Annexures

Glen Innes Severn Council Meeting

23 SEPTEMBER 2022

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GLEN INNES SEVERN COUNCIL

30 June 2022

Preliminary

Draft

REHBEIN Airport Consulting

Item 7.28 Annexure A

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0	30 June 2022	Preliminary Draft	BJH	BMW	BJH
1	6 Sep 2022	Draft Review GISC	BJH	CM	KA

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1. INTRODUCTION

Glen Innes Severn Council (GISC) engaged REHBEIN Airport Consulting to prepare a Master Plan for the Glen Innes Airport.

The Master Plan seeks to establish objectives, understand existing facilities, consider future demands, and develop plans for future enhancement and utilisation in consideration of the following GISC strategies:

- Community Strategic Plan;
- Local Strategic Planning Statement;
- Economic Development Strategy;
- Destination Management Plan and Background Analysis; and
- GeoToursim Scoping Studies – Glen Innes and New England North West

The existing situation in terms of current facilities and operations is described in **Section 2**.

An assessment of existing pavement condition forms an important driver of the Master Plan and this is summarised in **Section 3**.

Section 0 outlines the draft vision and strategic objectives which form the basis of the Master Plan, derived from GISC's background research and master planning requirements.

Growth and development potential for activity at the Glen Innes Airport is discussed in **Section 5**, while critical airport planning parameters and aerodrome classification considerations are described in **Section 6**.

Section 0 describes the concept land use plan and **Section 0** the staged concept facilities development plan.

Finally, **Section 0** discusses the airport safeguarding plan.

2. EXISTING SITUATION

The Glen Innes Airport is located eight (8) kilometres from the centre of the town of Glen Innes, in the New England High Country of New South Wales (NSW). **Figure 1** illustrates the location.

The airport is accessed off Emmaville Road which forms the eastern boundary of the site. The aerodrome land is approximately 227 hectares in total area. The aerodrome facilities occupy around 92 hectares and the remaining 135 hectares is currently leased to the NSW Department of Primary Industries (DPI) for agricultural pasture.

2.1 EXISTING FACILITIES

The Glen Innes Airport aerodrome facilities currently consist of two (2) runways, a taxiway, main apron, three (3) hangars and a small passenger terminal building. Landside is an aero club building and a Rural Fire Service (RFS) brigade shed.

Figure 2 illustrates the existing airport layout. **Figure 3** shows the existing development area.

Figure 1: Glen Innes Airport Location

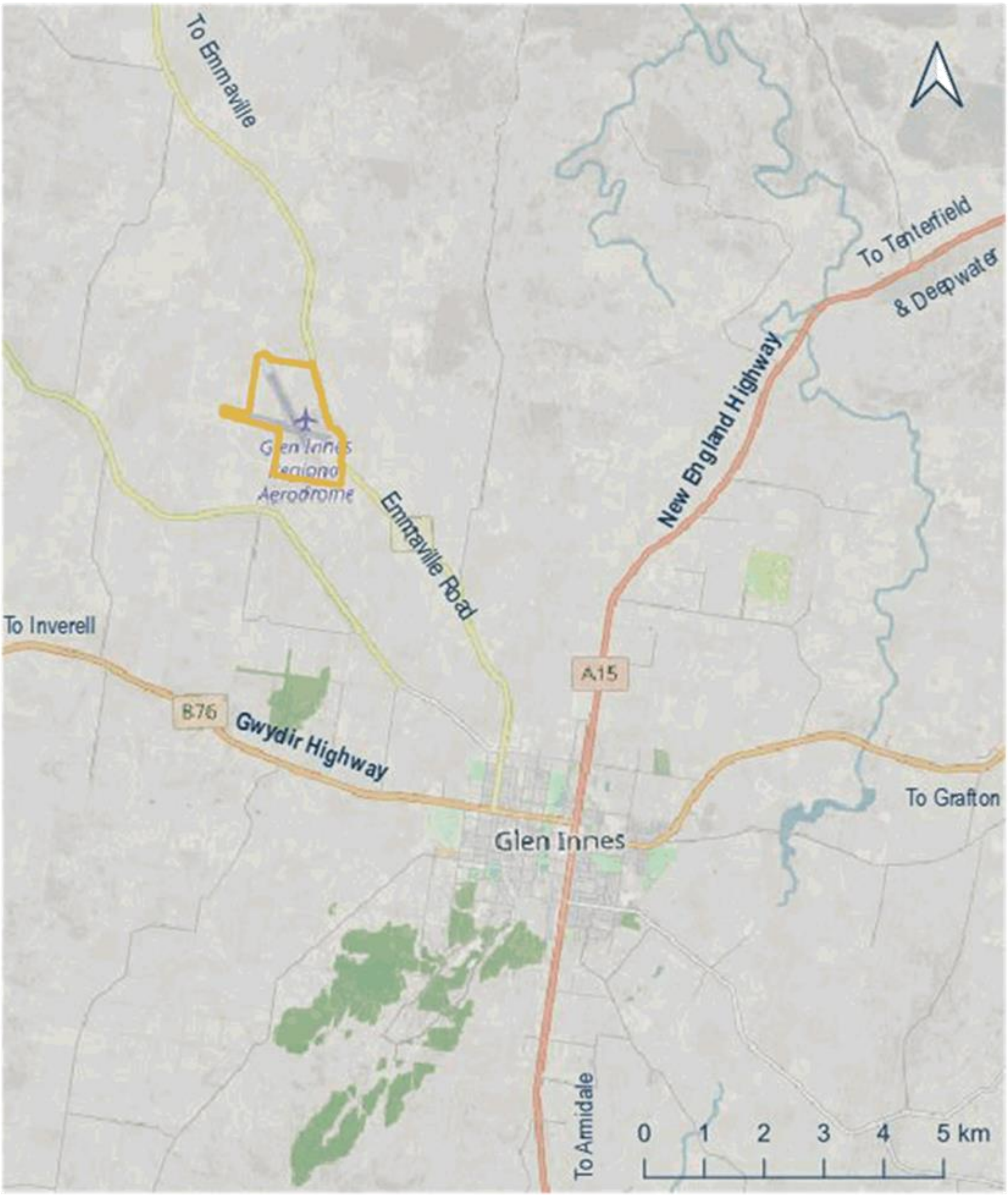

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Figure 2: Existing Airport Layout

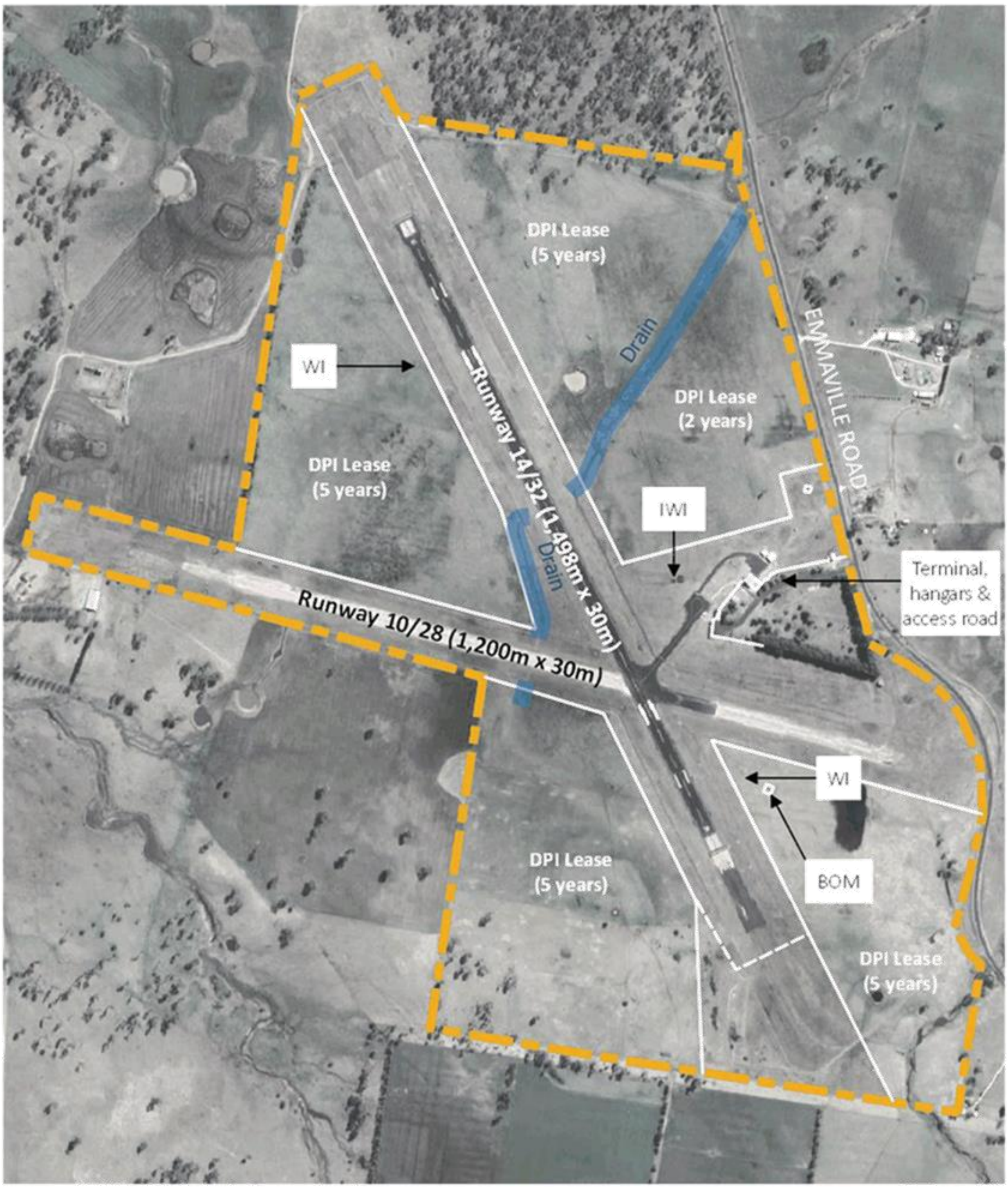

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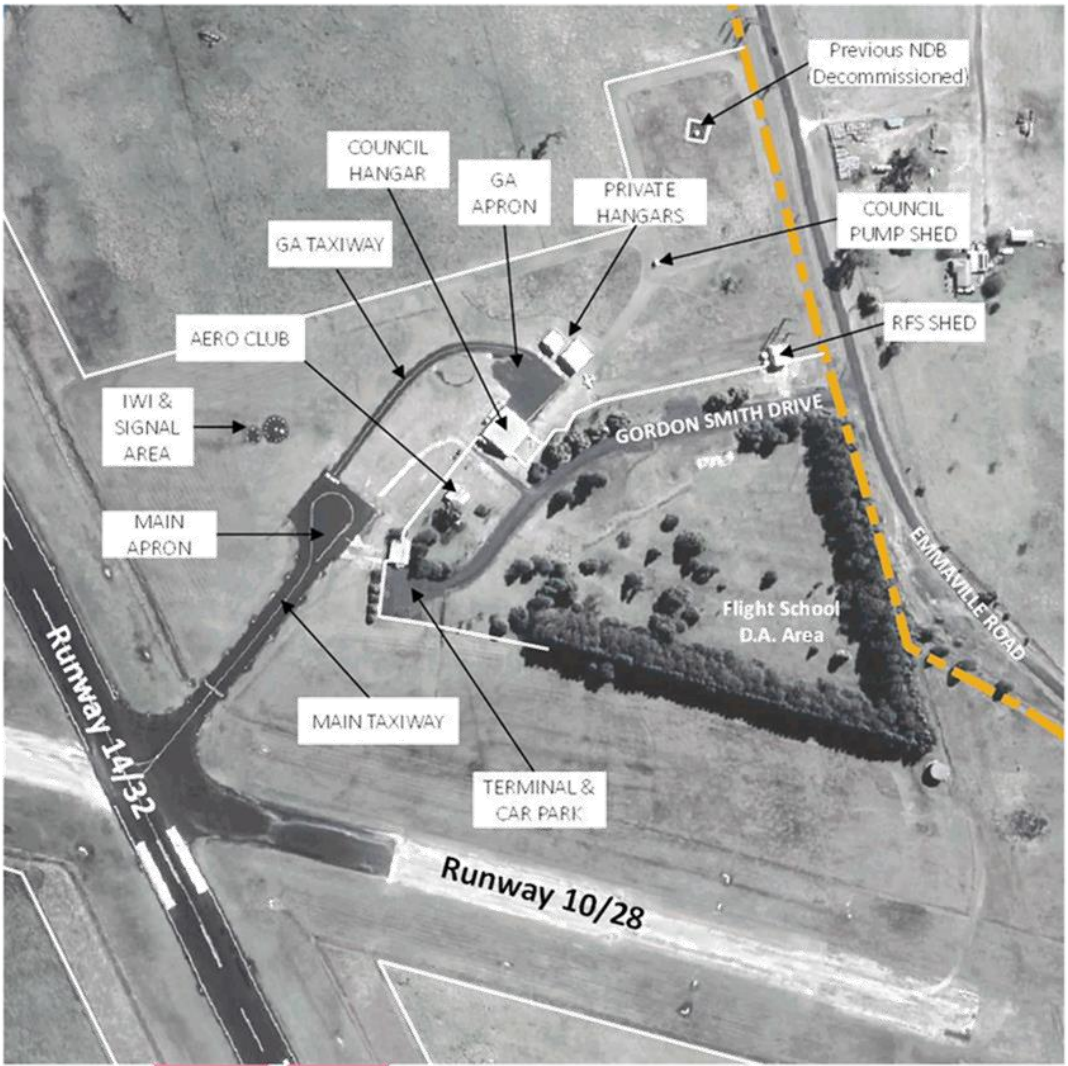
Figure 3: Existing Development



2.1.1 RUNWAY 10/28

Runway 10/28 is the secondary runway at Glen Innes. It is 30 m wide and 1,200 m in length with a grey gravel surface, except for a short section of approximately 150 m immediately to the east of the intersection with Runway 14/32. The runway has been reduced in length over time by approximately 240 m at the eastern end and approximately 330 m at the western end. The runway is situated within a 90 m wide by 1,320 m long runway strip.

2.1.2 RUNWAY 14/32

The main runway at Glen Innes is designated Runway 14/32. It is 30 m wide and currently 1,498 m long. It has a sealed surface. The runway is located within a 150 m wide and 1,618 m long runway strip. The central 90 m width of the runway strip is graded.

2.1.3 TAXIWAYS AND APRONS

The main apron is approximately 40 m by 40 m and is provided with a single marked aircraft parking position, in front of the terminal building.

A stub taxiway connects the main apron to the intersection of the runways. The taxiway is sealed 15 m in width.

A smaller taxiway, approximately 7.5 m wide, runs north-east from the main apron to a sealed GA Apron area in between the hangars.

2.1.4 HANGARS

There are three (3) existing hangars on site:

- A GISC-owned hangar, approximately 23 m x 23 m, a portion of which is used as the airport maintenance shed and the remainder leased out to private aircraft storage currently housing four to five light aircraft;
- A private hangar approximately 15 m x 15 m constructed on land leased to aircraft operator SupaAir; and
- A smaller private hangar approximately 12 m x 10 m constructed on privately leased land.

2.1.5 VISUAL AND RADIO NAVIGATION AIDS

The aerodrome is equipped with a primary illuminated wind indicator (IWI) to the north of the main apron, and two secondary wind direction indicators (WI) upwind of the 14 and 32 runway thresholds.

Runway 14/32 is equipped with a low intensity runway edge lighting (LIRL) system at 90 m spacing. The taxiway between the main apron and the runways are each equipped with blue elevated taxiway edge lights.

An Automatic Weather Station (AWS) is located between the runways south-east of the intersection. The previous automated weather information system was replaced in August 2022 by the latest technology (CAWIS) providing information to pilots via radio or telephone.

2.1.6 INSTRUMENT APPROACH PROCEDURES

The previous non-directional beacon (NDB) radio navigation aid has been decommissioned and removed. Required Navigation Performance (RNP) instrument approach procedures are published to both ends of the main runway 14/32. LNAV minima are 4,040 feet above mean sea level (amsl) (3,940 feet amsl with QNH) for both runways. These procedures allow aircraft to descend safely to approximately 500 feet above the runway before visual contact is made.

At night, LNAV minima were not available and the circling minima apply which are 300-500 feet higher than the LNAV. This is due to the unlit secondary wind indicators (IWI are required for instrument approach runways). GISC has recently obtained and installed an upgrade to the on-airport Bureau of Meteorology (BoM) instrumentation enclosure which enables an Automated Weather Information Broadcast (AWIB). An AWIB is an acceptable alternative means of providing wind information to pilots and alleviates the need for secondary IWI. Nevertheless, illumination of secondary WI is nonetheless recommended if practicable.

2.1.7 TERMINAL AND AEROCLUB FACILITIES

A small terminal with internal toilets is located adjacent to the main apron. Outside is a public toilet block and a small hut owned by Glen Innes Aero Club inc.

2.1.8 FLIGHT TRAINING SCHOOL DEVELOPMENT APPROVAL

In 2017, Council approved a Development Application to develop a commercial flight training academy using the area south of Gordon Smith Drive. The proposal has not gone ahead, being abandoned by the proponent Australia Asia Flight Training in 2018. However, the DA approval remains with the possibility of the project being reactivated should it prove viable again in the future.

2.2 CURRENT OPERATIONS

The most recent available usage data for Glen Innes Airport record some 3,700 usages (landings or training circuits) in the period from September 2018 through February 2021 inclusive. This translates to 7,400 period aircraft movements (landings or take-offs) or an average of around 3,000 annual movements.

Aerial firefighting related operations in the summer 2019-2020 bushfire season account for approximately 4,000 of the total movements.

Chart 1 and **Table 1** show the main contributors to aircraft traffic at Glen Innes Airport in recent years are:

- Firefighting (61% of movements);
- Other VH-registered (private, commercial, charter and aerial work) (14%);
- Flying School (8%);
- Aeromedical (7%);
- Unidentified customers, estimated as 50% Defence and 50% recreational (i.e. light sports aircraft or 'utralight' users) (7%); and
- Emergency (2%).

Chart 1: Estimated Monthly Aircraft Movements September 2018 – February 2022

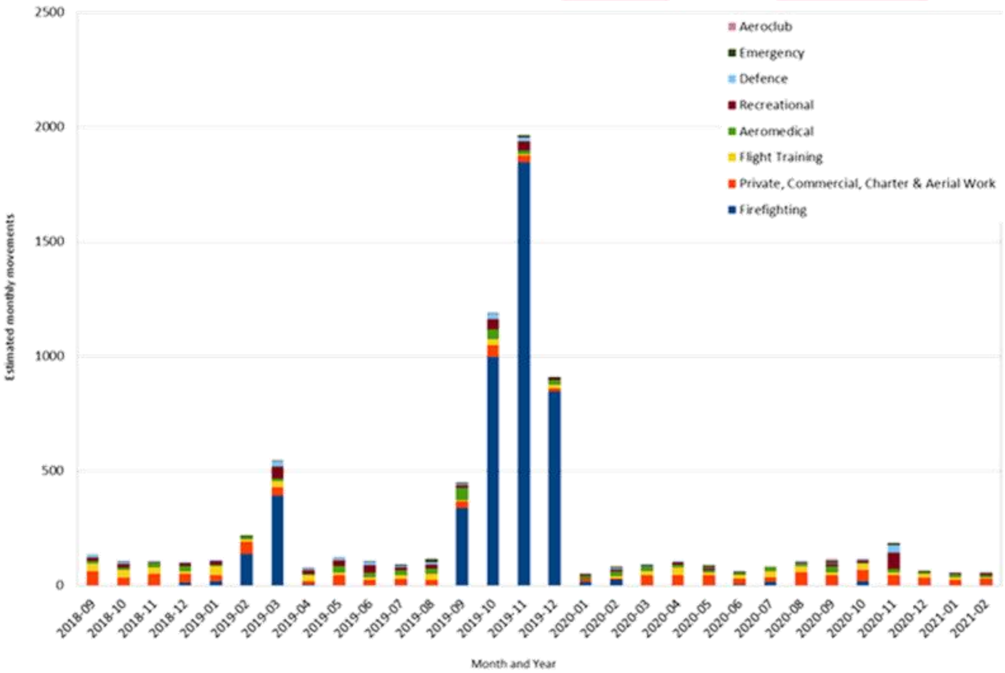


Table 1: Estimated Aircraft Operations

CATEGORY OF OPERATION	ESTIMATED MOVEMENTS 09/2019 THROUGH 02/2021"	"ESTIMATED AVERAGE ANNUAL MOVEMENTS"	% OF OVERALL USE
Firefighting	4,690	1,876	61.4%
Private, Commercial, Charter & Aerial Work	1,014	406	13.3%
Flight Training	566	226	7.4%
Aeromedical	528	211	6.9%
Recreational	468	187	6.1%

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CATEGORY OF OPERATION	ESTIMATED MOVEMENTS 09/2019 THROUGH 02/2021"	"ESTIMATED AVERAGE ANNUAL MOVEMENTS"	% OF OVERALL USE
Defence	241	96	3.2%
Emergency	114	46	1.5%
Aeroclub	12	5	0.2%
Total	7,633	3,053	100%

When adjusted to remove the firefighting operations, which predominantly occurred from September to December 2019, the aerodrome usage looks as shown in **Chart 2** and **Table 2**.

Chart 2: Estimated Monthly Aircraft Movements (No Firefighting)

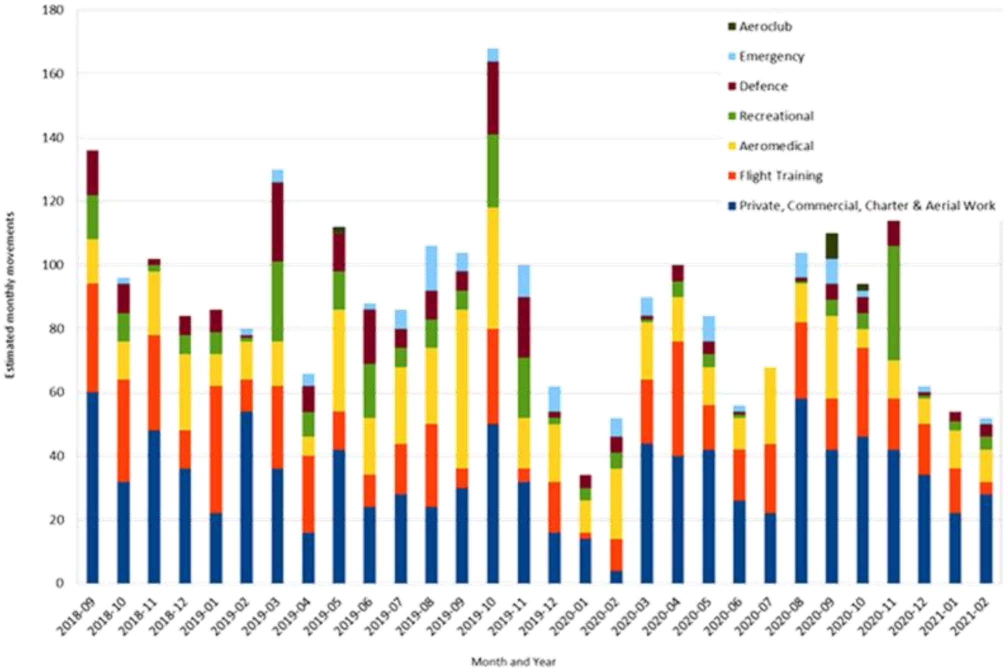

Table 2: Estimated Annual Operations (No Firefighting)

CATEGORY OF OPERATION	ESTIMATED MOVEMENTS 09/2019 THROUGH 02/2021"	"ESTIMATED AVERAGE ANNUAL MOVEMENTS"	% OF OVERALL USE
Private, Commercial, Charter & Aerial Work	1,014	406	34.5%
Flight Training	566	226	19.2%
Aeromedical	528	211	17.9%
Recreational	468	96	15.9%
Defence	241	96	8.2%
Emergency	114	46	3.9%
Aeroclub	12	5	0.4%
Total	2,943	1,117	100.0%

Table 2 shows that, after firefighting which is essential but by its nature is seasonal and may only occur in certain years, the main users of Glen Innes Airport are for private, commercial, charter and aerial work, flight training, and aeromedical purposes which together make up 75% of regular airport use.

The aero club aircraft recorded 6 usages (12 movements) over the 30 months of recorded usage and represents less than 1% of total activity at Glen Innes.

Total annual movements, at between 1,000 and 3,000 approximately, are low.

The largest aircraft type regularly using the airport is the Beechcraft King Air 350i (B350) operated by the Royal Flying Doctor Service. Infrequent usage by other aircraft types of a similar aerodrome reference code (ARC) and weight (6 to 8 tonnes Maximum Take-Off Weight – MTOW) also occurs. Air Tractor 802F aircraft anecdotally reported as being used during the bushfire operations, but not captured by aircraft type in the reported data, are approximately 7 tonnes MTOW.

2.3 AIRPORT MANAGEMENT

2.3.1 OWNERSHIP AND OPERATION

Glen Innes Airport is owned and operated by GISC and is a certified aerodrome under the *Civil Aviation Safety Regulations 1998* (CASR) and the Civil Aviation Safety Authority (CASA) *Part 139 (Aerodrome) Manual of Standards 2019* (Part 139 MOS (2019)). The aerodrome previously held 'registered' status under the CASR and is transitioning to equivalent 'certified' status under the current legislative framework.

2.3.2 REGULATORY CONTEXT

As a certified aerodrome, the aerodrome operator (GISC) is responsible for ensuring that facilities are maintained in accordance with the CASA Part 139 MOS (2019) and that the condition and status of aerodrome facilities is promulgated to pilots and aircraft operators through the Aeronautical Information Package (AIP).

2.3.3 OPERATING COSTS AND REVENUES

The airport is managed directly by GISC at an operating cost (historical) of approximately $200,000 per year. This includes aviation compliance activities and minor operational maintenance of airfield pavements but excludes capital costs of major rehabilitation or other cyclical maintenance requirements.

Aircraft landing fees are currently not charged by GISC. Landing fees charged at a selection of local airports (Armidale, Gunnedah, Inverell, Kempsey and Tamworth) very from around $9 to $13 (excluding GST) per 1,000 kg of MTOW, depending on aircraft type, fuel use and other factors. Based on a total annual landed MTOW weight of 725,545 kg eligible for billing (as recorded by AvData for GISC over 12 months between March 2020 and February 2021), current operations could be expected to recover around $7,000 to $9,000 per year (ex.GST). This level of revenue is an order of magnitude below the annual operating costs. This is a common scenario at regional aerodromes across Australia.

3. PAVEMENT INVESTIGATION

3.1 EXISTING CONDITION

Runway pavements typically require a complete re-surfacing every 10 years. The Glen Innes airport main runway was last re-sealed in 1998, the main taxiway and apron in 2002 and the GA taxiway and apron in 2011. All existing pavements are due for a reseal.

The main runway is currently adequate is strength for the existing aircraft types using it, however the surface is deteriorating due to age. Whilst currently serviceable, it requires regular and increasing maintenance to re-seal areas which become loose. Over time, it will pose an increasing risk of foreign object debris (FOD) damage to aircraft.

A full pavement condition assessment of the main runway, taxiway and apron has been conducted to inform this Airport Master Plan. The report prepared by Kamen Engineering is included at **Appendix B**. The technical assessment supports the current published PCN for Runway 14/32 but recommends a change in the subgrade classification from Category 'C' to Category 'D'.

3.2 DRAINAGE

The 2017 ASI report identifies issues with significant ponding of water at the runway intersection, which have been reiterated anecdotally by airport operational staff as still being an issue.

The installation of subsoil drainage along the runway, taxiway and apron pavement flanks is strongly recommended by the pavement assessment, especially so if larger aircraft are to be operate without risk of pavement damage.

3.3 TREATMENT OPTIONS

3.3.1 RUNWAY 14/32

The existing runway requires re-sealing as a matter of priority. In order to make this effective, rehabilitation of the existing granular base is required. To achieve this would require incorporating new crushed rock material to improve the grading of the base course and provide pavement surface shape correction, and at the same time stabilising the blended material by incorporating bitumen or another suitable binder for durability. By its nature, this treatment would most likely achieve a strengthening of the pavement to a degree suitable for aircraft up to around 20 tonnes, based on the preliminary pavement rehabilitation treatments identified by Kamen Engineering. The cost to complete this has been estimated as being in the order of $2.5 million, including the recommended subsoil drain installation.

Using a similar methodology, the runway could be increased further in strength to handle aircraft up to 30 tonnes MTOW, which would accommodate medium-size business jets and aerial firefighting aircraft including the Bombardier Dash 8 Q400AT air tanker, regional turboprop aircraft, and military airlift types such as the C130 Hercules and C27 Spartan. It is estimated that this would cost only around 10-15% more than the simple rehabilitation and reseal alone.

3.3.2 APRON & TAXIWAY

For the main taxiway and apron, the recommended treatment is to improve the existing granular subbase course with the addition of lime and to rework/improve the granular base course. If the base course is improved through the incorporation of bitumen as a stabiliser, the strength could be improved to match the 30 tonnes MTOW capability without increasing the pavement thickness.

To rehabilitate the main taxiway and apron to the same standard as Runway 14/32 (i.e. suitable for aircraft up to 30 tonnes MTOW) is estimated as being in the order of $0.5 million.

4. STRATEGIC VISION AND OBJECTIVES

4.1 DRAFT VISION

The draft strategic vision to be implemented by the Master Plan is:

"A place surrounded by nature where adventure is found, experienced, and remembered both on the ground, in the sky and throughout the community"

The draft vision encompasses the potential for a variety of uses and experiences at the Glen Innes Airport for the local community and those that utilise this community asset. Opportunities to increase utilisation which align with the draft vision are discussed in **Section 5**.

4.2 OBJECTIVES

The key objectives the Glen Innes Master Plan should deliver against include:

- Objectives which are key enablers for the **continued safe and unrestricted operation of aircraft** at the Glen Innes Airport in accordance with regulatory requirements and relevant aviation guidance. Objectives in this category include:
  - Maintain the ability for aircraft to operate safely and unrestricted through the maintenance of existing infrastructure, to agreed service levels
  - Ensure the airport is operating in accordance with National regulations, standards (including new MOS 139 standards), legislation and policies, including the National Airports Safeguarding Framework
  - Understand the class of airstrip from a technical perspective to set the maximum aircraft size taking into consideration emergency service aviation requirements, likely compatibility with other local RPT airports (Armidale) and likely aviation business requirements
  - Identify current operating surface condition (including testing and assigning a PCR value for runways, taxiways, and aprons), performance, utilisation (using two years of Council AVDATA and target group engagement) and costs and provide increased revenue and opportunity for Council and community
  - Plan for and support the ability for airport facilities to be maintained, enhanced and expanded where required to support master plan concepts and activities
  - Managing risks associated with asset liability
  - Managing risks outside of the airport, including land use conflicts, wildlife, and public safety.
- Objectives which relate to **developing a role for the airport** as a sustainable community asset and driver of visitation. Objectives in this category include:
  - Develop a role for the airport as a community asset and driver of visitation to enhance socio-economic prosperity including employment, education, entrepreneurialism and innovation
  - Develop options for attracting and developing more general and recreational aviation activity at the airport including administration, parking, and hangarage accommodation options (eg private land lease, communal hangarage, or Council/private hangar ownership models) for relevant target groups – consider industry partnerships to reduce capital expenditure to deliver such initiatives
  - Investigating future commercial usage for pilot training and aircraft engineering businesses
  - Improving financial sustainability through diverse income sources and providing a pricing model options for landing, parking, approach/training, Council hangarage fees
  - Identify key improvements and short-term gains to for the use of the airport as a regional staging area to support the Regional Fire Control Centre and Emergency Precinct; eg. multi-fuelling capability, low dust/recirculation helicopter parking areas, increasing runway/aprons load capacity to support RJ-type aircraft conducting admin support to RFS and other emergency services.
  - Plans ensuring improvements are made to support medevac, casevac, air mobility, and aerial fire-fighting/response units

- Objectives which provide guidance and direction to GISC in the form of a **forward-looking site plan which identifies and safeguards a phased approach** to development. Objectives in this category include:
  - Managing environmental and heritage constraints
  - Provide direction for Councillors, Council officers, user groups and the community
  - Airport Concept Plans to guide future development and priorities for investment, grant funding and socio-economic benefit
  - Provide a forward-looking site plan which specifically identifies and, therefore safeguards areas for a phased approach in developing possible:
    a. Refuel site with associated manoeuvring areas/access.
    b. Parking areas with associated manoeuvring areas/access.
    c. Communal, Council, or private hangarage areas and associated manoeuvring areas/access
    d. Airside Business hangarage areas and associated manoeuvring areas/access.
    e. Deployment area which can host surge operations such as rotary and fixed wing fire-fighting or emergency support operations.
    f. Flying school lay-down (current Development Application held by Council)
    g. The current long-term grazing lease areas.

5. GROWTH AND DEVELOPMENT POTENTIAL

5.1 STRATEGIC PLANNING CONTEXT

A series of strategic background documents have been prepared by GISC, regional and state agencies as part of their ongoing planning and development activities. These include:

- The New England North West Regional Plan 2036;
- Glen Innes Severn Community Strategic Plan 2022-2032;
- Glen Innes Highlands Economic Development Strategy 2020-2040 & Action Plan 2020-2025;
- Glen Innes Severn Council Local Strategic Planning Statement – A Strategic Land Use Vision to 2040; and
- Glen Innes Highlands Destination Management Plan 2021-2026.

These documents have been reviewed for relevance to the Glen Innes Airport Master Plan and the key aspects are summarised in the following sub-sections.

5.1.1 NEW ENGLAND NORTH WEST REGIONAL PLAN 2036

The *New England North West Regional Plan* is to guide the NSW Government's land use planning priorities and decisions to 2036 by providing an overarching framework of guidance and direction for subsequent detailed land use plans, development proposals and infrastructure funding decisions.

The vision includes nationally valued landscapes, and communities that are well connected, attractive, healthy, safe and prosperous with a strong sense of community identity.

Regional airports at Armidale, Inverell, Moree, Narrabri and Tamworth are identified as elements of the inter-regional transport connections within the Plan.

Glen Innes is identified as a centre of regional strategic importance focussed on the following priorities:

- Delivering housing options;
- Diversification in agriculture including harnessing international opportunities as well as maximising innovation and efficiencies;
- Supporting the growth of the hospital;
- Expanding nature based tourism and enhancing visitor experiences; and
- Wind, solar and other renewable energy production opportunities.

5.1.2 GLEN INNES SEVERN COMMUNITY STRATEGIC PLAN 2022-32

The Glen Innes Severn Community Strategic Plan is informed by the community for the future of the Glen Innes Severn local government area (LGA) as it grows over the 10-year period. One of the top priorities of the community is attracting new business and investment.

The vision for Glen Innes Severn is

A prosperous connected community that nurtures its people and places

The Community Strategic Plan contains five (5) strategic objectives each with multiple goals including

- **An Attractive Quality of Life** - that is enhanced by cultural expression, an active inclusive community, with accessibility to the best possible services and facilities in a high-country climate.
- **A Prosperous Local Economy** - that is encouraged and supported by sustainable investment opportunities, in a diversified business environment with accessibility to a trained and willing labour market.
- **Fit for Purpose Public Infrastructure** - that is designed, constructed and appropriately maintained, to keep our community and visitors, connected, safe and able to access the amenities and services they require. with a priority to provide adequate infrastructure and facilities for the existing and future population. This is to be achieved through ensuring optimal services, and proper management of infrastructure and assets while striving for funding.
- **An Appealing Sense of Place** - that is protected and preserved, so that our authentic natural and built assets are showcased and enhanced for the enjoyment of all and enriched by new developments.
- **Recognised for Local Leadership** - that upholds its values and responsibilities, is focused on the community through the custodianship of its assets and empowerment of its employees, to deliver the best value services and projects in partnership with others and within the means of Council.

5.1.3 ECONOMIC DEVELOPMENT STRATEGY 2020-2040 & ACTION PLAN 2020-2025

The Glen Innes Highlands Economic Development Strategy provides a clear pathway for Council and Community to foster local socio-economic prosperity and growth through the four key pillars of Partnerships, People, Place and Prosperity.

Various opportunities for growth are identified such as the visitor economy, value adding and niche agriculture, local business growth and support as well as asset-based place-making. Leveraging the Glen Innes Airport is raised as a top comment for growth and local opportunities.

Council's tasks include:

- Delivering an 'open for business' approach to attracting business through effective support and guidance;
- Delivering a vision for the town and villages to guide, prioritise and seek funding in order to invest in the activation, appeal and liveability of the LGA and leverage our natural and built assets;
- Health care and social assistance services;
- Attracting and retaining population through liveability and opportunities through starting a business and contributing to local economic prosperity;
- Facilitate agri-innovation business development to leverage agriculture for tourism and business-related opportunities to expand the agri-economy through value-adding and value chain development;
- Deliver the 'disused asset audit' of which the airport has been identified as a disused asset and link to ideas and opportunities; and
- Design and deliver an 'investment attraction policy' to encourage industry across sectors identified as growth opportunities.

5.1.4 GLEN INNES SEVERN COUNCIL LOCAL STRATEGIC PLANNING STATEMENT – A STRATEGIC LAND USE VISION TO 2040

The Local Strategic Planning Statement (LSPS) is informed by the New England North West Regional Plan, the Community Strategic Plan and the Economic Development Strategy. Population growth is a key focus, developing new strategies to attract people to the area. The aspirational target is to reach and maintain 10,000 residents by 2027. The vision is:

> *Glen Innes Highlands is the place to experience a unique lifestyle with opportunity, connection and wellbeing among a cherished and sustainable environment.*

There are four themes that make up the community vision with various planning priorities that are to be delivered through strategies to guide actions and land use directions to be undertaken by the Council.

- **A renewed economy and authentic place**
  - Support a 'whole of place' approach toward economic development and land-use planning. A renewed economy and authentic place approach identifies the airport as a developing key asset. Developing the airport, to support the delivery of a well-positioned place-based approach to economic development and sustainable land-use planning, is key;
  - Encourage diversification in agriculture, horticulture and agribusiness to grow these sectors and respond to domestic and international opportunities;
  - Expand nature-based adventure and cultural tourism places by leveraging environmental and iconic assets;
- **A thriving and vibrant community**
  - Deliver a variety of housing options and promote development that contributes to the community character;
  - Raise the awareness of employment, business development lifestyle opportunities, particularly for younger people and provide services for the ageing population,
- **Strong and connected infrastructure**
  - Continue to develop service and logistics infrastructure on appropriate sites to encourage new industry opportunities and population growth. The investment, integration and alignment of road, rail, port, utility and airport infrastructure across the New England North West to foster emerging industries;
- **Sustainable environment and protected heritage**
  - Protect and celebrate the unique natural and cultural heritage;
  - Protect areas of high environmental value and significance;
  - Adapt to natural hazards and climate change. Droughts and bushfires have highlighted to the community the severity of natural hazards, its vulnerability and the need to enable communities and individuals to be better prepared and more resilient to the impacts of insufficient water; and
  - Promote and support the transition to renewable energy.

