (mm)				
	P-401/403 HMA Surface	P-401/403 HMA Stabilised	P-209 Crushed Aggregate (Base)	P-154 Uncrushed Aggregate (Subbase)	CBR*
Runway 12-30	100	125	150	150	8%
Runway 06-24	75	-	100	150	4%
Taxiway B	100	125	150	150	8%

Taxiway C	75	-	100	150	4%
Taxiway D	75	-	100	150	4%
Taxiway E	75	-	100	150	4%
Taxilane 1	75	-	100	150	4%
Taxilane 2	75	-	100	150	4%
ATO APR-2	100	125	150	150	8%
New GA Apron	75	-	100	150	4%
GSE Parking 1 and 2	75	-	100	160	6%

*500 mm thickness of subgrade is adopted for the quantity calculation

Similarly, the proposed design for the functional overlay repair for existing pavement with residual life of more than 20 years have been tabulated in Table 10.

Table 10 Summary of Functional Overlay Design

Pavement Area	Flexible Pavement - Materials & Thicknesses (mm)	
	P-401/403 HMA Overlay	Existing Pavement
Taxiway A	50	810
ATO APR-1	50	710
Old GA Apron	50	250
GA Hangar Taxiway	50	250

The FAARFIELD section reports for the calculation of pavement design can be found in Appendix 5.

Figure 12, Figure 13 and Figure 14 below illustrate the reconstruction of runway 12/30, new construction of taxilane 1 & 2 and overlay design of taxiway A respectively.

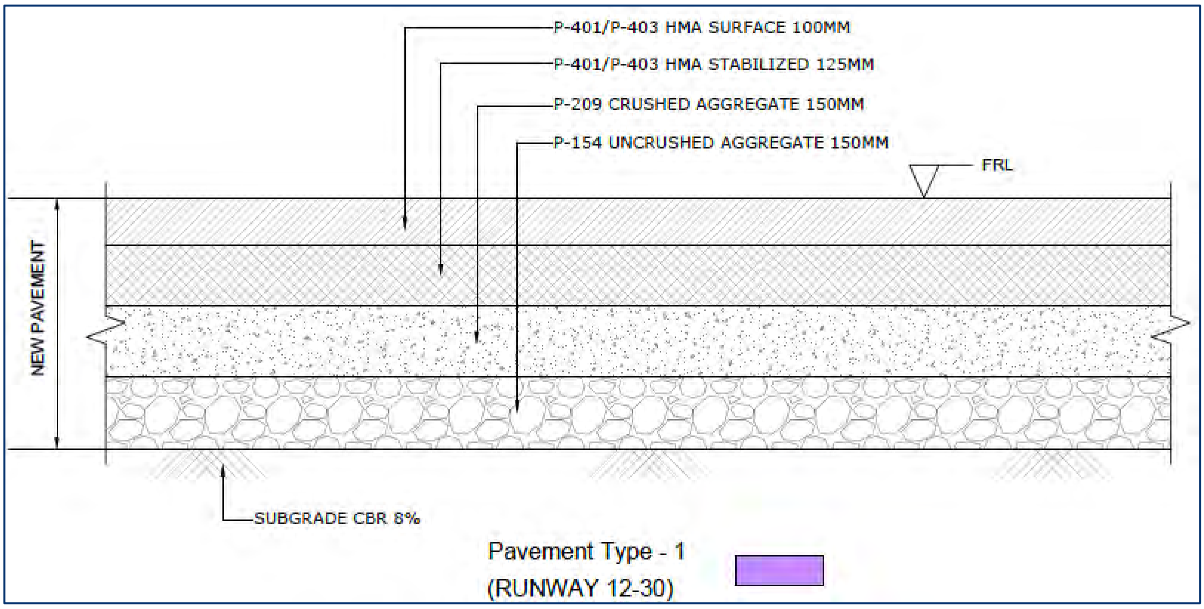

Figure 12 Reconstruction of Runway 12/30

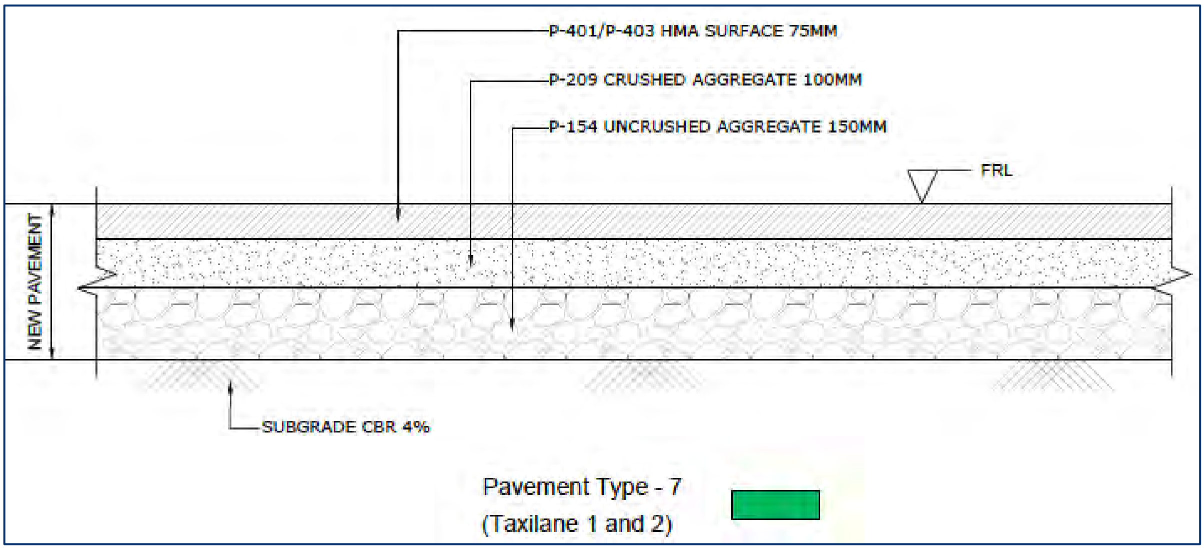

Figure 13 New Construction of Taxilane 1 & 2

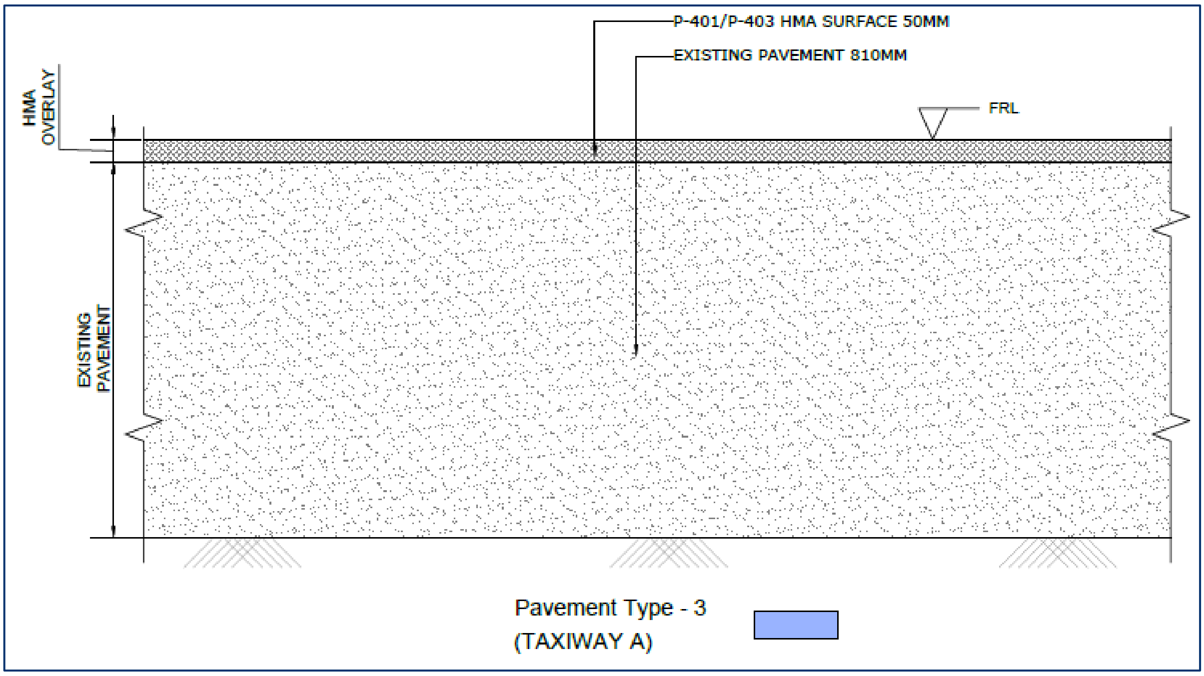

Figure 14 Functional Overlay of Taxiway A

Structural Design - Hangar Access Road

The hangar access road pavement has been designed as a spray seal pavement as it is economical. It has been designed as per the standard - *AGPT02-17_Guide to Pavement Technology Part 2 – Pavement*.

The design parameters and input used are as listed below:

- Design traffic of 5 movements per day of an equal standard axle load
- Design CBR of 4% (with stabilisation)
- Design crust thickness as per the standard. See Figure 15 for the graph used.

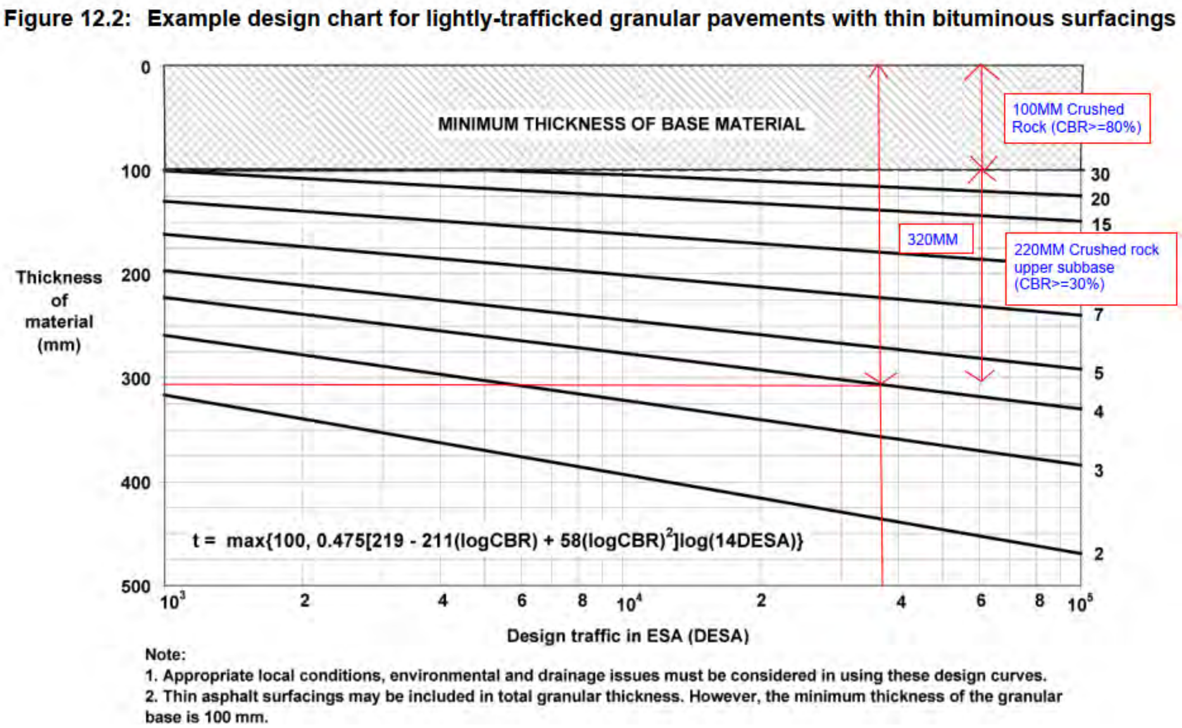

Figure 15 Crust Thickness Guide

Based on the considerations and parameters previously mentioned, the proposed design for reconstruction and new construction has been tabulated in Table 11.

Table 11 Summary of Spray Seal Design

Material	Thickness (mm)
Subgrade (CBR 4%) *	-
Crushed Rock upper subbase (CBR>30%)	220
Crushed Rock (CBR>80%)	100
Spray Seal	2 coat spray seal (min) 14mm/7mm

*500 mm thickness of subgrade is adopted for the quantity calculation

3.6 Sensitivity Analysis

A sensitivity analysis has been carried out for the airside pavements to determine whether the new pavement design can endure an increase in the traffic movements. This has been achieved by tripling the number of B737 departures on Code C pavements. The analysis shows that irrespective of the increase in traffic movement, the newly reconstructed areas and overlayed areas would be resilient and continue to have a structural life of 20 years.

Furthermore, an assessment for the residual life of the pavements with functional overlay was carried out. This was done to verify that the repaired pavement would possess a remaining life of 20 years, after the repair work. This includes the existing GA Apron that at present has a residual life of around 6 years. Refer to Appendix 6 for the section reports on the same.

4. Drainage Design

4.1 Background Information

The following is the basis for developing the drainage design for Cloncurry Airport:

- **Visual Site Inspection** recording an initial condition assessment of drainage structures including dimensions and material of the structures, conditions for water logging as well as outfalls to external network and stream.
- **Topographical Survey** which shows the invert levels of the manhole pits and culverts, thereby assessing the direction of flow and final outfalls, as well as the existing grading of the terrain within the airport site. Also, terrain data in form of tiff files is downloaded from https://elevation.fsdf.org.au/ to prepare terrain models outside the topographical surfaces.
- **As-Built Information** from 1963 scanned maps from department of civil aviation showing the existing and the abandoned pipes.
- **Flood Mapping** Department of Natural Resources and Mines (DNRM) Flood hazard mapping report December 2014 which shows the extent of flooding from Cloncurry River. The flood mapping was conducted considering March 1997 as a major historical flood event and simulation was carried out for three specified design events (2%, 1% and 0.2% annual exceedance probability).
- **River depths** data has been downloaded from the website to have an initial estimate of water depths in river http://www.bom.gov.au/fwo/IDQ65399/IDQ65399.529017.tbl.shtml
- **Rainfall Data** The design rainfall data is obtained from the Australian Government - Bureau of Meteorology's website as shown in Figure 16. The Intensity Frequency Duration (IFD) information is used in the design of gutters, culverts, and stormwater drains. The 2016 design rainfall mentioned on the website is based on a more extensive database, with more than 30 years of additional rainfall records.

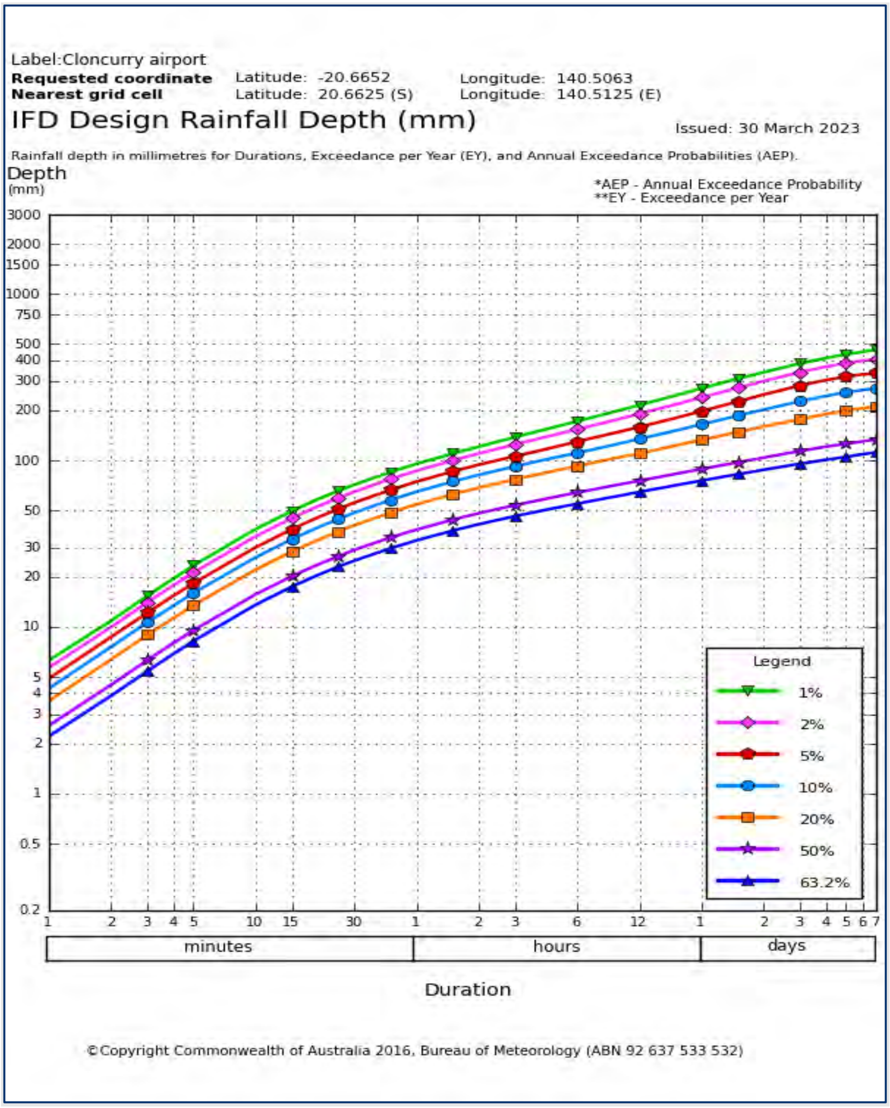

Figure 16 Intensity Frequency Durations (IFDs) for Cloncurry Airport

4.2 Assumptions and Limitations

The following assumptions are considered for the concept design of drainage:

- Existing invert levels of the pits from the topographical survey for all the locations are considered as bottom of the pit.
- The stormwater runoff from the proposed development would discharge into intended outfalls such as the pipe network and Cloncurry River etc. Any hydrological/ hydraulic justification and permissions required to allow discharge of the drained waters into Cloncurry River shall be taken care of in later stages of the project by the relevant parties (Engineering, Procurement and Construction (EPC) contractor in case Council chooses EPC, or Detailed Design Consultant)
- The design does not take into consideration any environmental and contamination issues at this stage. However, the design includes proper capture of oil spillage in the hangar/ apron areas, to avoid contamination of the surface runoff water and the surrounding soil.
- Shape of the open drain will be considered as trapezoidal and for the concrete box drain as rectangular.

- In the apron area, perforated cover slab is considered for the nosewheel area and grated inlet arrangement is considered for the other apron areas designed for Code C aircraft loading.
- Material of construction for all drains is assumed as Reinforced Cement Concrete (RCC).
- Grade of Concrete Portland Cement Concrete (PCC) – M15, RCC – M35 and Reinforcement – Fe500 or higher grades.
- As there is no change in the characteristics of the contributing catchment (i.e., runoff co-efficient, rainfall, area, and slope) from both the runways, it is assumed that the runoff from the runway system will enter the existing pipe network and there is no need to replace pipes which are of adequate size and in good condition.
- The IFD curves are downloaded from the Bureau of meteorology - Australian government for the estimation of design rainfall. However, potential EPC Contractor or other designer shall be responsible for obtaining any latest rainfall data, as per mutual agreement with the Council, during Detailed Design.

The following are the limitations to the drainage design:

- The borehole investigation for BH108 shows that there is no water table observed until 3m below the ground surface. Hence it is considered that there will be no impact of ground water table on stormwater design. EPC Contractor or Detailed Design Consultant shall make necessary provisions during detailed design.

4.3 Design Standards

The design standards followed are:

- *Civil Aviation Safety Authority (CASA) – Part 139 (Aerodromes) Manual of Standards 2019.*
- *ICAO Annex 14 Aerodromes – Volume I Aerodrome Design and Operations (to be used where referred to in CASA Part 139 MoS and/or where clear guidance is not provided in CASA Part 139 MoS)*
- *ICAO Document 9157, Aerodrome Design Manual, Part 1 - Runways*
- *ICAO Document 9157, Aerodrome Design Manual, Part 2 – Taxiways and Aprons*
- *Federal Aviation Administration (FAA) Advisory Circular Airport Drainage Design 150/5320-5D, 2013.*

4.4 Design Parameters

The below design parameters are considered for drainage design:

4.4.1 Design Storm Frequency

The summary of the rainfall events to be adopted for airside drains, landside drains, ponds etc. is documented in Table 12.

Table 12 Design storm frequency

Details	Return Event	Remarks
Airside Runway and Taxiway Drains	1 in 5 years	No encroachment of runoff on runway and taxiway pavements.
	1 in 10 years	Centre 50 percent of Runway and Taxiway pavement should be free of flooding.

Apron Drains	1 in 5 years	A temporary ponding not exceeding 100 mm around drainage inlets
Landside Drains	1 in 2 years	Allowable runoff spread limited to one half of roadway lane for main access road and other important roads.
	1 in 5 years	At least one lane free from water during the storm event.
Flood holding ponds	1 in 50 years	Design storm event
	1 in 100 years	Check storm event

Australian Government's drainage guideline publications such as the *Guide for Flood Studies and Mapping in Queensland* and the *Queensland Urban Drainage Manual*, define the required flood event to be considered as 1% or a 1 in 100 AEP.

To account for climate change, as most Australian guidelines (except a study by *The University of Adelaide*) do not mention the use of climate factors, inspiration has been taken from Scandinavian guidelines. For instance, in Sweden a climate factor of 20% is taken into consideration for rainfall events which span over longer durations for all kinds of infrastructure.

Therefore, for the drainage design at Cloncurry Airport, as per the Australian Standards a 1 in 100-year return period is used for flood mapping given the expanse of the airport and population of the town. And to accommodate any risk due to climate change, a 20% climate factor is used. This 1 in 100 return events with 20% climate factor would result in a more conservative design, as compared to a 1 in 200 return event design criteria.

4.4.2 Horizontal and Vertical Setting Criteria of Drains Considering Operational, Navigational & Other Critical Areas

Tabulated below in Table 13 are the horizontal and vertical setting criteria.

Table 13 Horizontal and Vertical Setting Criteria

Item	Design Basis	Description
Runway Strip	75m* from Runway centreline	An object within the strip endangering airplanes is regarded as an object. No open/ covered storm water drain/ conveyances to be installed. Delethalisation of the existing pits and pipes will need to be taken into consideration, if they are to be used or left in place.
Taxiway Strip	26m from taxiway centreline	Drainage structure should not protrude above strip
Taxilane Strip	22.5m from taxilane centreline	Drainage structure should not protrude above strip
Aprons		Top of drain cover should be flush with the apron top surface. It should not be protruding above the apron pavement surface.

Runway End Safety Areas (RESA)	90m from end of runway strip	No drainage structure or any other structure is allowed within mentioned distance
NDB/ Avis Towers		No waterlogging in critical and sensitive area and around antenna system of navaids.
General		No uncovered drainage/ water pipe allowed

*The runway strip at Cloncurry Airport is not as per the standards and has a dispensation for the same.

4.5 Drainage Design

The design for various airport features is listed as below:

Runway 12/30 and Runway 06/24

Both the runways 12/30 and 06/24 at present are drained by a series of existing stormwater pits and pipes. The existing stormwater pits are 750mm wide and 1000mm long, which are connected by concrete pipes of diameter 150mm. The existing stormwater pits and a percentage of the total pipes are clogged by vegetation and sand. The stormwater network for runway 12/30 drains to the existing swales, with the final outfall via an existing 600mm pipe to the east of the runway. The existing stormwater network for runway 06/24 drains to the stormwater network for the abandoned runway which further connects to the stormwater network of runway 12/30.

It is assumed that the existing stormwater pits will only be able to intercept 30% of the total runoff generated from the runways. Therefore, to avoid any ponding of water on the runways, the remaining runoff is designed to be intercepted by trapezoidal drains. As shown in Figure 17, these drains would have the bottom varying between 0.5m to 2m, while the height varies from 0.5m to 3m. The trapezoidal open drains are placed along the edge of the runway strip, i.e. 75m from the centreline of the runway as per CASA standards. The runoff generated from runway is captured by these open trapezoidal drains with outfalls to existing swales. As concrete lined open trapezoidal drains have a carrying capacity more than unlined trapezoidal drain, at locations where the depth of unlined drain is more than 3m the open drain is lined with concrete to control the depth. The size and depth of the trapezoidal drain is controlled by lining a part of the trapezoidal drain as shown in Figure 18.

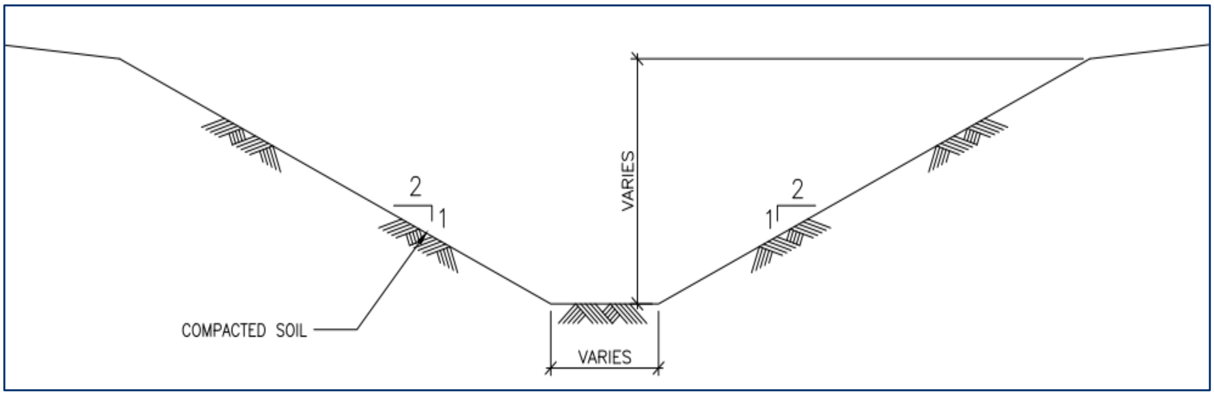

Figure 17 Trapezoidal Drain Cross Section

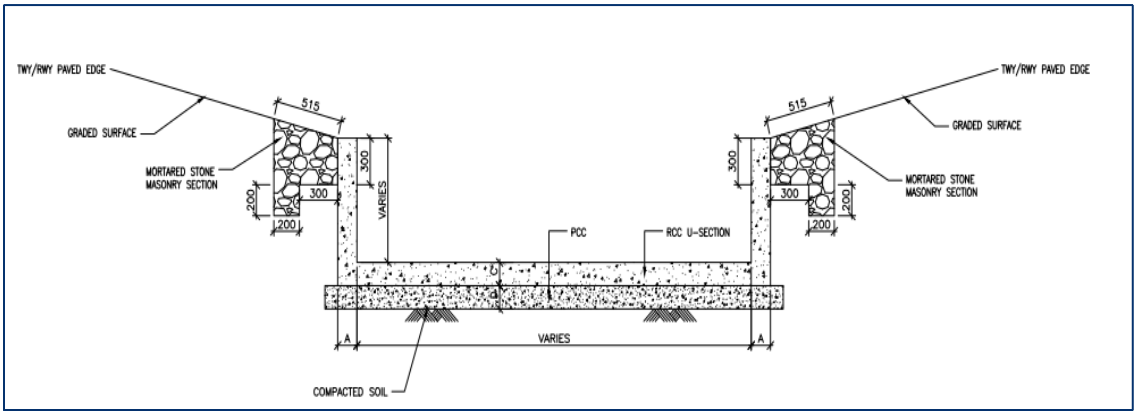

Figure 18 Trapezoidal Drain with Lining Cross Section

Existing Taxiways and Aprons

The existing drainage pipes carrying flows from terminal building, from taxiways A and B and from the apron are sufficient in size (450mm) and connects to retention basin. The pits 1/1 to 6/1 are in good condition and have been retained. A part of the existing ATO apron connects into an apron slot drain while the rest of the apron has no drainage arrangement. The GA apron has a pit in the centre which collects the flow and drains to the retention basin. The pit in the GA apron is retained and the size of the pipe is deemed sufficient. This existing drainage network has been shown in Figure 19.