Under these themes, the following planning priorities have may have relevance to the Glen Innes Airport:

- Planning **Priority 2**: Encourage diversification in agriculture, horticulture and agribusiness to grow these sectors and respond to domestic and international opportunities.
- Planning **Priority 3**: Expand nature-based adventure and cultural tourism by leveraging environmental and iconic assets such as World Heritage listed National Parks and the Australian Standing Stones.
- Planning **Priority 5**: Raise the area's profile and awareness of employment, business development and lifestyle opportunities particularly for younger people and provide services for the ageing population.
- Planning **Priority 9**: Adapt to natural hazard and climate change.
- Planning **Priority 10**: Promote and support renewable energy production opportunities.

5.1.5 GLEN INNES HIGHLANDS DESTINATION MANAGEMENT PLAN 2021-2026

The Glen Innes Highlands (GIH) Destination Management Plan (DMP) aims to development, management and marketing of the tourist destinations. In NSW, a DMP is a pre-requisite to accessing tourism funding and assists in accessing a range of Federal and State Government grant programs. The key strategic pillars are improving customer experiences, evolving the brand positioning, development and improving existing experiences and creating and delivering new experiences.

The primary goals of the DMP are:

- Increase visitation to and visitor expenditure;
- Diversity the local economy and create a stronger. More resilient community;
- Improve the viability and sustainability of local business;
- Attract public and private sector investment; and
- Create local employment

To achieve these goals focus needs to be directed to initiatives to grow and diversify visitation, develop attractions, activities, experiences and events, ensuring that infrastructure, facilities and services are in place to support the growth, and embracing opportunities to leverage nature-based, geo-tourism and agri-tourism.

The DMP identifies agriculture and tourism as the 'engine' industries in GIH. Adventure and sports are an established top attraction and continue to develop. Developing more adventure-based sporting activities and experiences utilising under-utilised assets and locations which provide breadth and depth across the nature and adventure-based tourism is identified as an opportunity for growth which potentially relates to the Glen Innes Airport.

The GIH marketing strategy is organised under the three pillars of Visit, Live and Invest and has six brand themes which represent the area's strengths, products and experiences – **Adventure** Country, **High** Country, **Ngoorabul** Country, **Celtic** Country, **Heritage** country and **Progressive** Country.

Under the DMP – Strategy, strategic objectives 3 and 4 relate to experiences that could have a connection to the Glen Innes Airport. The strategic goals under these pillars are:

- Improve the quality and capacity of our existing attractions, activities and experiences through connection, collaboration and support of local people and businesses.
- Be bold, adventurous, and ambitious to create new ideas and experiences to attract domestic and international visitors based on trends, interests, and the discerning traveller.

5.2 AIRPORT ROLE AND OPPORTUNITIES

A series of possible opportunities for increased utilisation and future development of the Glen Innes Airport were identified through reference to the strategic planning documents discussed in **Section 5.1** above and reviewed against the Airport Master Plan objectives. These are illustrated conceptually in **Figure 4**.

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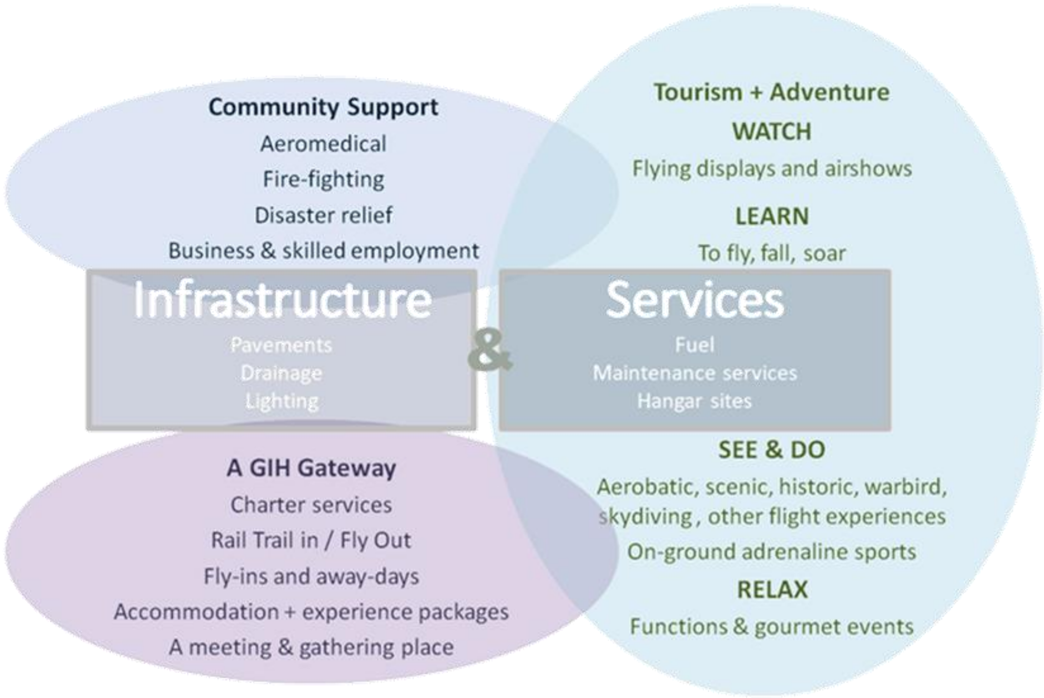
Figure 4: Glen Innes Airport Role & Opportunities



Some of the main opportunities are discussed below and include:

- Aviation and aviation-related opportunities
  - Passenger services;
  - Fuel facility;
  - Aircraft maintenance;
  - Private hangarage;
  - Airpark estate and premium hangar accommodation;
  - Scenic and other flight experiences;
  - Flying training;
  - Other aviation businesses;
  - Community support;
  - Aviation events;
  - A complementary Glen Innes gateway; and
- Non-aviation related opportunities
  - Non-aviation events;
  - Motor sports complex;

- Other non-aviation opportunities.

The list is not exhaustive and is intended to provide a flavour of the types of activity which the Land Use Plan and Concept Development Plan should make provision for, to maximise the development and growth potential of Glen Innes Airport.

5.2.1 PASSENGER SERVICES

The possibility of passenger services has been a topic discussed in previous Council plans and is worth addressing. Passenger services can be provided in two ways: through Regular Public Transport (RPT) – i.e. scheduled airline services; or through charter operators.

Glen Innes is unlikely to be able to sustain viable RPT services, principally on the basis of population size, the economics of regional airline operations and the presence of established RPT services from Armidale (20 weekly return flight to Sydney) and Inverell (3 weekly return flights to Brisbane and Sydney), both accessible within a 1 – 1.5 hour drive.

Charter operations are more likely to be viable. In contrast to RPT, where aircraft smaller than 70 seats are no longer in global production, charter services can avail of a wider fleet of smaller aeroplanes that are established in the Australian general aviation fleet and will continue to operate for the foreseeable future.

A charter operator might be attracted to establish at Glen Innes Airport if tourism or agri-business driven visitation were to increase substantially. Alternatively, or in parallel, Glen Innes Airport might be served by operators based elsewhere, potentially complementing RPT services as a means of accessing the GIH region for those wishing to experience the area without bringing in a vehicle.

5.2.2 FUEL FACILITY

Access to aviation fuel is an essential enabler for increased asset utilisation. Private flyers, in particular, commonly flight plan and actively choose destinations to visit based around availability of competitively priced fuel. Fuel provision is also an essential consideration for emergency services use including visitation by police and air ambulance. For air ambulance, in particular, access to fuel can increase aeromedical coverage and response across regional areas. Charter and freight operations may also be constrained by a lack of available fuel on site.

Various models exist for service provision, however a common model at regional airports is for a specialist provider to lease a suitable portion of land on-airport and construct the facility to its own specifications ensuring all regulatory requirements are adhered to. The refuelling company then sells the fuel at a commercial rate to recover its costs. Facilities can include taxi-up card-swipe bowsers offering Avgas and Jet A-1 for users to self-fuel. Larger facilities at busier airport can also include a refuelling truck on site which can travel to individual hangar facilities.

5.2.3 AIRCRAFT MAINTENANCE

After fuel, provision of aircraft maintenance services is typically the next key enabler for greater airport utilisation. Aircraft maintenance businesses attract aircraft and their pilots to visit communities through ferrying aircraft. Maintenance providers will need a hangar workshop and space to park aircraft. They would either fit out an existing facility or more commonly build to their own requirements. Constructing such a facility is a significant investment and so businesses would likely be looking for a long-term lease arrangement. In the interim, in order to kick-start development, GISC could consider leasing the existing Council Hangar to a prospective maintenance business until the market is proven and established.

5.2.4 PRIVATE HANGARAGE

The ability to accommodate local aircraft is important. While demand is hard to predict, having suitable space for aircraft owners to lease is essential for increasing asset activation. This should include a mix of space for co-habitation of several smaller aircraft in a single hangar, individual hangar site for light aircraft, and larger sites suitable to accommodate private or corporate aircraft including light jets.

5.2.5 AIRPARK ESTATE

Airpark development in Australia has had mixed results. There are several commercially successful developments, as well as many which have been proposed but have not been developed for whatever reason. The quality of the resulting community varies greatly and success relies heavily on the right mix of vision and strategic investment by Council, with appropriate land development skills and expertise from the private sector. The viability of an airpark development at Glen Innes needs greater proving at a feasibility level before incorporating into any land use plan or development concept.

The conventional approach is to sell land to prospective owners. Given the need to offer a freehold tenure (or a very long leasehold) to enable owners to invest in the property, any land occupied by the airpark should be that which otherwise makes the least contribution to the airport operations. Airside and landside access, and servicing requirements, need careful consideration. The costs of providing and maintaining infrastructure need to be factored into any business case.

Until such detailed feasibility is concluded, and the appropriate location and size determined, the airpark should not be included in the Airport Master Plan.

5.2.6 FLY-IN TOURISM ACCOMMODATION

Although freehold airpark-style development requires further investigation and feasibility, several models are available for short-term accommodation on regional airports which allow users to access directly to the runway. At Glen Innes these could leverage the GIH brand and the Destination Management Plan by encouraging businesses to establish accommodation which allows aviators to fly themselves into the region and experience adventure on the ground through a tourism 'hangar + residence + vehicle' package. As a commercial operation, rather than someone's home, a long leasehold arrangement on the airside lots is likely to be more palatable to all parties and maintains flexibility for redevelopment in the longer term.

5.2.7 SCENIC AND OTHER FLIGHT EXPERIENCES

With the GIH and New England North West focus on stunning landscapes there is potential for scenic flights to offer another way to experience this stunning natural beauty, as a complement for visitors also immersing themselves in it on the ground. These scenic geo-tourism experiences could be through aeroplane, gliding or helicopter flights and might be provided by businesses based at Glen Innes Airport as well as itinerant operators using them as part of a passenger transport charter package.

Other experiences could leverage the Glen Innes Highlands DMP goals to create new experiences. These could initially build on more conventional aviation thrill-seeking experiences such as aerobatic flights, vintage aircraft and warbirds, skydiving and gliding while encouraging the market to innovate with new experiences over time.

Sports such as hang gliding, paragliding and hot air ballooning, whilst not suitable to take place at the airport itself (for practical and safety reasons) could be based here taking customers to more suitable sites.

5.2.8 FLYING TRAINING

Private flight schools, in contrast to a commercial training academy as has previously been proposed at Glen Innes, might serve not only the local community, but also the visitor economy. With a recreational pilot licence (RPL), people can obtain a certificate in as little as 20 hours flight time. Glen Innes may be an attractive location for people to come for an intensive experience to cover elements of the syllabus. Some may continue, once qualified, to obtain their private pilot licence (PPL) or perhaps wish to hire a light sport aircraft for their own recreation on a future visit to the GIH.

5.2.9 OTHER AVIATION BUSINESSES

A range of other aviation and aviation-support businesses might be attracted to establish at Glen Innes Airport, if and when, activity levels and support facilities are established. These might include light sport aircraft and/or RPAS (drone) manufacturing, avionics, survey and other aerial work, mustering and helicopters. All of these are likely to have a need for hangar and other facilities, including fuel and maintenance services, within an aviation business park arrangement.

5.2.10 COMMUNITY SUPPORT

Increased provision for aviation services supporting the community in adapting to the consequences of climate change, notably aerial fire-fighting and aeromedical services as well as disaster relief, is an important role for regional airports which can provide an essential lifeline.

5.2.11 AVIATION EVENTS

A vibrant aviation events scene is an effective way to increase airport utilisation and grow the visitor economy. Examples of such events at regional airports include Wings Over Illawarra at the Shellharbour Regional Airport and Warbirds Downunder at Temora. Whilst events of this size take time to establish, smaller-scale flying displays, aerobatics displays, competitions and other airshow type events are consistent with the Strategic Vision and Objectives and, with the necessary product development and promotion, are conceivable at Glen Innes.

These events would need to be the subject of thorough management plans to mitigate the risk of wildlife attraction.

5.2.12 A COMPLEMENTARY GLEN INNES HIGHLANDS GATEWAY

With the establishment of the New England Rail Trail, the railhead will become a significant gateway to GIH. With charter services and other flight experiences as discussed above, the Glen Innes Airport could become a complementary gateway to travel in and out of the region. In keeping with the GIH brand, it is possible to envisage visitors travelling by airline service to Armidale, experiencing the rail trail, enjoying the Glen Innes region and leaving via charter transfer (or perhaps as an add-on to a scenic flight) to connect back to the airline network and home.

The airport might also serve as a stopping off point for purely ground-based travellers as they make their way around the region into or out of Glen Innes by road, and/or a place for people to fly in and meet tour operators for a motorcycle, 4WD or gravel/mountain bike experience.

It is possible to see an opportunity for comfortable visitor facilities and amenities including places to meet and wait, enjoy food and drink, and learn more about the region's attractions. Facilities might include a cafe/restaurant (which might be a gourmet destination in itself), lounge with visitor information and passenger access to the aircraft.

5.2.13 MOTOR SPORTS COMPLEX

The concept of a motor sports complex at Glen Innes Airport has been identified by GISC in stakeholder consultation. In considering motor sports on airport land, it is important to differentiate between those that would use the runway (such as drag racing) and a separate facility such as a karting track which is landside.

Motor sports on airfield pavements should not be permitted. Such activities are completely incompatible with the vision of a functioning and vibrant airport. In order to undertake events, the aerodrome must be closed. This prevents essential aeromedical access and disrupts other aviation users from going about their business and enjoyment. Motor sports and drag racing will damage the runway surface and risks damage to other infrastructure such as lighting, causing safety issues and expensive repairs. If there is demand for a facility for drag racing and the like in the Glen Innes region, it is not recommended to utilise the airport for this purpose.

Other motor sports facilities, such as a kart track or dirt bike course, could potentially be developed on non-airside land, subject to ensuring aspects such as dust, smoke, and lighting are managed carefully in accordance with the Airport Safeguarding Plan to avoid any impact on aviation safety.

5.2.14 NON-AVIATION EVENTS

In addition to aviation events, potential exists to use landside areas for outdoor events such as farmer's and craft markets, weddings and corporate events, shows and festivals. Through temporary and semi-permanent structures such as marquees, seating and amenities, the Flight School D.A. Area could be used without impinging on the ability to capitalise on any future flight school opportunity.

These events would need to be the subject of thorough management plans to mitigate the risk of wildlife attraction.

5.2.15 OTHER NON-AVIATION OPPORTUNITIES

Other opportunities which may be able to utilise some of the space available on airport land, but which are not otherwise related to aviation, include:

- Archery or shooting range (indoor);
- Bowling (strike or lawn, indoor or outdoor);
- Assault-style adventure course;
- Mountain bike or BMX track;
- Museum (aviation – non-flying – or non-aviation); and
- Continuation of the current DPI lease arrangements. The DPI agricultural grazing and research activity is quite compatible with airport operations (providing livestock is adequately separated from the airside by appropriate fencing). As it does not involve development of infrastructure, it preserves the flexibility for future uses to evolve and for progressive development of aviation and non-aviation facilities as the airport activity grows.

6. CRITICAL AERODROME PLANNING PARAMETERS

Central to the development layout planning is the establishment of appropriate airport planning parameters. These are based on the most critical design aircraft intended to use each of the airport facilities and infrastructure.

There are several parameters which contribute to determining the planning and design standards to which the future layout must adhere. These parameters are informed by the growth opportunities outlined above in **Section 5.2**.

6.1 THE AERODROME REFERENCE CODE SYSTEM

The standards an aerodrome must meet, if it is to be suitable for use by aeroplanes within a particular range of performance and size, are determined by the aerodrome reference code (ARC) chosen by the aerodrome operator. This system is established by the International Civil Aviation Organisation (ICAO) and is implemented in Australian aviation standards through the Civil Aviation Safety Authority (CASA).

The ARC links the aerodrome design criteria to the operational and physical characteristics of the design aircraft. The 2019 CASA *Part 139 (Aerodromes) Manual of Standards 2019* (Part 139 MOS) sets out three (3) elements that make up the ARC as described in the following subsections.

6.1.1 ARC ELEMENT 1: CODE NUMBER

The ARC code number is one of the key parameters which determine the required physical characteristics of runways and the surrounding obstacle restrictions. The code number is determined by the aeroplane reference field length of the aircraft intended to use a runway. The aeroplane reference field length is a measure of the runway length required by an aeroplane in certain standardised conditions, which allows a comparison between different aircraft to be made. **Table 3** indicates how the code number is related to aeroplane reference field length.

Table 3: Code Element 1 - ARC Number (or runway code number)

Code number	Aeroplane reference field length
1	Less than 800 m
2	Not less than 800 m
3	Not less than 1,200 m
4	Not less than 1,800 m

Source: Part 139 (Aerodromes) Manual of Standards 2019 [Table 4.01(3)]

Reference field length is related to, but is not the same as, the physical runway length available. The operational runway length required by aircraft varies dependent on a number of factors such as aircraft load factor, wind direction, altitude, temperature and runway slope. It may also be influenced by surrounding obstacles.

6.1.2 ARC ELEMENT 2: CODE LETTER

The code letter is used to define required clearances to objects for aeroplanes manoeuvring on the runways, taxiways and aprons. It is determined by the wingspan of the design aircraft as per **Table 4** below.

Table 4: Code Element 2 - ARC letter

Code letter	Aeroplane wingspan
A	Up to but not including 15 m
B	15 m up to but not including 24 m
C	24 m up to but not including 36 m
D	36 m up to but not including 52 m

Code letter	Aeroplane wingspan
E	52 m up to but not including 65 m
F	65 m up to but not including 80 m

Source: Part 139 (Aerodromes) Manual of Standards 2019 [Table 4.01 (4)]

6.1.3 ARC ELEMENT 3: OUTER MAIN GEAR WHEEL SPAN

The Outer Main Gear Wheel Span (OMGWS) relates to the ground-based manoeuvring capability of the aircraft and therefore applies to the movement area pavements, including runways, taxiways and aprons. OMGWS can be in one of four categories as per **Table 5**.

Table 5: Code Element 3 - OMGWS

Aeroplane OMGWS
OMGWS up to but not including 4.5 m
OMGWS 4.5 m up to but not including 6 m
OMGWS 6 m up to but not including 9 m
OMGWS 9 m up to but not including 15 m

Source: Part 139 (Aerodromes) Manual of Standards 2019 [Table 4.01 (5)]

6.2 GLEN INNES AERODROME CLASSIFICATION

The ARC elements described in **Section 6.1** above apply separately to each aerodrome facility (i.e. each runway, taxiway section, apron and aircraft parking position). However, the overall aerodrome classification is generally described in relation to the physical characteristics of the main runway and its associated obstacle limitation surfaces and navigational aids.

Glen Innes Airport facilities currently meet the dimensional requirements as follows:

6.2.1 RUNWAY 14/32

The main runway 14/32 is currently published as an ARC code number 3 non-precision instrument approach runway. The dimensions of the runway and associated runway strip meet the following:

- The runway width of 30 m meets the standards for a runway ARC code number of 3 and on OMGWS of 6 m up to but not including 9 m, in accordance with Part 139 MOS 2019 6.02 (1);
- The runway graded strip width of 90 m meets the standards for a non-instrument approach runway ARC code number of 3, where the runway width is 30 m and the runway is not used for schedule international air transport operations, in accordance with Part 139 MOS 2019 6.17 (2);
- The overall runway strip width, including the flyover area of 150 m, meets the standards for an instrument non-precision approach runway ARC code number of 2, in accordance with Part 139 MOS 2019 6.17 (4); and
- The overall runway strip width of 150 m can be deemed to comply with the standards for an instrument non-precision approach runway ARC code number 3 as an existing grandfathered facility which meets the standards that were in place immediately before the commencement of the Part 139 MOS 2019 under the transitional provisions set out in Section 2.04 therein.

Continued compliance with these and other relevant provisions of the Part 139 MOS 2019 for a code number 3 instrument non-precision approach runway is considered appropriate to the Glen Innes Airport role and opportunities set out in **Section 5.2**.

6.2.2 RUNWAY 10/28

The cross runway 10/28 is currently published as an ARC code number 2 non-instrument approach runway. The dimensions of the runway and associated runway strip meet the following:

- The runway width of 30 m meets the standards for a runway ARC code number of 3 and on OMGWS of 6 m up to but not including 9 m, in accordance with Part 139 MOS 2019 6.02 (1);
- The current runway strip width is 90 m. A runway graded strip width of 80 m will meet the standards for a non-instrument approach runway ARC code number of 2, in accordance with Part 139 MOS 2019 6.17 (2).

Continued compliance with these and other relevant provisions of the Part 139 MOS 2019 for a code number 2 non-instrument approach runway is considered appropriate to the Glen Innes Airport role and opportunities set out in **Section 5.2**.

6.3 DESIGN AIRCRAFT

The design aircraft is selected by the airport operator to inform the master planning process, by determining the set of standards and regulations which will apply to the airport and which should be adopted in the layout planning.

The design aircraft defines which operations may be accommodated at the airport in the future and, conversely, the operations which the airport will not be able to accept.

Typically, non-passenger (i.e. General Aviation) operations fall into three groups:

- Code 1A/2A aeroplanes, which are typical of private and recreational flying and some smaller charter operations;
- Code 1B/2B aeroplanes, which are typical of aeromedical, aerial work, charter, freight and private or small business jet operations; and
- Code 3C/4C aeroplanes, which include some aerial work, (especially large air tanker types for fire-fighting), charter, freight and larger business jets.

Most facilities at Glen Innes can be adequately planned for use by aeroplanes up to ARC 2B, which is typical of current operations at the airport. However, it is prudent to maintain flexibility for larger aircraft up to Code 3C in order to preserve opportunities into the future.

Table 6 provides some critical parameters associated with the range of aircraft types anticipated to serve the opportunities discussed in **Section 5.2**.

Table 6: Typical Aircraft Types

Aircraft	ICAO Designator	Pax	MTOW (kg)	Wingspan (m)	ARC Number	ARC Letter	ARC OMGWS
Cessna 172R Skyhawk	C172	3	1,100	10.9	1	A	0 < 4.5m
Beech Baron 58	BE58	5	2,450	11.5	1	A	0 < 4.5m
Learjet-60	LJ60	8	10,650	13.4	1	A	0 < 4.5m
Piper PA-42	PAY4	6-9	5,460	14.5	1	A	4.5 < 6m
Cessna 208 Caravan	C208	9	3,630	15.9	1	B	0 < 4.5m
Air Tractor AT-802F	AT8T	-	7,250	18.1	1	B	0 < 4.5m
Cessna Citation 560	C560	9	9,200	17.0	2	B	4.5 < 6m
Beech King Air 350i	B350	9	6,800	17.7	2	B	4.5 < 6m
Embraer Legacy 500	E550	8-12	10,750	20.3	3	B	0 < 4.5m
Fairchild Metro III / 23	SW4	19	7,250	17.4	3	B	4.5 < 6m
Beech 1900D	B190	19	7,770	17.7	3	B	4.5 < 6m
Embraer ERJ-145	E145	50	22,000	20.1	3	B	4.5 < 6m
Embraer Legacy 600	E35L	13-14	22,500	21.2	3	B	4.5 < 6m
SAAB 340B	SF34	34	13,160	21.5	3	B	4.5 < 6m

Aircraft	ICAO Designator	Pax	MTOW (kg)	Wingspan (m)	ARC Number	ARC Letter	ARC OMGWS
Jetstream 41	JS41	19	6,950	18.4	3	B	6 < 9m
ATR72	AT76	68	23,000	27.1	3	C	4.5 < 6m
Dash 8-100/200	DH8B	36	16,470	27.4	3	C	6 < 9m
Dash 8-300	DH8C	50	19,510	27.4	3	C	6 < 9m
Dash 8-Q400	DH8D	72	29,260	28.4	3	C	9 < 15m

Note: Data are indicative only to illustrate common aircraft groupings for master planning purposes only. Actual data may vary according to manufacturer's data and actual aircraft operator configuration.

Source: AviPlan, Wikipedia

6.4 FACILITY REQUIREMENTS

6.4.1 RUNWAYS

Runway width requirements are determined by reference to ARC number and OMGWS. A runway width of 30 m allows for Code 3 Aeroplanes with OMGWS up to but not including 9 m, which encompasses all of the design aircraft for Glen Innes except for the Dash-8 Q400. However, the Q400 has previously been given approval for use on 30 m wide runways. The current runways are adequate for the expected operating aircraft types into the future.

Although not envisaged as an immediate requirement under this Master Plan, additional length may be beneficial for larger aircraft, in particular Q400 aerial fire-fighting units, as the current length may not allow take-off at maximum weight. Additional length could be provided within the airport land to the north and the south. The actual length and the nature of the extension (conventional for use by all operations in each direction, or 'starter' extension to provide additional take-off length in one direction only and/or stopway in the opposite direction) would need to be determined through further detailed feasibility investigations. Such investigations should cover all aspects of compliance including examination of runway longitudinal profile and the obstacle environment. However, the Master Plan should preserve the land to the north and south of the existing runway for some form of extension in each direction, should this prove necessary and justifiable in the future. The obstacle environment off-airport should also be protected as far as possible, to maximise the operational benefit-to-cost of any extension/s.

6.4.2 RUNWAY END SAFETY AREAS

Even if runway extensions are not provided, the land at each end of both runways beyond the end of the runway strip (clearway) should be preserved in a state compliant with the requirements Runway End Safety Areas (RESAs), in accordance with CASA Part 139 MOS (2019) which are:

- A minimum width of 60 m for both runways;
- A minimum length of 60 m and a preferred length of 120 m for Runway 10/28; and
- A minimum length of 240 m and a preferred length of 240 m for Runway 14/32.

The preferred length should be provided where space is available. The slopes on a RESA should not exceed 5% for the downward longitudinal slope, or the transverse slope (upward or downward).

6.4.3 TAXIWAYS & APRONS

Taxiway and apron spatial planning is dependent on the ARC letter (for wingtip clearances) and the OMGWS (for pavement requirements). For the purposes of taxiways and apron layout, the following groups of aircraft are logical:

- Code A aeroplanes with OMGWS less than 4.5m
- Code B aeroplanes with OMGWS less than 6 m and Code A aeroplanes with OMGWS greater than 4.5m but less than 6 m; and

- Code C aeroplanes with OMGWS less than 9 m and Code B aeroplanes with OMGWS greater than 6 m but less than 9 m.

In general, areas on-airport intended for use by aircraft in each group should be planned to meet the wingtip and pavement width/wheel clearance requirements (as defined in Part 139 MOS (2019) applicable to the ARC letter and OMGWS category of each group, as set out in Table 7

Table 7: Aircraft Groups for Taxiway & Apron Planning

Group	ARC Letter	OMGWS	Min TWY Width	Min Wheel Clearance	Taxiway CL to object clearance	Taxilane CL to object clearance
I	A	0 < 4.5m	7.5 m	1.5 m	15.5 m	12.0 m
II	A	4.5 < 6 m	10.5 m	2.25 m	20.0 m	16.5 m
	B	< 6 m				
III	B	6 m < 9 m	15.0 m	3.0 m	26.0 m	24.5 m
	C	< 9m				

Note: the Dash-8 Q400 has an OMGWS of 9 m < 15m, which would require a 45 m wide runway and 23 m wide taxiway under the Part 139 MOS (2019). However as this aircraft has historically been approved to operate on 15 m wide taxiways and 30 m wide runways throughout Australia and is only anticipated to operate to Glen Innes infrequently for fire-fighting duties, this approval is assumed to endure for master planning purposes.

6.4.4 HANGAR LOTS

In practice, hangar lots sizes can vary greatly, due to a range of factors which relate to the operational requirements of the users. However, for planning purposes, two hangar lot sizes have been assumed based on experience of typical requirements at other regional airports.

- Large hangar lots 50 m deep and nominally 35 m wide. These lots are suitable to accommodate a medium-sized hangar of approximately 30 m wide and 20 m deep and could house 1 or 2 aircraft 15 - 20 m in length, with space to park the aircraft in front of the hangar clear of the taxilane and room landside for vehicle parking.
- Small hangar lots 25-30 m deep and nominally 18 m wide. These lots are suitable to accommodate a small hangar of approximately 15 m x 15 m, sufficient to house a typical light private aircraft, with space to park the aircraft in front of the hangar clear of the taxilane.

Hangar lot boundaries should be subject to further detailed design and investigation/consultation on specific user requirements is recommended prior to finalising and design or subdivision plans.

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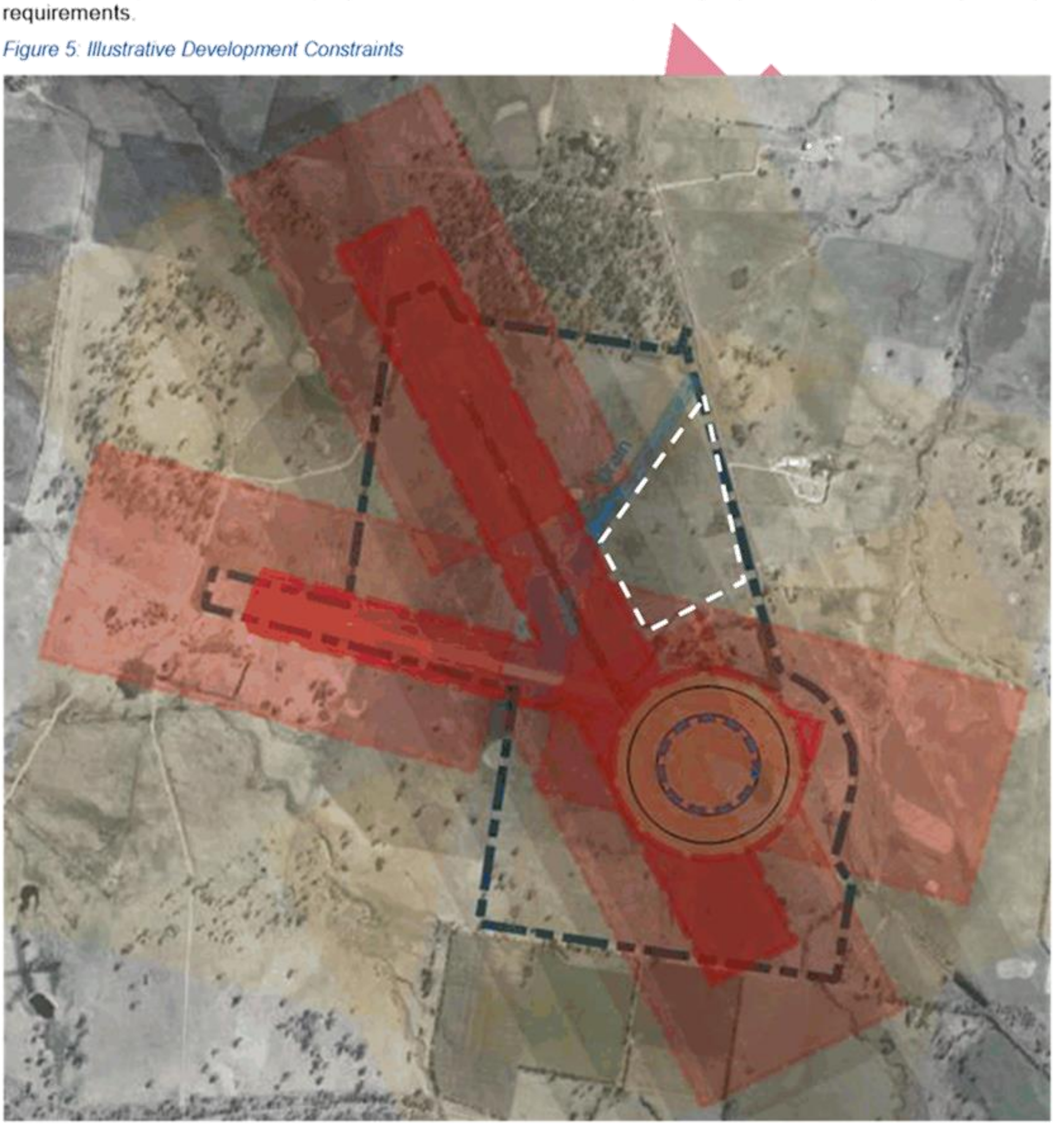
7. CONCEPT LAND USE PLAN

7.1 DEVELOPMENT CONSTRAINTS

Various constraints existing which limit the possible development and appropriate land uses on the Glen Innes Airport site. These include various airport safeguarding requirements (as described in detail in **Section 0**) and Bureau of Meteorology anemometer obstacle clearance limits. These constraints are indicated conceptually in **Figure 5**. This assessment identifies that the area immediately to the north of the existing facilities and south of the open drain (outlined in white dashed line) is the least constrained area on airport land. With proximity to existing services also, it makes sense for development to proceed first in this area. Future development could then progress to the north of the drain, having regard to the airport safeguarding requirements.

Figure 5: Illustrative Development Constraints



7.2 LAND USE PRECINCTS

The Glen Innes Airport Concept Land Use Plan provides a framework to accommodate a range of aviation and non-aviation growth and development opportunities in a phased and flexible manner. Precincts have been established for the following:

» Aviation Operations and Immediate Development

» Aviation Business Park

» Multi-Use (Airside/Landside) Zone

» Gateway and Events Zone

» Non-Aviation Activities

» Future Aviation and Non-Aviation Development.

The Concept Land Use plan is illustrated on **Figure B21641/01** at **Appendix B**. Anticipated uses and development for each are described in the following subsections.

7.2.1 AIRPORT OPERATIONS & IMMEDIATE DEVELOPMENT

Areas have been defined to preserve current and future aviation operations, and to enable immediate development opportunities close to existing hangar, taxiway and apron infrastructure and services. It is anticipated that this could facilitate the accommodation of an aircraft maintenance business, fuel facility and private hangarage in a layout consistent with future aviation and non-aviation development.

7.2.2 AVIATION BUSINESS PARK

To accommodate the range of aviation business opportunities presented by the Glen Innes Airport strategic vision and role, an area suitable for the construction of hangars with appropriately-sized lease lots for aviation uses is required.

The aviation business park – an area located on airport that is related to aviation business activity – diversifies the economy and generates activity at the airport. A consolidated area has been identified that can support and facilitate a range of aviation businesses such as aircraft maintenance and repair, agricultural support, private flight schools, charter operators and aircraft manufacture. This area can also incorporate fly-in hangar accommodation in premium lots facing the runway, which would be especially attractive to these types of customer.

7.2.3 MULTI-USE (AIRSIDE/LANDSIDE) ZONE

An area suitable for a variety of interchangeable uses has been defined to the north of the Runway 28 threshold and south of the Flight School D.A. Area. This area corresponds to the apron and taxiway extents defined in the Local Government Engineering Services (LGES) Glen Innes Aerodrome Upgrade design for Australia Asia Flight Training Pty Ltd (AAFT). In this way, infrastructure and uses in this area can respect the pre-existing design and will not prohibit the ability to revert to the AAFT concept should another commercial flight training opportunity arise in the future.

It is anticipated this zone could accommodate the following uses, with periodic transition of uses to suit demand through the year:

- Intensive aerial fire-fighting ground operations, similar to what occurred in the 2020 bushfire season;
- Flight-line activity associated with aviation events;
- Intermittent landside areas for spectator viewing of aviation events (through deployment of temporary fencing);
- Overflow itinerant aircraft parking for fly-ins and other private recreational flying events, or for overnight charter/corporate/private jet aircraft; and
- Other community support emergency services deployment such as disaster relief.

This zone is adjacent to the Gateway & Events Zone and some permeability/connectivity is envisaged between these areas during aviation events.

7.2.4 GATEWAY & EVENTS ZONE

Similarly to the Multi-Use (Airside/Landside) Zone, the Gateway & Events Zone is planned so as not to impinge on the opportunity to develop a flight school as previously envisaged, should that opportunity re-emerge, while at the same time not unduly preventing activation of the area in the absence of a flight school.

The current Flight School D.A. Area is a pleasantly landscaped area where it is envisaged a range of non-aviation events such as such as festivals, markets, concerts and potentially weddings and corporate events, could take place, through the use of temporary facilities. This area could also be used to provide greater amenity to aviation events, providing landside areas for hospitality, food and beverage, exhibitions and related entourage away from the airside movement area.

Also in this zone, in and around the existing terminal and aero club, the 'gateway' facilities such as meeting and waiting spaces, café/restaurant, visitor information, passenger terminal/transit and flight administration areas, and amenities. It is envisaged the aero club could be incorporated within the redevelopment of this area, or it could be relocated to another area, depending on what is appropriate to all parties.

Finally in this zone, an air ambulance patient transfer facility is provided, with access from Gordon Smith Drive and direct access to the apron, separate from the public areas for patient privacy.

7.2.5 NON-AVIATION ACTIVITIES

The area along the eastern boundary of the airport, adjacent to Emmaville Road, is not envisaged to be required for aviation uses in this Master Plan. The cost to provide taxiway access from the runway all the way to hangar sites at the eastern boundary would be significant and may inhibit the business case for development. Being further from the runway, this area is less constrained by height limits and other safeguarding requirements and so may lend itself to a wider variety of development options.

Some activities that might be accommodated in this area include car parking for events (in the southern portion, just north of the RFS shed), motor sports of an airport-compatible nature and other non-aviation opportunities.

7.2.6 FUTURE DEVELOPMENT

Areas are identified east of Runway 14/32 and to the north of the existing open drain for future development of aviation uses (closest to the runway) and non-aviation uses (closest to Emmaville Road). The exact delineation and layout would be subject to more detailed analysis and planning beyond this Master Plan. This land can continue on long-term lease to DPI indefinitely, until such time as demand for development requires.

An airpark estate, if it were to be further investigated in the future, might consider the area along the northern boundary of this future development zone, allowing it to be somewhat separated from commercial aircraft operations and to have a separate access from Emmaville Road.

Future development of the remaining areas of the airport site (the long-term DPI lease areas to the west of Runway 14/32 and southeast of the runway intersection, would be the subject of possible development beyond this Master Plan provided that access and services infrastructure can be resolved.