Figure 19 Existing Drainage Infrastructure for Existing Taxiways and Aprons

During the 2019 floods, ponding has been observed on the ATO Apron. As there should be no ponding of water on the paved taxiways and the aprons, the design is to integrate a box drain adjacent to the ATO Apron with the existing network. The surface runoff generated from the apron is intercepted by the grated cover over the box drain, which would further connect to the RCC pipe under runway 12/30.

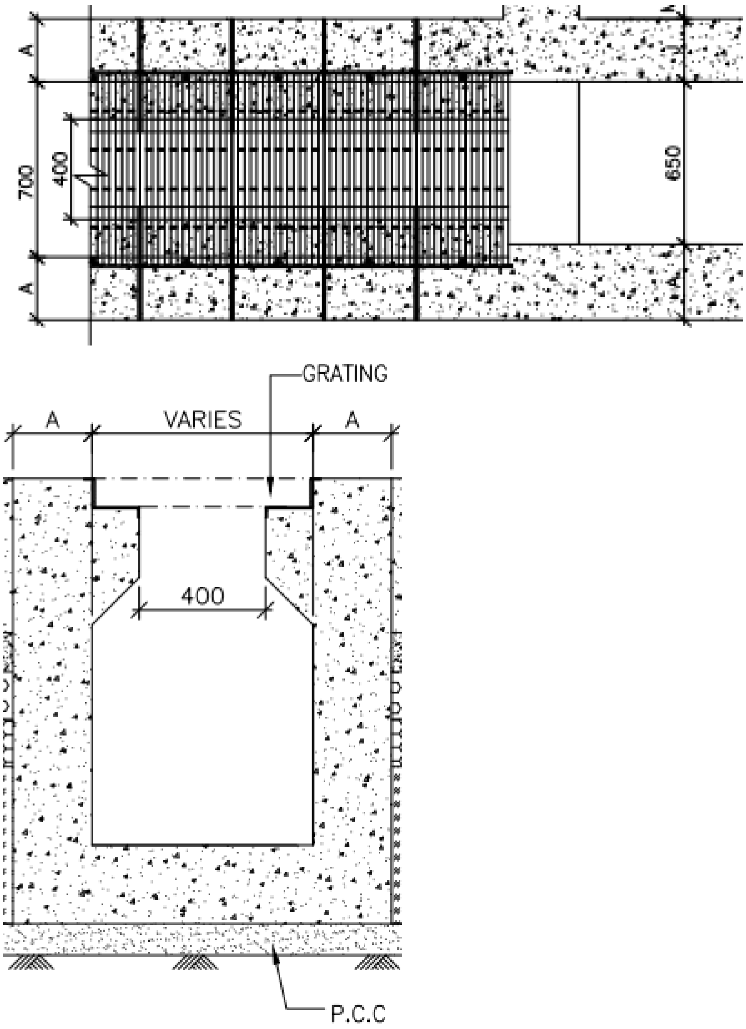

Figure 20 Box Drain Details

New GA Infrastructure

The new GA infrastructure includes Taxiways D & E, Taxilanes 1 & 2, New GA Apron, Hangar Plots as well as the Hangar Access Road.

Box drains are provided at the edge of the taxilanes and hangar roads to capture the surface runoff generated from the hangar areas. The box drains are provided with perforated covers to allow the water to enter the drain. The details of this have been shown in Figure 21.

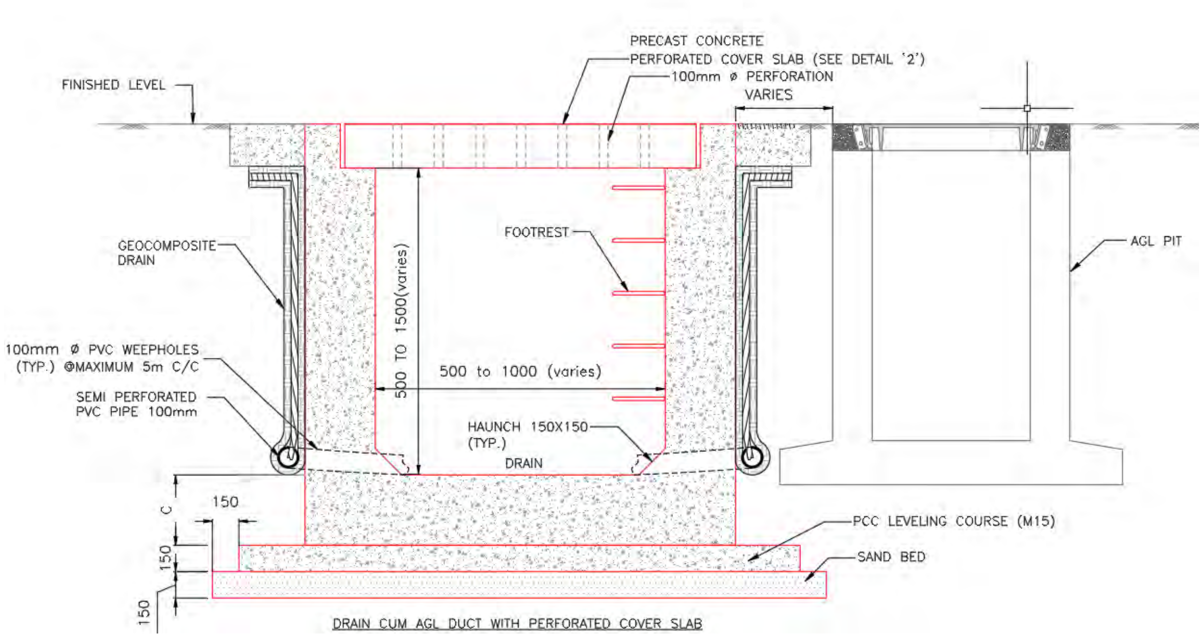

Figure 21 Box Drain Adjacent to Taxilanes Details

All the surface runoff generated over the new infrastructure is collected by box drains and culverts and is drained to longitudinal trapezoidal drain as shown in Figure 22. The trapezoidal drain outfalls to Cloncurry River.

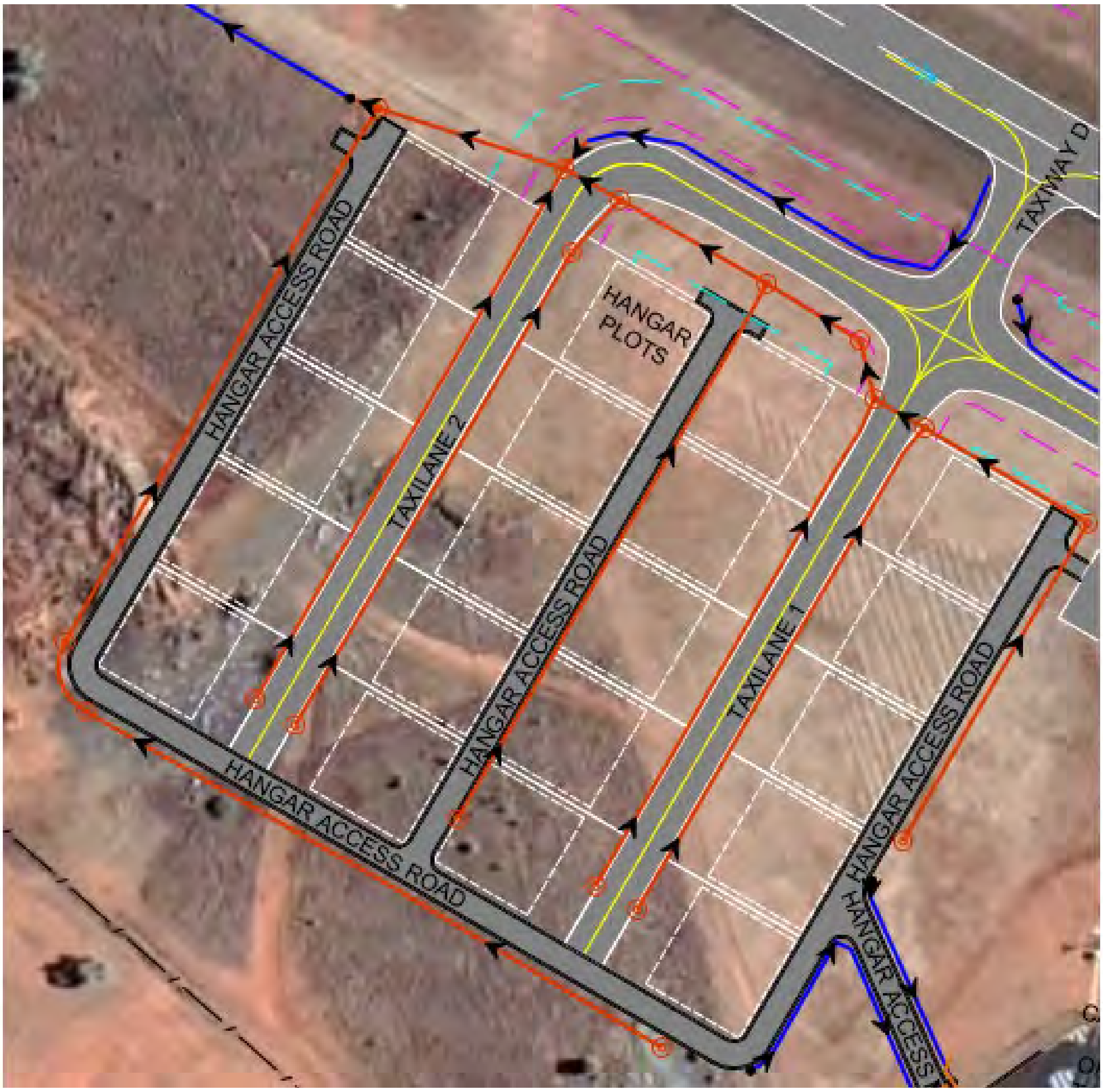

Figure 22 Surface Runoff Design for New GA Infrastructure (1)

For the New GA Apron, a slot drain is provided at the northern end (lower edge) of the GA apron and the surface runoff generated over the GA apron is collected and drained to storm network of the runway 12/30. Taxiway D and E are drained by trapezoidal drains which connect to the proposed new culvert under taxiway C. This has been illustrated in Figure 23 below.

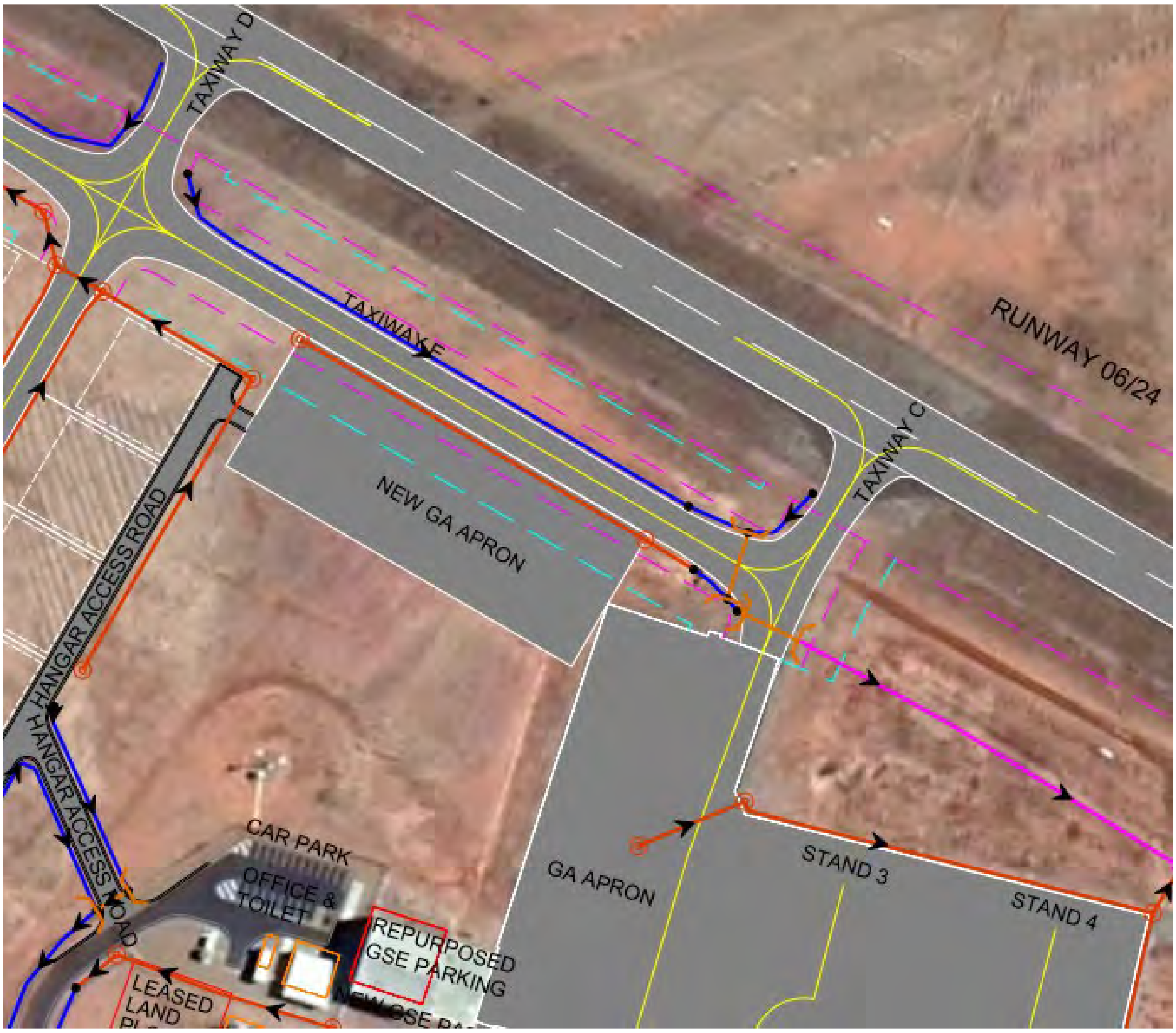

Figure 23 Surface Runoff Design for New GA Infrastructure (2)

4.6 Hydraulic Design

Hydraulic modelling for the proposed drainage scheme has been carried out using SewerGems software. The catchment contributing to each, and every drain was assessed. The proposed land use of the contributing catchments was taken into consideration while deciding on the runoff coefficient.

As per clause 6-2.4.2 of 150_5320_5D FAA guidelines, the minimum time of concentration of 5 mins is to be used if the calculated value is less than 5min. The peak flow from a catchment can be estimated by the rational formula. The Rational equation is a simple method to get peak discharge from basin runoff, given the runoff coefficient, rainfall intensity and catchment area.

Rational Formula:

$$Q = 0.0028 * c * i * A$$

where:

Q = Peak discharge, in cumsecs

c = Rational method runoff coefficient (unitless)

i = Rainfall intensity, in mm/hour

A = Drainage area, in Hectare

The runoff coefficient noted in this formula is dependent upon the land use and is stated in Table 14 below.

Table 14 Runoff coefficient for airports

Land use	Runoff coefficient
Runway	0.9
Runway graded strip	0.6
Taxiways, taxilanes and aprons	0.9
Land cover	0.2

Hydraulic capacity of a drain is controlled by its size, shape, slope, and friction resistance.

Manning's equation is generally used for calculating flow velocity in pipes and open channels. The equation is as below:

$$V = \frac{1}{n}.R^{2/3}.S^{1/2}$$

Where, V = Flow velocity, m/s
R = Hydraulic Radius, m
S = Slope, m/m
n = Manning's roughness coefficient

4.7 Oil Separator

An oil separator is provided to segregate any oil spill from hangars and aprons before connecting to swales and trapezoidal that drain into the Cloncurry River.

The oil separator shown in Figure 24 is to be provided for the ATO Apron and the GA Aprons and caters to a catchment area of 3.6ha.

Figure 24 Oil separator to cater the flow for existing ATO apron and GA apron.

The oil separator shown in Figure 25 is provided to cater to the new Hangar Plots and cater to a catchment area of 1.3ha.

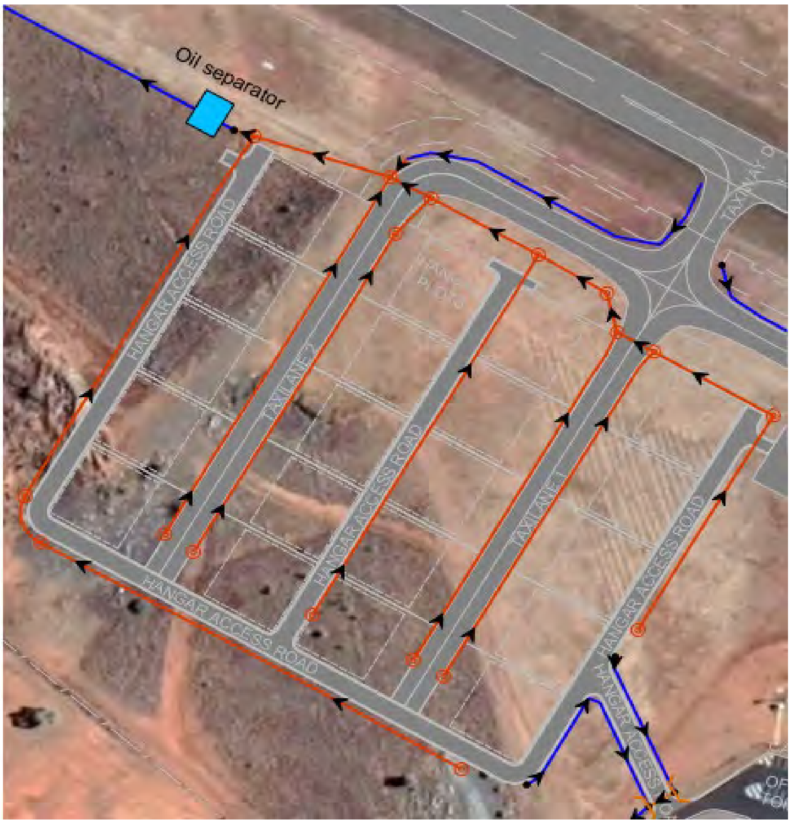

Figure 25 Oil separator to cater to flow for new hangar plots.

The class 1 SPEL bypass stormceptors provided for catchment area 3.6ha and 1.3ha are 470C1/S and 325C1/SC respectively. The details are shown in Figure 26.

Compliant to the European Standard BS EN 858-1 and the Construction Products Regulations

	Nominal size (NSB)		Catchment area (m²)	Oil storage (litres)	Silt storage (litres)	Length (mm)	Diameter (mm)	Inlet Invert (mm)	Base to inlet (mm)	Base to outlet	Max in/out pipe diameter (mm) for orientation		Number of access shafts Diameter (mm)			
Model	Flow (l/s)	Peak Flow (l/s)		NSB x 15	NSB x 100	L	W	A	B	C	A-C	D-I	450	600	750	900
320 C1/SC	20	200	11111	300	2000	3200	1875	700	1450	1350	450	600	-	2	-	-
325 C1/SC	25	250	13889	375	2500	3540	1875	700	1450	1350	450	600	-	2	-	-
330 C1/SC	30	300	16667	450	3000	4420	1875	700	1450	1350	450	600		-	1	1
340 C1/SC	40	400	22222	600	4000	5760	1875	740	1410	1310	450	600	-	1	1	-
345 C1/SC	45	450	25000	675	4500	6570	1875	740	1410	1310	450	600	-	1	1	-
350 C1/SC	50	500	27778	750	5000	7060	1875	740	1410	1310	450	600	-	1	1	-

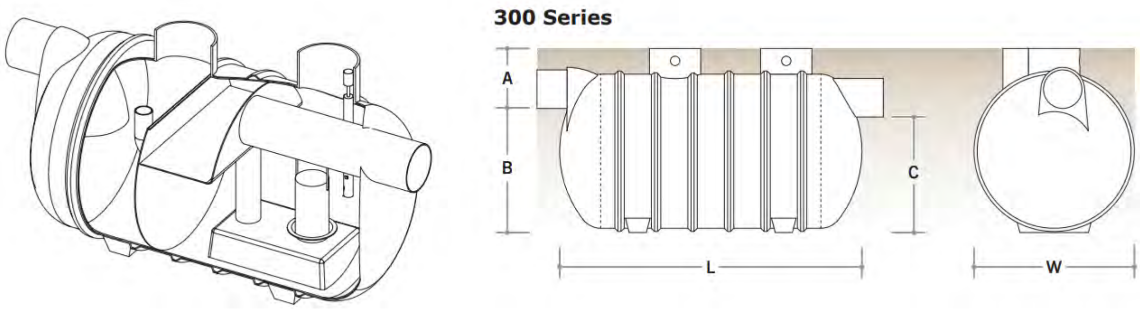

Figure 26 SPEL bypass stormceptors 300 series

4.8 Design Basis for Pond

- FAA guidelines state that ponding or storage of water of more than a temporary nature may be acceptable on the airport site other than between runways, taxiways, and aprons. Such temporary storage may indeed be essential because of limitations in offsite outfalls.
- FAA recommends that Retention/Detention ponds to be emptied within 24 hours of last rain to avoid Bird strike Hazard.
- Ponds have been designed for 1 in 50 years return period and the adopted check period for the ponds is 100 years. The design of the ponds assumes that with 100 years of runoff too there will not be any back flow towards the drainage network.
- The level of the inlet structure is governed by the minimum level of the incoming drain and the bottom level of the pond is governed by the ground water table.

The detention pond is proposed at the current location of ponding of water near the aerodrome road which has a larger footprint on the ground. The detention pond will be limited to a smaller footprint with a larger depth of 3m. The overflow from detention pond will be connected to swale on the southern perimeter of the fence.

5. Visual and Navigational Aids (Navaids) Design (including lighting)

5.1 Background Information

The visual and navaids design is as per the following background information:

- **Visual Site Inspection** of the condition and performance of the visual and navaids on-site, including lighting
- **Topographical Survey** conducted as part of the on-site investigations, which shows the placement of the lighting

5.2 Assumptions and Limitations

The following assumptions and limitations are applicable to the visual and navigational aids design:

- The precision approach path indicator (PAPI) lights for runway 12/30, have been installed in 2022 and are deemed to be in a good condition. Therefore, no changes would be made to the PAPI lights.
- The installation of a simple approach lighting system (SALS), for a non-precision approach runway is only a recommendation and not a requirement as per *CASA Part 139 MoS*. The SALS extends to a length of at least 420m beyond the edge of the pavement. At present, for Runway 12/30, there isn’t sufficient length at the ends of the runway within the airport boundary for the installation of SALS. Therefore, considering the additional land acquisition and the optional installation of the SALS, this has not been included in the design for Cloncurry Airport.
- Runway 06/24 is declared as a non-instrument runway with no night or low visibility operations and therefore it is assumed no airfield lighting is required.
- The design does not include any design related to civil and electrical works required for the installation of Airfield Ground Lighting (AGL) and apron flood lights (not part of concept design contract). It is recommended that whenever Council initiates Detailed Design either via a Consultant or an EPC Contractor, it be clarified what the requirements for electrical system upgrades will be, and that this is designed in unison with the rest of the disciplines.
- The navigational aids present at the airport today is a Non-Directional Beacon (NDB) and this is deemed sufficient for the operations at Cloncurry Airport currently and in the future, whilst maintaining the main runway as an instrument non-precision runway.

5.3 Design Standards

The design standards to be followed are:

- *Civil Aviation Safety Authority (CASA) – Part 139 (Aerodromes) Manual of Standards 2019.*
- *ICAO Annex 14 Aerodromes – Volume I Aerodrome Design and Operations (to be used where referred to in CASA Part 139 MoS and/or where clear guidance is not provided in CASA Part 139 MoS)*
- *ICAO Document 9157, Aerodrome Design Manual, Part 4 - Visual Aids*
- *ICAO Document 9157, Aerodrome Design Manual, Part 5 – Electrical Systems*
- *ICAO Document 9157, Aerodrome Design Manual, Part 6 – Frangibility*

5.4 Design Objective

At present, the entire AGL and apron lighting system at Cloncurry Airport is not compliant with respect to the placement and the lux requirements. The new design would ensure that the aforementioned lights are compliant as per the relevant standards.

5.5 Airfield Ground Lighting Design

Listed below in Table 15 are the visual aids (AGL) that are included within the design:

Table 15 AGL and Apron Flood Lighting Design Scope and Performance

Infrastructure	Design Element	Design Performance
Runway 12/30	Simple approach lighting system (SALS)	CASA recommendation. Not considered for this project. CASA, Part 139, MOS, Chapter 9, 9.39, 9.40 CASA, AC 139.C-09v1.0
	Runway Threshold Lights	Fixed; Unidirectional; Green Row of 6 elevated lights, evenly spaced. CASA, Part 139, MOS, Chapter 9, 9.54, 9.55, 9.57 CASA, AC 139.C-09v1.0
	Runway End Lights	Fixed; Unidirectional; Red Row of 6 elevated lights, evenly spaced. CASA, Part 139, MOS, Chapter 9, 9.64, 9.65 CASA, AC 139.C-09v1.0
	Runway Turn Pad Edge Light	Fixed; Omnidirectional; Blue Lights around the perimeter of turn pad spaced at max. 30m. CASA, Part 139, MOS, Chapter 9, 9.67 CASA, AC 139.C-09v1.0
	PAPI lights	Existing lights remains in existing location. No new PAPIs required. CASA, Part 139, MOS, Chapter 9, 9.48, 9.49, 9.50 CASA, AC 139.C-09v1.0
	Runway Edge Lights	Fixed; Omnidirectional; White

		Two parallel rows of lights, equal distance from centreline, evenly spaced at max. 60m. CASA, Part 139, MOS, Chapter 9, 9.51, 9.52 CASA, AC 139.C-09v1.0
	Wind Direction Indicator (WDI)	Existing WDI remains in existing location. No new required. CASA, Part 139, MOS, Chapter 9, 9.38 CASA, AC 139.C-09v1.0
Runway 06/24	Non-Instrument runway with no night or low visibility operations – No lights required.	
Taxiway A **Taxiway 2**	Taxiway Edge Lights	Fixed; Omnidirectional; Blue CASA, Part 139, MOS, Chapter 9, 9.78, 9.91, 9.92, 9.93 CASA, AC 139.C-09v1.0
	Runway Guard Lights	CASA recommendation. Not considered for this project. Fixed; Flashing; Yellow CASA, Part 139, MOS, Chapter 9, 9.98, 9.99, 9.100 9.105, 9.106, 9.107 CASA, AC 139.C-09v1.0
Taxiway C **Taxiway D** **Taxiway E** **GA Hangar Taxiway** **Taxilane 1** **Taxilane 2**	Non-Instrument with no night or low visibility operations – No lights required.	

ATO Apron	Apron Flood Lights	Illuminance of the entire ATO apron, GA Apron and GSE areas. CASA, Part 139, MOS, Chapter 9, 9.113, 9.114, 9.1115, 9.116 CASA, AC 139.C-09v1.0
	Apron Edge Lights	Fixed; Omnidirectional; Blue CASA, Part 139, MOS, Chapter 9, 9.78 CASA, AC 139.C-09v1.0
	Stand Parking Identification Signs	CASA recommendation. Not considered for this project. Illuminated (or non-illuminated) stand designation number signs CASA, Part 139, MOS, Chapter 9, 9.126 CASA, AC 139.C-09v1.0
Movement Area Guidance Signs (MAGS)	CASA recommendation. Not considered for this project. Varies, as per CASA requirements. CASA, Part 139, MOS, Chapter 8, Division 6, 8.85 CASA, AC 139.C-09v1.0	

5.6 Apron Flood Lighting Design

At present there are six apron flood lights masts at Cloncurry Airport. Three are positioned on the northern side of the ATO Apron, while the remaining three are located on the southern side of the ATO Apron, adjacent to the terminal building. Each of these apron flood light masts has one light fixture, that has been installed at an angle which could potentially dazzle the pilots manoeuvring into a stand (non-compliant lighting).

To verify this non-compliance, a lighting analysis of the existing scenario was conducted. The existing mast locations and heights as well as the single light fitting on each mast was reviewed. This analysis confirmed that the existing condition was non-compliant as the minimum required lux levels were not achieved throughout the apron area.

New apron flood lights were designed at the existing mast locations but with new mast heights within the allowable OLS limitations where each mast was mounted with multiple lights on each mast. This analysis was performed to check if it was possible to reach a compliant design based on the existing mast locations but with an increased number of lights per mast. Preliminary analysis indicates that it is possible to meet the minimum lux requirements based on this design.

Tabulated below in Table 16 are the results of the lighting analysis for the existing scenario and the new scenario, along with the height of the OLS surface at the mast locations.

Table 16 Apron Flood Lighting Analysis

	Mast 1	**Mast 2**	**Mast 3**	**Mast 4**	**Mast 5**	**Mast 6**		
OLS Height Limitation	11m	10m	8m	6m	15.5m	20m		
Scenario	**Height of mast / No. of lights**						**Avg. lux at surface / Uniformity**	**Comments**
Existing Scenario	10.07m/ 1 Nos.	8.96m/ 1 Nos.	7.52m/ 1 Nos.	5.95m/ 1 Nos.	15.22m/ 1 Nos.	15.13m/ 1 Nos.	5.54/ 0.08	Lux & uniformity are not meeting as per standard.
New Scenario	9m/ 6 Nos.	9m/ 3 Nos	5m/ 3 Nos	5m/ 3 Nos	15m/ 5 Nos	15m/ 4 Nos	21 0.27	Lux & uniformity are meeting as per standard.

It should be noted that it may not be possible to reuse the existing masts or mast foundations. Additionally, a study for alternative light mast locations could be considered and suggest this be investigated further at later design stages.

6. Pavement Paint Markings Design

6.1 Background Information

The design of the pavement paint markings uses the following background information:

- **Visual Site Inspection** of the condition of the current paint markings on-site
- **Topographical Survey** shows the placement of the paint markings

6.2 Design Standards

The design standards followed are:

- *Civil Aviation Safety Authority (CASA) – Part 139 (Aerodromes) Manual of Standards 2019.*
- *ICAO Annex 14 Aerodromes – Volume I Aerodrome Design and Operations (to be used where referred to in CASA Part 139 MoS and/or where clear guidance is not provided in CASA Part 139 MoS)*

6.3 Markings Design

On paved surfaces, the markings should be as follows:

- Runway markings on sealed runway surfaces must be white.
- Taxiway markings must be coloured yellow and provide continuous guidance between the runway and the apron
- Apron markings must be designed to be clearly discernible, succinct, uncluttered and, as far as possible, not overlapping to ensure that all applicable clearance standards are met and safe manoeuvring and precise positioning of aircraft is achieved.

As documented in Table 17, the following pavement paint markings are to be designed for the existing and the new paved areas as per the relevant CASA clauses.

Table 17 Pavement Paint Markings Design

Infrastructure	Design Element	CASA MoS Part 139
Runway 12/30 Runway 06/24	Runway Threshold Markings	Clause 8.17
	Runway Designation Markings	Clause 8.18
	Runway Centreline Markings	Clause 8.19
	Runway End Markings	Clause 8.20
	Runway Side-Stripe Markings	Clause 8.21
	Aiming Point Markings (applicable only to RWY 12/30)	Clause 8.22
	Touchdown Zone Markings (applicable only to RWY 12/30)	Clause 8.23, 8.25
	Runway Turn Pad Markings	Clause 8.33
Taxiway A	Taxi Guideline Markings	Clause 8.36

Taxiway B Taxiway C Taxiway D Taxiway E	Taxi Guidelines on Runways (not applicable to TWY E)	Clause 8.37
	Runway Holding Position Markings (not applicable to TWY E)	Clause 8.39
	Taxiway Edge Markings	Clause 8.43
GA Hangar Taxiway Taxilane 1 Taxilane 2	Taxi Guideline Markings	Clause 8.36
ATO Apron	Apron Taxi Guidelines	Clause 8.47
	Apron Edge Markings	Clause 8.48
	Aircraft Type Designator Markings	Clause 8.49
	Aircraft Parking Position Markings	Clause 8.55
	Lead-In Lines	Clause 8.56
	Aircraft Parking Position Designation Markings – Apron Taxiway and Taxilane	Clause 8.57
	Aircraft Parking Position Designations - Parking Position	Clause 8.58
	Primary Aircraft Parking Position Markings	Clause 8.62
	Marshaller Stop Lines	Clause 8.63
	Pilot Stop Line Markings	Clause 8.64
	Alignment Lines	Clause 8.65
	Lead-Out Lines	Clause 8.68
	Designation Characters for Taxi and Apron Markings	Clause 8.69
	Passenger Path Markings	Clause 8.76
GA Apron New GA Apron	Apron Edge Markings	Clause 8.48
	Parking Clearance Line	Clause 8.50

	Designation Characters for Taxi and Apron Markings	Clause 8.69

7. Cost Estimate

As part of this Concept Design, the indicative capital expenditure required has been estimated.

7.1 Assumptions and Limitations

The following assumptions are considered for the concept design estimates:

- The investment budget estimate includes infrastructure that has been designed as per the scope of the concept design, except the estimate on the terminal building design and the enabling works/ utilities to the new GA area where this estimate has been carried over from WP3 – Master Planning.
- This budget does not reflect any investments the Airport/ Council need to make with respect to equipment on airside, terminal, or landside, as it is subject to conditional repair/ replacement and operational preference.
- This investment estimate does not include costs associated to civil works, electrical works and installation charges for AGL.

7.2 Cost Estimate

The summary of the cost estimate has been tabulated in Table 18.

Table 18 Summary of cost estimate

Item		Investment Estimate (million AUD)
Airside	Civil Works – Existing Infra	23.17
	Civil Works – New Infra	3.30
	AGL & Floodlighting	0.45
	Pavement Markings	0.15
	Ancillary	0.02
Terminal Building		0.05
Landside		0.01
Miscellaneous		2.17
Total CAPEX		**29.31**
Mobilisation, Administration & Contingencies		23.45
GRAND TOTAL INVESTMENT		**52.76**

The detailed cost estimation can be found in Appendix 7.

7.3 Observations

With the refinement in design from WP3 – Master Plan to WP4 – Concept Design, so has the investment budget estimates. This investment estimate has been streamlined, and a reduction in the values has been observed across almost all items, expect the airside civil works for the existing infrastructure. There is a substantial increase in the cost estimate of these works which further reflects in the increase in total CAPEX and the grand total investment.

Listed below are the causes for the substantial increase in the cost estimate for the airside civil works associated to the existing infrastructure:

- Pavements

Based on the pavement information available from the site inspections and investigations which were conducted prior to WP3 – Master Planning (except geotechnical investigations – due to unforeseen delays), the existing pavements were considered to be in fairly decent condition. Most Code C pavements were assumed to require a new surface course and most Code B pavements were assumed to require a new surface course and base course.

However, the completion and the results from the geotechnical investigations, which were completed and received during the early works of WP4 -Concept Design, reveal that the pavement layers underneath the surface are in poor condition. The assessment of the pavement layers and the residual life now show that both the runways, two taxiways and part of the ATO apron require a full reconstruction as the remaining life is zero. A full reconstruction would require digging up the layers of the old pavement and replacing it all with new pavement. This has been a major contributor to the increase in cost estimates.

- Drainage
  New information on on-site drainage infrastructure was discovered during WP4 - Concept Design. This information brought to light primarily the existence of an entire series of pits and pipes that have been abandoned since the demolition of the old runways. Therefore, additional cost is now associated to the rehabilitation and demolition of this pipe network.

8. Further Considerations and Conclusion

8.1 Further Considerations

The following sections present further considerations to be undertaken by the Council.

8.1.1 Electrical

This concept design does not include any design related to civil and electrical works required for the installation of Airfield Ground Lighting (AGL) and apron flood lights (not part of concept design contract). However, it is recommended that whenever Council initiates Detailed Design either via a Consultant or an EPC Contractor, it be clarified what the requirements for electrical system upgrades will be, and that this is designed in unison with the rest of the disciplines. Some of these components to be looked into would need to include the following:

Existing Electrical Distribution Systems

It is understood the existing site wide electrical distribution systems are old and not in accordance with current regulations. It is recommended prior to commencing with detailed design to carry out a full electrical condition survey including recommendations for system upgrades and/or replacements.

AGL Circuits

It is proposed that the new AGL be supplied from new Constant Current Regulators (CCRs) on interleaved series circuits. For the existing PAPIs, it is recommended to replace the existing circuits with new circuits which are supplied from new CCRs.

AGL Ducts and Chambers

It is recommended that the AGL's primary and secondary cables be installed in a duct and chamber network. Cable connections and AGL series transformers should be installed within the chambers.

Pilot Activated Lights (PAL) System

At present, there is an existing PAL system in use at Cloncurry Airport and it is proposed that the existing system be upgraded with a new modern PAL system. Additionally, it should be ensured that all AGL shall be PAL compatible.

Electrical Supplies

It is recommended the proposed new floodlighting be supplied with a new electrical supply. A control system shall be included for the apron floodlighting and the type of control system shall be determined at later design stages.

The proposed hangar plots will require connection to the electrical distribution system. It is recommended that the demand and metering requirements for the new hangar plots be determined, and new electrical supplies be designed for each of the hangar plots at later design stage.

It shall also be decided if the M&E systems within the hangar plots are included in the detailed design.

8.1.2 Sewar

The proposed hangars in the new infratructure could be provided with sewer pipes for collecting the waste from any toilets and/or kitchens. As per the proposed terminal redevelopment report, *Schematic Design Report Cloncurry Airport Terminal Upgrade*, a new pumping station would be provided in the south west corner of the site. Additionally a suitable discharge point for the airport facility by means of this new pumping station and raising the sewar mains connecting back to the town's suburban infrastructure to the south-west corner of the site has been identified.

The new hangars infrastructure could have an internal sewer network which will drain to the proposed terminal manhole and further connect to pumping station. See schematic sketch for this in Figure 27.

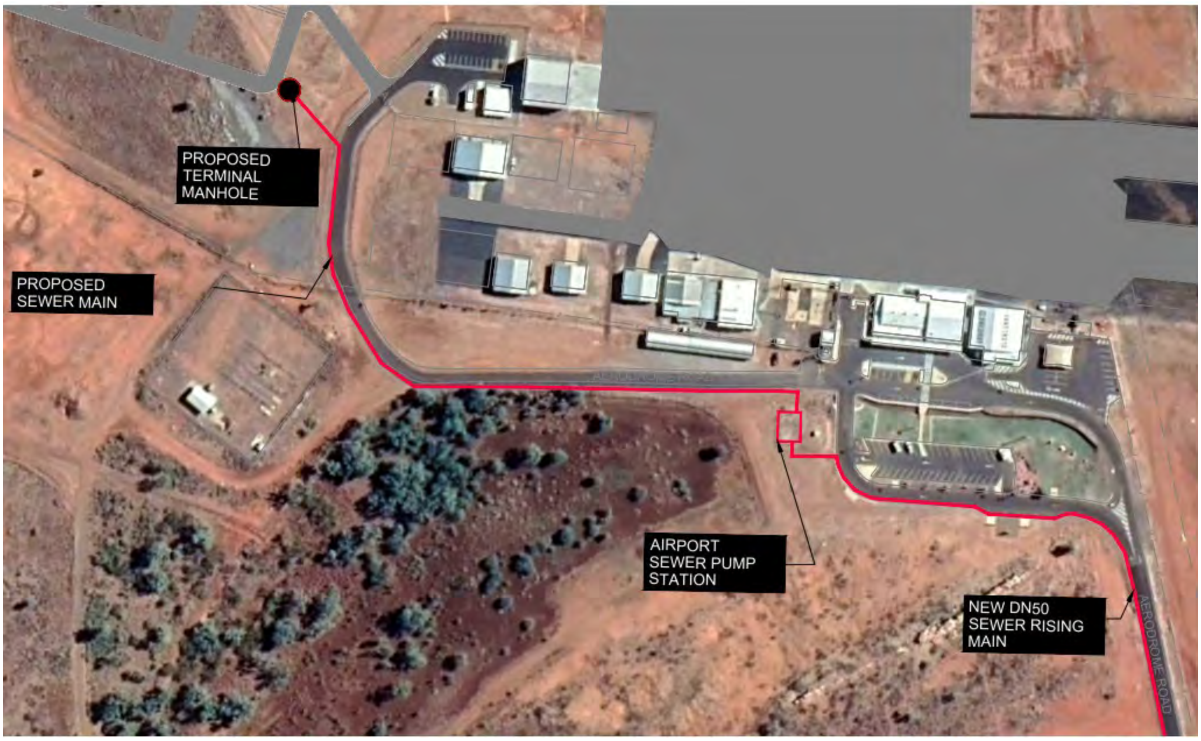

Figure 27 Schematic Sewar Connection

8.2 Conclusion

This concept design was prepared such that, depending on the desired procurement approach to be adopted by Cloncurry Shire Council, the design could be adopted and developed further as a detailed design or directly to a design and build arrangement.

Appendix 1
Existing Infrastructure Layout Drawings

KEY PLAN

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. THE DRAWING IS IN COORDINATE SYSTEM MGA Zone 54.
3. RUNWAY AND TAXIWAY/ TAXILANE CENTRELINES ARE FOR VISUAL REPRESENTATION ONLY.

LEGEND:-

- RUNWAY
- RUNWAY STRIP
- CLEARWAY
- RUNWAY END SAFETY AREA (RESA)
- TAXIWAYS/ TAXILANES
- APRON AREA
- AIRPORT FENCE
- EXISTING BUILDINGS
- LEASED LAND PLOTS

REV.	DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED

PROJECT NO. 1100053797 | SCALE 1:4000

DATE	DRAWN	DESIGNED	CHECKED	APPROVED
25-05-2023	SUAB	DPCA	ALIP	HNM

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Cloncurry Airport Master Plan And Concept Design

CONCEPT DESIGN
EXISTING SITE PLAN - OVERALL PLAN

DRAWING NO. CNJ-CD-GL-DW-1-100 | REV. 00

KEY PLAN

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. THE DRAWING IS IN COORDINATE SYSTEM MGA Zone 54.
3. RUNWAY AND TAXIWAY/ TAXILANE CENTRELINES ARE FOR VISUAL REPRESENTATION ONLY.

LEGEND:-

- RUNWAY
- RUNWAY STRIP
- CLEARWAY
- RUNWAY END SAFETY AREA (RESA)
- TAXIWAYS/ TAXILANES
- APRON AREA
- AIRPORT FENCE
- EXISTING BUILDINGS
- LEASED LAND PLOTS

REV.	DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED

PROJECT NO. 1100053797

SCALE 1:1000

DATE	DRAWN	DESIGNED	CHECKED	APPROVED
25-05-2023	SUAB	DPCA	ALIP	HNM

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CONCEPT DESIGN
EXISTING SITE PLAN - SHEET 11

DRAWING NO. CNJ-CD-GL-DW-1-111

REV. 00

Appendix 2
New Infrastructure Layout Drawings

KEY PLAN

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. THE DRAWING IS IN COORDINATE SYSTEM MGA Zone 54.
3. RUNWAY AND TAXIWAY/ TAXILANE CENTRELINES ARE FOR VISUAL REPRESENTATION ONLY.
4. THIS DRAWING BELONGS TO A CONCEPT DESIGN STAGE AND SHALL NOT BE USED FOR CONSTRUCTION PURPOSES.

LEGEND:-

- RUNWAY
- RUNWAY STRIP
- TAXIWAY STRIP
- JET BLAST PAD
- CLEARWAY
- RUNWAY END SAFETY AREA (RESA)
- TAXIWAYS/ TAXILANES
- HANGAR ROAD
- APRON AREA
- AIRPORT FENCE
- EXISTING BUILDINGS
- LEASED LAND PLOTS

REV.	DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED

PROJECT NO. 1100053797

SCALE 1:4000

DATE	DRAWN	DESIGNED	CHECKED	APPROVED
25-05-2023	KUSO	DPCA	ALIP	HNM

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Cloncurry Airport Master Plan And Concept Design

CONCEPT DESIGN
GENERAL ARRANGEMENT PLAN - OVERALL PLAN

DRAWING NO. CNJ-CD-GM-DW-1-100

REV. 00

KEY PLAN

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. THE DRAWING IS IN COORDINATE SYSTEM MGA Zone 54.
3. RUNWAY AND TAXIWAY/ TAXILANE CENTRELINES ARE FOR VISUAL REPRESENTATION ONLY.
4. THIS DRAWING BELONGS TO A CONCEPT DESIGN STAGE AND SHALL NOT BE USED FOR CONSTRUCTION PURPOSES.

LEGEND:-

- RUNWAY
- RUNWAY STRIP
- TAXIWAY STRIP
- JET BLAST PAD
- CLEARWAY
- RUNWAY END SAFETY AREA (RESA)
- TAXIWAYS/ TAXILANES
- HANGAR ROAD
- APRON AREA
- AIRPORT FENCE
- EXISTING BUILDINGS
- LEASED LAND PLOTS

REV.	DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED

PROJECT NO.	SCALE
1100053797	1:1000

DATE	DRAWN	DESIGNED	CHECKED	APPROVED
25-05-2023	KUSO	DPCA	ALIP	HNM

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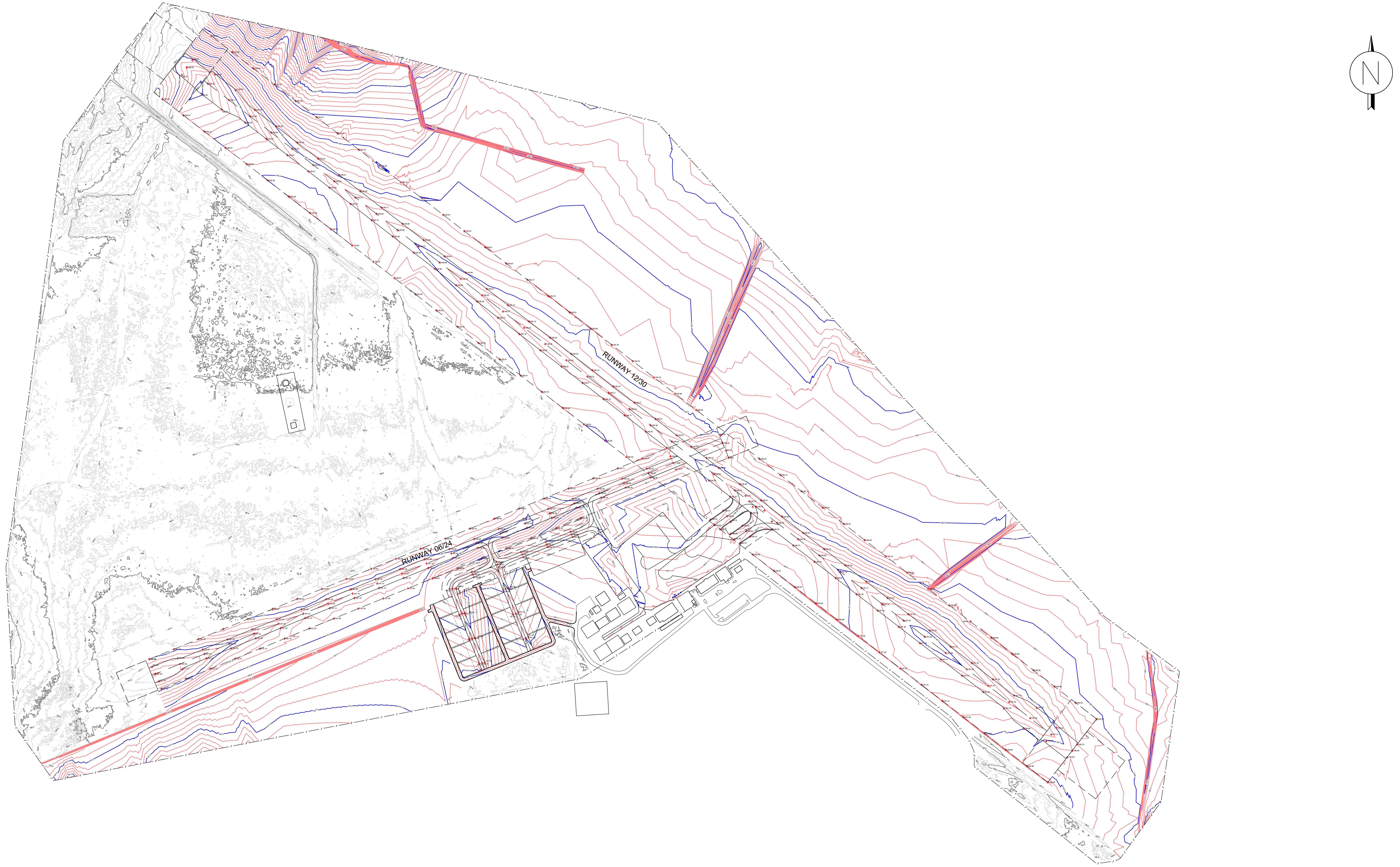
Cloncurry Airport Master Plan And Concept Design

CONCEPT DESIGN
GENERAL ARRANGEMENT PLAN
SHEET 11

DRAWING NO. CNJ-CD-GM-DW-1-111
REV. 00

Appendix 3
General Levels Plan Drawing



KEY PLAN

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
2. THE DRAWING IS IN COORDINATE SYSTEM MGA Zone 54.
3. RUNWAY AND TAXIWAY/ TAXILANE CENTRELINES ARE FOR VISUAL REPRESENTATION ONLY.
4. THIS DRAWING BELONGS TO A CONCEPT DESIGN STAGE AND SHALL NOT BE USED FOR CONSTRUCTION PURPOSES.