7.3 AIRSIDE INFRASTRUCTURE

Airside infrastructure consists of the runway system, taxiway network and apron areas. Although some existing aerodrome facilities are 'grandfathered' in accordance with the old MOS under the transition to new Part 139 MOS (2019) standards, all future airside infrastructure should be planned as far as is practicable to be in accordance with the new standards.

The airside infrastructure concept maintains, as far as possible, the LGES design for the AAFT concept, with the main difference that the parallel taxiway to Runway 14/32 (TWY L) north of the existing taxiway (TWY A) is separated 158 m from the runway centreline, rather than 93 m, in order to ensure compliance with the new standards.

8. CONCEPT FACILITIES DEVELOPMENT PLAN

The staged concept facilities development plan is presented below. All concept layouts are indicative in nature and, although they have been planned to enable compliance in accordance with the applicable aviation standards for aerodrome facilities, detailed planning and design in accordance with the CASA *Part 139 (Aerodromes) Manual of Standards 2019* and other applicable standards must be completed prior to implementation of any development.

8.1 STAGE 1 (IMMEDIATE) DEVELOPMENT

The following elements are recommended for implementation as soon as possible, to preserve the operational capability of the airport and establish the infrastructure and services necessary to attract more aviation activity over time:

- Rehabilitation of the existing runway, taxiway and apron pavement;
- Replacement and upgrade of the airfield lighting system with more efficient and less maintenance-intensive LED technology in accordance with the latest standards;
- Upgrade of the drainage network to improve operational outcomes due to inundation of the runway intersection;
- Provision of the taxiway connection between TWY A and Runway 14/32 may provide operational advantage for high-intensity fire-fighting operations and consultation with the RFS on this matter is recommended. Construction of this could be considered in conjunction with the drainage upgrade work, as it may be easier to undertake at the same time rather than at a later date;
- Establishment of an aviation refuelling facility; and
- Provision of hangar lots suitable for one or two larger commercial businesses and two to six smaller private sites.

To facilitate this development, a grass taxiway network and unsealed landside access road are proposed. A small amount of expansion of the main apron is also recommended, undertaken in conjunction with the pavement reconstruction, in order to allow aeromedical and other itinerant aircraft to park clear of the taxiway access to the fuel facility and hangar developments.

Stage 1 (Immediate) development is illustrated on **Figure B21641/02** at **Appendix A**.

8.2 STAGE 2 (MEDIUM TERM) DEVELOPMENT

Medium term development is more speculative than the Stage 1 (Immediate) and the timing and nature of individual developments will depend on a combination of demand, business case, operational need and the alignment of particular opportunities with the strategic objectives and vision for the Glen Innes Airport. The Stage 2 development concept is intended to map out the indicative development framework and broad concept into which detailed layouts can be established in response to specific triggers.

Some of the developments anticipated over the medium term (nominally five to fifteen years) in order to facilitate the vision are illustrated in **Figure B21641/03** at **Appendix B** and discussed below.

8.2.1 AVIATION BUSINESS PARK

As activity increases, there is potential for progressive development of the aviation business park precinct, working northwards from the Stage 1 facilities. This precinct would include incremental construction of sealed taxiways, an area for larger commercial hangars and a separate area for smaller commercial and private aircraft.

The development concept is illustrated indicatively on **Figure B21641/03** at **Appendix A**. It is anticipated development would commence once the area for immediate hangar development is full and a business or private tenant requires a site of a different size than is available.

Development of larger hangar sites is intended to be incremental east-to-west and south-to-north, so that access roads, services and all-weather taxiway access of a suitable strength can be progressively provided. It is important to note that, while the larger hangar lots have been sized to suit a typical aviation business development, detailed layouts in this area should be prepared closer to the commencement of the Aviation Business Park development to ensure the configuration of facilities is closely matched to the precise nature of the demand, as best can be identified at the time through discussions with potential lessees.

For the most space-efficient layout, smaller hangars should be grouped together in their own sub-precinct, which is positioned to the north of the park. These hangars can often be 'off-grid', with solar power and rainwater tanks incorporated, if required before it is economical to provide mains services. These could also be accessed initially by grass taxiway, until such time as there is an operational and economic basis for providing all-weather taxiway along the ultimate parallel taxiway alignment in Stage 3.

To facilitate the business park development, it is anticipated that an all-weather taxiway connection to the main taxiway and thence the runways would be required, and that sealing the taxiway loop access to the fuel facility would improve the amenity to users. The Code A grass taxilane developed in Stage 1 could also be upgraded to all-weather, if operationally and commercially justified.

Sealing an extension of the Stage 1 access road would also be appropriate in this Stage.

8.2.2 MAIN APRON EXPANSION

Expansion of the main apron to accommodate two KingAir 350 or similar aircraft, or one larger aeroplane, is envisaged within Stage 2, to allow charter operators greater access to the terminal area for transiting passengers, without limiting access for aeromedical aircraft.

8.2.3 PATIENT TRANSFER FACILITY

A patient transfer facility would provide additional amenity for aeromedical patients and could be provided in collaboration with the air ambulance aircraft operators.

8.2.4 EVENTS ARENA

Establishment of the Events Arena portion of the Gateway & Events Zone could be activated with minimal infrastructure development, as it is envisaged the use of this area will be conducted with temporary facilities on an event-by-event basis.

8.2.5 'GATEWAY' FACILITIES

The area in and around the current terminal and public toilets would be re-developed to incorporate integrated 'gateway' facilities including meeting and waiting spaces, café/restaurant, passenger transfer, amenities, aero club and administration/briefing areas. These could be in a single or several interrelated and sympathetically designed buildings.

8.2.6 MULTI-USE AIRSIDE/LANDSIDE ZONE

Sealed apron and taxiway development of part of the LGES flight school apron design would provide a multi-use hardstand area for aircraft operations, and taxiway connection to the main taxiway and Runway 28 threshold. It is anticipated that the remainder of the eastern portion of Runway 10/28, at least, would be sealed at this stage to assist in pavement surface maintenance under regular traffic.

8.2.7 NON-AVIATION ACTIVIES ZONE

Through the upgrade of the aviation business park access road, connectivity is provided to a zone north of the previous NDB location allowing this area to be used for activities that do not require direct access to the airside. Possible uses that might be appropriate in this area with appropriate safeguarding controls to avoid any impacts on aviation safety include car parking for events, non-aviation facilities, or a motor sports area for activities such as karting or motocross.

8.3 STAGE 3 (LONG TERM) DEVELOPMENT

Stage 3 (Long Term) represents the ultimate development envisaged by this Master Plan prior to encroaching into 'future' development areas. The key facilities and infrastructure anticipated under the Long Term development concept are illustrated on **Figure B21641/04** at **Appendix A** and include:

- Sealing of Runway 10/28 and completion of the parallel taxiway to the west of Runway 14/32 in accordance with the LGES upgrade design;
- Connection of the parallel taxiway from the Aviation Business Park to the runway for improved operational traffic flow and possible widening of the southern section of parallel taxiway to accommodate larger (group III) aircraft;
- Possible expansion of the main apron to accommodate additional and potentially larger (Group III) aircraft; and
- Expansion of the multi-use precinct apron to the full LGES flight school design extents, for potential increased use by community support and aviation events (unless and until re-purposed for a possible future flight training school use).

9. AIRPORT SAFEGUARDING PLAN

9.1 THE NEED FOR SAFEGUARDING

Adequate protection of the basic capability to undertake aircraft operations in accordance with accepted safety standards and regulatory requirements, and in efficient and economic manner, is imperative to the future realisation of aeronautical opportunities at Glen Innes Airport. Safeguarding is particularly important where the capability for future upgrades is to be preserved, for example to accommodate larger aircraft. Development on and around Glen Innes Airport will require adequate respect for safeguarding in order to develop the vision and objectives of the Master Plan and preserve possible future opportunities.

Airport safeguarding includes a number of elements that will be required throughout the planning and development processes. The various safeguarding elements will be triggered by different activities and aircraft operations.

9.2 NATIONAL AIRPORTS SAFEGUARDING FRAMEWORK

The National Airports Safeguarding Framework (NASF) is a national land use planning framework that aims to:

- Improve community amenity by minimising aircraft noise-sensitive developments near airports including the use of additional noise metrics and improved noise-disclosure mechanisms; and
- Improve safety outcomes by ensuring aviation safety requirements are recognised in land-use planning decisions through guidelines being adopted by jurisdictions on various safety-related issues.

The NASF was developed by the National Airports Safeguarding Advisory Group (NASAG), comprising of Commonwealth, State and Territory Government planning and transport officials, the Australian Government Department of Defence, the Civil Aviation Safety Authority (CASA), Airservices Australia and the Australian Local Government Association (ALGA).

NASF currently consists of a set of seven principles and nine guidelines. The full NASF principles and guidelines can be found on the Department of Infrastructure and Regional Development's website at: www.infrastructure.gov.au/aviation/environmental/airport_safeguarding/nasf .

The NASF principles are as follows, and each guideline is described in the following subsections.

- **Principle 1:** The safety, efficiency and operational integrity of airports should be protected by all governments, recognising their economic, defence and social significance
- **Principle 2:** Airports, governments and local communities should share responsibility to ensure that airport planning is integrated with local and regional planning
- **Principle 3:** Governments at all levels should align land use planning and building requirements in the vicinity of airports
- **Principle 4:** Land use planning processes should balance and protect both airport/aviation operations and community safety and amenity expectations
- **Principle 5:** Governments will protect operational airspace around airports in the interests of both aviation and community safety
- **Principle 6:** Strategic and statutory planning frameworks should address aircraft noise by applying a comprehensive suite of noise measures
- **Principle 7:** Airports should work with governments to provide comprehensive and understandable information to local communities on their operations concerning noise impacts and airspace requirements.

9.2.1 GUIDELINE A

Measures for Managing Impacts of Aircraft Noise

NASF Guideline A can be used in the assessment of new development applications for noise sensitive uses.

While the Australian Noise Exposure Forecast (ANEF) system is recognised by a number of jurisdictions in land use planning decisions, the 20 and 25 ANEF zones do not capture all high noise affected areas around an airport. In addition, Australian Standard AS2021-2015 recognises that the ANEF contours are not necessarily an indicator of the full spread of noise impacts, particularly for residents newly exposed to aircraft noise.

Guideline A is the Government's recognition of the need to consider a complementary suite of noise measures in conjunction with the ANEF system to better inform strategic planning and to provide more comprehensive and understandable information on aircraft noise for communities.

The guideline notes that an ANEF may not be available at all general aviation airports or airports with low frequencies of scheduled flights, but that whether or not an ANEF is prepared, land use planning should take account of flight paths and the nature of activity on airports.

No noise contours are provided as a part of this Master Plan however, prior to any rezoning of surrounding land, Guideline A should be taken into account. Guideline A suggest minimum 'zone of influence' of five (5) kilometres around an aerodrome for the purposes of considering aircraft noise with respect to land use planning.

Figure B16241/05 at **Appendix A** illustrates a distance of five kilometres from each of the ultimate runway ends at Glen Innes Airport.

9.2.2 GUIDELINE B

Managing the Risk of Building Generated Windshear and Turbulence at Airports

The purpose of this guideline is to assist land use planners and airport operators in their planning and development processes to reduce the risk of building generated windshear and turbulence at airports near runways.

Applicability of this Guideline is initially determined by the location of the building within an 'assessment trigger area' around the runway ends, that is:

- 1200 metres or closer perpendicular from the runway centreline (or extended runway centreline);
- 900 metres or closer in front of runway threshold (towards the landside of the airport); and
- 500 metres or closer from the runway threshold along the runway.

The guideline recommends that all developments within the assessment trigger areas which will infringe a 1:35 sloping surface from the runway centreline should be subject to further assessment.

Positioning of all developments on airport will need to be evaluated on a case-by-case basis. Subject to confirmation through such evaluation that no adverse impact on aircraft operations is predicted, then buildings may be located closer to the runways and within the 1:35 surface.

Figure B16241/06 at **Appendix A** illustrates the assessment trigger areas. Proposed developments in these areas should initially be assessed against the relevant 1:35 surface as described in Guideline B. Buildings that are proposed to infringe this surface may require further assessment in accordance with Guideline B to confirm that no adverse impact on aircraft operations is predicted.

9.2.3 GUIDELINE C

Managing the Risk of Wildlife Strikes in the Vicinity of Airports

The purpose of Guideline C is to inform the land use planning decisions and the way in which existing land use is managed in the vicinity of airports with respect to the attraction of wildlife, particularly birds. A table is included in Attachment 1 which indicates wildlife attraction risk and associated actions for developments within buffer zones around airports of 3, 8 and 13 kilometres radius.

GISC should consider Guideline C in its planning decisions with respect to land uses and developments within 13 kilometres of the Airport. Refer **Figure B16241/07** at **Appendix A**.

9.2.4 GUIDELINE D

Managing the Risk to Aviation Safety of Wind Turbine Installations

This guideline provides general information and advice in relation to wind farms and turbines and their hazards to aviation. Proponents of such installations should take account of Guideline D in undertaking assessments of the impacts of the proposals, including on aviation.

GISC should be aware of Guideline D and it may assist in evaluating and commenting on any wind farm proposals.

9.2.5 GUIDELINE E

Managing the Risk of Distraction to Pilots from Lighting in the Vicinity of Airports

The control of light emissions near the airport is of importance to safe aircraft operations for two reasons. Firstly, if lights emit too much light above the horizontal plane, there is the possibility that a pilot can be momentarily dazzled and unable to read instruments or recognise essential cues from aeronautical lights. Secondly, lights might create a pattern that looks similar runway lighting and which may cause confusion for pilots.

NASF Guideline E provides guidance on the risk of distractions to pilots of aircraft from lighting and light fixtures near airports. The CASA *Manual of Standards part 139 Aerodromes* Section 9.21: *Lighting in the Vicinity of Aerodromes* sets out the restrictions and provides advice to lighting suppliers on the general requirements, information and correspondence avenues.

Advice for the guidance of designers and installation contractors is provided for situations where lights are to be installed within a 6 kilometre radius of the airport. Lights within this area fall into a category most likely to be subject to the provisions of regulation 94 of CAR 1988.

The primary area is divided into four light control zones; A, B, C and D. These zones reflect the degree of interference ground lights are permitted to cause pilots as they approach. Lighting associated with any developments should therefore meet the maximum intensity of light sources measured at 3 degrees above the horizontal associated with each Zone as follows:

- Zone A – 0 cd;
- Zone B – 50 cd;
- Zone C – 150 cd; and
- Zone D – 450 cd.

GISC should consider Guideline E in relation to any proposed lighting installations on airport, as well as off-airport (for example, associated with sports fields, industrial facilities and similar) within 6 kilometres of the Airport. Refer **Figure B16241/08** at **Appendix A**.

9.2.6 GUIDELINE F

Managing the Risk of Intrusions into the Protected Airspace of Airports

Guideline F is designed to address the issue of intrusions into the operational airspace of airports by tall structures, such as buildings and cranes in the vicinity of airports.

The safety, efficiency and regularity of aircraft operations require airspace to be largely free of obstacles which may make it unsuitable for the conduct of visual and instrument flights.

The OLS for an airport describe the airspace boundaries for flight in proximity to an airport which should be kept free of obstacles that may endanger aircraft operations in visual operations or during the visual stages of an instrument flight. The OLS components are defined in the International Civil Aviation Organization (ICAO) Annex 14 and in Chapter 7 of the CASA Part 139 (Aerodromes) Manual of Standards 2019.

At Glen Innes Airport the Obstacle Limitation Surfaces (OLS) are currently prepared based on the existing published runway lengths of 1,200 m for Runway 10/28 (as a Code 2 non-instrument runway grandfathered in accordance with CASA MOS Part 139 v.1.15 and 1,498 m for Runway 14/32 (as a Code 3 instrument non-precision runway grandfathered in accordance with CASA MOS Part 139 v1.15). See also **Section 6.2** for further discussion on the compliance and category of runway regarding the transitional arrangements from CASA MOS Part 139 v1.15 to the Part 139 MOS (2019) OLS standards.

Aerosafe Inspections Aerodrome Safety Inspection report 2017 recommended that GISC should be encouraged to prepare future OLS plans based on both runways being Code 3 instrument non-precision at their optimum length of 2,150 m for Runway 14/32 and 1,676 m for Runway 10/28. However the same report also notes that a return to the previous Code 3 status is unlikely for Runway 10/28 in the short-medium term as it would result in building and vegetation transitional surface penetrations and land acquisition at the 10 end. As a result of the transition to the Part 139 MOS (2019) any upgrade to the runway code would require the OLS to meet the new standards for Code 3 non-precision approach, with a slope of 2% and an inner edge/runway strip width of 280 m. This would not be possible within the current airport land boundary to the west of Runway 14/32 and would sterilise the area identified for the airside/landside multi-use precinct.

GISC may wish to consider the protection of approach and take-off climb surfaces applicable to an increase in the length of Runway 14/32 as illustrated on **Figure B16241/09** at **Appendix A**.

Subject to aeronautical assessment, an obstacle may be permitted to penetrate the OLS without placing restrictions on the allowable operations, but will normally require it to be marked and/or lit to make it conspicuous to pilots. CASA may also impose operational limitations on aerodrome users in the presence of obstacles. To avoid any undesirable limitations on operations, it is recommended to ensure that obstacles are not permitted to penetrate the approach or departure areas.

The Guideline also addresses activities that could cause air turbulence that could affect the normal flight of aircraft operating in the prescribed airspace and/or emissions of steam, other gas, smoke, dust or other particulate matter that could affect the prescribed airspace in accordance with Visual Flight Rules (VFR).

Glen Innes Airport has published instrument approaches to Runway 14 and Runway 32. GISC should work with Airservices Australia to ensure the information needed for monitoring obstacles within the associated instrument approach procedure protection areas is available, to allow it to fulfil its obligations under the relevant regulations.

9.2.7 GUIDELINE G

Protecting Aviation Facilities – Communication, Navigation and Surveillance (CNS)

The purpose of Guideline G is to provide a consistent approach to land use planning protection of CNS facilities. Guideline G assists land use planning decision makers with guidance for assessing development proposals in Building Restricted Areas (BRA). Attachment 3 to the Guideline provides the BRAs for aviation facilities.

Since the NDB has been decommissioned and subsequently removed, Glen Innes Airport does not have any of the aviation facilities which are the subject of Guideline G.

9.2.8 GUIDELINE H

Protecting Strategically Important Helicopter Landing Sites (HLS)

Guideline H provides guidance on the ongoing operations, protection of flight paths and areas for off-airport HLS. As such it is not applicable to on-airport facilities. However, any on-airport helicopter facilities should be planned and designed in accordance with the guidance set out in CAAP 92-2(2) *Guidelines for the establishment of on-shore helicopter landing sites*.

9.2.9 GUIDELINE I

Managing the Risk in Public Safety Areas at the Ends of Runways

Guideline I provides guidance on approaches for the application of a Public Safety Area (PSA) planning framework in Australian jurisdictions. The Guideline is intended to ensure there is no increase in risk from new development and to assist land-use planners to better consider public safety when assessing development proposals, rezoning requests and when developing strategic land use plans.

A PSA is a designated area of land at the end of an airport runway within which development may be restricted in order to control the number of people on the ground around runway ends. The size and shape of a PSA typically depend on the statistical chance of an accident occurring at a particular location. The risk is related to the number and type of aircraft movements and the distance from the critical take-off and landing points. PSAs are based on the landing threshold for each end of the runway and in most cases become narrower with increasing distance before the threshold.

Guideline I provides two examples of most relevance to Australia (the UK and Queensland approaches) to developing PSA extents:

- The UK model is the most formalised approach to defining a PSA and has been applied at a number of international and Australian airports; and
- The Queensland model is a modified version of the policy and research conducted in the UK.

The Queensland model may be more appropriate at a regional airport such as Glen Innes. Under the Queensland model, an airport's main runway requires a PSA if the runway meets the following criteria:

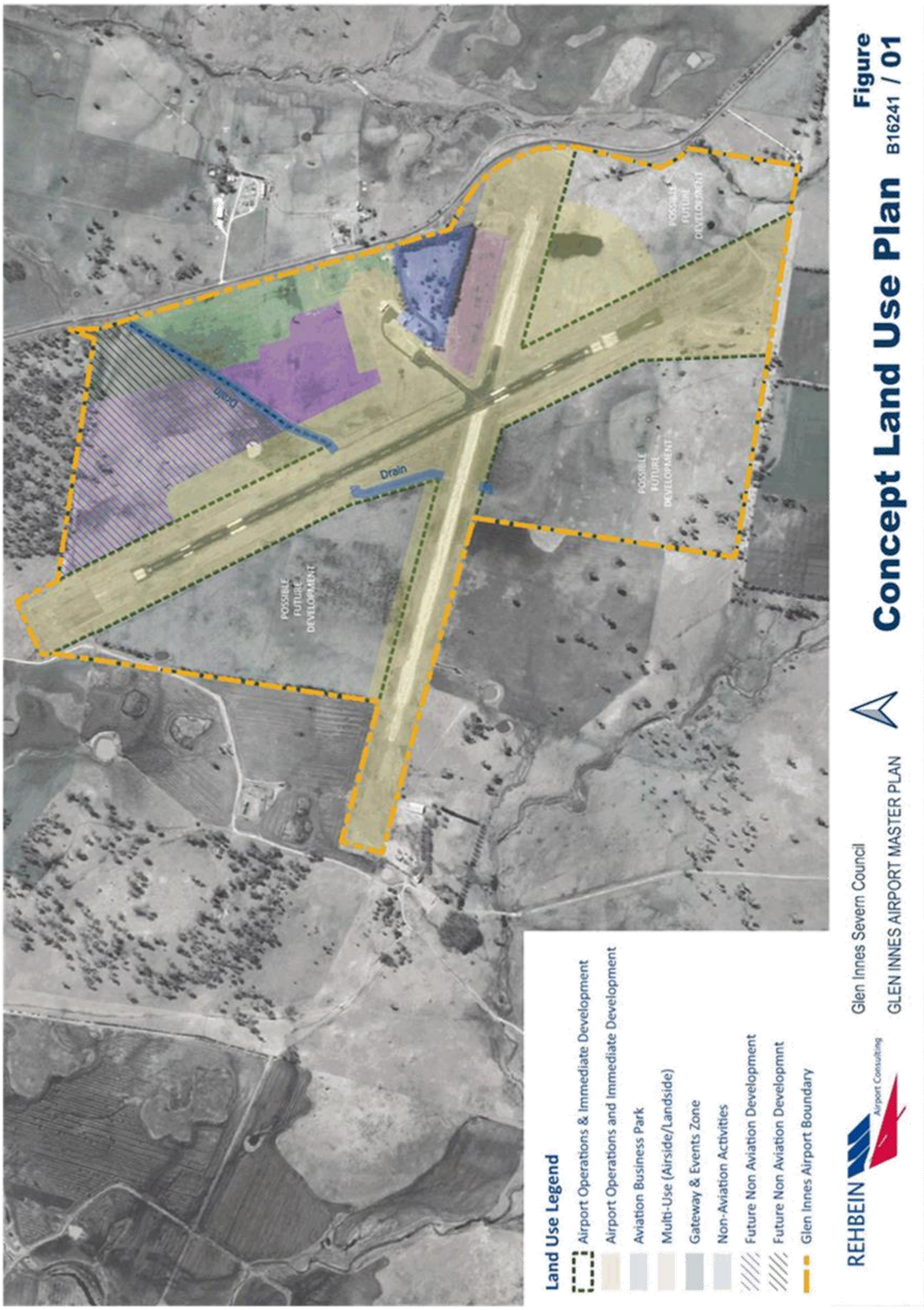
- RPT jet aircraft services are provided, or

- Greater than 10 000 aircraft movements occur per year (excluding light aircraft movements).

As neither of these criteria are likely to be exceeded at Glen Innes, the requirement for Public Safety Areas is not triggered under this Master Plan. Nevertheless, Council should be cognisant that the areas around the ends of runways (generally within 1 kilometre of the runway end and within 150 metres of the centreline) are subject to greater risk from aircraft accidents than other areas. Development within these areas should be sensitive to this situation. NASF Guideline I provides more information.

APPENDIX A: AIRPORT MASTER PLAN FIGURES

REHBEIN Airport Consulting



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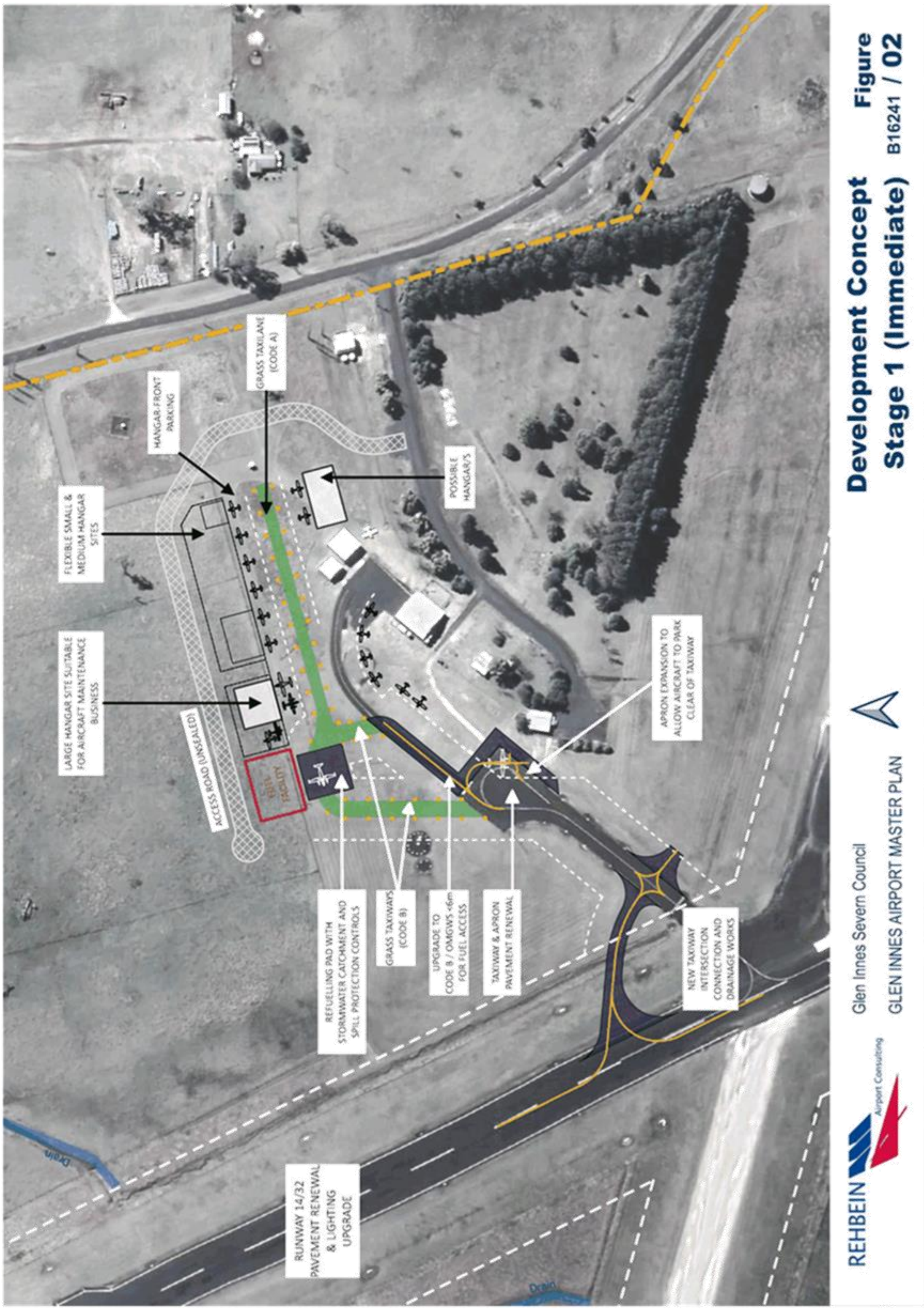

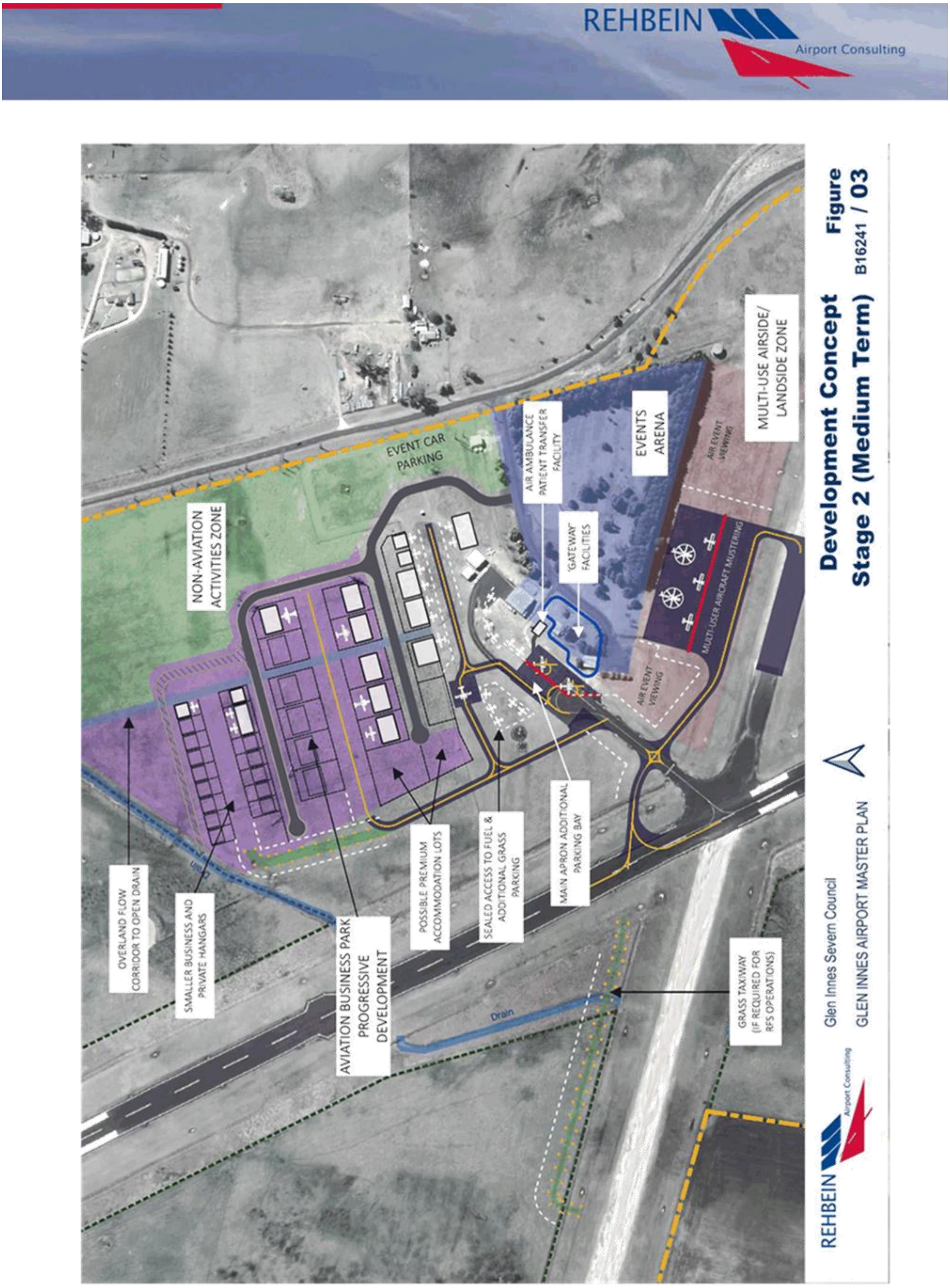

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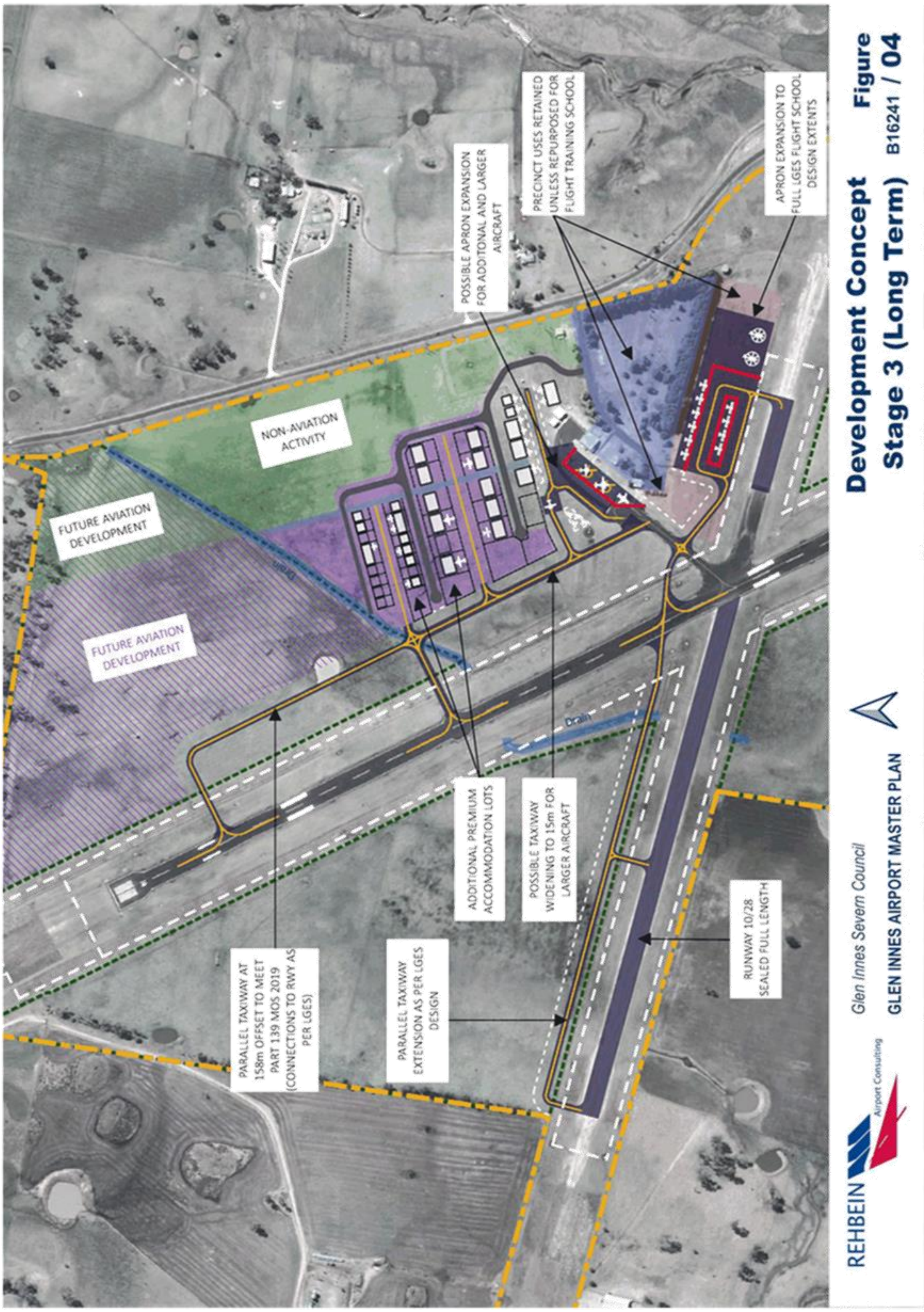

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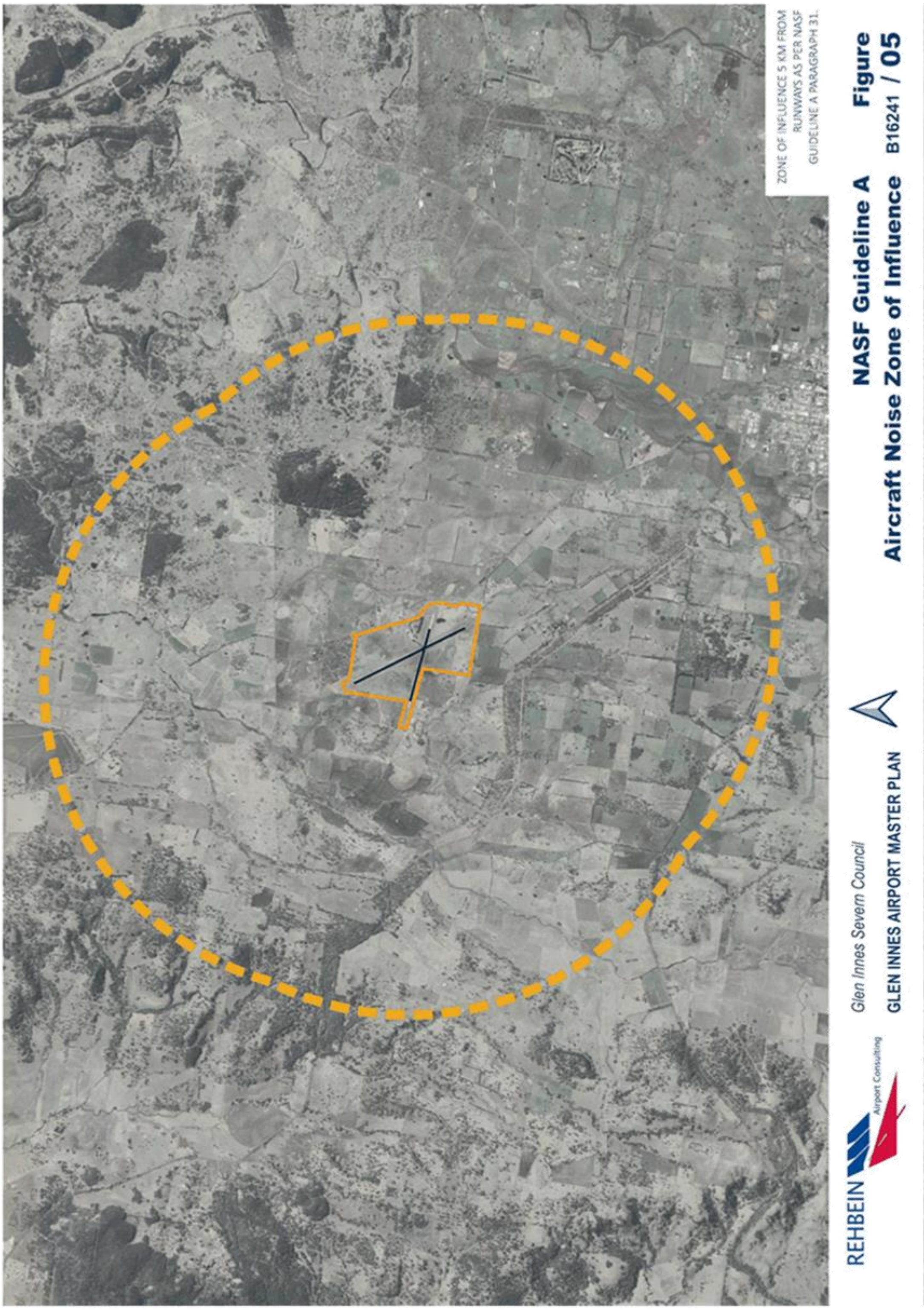