LEGEND:-

186.5	PROPOSED MAJOR CONTOUR
186.1	PROPOSED MINOR CONTOUR
186.0	EXISTING MAJOR CONTOUR
186.2	EXISTING MINOR CONTOUR
—/—/—/—	AIRPORT FENCE

REV.	DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED

PROJECT NO. 1100053797

SCALE 1:4000

DATE	DRAWN	DESIGNED	CHECKED	APPROVED
29-05-2023	KUSO	ARKUM	ALIP	HNM

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Cloncurry Airport Master Plan And Concept Design

CONCEPT DESIGN
GENERAL LEVELS PLAN - OVERALL PLAN

DRAWING NO. CNJ-CD-GM-DW-2-100

REV. 00

Appendix 4
FAARFIELD Section Report – Calculation of Residual Life of Existing Pavement

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Runways

Section: Rwy 12-30 - Part 1

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-11 17:26:04

Calculated Life = 0.0 Years

Total thickness to the top of the subgrade = 440mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	220	217.00	0.35	0
2	User Defined	220	217.00	0.35	0
3	Subgrade	0	22.00	0.35	0

Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	3,384	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	3,384	0
3	Beechcraft King Air B200	5,711	1,665	0
4	Beechcraft King Air 350	6,849	1,665	0
5	Q400/Dash 8 Series 400	29,347	1,523	0
6	EMB-190 STD	47,950	248	0
7	Fokker-F-100	45,813	248	0
8	Fokker-F-100	45,813	1,752	0
9	B737-800	79,242	39	0

Additional Airplane Information

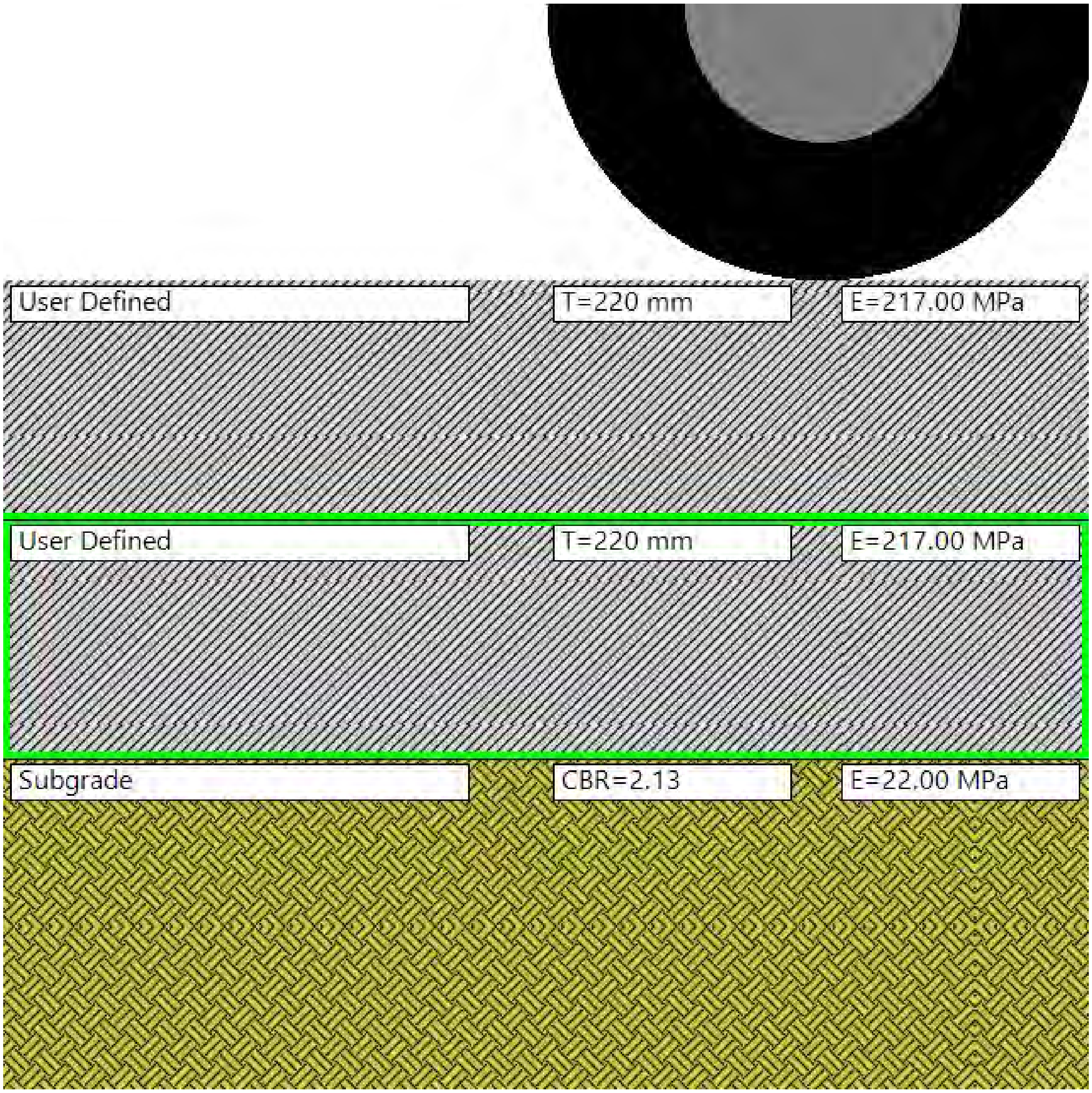
Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	0
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	0
3	Beechcraft King Air B200	0.00	0.00	0
4	Beechcraft King Air 350	0.00	0.00	0
5	Q400/Dash 8 Series 400	0.00	0.00	0
6	EMB-190 STD	0.00	0.00	0
7	Fokker-F-100	0.00	0.00	0
8	Fokker-F-100	0.00	0.00	0
9	B737-800	0.00	0.00	0

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	7.93
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	7.07
3	Beechcraft King Air B200	0.00	0.00	3.83
4	Beechcraft King Air 350	0.01	0.01	3.60
5	Q400/Dash 8 Series 400	0.00	0.04	2.14
6	EMB-190 STD	0.04	0.04	1.94
7	Fokker-F-100	0.08	0.08	1.83
8	Fokker-F-100	0.57	0.57	1.83
9	B737-800	0.28	0.29	1.86

User Is responsible For checking frost protection requirements.


User Defined
T=220 mm
E=217.00 MPa
User Defined
T=220 mm
E=217.00 MPa
Subgrade
CBR=2.13
E=22.00 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Runways

Section: Rwy 12-30 Part 2

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-11 17:27:24

Calculated Life = 0.0 Years

Total thickness to the top of the subgrade = 620mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	310	114.00	0.35	0
2	User Defined	310	114.00	0.35	0
3	Subgrade	0	25.00	0.35	0

Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	3,384	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	3,384	0
3	Beechcraft King Air B200	5,711	1,665	0
4	Beechcraft King Air 350	6,849	1,665	0
5	Q400/Dash 8 Series 400	29,347	1,523	0
6	EMB-190 STD	47,950	248	0
7	Fokker-F-100	45,813	248	0
8	Fokker-F-100	45,813	1,752	0
9	B737-800	79,242	39	0

Additional Airplane Information

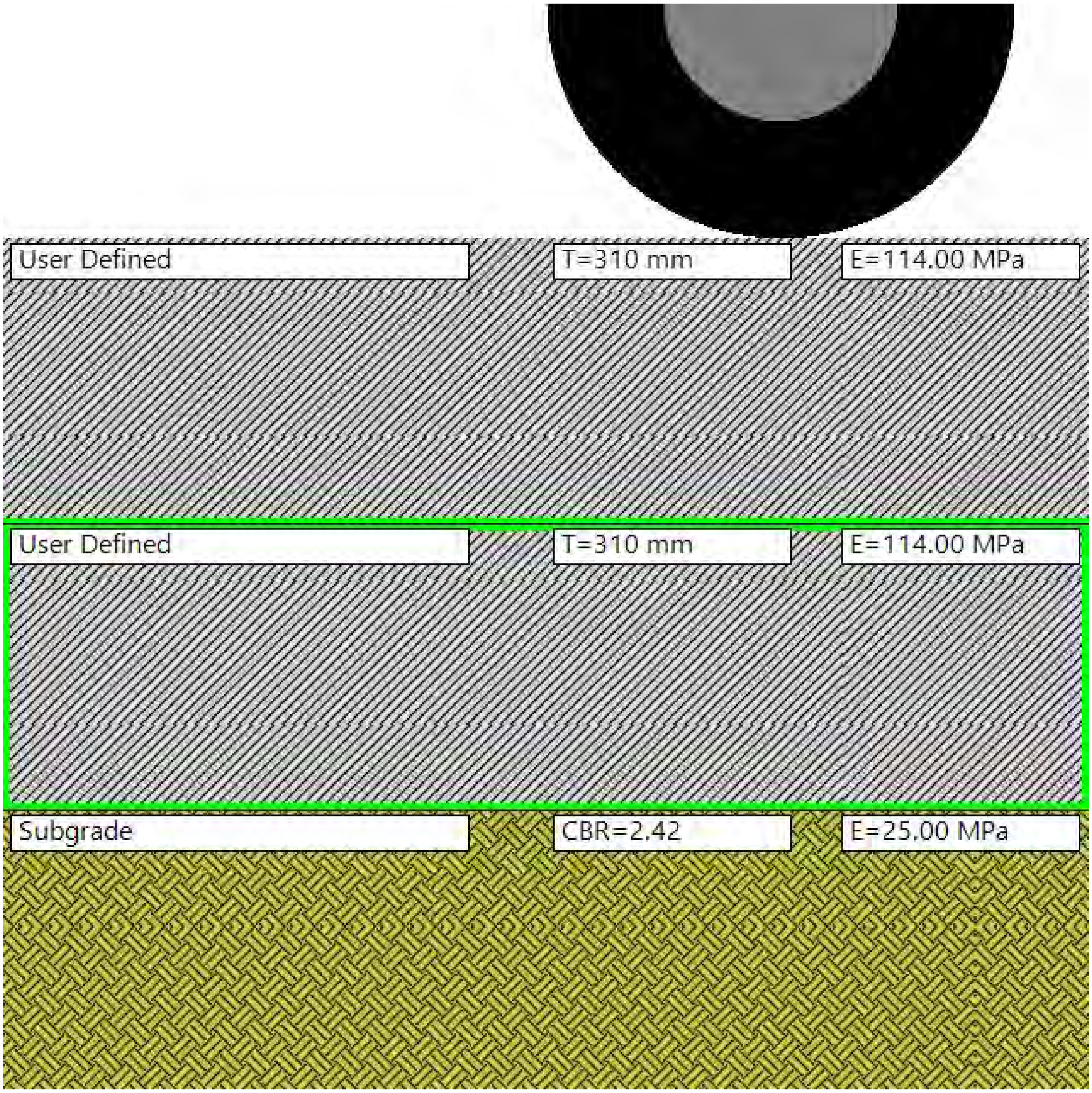
Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	2.76
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	2.66
3	Beechcraft King Air B200	0.00	0.00	2.01
4	Beechcraft King Air 350	0.00	0.00	1.99
5	Q400/Dash 8 Series 400	60.80	614.03	1.67
6	EMB-190 STD	452.04	497.56	1.34
7	Fokker-F-100	1455.98	1455.98	1.51
8	Fokker-F-100	10285.80	10285.80	1.51
9	B737-800	3888.11	4089.60	1.32

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	7.93
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	7.07
3	Beechcraft King Air B200	0.00	0.00	3.83
4	Beechcraft King Air 350	0.01	0.01	3.60
5	Q400/Dash 8 Series 400	0.00	0.04	2.14
6	EMB-190 STD	0.04	0.04	1.94
7	Fokker-F-100	0.08	0.08	1.83
8	Fokker-F-100	0.57	0.57	1.83
9	B737-800	0.28	0.29	1.86

User Is responsible For checking frost protection requirements.


User Defined
T=310 mm
E=114.00 MPa
User Defined
T=310 mm
E=114.00 MPa
Subgrade
CBR=2.42
E=25.00 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Runways

Section: Rwy 12-30 Part 3

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-11 17:28:09

Calculated Life = 0.0 Years

Total thickness to the top of the subgrade = 300mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	150	352.00	0.35	0
2	User Defined	150	352.00	0.35	0
3	Subgrade	0	20.00	0.35	0

Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	3,384	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	3,384	0
3	Beechcraft King Air B200	5,711	1,665	0
4	Beechcraft King Air 350	6,849	1,665	0
5	Q400/Dash 8 Series 400	29,347	1,523	0
6	EMB-190 STD	47,950	248	0
7	Fokker-F-100	45,813	248	0
8	Fokker-F-100	45,813	1,752	0
9	B737-800	79,242	39	0

Additional Airplane Information

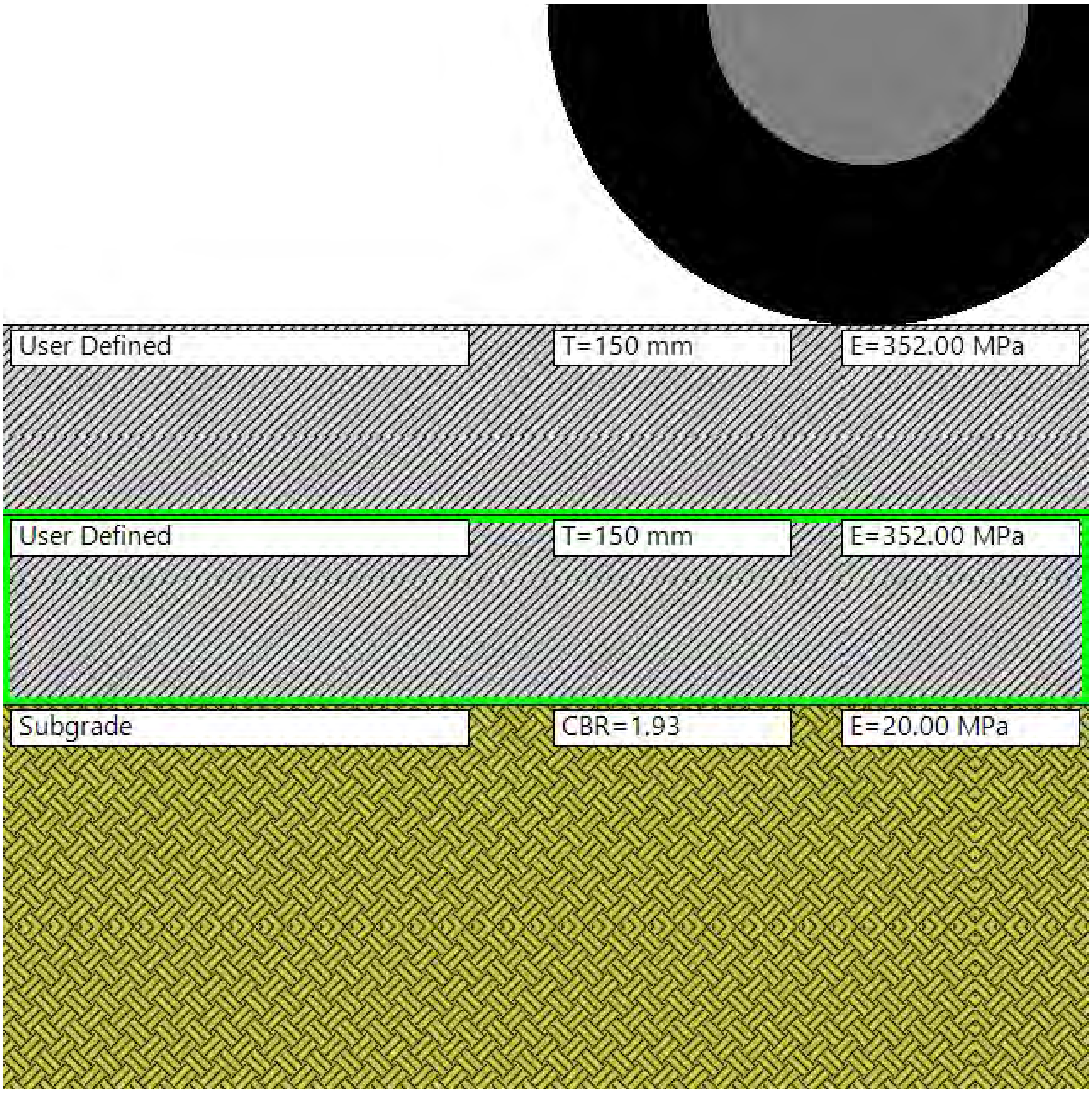
Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	4.78
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	4.47
3	Beechcraft King Air B200	0.04	0.04	2.8
4	Beechcraft King Air 350	1.43	1.43	2.75
5	Q400/Dash 8 Series 400	4153.46	51913.38	2.14
6	EMB-190 STD	48752.55	53976.80	1.94
7	Fokker-F-100	105487.61	105487.61	1.83
8	Fokker-F-100	745218.94	745218.94	1.83
9	B737-800	363532.81	383794.53	1.86

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	7.93
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	7.07
3	Beechcraft King Air B200	0.00	0.00	3.83
4	Beechcraft King Air 350	0.01	0.01	3.60
5	Q400/Dash 8 Series 400	0.00	0.04	2.14
6	EMB-190 STD	0.04	0.04	1.94
7	Fokker-F-100	0.08	0.08	1.83
8	Fokker-F-100	0.57	0.57	1.83
9	B737-800	0.28	0.29	1.86

User Is responsible For checking frost protection requirements.



User Defined
T=150 mm
E=352.00 MPa
User Defined
T=150 mm
E=352.00 MPa
Subgrade
CBR=1.93
E=20.00 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Runways

Section: Rwy 06-24

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-11 17:29:06

Calculated Life = 0.2 Years

Total thickness to the top of the subgrade = 270mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	135	249.00	0.35	0
2	User Defined	135	249.00	0.35	0
3	Subgrade	0	13.00	0.35	0

Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	1,665	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	1,665	0
3	Beechcraft King Air B200	5,711	714	0
4	Beechcraft King Air 350	6,849	714	0

Additional Airplane Information

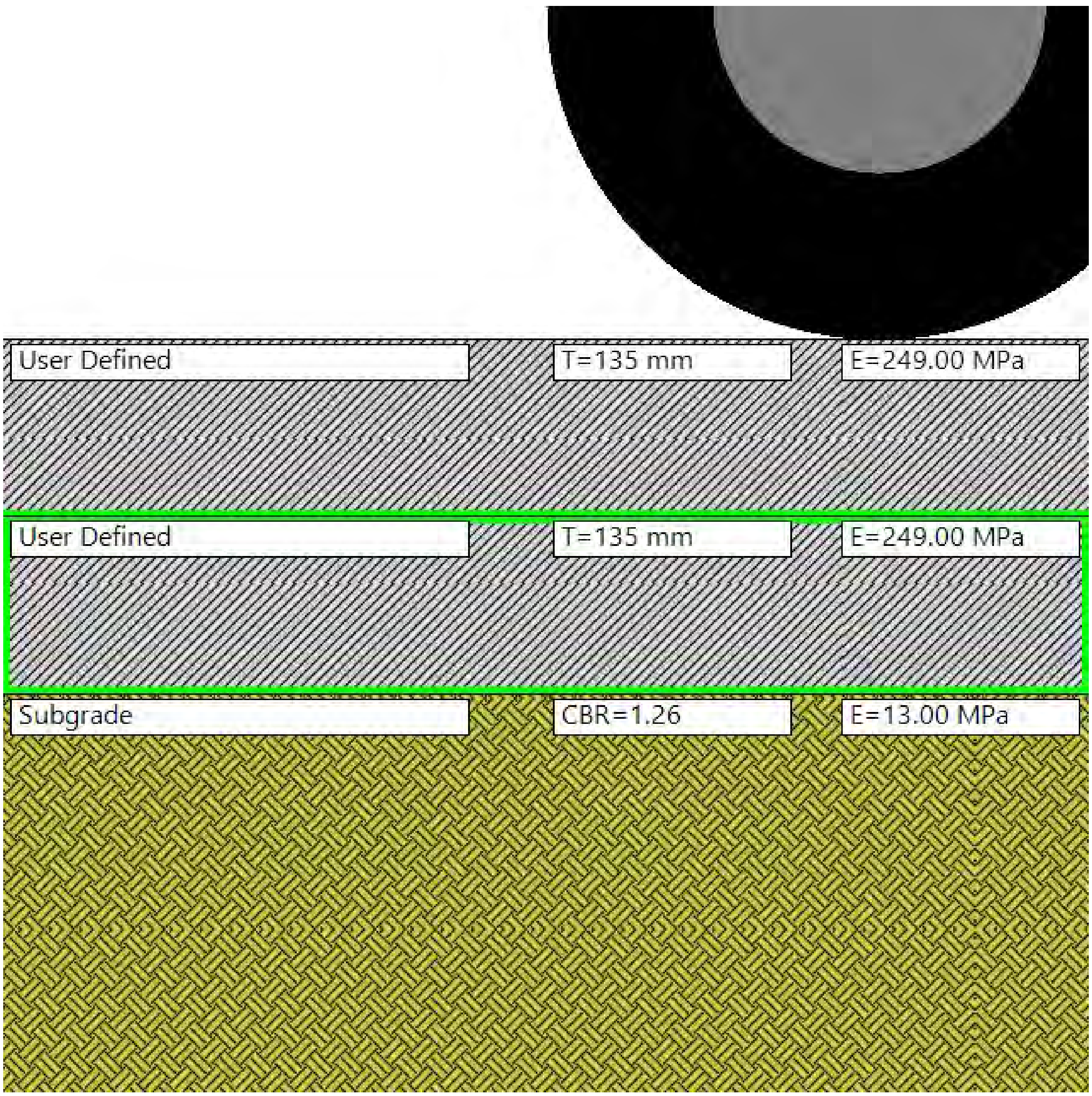
Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	5.15
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	4.79
3	Beechcraft King Air B200	18.49	18.49	2.92
4	Beechcraft King Air 350	77.04	77.04	2.85

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	7.93
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	7.07
3	Beechcraft King Air B200	0.00	0.00	3.83
4	Beechcraft King Air 350	0.01	0.01	3.60

User Is responsible For checking frost protection requirements.



Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Remaining life - Existing Pavements

Section: Twy A

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-11 16:55:51

Calculated Life = 15,184.7 Years

Total thickness to the top of the subgrade = 840mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	420	479.00	0.35	0
2	User Defined	420	479.00	0.35	0
3	Subgrade	0	46.00	0.35	0

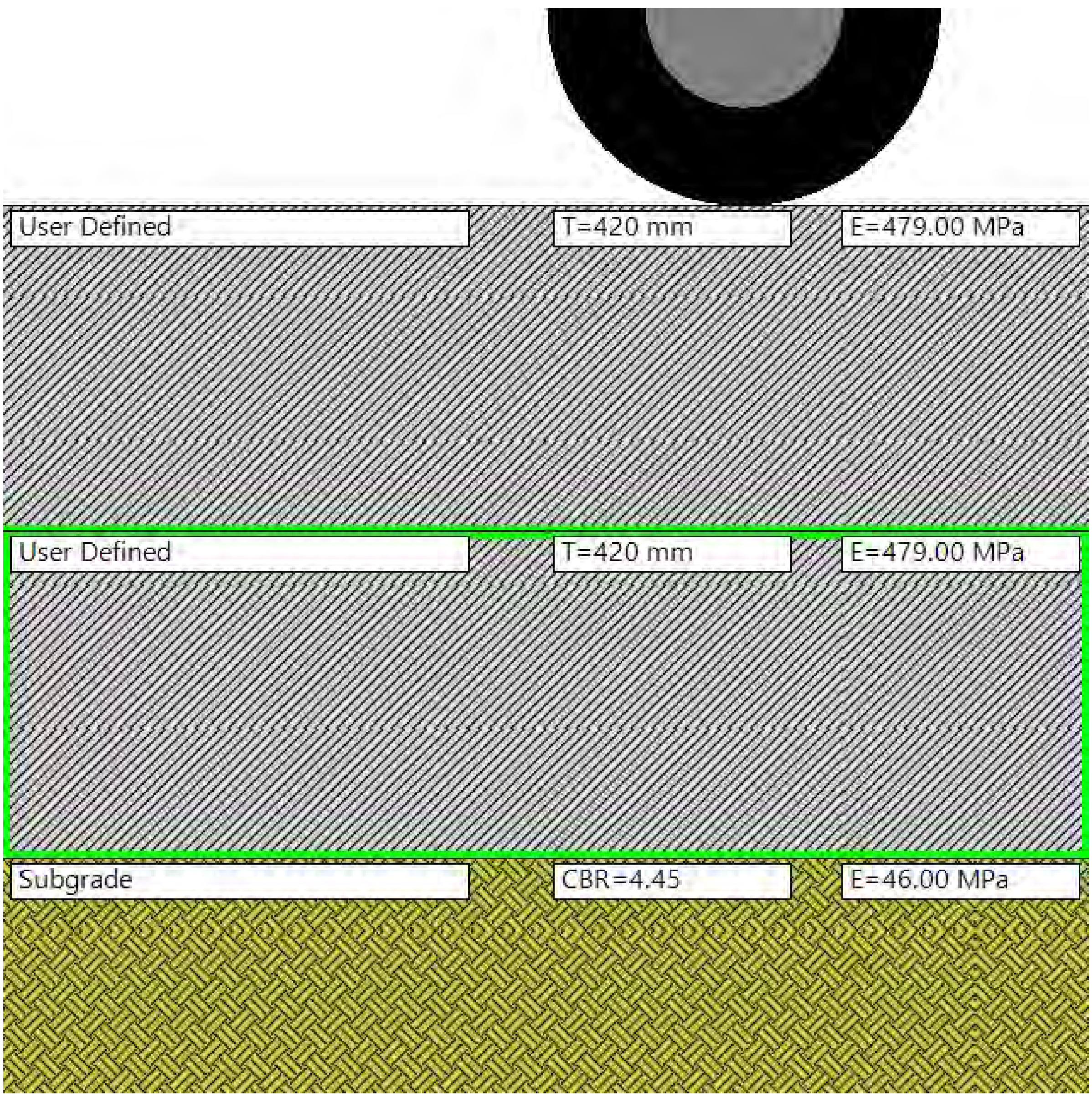
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	1,360	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	1,360	0
3	Beechcraft King Air B200	5,711	583	0
4	Beechcraft King Air 350	6,849	583	0
5	Q400/Dash 8 Series 400	29,347	533	0
6	EMB-190 STD	47,950	87	0
7	Fokker-F-100	45,813	87	0
8	Fokker-F-100	45,813	613	0
9	B737-800	79,242	14	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	2.17
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	2.12
3	Beechcraft King Air B200	0.00	0.00	1.72
4	Beechcraft King Air 350	0.00	0.00	1.7
5	Q400/Dash 8 Series 400	0.00	0.00	1.49
6	EMB-190 STD	0.00	0.00	1.25
7	Fokker-F-100	0.00	0.00	1.37
8	Fokker-F-100	0.00	0.00	1.37
9	B737-800	0.00	0.00	1.24

User Is responsible For checking frost protection requirements.



Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Remaining life - Existing Pavements

Section: Twy B

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-11 16:57:49

Calculated Life = 0.0 Years

Total thickness to the top of the subgrade = 270mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	135	289.00	0.35	0
2	User Defined	135	289.00	0.35	0
3	Subgrade	0	34.00	0.35	0

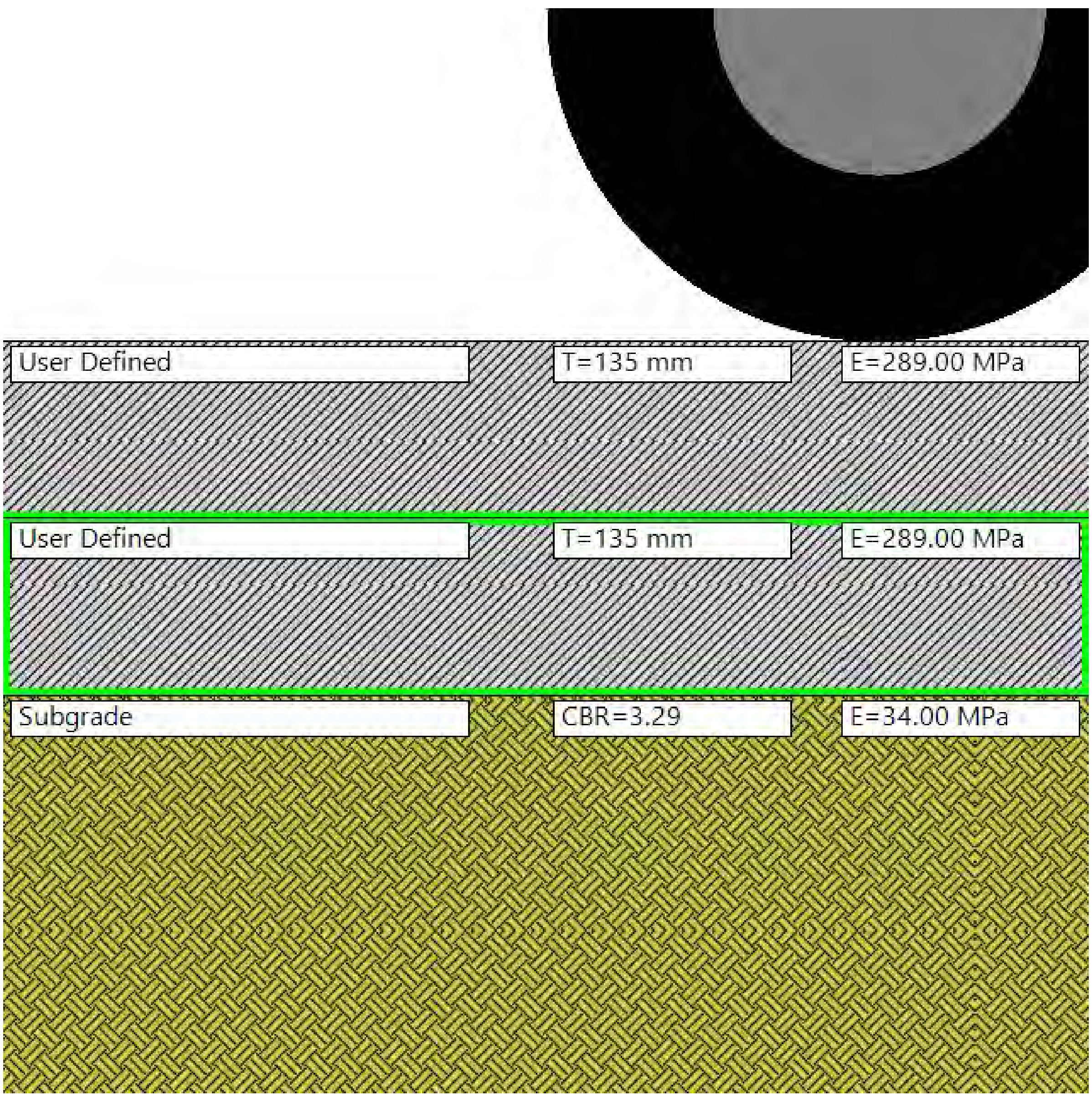
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	1,360	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	1,360	0
3	Beechcraft King Air B200	5,711	583	0
4	Beechcraft King Air 350	6,849	583	0
5	Q400/Dash 8 Series 400	29,347	533	0
6	EMB-190 STD	47,950	87	0
7	Fokker-F-100	45,813	87	0
8	Fokker-F-100	45,813	613	0
9	B737-800	79,242	14	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	5.15
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	4.79
3	Beechcraft King Air B200	0.03	0.03	2.92
4	Beechcraft King Air 350	0.61	0.61	2.85
5	Q400/Dash 8 Series 400	1496.13	18867.24	2.27
6	EMB-190 STD	15020.10	16634.44	2.04
7	Fokker-F-100	26810.07	26810.07	1.92
8	Fokker-F-100	188903.14	188903.14	1.92
9	B737-800	100619.87	106244.83	1.95

User Is responsible For checking frost protection requirements.



Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Remaining life - Existing Pavements

Section: Twy C

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-11 16:59:19

Calculated Life = 4.8 Years

Total thickness to the top of the subgrade = 270mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	135	372.00	0.35	0
2	User Defined	135	372.00	0.35	0
3	Subgrade	0	15.00	0.35	0

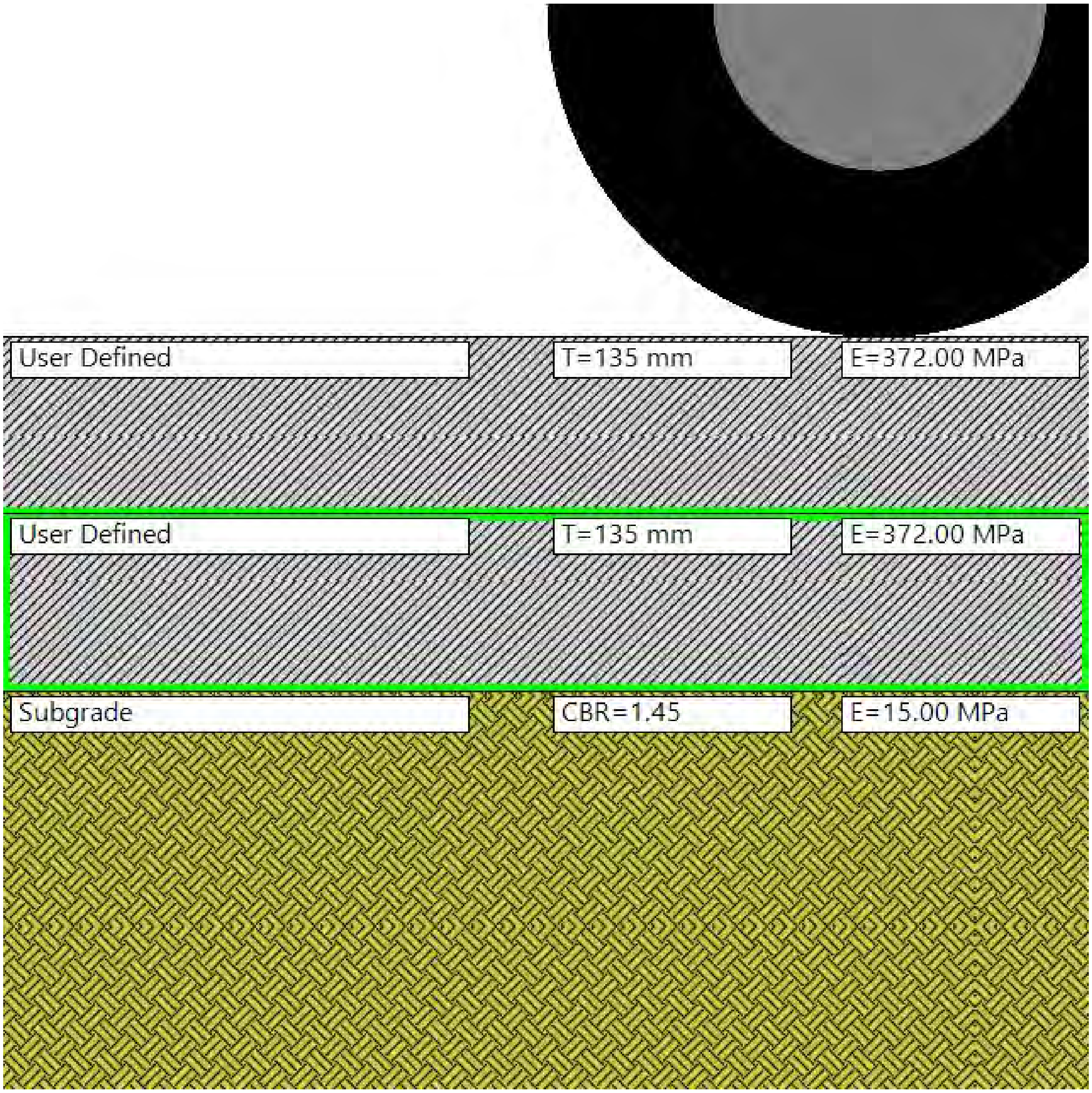
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	833	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	833	0
3	Beechcraft King Air B200	5,711	357	0
4	Beechcraft King Air 350	6,849	357	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	5.15
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	4.79
3	Beechcraft King Air B200	0.66	0.66	2.92
4	Beechcraft King Air 350	3.48	3.48	2.85

User Is responsible For checking frost protection requirements.


User Defined
T=135 mm
E=372.00 MPa
User Defined
T=135 mm
E=372.00 MPa
Subgrade
CBR=1.45
E=15.00 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Remaining life - Existing Pavements

Section: ATO APR - 1

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-11 17:04:48

Calculated Life = 23.4 Years

Total thickness to the top of the subgrade = 740mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	370	379.00	0.35	0
2	User Defined	370	379.00	0.35	0
3	Subgrade	0	37.00	0.35	0

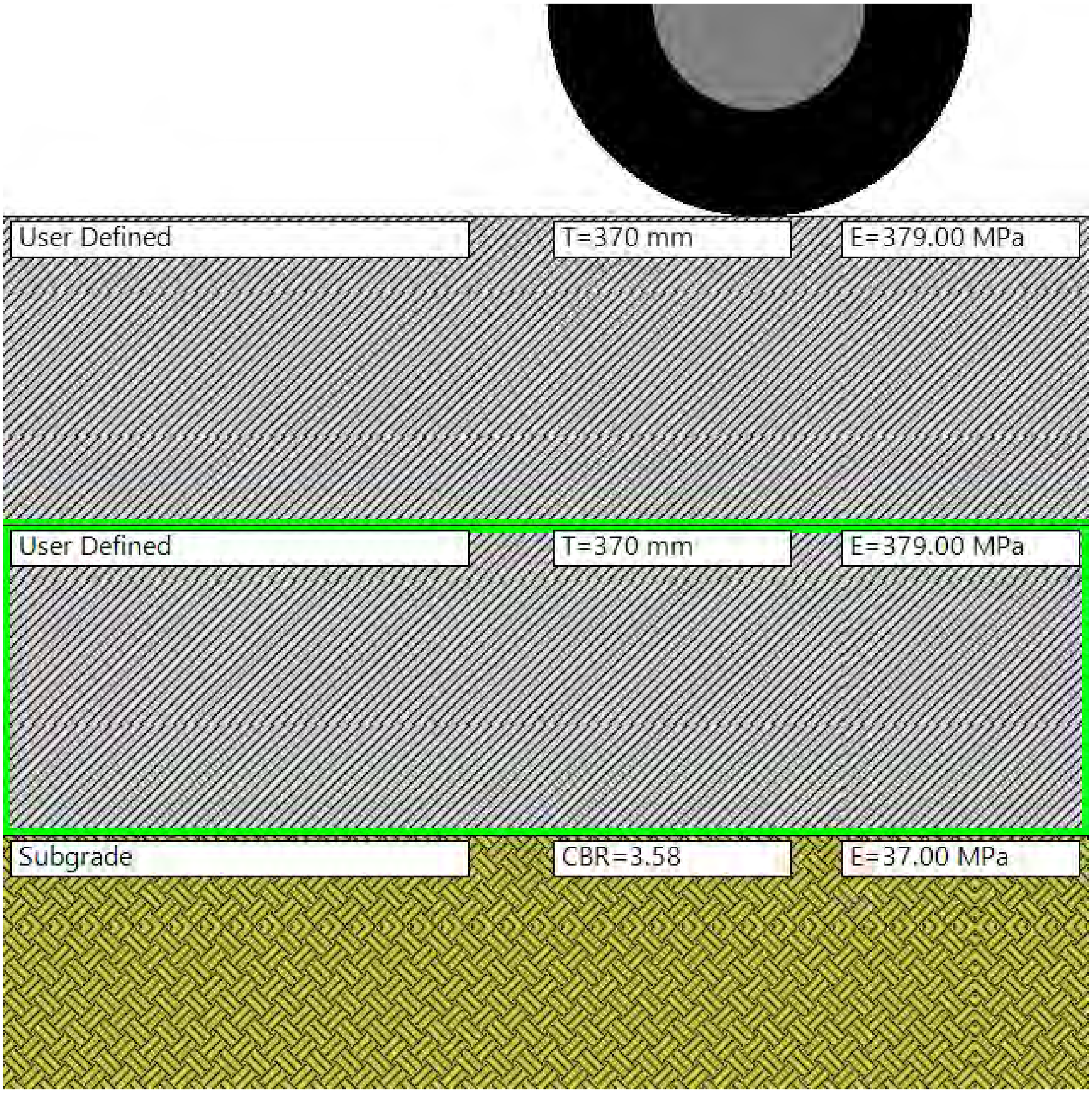
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Q400/Dash 8 Series 400	29,347	762	0
2	EMB-190 STD	47,950	124	0
3	Fokker-F-100	45,813	124	0
4	Fokker-F-100	45,813	876	0
5	B737-800	79,242	20	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Q400/Dash 8 Series 400	0.00	0.00	1.56
2	EMB-190 STD	0.00	0.00	1.28
3	Fokker-F-100	0.04	0.05	1.43
4	Fokker-F-100	0.31	0.32	1.43
5	B737-800	0.50	0.50	1.27

User Is responsible For checking frost protection requirements.



User Defined
T=370 mm
E=379.00 MPa
User Defined
T=370 mm
E=379.00 MPa
Subgrade
CBR=3.58
E=37.00 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Remaining life - Existing Pavements

Section: ATO APR - 2

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-12 11:35:05

Calculated Life = 0.5 Years

Total thickness to the top of the subgrade = 550mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	275	367.00	0.35	0
2	User Defined	275	367.00	0.35	0
3	Subgrade	0	41.00	0.35	0

Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Q400/Dash 8 Series 400	29,347	762	0
2	EMB-190 STD	47,950	124	0
3	Fokker-F-100	45,813	124	0
4	Fokker-F-100	45,813	876	0
5	B737-800	79,242	20	0

Additional Airplane Information

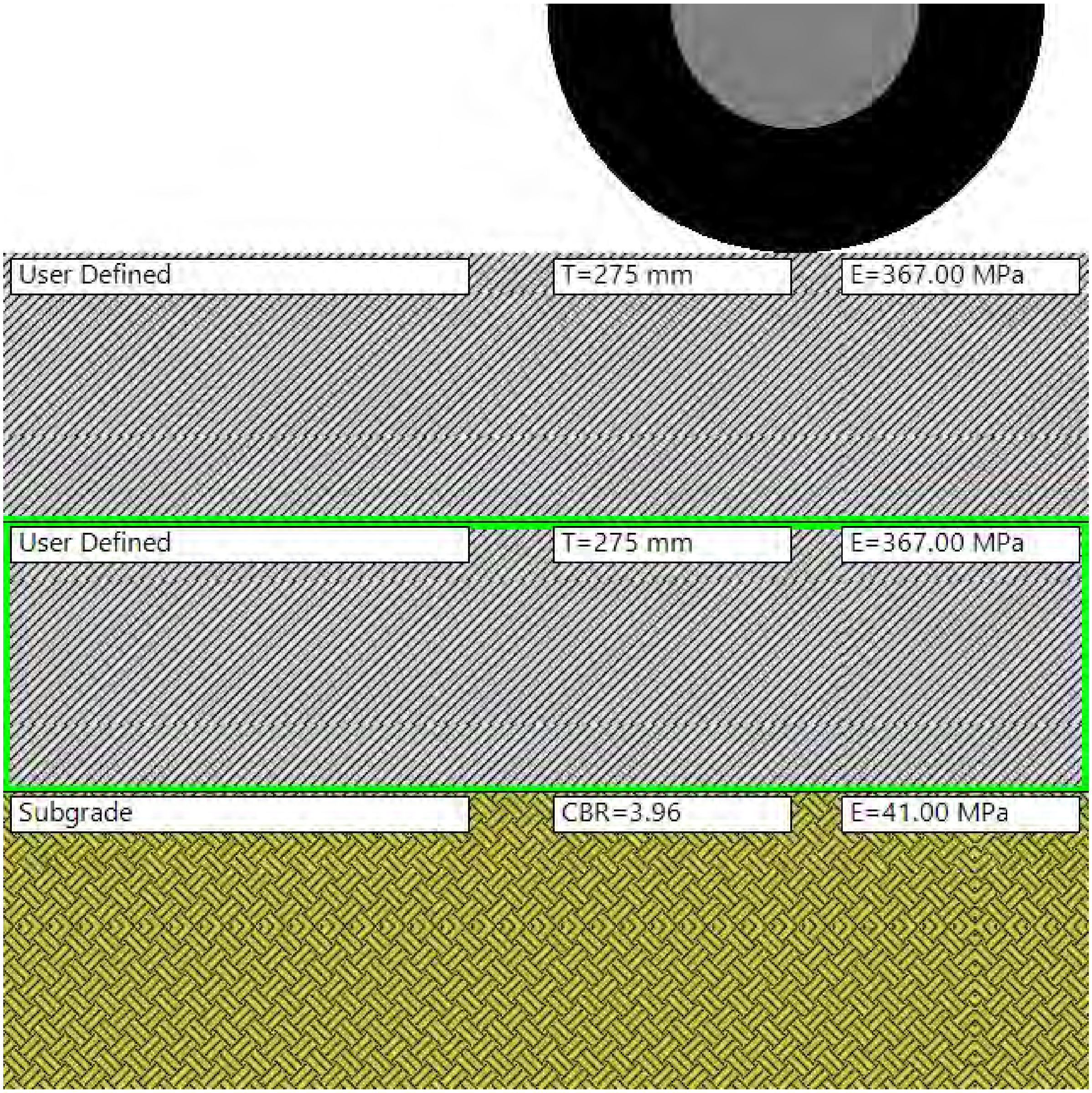
Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Q400/Dash 8 Series 400	0.06	0.62	1.75
2	EMB-190 STD	1.32	1.45	1.39
3	Fokker-F-100	3.51	3.51	1.56
4	Fokker-F-100	24.79	24.79	1.56
5	B737-800	11.84	12.47	1.36

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Q400/Dash 8 Series 400	0.00	0.01	2.25
2	EMB-190 STD	0.00	0.00	2.02
3	Fokker-F-100	0.00	0.00	1.91
4	Fokker-F-100	0.02	0.02	1.91
5	B737-800	0.00	0.00	1.93

User Is responsible For checking frost protection requirements.



Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Remaining life - Existing Pavements

Section: Old GA Apron

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-11 18:09:18

Calculated Life = 5.8 Years

Total thickness to the top of the subgrade = 270mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	135	160.00	0.35	0
2	User Defined	135	160.00	0.35	0
3	Subgrade	0	41.00	0.35	0

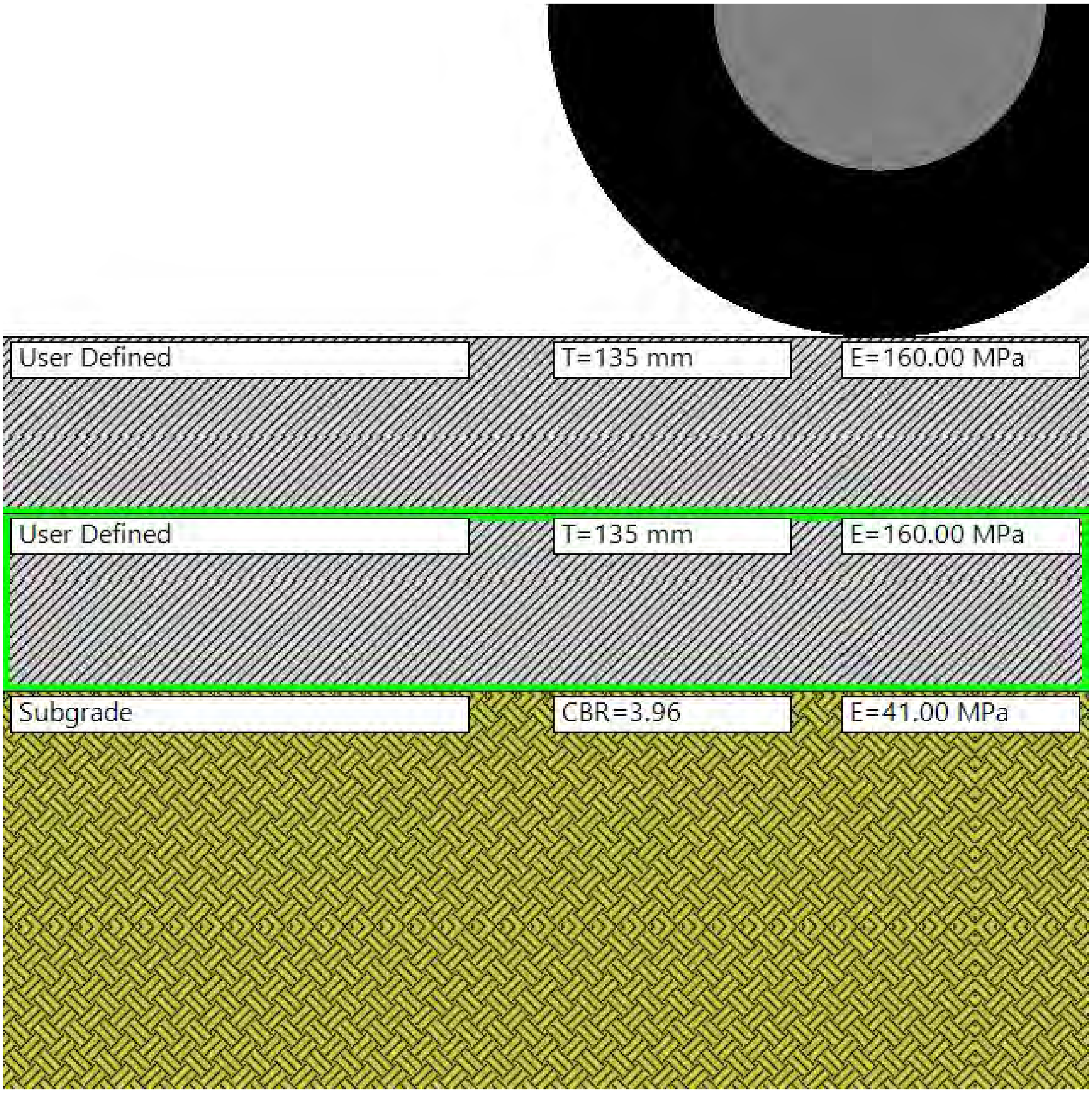
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	1,110	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	1,110	0
3	Beechcraft King Air B200	5,711	476	0
4	Beechcraft King Air 350	6,849	476	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	5.15
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	4.79
3	Beechcraft King Air B200	0.50	0.50	2.92
4	Beechcraft King Air 350	2.96	2.96	2.85

User Is responsible For checking frost protection requirements.


User Defined
T=135 mm
E=160.00 MPa
User Defined
T=135 mm
E=160.00 MPa
Subgrade
CBR=3.96
E=41.00 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Remaining life - Existing Pavements

Section: GA Hangar Taxiway

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-13 11:21:11

Calculated Life = 607,714,400.0 Years

Total thickness to the top of the subgrade = 301mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	51	1,378.95	0.35	0
2	User Defined	125	147.00	0.35	0
3	User Defined	125	147.00	0.35	0
4	Subgrade	0	24.00	0.35	0

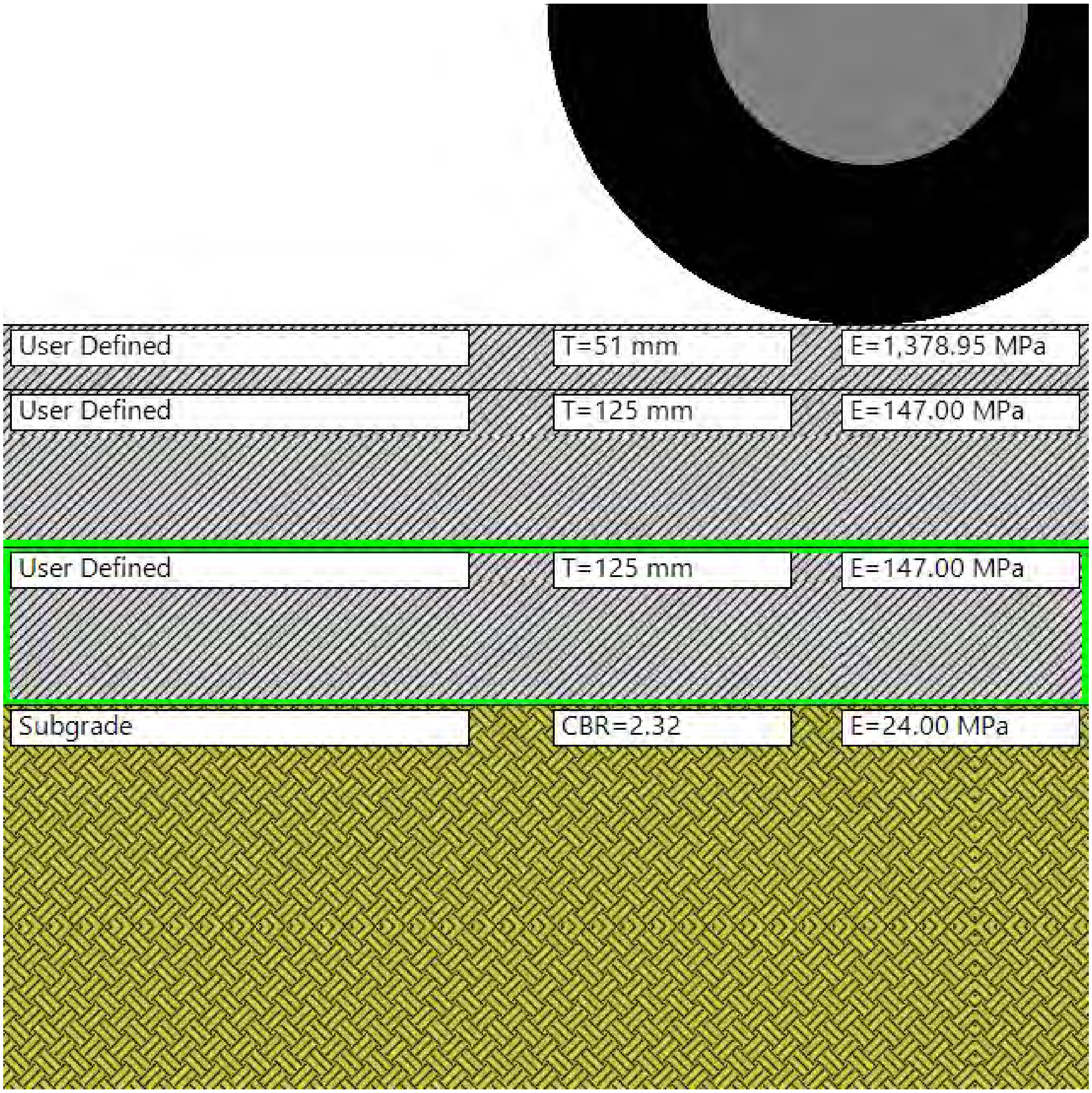
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	75	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	75	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	0
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	0

User Is responsible For checking frost protection requirements.