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Annexure A

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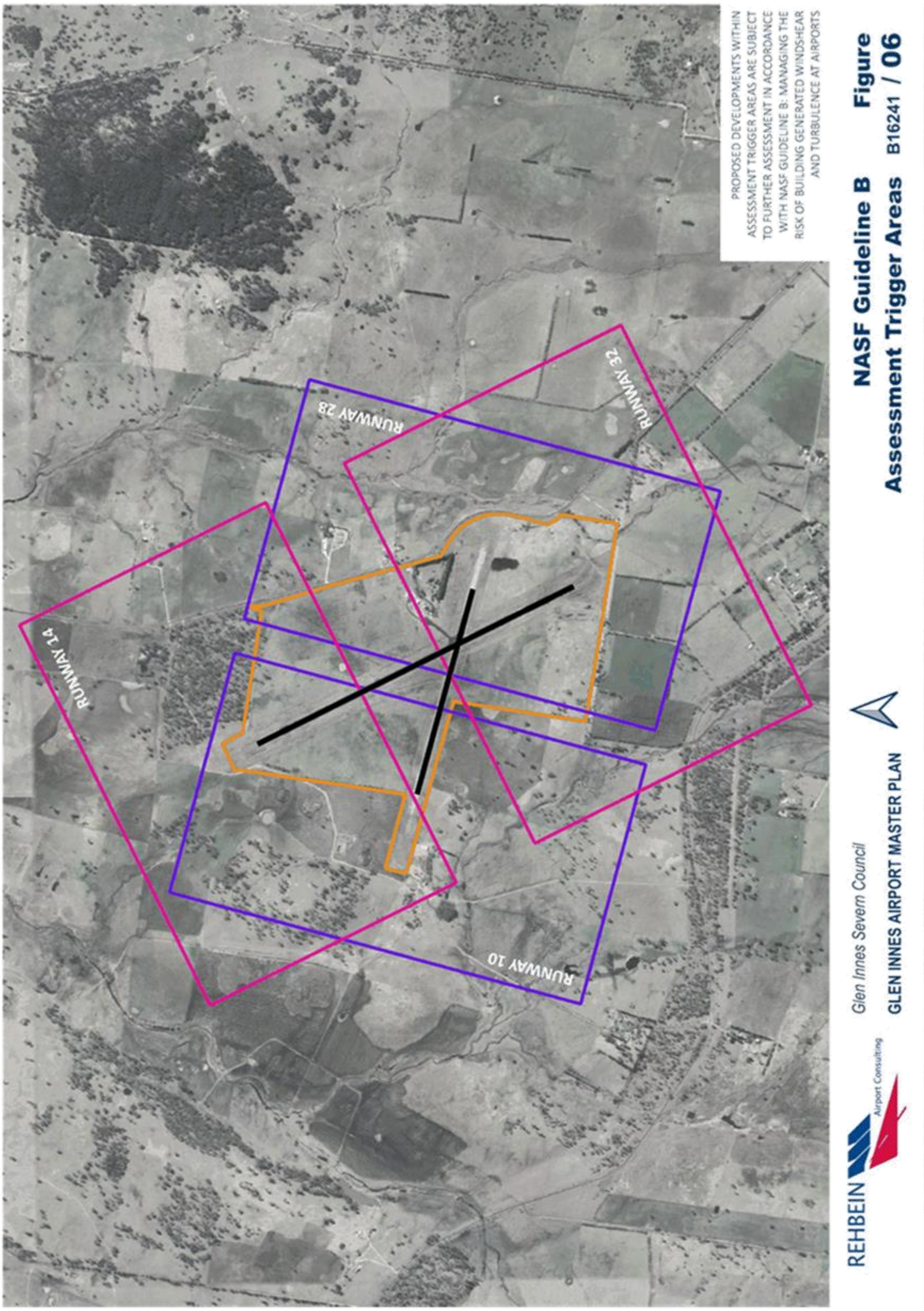

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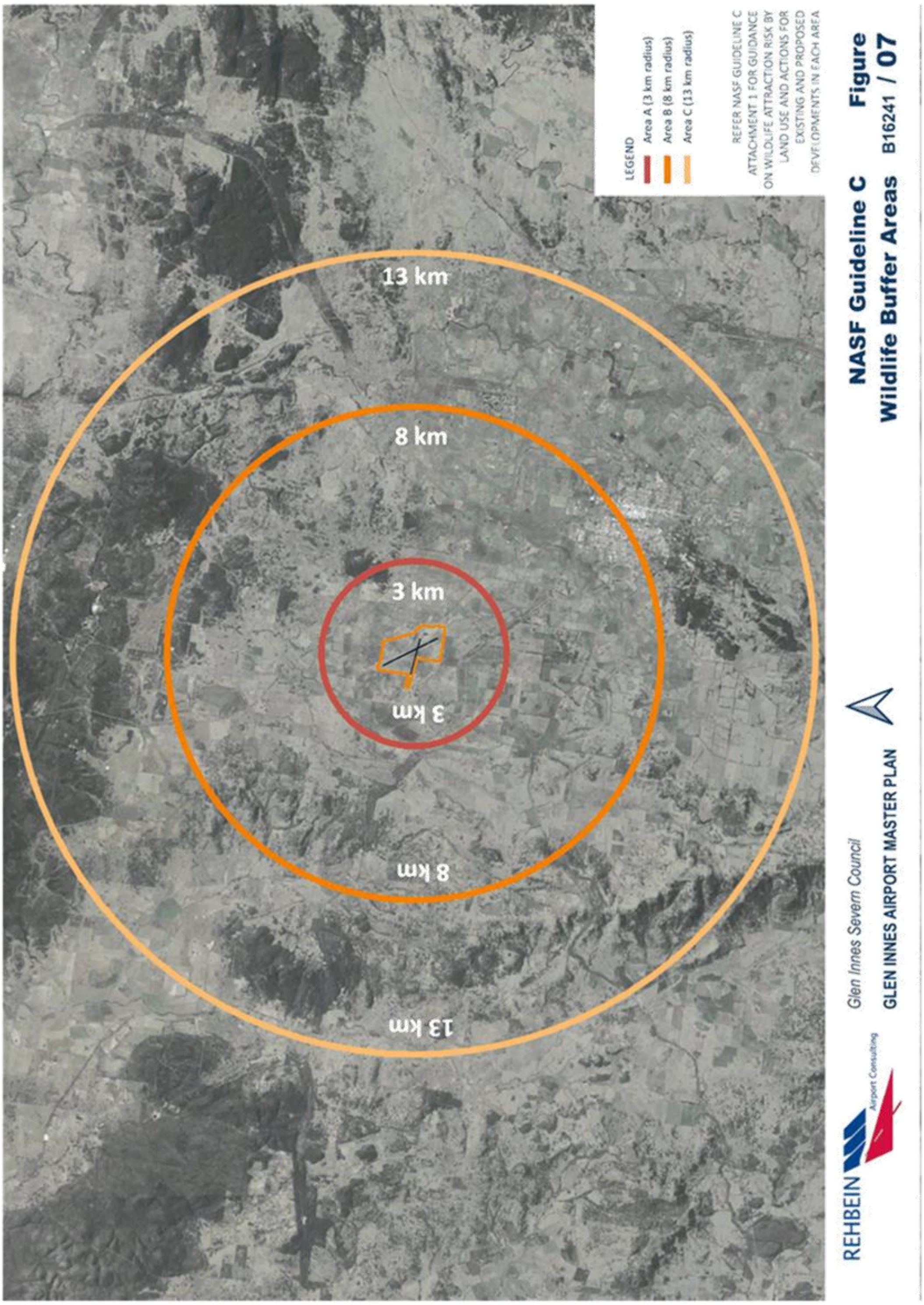

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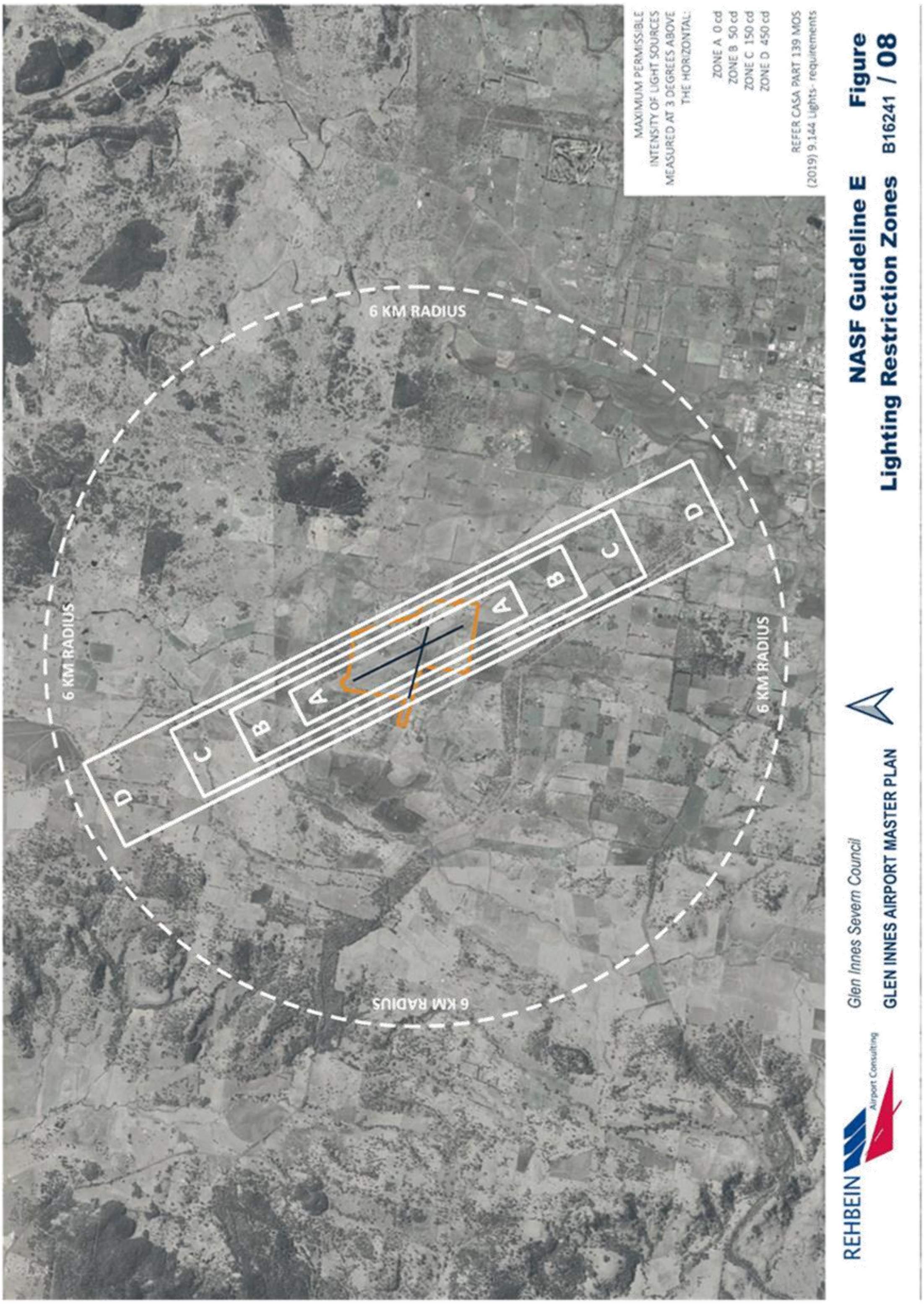

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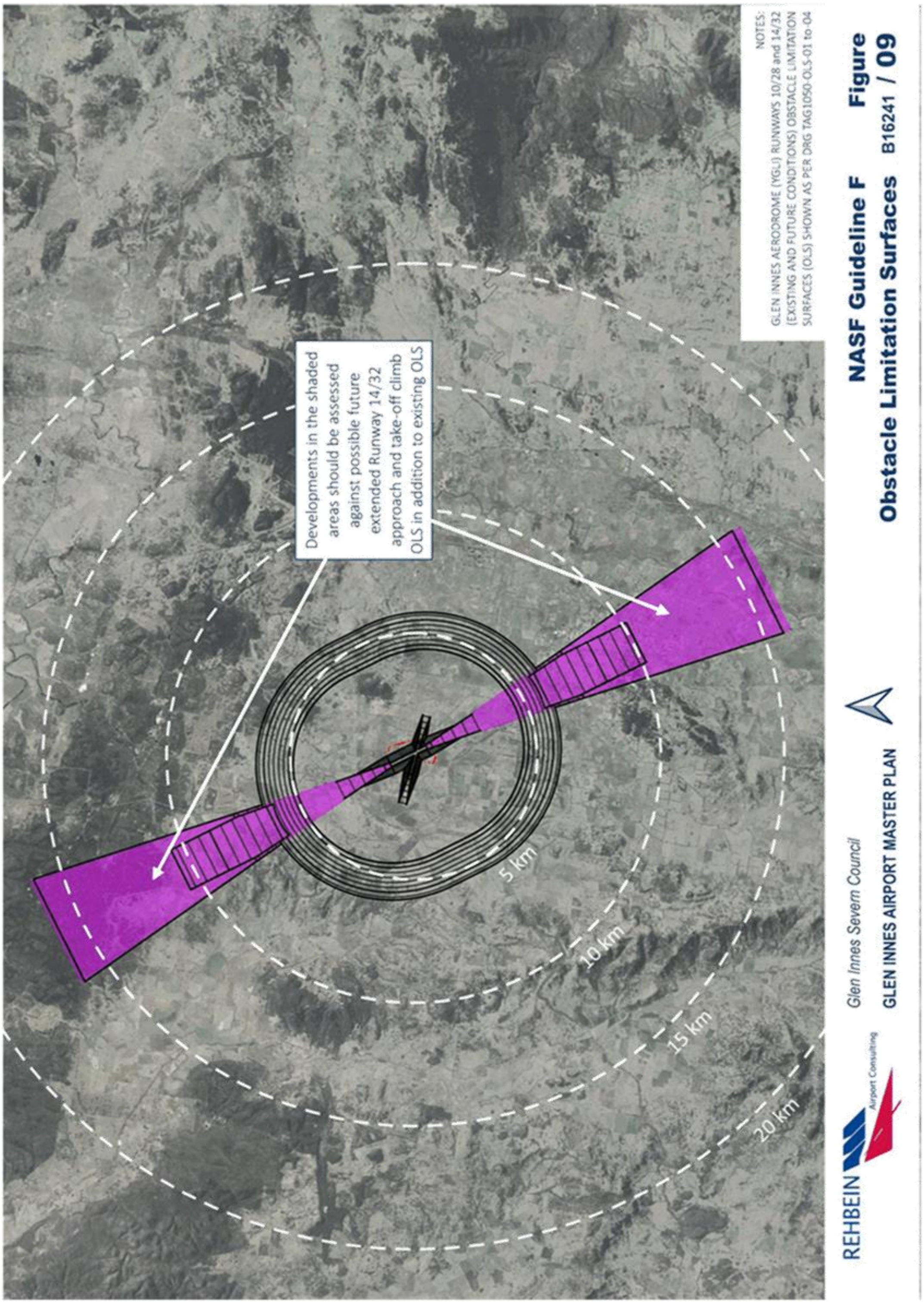

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APPENDIX B: PAVEMENT ASSESSMENT

See separate cover: Annexure B to Draft Airport Master Plan dated 6 Sep 22.

Glen Innes Airport – Structural Pavement Assessment

March 10, 2022
Version 1c

Notes relating to this report

TITLE: Glen Innes Airport – Structural Pavement Assessment

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KEYWORDS: pavement, runway, pavement classification number (PCN), pavement classification rating (PCR), rehabilitation
STATUS: open
COMPILER: Kamen Engineering Pty Ltd is a pavement and material technology consultancy undertaking pavement investigation, forensic failure investigations and pavement construction and design works.

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Ivan Mihaljevic is a registered professional Geotechnical Engineer and has worked in the civil and pavement construction sector for the past 20 years. He heads Kamen Engineering which undertakes design, failure investigation, project management and consulting in pavement and geotechnical engineering. He has previously worked for CSIRO and within the private pavement construction sector focusing on concrete, asphalt and bituminous materials. He has been involved in pavement engineering works for the past 20 years in Australia, Asia and the Middle East.

This report has been prepared by Kamen Engineering Pty Ltd and submitted to The Client. The results and analysis contained in this report are based on a number of technical, circumstantial or otherwise specified assumptions and parameters. The user must make its own assessment of the suitability for the use of the information or material contained within or generated from the report. Kamen Engineering Pty Ltd and Ivan Mihaljevic excludes all liability to any party for expenses, losses, damages and costs arising directly or indirectly from using this report.

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This report may contain technical or complex issues presented at a level that requires the reader to have appropriate qualifications in engineering, science, mathematics, technology and/or business to be able to understand and integrate the issues. Readers without qualifications or experience in these fields should refer the report to qualified and experienced personnel to translate and present it in conjunction with any additional material for understanding.

The Report
This has been prepared for the stated purpose by suitably qualified and experience personnel. It is based on the information obtained, conditions at the time or writing the report, and on current standards of interpretation and analysis. The report has been prepared for a specific case. The report may not be relevant if the project proposal is changed. Under changed conditions Kamen Engineering Pty Ltd should be consulted for further investigation and reporting or review of the report, for sufficiency and validity.

Every care is taken with the report as it is related to interpretation of conditions, forecasts and market analysis, discussion of factors, and recommendations or suggestions for development and implementation. However, Kamen Engineering Pty Ltd cannot always anticipate or assume responsibility for unexpected variations in environment, usage, government, legal, business, market or other conditions, given the fact that all reports are based on limited information, and they represent the snapshot in time which is at the time of preparation. The report is not an audit report, and is not a guarantee of success. The conclusions and recommendations of the report are likely to be affected by subsequent actions and developments.

The report should be considered as a starting point and the conditions predicted, issues raised and recommendations made, should be continuously reviewed during the implementation phase.

Reproduction of Information
For all aspects, in situations where the Client wishes to provide only part of the report, it is requested the Kamen Engineering Pty Ltd be informed. Kamen Engineering Pty Ltd would be pleased to advise the Client on the implications and if necessary prepare an edited report. Copying of this report can only be done in full and not in part.

Document Issue Record

Version	Author/ Verified	Description of Amendments	Date Issued
1	IM	Version 1 – preliminary draft	09 March 2022
1a	IM	Internal review	10 March 2022
1b	IM	Client review - amended elected details and corrected typos	21 July 2022

1 Executive Summary

Rehbein Airport Consulting requested Kamen Engineering Pty Ltd to undertake structural assessment of pavement elements at Glen Innes Airport.

PCN/PCR Review

The methodology outlined by Australia's Civil Aviation Safety Authority (CASA) and the Federal Aviation Authority (FAA - USA) has been used for PCN/PCR review. King Air B200 and B350 aircraft at current predicted traffic volumes with the addition of a 21-ton jet aircraft was used to review the PCN/PCR designation. The RWY1432 designation is summarised in the table below which may also be adopted for taxiway and apron pavements.

Designation	Recommended	Current
PCN	11/F/D/700 kPa (102PSI)/T Central Section	10/F/C/580 (84PSI) /T Central Section
PCR	109/F/D/700 kPa (102PSI)/T Central Section	-

The revised PCN number is similar in magnitude to the current number. A change in subgrade classification from category "C" to "D" is however recommended.

Functional Pavement Condition

It is confirmed that the runway, taxiway and apron pavements are of a suitable functional condition for current aircraft traffic frequency and weight, provided that current monitoring and maintenance treatment frequency is maintained.

Pavement Assessment and Pavement Rehabilitation Options

Pavement base course layers consist of local dolerite, shale and/or granite granular materials which appear in the majority of bore hole excavation sites to be of adequate quality and durability. High clay content and finer than normal combined aggregate grading characteristics within some bore hole locations however do not meet quality standards which are typically apply to aircraft pavement construction materials. These variations make these materials more susceptible to distress when in saturated conditions. Moisture conditions throughout the pavement profile were found to be elevated. Moisture also was found to accumulated immediately beneath the bituminous surfacing seal, promoting delamination of the bituminous surface to underlying cemented and unbound granular base layer materials.

It is recommended that moisture be controlled by drainage improvements including at the sub-soil level.

Natural subgrade clays are soft, weak and organic in nature. Low strength subgrade conditions have been adopted for this structural assessment.

Preliminary pavement improvement treatments have been provided and are designed in accordance with FAA models and guidelines. Pavement improvement strategies including the addition of lime to neutralise active clays, and the use of in-situ foam bitumen stabilisation processes are proposed. This approach aims to improve and reuse existing materials, reducing cost, and negating the need to import new resources. Verification of engineering material characteristics by laboratory scale testing, is required prior to final design, and therefore the designs contained herein are of a preliminary nature. Alternative design options may also be considered in consultation and on request.

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2 Introduction

Rehbein Airport Consulting commissioned Kamen Engineering Pty Ltd to undertake structural assessment of runway, taxiway and apron pavement elements within Glen Innes Airport. The scope of this review includes:

a. confirmation and update of the pavement classification number (PCN) and the provision of an equivalent pavement classification rating (PCR) number;
b. a structural and functional condition assessment of pavement elements; and
c. provision of preliminary pavement improvement and/or rehabilitation measures to support proposed future aircraft use.

This review is based on the following information:

a. current and future predicted aircraft traffic volumes;
b. pavement investigations completed 14 February 2022 by Kamen Engineering Pty Ltd;
c. geotechnical study completed 21 February 2014 by Regional Geotechnical Solutions; and
d. falling weight deflectometer testing and assessment completed by Kamen Engineering Pty Ltd – 13 February 2022.

2.1 References

a. Advisory Circular AC139.C-07 v1.0 – Strength Rating of Aerodrome Pavements – CASA February 2021
b. Advisory Circular AC139.25 (0) – Strength Rating of Aerodrome Pavements – CASA August 2011
c. Advisory Circular AC150/5335-5D Standardized Method of Reporting Airport Pavement Strength – PCR – US Department of Transportation, Federal Aviation Administration – Draft
d. Advisory Circular AC 150/5335-5C - Standardized Method of Reporting Airport Pavement Strength – PCN – US Department of Transportation, Federal Aviation Administration – August 14, 2014

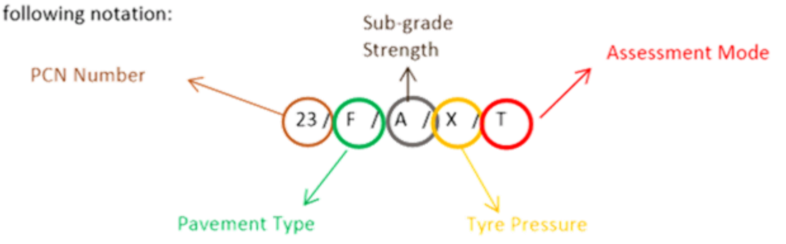
2.2 Abbreviations

a. PCN – Pavement Classification Number
b. PCR – Pavement Classification Rating – this system of rating pavements is replacing the current PCN system
c. CoV – Coefficient of Variation
d. CBR - California Bearing Ratio – used to classify strength of natural subgrade materials
e. MTOW – Maximum take-off weight for aircraft
f. DCP - Dynamic Cone Penetrometer – apparatus used to measure in-situ CBR strength of subgrade and pavement materials

3 Pavement Classification Number (PCN)

The PCN system classifies pavement strength in terms of aircraft weight, wheel load, and tyre pressure characteristics. The PCN aims to simplify what is generally a complex interaction between aircraft and pavement. PCN is used by airport authorities to assign a strength rating which can be used to determine which aircraft can use the pavement structure.

PCN has the following notation:



The five components of PCN are described as follows:

i. **PCN – a number which is determined by the weight and frequency of travel of a critical aircraft for a designated period.** This number is influenced by the pavement profile and also the strength of the in-situ sub-grade material. Pavement materials are defined into pre-determined categories and engineering characteristics for the purpose of PCN determination. The PCN is determined based on the analysis of this information and the predicted damage that the proposed traffic will have on the pavement. ACN (Aircraft Classification Number) is an associated number categorizing individual aircraft types. If the ACN is higher than the PCN for the same subgrade conditions, then the aircraft is too heavy to operate on the pavement and will require a concession to do so.

ii. "F" or "R" signifies flexible or rigid pavement structures respectively.

iii. Subgrade – Categories A, B, C or D describe different subgrade materials in relation to in-situ bearing capacity. Table 1 lists these categories.

iv. The maximum allowable tyre pressure is denoted using alphanumeric notation. Numerical numbers are quoted in units of pressure, either kPa (metric) or psi (imperial). Table 2 lists the tyre pressure categories. Generally, concrete pavements attract a tyre category rating of "W", where the tyre pressure is unlimited; however bituminous surfaced pavements can be susceptible to surface deformation if the surface is of poor quality, thin or built on a poorly constructed granular base layer. Typically, maximum tyre pressure limits for flexible pavements are quoted in the PCN designation.

Subgrade Strength Category	Flexible Pavements Subgrade CBR Value (%)	Flexible Pavement Standard CBR (%)	Code
High	> 13	15	A
Medium	8 to 13	10	B
Low	4 to 8	6	C
Ultra-Low	< 4	3	D

Table 1- Subgrade Strength Categories

Tyre Category	Code	Tyre Pressure Maximum Limits
High	W	No Pressure Limit
Medium	X	1500 kPa
Low	Y_1	1000 kPa
Low	Y_2	800 kPa
Very Low	Z	500 kPa

Table 2- Tyre Categories

v. The final symbol of the PCN number is either a U or T. This notation refers to the method of PCN determination either by aircraft usage (U) or by using technical (T) evaluation techniques. PCN determination by usage is an assessment of the aircraft mix using the aerodrome without major pavement distress or failure. This assessment is usually undertaken when the pavement structure is unknown. There is no technical basis for this determination; however some knowledge of the subgrade strength is required to appropriately designate the subgrade category. A technical study of the pavements engineering characteristics together with an evaluation of aircraft load and frequency is required to determine the PCN using the technical classification method.

3.1 FAA and Australian Methods

Procedures listed in AC 139-25(0)[1] and AC 150/5335-5C[2] have been used as a guide for the assessment of the PCN. The assessment procedure is summarized as follows:

i. determine the traffic volume in terms of aircraft type and number of annual departures/traffic cycles of each aircraft over the declared life of the pavement or until such time a maintenance treatment has taken place;
ii. determine pavement characteristics, including layer thickness, pavement layer engineering characteristics and subgrade CBR capacity/strength;
iii. determine the critical aircraft. This is the aircraft that demands the thickest pavement structure or the aircraft most frequently used within the pavement segment. Some judgment is required to select the right aircraft;
iv. convert traffic volumes to equivalent coverages of the critical aircraft;
v. determine the maximum gross weight of the critical aircraft for the pavement structure; and
vi. use the maximum gross weight of the critical aircraft to determine the aircrafts ACN and use this as the PCN.

The above procedure is simplified using COMFAA3 which completes all steps using computational techniques. The COMFAA3 methodology is outlined in FAA AC 150/5335-5C. This method is highly dependent on pavement material engineering parameters and pavement layer profile therefore derivation of these characteristics is fundamental in achieving accurate PCN ratings. The standard also recommends pavement segmentation into sub-lots if the subgrade CBR or pavement profile varies.

4 Aircraft Traffic

Table 3 lists the design aircraft used to assess PCN of RWY1432. Aircraft trafficking data collected by the AvData system, showed that in the 12 months to February 2021, over 90% of BE20 aircraft arrivals weighed 5.7 ton and the remainder weighed 6.1 ton. Further, all BE35 aircraft arrivals registered no less than 6.8ton in mass. A heavier 22ton Challenger aircraft has been added to the list to maximise the PCN. Lighter aircraft do not influence cumulative pavement damage to any significant effect and therefore the PCN assessment will be low.

The number of times the aircraft travels on the pavement during each visit must be considered for traffic loading evaluation. The FAA procedure ignores arriving aircraft which have an expended fuel load as the cumulative damage to the pavement structure is negligible compared to fully fuelled and fully loaded aircraft. For the Glen Innes airport assessment, AvData confirms similar landing and take-off weights and therefore each aircraft makes at least 2 passes on the runway being one taxing/backtracking movement and the other landing or take-off. The pass to coverage ratio is therefore set at 2. MTOW shall be used for assessment for all aircraft based on the AvData aircraft weights.

Item	Aircraft Type	Weight (t) (MOTW)	Tyre Pressure (kPa)	Annual Departures	ACN (subgrade "D")
1	BE20 – Beechcraft Super King Air 200	5.71	676	52 (x2)	3.7
2	BE35 – Beechcraft Super King Air 350	6.85	364	52 (x2)	4.6
3	Challenger CL-604*	21.9	999	12 (x2)	15.5

Table 3 – Estimated annual aircraft movement and aircraft characteristics

**As PCN determination is a function of aircraft type and weight the inclusion of the 21-ton Challenger aircraft is used to maximise PCN number and does not currently use Glen Innes airport*

[1] AC139-25(0) – Strength rating of aerodrome pavements, CASA, August 2011

[2] AC150 5335 5c Standardised Method of Reporting Airport Pavement Strength – PCN, FAA

5 Pavement Segmentation

Statistical evaluation of the maximum deflection data from FWD test data can be used to sub-lot the pavement into homogeneous segments which is useful for engineering analysis. A homogenous segment is defined as sections where the maximum deflection are more or less constant.

Figure 1 graphically illustrates this method for RWY1432 with homogeneous segments detailed and delineated by a change in direction of the graphed data. FWD data for the ±3m offset was used for this purpose. Five (5) segments have been identified within RWY1432.

Homogenous segments can be defined by a Coefficient of Variation (CoV) of the maximum deflection data of less than 25% within any single segment. Table 4 lists this statistical analysis with 2 highlighted segments defined by high CoV's.

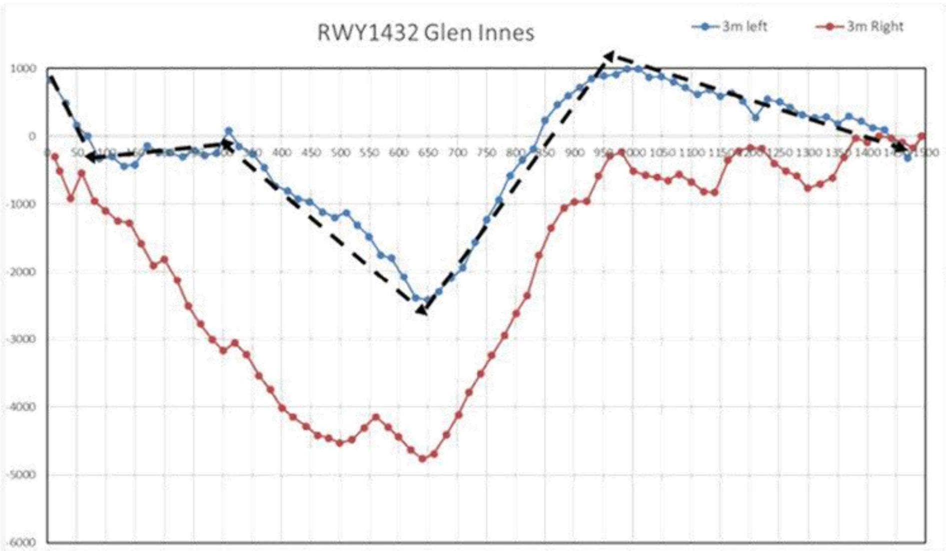


Figure 1 - Cumulative Sum Graph – RWY1432 showing x5 segments based on FWD load testing

	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5
3m Left o/s center line					
Start Chainage	0	100	320	650	950
Finish Chainage	100	320	650	950	1500
Average Deflection (µm)	356	654	491	850	703
Standard Deviation	89	117	106	125	173
Coefficient of Variation	25%	18%	22%	15%	25%
Characteristic Max Deflection (µm)	471	805	629	1013	927
3m Right o/s center line					
Start Chainage	0	100	320	650	950
Finish Chainage	100	320	650	950	1500
Average Deflection (µm)	321	432	533	919	751
Standard Deviation	154	145	135	139	205
Coefficient of Variation	48%	34%	25%	15%	27%
Characteristic Max Deflection (µm)	521	621	708	1100	1017

Table 4 – Maximum Deflection – RWY1432

Characteristic values are statistically determined in order to establish a value that represents no less than 90% of the spread of results i.e. in the case of maximum deflection not more than 10% of the data set has a value greater than the defined characteristic value. Characteristic values are used in pavement assessment and design, ensuring a realistic engineering assessment is made. In the case of maximum deflection, characteristic values are determined by the formular – max. deflection + (1.3 x standard deviation).

6 Pavement Material Characterization

Intrusive bore hole investigation was completed within the runway, taxiway and apron pavements on 14 February 2022. The pavement investigation report is appended to this report. In general, the pavement structure consists of granular base and subbase layers placed directly on a natural organic silty clay subgrade. The upper 200mm to 300mm of the subgrade clay has been improved by the addition of gravelly sands.

6.1 RWY1432

It is understood that RWY1432 was constructed in 1956. The pavement is of a flexible build containing local borrowed pit type materials used for base and subbase layer construction. In the mid 1990's the central 18m was treated by the addition of granite-based gravelly sands and low shrinkage cement binder, mixed in-place with the existing granular base layer. A summary of the pavement profile measured by intrusive investigation is listed in Table 5.

Bore Hole	01	02	04	05	08	09
Location	**RWY1432**	**RWY1432**	**RWY1432**	**RWY1432**	**RWY1432**	**RWY1432**
Chainage (m)	300	500	1250	1400	800	750
Offset from Centerline (m)	3m Left	6m Left	3m left	6m Left	6m Right	3m Right
Bituminous Seal (mm)	10	10	10	10	10	10
Cemented Granular base layer (mm)	130	140	180	180	390	250
Granular sub-base layer (mm)	180	160	120	120		90
Gravelly Clays (mm)	-	230				
Clayey Sands (mm)	-		400	250		400
Subgrade Material	Organic Clay	Not determined	Clayey Sands	Clayey Sands	Large cobbles + BIDIM geofabric	Clayey Sands
Total Granular (mm)	350	530	300	300	390	340
Hand Auger Refusal Depth (mm)	-	530	-	600	390	-

Bore Hole	03	10	11
Location	**RWY1432**	**RWY1432**	**RWY1432**
Chainage (m)	300	700	575
Offset from Centerline (m)	11m Right	11m Left	11m Left
Bituminous Seal (mm)	20	10	10
Granular base layer (mm)	155	70	100
Clayey granular sub-base layer (mm)	90	100	290
Gravelly Clays (mm)			
Subgrade Material	Sandy Clays	Over Concrete Culvert	Clays
Total Granular (mm)	245	170	390
Hand Auger Refusal Depth (mm)	-	end of BH at 170mm	

Table 5 – Pavement Profile Summary – RWY1432

6.1.1 Subgrade Material

Intrusive bore hole investigation confirmed a natural silty organic clay subgrade material. The material is generally soft in place and moist to wet in consistency. The addition of weathered granite gravelly sands improved the strength of the upper 200mm to 300mm thick layer. This improvement was likely completed to provide a firm working platform for the installation of the upper granular pavement base layers.

Elastic layer modulus was determined using back calculation techniques from FWD data within each segment – see Table 6. Back calculated layer modulus is determined over a depth of up to 1800mm and therefore the elastic layer modulus is averaged over this vertical profile. Inaccuracies in modulus values can occur particularly when pavement layer thicknesses vary and changes in moisture and density are encountered. For

RWY1432 the upper subgrade has been improved by the addition of weathered granite gravelly sands and therefore the elastic modulus is determined as an average over the improved material and the softer underlying natural clay. These values do not necessarily represent the modulus of the underlying soft natural clays.

Subgrade strength was also determined using in-situ Dynamic Cone Penetration (DCP) testing. The South African ST6[3] method was applied here which is also specified and used by the US Army Corps. The driving impact energy is the same as that used in local Australian methods, however the ST6 specifies a 60° penetration cone angle whilst the Australian method uses a 30° cone. The main difference is that the ST6 method has been developed and calibrated to measure CBR strength within both cohesive and cohesionless materials while Australian methods are suited to cohesive soils only.

DCP test results are summarized in Table 7 with test records appended to this report. Subgrade strength varies across the RWY length and also as a function of the profile depth, as demonstrated in Table 7.

For the RWY1432, subgrade CBR strength is assessed as follows:

a. 17% to 22% CBR strength between depths of 300mm and 500mm;
b. 9% CBR strength between depths of 500mm and 600mm; and
c. 4% CBR strength below 600mm depth.

Elastic Layer Modulus	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5
3m Left o/s centre line					
Start Chainage	0	100	320	650	950
Finish Chainage	100	320	650	950	1500
Average Elastic Modulus (MPa)	183	154	214	135	182
Standard Deviation	36	45	46	35	53
Coefficient of Variation	20%	29%	22%	26%	29%
Characteristic Elastic Modulus (MPa)	136	95	154	89	113
3m Right o/s centre line					
Start Chainage	0	100	320	650	950
Finish Chainage	100	320	650	950	1500
Average Elastic Modulus (MPa)	240	302	208	120	170
Standard Deviation	62	104	58	25	56
Coefficient of Variation	26%	34%	28%	21%	33%
Characteristic Elastic Modulus (MPa)	160	167	133	87	97

Table 6 – Subgrade Elastic Layer Modulus – Back Calculated from FWD data

<table>
<tr><th>Depth</th><th>BH01</th><th>BH02</th><th>BH04</th><th>BH05</th><th>BH08</th><th>BH09</th><th>BH11</th><th>BH03</th></tr>
<tr><th>Chainage (m)</th><th>300</th><th>500</th><th>1250</th><th>1400</th><th>800</th><th>750</th><th>575</th><th>800</th></tr>
<tr><th>O/S from Centreline (m)</th><th>3m left</th><th>6m left</th><th>3m left</th><th>6m left</th><th>6m right</th><th>3m right</th><th>11m left</th><th>11m left</th></tr>
<tr><td>300 – 400</td><td>19</td><td>-</td><td rowspan="3">19</td><td>-</td><td>-</td><td rowspan="4">22</td><td>27</td><td>12</td></tr>
<tr><td>400 – 500</td><td rowspan="5">5</td><td>11</td><td>-</td><td>-</td><td rowspan="2">3</td><td rowspan="5">7</td></tr>
<tr><td>500 – 600</td><td>9</td><td>17</td><td>21</td></tr>
<tr><td>600 – 700</td><td>-</td><td>11</td><td rowspan="4">4</td><td>-</td><td rowspan="3">6</td></tr>
<tr><td>700 – 800</td><td>-</td><td>14</td><td>-</td><td>11</td></tr>
<tr><td>800 – 900</td><td>-</td><td rowspan="2">3</td><td>-</td><td rowspan="2">4</td></tr>
<tr><td>900 – 1000</td><td>8</td><td>-</td><td>-</td><td>10</td><td>-</td></tr>
<tr><td>In-situ Moisture Condition</td><td>Moist</td><td>Moist</td><td>Moist</td><td>Moist</td><td>Wet at 400mm</td><td>Moist</td><td>Moist</td><td>Moist</td></tr>
</table>

Table 7 – Subgrade Strength Characteristics – DCP test results

Regional geotechnics obtained residual clay soils from site in 2014 and undertook laboratory based CBR testing. Samples were remoulded to 100% standard compaction effort and conditioned at optimum moisture levels. CBR strengths of between 0.5% and 2.5% were obtained for the natural clay subgrade and up to 6% CBR for improved sandy/gravelly clays. Table 7 shows in-place natural clays to have a nominal CBR strength of

[3] ST6 (1984) – Measurement of the In-situ Strength of Soils by the Dynamic Cone Penetrometer (DCP) Special Method for Testing Roads, TMH6, Pretoria South Africa.