User Defined
T=51 mm
E=1,378.95 MPa
User Defined
T=125 mm
E=147.00 MPa
User Defined
T=125 mm
E=147.00 MPa
Subgrade
CBR=2.32
E=24.00 MPa

Appendix 5
FARFIELD Section Report – Calculation of Pavement Structural Design

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - New Pavements - Runway 12-30 and Taxiway B

Section: Runway 12-30 - CBR 8%

Analysis Type: New Flexible

Last Run: Thickness Design 2023-07-11 19:02:05

Design Life = 20 Years

Total thickness to the top of the subgrade = 477mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	P-401/P-403 HMA Surface	100	1,378.95	0.35	0
2	P-401/P-403 HMA Stabilized	125	2,757.90	0.35	0
3	P-209 Crushed Aggregate	150	286.35	0.35	0
4	P-154 Uncrushed Aggregate	102	108.46	0.35	0
5	Subgrade	0	82.74	0.35	0

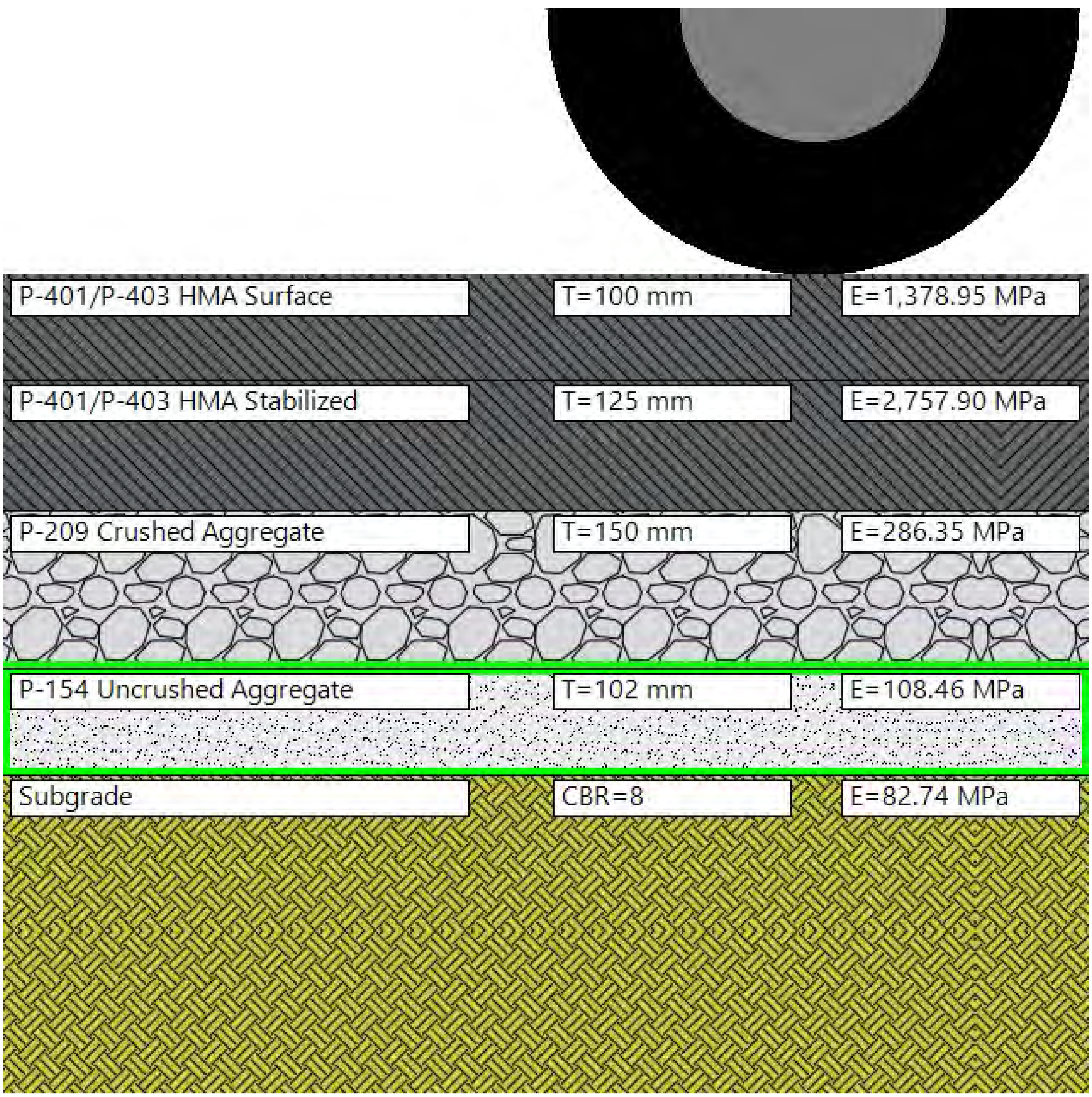
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	3,384	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	3,384	0
3	Beechcraft King Air B200	5,711	1,665	0
4	Beechcraft King Air 350	6,849	1,665	0
5	Q400/Dash 8 Series 400	29,347	1,523	0
6	EMB-190 STD	47,950	248	0
7	Fokker-F-100	45,813	248	0
8	Fokker-F-100	45,813	1,752	0
9	B737-800	79,242	39	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	3.39
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	3.23
3	Beechcraft King Air B200	0.00	0.00	2.29
4	Beechcraft King Air 350	0.00	0.00	2.26
5	Q400/Dash 8 Series 400	0.00	0.00	1.84
6	EMB-190 STD	0.00	0.00	1.51
7	Fokker-F-100	0.03	0.03	1.63
8	Fokker-F-100	0.19	0.19	1.63
9	B737-800	0.50	0.50	1.46

User Is responsible For checking frost protection requirements.



Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Runway 06-24 New Pavements

Section: CBR 4%

Analysis Type: HMA on Aggregate

Last Run: Thickness Design 2023-07-11 18:47:03

Design Life = 20 Years

Total thickness to the top of the subgrade = 278mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	P-401/P-403 HMA Surface	75	1,378.95	0.35	0
2	P-209 Crushed Aggregate	102	167.50	0.35	0
3	P-154 Uncrushed Aggregate	102	65.93	0.35	0
4	Subgrade	0	41.37	0.35	0

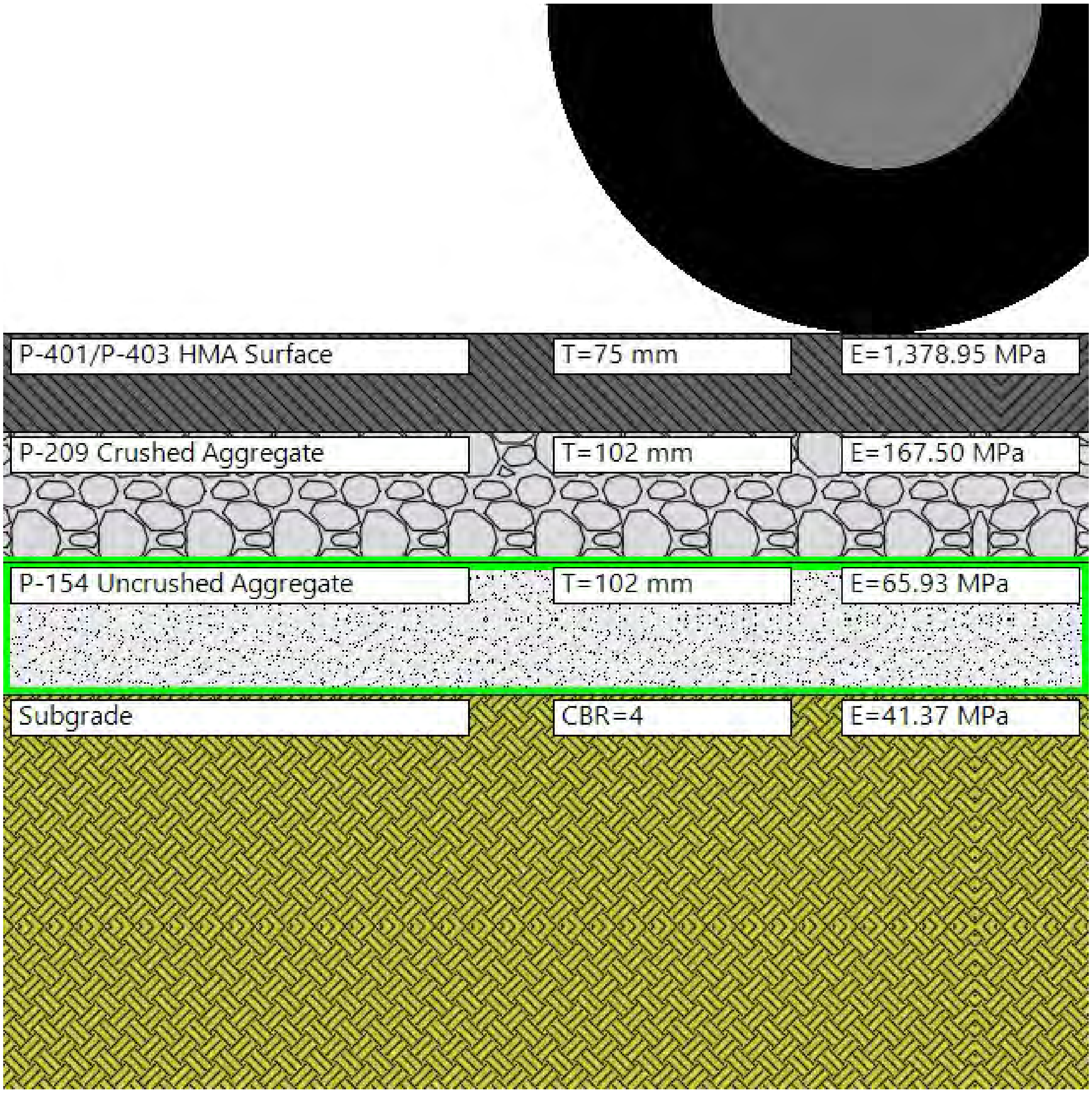
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	1,665	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	1,665	0
3	Beechcraft King Air B200	5,711	714	0
4	Beechcraft King Air 350	6,849	714	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	5.05
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	4.69
3	Beechcraft King Air B200	0.01	0.01	2.89
4	Beechcraft King Air 350	0.39	0.39	2.82

User Is responsible For checking frost protection requirements.



P-401/P-403 HMA Surface
T=75 mm
E=1,378.95 MPa
P-209 Crushed Aggregate
T=102 mm
E=167.50 MPa
P-154 Uncrushed Aggregate
T=102 mm
E=65.93 MPa
Subgrade
CBR=4
E=41.37 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - New Pavements - Runway 12-30 and Taxiway B

Section: Twy B - CBR 8%

Analysis Type: New Flexible

Last Run: Thickness Design 2023-07-11 19:03:11

Design Life = 20 Years

Total thickness to the top of the subgrade = 477mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	P-401/P-403 HMA Surface	100	1,378.95	0.35	0
2	P-401/P-403 HMA Stabilized	125	2,757.90	0.35	0
3	P-209 Crushed Aggregate	150	286.35	0.35	0
4	P-154 Uncrushed Aggregate	102	108.46	0.35	0
5	Subgrade	0	82.74	0.35	0

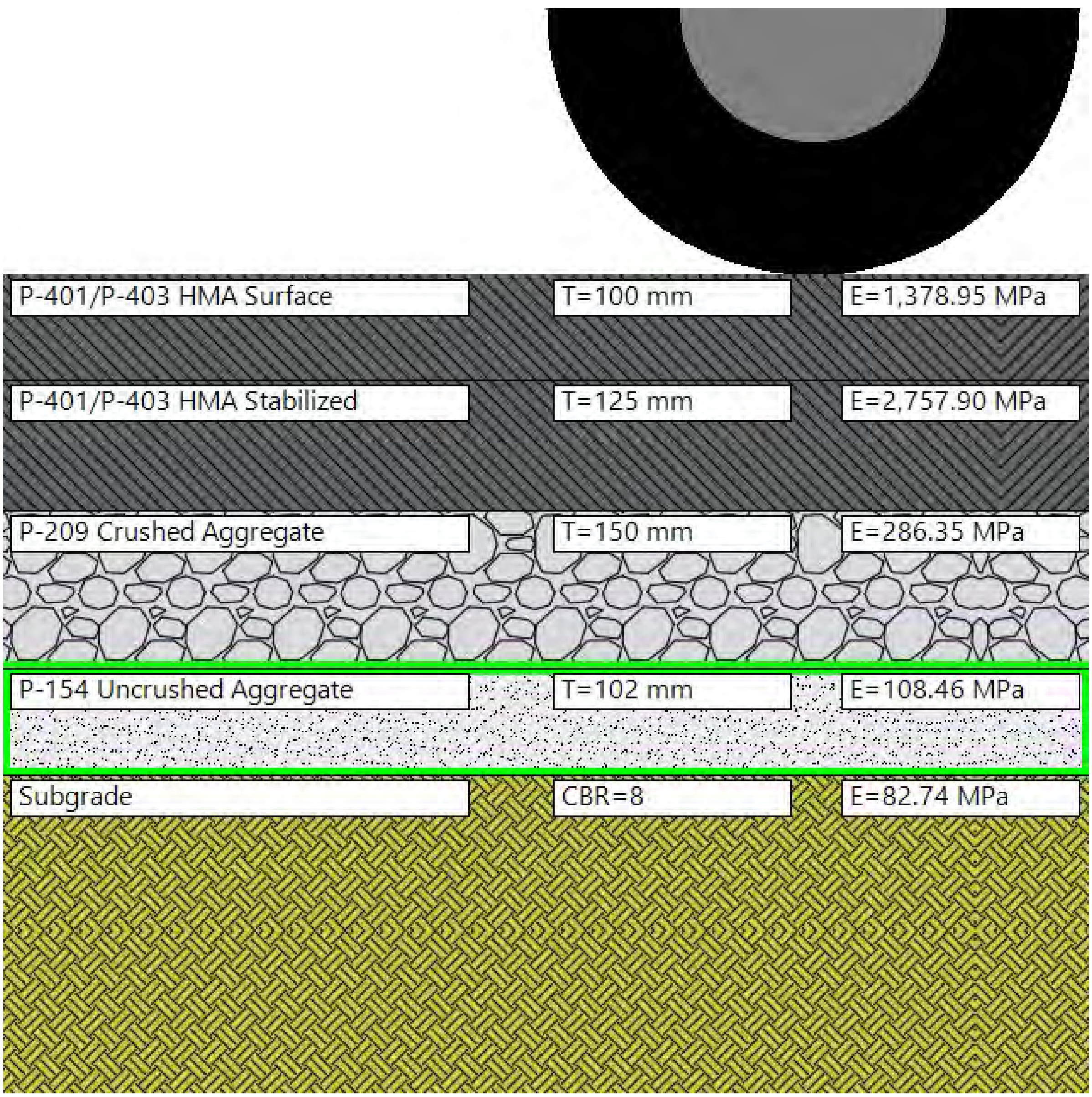
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	1,360	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	1,360	0
3	Beechcraft King Air B200	5,711	583	0
4	Beechcraft King Air 350	6,849	583	0
5	Q400/Dash 8 Series 400	29,347	533	0
6	EMB-190 STD	47,950	87	0
7	Fokker-F-100	45,813	87	0
8	Fokker-F-100	45,813	613	0
9	B737-800	79,242	14	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	3.39
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	3.23
3	Beechcraft King Air B200	0.00	0.00	2.29
4	Beechcraft King Air 350	0.00	0.00	2.26
5	Q400/Dash 8 Series 400	0.00	0.00	1.84
6	EMB-190 STD	0.00	0.00	1.51
7	Fokker-F-100	0.01	0.01	1.63
8	Fokker-F-100	0.06	0.07	1.63
9	B737-800	0.18	0.18	1.46

User Is responsible For checking frost protection requirements.



Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Taxiway C- New Pavements

Section: CBR 4%

Analysis Type: HMA on Aggregate

Last Run: Thickness Design 2023-07-13 15:34:10

Design Life = 20 Years

Total thickness to the top of the subgrade = 278mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	P-401/P-403 HMA Surface	75	1,378.95	0.35	0
2	P-209 Crushed Aggregate	102	167.50	0.35	0
3	P-154 Uncrushed Aggregate	102	65.93	0.35	0
4	Subgrade	0	41.37	0.35	0

Airplane Information

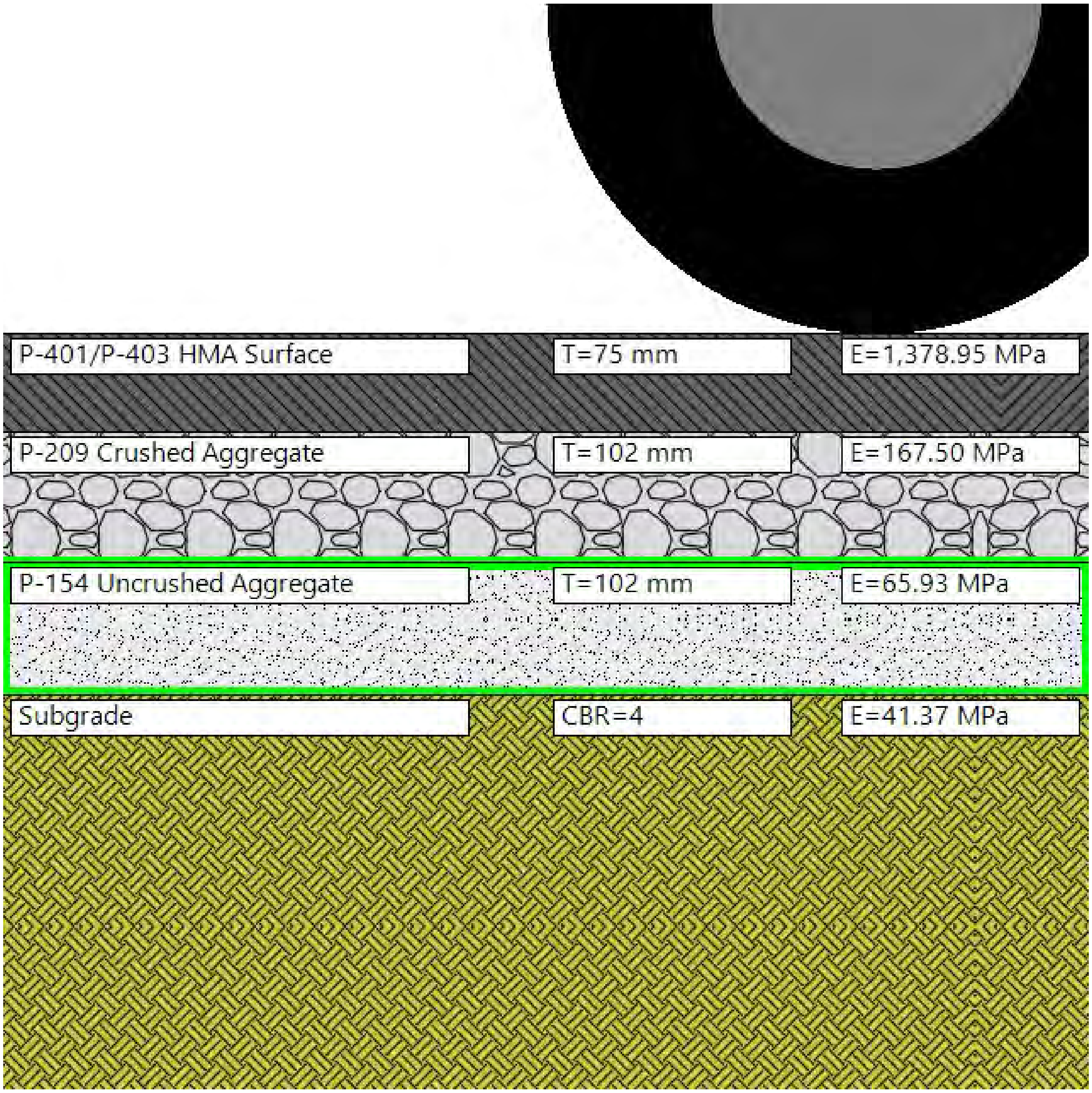
No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	833	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	833	0
3	Beechcraft King Air B200	5,711	357	0
4	Beechcraft King Air 350	6,849	357	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	5.05
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	4.69
3	Beechcraft King Air B200	0.00	0.00	2.89
4	Beechcraft King Air 350	0.19	0.19	2.82

User Is responsible For checking frost protection requirements.


P-401/P-403 HMA Surface
T=75 mm
E=1,378.95 MPa
P-209 Crushed Aggregate
T=102 mm
E=167.50 MPa
P-154 Uncrushed Aggregate
T=102 mm
E=65.93 MPa
Subgrade
CBR=4
E=41.37 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Taxiway D, E, Taxilane 1, 2 and GA Apron

Section: Taxiway D

Analysis Type: HMA on Aggregate

Last Run: Thickness Design 2023-07-11 11:23:11

Design Life = 20 Years

Total thickness to the top of the subgrade = 278mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	P-401/P-403 HMA Surface	75	1,378.95	0.35	0
2	P-209 Crushed Aggregate	102	167.50	0.35	0
3	P-154 Uncrushed Aggregate	152	65.93	0.35	0
4	Subgrade	0	41.37	0.35	0

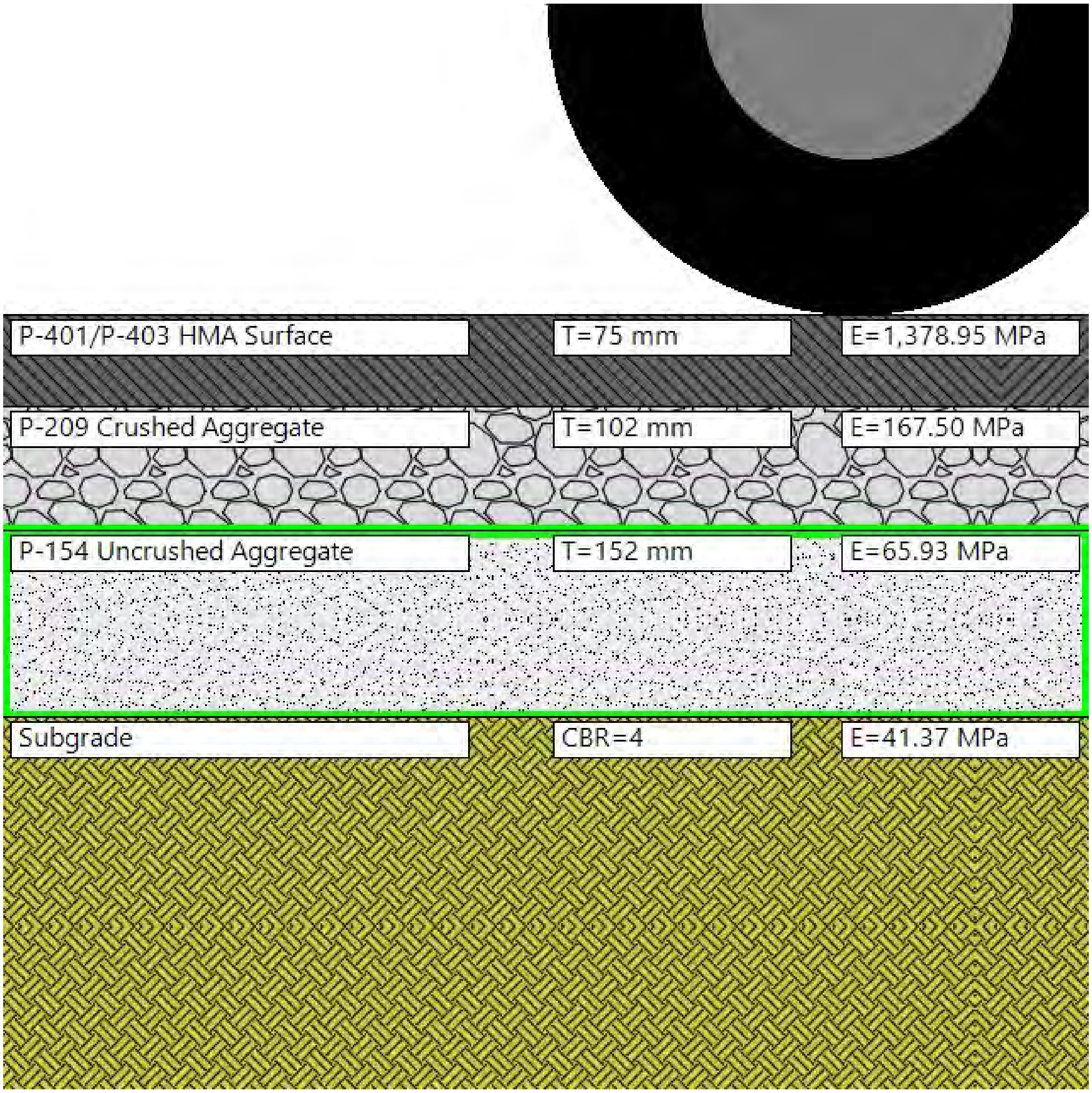
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	833	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	833	0
3	Beechcraft King Air B200	5,711	357	0
4	Beechcraft King Air 350	6,849	357	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	0
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	0
3	Beechcraft King Air B200	0.00	0.00	0
4	Beechcraft King Air 350	0.00	0.00	0

User Is responsible For checking frost protection requirements.