4%, which is higher than that obtained in the laboratory. For assessment and design purposes a value of 4% CBR shall be used, representing the condition of the in-place natural clay.

6.1.2 Granular Base Layer

Granite based gravelly sands were added to the existing shale base course and mixed in-situ with the addition of slow setting cementitious binders to from a cemented base course layer within the central 18m width of RWY1432.

The absence of high-density block shrinkage cracking at the runway surface, suggests that the cementitious binder is slow setting such as a slag/lime blend which is common in NSW. The neutralization of clay fines within the existing shale gravel confirms that lime was used in this mix.

The base layer material is of mixed moisture consistency, appears to be well graded and generally of high density/stiffness in place. The upper 50mm to 70mm material is loose and of low density as a result of cement carbonization within this zone. Strength loss is consistent with high moisture content which over many years destroys the cemented bonds. During times of high temperature, moisture migrates and accumulates under the bitumen seal and acts to saturate this upper portion initiating the carbonization process. The upper portion of the granular base course layer was relatively loose in place and could physically be removed with ease. The remaining base layer is moderately bound, however variable in strength. Strength variability is likely a function of poorly controlled construction processes.

The bitumen seal surface has been repaired in many locations, which can be attributed to deterioration of adhesion between the bitumen seal and granular layer. The thin weak granular material immediately below the seal can also deform under aircraft shear loads.

Table 8 lists the back-calculated layer modulus determined for the granular base course using FWD test data within both 3m and 6m offset alignments from the runway centreline. Most pavement segments exceed the homogeneous CoV limit of 25%. In review of the average elastic layer modulus values, it is obvious that segment 1 located at the RWY14 threshold has retained good strength at about 2000MPa. This level of stiffness is expected from a cemented granular base layer. The remaining pavement segments are consistent of moderate stiffness measuring between 400MPa and 700MPa. It is considered that at these stiffness levels the bound layer has reverted back to an unbound granular material.

For PCN/PCR assessment and design it is necessary that this material be classified in accordance with FAA definitions. The material will be treated as an unbound material and classified as P209 according to the FAA guide, given in-situ stiffness levels.

Segment	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
	3m Left o/s centre line					**6m Left o/s centre line**				
Start Chainage	0	100	320	650	950	0	100	320	650	950
Finish Chainage	100	320	650	950	1500	100	320	650	950	1500
Average Elastic Modulus (MPa)	2570	538	706	373	444	1822	636	494	247	417
Standard Deviation	861	296	226	72	119	1152	470	132	89	65
Coefficient of Variation	34%	55%	32%	19%	27%	63%	74%	27%	36%	16%
Characteristic Elastic Modulus (MPa)	1450	154	412	280	290	324	26	323	131	332
	3m Right o/s centre line					**6m Right o/s centre line**				
Start Chainage	0	100	320	650	950	0	100	320	650	950
Finish Chainage	100	320	650	950	1500	100	320	650	950	1500
Average Elastic Modulus (MPa)	1958	576	696	332	453	1992	694	507	418	409
Standard Deviation	1232	169	116	56	233	1125	408	141	118	112
Coefficient of Variation	63%	29%	17%	17%	51%	56%	59%	28%	28%	27%
Characteristic Elastic Modulus (MPa)	356	356	545	260	151	529	164	325	265	264

Table 8 – Base Course Elastic Layer Modulus – Back Calculated from FWD data

The granular base course material located within the outer runway alignment (i.e. either side of the central 18m width) consists of a wet and coarsely graded granular shale material, which is poorly compacted. It is recommended that the pavement within this outer runway alignment be strengthened.

6.1.3 Granular Subbase Layer

The subbase material is consistent throughout the runway length, consisting of a variable thickness 75mm nominal sized hard granite gravel which includes a high clay content. The material is generally well compacted, difficult to excavate as the large size aggregate forms a well-established interlocked aggregate matrix. Notwithstanding, the layer also contains high moisture content which generally exceeds the optimum moisture content.

Back calculated elastic layer modulus was determined using FWD test data and is listed in Table 9. Elastic layer modulus values are highly variable, confirmed by high CoV values. To some extent the elastic modulus is influenced by the variability of the upper cemented base layer. The subbase material will be designated as P208 according to FAA guidelines.

Segment	1	2	3	4	5	1	2	3	4	5
	3m Left o/s centre line					**6m Left o/s centre line**				
Start Chainage	0	100	320	650	950	0	100	320	650	950
Finish Chainage	100	320	650	950	1500	100	320	650	950	1500
Average Elastic Modulus (MPa)	847	338	510	128	311	776	93	246	120	289
Standard Deviation	106	175	213	60	112	426	30	111	37	85
Coefficient of Variation	13%	52%	42%	47%	36%	55%	32%	45%	31%	29%
Characteristic Elastic Modulus (MPa)	709	111	234	50	166	222	54	102	71	178
	3m Right o/s centre line					**6m Right o/s centre line**				
Start Chainage	0	100	320	650	950	0	100	320	650	950
Finish Chainage	100	320	650	950	1500	100	320	650	950	1500
Average Elastic Modulus (MPa)	1289	1172	431	135	224	635	528	287	496	274
Standard Deviation	366	356	202	39	120	375	315	136	158	177
Coefficient of Variation	28%	30%	47%	29%	53%	59%	60%	47%	32%	65%
Characteristic Elastic Modulus (MPa)	813	709	169	84	68	146	119	110	291	44

Table 9 – Subbase Course Elastic Layer Modulus – Back Calculated from FWD data

6.1.4 Bituminous Seal Surfacing

The bituminous seal consists of a single size 7mm bituminous seal layer and a bituminous prime layer. The surface is in fair and functional condition under current aircraft traffic. The bituminous prime penetration into the granular base course is very shallow which contributes to poor adhesion between layers. Within all bore holes the seal was found to dislodge from the granular base layer quite readily during excavation – see Figure 2.

Figure 2 - Bitumen seal / granular interface poor adhesion

6.2 Taxiway and Apron

The taxiway and Apron pavements are of similar structure. A summary of the pavement profile measured by intrusive bore holes is listed in Table 10.

6.2.1 Subgrade Material

Subgrade material strength was not established as hand auger refusal was encountered within the lower clayey granular subbase layer in both bore holes. This layer consists of cobble size granite aggregate which could not be penetrated using hand digging techniques. FWD testing shows that this layer is of high stiffness with a back calculated elastic layer modulus in-excess of 1000MPa. It is expected that the layer is of a substantial thickness and strength consisting of large armour or cobble type rock material.

Bore Hole	06	07
Location	**Apron**	**TWY**
Chainage (m)	20	100
Offset from Centreline (m)	2nd FWD alignment	3m Left
Bituminous Seal (mm)	10	10
Clayey Granular Base Layer (mm)	210	215
Clayey Sands Sub-base layer (mm)	250	305
Clayey Gravel (mm)	100 +	150 +
Subgrade Material	Not determined	Not determined
Total Granular (mm)	>560	>670
Hand Auger Refusal Depth (mm)	560	670

Table 10 – Pavement Profile Summary – TWY and Apron

Elastic layer modulus was determined using back calculation techniques from FWD data within each test alignment – see Table 11. It is noted that these values are skewed by the high stiffness of the cobble size rock layer. Elastic layer modulus values shown in Table 11 therefore must be used with caution. For assessment and design purposes a 4% CBR subgrade strength shall be adopted.

Elastic Layer Modulus	**0m o/s**	**10m o/s**	**20m o/s**	**30m o/s**	**40m o/s**
Start Chainage	0	0	0	0	0
Finish Chainage	33	37	56	220	200
Average Elastic Modulus (MPa)	437	482	489	410	334
Standard Deviation	81	123	131	125	83
Coefficient of Variation	18%	26%	27%	31%	25%
Characteristic Elastic Modulus (MPa)	333	321	319	247	226

Table 11 – Subgrade Elastic Layer Modulus – Back Calculated from FWD data

6.2.2 Granular Base Layer

The granular base course layer consists of a coarsely graded dolerite granular material which is of medium in-place density. The layer is a nominal 210mm thickness and is of adequate quality and durability. The coarse grading attracts and retains moisture within the layer.

Table 12 lists the back-calculated characteristic layer modulus within the five FWD test alignments. All five data sets satisfy the CoV limit of 25% which defines a homogeneous data set. Characteristic elastic modulus measures between 140MPa and 230MPa.

Elastic Layer Modulus	**0m o/s**	**10m o/s**	**20m o/s**	**30m o/s**	**40m o/s**
Start Chainage	0	0	0	0	0
Finish Chainage	33	37	56	220	200
Average Elastic Modulus (MPa)	184	243	188	256	290
Standard Deviation	38	32	32	55	40
Coefficient of Variation	21%	13%	17%	22%	14%
Characteristic Elastic Modulus (MPa)	135	201	147	184	238

Table 12 – Base Course Elastic Layer Modulus – Back Calculated from FWD data

6.2.3 Granular Subbase Layer

The subbase material consists of a 3mm single sized clayey sand material. The clay content is estimated at approximately 10%. The high moisture content within this layer binds the clay and sand together which entraps moisture making this layer relatively impermeable and also weak. The material could be removed by hand.

Table 13 lists the back calculated layer modulus values which reflect the weak nature of this layer. All characteristic values have a CoV of less than 25% making these values homogeneous across the pavement area.

Elastic Layer Modulus	0m o/s	10m o/s	20m o/s	30m o/s	40m o/s
Start Chainage	0	0	0	0	0
Finish Chainage	33	37	56	220	200
Average Elastic Modulus (MPa)	82	82	75	74	65
Standard Deviation	10	16	22	12	12
Coefficient of Variation	12%	20%	29%	17%	19%
Characteristic Elastic Modulus (MPa)	68	61	46	58	49

Table 13 – Clayey Sand Subbase Layer Elastic Layer Modulus – Back Calculated from FWD data

6.2.4 Bituminous Seal Surfacing

The bituminous seal is in fair and functional condition. The surface consists of a single 7mm spray seal layer with a lower bituminous prime layer. The prime has penetrated the granular base layer to an adequate depth providing good interfacial adhesion between layers.

7 Pavement Assessment

7.1 Structural Assessment - FWD testing

The FWD apparatus uses an impulse load applied to the pavements surface via a 300mm diameter loading plate. For Glen Innes Airport the applied target load was 700kPa (50kN) which is representative of the standard wheel pressures currently applied by operating aircraft (Table 3).

The pavements deflection response is measured at various distances up to 1.5 m from the load source using accelerometers (geophones) which are in contact with the pavements surface (see Figure 3). This data can be used to segment the pavement into homogenous sections and back calculate elastic layer modulus.

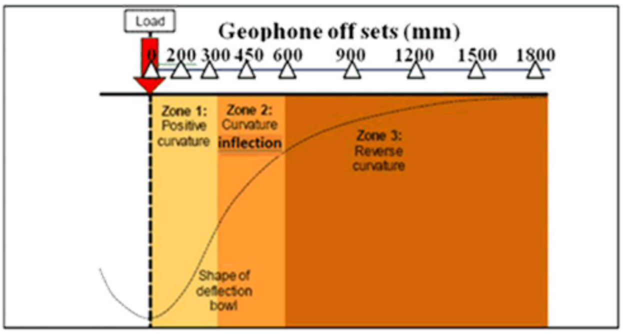


Figure 3 – FWD loading and measuring layout

7.2 Benchmarking - Pavement Layer Indices

FWD test results were analysed to review the structural condition of the pavement using a semi empirical /mechanistic and non-quantitative benchmarking method described by Horak[4]. This analysis uses a simple

[4] Horak E, Emery S, Maina J, Review of Falling Weight Deflectometer Deflection Benchmark Analysis on Roads and Airfields, CAPSA 2015

mathematical approach to provide guidance to the structural condition of the base course, middle and lower pavement layers. These are segmented into 3 zones which are illustrated in Figure 3.

Base layer indices (BLI) are representative of the upper granular base layer structure, the middle layer indices (MLI) are representative of the lower granular layer(s) and the lower layer indices (LLI) is representative of the subgrade.

Severe and warning limits are applied to the analysis as a guide to the pavements layer condition. These limits are derived relative to the applied test load pressure which replicates the design traffic loading. For Glen Innes airport the benchmarking limits were extrapolated to 700kPa test load pressure.

This analysis has been used to assess the structural aspects of the pavement profile within the runway, taxiway and apron. Three offset alignments from RWY1432 centreline were tested with results being variable. The plots are provided in separate graphs for clarity.

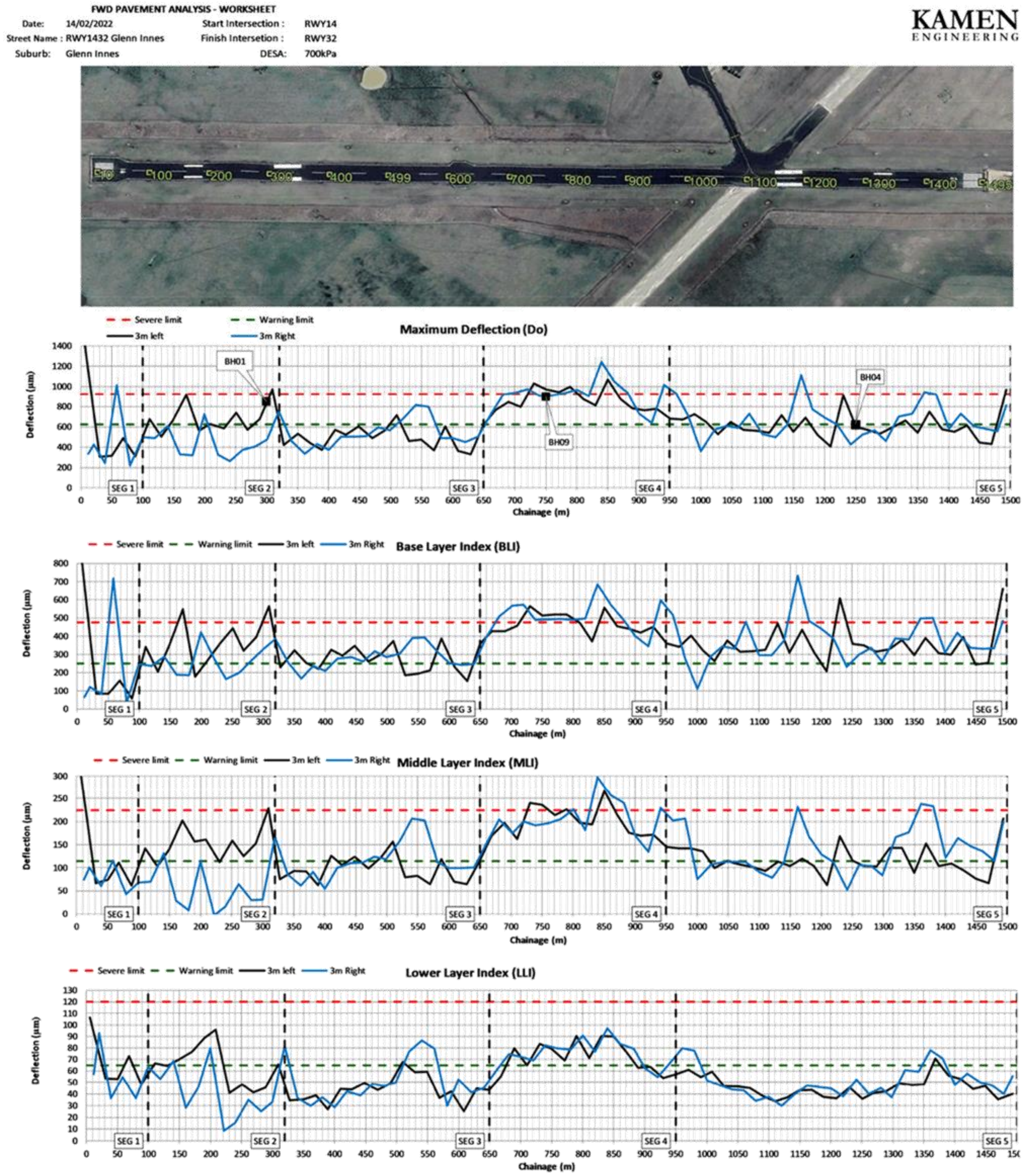
I have assumed that the cemented granular base course layer has essentially taken the form of an unbound granular material to which these benchmarking limits apply.

7.2.1 RWY1432

The benchmarking response at the 3m, 6m and 11m offsets are illustrated in Figure 4. The 3m and 6m offset covers the central 18m portion of the runway showing similar responses to FWD test loading whilst data from the 11m offset alignment represents the weaker pavement structure aligned 9m either side of the centreline. In general:

a. the pavements response in segment 1 is below the warning limit demonstrating stiffer properties of the granular base and subbase layers – see back-calculated elastic layer modulus of >800MPa (Table 8);
b. the pavements response in segment 2 is variable but generally at or above the warning limit within the 3m offset. This response suggests that the pavement is in need of improvement to cater for design aircraft;
c. the pavements response in segments 3 and 5 are at or above the warning limit within the granular profile i.e. BLI and MLI depicting weaker material layers here. The response at the subgrade level is below the warning limit which is a function of subgrade improvement by addition of granular sandy materials;
d. the pavements response in segment 4 is at or above the severe limit for the granular layers i.e. BLI and MLI. BH08 is located within this segment was found to contain free water above the subgrade level and a BIDIM geofabric layer, over a soft subgrade. The extent of the weaker pavement appears to extend between chainage 650m and 950m (see Figure 4). Weak responses within the upper layers can also reflect a weaker subgrade layer which is the case here; and
e. the response at the subgrade is generally below the warning limit in a large portion of the runway other than segment 4.

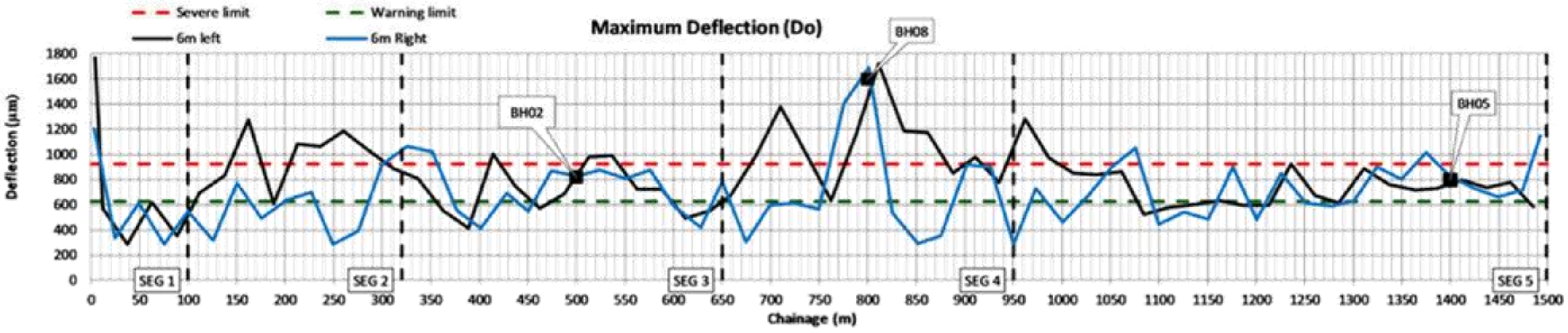
The response to FWD test loading for the 11m offset alignment is generally above the severe limit within both granular layer profiles (i.e. BLI and MLI) signifying weak granular layers. BH03 also recorded a relatively thin pavement profile which provides for a weaker response to FWD test loading. The subgrade response generally mimics that observed within the 3m and 6m offset being at or below the warning limit line. Subgrade improvement by the additional of gravelly sands has taken place within the whole runway area.

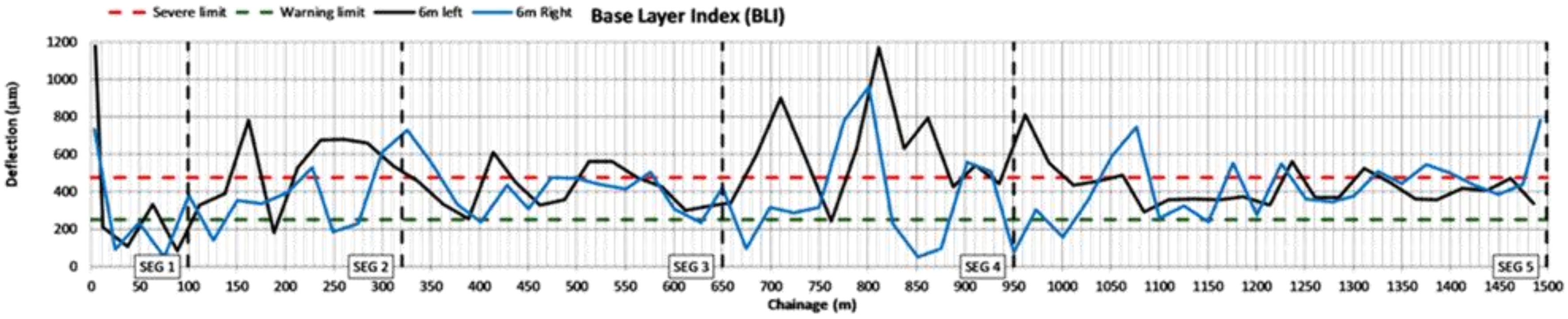

FWD PAVEMENT ANALYSIS - WORKSHEET
Date: 14/02/2022
Street Name : RWY1432 Glenn Innes
Suburb: Glenn Innes
Start Intersection : RWY14
Finish Intersetion : RWY32
DESA: 700kPa
KAMEN
ENGINEERING
Maximum Deflection (Do)
Severe limit
Warning limit
3m left
3m Right
BH01
BH04
BH09
Deflection (µm)
Chainage (m)
SEG 1
SEG 2
SEG 3
SEG 4
SEG 5
Base Layer Index (BLI)
Middle Layer Index (MLI)
Lower Layer Index (LLI)

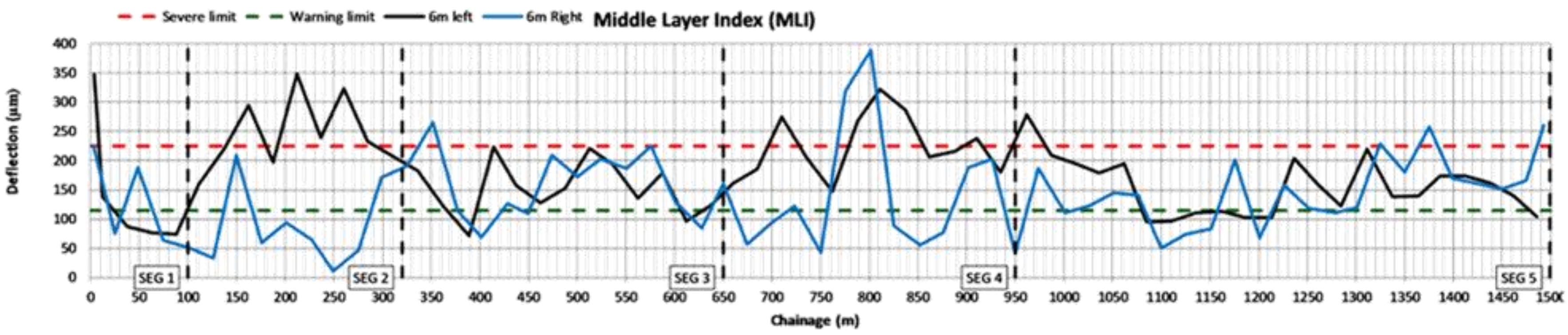
FWD PAVEMENT ANALYSIS - WORKSHEET

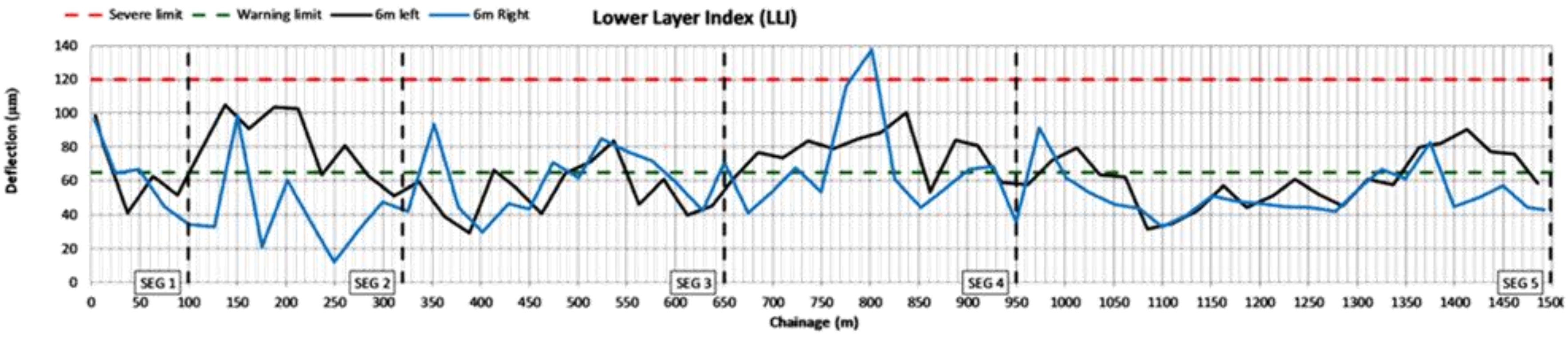
KAMEN ENGINEERING

Date:	14/02/2022	Start Intersection :	RWY14
Street Name :	RWY Glenn Innes	Finish Intersetion :	RWY32
Suburb:	Glenn Innes	DESA:	700kPa









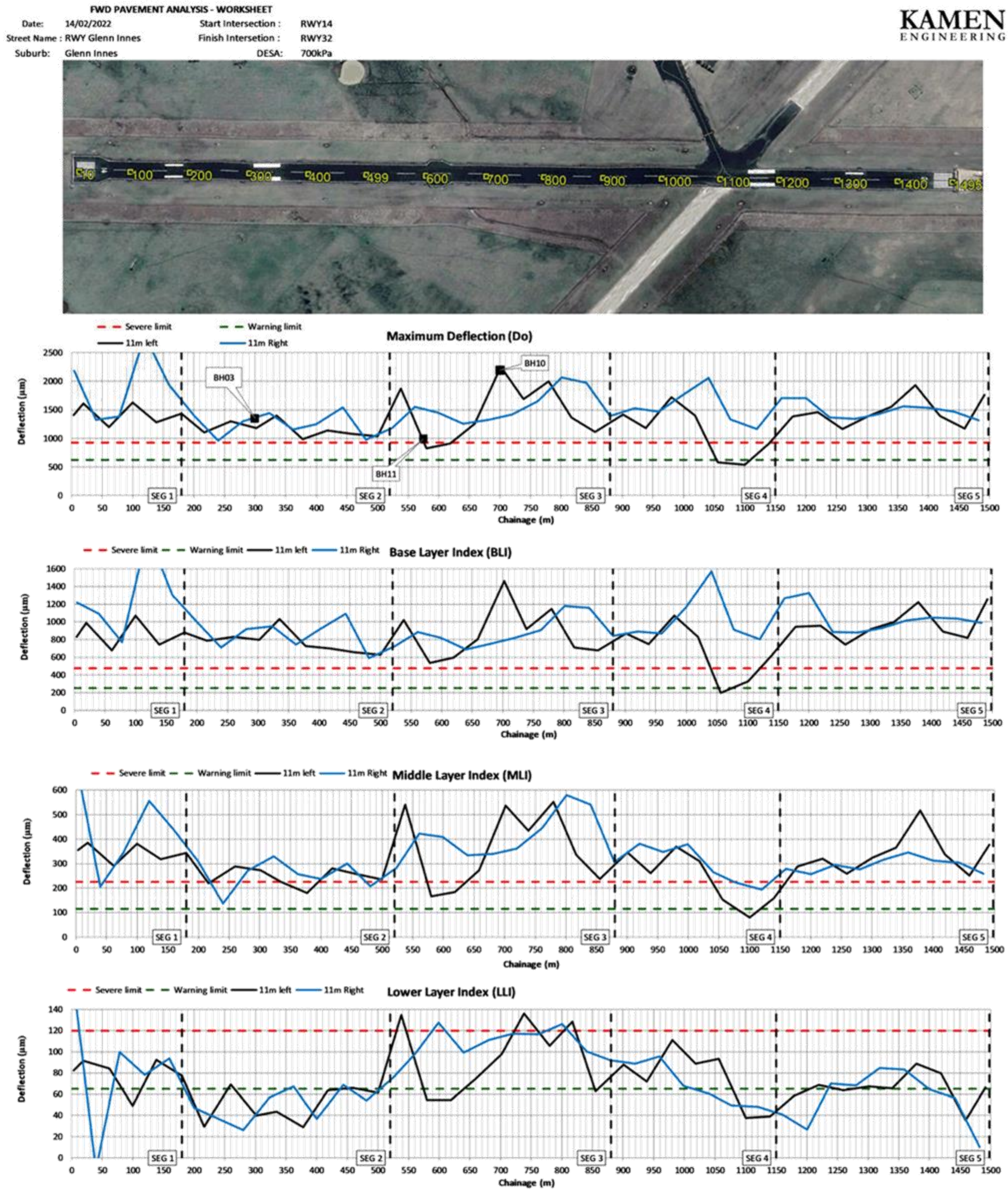


Figure 4 – Benchmarking assessment RWY1432

FWD PAVEMENT ANALYSIS - WORKSHEET

KAMEN ENGINEERING

Date:	17/01/2021	Start Intersection :	TWY / Apron
Street Name :	Glenn Innes Airport	Finish Intersection :	RWY 32
Suburb:	Glenn Innes	Load:	700kPa

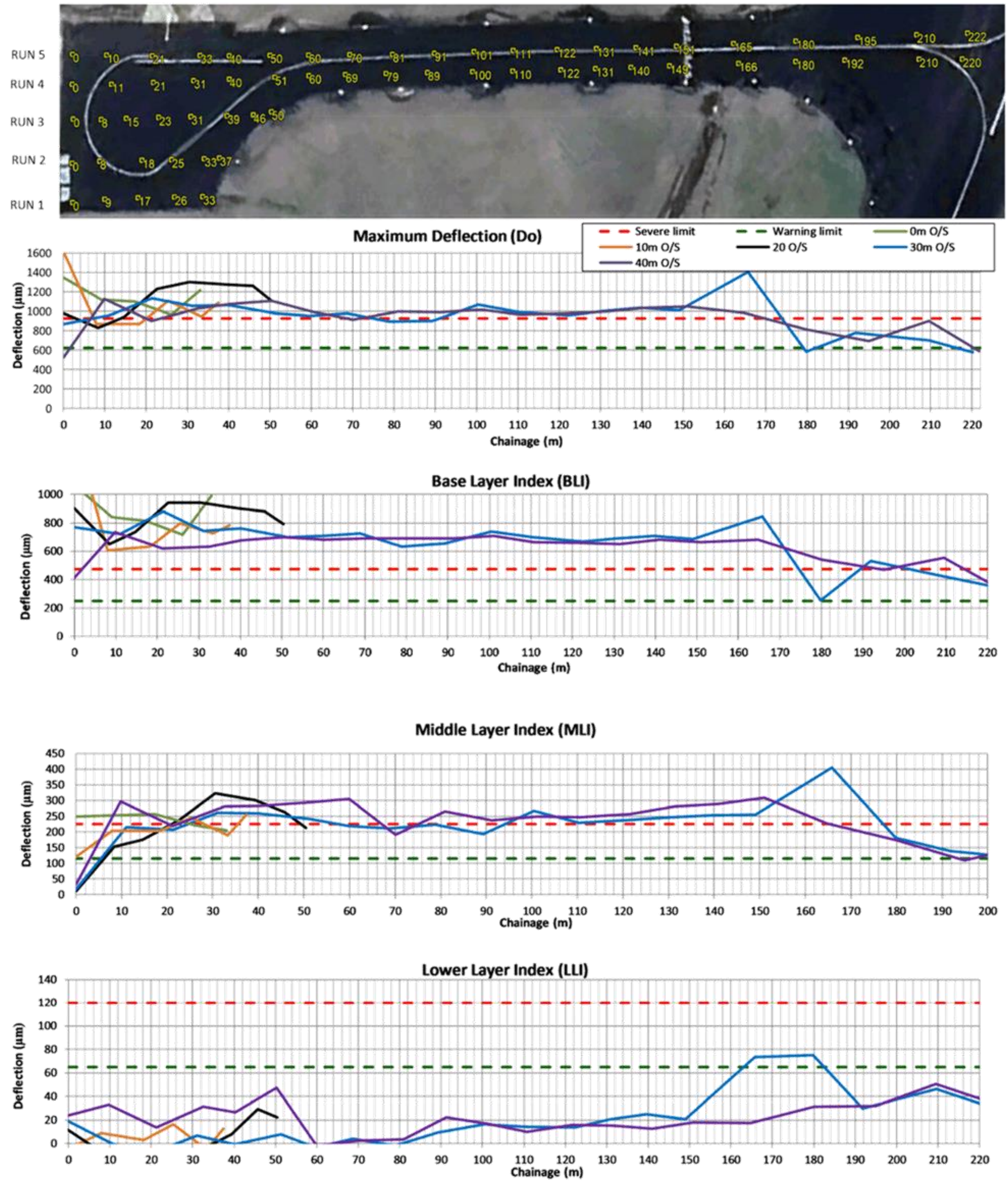


Figure 5 – Benchmarking assessment Apron

7.2.2 Taxiway and Apron

The benchmarking response within 5 test alignments along the taxiway and apron are illustrated in Figure 5. This assessment shows:

a. the pavements response within the granular base and subbase layers (BLI and MLI graphs) to be above the severe limit confirming the weak nature of these layers and the pavement in general; and
b. the pavements response at the subgrade level is well below the warning limit. This response is reflective of the very hard and stable cobble size aggregate layer that has been constructed on the subgrade (see clause 6.2.1).

8 PCN Assessment

8.1 Equivalent Pavement Thickness

FAA[5] pavement design methods use standard materials and pavement profiles for PCN assessment. The standard pavement profile which is applicable for RWY1432 is listed in Table 14. Therefore the RWY1432 pavement profile must be converted to this standard structure, using equivalency ratios specified by FAA, which are listed in Table 15. Pavement layer thicknesses are reduced or increased by simple multiplication or division. The result of this process is shown in Table 16.

Layer Type | Material Strength	Two (2) Wheel per Landing Gear Strut
Asphalt (P-401)	75 mm
Granular Base Course (P-209) (minimum 80% CBR)	150 mm
Granular Sub-base Layer (P-154) (minimum 20% CBR)	Variable Thickness
Subgrade of known Strength	-

Table 14- Standard Pavement Profiles

Equivalence	FAA range	Adopted Value*
Crushed Rock (P209) to Granular Sub-base (P154)	1.2 – 1.6	1.4
Crushed Rock (P208) to Granular Sub-base (P154)	1.0 – 1.5	1.2
Asphalt (P401) to Granular Sub-base (P154)	1.7 – 2.3	2.3
Sand – Clay Base	n/a	n/a

To use the equivalency factors in reverse the reciprocal is used with an addition of 0.1; e.g. to convert P154 to asphalt 1/(2.0+0.1) is used.

Table 15 - Equivalency Factors

For RWY1432, pavement segments 1, 2 and 3 were grouped together guided by the response to FWD load testing and segments 4 and 5 remain stand alone. A higher deflection response is noted within segment 4 (Figure 4), attributed to the high moisture content in this segment. It is understood that natural springs are active with the airport which also contribute to the increased moisture condition, particularly within segment 4 where the pavement elevation is at a low point.

Table 16 lists pavement layer thickness measured on site for each segment(s) and also equivalent standard FAA pavement profiles sued for PCN analysis.

[5] AC150 5335 5c Standardised Method of Reporting Airport Pavement Strength – PCN, FAA.

Alignment	Central 18m RWY Alignment						Outer RWY Alignment	
Chainage	Chainage 0 - 640		Chainage 640 - 950		Chainage 950 - 1500		Chainage 0 - 1500	
Segment	1, 2 and 3		4		5		n/a	
Layer	Actual Layer Thickness (mm)	FAA Equivalent Pavement Thickness (mm)	Actual Layer Thickness (mm)	FAA Equivalent Pavement Thickness (mm)	Actual Layer Thickness (mm)	FAA Equivalent Pavement Thickness (mm)	Actual Layer Thickness (mm)	FAA Equivalent Pavement Thickness (mm)
Asphalt (P401)	-	75	-	75	-	75	-	75
Granular Base (P209)	140	150	250	150	180	150	-	150
Granular Base (P208)	170		100		120		130	
Subbase (P154)	-	50	-	105	-	35		10
Sands Clay (P213)							120	-
Lower Granular Base (P209)							150 min	
Total Pavement Thickness (mm)	310	275	350	325	300	260	250	235

Table 16 – Equivalent Pavement Thickness – RWY1432

8.2 PCN Review and Analysis

The base load traffic consists of King Air 200 and 350 series aircraft whilst a 21-ton jet aircraft is included to maximise the PCN derivation. The traffic volume used for PCN assessment is as follows:

i. King Air 350 – 2 arrivals per week
ii. King Air 200 – 2 arrivals per week
iii. Challenger 604 – 1 arrival per month

It is also noted that the subgrade has been improved from the soft natural clays with the addition of sandy gravels to a depth of between 300 and 600mm, but it is not enough to designate this layer as a select fill, so it has been ignored for assessment purposes. Based on the subgrade material results, a subgrade category of D is considered more appropriate than the current published category of C (i.e. subgrade hasn't changed, it was just published inaccurately). This reduced classification has the effect of increasing the Aircraft Classification Number's (ACN). Site investigations identified the in-situ subgrade strength to be relatively low at a CBR of 4%. It is unlikely that the subgrade strength profile in the field will change significantly unless highly variable weather patterns prevail.

PCN analysis was completed using the thinnest equivalent pavement thicknesses of between chainage 0m to 640m and between chainage 950m and 1500m as these segments contain the thinnest pavement profiles. The pavement located out-side of the central 18m of the runway much thinner however is ignored as it is known that the pavement within this alignment is weak. The existing PCN is categorised by the nomenclature "Central Section" which is to be retained for use with the updated PCN.