P-401/P-403 HMA Surface
T=75 mm
E=1,378.95 MPa
P-209 Crushed Aggregate
T=102 mm
E=167.50 MPa
P-154 Uncrushed Aggregate
T=152 mm
E=65.93 MPa
Subgrade
CBR=4
E=41.37 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Taxiway D, E, Taxilane 1, 2 and GA Apron

Section: Taxiway E

Analysis Type: HMA on Aggregate

Last Run: Thickness Design 2023-07-11 11:26:32

Design Life = 20 Years

Total thickness to the top of the subgrade = 278mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	P-401/P-403 HMA Surface	75	1,378.95	0.35	0
2	P-209 Crushed Aggregate	102	167.50	0.35	0
3	P-154 Uncrushed Aggregate	152	65.93	0.35	0
4	Subgrade	0	41.37	0.35	0

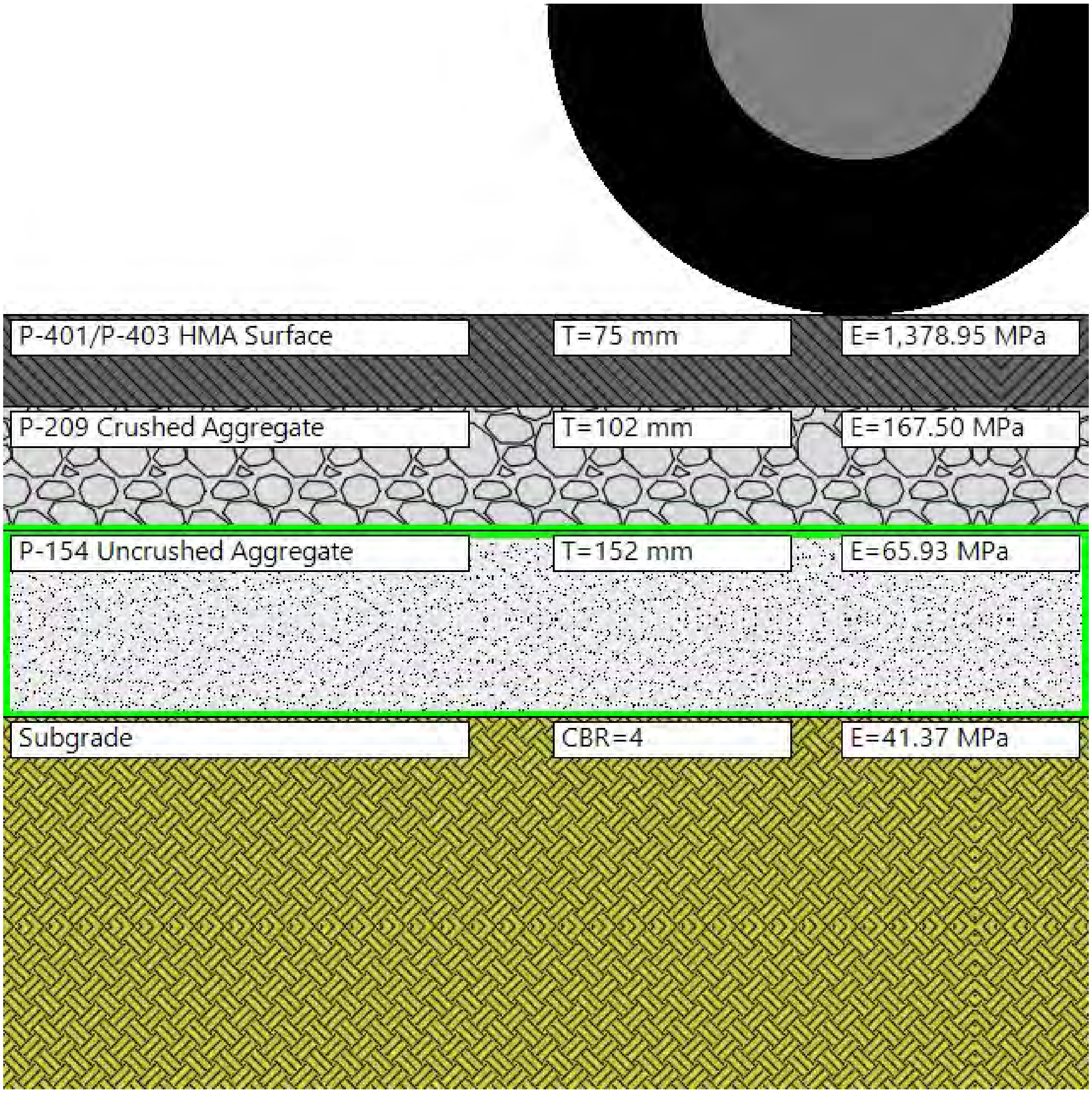
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	833	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	833	0
3	Beechcraft King Air B200	5,711	357	0
4	Beechcraft King Air 350	6,849	357	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	5.05
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	4.69
3	Beechcraft King Air B200	0.00	0.00	2.89
4	Beechcraft King Air 350	0.19	0.19	2.82

User Is responsible For checking frost protection requirements.


P-401/P-403 HMA Surface
T=75 mm
E=1,378.95 MPa
P-209 Crushed Aggregate
T=102 mm
E=167.50 MPa
P-154 Uncrushed Aggregate
T=152 mm
E=65.93 MPa
Subgrade
CBR=4
E=41.37 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Taxiway D, E, Taxilane 1, 2 and GA Apron

Section: Taxilanes

Analysis Type: HMA on Aggregate

Last Run: Thickness Design 2023-07-11 11:31:10

Design Life = 20 Years

Total thickness to the top of the subgrade = 278mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	P-401/P-403 HMA Surface	75	1,378.95	0.35	0
2	P-209 Crushed Aggregate	102	167.50	0.35	0
3	P-154 Uncrushed Aggregate	152	65.93	0.35	0
4	Subgrade	0	41.37	0.35	0

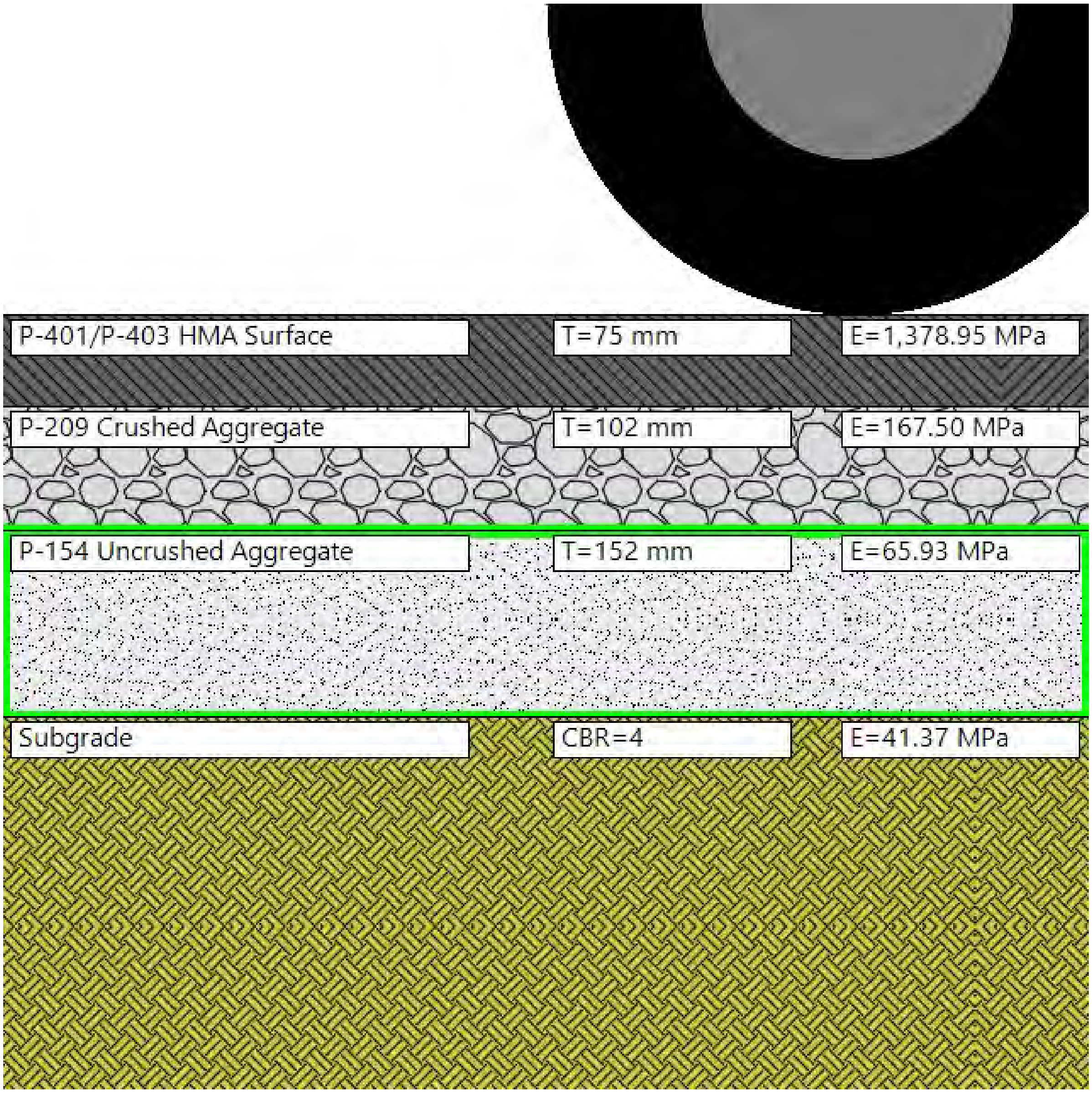
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	417	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	417	0
3	Beechcraft King Air B200	5,711	179	0
4	Beechcraft King Air 350	6,849	179	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	5.05
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	4.69
3	Beechcraft King Air B200	0.00	0.00	2.89
4	Beechcraft King Air 350	0.10	0.10	2.82

User Is responsible For checking frost protection requirements.


P-401/P-403 HMA Surface
T=75 mm
E=1,378.95 MPa
P-209 Crushed Aggregate
T=102 mm
E=167.50 MPa
P-154 Uncrushed Aggregate
T=152 mm
E=65.93 MPa
Subgrade
CBR=4
E=41.37 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - New Pavements - ATO Apron

Section: CBR 8%

Analysis Type: New Flexible

Last Run: Thickness Design 2023-07-11 19:32:45

Design Life = 20 Years

Total thickness to the top of the subgrade = 477mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	P-401/P-403 HMA Surface	100	1,378.95	0.35	0
2	P-401/P-403 HMA Stabilized	125	2,757.90	0.35	0
3	P-209 Crushed Aggregate	150	286.35	0.35	0
4	P-154 Uncrushed Aggregate	102	108.46	0.35	0
5	Subgrade	0	82.74	0.35	0

Airplane Information

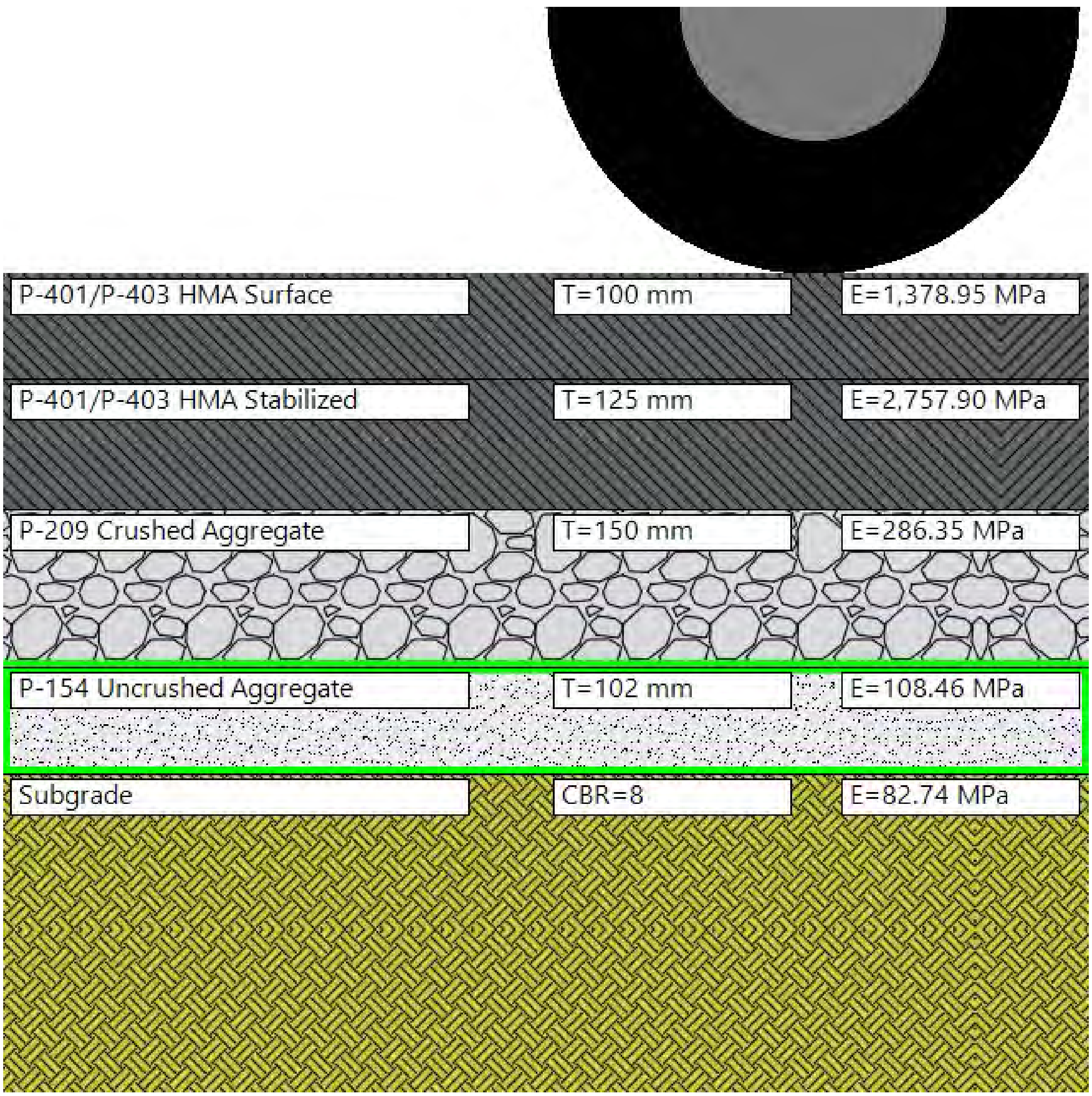
No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Q400/Dash 8 Series 400	29,347	762	0
2	EMB-190 STD	47,950	124	0
3	Fokker-F-100	45,813	124	0
4	Fokker-F-100	45,813	876	0
5	B737-800	79,242	20	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Q400/Dash 8 Series 400	0.00	0.00	1.84
2	EMB-190 STD	0.00	0.00	1.51
3	Fokker-F-100	0.01	0.01	1.63
4	Fokker-F-100	0.09	0.10	1.63
5	B737-800	0.26	0.26	1.46

User Is responsible For checking frost protection requirements.



Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Taxiway D, E, Taxilane 1, 2 and GA Apron

Section: New GA Apron

Analysis Type: HMA on Aggregate

Last Run: Thickness Design 2023-07-11 11:33:01

Design Life = 20 Years

Total thickness to the top of the subgrade = 278mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	P-401/P-403 HMA Surface	75	1,378.95	0.35	0
2	P-209 Crushed Aggregate	102	167.50	0.35	0
3	P-154 Uncrushed Aggregate	152	65.93	0.35	0
4	Subgrade	0	41.37	0.35	0

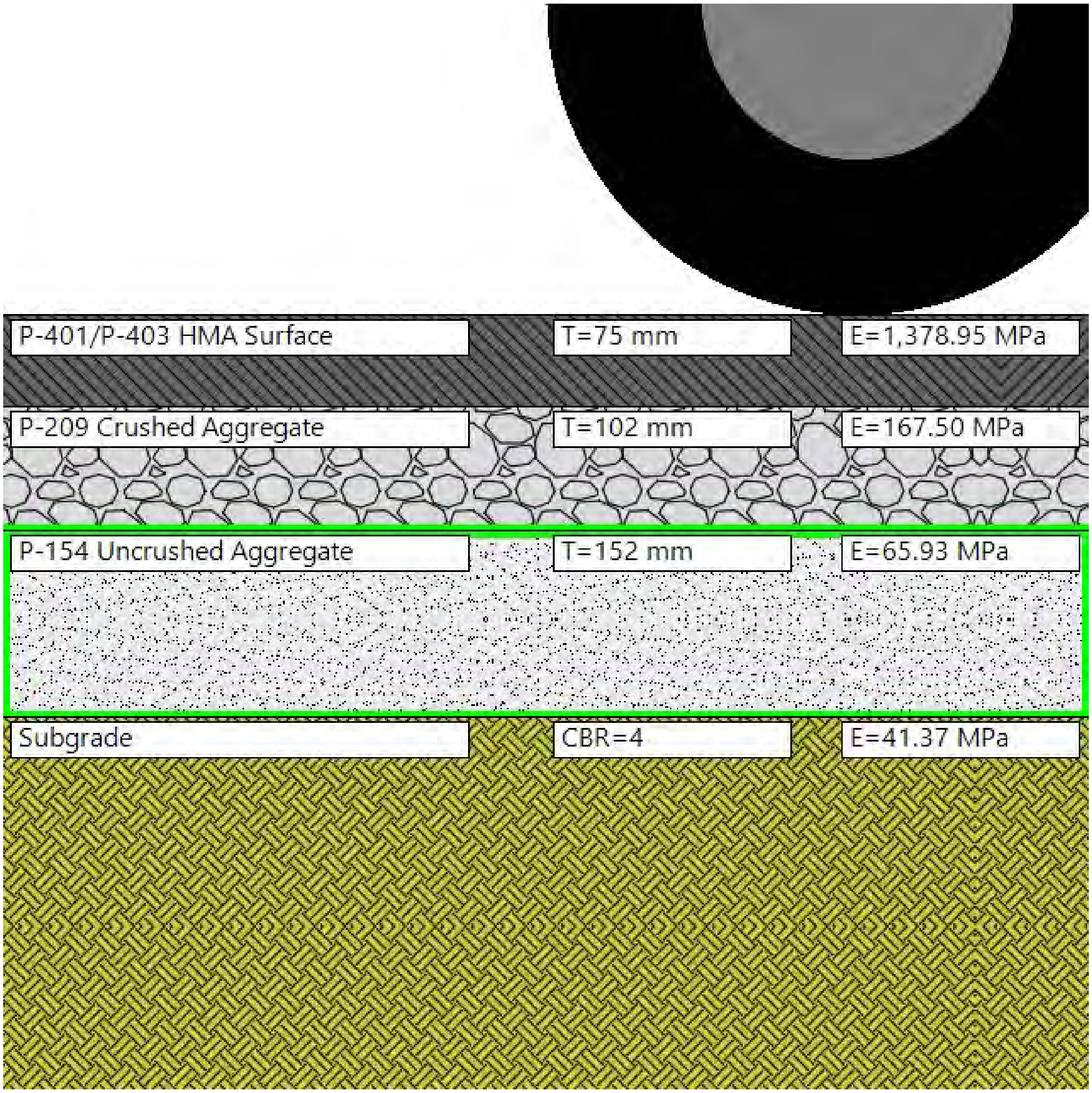
Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	1,110	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	1,110	0
3	Beechcraft King Air B200	5,711	476	0
4	Beechcraft King Air 350	6,849	476	0

Additional Airplane Information

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	0
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	0
3	Beechcraft King Air B200	0.00	0.00	0
4	Beechcraft King Air 350	0.00	0.00	0

User Is responsible For checking frost protection requirements.


P-401/P-403 HMA Surface
T=75 mm
E=1,378.95 MPa
P-209 Crushed Aggregate
T=102 mm
E=167.50 MPa
P-154 Uncrushed Aggregate
T=152 mm
E=65.93 MPa
Subgrade
CBR=4
E=41.37 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - GSE Parking

Section: GSE Parking - CBR 6

Analysis Type: HMA on Aggregate

Last Run: Thickness Design 2023-07-13 12:59:41

Design Life = 20 Years

Total thickness to the top of the subgrade = 338mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	P-401/P-403 HMA Surface	75	1,378.95	0.35	0
2	P-209 Crushed Aggregate	102	227.70	0.35	0
3	P-154 Uncrushed Aggregate	161	97.47	0.35	0
4	Subgrade	0	62.05	0.35	0

Airplane Information

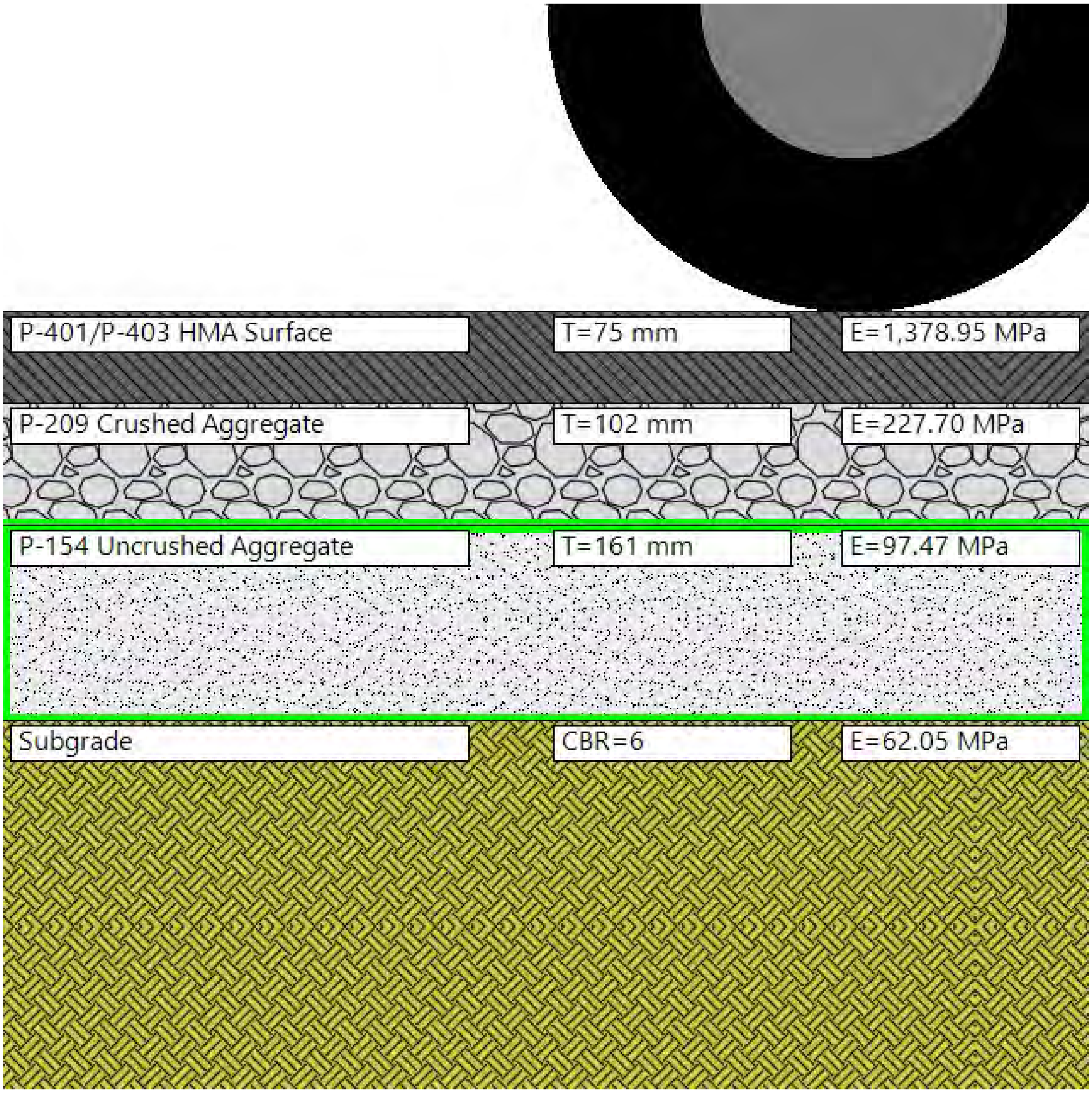
No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Truck Axle Single	8,500	7,300	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Truck Axle Single	1.00	1.00	3.53

User Is responsible For checking frost protection requirements.


P-401/P-403 HMA Surface
T=75 mm
E=1,378.95 MPa
P-209 Crushed Aggregate
T=102 mm
E=227.70 MPa
P-154 Uncrushed Aggregate
T=161 mm
E=97.47 MPa
Subgrade
CBR=6
E=62.05 MPa

Appendix 6
FARFIELD Section Report – Calculation of Residual Life for Overlay Pavement Repairs

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Remaining Life - ATO, Old GA,Taxiway A and GA Hangar Twy

Section: Twy A

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-13 11:11:59

Calculated Life = 402,482.8 Years

Total thickness to the top of the subgrade = 861mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	51	1,378.95	0.35	0
2	User Defined	405	479.00	0.35	0
3	User Defined	405	479.00	0.35	0
4	Subgrade	0	46.00	0.35	0

Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	1,360	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	1,360	0
3	Beechcraft King Air B200	5,711	583	0
4	Beechcraft King Air 350	6,849	583	0
5	Q400/Dash 8 Series 400	29,347	533	0
6	EMB-190 STD	47,950	87	0
7	Fokker-F-100	45,813	87	0
8	Fokker-F-100	45,813	613	0
9	B737-800	79,242	14	0

Additional Airplane Information

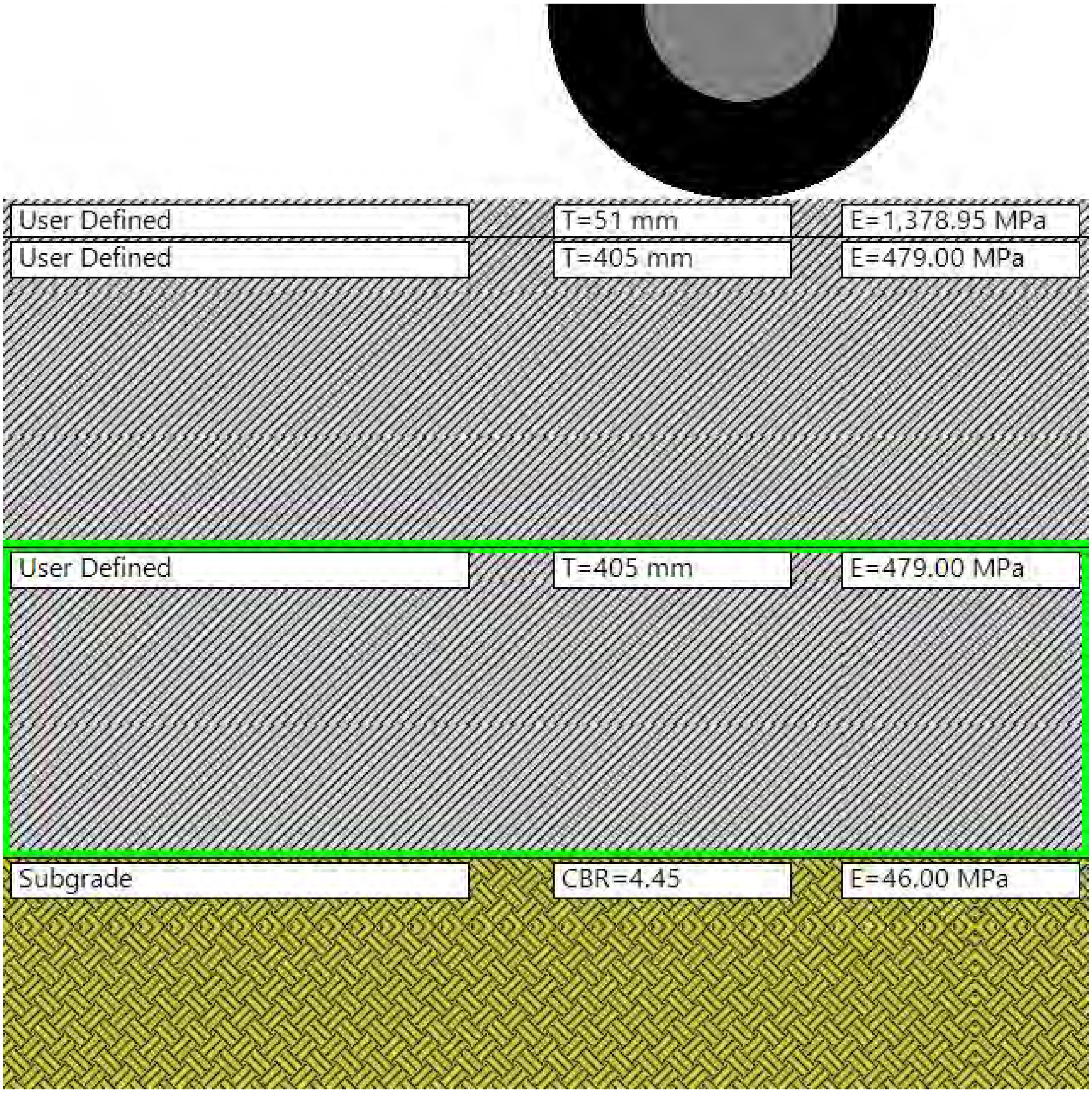
Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	2.13
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	2.08
3	Beechcraft King Air B200	0.00	0.00	1.69
4	Beechcraft King Air 350	0.00	0.00	1.68
5	Q400/Dash 8 Series 400	0.00	0.00	1.47
6	EMB-190 STD	0.00	0.00	1.24
7	Fokker-F-100	0.00	0.00	1.36
8	Fokker-F-100	0.00	0.00	1.36
9	B737-800	0.00	0.00	1.23

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	12.00
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	10.12
3	Beechcraft King Air B200	0.02	0.02	5.64
4	Beechcraft King Air 350	0.02	0.02	5.17
5	Q400/Dash 8 Series 400	0.93	0.93	1.26
6	EMB-190 STD	0.00	0.00	1.24
7	Fokker-F-100	0.00	0.00	1.36
8	Fokker-F-100	0.01	0.01	1.36
9	B737-800	0.96	0.96	1.23

User Is responsible For checking frost protection requirements.