8.3 RWY1432 - btw ch 0m & 640m

Table 17 provides the COMFAA3 output for analysis within this pavement segment. The PCN is 12 for this traffic arrangement.

```
This file name = PCN Results Flexible 8-03-2022 07;04;05.txt
Library file name = C:\Program Files (x86)\COMFAA 30\glenn_innes.Ext
Units = Metric

Evaluation pavement type is flexible and design procedure is CBR.
Alpha Values are those approved by the ICAO in 2007.

                                          CBR = 4.00 (Subgrade Category is D(3))
             Evaluation pavement thickness = 275.0 mm
        Pass to Traffic Cycle (PtoTC) Ratio = 1.00
          Maximum number of wheels per gear = 2
       Maximum number of gears per aircraft = 2

No aircraft have 4 or more wheels per gear.  The FAA recommends a reference section assuming
76 mm of HMA and 152 mm of crushed aggregate for equivalent thickness calculations.

Results Table 1. Input Traffic Data
                              Gross   Percent    Tire     Annual      20-yr    6D
 No.  Aircraft Name          Weight  Gross Wt   Press      Deps    Coverages  Thick
------------------------------------------------------------------------------------
  1  SuperKingAir-B200        5.711  95.00       676       156         395   198.0
  2  SuperKingAir-350         6.849  95.00       634       104         298   213.9
  3  Challenger-CL-604       21.863  95.00       676        12          58   309.0

Results Table 2. PCN Values
                          Critical        Thickness      Maximum       ACN Thick at
                        Aircraft Total    for Total     Allowable     Max. Allowable              PCN on
 No. Aircraft Name       Equiv. Covs.    Equiv. Covs.  Gross Weight    Gross Weight     CDF       D(3)
-------------------------------------------------------------------------------------------------------
  3  Challenger-CL-604           62         312.9         17.829          583.10      1.7545     12.1
                                                                      Total CDF =   1.7545
```

Table 17 - COMFAA3 PCN Assessment –RWY1432 Chainage 0m to 640m

8.4 RWY1432 - btw ch 950m & 1500m

Table 18 provides the COMFAA3 output for this segment. The PCN is 11 for this traffic arrangement.

```
This file name = PCN Results Flexible 8-03-2022 07;08;20.txt
Library file name = C:\Program Files (x86)\COMFAA 30\glenn_innes.Ext
Units = Metric

Evaluation pavement type is flexible and design procedure is CBR.
Alpha Values are those approved by the ICAO in 2007.

                                          CBR = 4.00 (Subgrade Category is D(3))
             Evaluation pavement thickness = 260.0 mm
        Pass to Traffic Cycle (PtoTC) Ratio = 1.00
          Maximum number of wheels per gear = 2
       Maximum number of gears per aircraft = 2

No aircraft have 4 or more wheels per gear.  The FAA recommends a reference section assuming
76 mm of HMA and 152 mm of crushed aggregate for equivalent thickness calculations.

Results Table 1. Input Traffic Data
                              Gross   Percent    Tire     Annual      20-yr    6D
 No.  Aircraft Name          Weight  Gross Wt   Press      Deps    Coverages  Thick
------------------------------------------------------------------------------------
  1  SuperKingAir-B200        5.711  95.00       676       156         395   198.0
  2  SuperKingAir-350         6.849  95.00       634       104         298   213.9
  3  Challenger-CL-604       21.863  95.00       676        12          58   309.0

Results Table 2. PCN Values
                          Critical        Thickness      Maximum       ACN Thick at
                        Aircraft Total    for Total     Allowable     Max. Allowable              PCN on
 No. Aircraft Name       Equiv. Covs.    Equiv. Covs.  Gross Weight    Gross Weight     CDF       D(3)
-------------------------------------------------------------------------------------------------------
  3  Challenger-CL-604           64         315.0         16.099          550.13      2.2392     10.8
                                                                      Total CDF =   2.2392
```

Table 18 - COMFAA3 PCN Assessment –RWY1432 Chainage 950m to 1500m

9 Pavement Classification Rating (PCR)

The ACR - PCR system is to replace the current PCN rating system in 2024. The aim of the section of the report is provide an equivalent PCR number as that of the derived PCN.

9.1 Introduction

The ACR-PCR system replicates the pavement assessment in the same manner as that used for PCN, in that if an aircraft has an aircraft classification rating (ACR) of equal to or less than the declared PCR then the aircraft can operate without concession on that pavement. The PCR system only applies to pavements with carrying capacity above 5.7 tons.

Like the PCN system, this new system calculates the PCR number based on the weight, number and type of aircraft over a designated assessment life as a function of the pavement profile and engineering characteristics. The assessment life is typically taken as the design life before pavement maintenance or rehabilitation is undertaken. ***Therefore, it is important to understand that the PCR must be re-evaluated in the event of the introduction of new aircraft type, increase in current traffic volumes, change in use and/or a change in the pavements physical and/or engineering properties***.

Like the PCN system a standard pavement structure is used to assess the PCR. This structure is listed in Table 19. Table 20 lists the subgrade conditions used in ACR-PCR assessment.

Layer	Aircraft with 2 or less Wheels on each Strut	Aircraft with 2 of more Wheels on each Strut	Modulus (MPa)	Poisson's Ratio (v)
Surface (Asphalt)	75 mm	125 mm	1379	0.35
Fine Crushed Rock Base Layer	Variable	Variable	Variable	0.35
Subgrade	Infinite	Infinite	User defined	0.35

Table 19- Standard Pavement Profiles for PCR Assessment

Subgrade Strength Category	Subgrade Support Elastic Modulus (MPa)	Code
High	≥150	A
Medium	≥100 to <150	B
Low	≥60 to <100	C
Ultra-Low	< 60	D

Table 20- Subgrade Strength Categories

The following is a summary methodology for PCR determination:

1. Determine pavement physical and engineering properties including layer thickness, elastic layer modulus & poisons ratio;
2. Define the aircraft mix by aircraft type, number of departures and weight which the pavement is expected to experience over its design or estimated remaining structural life. (Note: the FAARfield linear elastic structural analysis software applies a lateral wander factor to traffic movements of a standard deviation of 776mm irrespective of aircraft type);
3. Determine ACR's for each aircraft in the aircraft mix at its operating weight of MTOW, determining the aircraft with the maximum ACR. ACR is determined using the ICAO-ACR software;
4. Determine the maximum Critical Damage Factor (CDF) of the aircraft mix;
5. Select the aircraft with the highest contribution to CDF as the critical aircraft. This aircraft is designated AC(i), where *i* is an index value with an initial value 1. Remove all aircraft other than the current critical aircraft AC(i) from the traffic list.
6. Adjust the annual departures of the critical aircraft until the maximum aircraft CDF is equal to the value recorded in (4). Record the equivalent annual departures of the critical aircraft;
7. Adjust the critical aircraft weight to obtain a maximum CDF of 1.0 for the number of annual departures obtained at step (6). This is the Maximum Allowable Gross Weight (MAGW) of the critical aircraft.
8. Determine the ACR of the critical aircraft at its MAGW. This value is designated PCR(i).
9. If AC(i) is the maximum ACR aircraft from step 3, then skip to step 13.
10. Remove the current critical aircraft AC(i) form the traffic list and re-introduce the other aircraft not previously considered as critical aircraft. The new aircraft list, which does not contain any of the previous critical aircraft, is referred to as the reduced aircraft list. Increment the index value (*i*=*i*+1).
11. Determine the maximum CDF of the reduce aircraft list and select the new critical aircraft AC(i).
12. Repeat steps 5 – 9 for AC(i). In step 7, use the same CDF as determined for the initial aircraft mix to determine the equivalent annual departures for the reduced list.
13. The PCR to be reported is the maximum value of all computed PCR(i). The critical aircraft is the aircraft associated with this maximum value of PCR(i).

The thinnest pavement profile located between chainage 950m and 1500m was used to determine PCR and this will provide the worst case and should be used as the published PCR number.

9.2 Aircraft Classification Rating

The aircraft classification rating (ACR) for the design aircraft are listed in Table 21.

Aircraft	Subgrade A	Subgrade B	Subgrade C	Subgrade D
King Air B200	22	24	27	32
King Air B350	25	28	33	41
Dash8 300	76	91	107	132
Dash 8 Q400	tbc	tbc	tbc	tbc
Challenger 604	95	110	122	148

Table 21- ACR Summary

9.3 PCR Determination - Ch 950m to 1500m

Assessment variables are as follows:

a. Traffic – see Table 3
b. Pavement structure – see Table 16 chainage 950 to 1500
c. Pass/Traffic Cycles - 2

The PCR report is appended to this report and a summary listed is in Table 22.

Aircraft	ACR Subgrade D	PCR (D Subgrade)
King Air B200	32	-
King Air B350	41	-
Dash8 300	132	-
Dash 8 Q400	tbc	-
Challenger 604	148	108

Table 22- PCR Summary

The PCR is defined as follows: **108 / F / D / 700 kPa / T Central Section**. This PCR value allows unrestricted traffic of B200 and B350 aircraft as for both aircraft, the ACR is less than the PCR of 108. Restricted traffic of the larger aircraft including the Challenger and similar weighted aircraft such as the Dash 8 variants, requires concessional approval.

10 Recommended PCN/PCR for RWY1432

RWY1432 PCN/PCR was determined for segments with the thinnest pavement profile. A uniformed 4% CBR strength value was adopted for all pavement segments as this value is representative of the in-situ subgrade condition. Current aircraft traffic generally is less than 7 ton in weight, however the inclusion of a larger 21-ton aircraft in the mix increases the PCN/PCR. Recommended PCN/PCR values are listed in Table 23.

Designation	Recommended	Current
PCN	11/F/D/700 kPa (101PSI)/T Central Section	11/F/C/580 (84PSI) /T Central Section
PCR	109/F/D/700 kPa (101PSI)/T Central Section	-

Table 23 – Recommended PCN/PCR for RWY1432

11 Pavement Rehabilitation Treatment

Runway, taxiway and apron pavements are in fair condition and appear to be functional for current aircraft volumes, provided that current maintenance treatment and frequency is maintained.

The central 18m of the runway pavement had been treated approximately 20 years ago by the addition of both granite gravelly sands and a cementitious binder, mixed and compacted in place. This upper granular base layer was measured to be between 120 and 180mm thick. The layer was found to be moderately bound, and in the absence of regular shrinkage cracking, the binder would likely contain a slow setting cement such as a lime/slag blend. Carbonisation of cement bonds within the upper 60mm of the layer confirms the presence of high moisture volumes immediately under the bituminous surface seal. The interlayer bond between the bitumen seal and the granular base layer is poor, as a result of inadequate penetration of the bituminous prime and the presence of high moisture content.

The granular subbase layer consists of a 75mm nominal size granite-based material with high clay fines content. This layer is well compacted, with good large aggregate interlock, appearing to provide adequate subbase layer support.

The upper portion of the subgrade has been improved by the addition of weathered granite sand and gravels to a depth of up to 200mm. This treatment has strengthened this subgrade profile, measuring between 9% and 22% CBR strength. Inclusion of this improved 150mm thick layer as a stand-alone layer for pavement design is appropriate as its presence reduces rehabilitation thickness and the demand for new materials. A 9% CBR strength shall categorise this layer and shall be used for pavement rehabilitation design purposes. The underlying softer 4% CBR subgrade strength material will be retained for design purposes.

The taxiway and apron pavements are of identical construction consisting of a 210mm thick dolerite-based granular base layer which is wet in-place, containing plastic fines. The subbase consists of a single sized clayey sand which appears to be designed as a drainage layer. The high clay content however acts to retain moisture making this layer very weak and wet. A heavy large size armour rock subbase is in place between the pavement structure and subgrade. This material could not be penetrated using hand excavation techniques.

Intrusive pavement investigation report is appended to this report, and the pavement profiles are summarised in clause 6. These investigations identified the presence of high moisture contents within all pavement layers and in some locations free water was evident at the natural clay subgrade level. It is understood that natural springs are active within the airport which invariably contribute to the high moisture contents. A pit and pipe drainage system is positioned adjacent to the eastern flank of RWY1432. Neither the extent of the drainage system nor the engineering detail was available at the time of writing this report.

To be able to minimise risk in both design and rehabilitation treatment, it is necessary to reduce moisture content within the pavement structures. It is recommended that drainage detail be revised with a strong recommendation to install subsoil drainage along the runway, taxiway and apron pavement flanks. The design of this system should include adequate and frequent outlets into existing on-site open and closed drainage systems.

11.1 Pavement Structural Design

The FAA's software FAARfield is used to determine the thickness of proposed pavement structures. This software uses a linear elastic layer model for structural pavement design. Pavement strengthening and rehabilitation needs are assessed using two (2) traffic options, detailed in Table 24.

Option one supports a daily Dash 8-Q300 aircraft movement whilst option two supports 3 weekly Dash 8-Q400 movements. Both traffic scenarios are in addition to the itinerate B200 and B350 traffic detailed in Table 24. 100% of the traffic volume is used for analysis within the central 18m runway segment and TWY and apron pavements, whilst 50% of the traffic movements are used in the design of the outer runway segment. The latter volume is highly conservative as it is unlikely that 50% of traffic will use this outer runway alignment.

A subgrade CBR strength of 4% will be adopted for design. It is anticipated that this strength condition will not significantly alter even following sub-soil drainage installation.

Item	Aircraft Type	Weight (ton) (MTOW)	Tyre Pressure (kPa)	Annual Departures
1	BE20 – Beechcraft Super King Air 200	5.71	676	365
2	BE35 – Beechcraft Super King Air 350	6.85	670	365
3	Dash 8 – 300 series	19.6	670	365
3a	Dash 8 – Q400 series	29.3	670	156

Table 24 – Design Traffic Options

11.2 Design Options - RWY1432

The aim of these preliminary design options is to retain the majority of the pavement profile. Proposed drainage improvement measures aim to reduce the moisture condition and stabilise granular pavement layers, increasing strength.

The base course layer has been treated previously and is moderately bound. It will be necessary to disturb this base layer to a depth of at least 150mm by use of milling (profiling machines). The lower granular subbase course is proposed to be retained and is in no need of reworking.

11.2.1 Granular Improvement

This treatment retains the existing granular pavement base layer, and adds to and/or mixes-in additional granular material, increasing the pavement thickness profile. As a minimum, the following is necessary to treat the existing granular base layer:

a. the cemented granite/shale granular base layer within the central 18m of RWY1432 must be disturbed by milling and recompacted to a depth of at least 150mm. This treatment aims to blend sound and carbonised cemented materials, redistributing the aggregate grading within the layer, and modifying the material back into an unbound condition. Combined aggregate grading should be determined to understand if the milled material requires modification by the addition of granular materials so that an airfield compliant properties can be attained;
b. the shale-based granular base layer positioned outside of the central 18m of RWY1432 requires lime addition to neutralise plastic fines. This material appears to have a very coarse grading. Assessment of the combined aggregate grading is required to understand if the material requires modification with additional of finer materials to attain aircraft compliant material characteristics;
c. the sandy clay subbase layer within the TWY and apron requires lime addition to neutralise the high clay content within this layer; and
d. the dolerite granular base course layer within the TWY and apron requires lime addition to neutralise the plastic fines. This material appears to have a very coarse grading. Assessment of the combined aggregate grading is required to understand if the material requires modification with additional materials to attain aircraft compliant material characteristics.

11.2.2 In-situ Foam Bitumen Stabilization of Existing Granular Base Materials

In-situ foam bitumen stabilisation of the existing granular base course is a suitable option for pavement rehabilitation on Glen Innes airport. This process has been used elsewhere in Australia in the aim to reduce costs, provide water-resistant materials and reuse existing material resources.

Foam bitumen treatments however require specific planning and design processes that must be completed at the commencement of the design phase. Engineering parameters which are to be confirmed include suitability of existing granular material to be modified, suitability of the combined aggregate grading, affinity of the source rock and fine material, in particular, to bitumen binder, moisture condition and resultant material elastic modulus which is used as a structural design variable. Structural pavement design profiles listed herein are preliminary only and may change following determination of the material characteristics.

Furthermore, we have allowed for a two-coat bitumen spray seal surfacing to be applied on all pavement elements which may or may not be suitable under aircraft containing higher tyre pressures and increased weights. The success of applying early aircraft traffic to the surface of bitumen modified materials is dependent on strength gain with time.

Figure 6, Figure 7 and Figure 8 illustrate pavement design treatments determined for the central 18m portion of RWY1432, the outer RWY1432 portion and the apron and taxiway pavements, respectively.

11.2.3 Other Treatments

Other treatments that may be suitable but have not been considered here include:

i. in-situ cement treated base course. This treatment provides a hard and robust surface that is readily trafficked by aircraft with higher tyre pressures. However, high frequency shrinkage cracking can occur, reflecting to the surface. These cracks require regular maintenance using flexible bitumen-based sealants, and in colder weather crack width and severity can increase. For this reason, it is recommended that this treatment not be considered;

ii. deep lift asphalt overlay or mill and fill treatments. Although this treatment is considered appropriate for the operating conditions and pavement structure, initial capital and on-going maintenance costs can be prohibitive; and

iii. granular overlay treatment. This option is suitable for all pavement elements. Additional geometrical design considerations including flank regrading and repositioning of aircraft ground lights is required.

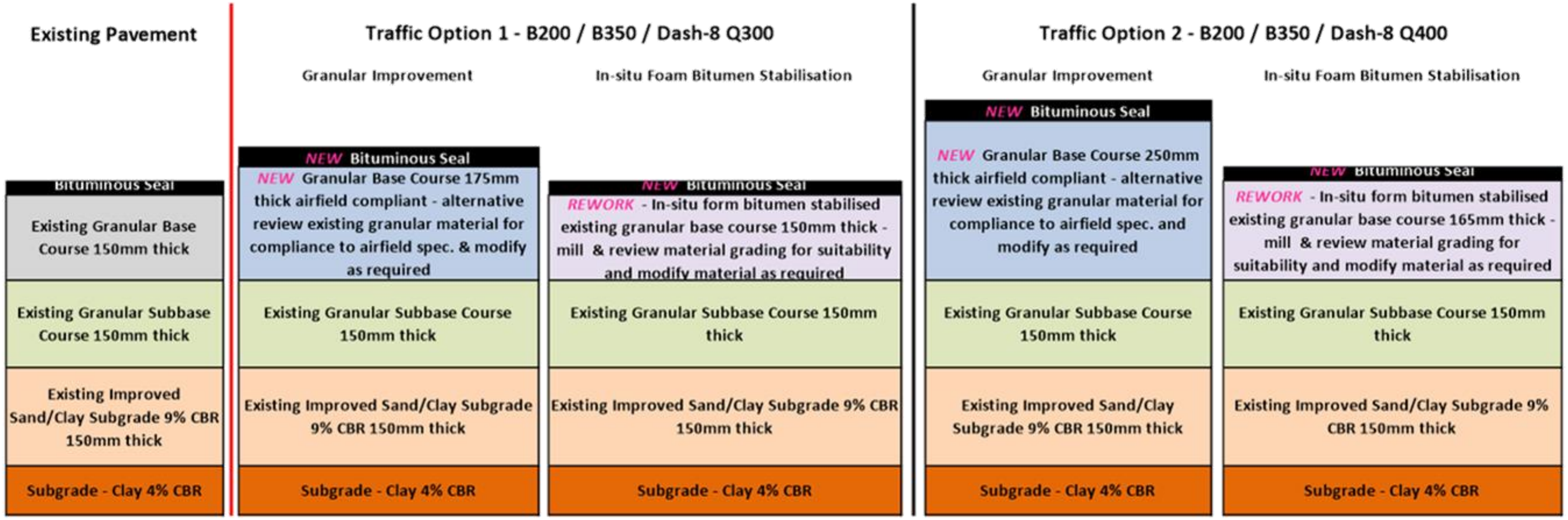


Figure 6 – Pavement Rehabilitation Thickness – RWY1432 Central 18m of the Runway

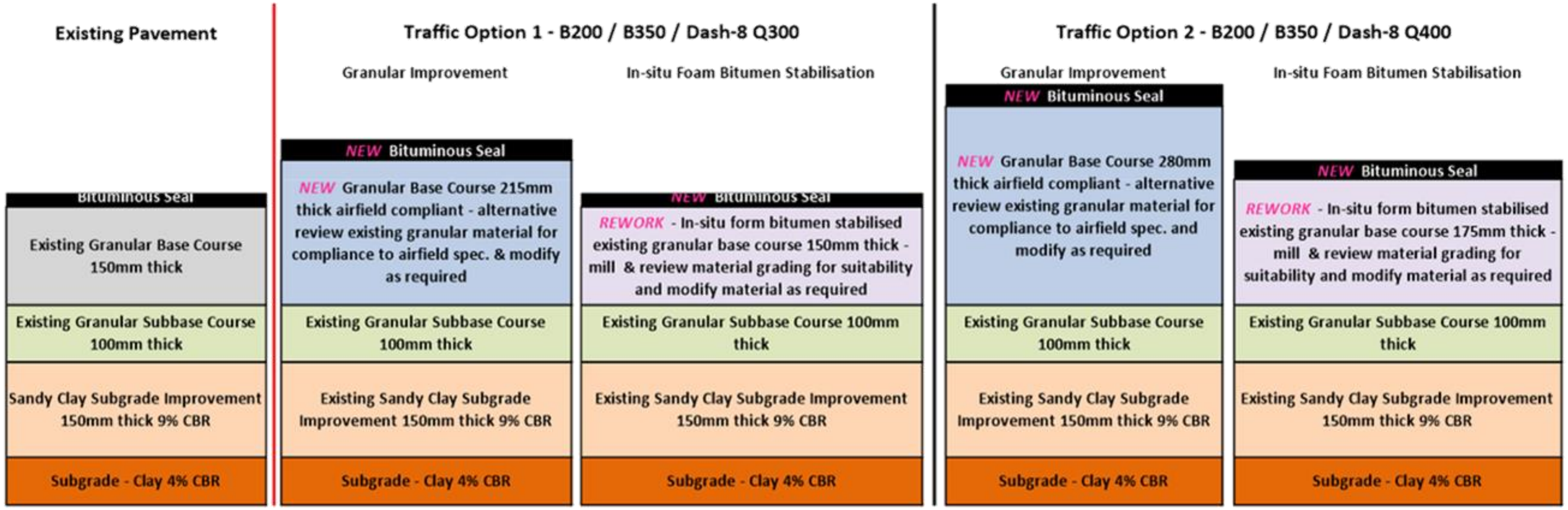


Figure 7 – Pavement Rehabilitation Thickness – RWY1432 Outer Runway

Existing Pavement	Traffic Option 1 - B200 / B350 / Dash-8 Q300		Traffic Option 2 - B200 / B350 / Dash-8 Q400	
	Granular Improvement	In-situ Foam Bitumen Stabilisation	Granular Improvement	In-situ Foam Bitumen Stabilisation
Bituminous Seal	*NEW* Bituminous Seal	*NEW* Bituminous Seal	*NEW* Bituminous Seal	*NEW* Bituminous Seal
Existing Granular Base Course 210mm thick	*IMPROVED* Existing Granular Base Course 210mm thick airfield compliant with addition of lime and aggregate as required	*REWORK* - In-situ form bitumen stabilised existing granular base course 210mm thick - mill & review material grading for suitability and modify material as required	*IMPROVED* Existing Granular Base Course 240mm thick airfield compliant with addition of lime and granular as required - apply in two layers	*REWORK* - In-situ form bitumen stabilised existing granular base course 210mm thick - mill & review material grading for suitability and modify material as required
Existing Clayey Sand Subbase Course 250mm thick	Lime *IMPROVED* Clayey Sand Granular Subbase Course 250mm thick	Lime *IMPROVED* Clayey Sand Granular Subbase Course 250mm thick	Lime *IMPROVED* Clayey Sand Granular Subbase Course 250mm thick	Lime *IMPROVED* Clayey Sand Granular Subbase Course 250mm thick
Existing Gabion Armour Rock Working Platform - assume 100mm thick	Existing Gabion Armour Rock Working Platform - assume 100mm thick	Existing Gabion Armour Rock Working Platform - assume 100mm thick	Existing Gabion Armour Rock Working Platform - assume 100mm thick	Existing Gabion Armour Rock Working Platform - assume 100mm thick
Subgrade - Clay 4% CBR	Subgrade - Clay 4% CBR	Subgrade - Clay 4% CBR	Subgrade - Clay 4% CBR	Subgrade - Clay 4% CBR

Figure 8 – Pavement Rehabilitation Thickness – Taxiway and Apron

Appendix One - Pavement Investigation

Pavement Investigation Glen Innes Airport

Rehbein Airport Consulting

Date: 14/02/2021

Notes relating to this Report

TITLE: Pavement Investigation: Glen Innes Airport – Pavement Investigation Report

COMPILED BY:
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COMMISSIONED BY: Ben Hargreaves

KEYWORDS: pavement investigation, bore hole logs
STATUS: open
COMPILER: Kamen Engineering Pty Ltd is a pavement and material technology consultancy undertaking pavement investigation, forensic failure investigations and pavement construction and design works.

This report has been prepared by Kamen Engineering Pty Ltd and submitted to the Client. The results and analysis contained in this report are based on a number of technical, circumstantial or otherwise specified assumptions and parameters. The user must make its own assessment of the suitability for the use of the information or material contained within or generated from the report. Kamen Engineering Pty Ltd and Ivan Mihaljevic excludes all liability to any party for expenses, losses, damages and costs arising directly or indirectly from using this report.

Qualified persons using this report
This report may contain technical or complex issues presented at a level that requires the reader to have appropriate qualifications in engineering, science, mathematics, technology and/or business to be able to understand and integrate the issues. Readers without qualifications or experience in these fields should refer the report to qualified and experienced personnel to translate and present it in conjunction with any additional material for understanding.

The Report
This has been prepared for the stated purpose by suitably qualified and experience personnel. It is based on the information obtained, conditions at the time or writing the report, and on current standards of interpretation and analysis. The report has been prepared for a specific case. The report may not be relevant if the project proposal is changed. Under changed conditions Kamen Engineering Pty Ltd should be consulted for further investigation and reporting or review of the report, for sufficiency and validity.

Every care is taken with the report as it is related to interpretation of conditions, forecasts and market analysis, discussion of factors, and recommendations or suggestions for development and implementation. However, Kamen Engineering Pty Ltd cannot always anticipate or assume responsibility for unexpected variations in environment, usage, government, legal, business, market or other conditions, given the fact that all reports are based on limited information, and they represent the snapshot in time which is at the time of preparation. The report is not an audit report, and is not a guarantee of success. The conclusions and recommendations of the report are likely to be affected by subsequent actions and developments.

The report should be considered as a starting point and the conditions predicted, issues raised and recommendations made, should be continuously reviewed during the implementation phase.

Reproduction of Information
For all aspects, in situations where the Client wishes to provide only part of the report, it is requested the Kamen Engineering Pty Ltd be informed. Kamen Engineering Pty Ltd would be pleased to advise the Client on the implications and if necessary prepare an edited report. Copying of this report can only be done in full and not in part.

Document Issue Record

Version	Author/ Verified	Description of Amendments	Date Issued
1	IM	Preliminary	02/03/2022
1a	IM	Client Review – corrected typos	21/07/2022

Bore Hole Log Summary

Bore Hole	01	02	04	05	08	09
Location	**RWY1432**	**RWY1432**	**RWY1432**	**RWY1432**	**RWY1432**	**RWY1432**
Chainage (m)	300	500	1250	1400	800	750
Offset from Centerline (m)	3m Left	6m Left	3m left	6m Left	6m Right	3m Right
Bituminous Seal (mm)	10	10	10	10	10	10
Cemented Granular base layer (mm)	130	140	180	180	390	250
Granular sub-base layer (mm)	180	160	120	120		90
Gravelly Clays (mm)	-	230				
Clayey Sands (mm)	-		400	250		400
Subgrade Material	Organic Clay	Not determined	Clayey Sands	Clayey Sands	Large cobbles + BIDIM	Clayey Sands
Total Granular (mm)	350	530	300	300	390	340
Hand Auger Refusal Depth (mm)	-	530	-	600	390	-

Bore Hole	03	10	10
Location	**RWY1432**	**RWY1432**	**RWY1432**
Chainage (m)	300	700	575
Offset from Centerline (m)	11m Right	11m Left	11m Left
Bituminous Seal (mm)	20	10	10
Granular base layer (mm)	155	70	100
Clayey granular sub-base layer (mm)	90	100	290
Subgrade Material	Sandy Clays	Over Concrete Culvert	Organic Clays
Total Granular (mm)	245	170	390
Hand Auger Refusal Depth (mm)	-	end of BH over culvert	

Bore Hole	06	07
Location	**APRON**	**TWY**
Chainage (m)	20	100
Offset from Centerline (m)	2nd FWD run	3m Left
Bituminous Seal (mm)	10	10
Granular base layer (mm)	210	215
Clayey Sands (mm)	290	305
Clayey Granular (mm)	100	150
Subgrade Material	Clayey Granular	Clayey Granular
Total Granular (mm)	600	665
Hand Auger Refusal Depth (mm)	600	665

Table 1 – Bore Hole Log Summary and Layer thickness

Bore Hole Locations

Site Photos

BH01 – Granular Base Course

BH01 – Organic Clays Subgrade

BH02 – Location

BH02 – Granular Base Course

BH02 - Granular Subbase

BH02 – Subgrade Clay

BH03 - Location

BH03 – Granular base layer

BH03 – Granular subbase layer

BH03 – Subgrade clay

BH04 – Location

BH04 – Granular Base layer

BH04 – Subgrade

BH05 – Location

BH05 – Granular base layer

BH05 – Granular subbase

BH05 – Subgrade clay

BH06 – Location

BH06 – Granular Base Course

BH06 – Granular Subbase (clayey sands)

BH07 – Location

BH07 – Granular base course

BH07- Clayey Sand

BH08 – Location

BH08 – Granular base layer

BH08 – BIDIM geofabric + free water at 390mm depth

BH09 – Location

BH09 - Poor bituminous seal to granular base course bond

BH09 – Granular base course

BH09 – Granular subbase

Item 7.28

Annexure B

BH09 – Subgrade Clayey Sand

BH10 – Location

BH10 – Granular Base Layer

BH11 – Location

BH11 – Granular Base Course

BH11 – Granular Subbase Layer

BH11 – Subgrade Organic Clay

PAVEMENT INVESTIGATION LOG REPORT

Client : Rehbein Airports
Location : RWY1432
Intersection Start : RWY14
Intersection Finish : RWY32
Report No: 220214

Chainage (m) : 300
Offset from Kerb (m) : 3m left
Direction :
Hole Diameter (mm) : 200
Excavation Method : Hand Excavation

Investigation Date : 14/02/2022
Report Date : 23/02/2022
Site Engineer / Tech : IM
Review : IM
Conditions : Fine 20oC

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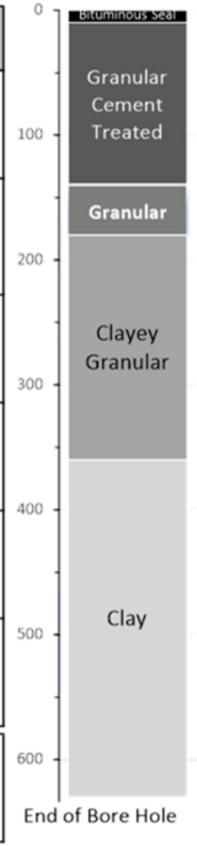
Bore Hole ID: 01

Layer	Layer Identification	Material Type	Layer Thickness (mm)	Aggregate Type	Nominal Size (mm)	Grading	Moisture Condition	Colour	Classification	In-Situ Condition	Auger Resistance	Consistency / Density	Plasticity	Plastic Limit
1	Surface	Bituminous Seal	10		7mm					Fair				
2	Base Course	Granular Cement Treated	130	Shale Granite	20 mm	Well Graded	Moist, MC<OMC	Grey Black White	GW - gravel well graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Non-plastic	
3	Sub-Base Course	Granular	40	Shale	20 mm	Well Graded	Moist, MC<OMC	Black Grey	GW - gravel well graded	Poor	Low	Loose (L) - removed by hand/easy to auger	Non-plastic	
4	Sub-Base Course	Clayey Granular	180	Granite	40 mm	Well Graded	Moist, MC<OMC	Grey Brown White	GW - gravel well graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Low to Medium	
5	Subgrade	Clay	270		0.002 - 0.075 mm Silt		Moist	Black Brown	OH - organic silts/clays/high plasticity		Low	Very Soft (VS) - oozes between fingers	High	MC > PL
6														



Comments -
Bitumen seal is brittle, fair condition, carbonisation of upper portion of cemented base layer & poor adhesion to upper bitumen seal, shallow bituminous prime penetration
Granular base course - in-situ cemented granular base course, low to mod. strength shale agg with added -7mm granite sand, nil to lightly bound / subbase - granite with est. 20% clays, good strength rock
Subgrade - organic silts

PAVEMENT INVESTIGATION LOG REPORT

Client : Rehbein Airports
Location : RWY1432
Intersection Start : RWY14
Intersection Finish : RWY32

Report No: 220214

Chainage (m) : 500
Offset from Kerb (m) : 6m left
Direction :
Hole Diameter (mm) : 200
Excavation Method : Hand Excavation

Investigation Date : 14/02/2022
Report Date : 23/02/2022
Site Engineer / Tech : IM
Review : IM
Conditions : Fine 20oC

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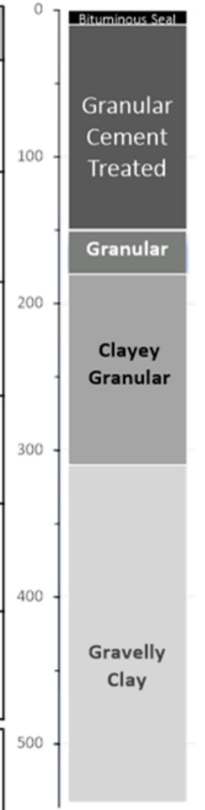
Bore Hole ID: 02

Layer	Layer Identification	Material Type	Layer Thickness (mm)	Aggregate Type	Nominal Size (mm)	Grading	Moisture Condition	Colour	Classification	In-Situ Condition	Auger Resistance	Consistency / Density	Plasticity	Plastic Limit
1	Surface	Bituminous Seal	10		7mm					Fair				
2	Base Course	Granular Cement Treated	140	Shale Granite	20 mm	Well Graded	Moist, MC<OMC	Grey Black White	GW - gravel well graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Non-plastic	
3	Sub-Base Course	Granular	30	Shale	20 mm	Well Graded	Moist, MC<OMC	Black Grey	GW - gravel well graded	Poor	Low	Loose (L) - removed by hand/easy to auger	Non-plastic	
4	Sub-Base Course	Clayey Granular	130	Granite	75 mm	Well Graded	Moist, MC<OMC	Grey White	GW - gravel well graded	Adequate	High	Dense (D) - difficult to auger	Low to Medium	
5	Subgrade	Gravelly Clay	230		0.002 - 0.075 mm Silt		Moist	Grey Brown Yellow	OH - organic silts/clays/high plasticity		Low	Very Soft (VS) - oozes between fingers	High	MC > PL
6														



End of Bore Hole

Comments -
Bitumen seal is brittle, fair condition, carbonisation of upper portion of cemented base layer & poor adhesion to upper bitumen seal, shallow bituminous prime penetration
Granular base course - in-situ cemented granular base course, low to mod. strength shale agg with added -7mm granite sand, nil to lightly bound / subbase - granite with est. 25% clay, good strength rock
Subgrade - organic silts mixed with granite sands and large rock fragments, fill material, wet and very soft, end of bore hole hand auger refusal in rock fragments

Item 7.28
Annexure B

PAVEMENT INVESTIGATION LOG REPORT

Client : Rehbein Airports
Location : RWY1432
Intersection Start : RWY14
Intersection Finish : RWY32
Report No: 220214

Chainage (m) : 800
Offset from Kerb (m) : 11m right
Direction :
Hole Diameter (mm) : 200
Excavation Method : Hand Excavation

Investigation Date : 14/02/2022
Report Date : 23/02/2022
Site Engineer / Tech : IM
Review : IM
Conditions : Fine 20oC

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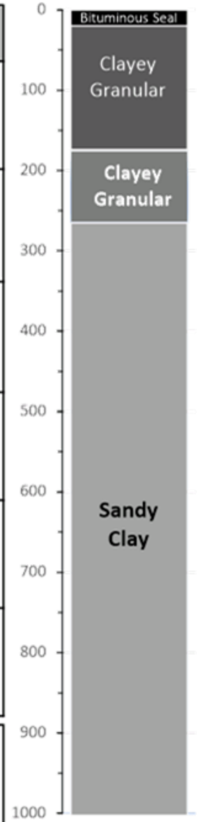
Bore Hole ID: 03

Layer	Layer Identification	Material Type	Layer Thickness (mm)	Aggregate Type	Nominal Size (mm)	Grading	Moisture Condition	Colour	Classification	In-Situ Condition	Auger Resistance	Consistency / Density	Plasticity	Plastic Limit
1	Surface	Bituminous Seal	20		7mm					Fair				
2	Base Course	Clayey Granular	155	Shale	20 mm	Poorly Graded - coarse	Moist, MC<OMC	Brown Black	GP - gravel poorly graded	Adequate	Low	Loose (L) - removed by hand/easy to auger	Medium	
3	Sub-Base Course	Clayey Granular	90	Granite	75 mm	Poorly Graded - coarse	Moist, MC<OMC	Grey Yellow White	GP - gravel poorly graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Medium	
4	Subgrade	Sandy Clay	750		0.002 - 0.075 mm Silt		Moist	Black Brown	OH - organic silts/clays/high plasticity		Medium	Firm (F) - can be moulded under strong pressure	High	MC < PL
5														
6														

Comments -
Bitumen seal - multiple layers, brittle, loose aggregate, good prime penetration, inadequate adhesion to granular layer
Granular base course - clayey shale of moderate strength agg., clay cont. est. 10%, poorly compacted / subbase - clayey granite, good str. rock, good agg. Interlock, clay est. @ 15%
Subgrade - organic silts mixed with granite sands fill material, firm in place & well compacted



End of Bore Hole

PAVEMENT INVESTIGATION LOG REPORT

Client : Rehbein Airports
Location : RWY1432
Intersection Start : RWY14
Intersection Finish : RWY32

Report No: 220214

Chainage (m) : 1250
Offset from Kerb (m) : 3m left
Direction :
Hole Diameter (mm) : 200
Excavation Method : Hand Excavation

Investigation Date : 14/02/2022
Report Date : 23/02/2022
Site Engineer / Tech : IM
Review : IM
Conditions : Fine 20oC

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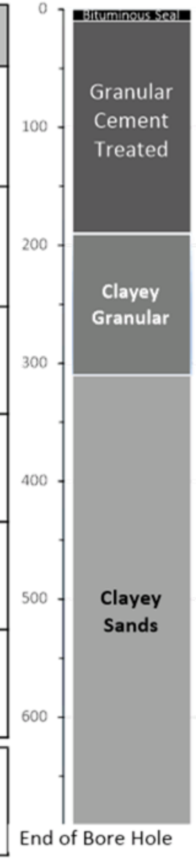
Bore Hole ID: 04