User Defined
T=51 mm
E=1,378.95 MPa
User Defined
T=405 mm
E=479.00 MPa
User Defined
T=405 mm
E=479.00 MPa
Subgrade
CBR=4.45
E=46.00 MPa

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Remaining Life - ATO, Old GA,Taxiway A and GA Hangar Twy

Section: ATO APR - 1

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-13 11:17:19

Calculated Life = 110.3 Years

Total thickness to the top of the subgrade = 761mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	51	1,378.95	0.35	0
2	User Defined	355	379.00	0.35	0
3	User Defined	355	379.00	0.35	0
4	Subgrade	0	37.00	0.35	0

Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Q400/Dash 8 Series 400	29,347	762	0
2	EMB-190 STD	47,950	124	0
3	Fokker-F-100	45,813	124	0
4	Fokker-F-100	45,813	876	0
5	B737-800	79,242	20	0

Additional Airplane Information

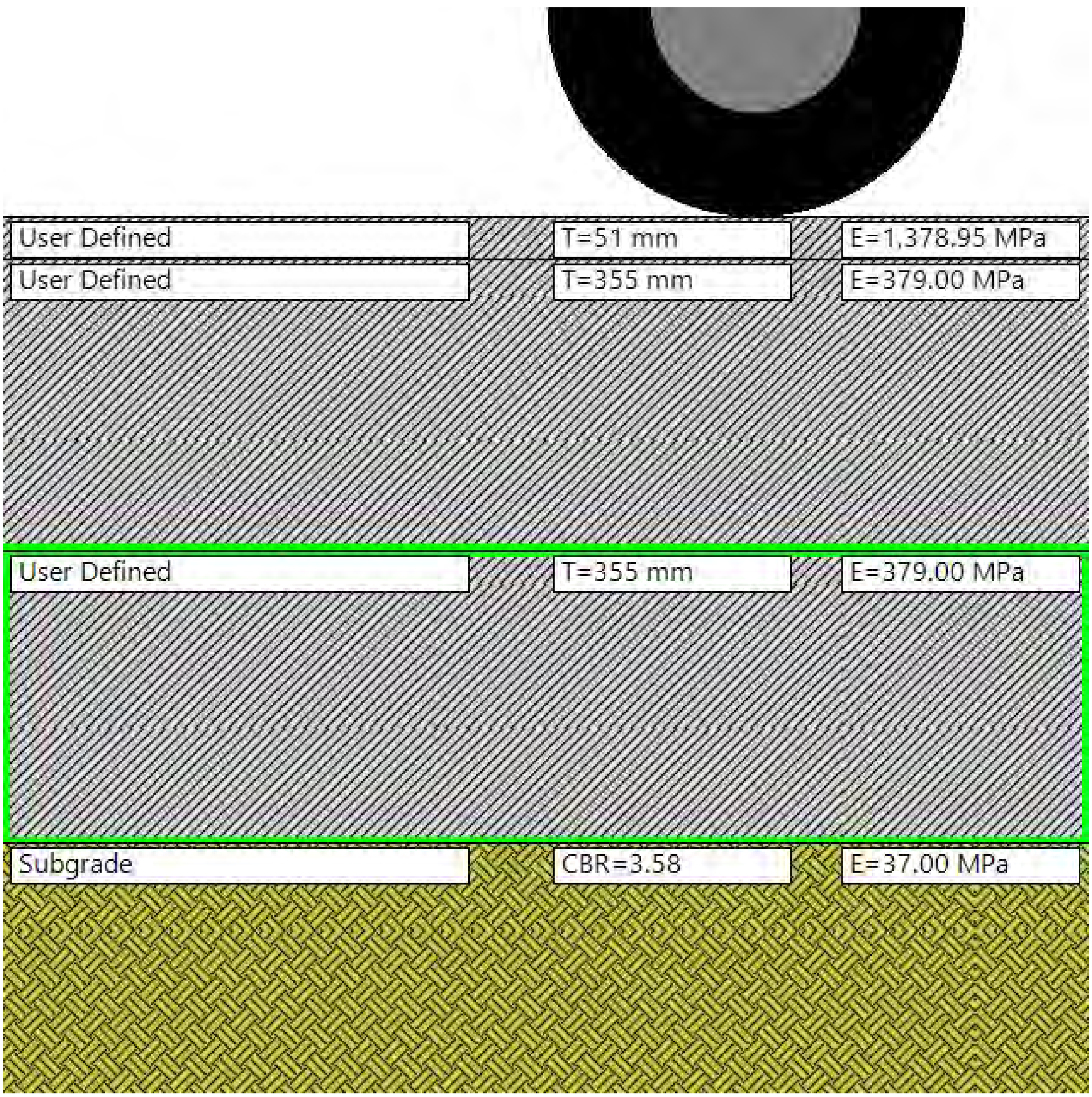
Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Q400/Dash 8 Series 400	0.00	0.00	1.55
2	EMB-190 STD	0.00	0.00	1.28
3	Fokker-F-100	0.00	0.00	1.41
4	Fokker-F-100	0.01	0.01	1.41
5	B737-800	0.17	0.17	1.26

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Q400/Dash 8 Series 400	0.00	0.00	12.00
2	EMB-190 STD	0.00	0.00	10.12
3	Fokker-F-100	0.02	0.02	5.64
4	Fokker-F-100	0.02	0.02	5.17
5	B737-800	0.93	0.93	1.26

User Is responsible For checking frost protection requirements.



Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Remaining Life - ATO, Old GA,Taxiway A and GA Hangar Twy

Section: Old GA Apron

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-13 11:22:46

Calculated Life = 367.5 Years

Total thickness to the top of the subgrade = 301mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	51	1,378.95	0.35	0
2	User Defined	125	160.00	0.35	0
3	User Defined	125	160.00	0.35	0
4	Subgrade	0	41.00	0.35	0

Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	1,110	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	1,110	0
3	Beechcraft King Air B200	5,711	476	0
4	Beechcraft King Air 350	6,849	476	0

Additional Airplane Information

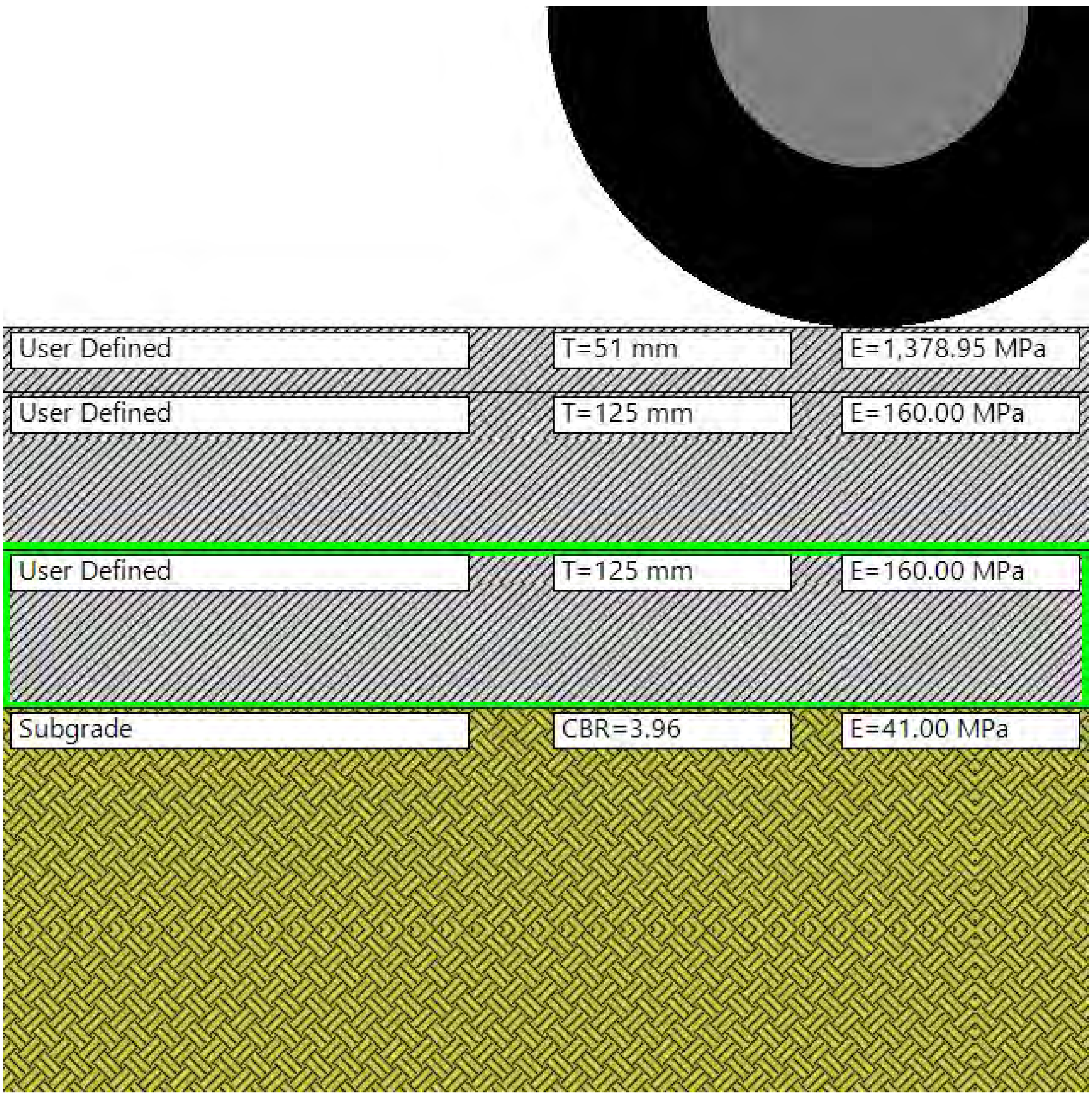
Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	4.78
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	4.46
3	Beechcraft King Air B200	0.00	0.00	2.8
4	Beechcraft King Air 350	0.05	0.05	2.74

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	12.00
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	10.12
3	Beechcraft King Air B200	0.02	0.02	5.64
4	Beechcraft King Air 350	0.02	0.02	5.17

User Is responsible For checking frost protection requirements.



Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.18 (Build 05/26/2022)

Job Name: Pavement Design - Remaining Life - ATO, Old GA,Taxiway A and GA Hangar Twy

Section: GA Hangar Taxiway

Analysis Type: New Flexible

Last Run: Life Analysis 2023-07-13 11:21:11

Calculated Life = 607,714,400.0 Years

Total thickness to the top of the subgrade = 301mm

Pavement Structure Information by Layer

No.	Type	Thickness (mm)	Modulus (MPa)	Poisson's Ratio	Strength R (MPa)
1	User Defined	51	1,378.95	0.35	0
2	User Defined	125	147.00	0.35	0
3	User Defined	125	147.00	0.35	0
4	Subgrade	0	24.00	0.35	0

Airplane Information

No.	Name	Gross Wt. (kg)	Annual Departures	% Annual Growth
1	Cessna 172 Skyhawk	1,160	75	0
2	PA-34-220T Seneca II/ III/ IV/V	2,073	75	0

Additional Airplane Information

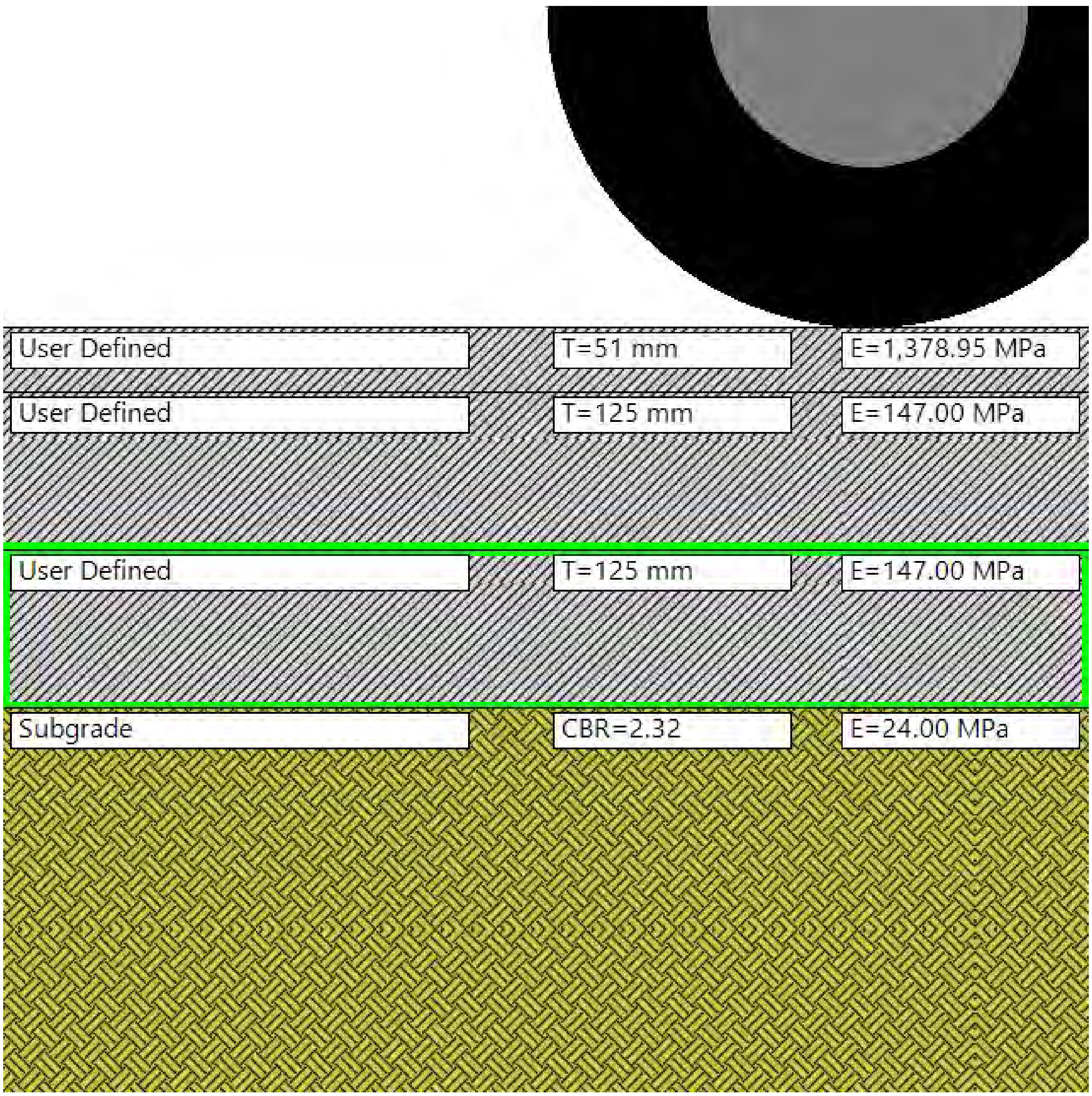
Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	0
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	0

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Cessna 172 Skyhawk	0.00	0.00	12.00
2	PA-34-220T Seneca II/ III/ IV/V	0.00	0.00	10.12

User Is responsible For checking frost protection requirements.



Appendix 7
Cost Estimates

Cloncurry Airport

Master Plan & Concept Design Project

CONCEPT DESIGN INVESTMENT BUDGET ESTIMATE

RAMBOLL
Bright ideas. Sustainable change.

Project no. 1100053797
Recipient Cloncurry Shire Council
Version 00
Date 21 July 2023
Prepared by Alisha Patnaik
Checked by Jesper Sundahl
Approved by Henrik Mortensen

Sl. No.	Item	Unit	Number of Units	Unit Price (AUD)	Investment Estimate (AUD)
1.0	**Airside - Civil Works**				
	Existing Infrastructure Development				**23,165,995**
1.1	**Primary Runway 12/30**				**13,863,745**
	Pavement Rehabilitation (including Jet Blast Pad)				9,390,433
	Demolition of pavement	m2	12,000	6	74,100
	Removal of pavement layers for reconstruction	m3	63,655	16	1,007,871
	Reconstruction of pavement layers	m2	62,100	134	8,308,463
	Drainage System Rehabilitation (including Clearway & RESA)				4,473,312
	Pipe Network Replacement	m	1,357	57	77,335
	Manhole Replacement	nos.	14	440	6,052
	Swales to be rehabiliated	m	2,910	177	513,736
	Total excavation for trapezoidal drain	m3	18,619	14	265,325
	Concrete lining for channels	m3	10,551	322	3,394,784
	Box drain (1.5x1.5)	m	412	524	216,080
1.2	**Secondary Runway 06/24**				**4,424,661**
	Pavement Rehabilitation				1,782,516
	Demolition of pavement	m2	1,230	6	7,595
	Removal of pavement layers for reconstruction	m3	17,210	16	272,492
	Reconstruction of pavement layers	m2	20,855	72	1,502,429
	Drainage System Rehabilitation (including Clearway)				2,642,145
	Pipe Network Replacement	m	688	57	39,202
	Manhole Replacement	nos.	11	440	4,622
	Total excavation for trapezoidal drain	m3	17,354	14	247,295
	Concrete lining for channels	m3	7,307	322	2,351,027
1.3	**Taxiway A**				**62,977**
	Pavement Rehabilitation				62,977
	Removal of pavement layers for overlay	m3	1,420	16	22,483
	Overlay of pavement	m2	1,650	25	40,494
1.4	**Taxiway B**				**270,038**
	Pavement Rehabilitation				270,038
	Removal of pavement layers for reconstruction	m3	1,845	16	29,213
	Reconstruction of pavement layers	m2	1,800	134	240,825
1.5	**Taxiway C (including width expansion from 7.5m to 10.5m)**				**76,730**
	Pavement Rehabilitation				66,342
	Removal of pavement layers for reconstruction	m3	705	16	11,163
	Reconstruction of pavement layers	m2	850	65	55,179
	Drainage System Rehabilitation				10,388
	Dismantling of existing culvert 1/1200X300	m	46	57	2,622
	New culvert under taxiway C 750mm pipe	m	18	431	7,766
1.6	**GA Hangar Taxiway**				**2,529,421**
	Pavement Rehabilitation				60,943
	Removal of pavement layers for overlay	m3	625	16	9,896
	Overlay of pavement	m2	2,080	25	51,047
	Drainage System Rehabilitation				2,468,479
	Box Drain (0.75x0.75)	m	134	524	70,227
	Total excavation for trapezoidal drain	m3	3,314	14	47,225
	Concrete lining for channels	m3	7,307	322	2,351,027
1.7	**ATO Apron**				**1,767,596**
	Pavement Rehabilitation				1,652,822
	Removal of pavement layers for overlay	m3	10,965	16	173,613
	Overlay of pavement	m2	14,425	25	354,014

	Removal of pavement layers for reconstruction	m3	7,690	16	121,758
	Reconstruction of pavement layers	m2	7,500	134	1,003,438
	Drainage Rehabilitation - Box drain (2.0X2.0)	m	219	524	114,774
1.8	**GA Apron**				**170,827**
	Pavement Rehabilitation				160,411
	Removal of pavement layers for overlay	m3	1,645	16	26,046
	Overlay of pavement	m2	5,475	25	134,366
	Drainage System Rehabilitation				10,415
	Existing drainage filling in (TMR 22)	m	132	14	1,881
	*Blocking culvert 5*0.3*0.6*	m	28	305	8,534
	New Infrastructure Development				**3,296,163**
1.9	**Taxiway D**				**141,594**
	Earthworks	m3	576	14	8,208
	Pavement	m2	640	65	41,547
	Drainage				91,840
	Total excavation for trapezoidal drain	m3	755	14	10,759
	Concrete lining for channels	m3	252	322	81,081
1.10	**Taxiway E**				**334,156**
	Earthworks	m3	3,110	14	44,318
	Pavement	m2	3,275	65	212,602
	Drainage				77,236
	Total excavation for trapezoidal drain	m3	413	14	5,885
	Concrete lining for channels	m3	206	322	66,281
	New culvert 600mm pipe	m	18	277	5,071
1.11	**Taxilane 1**				**255,503**
	Earthworks	m3	1,385	14	19,736
	Pavement	m2	1,775	65	115,227
	Drainage - Box Drains	m	230	524	120,539
1.12	**Taxilane 2**				**261,606**
	Earthworks	m3	1,950	14	27,788
	Pavement	m2	1,745	65	113,280
	Drainage - Box Drains	m	230	524	120,539
1.13	**New GA Apron**				**374,300**
	Earthworks	m3	2,800	14	39,900
	Pavement	m2	4,200	65	272,650
	Drainage - Slot Drains	m	120	515	61,750
1.14	**GA Hangar Lots**				**508,220**
	Earthworks	m3	5,370	14	76,523
	Drainage				431,697
	Longitudinal trapeziodal drain	m3	1,755	14	25,009
	Box drains	m	776	524	406,689
1.15	**Access/ Service Roads**				**279,935**
	Earthworks	m3	3,540	14	50,445
	Pavement	m2	4,330	53	229,490
1.16	**Enabling Works/ Utilities**	m2	22,800	27	**615,600**
1.17	**Site Drainage**				**525,249**
	Earthworks	m3	2,869	14	40,883
	Total abandoned pipes length - demolition	m	3,615	57	206,055
	Total abandoned manholes - demolition	nos.	11	2,359	25,361
	Pipe length 600mm RCC	m	55	277	15,129
	Pipe length 750mm RCC	m	133	431	57,384
	Pipe length 900mm RCC	m	285	633	180,437
	Sub-total				**26,462,158**
2.0	**Airside - AGL & Floodlighting**				
	AGL & Floodligting for Existing Infrastructure				
2.1	**AGL**				**218,476**
	Elevated Omnidirectional Runway Edge Lights	nos.	64	1,876	**120,080**
	Inset Omnidirectional Runway Edge Lights	nos.	6	1,797	**10,783**
	Elevated Bidirectional Runway End/ Threshold Lights	nos.	12	1,718	**20,615**
	Elevated Omnidirectional Taxiway Edge/ Turn Pad Lights	nos.	39	1,718	**66,999**
2.2	**Floodligting**				**226,980**
	Floodlights	nos.	24	2,063	**49,500**
	Masts	m	58	3,060	**177,480**
	Sub-total				**445,456**
3.0	**Airside - Pavement Markings**				
	Markings for Existing Infratsructure				**129,381**
3.1	**Primary Runway 12/30**	m2	62,100	1	**68,828**
3.2	**Secondary Runway 06/24**	m2	20,855	1	**23,114**
3.3	**Taxiway A**	m2	1,650	1	**1,829**
3.4	**Taxiway B**	m2	1,800	1	**1,995**
3.5	**Taxiway C**	m2	850	1	**942**
3.6	**GA Hangar Taxiway**	m2	2,080	1	**2,305**

3.7	**ATO Apron**	m2	21,925	1	**24,300**
3.8	**GA Apron**	m2	5,475	1	**6,068**
	Markings for New Infrastructure				**16,666**
3.9	**Taxiway D**	m2	640	1	**709**
3.10	**Taxiway E**	m2	3,275	1	**3,630**
3.11	**Taxilane 1**	m2	1,775	1	**1,967**
3.12	**Taxilane 2**	m2	1,745	1	**1,934**
3.13	**New GA Apron**	m2	4,200	1	**4,655**
3.14	**Access/ Service Roads**	m2	4,330	1	**3,771**
	Sub-total				**146,047**
4.0	**Airside - Ancillary**				
4.1	**New GSE Outdoor Parking A and B**	m2	275	74	**20,465**
	Sub-total				**20,465**
5.0	**Terminal**				
5.1	**Building Layout Rearrangement and Refurbishment**	sum	1	50,000	**50,000**
	Sub-total				**50,000**
6.0	**Landside**				
6.1	**Drainage System Rehabilitation**				**14,622**
	Longitudinal Drain Regrading	m3	540	14	7,695
	Culvert	m	35	198	6,927
	Sub-total				**14,622**
7.0	**Ancillary/ Miscellaneous**				
7.1	**Overall Drainage System Rehabilitation**				**523,018**
	Retention Basin Cutting	m3	36,703	14	523,018
7.2	**Fence**				**1,646,683**
	Removal of Existing Airport Fence	m	6,310	3	18,183
	Installation of New Airport Fence	m	6,310	250	1,577,500
	Installation of New Retention Basin Fence	m	255	200	51,000
	Sub-total				**2,169,701**
	Total CAPEX				**29,308,449**
8.0	**Administration and Contingences**				
8.1	**Mobilisation to Remote Sites**		40%		**11,723,380**
8.2	**Administration, Analysis, Design, Certification and Supervision**		10%		**2,930,845**
8.3	**Contingencies and Reserves**		30%		**8,792,535**
	Sub-total				**23,446,759**
	Grand Total Investment				**52,755,208**