Layer	Layer Identification	Material Type	Layer Thickness (mm)	Aggregate Type	Nominal Size (mm)	Grading	Moisture Condition	Colour	Classification	In-Situ Condition	Auger Resistance	Consistency / Density	Plasticity	Plastic Limit
1	Surface	Bituminous Seal	10		7mm					Fair				
2	Base Course	Granular Cement Treated	180	Shale Granite	20 mm	Well Graded	Moist, MC>OMC	Grey Black Yellow	GW - gravel well graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Non-plastic	
3	Sub-Base Course	Clayey Granular	120	Granite	75 mm	Poorly Graded - coarse	Moist, MC>OMC	Grey Brown	GP - gravel poorly graded	Adequate	High	Dense (D) - difficult to auger	Medium	
4	Subgrade	Clayey Sands	400		< 0.002 mm Clay		Moist	Grey Brown	SC - clayey sands		Medium	Dense (D) - difficult to auger	Medium to High	
5														
6														

Comments -
Bitumen seal is brittle, fair condition, carbonisation of upper portion of cemented base layer & poor adhesion to upper bitumen seal, shallow bituminous prime penetration
Granular base course - low cemented bond strength, moderate compaction, wet, low density / subbase layer - clayey gravel, good agg. Interlock, high clay content
Subgrade - organic silts mixed with high granite sands content, fill material, stiff in place, dense



PAVEMENT INVESTIGATION LOG REPORT

Client : Rehbein Airports
Location : RWY1432
Intersection Start : RWY14
Intersection Finish : RWY32

Report No: 220214

Chainage (m) : 1400
Offset from Kerb (m) : 6m left
Direction :
Hole Diameter (mm) : 200
Excavation Method : Hand Excavation

Investigation Date : 14/02/2022
Report Date : 23/02/2022
Site Engineer / Tech : IM
Review : IM
Conditions : Fine 20oC

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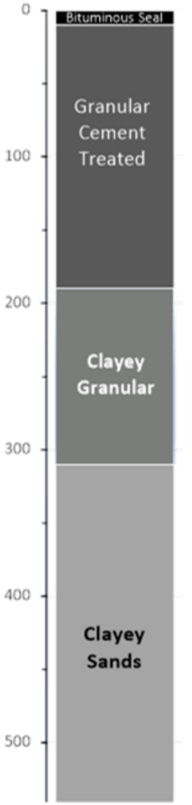
Bore Hole ID: 05

Layer	Layer Identification	Material Type	Layer Thickness (mm)	Aggregate Type	Nominal Size (mm)	Grading	Moisture Condition	Colour	Classification	In-Situ Condition	Auger Resistance	Consistency / Density	Plasticity	Plastic Limit
1	Surface	Bituminous Seal	10		7mm					Fair				
2	Base Course	Granular Cement Treated	180	Shale Granite	20 mm	Well Graded	Moist, MC>OMC	Grey Brown	GW - gravel well graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Non-plastic	
3	Sub-Base Course	Clayey Granular	120	Granite	75 mm	Well Graded	Moist, MC>OMC	Grey Brown	GW - gravel well graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Medium	
4	Subgrade	Clayey Sands	250		< 0.002 mm Clay		Moist	Grey	SC - clayey sands		Medium	Dense (D) - difficult to auger	Medium to High	
5														
6														



End of Bore Hole

Comments -
Bitumen seal is brittle, fair condition, carbonisation of upper portion of cemented base layer & poor adhesion to upper bitumen seal, shallow bituminous prime penetration
Granular base course - low cemented bond strength, moderate compaction, wet, low density / subbase layer - clayey gravel, good agg. Interlock, est. 25% clay content
Subgrade - highly sandy plastic clays, trace organics and aggregates - end of bore hole auger refusal on rock fragment

PAVEMENT INVESTIGATION LOG REPORT

Client : Rehbein Airports
Location : RWY1432
Intersection Start : RWY14
Intersection Finish : RWY32

Report No: 220214

Chainage (m) : 800
Offset from Kerb (m) : 6m right
Direction :
Hole Diameter (mm) : 200
Excavation Method : Hand Excavation

Investigation Date : 14/02/2022
Report Date : 23/02/2022
Site Engineer / Tech : IM
Review : IM
Conditions : Fine 20oC

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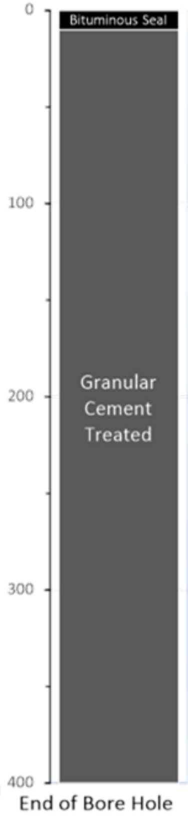
Bore Hole ID: 08

Layer	Layer Identification	Material Type	Layer Thickness (mm)	Aggregate Type	Nominal Size (mm)	Grading	Moisture Condition	Colour	Classification	In-Situ Condition	Auger Resistance	Consistency / Density	Plasticity	Plastic Limit
1	Surface	Bituminous Seal	10		7mm					Fair				
2	Base Course	Granular Cement Treated	390	Shale Granite	20 mm	Well Graded	Moist, MC>OMC	Grey Brown	GW - gravel well graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Non-plastic	
3														
4														
5														
6														

BIDIM Geofabric at bottom of granular layer
Free water under granular layer
Hand auger refusal in cobble size granite rock at subgrade level



Comments -
Bitumen seal is brittle, fair condition, carbonisation of upper portion of cemented base layer & poor adhesion to upper bitumen seal, shallow bituminous prime penetration
Granular base course - low cemented bond strength, moderate compaction, wet, low density, mostly granite sand, poorly graded, BIDIM geofabric at bottom of layer, free water at 380mm de
Subgrade - high volume of cobble rock under geofabric, could not penetrate - end of bore hole

PAVEMENT INVESTIGATION LOG REPORT

Client : Rehbein Airports
Location : RWY1432
Intersection Start : RWY14
Intersection Finish : RWY32

Report No: 220214

Chainage (m) : 750
Offset from Kerb (m) : 3m right
Direction :
Hole Diameter (mm) : 200
Excavation Method : Hand Excavation

Investigation Date : 14/02/2022
Report Date : 23/02/2022
Site Engineer / Tech : IM
Review : IM
Conditions : Fine 20oC

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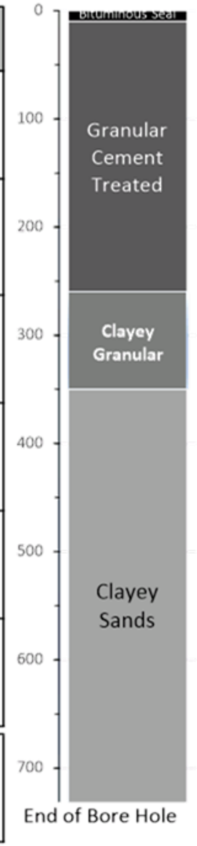
Bore Hole ID: 09

Layer	Layer Identification	Material Type	Layer Thickness (mm)	Aggregate Type	Nominal Size (mm)	Grading	Moisture Condition	Colour	Classification	In-Situ Condition	Auger Resistance	Consistency / Density	Plasticity	Plastic Limit
1	Surface	Bituminous Seal	10		7mm					Fair				
2	Base Course	Granular Cement Treated	250	Shale Granite	20 mm	Well Graded	Moist, MC@OMC	Grey Brown Yellow	GW - gravel well graded	Adequate	High	Dense (D) - difficult to auger	Low	
3	Sub-Base Course	Clayey Granular	90	Granite	75 mm	Poorly Graded - fine	Moist, MC@OMC	Grey Yellow Brown	GP - gravel poorly graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Medium	
4	Subgrade	Clayey Sands	400		< 0.002 mm Clay		Moist, MC>OMC	Grey Green	SC - clayey sands		Medium	Dense (D) - difficult to auger	Medium to High	
5														
6														



Comments -
Bitumen seal is brittle, fair condition, carbonisation of upper portion of cemented base layer & poor adhesion to upper bitumen seal, shallow bituminous prime penetration
Granular base course - in-situ cemented granular base course, mod. to high strength shale agg with added -7mm granite sand & 5% clay cont. / subbase - granite sand with est. 15% clays, very fine with some 75mm rock
Subgrade - weathered granite sand mixed with organic silts, 10% added 10mm size agg.

PAVEMENT INVESTIGATION LOG REPORT

Client : Rehbein Airports
Location : RWY1432
Intersection Start : RWY14
Intersection Finish : RWY32
Report No: 220214

Chainage (m) : 700
Offset from Kerb (m) : 11m left
Direction :
Hole Diameter (mm) : 200
Excavation Method : Hand Excavation

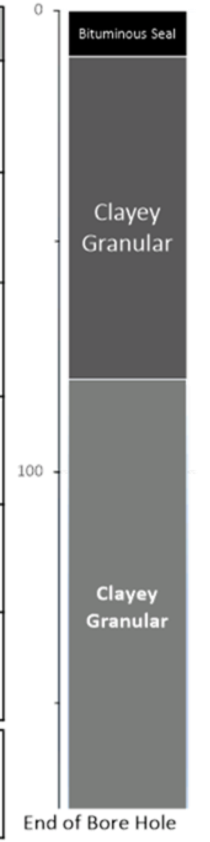
Investigation Date : 14/02/2022
Report Date : 23/02/2022
Site Engineer / Tech : IM
Review : IM
Conditions : Fine 20oC

KAMEN ENGINEERING
ACN 59 093 900 906
27/192A Kingsgrove Rd Kingsgrove NSW 2208
Phone: +61 2 9099 4810
email: kamen@kameneng.com

Bore Hole ID: 10

Layer	Layer Identification	Material Type	Layer Thickness (mm)	Aggregate Type	Nominal Size (mm)	Grading	Moisture Condition	Colour	Classification	In-Situ Condition	Auger Resistance	Consistency / Density	Plasticity	Plastic Limit
1	Surface	Bituminous Seal	10		7mm					Fair				
2	Base Course	Clayey Granular	70	Shale	20 mm	Poorly Graded - coarse	Moist, MC<OMC	Brown	GP - gravel poorly graded	Adequate	Low	Loose (L) - removed by hand/easy to auger	Medium	
3	Sub-Base Course	Clayey Granular	100	Granite	7mm	Poorly Graded - coarse	Moist, MC@OMC	Grey Yellow White	GP - gravel poorly graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Medium	
4														
5														
6														

Comments -
Bitumen seal is brittle, fair condition, seal and prime good bond with granular base
Granular base course - shale gravel, too coarse, very wet, poorly compacted, loose in place / subbase granite sand well compacted / end of bore hole over concrete culvert



Item 7.28

Annexure B

PAVEMENT INVESTIGATION LOG REPORT

Client : Rehbein Airports
Location : RWY1432
Intersection Start : RWY14
Intersection Finish : RWY32
Report No: 220214

Chainage (m) : 575
Offset from Kerb (m) : 11m left
Direction :
Hole Diameter (mm) : 200
Excavation Method : Hand Excavation

Investigation Date : 14/02/2022
Report Date : 23/02/2022
Site Engineer / Tech : IM
Review : IM
Conditions : Fine 20oC

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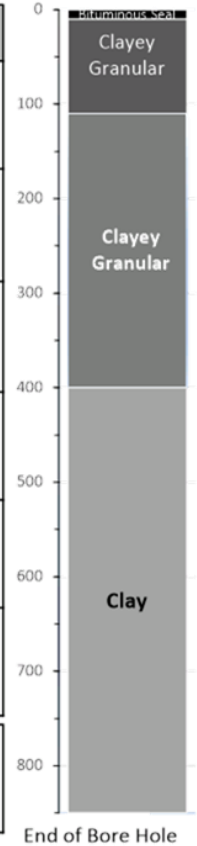
ACN 59 093 900 906
27/192A Kingsgrove Rd Kingsgrove NSW 2208
Phone: +61 2 9099 4810
email: kamen@kameneng.com

Bore Hole ID: 11

Layer	Layer Identification	Material Type	Layer Thickness (mm)	Aggregate Type	Nominal Size (mm)	Grading	Moisture Condition	Colour	Classification	In-Situ Condition	Auger Resistance	Consistency / Density	Plasticity	Plastic Limit
1	Surface	Bituminous Seal	10		7mm					Fair				
2	Base Course	Clayey Granular	100	Shale	20 mm	Poorly Graded - coarse	Moist, MC@OMC	Brown Black	GP - gravel poorly graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Low	
3	Sub-Base Course	Clayey Granular	290	Granite	75 mm	Poorly Graded - coarse	Moist, MC<OMC	Brown Yellow White	GP - gravel poorly graded	Adequate	High	Dense (D) - difficult to auger	Medium	
4	Subgrade	Clay	450		0.002 - 0.075 mm Silt		Moist	Grey Green	OH - organic silts/clays/high plasticity		Low	Very Soft (VS) - oozes between fingers	High	MC > PL
5														
6														



Comments -
Bitumen seal - multiple layers, brittle, loose aggregate, good prime penetration, good adhesion to granular layer
Granular base course - shale gravel, too coarse, moderate compaction, clay fines at 10% est. / subbase granite gravel, well compacted, good agg. Interlock, clay cont. est. at 20%
Subgrade - organic silts, natural subgrade

PAVEMENT INVESTIGATION LOG REPORT

Client : Rehbein Airports
Location : APRON
Intersection Start :
Intersection Finish :
Report No: 220214

Chainage (m) : 20
Offset from Kerb (m) : 2 FWD run
Direction :
Hole Diameter (mm) : 200
Excavation Method : Hand Excavation

Investigation Date : 14/02/2022
Report Date : 23/02/2022
Site Engineer / Tech : IM
Review : IM
Conditions : Fine 20oC

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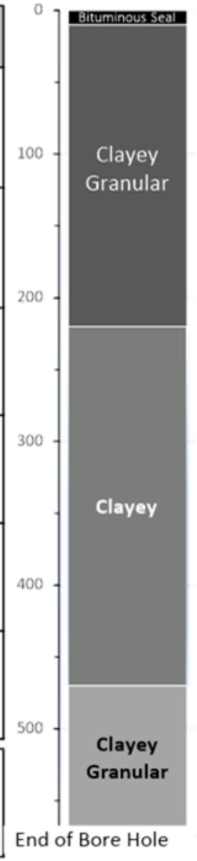
email: kamen@kameneng.com

Bore Hole ID: 06

Layer	Layer Identification	Material Type	Layer Thickness (mm)	Aggregate Type	Nominal Size (mm)	Grading	Moisture Condition	Colour	Classification	In-Situ Condition	Auger Resistance	Consistency / Density	Plasticity	Plastic Limit
1	Surface	Bituminous Seal	10		7mm					Fair				
2	Base Course	Clayey Granular	210	Dolerite	14 mm	Poorly Graded - coarse	Moist, MC@OMC	Brown Grey	GP - gravel poorly graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Low	
3	Sub-Base Course	Clayey Sands	250	Quartz	3mm	Single Sized	Moist, MC>OMC	Grey	SC - clayey sands	Fair	Low	Loose (L) - removed by hand/easy to auger	Medium	
4	Sub-Base Course	Clayey Granular	100	Granite	50 mm	Poorly Graded - middle missing	Moist, MC>OMC	Brown	GP - gravel poorly graded	Adequate	High	Dense (D) - difficult to auger	Medium	
5														
6														



Comments -
Bitumen seal is brittle, fair condition, delaminated from prime, poor adhesion
Granular base course - dolerite gravel, good str. agg., clay content <10%, too coarse, holds water and wet, good compaction density / subbase - clayey sand, single size, moist, low moisture penetration
Subbase lower layer - clayey sand + 50mm size granite rock, well compacted hard in place, bore hole at refusal in this material

PAVEMENT INVESTIGATION LOG REPORT

Client : Rehbein Airports
Location : TWY
Intersection Start :
Intersection Finish :

Report No: 220214

Chainage (m) : 100
Offset from Kerb (m) : 3m left
Direction :
Hole Diameter (mm) : 200
Excavation Method : Hand Excavation

Investigation Date : 14/02/2022
Report Date : 23/02/2022
Site Engineer / Tech : IM
Review : IM
Conditions : Fine 20oC

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ACN 59 093 900 906
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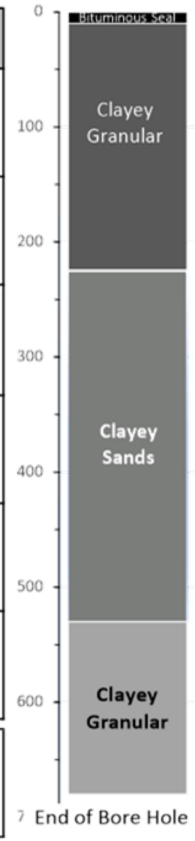
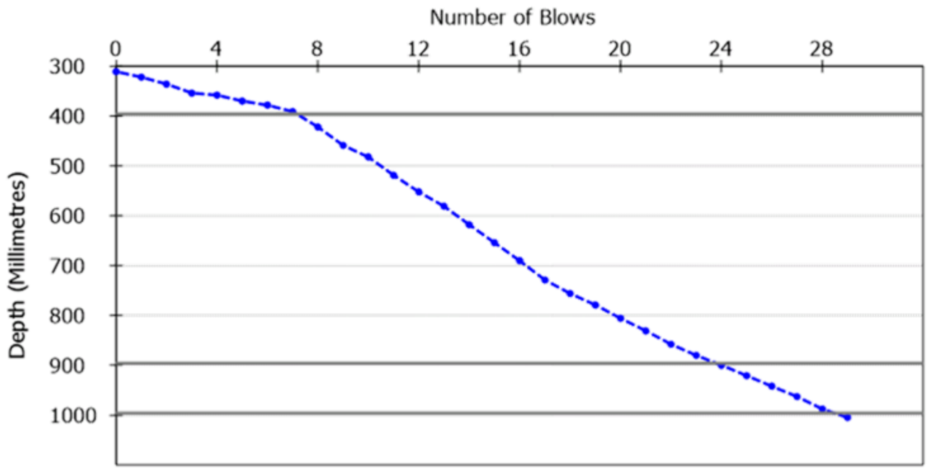
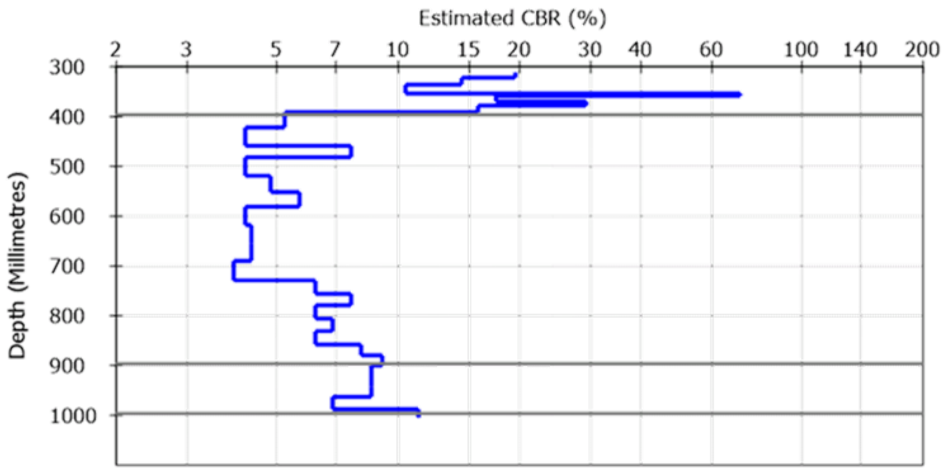
Bore Hole ID: 07

Layer	Layer Identification	Material Type	Layer Thickness (mm)	Aggregate Type	Nominal Size (mm)	Grading	Moisture Condition	Colour	Classification	In-Situ Condition	Auger Resistance	Consistency / Density	Plasticity	Plastic Limit
1	Surface	Bituminous Seal	10		7mm					Fair				
2	Base Course	Clayey Granular	215	Dolerite	14 mm	Poorly Graded - coarse	Moist, MC@OMC	Brown Grey	GP - gravel poorly graded	Adequate	Medium	Medium Dense (MD) - strain under auger extraction	Low	
3	Sub-Base Course	Clayey Sands	305	Quartz	3mm	Single Sized	Moist, MC>OMC	Grey	SC - clayey sands	Fair	Low	Loose (L) - removed by hand/easy to auger	Medium	
4	Sub-Base Course	Clayey Granular	150	Granite	50 mm	Poorly Graded - middle missing	Moist, MC@OMC	Brown	GP - gravel poorly graded	Adequate	High	Very Dense (VD) - difficult to auger	Medium	
5														
6														



Comments -
Bitumen seal is brittle, fair condition, delaminated from prime, poor adhesion
Granular base course - dolerite gravel, good str. agg., clay content <10%, too coarse, holds water and wet, good compaction density / subbase - clayey sand, single size, moist, low moisture penetration
Subgrade - highly plastic clays, trace organics and aggregates - end of bore hole auger refusal on rock fragment





Layer Property Summary (for Reference Depth of 311 Millimetres)

Thickness (Millimetres)	Avg. Penetration Rate (Millimetres/Blow)	Estimated CBR (%)	Estimated Stiffness (MPa)
85	11.4	19	36.8- (84) - 192
500	30.6	5	13- (29.6) - 67.4
100	21.6	8	18.7- (42.7) - 97.5

Total Penetration Summary

Est. Pavement Capacity Based on DSN800	General Notes
< 0.1 MESA if Dry < 0.1 MESA if at Optimum Moisture < 0.1 MESA if Wet < 0.1 MESA if Saturated	Blows to penetrate 800 mm = 20 Penetration Rate to CBR conversion is based on the relationship published by Kleyn (60 Deg. Cone)

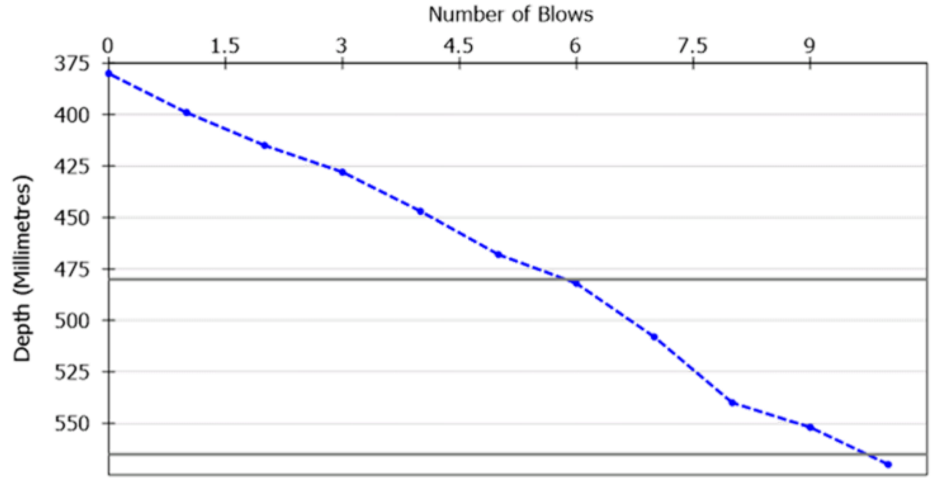
KAMEN ENGINEERING

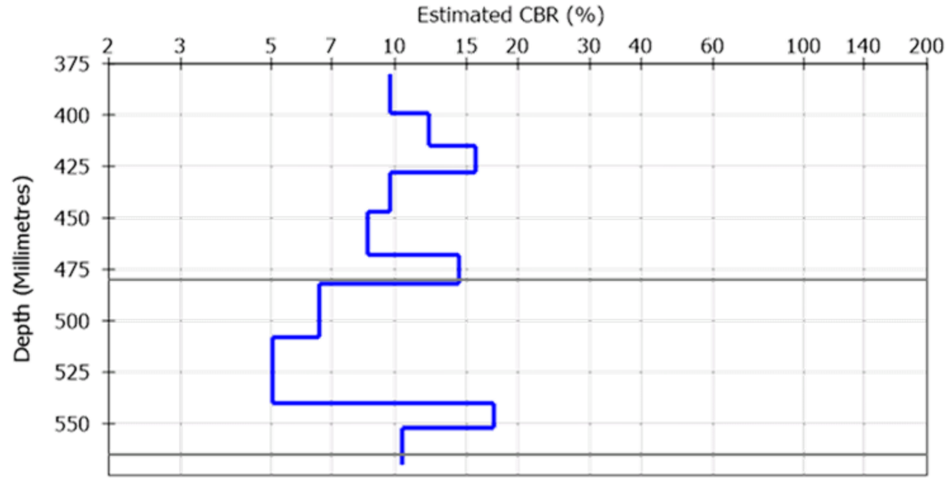
Glen Innes Airport

BH01

BH01

Rubicon Toolbox: DCP Analysis / Ver: 4.6 / (Licenced)





Layer Property Summary (for Reference Depth of 380 Millimetres)			
Thickness (Millimetres)	Avg. Penetration Rate (Millimetres/Blow)	Estimated CBR (%)	Estimated Stiffness (MPa)
100	17.6	11	23.3- (53.1) - 121
85	21	9	19.3- (44) - 100

Total Penetration Summary	
Est. Pavement Capacity Based on DSN800	General Notes
< 0.1 MESA if Dry < 0.1 MESA if at Optimum Moisture < 0.1 MESA if Wet < 0.1 MESA if Saturated	Blows to penetrate 800 mm = 21 Penetration Rate to CBR conversion is based on the relationship published by Kleyn (60 Deg. Cone)

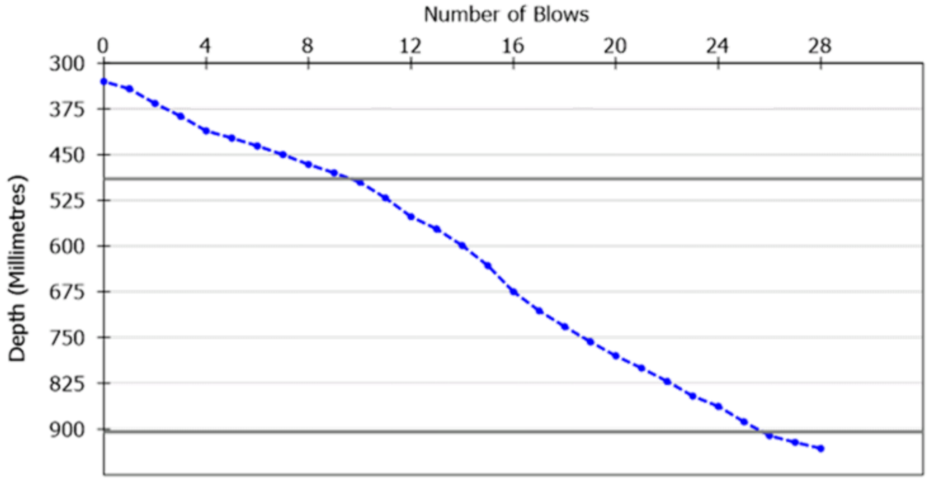
KAMEN ENGINEERING

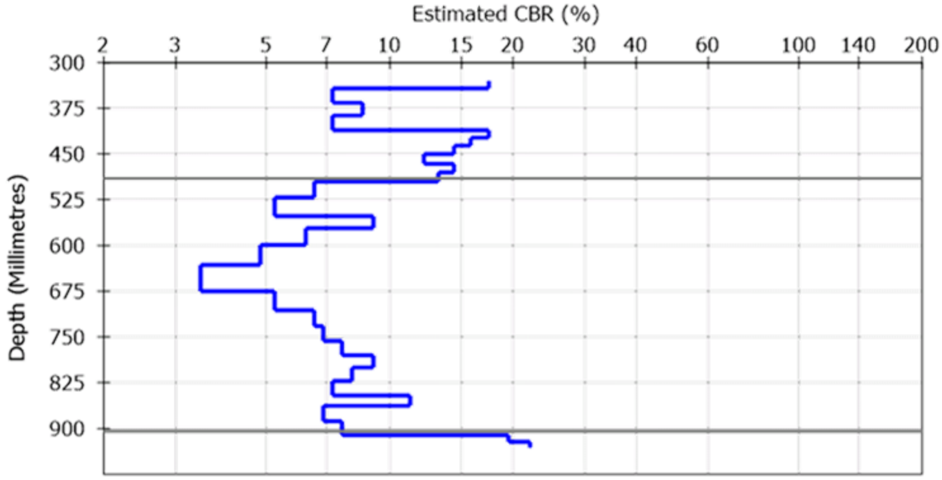
Glen Innes Airport

BH02

BH02

Rubicon Toolbox: DCP Analysis / Ver: 4.6 / (Licenced)





Layer Property Summary (for Reference Depth of 330 Millimetres)			
Thickness (Millimetres)	Avg. Penetration Rate (Millimetres/Blow)	Estimated CBR (%)	Estimated Stiffness (MPa)
160	16.7	12	24.7- (56.3) - 128
415	25.5	7	15.7- (35.8) - 81.7

Total Penetration Summary

Est. Pavement Capacity Based on DSN800	General Notes
< 0.1 MESA if Dry < 0.1 MESA if at Optimum Moisture < 0.1 MESA if Wet < 0.1 MESA if Saturated	Blows to penetrate 800 mm = 21 Penetration Rate to CBR conversion is based on the relationship published by Kleyn (60 Deg. Cone)

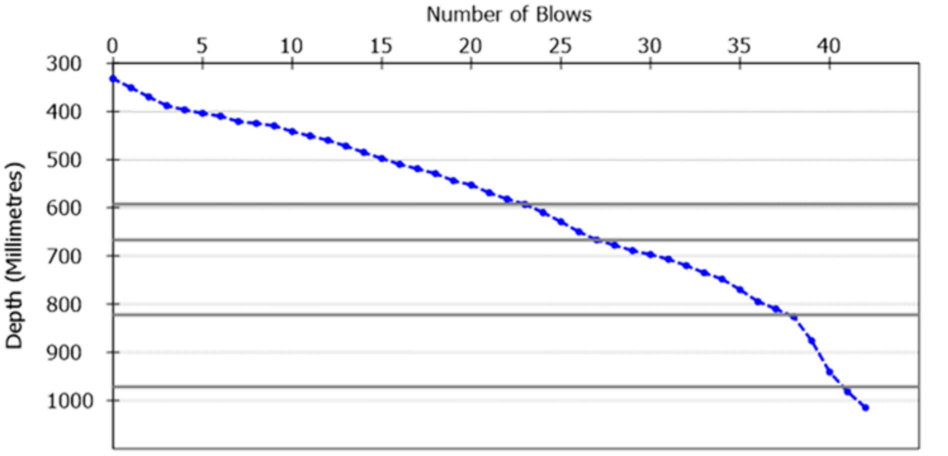
KAMEN ENGINEERING

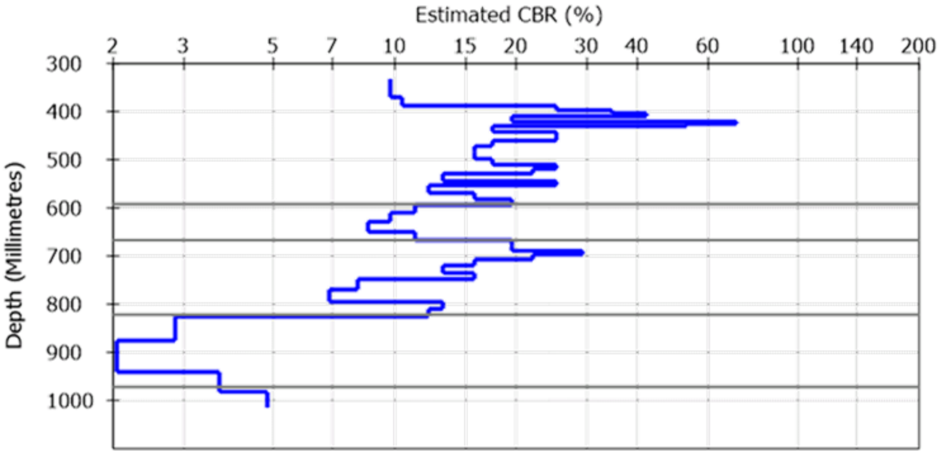
Glen Innes Airport

BH03

BH03

Rubicon Toolbox: DCP Analysis / Ver: 4.6 / (Licenced)





Layer Property Summary (for Reference Depth of 332 Millimetres)

Thickness (Millimetres)	Avg. Penetration Rate (Millimetres/Blow)	Estimated CBR (%)	Estimated Stiffness (MPa)
260	11.4	19	37.1- (84.5) - 193
75	17	11	24.2- (55.1) - 126
155	14.3	14	29- (66.2) - 151
150	43.7	3	8.88- (20.2) - 46.2

Total Penetration Summary

Est. Pavement Capacity Based on DSN800	General Notes
< 0.1 MESA if Dry < 0.1 MESA if at Optimum Moisture < 0.1 MESA if Wet < 0.1 MESA if Saturated	Blows to penetrate 800 mm = 36 Penetration Rate to CBR conversion is based on the relationship published by Kleyn (60 Deg. Cone)

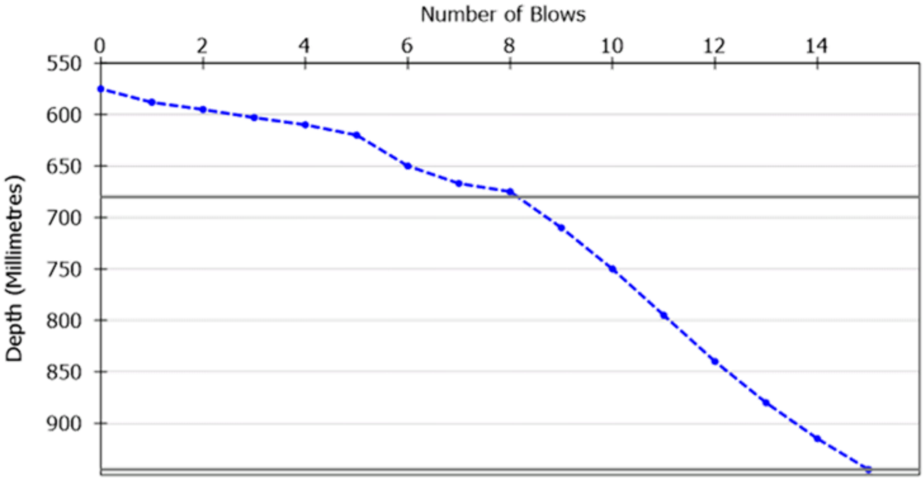
KAMEN ENGINEERING

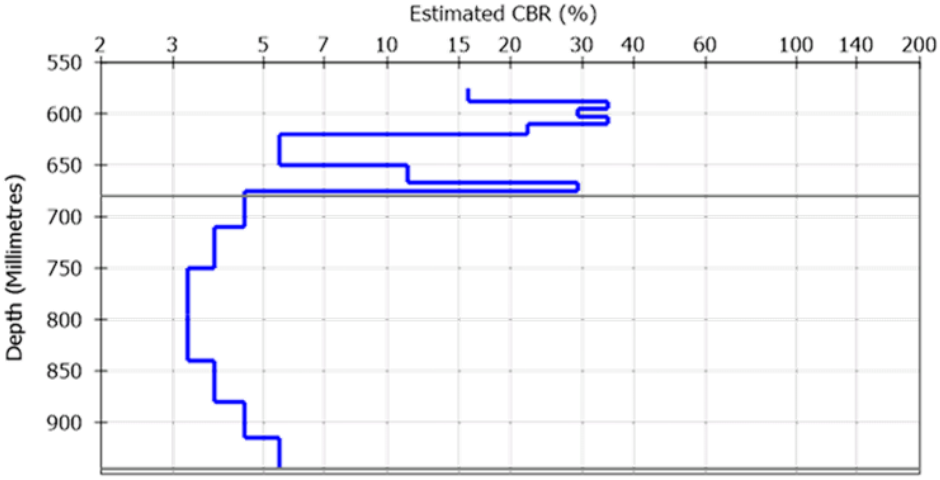
Glen Innes Airport

BH04

BH04

Rubicon Toolbox: DCP Analysis / Ver: 4.6 / (Licenced)





Layer Property Summary (for Reference Depth of 575 Millimetres)			
Thickness (Millimetres)	Avg. Penetration Rate (Millimetres/Blow)	Estimated CBR (%)	Estimated Stiffness (MPa)
105	12.5	17	33.5- (76.4) - 174
265	38.6	4	10.1- (23.1) - 52.7

Total Penetration Summary

Est. Pavement Capacity Based on DSN800	General Notes
< 0.1 MESA if Dry < 0.1 MESA if at Optimum Moisture < 0.1 MESA if Wet < 0.1 MESA if Saturated	Blows to penetrate 800 mm = 11 Penetration Rate to CBR conversion is based on the relationship published by Kleyn (60 Deg. Cone)

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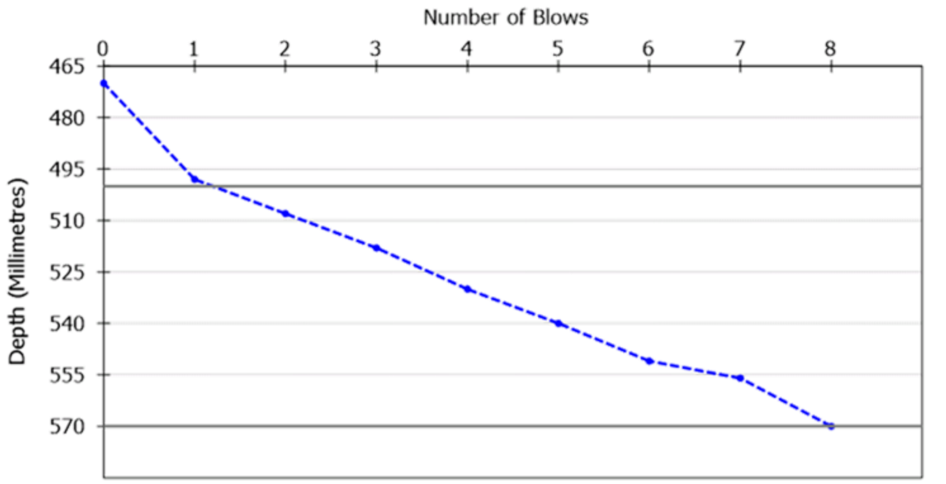
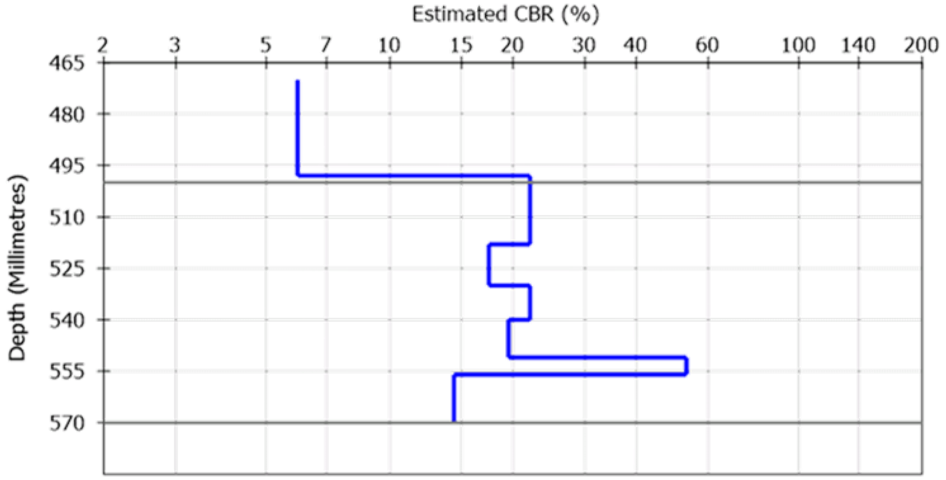
BH05

BH05

Rubicon Toolbox: DCP Analysis / Ver: 4.6 / (Licenced)





Layer Property Summary (for Reference Depth of 470 Millimetres)			
Thickness (Millimetres)	Avg. Penetration Rate (Millimetres/Blow)	Estimated CBR (%)	Estimated Stiffness (MPa)
30	28	6	14.2- (32.4) - 74
70	10.3	21	41.2- (94) - 214

Total Penetration Summary

Est. Pavement Capacity Based on DSN800	General Notes
< 0.1 MESA if Dry < 0.1 MESA if at Optimum Moisture < 0.1 MESA if Wet < 0.1 MESA if Saturated	Blows to penetrate 800 mm = 31 Penetration Rate to CBR conversion is based on the relationship published by Kleyn (60 Deg. Cone)

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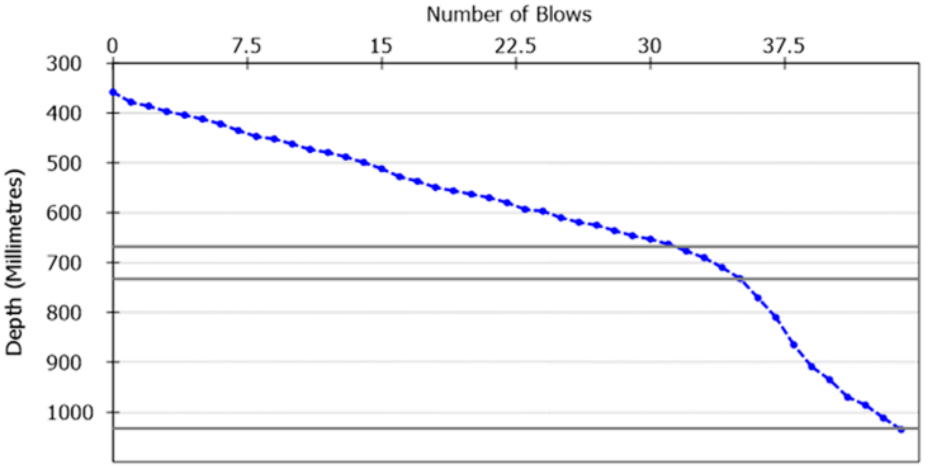
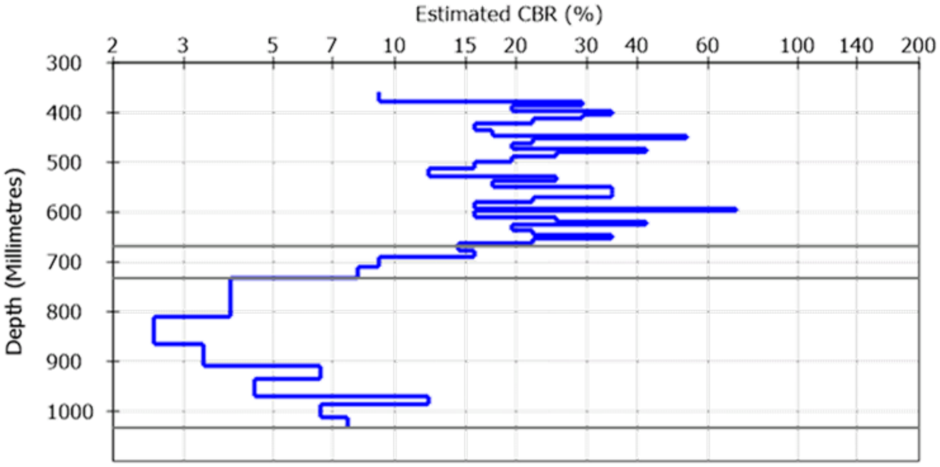
Glen Innes Airport

BH08

BH08

Rubicon Toolbox: DCP Analysis / Ver: 4.6 / (Licenced)





Layer Property Summary (for Reference Depth of 358 Millimetres)

Thickness (Millimetres)	Avg. Penetration Rate (Millimetres/Blow)	Estimated CBR (%)	Estimated Stiffness (MPa)
310	9.84	22	43.2- (98.5) - 225
65	17.2	11	23.8- (54.3) - 124
300	35	4	11.2- (25.6) - 58.4

Total Penetration Summary

Est. Pavement Capacity Based on DSN800	General Notes
< 0.1 MESA if Dry < 0.1 MESA if at Optimum Moisture < 0.1 MESA if Wet < 0.1 MESA if Saturated	Blows to penetrate 800 mm = 37 Penetration Rate to CBR conversion is based on the relationship published by Kleyn (60 Deg. Cone)

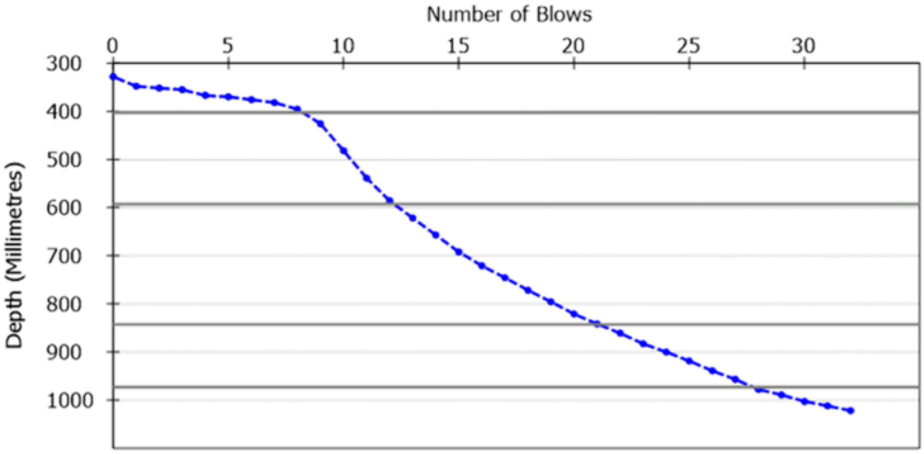
KAMEN ENGINEERING

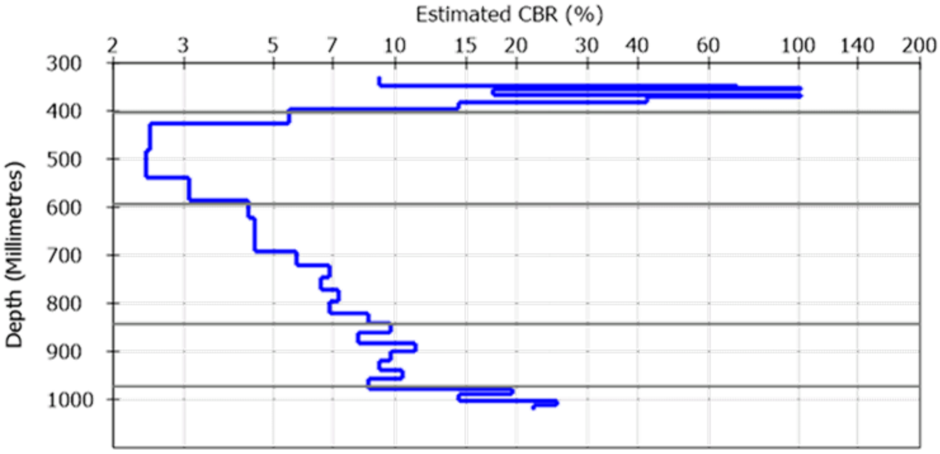
Glen Innes Airport

BH09

BH09

Rubicon Toolbox: DCP Analysis / Ver: 4.6 / (Licenced)





Layer Property Summary (for Reference Depth of 328 Millimetres)			
Thickness (Millimetres)	Avg. Penetration Rate (Millimetres/Blow)	Estimated CBR (%)	Estimated Stiffness (MPa)
75	8.5	27	50.4- (115) - 262
190	47.5	3	8.12- (18.5) - 42.2
250	28.4	6	14- (31.9) - 72.8
130	19.2	10	21.3- (48.5) - 111

Total Penetration Summary

Est. Pavement Capacity Based on DSN800	General Notes
< 0.1 MESA if Dry < 0.1 MESA if at Optimum Moisture < 0.1 MESA if Wet < 0.1 MESA if Saturated	Blows to penetrate 800 mm = 19 Penetration Rate to CBR conversion is based on the relationship published by Kleyn (60 Deg. Cone)

KAMEN ENGINEERING

Glen Innes Airport

BH11

BH11

Rubicon Toolbox: DCP Analysis / Ver: 4.6 / (Licenced)

Appendix Two - FAARField Outputs

Table 1 - Traffic Option 1 - B200 / B350 / Dash-9 Q300 - Granular Improvement

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1

Central 18m Alignment RWY1432

Analysis Type: New Flexible

Last Run: Thickness Design

Design Life = 20 Years

Total thickness to the top of the subgrade = 471mm

Pavement Structure Information by Layer

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R MPa
1	User Defined	175.0	500	0.35	0
2	P-208 Crushed Aggregate	150.0	517	0.35	0
3	User Defined	146.2	90	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	365	0
2	Beechcraft King Air 350	6849	365	0
3	Q300/Dash 8 Series 300	19595	365	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.31

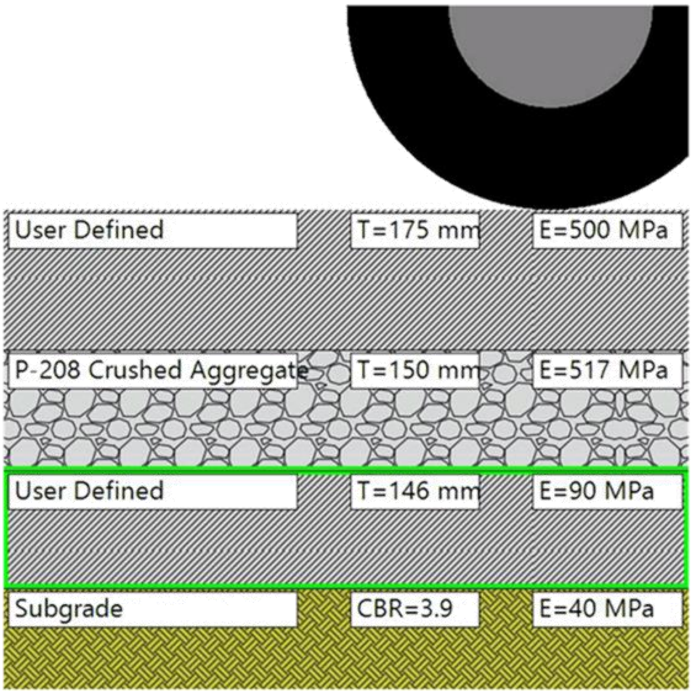
Page 1

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.27
3	Q300/Dash 8 Series 300	1.0	1.00	1.88

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.00	0.00	3.36
2	Beechcraft King Air 350	0.00	0.00	3.27
3	Q300/Dash 8 Series 300	0.02	0.02	2.56

User Is responsible For checking frost protection requirements.



Page 2

Table 2 - Traffic Option 1 - B200 / B350 / Dash-8 Q300 Bitumen Stabilisation

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1

Central 18m Alignment RWY1432

Analysis Type: New Flexible

Last Run: Thickness Design

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	User Defined	150.0	2200	0.35	0
2	P-208 Crushed Aggregate	150.0	517	0.35	0
3	User Defined	38.2	90	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	365	0
2	Beechcraft King Air 350	6849	365	0
3	Q300/Dash 8 Series 300	19595	365	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.67

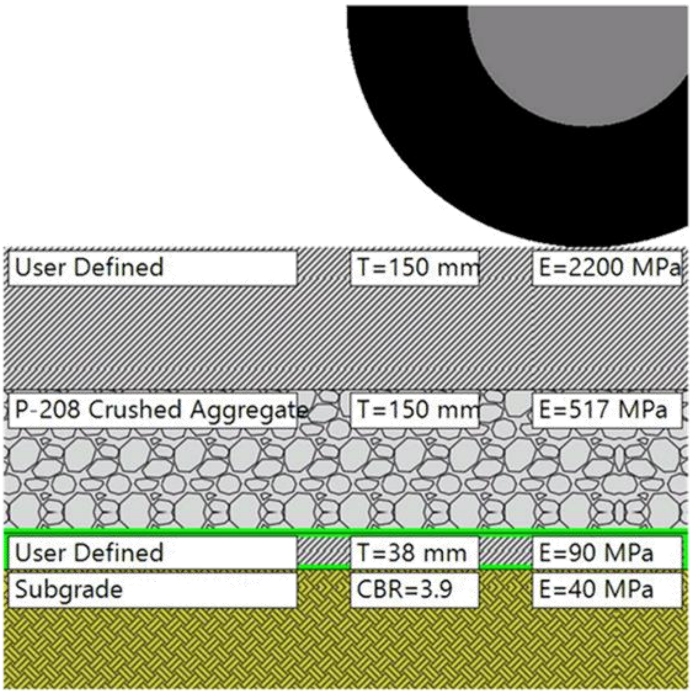
Page 1

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.62
3	Q300/Dash 8 Series 300	1.0	1.00	2.09

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.00	0.00	3.62
2	Beechcraft King Air 350	0.00	0.00	3.42
3	Q300/Dash 8 Series 300	0.01	0.01	2.73

User Is responsible For checking frost protection requirements.



Page 2

Table 3 - Traffic Option 2 - B200 / B350 / Q400 - Granular Improvement

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1

Analysis Type: New Flexible

Central 18m Alignment RWY1432

Last Run: Thickness Design

Design Life = 20 Years

Total thickness to the top of the subgrade = 551mm

Pavement Structure Information by Layer

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R MPa
1	User Defined	250.0	500	0.35	0
2	P-208 Crushed Aggregate	150.0	517	0.35	0
3	User Defined	151.2	90	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	365	0
2	Beechcraft King Air 350	6849	365	0
3	Q400/Dash 8 Series 400	29347	156	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.14

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.11
3	Q400/Dash 8 Series 400	1.0	1.00	1.75

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.00	0.00	3.00
2	Beechcraft King Air 350	0.00	0.00	2.93
3	Q400/Dash 8 Series 400	0.03	0.03	2.39

User Is responsible For checking frost protection requirements.

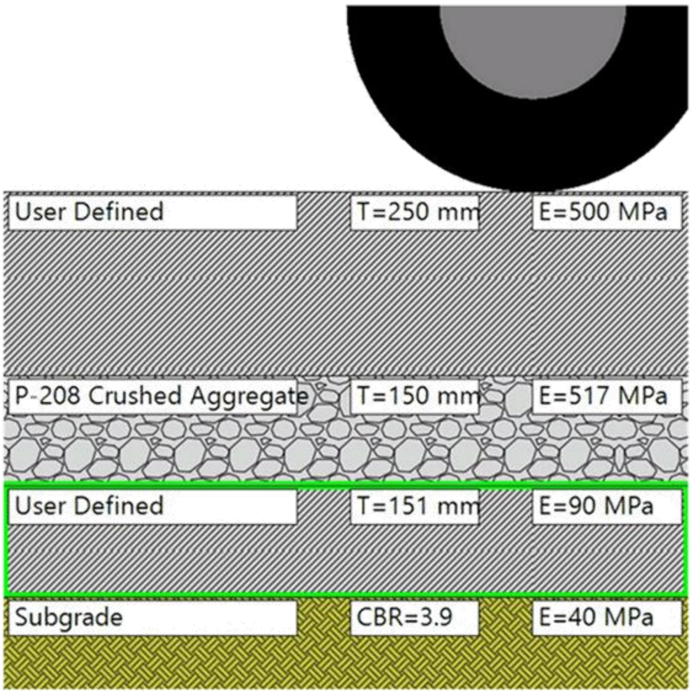


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Table 4 - Traffic Option 2 - B200 / B350 / Dash-8 Q400 - Bitumen Stabilisation

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1

Central 18m Alignment RWY1432

Analysis Type: New Flexible

Last Run: Thickness Design

Design Life = 20 Years

Total thickness to the top of the subgrade = 456mm

Pavement Structure Information by Layer

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R MPa
1	User Defined	165.0	2200	0.35	0
2	P-208 Crushed Aggregate	150.0	517	0.35	0
3	User Defined	141.1	90	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	365	0
2	Beechcraft King Air 350	6849	365	0
3	Q400/Dash 8 Series 400	29347	156	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.34

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No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.3
3	Q400/Dash 8 Series 400	1.0	1.00	1.87

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.00	0.00	3.44
2	Beechcraft King Air 350	0.00	0.00	3.32
3	Q400/Dash 8 Series 400	0.02	0.02	2.95

User Is responsible For checking frost protection requirements.

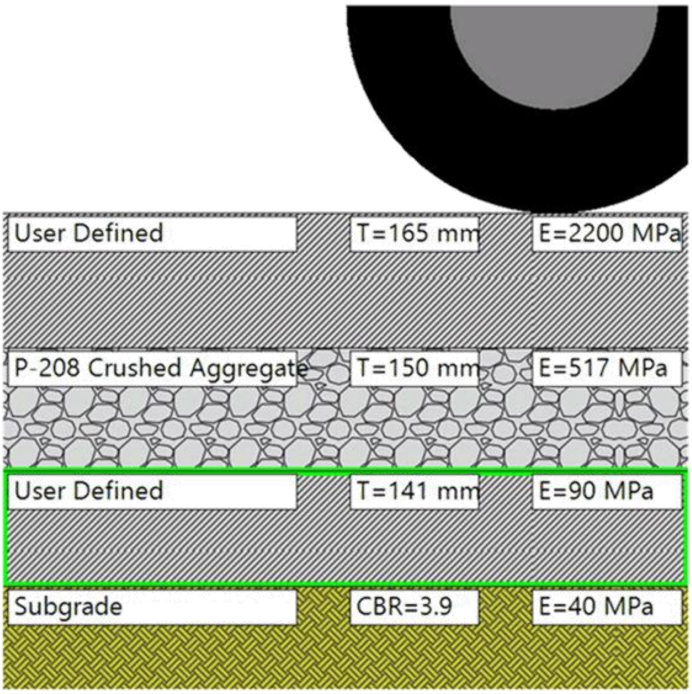

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Table 5 - Traffic Option 1 - B200 / B350 / Dash-8 Q300 - Granular Improvement

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1 Outer Alignment RWY1432

Analysis Type: New Flexible

Last Run: Thickness Design

Design Life = 20 Years

Total thickness to the top of the subgrade = 464mm

Pavement Structure Information by Layer

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R MPa
1	User Defined	215.0	500	0.35	0
2	P-154 Uncrushed Aggregate	102.0	276	0.35	0
3	User Defined	146.5	90	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	180	0
2	Beechcraft King Air 350	6849	180	0
3	Q300/Dash 8 Series 300	19595	180	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.32

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No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.29
3	Q300/Dash 8 Series 300	1.0	1.00	1.89

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.00	0.00	3.16
2	Beechcraft King Air 350	0.00	0.00	3.08
3	Q300/Dash 8 Series 300	0.07	0.07	2.35

User Is responsible For checking frost protection requirements.

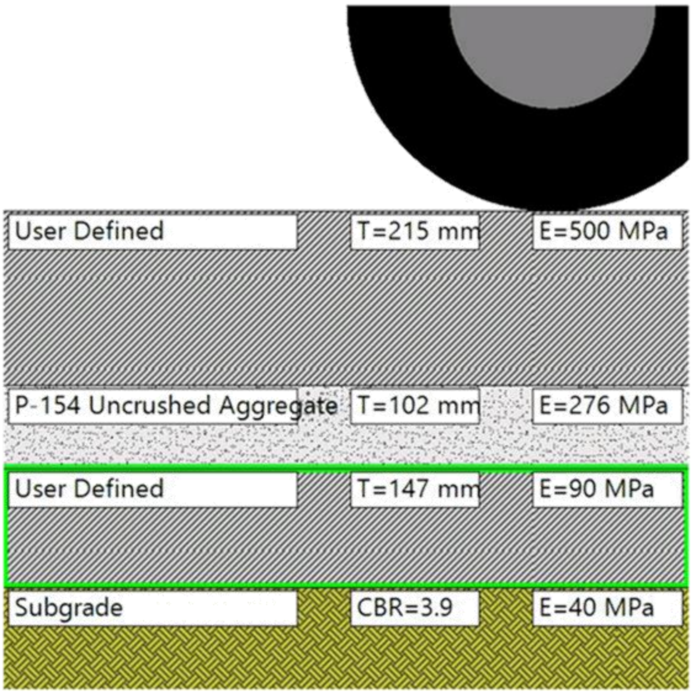

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Table 6 - Traffic Option 1 - B200 / B350 / Dash-8 Q300 - Bitumen Stabilisation

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1 Outer Alignment RWY1432

Analysis Type: New Flexible

Last Run: Thickness Design

Design Life = 20 Years

Total thickness to the top of the subgrade = 349mm

Pavement Structure Information by Layer

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R MPa
1	User Defined	150.0	2200	0.35	0
2	P-154 Uncrushed Aggregate	102.0	276	0.35	0
3	User Defined	97.4	90	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	180	0
2	Beechcraft King Air 350	6849	180	0
3	Q300/Dash 8 Series 300	19595	180	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.64

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No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.59
3	Q300/Dash 8 Series 300	1.0	1.00	2.07

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.00	0.00	3.62
2	Beechcraft King Air 350	0.00	0.00	3.42
3	Q300/Dash 8 Series 300	0.01	0.01	2.73

User Is responsible For checking frost protection requirements.

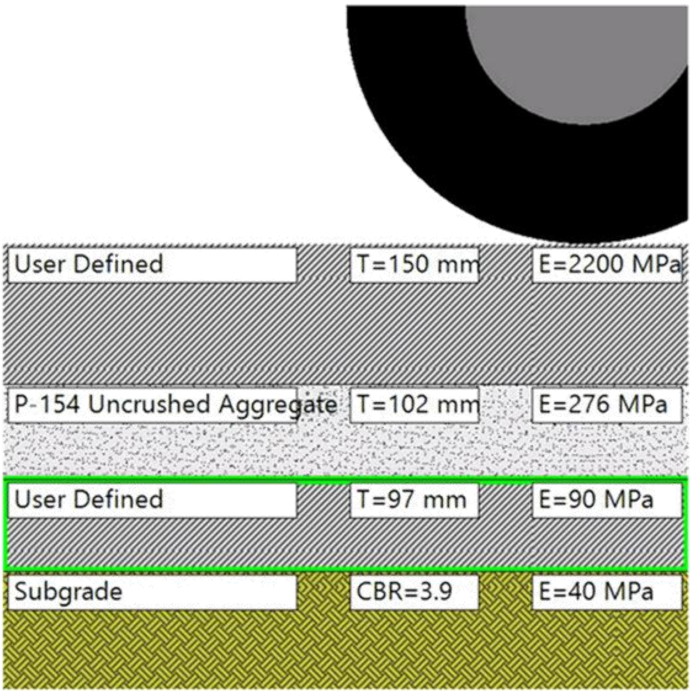

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Table 7 - Traffic Option 2 - B200 / B350 / Dash-8 Q400 - Granular Improvement

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1 Outer Alignment RWY1432

Analysis Type: New Flexible

Last Run: Thickness Design

Design Life = 20 Years

Total thickness to the top of the subgrade = 535mm

Pavement Structure Information by Layer

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R MPa
1	User Defined	280.0	500	0.35	0
2	P-154 Uncrushed Aggregate	102.0	276	0.35	0
3	User Defined	153.3	90	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	180	0
2	Beechcraft King Air 350	6849	180	0
3	Q400/Dash 8 Series 400	29347	78	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.17

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No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.14
3	Q400/Dash 8 Series 400	1.0	1.00	1.77

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.00	0.00	2.88
2	Beechcraft King Air 350	0.00	0.00	2.82
3	Q400/Dash 8 Series 400	0.06	0.06	2.24

User Is responsible For checking frost protection requirements.

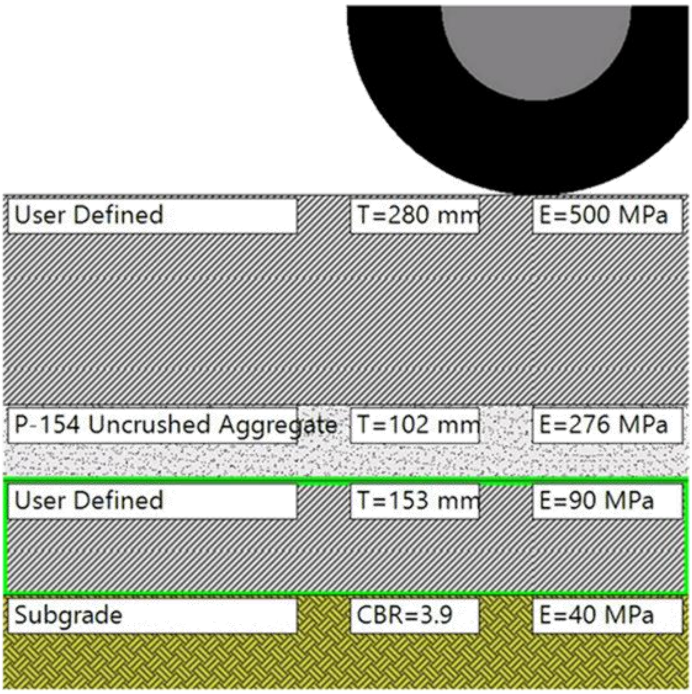

Table 8 - Traffic Option 2 - B200 / B350 / Dash-8 Q400 - Bitumen Stabilisation

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1

Outer Alignment RWY1432

Analysis Type: New Flexible

Last Run: Thickness Design

Design Life = 20 Years

Total thickness to the top of the subgrade = 427mm

Pavement Structure Information by Layer

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R MPa
1	User Defined	175.0	2200	0.35	0
2	P-154 Uncrushed Aggregate	101.6	276	0.35	0
3	User Defined	150.3	90	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	180	0
2	Beechcraft King Air 350	6849	180	0
3	Q400/Dash 8 Series 400	29347	78	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.42

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.37
3	Q400/Dash 8 Series 400	1.0	1.00	1.91

User Is responsible For checking frost protection requirements.

Table 9 - Traffic Option 1 - B200 / B350 / Dash-8 Q300 - Granular Improvement

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1 TWY and Apron

Analysis Type: New Flexible

Last Run: Thickness Design

Design Life = 20 Years

Total thickness to the top of the subgrade = 487mm

Pavement Structure Information by Layer

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R MPa
1	User Defined	210.0	500	0.35	0
2	P-154 Uncrushed Aggregate	155.2	276	0.35	0
3	User Defined	121.5	100	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	365	0
2	Beechcraft King Air 350	6849	365	0
3	Q300/Dash 8 Series 300	19595	365	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.27

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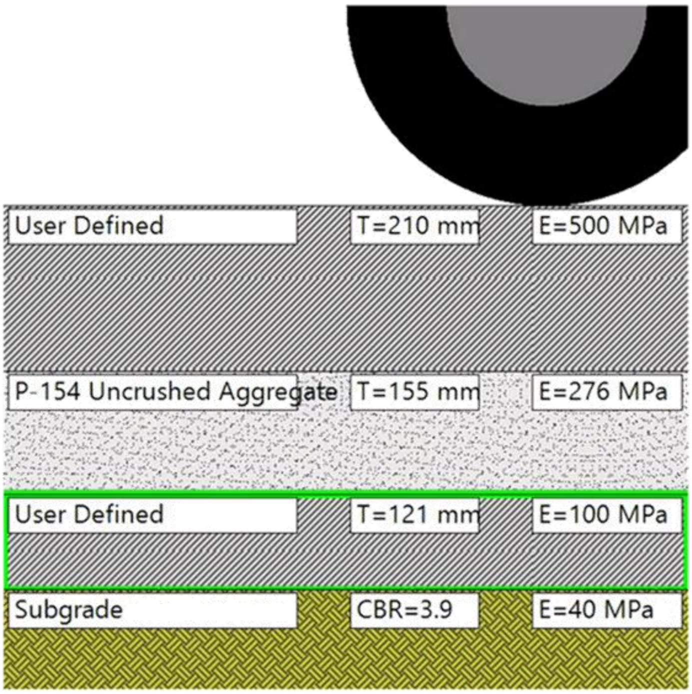
No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.24
3	Q300/Dash 8 Series 300	1.0	1.00	1.86

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.00	0.00	3.18
2	Beechcraft King Air 350	0.00	0.00	3.10
3	Q300/Dash 8 Series 300	0.09	0.09	2.36

User Is responsible For checking frost protection requirements.



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Item 7.28

Annexure B

Table 10 - Traffic Option 1 - B200 / B350 / Dash-8 Q300 - Bitumen Stabilisation

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1 TWY and Apron

Analysis Type: New Flexible

Last Run: Thickness Design

Design Life = 20 Years

Total thickness to the top of the subgrade = 465mm

Pavement Structure Information by Layer

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R MPa
1	User Defined	210.0	2200	0.35	0
2	P-154 Uncrushed Aggregate	155.2	276	0.35	0
3	User Defined	100.0	100	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	365	0
2	Beechcraft King Air 350	6849	365	0
3	Q300/Dash 8 Series 300	19595	365	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.59

Page 1

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.54
3	Q300/Dash 8 Series 300	0.0	0.01	2.04

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.00	0.00	3.18
2	Beechcraft King Air 350	0.00	0.00	3.10
3	Q300/Dash 8 Series 300	0.09	0.09	2.36

User Is responsible For checking frost protection requirements.

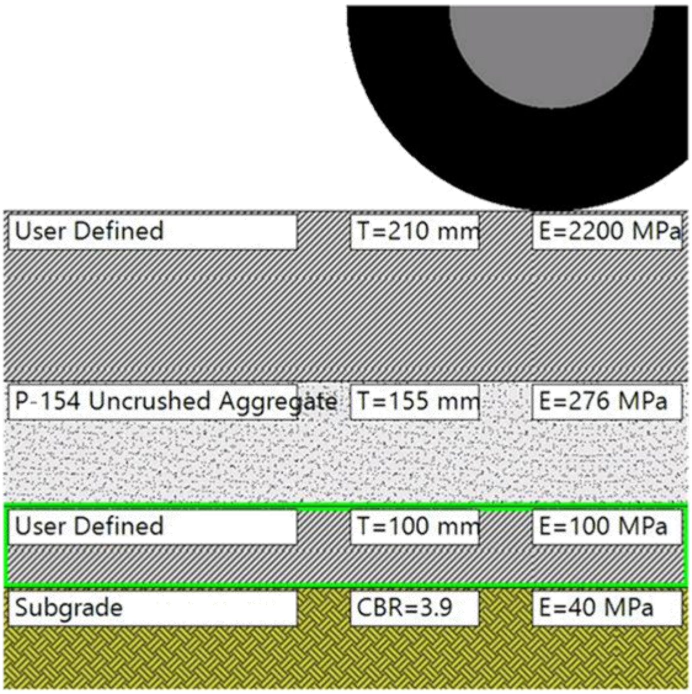

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Table 11 - Traffic Option 2 - B200 / B350 / Dash-8 Q400 - Granular Improvement

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1 TWY and Apron

Analysis Type: New Flexible

Last Run: Thickness Design

Design Life = 20 Years

Total thickness to the top of the subgrade = 586mm

Pavement Structure Information by Layer

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R MPa
1	User Defined	240.0	500	0.35	0
2	P-154 Uncrushed Aggregate	250.0	276	0.35	0
3	User Defined	96.0	100	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	365	0
2	Beechcraft King Air 350	6849	365	0
3	Q400/Dash 8 Series 400	29347	154	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.07

Page 1

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.04
3	Q400/Dash 8 Series 400	1.0	1.00	1.71

User Is responsible For checking frost protection requirements.

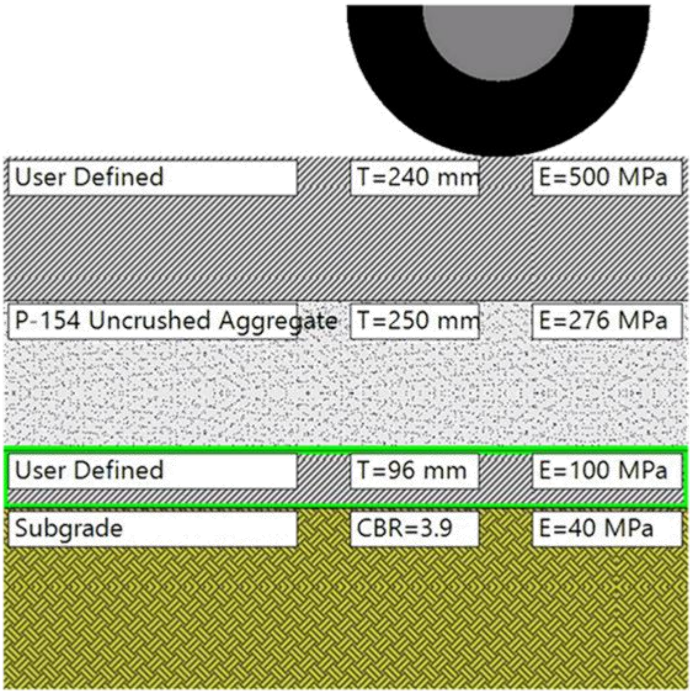

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Table 12 - Traffic Option 2 - B200 / B350 / Dash-8 Q400 - Bitumen Stabilisation

Federal Aviation Administration FAARFIELD 2.0 Section Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1 TWY and Apron

Analysis Type: New Flexible

Last Run: Thickness Design

Design Life = 20 Years

Total thickness to the top of the subgrade = 372mm

Pavement Structure Information by Layer

No.	Type	Thickness mm	Modulus MPa	Poisson's Ratio	Strength R MPa
1	User Defined	210.0	2200	0.35	0
2	P-154 Uncrushed Aggregate	155.2	276	0.35	0
3	User Defined	7.1	100	0.35	0
4	Subgrade	0	40	0.35	0

Airplane Information

No.	Name	Gross Wt. kg	Annual Departures	% Annual Growth
1	Beechcraft King Air B200	5711	365	0
2	Beechcraft King Air 350	6849	365	0
3	Q400/Dash 8 Series 400	29347	156	0

Additional Airplane Information

Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.0	0.00	2.57

Page 1

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
2	Beechcraft King Air 350	0.0	0.00	2.52
3	Q400/Dash 8 Series 400	1.0	1.00	1.99

HMA CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	Beechcraft King Air B200	0.00	0.00	3.18
2	Beechcraft King Air 350	0.00	0.00	3.10
3	Q400/Dash 8 Series 400	0.02	0.02	2.62

User Is responsible For checking frost protection requirements.

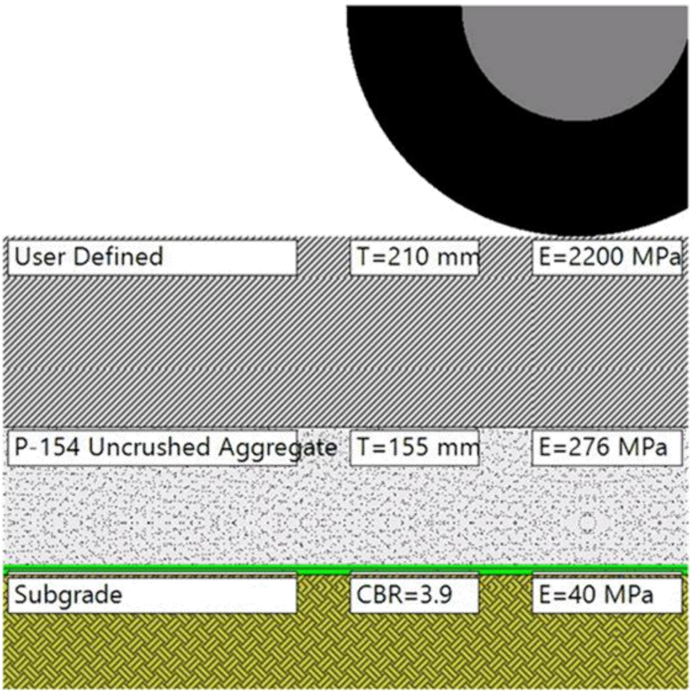

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Table 13 - PCR assessment

Federal Aviation Administration FAARFIELD 2.0 PCR Report

FAARFIELD 2.0.0.e RC 06/19/2020

Working directory is C:\Users\kamen09\Documents\My FAARFIELD

Job Name: New Job 1

Section: New Section 1

This file name = PCR Results for Flexible 2022-03-08 10:55:21.txt

Evaluation pavement type is flexible and design program is FAARFIELD.

Section name: New Section 1 in job file: C:\Users\kamen09\Documents\My FAARFIELD\PrintOut-New Job 1-New Section 1\\New Job 1.JOB.xml

Units = Metric

Analysis Type: New Flexible

Subgrade Modulus =40MPa (Subgrade Category is D(50 MPa))

Evaluation Pavement Thickness = 330 mm

Pass to Traffic Cycle (PtoTC) Ratio = 2.00

Maximum number of wheels per gear = 2

CDF = 11.365

No aircraft have 4 or more wheels per gear.

Results Table 1. Input Traffic Data

No.	Aircraft Name	Gross Weight kg	Percent Gross Weight	Tire Pressure MPa	Annual Departure	20 Years Coverage
1	Beechcraft King Air B200	5711	95.00	675.7	150	1802
2	Beechcraft King Air 350	6849	95.00	634.3	150	1848
3	Bombardier CL-604/605	21863	95.00	999.7	12	181

Results Table 2. ACR Value

No.	Aircraft Name	Critical aircraft Total equiv. departures	Max allowable Gross Weight of critical aircraft	ACR Thick at max. MGW (mm)	PCR on D(50 MPa)
1	Bombardier CL-604/605	24	16	416.77	109.2

Results Table 3. Flexible ACR at Indicated Gross Weight and Strength

PAGE 1

No.	Aircraft Name	Gross Weight kg	Percent Gross Weight on Main Gear	Tire Pressure MPa	ACR Thick(mm)(D)	ACR//F/D
1	Beechcraft King Air B200	5711	95.00	675.7	208.28	32
2	Beechcraft King Air 350	6849	95.00	634.3	241.3	40.6
3	Bombardier CL-604/605	21863	95.00	999.7	497.84	164.3