Future-proofing the aviation sector:

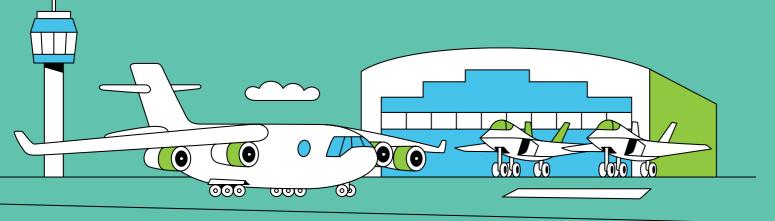
Optimising the benefit of Contractor input





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Introduction

Airports today face unprecedented challenges and opportunities in asset construction and maintenance requirements and decisions.

Considerations include evolving aircraft needs, a greater focus on sustainability and rising customer expectations—alongside ageing infrastructure and funding constraints.

Increasing passenger demand and rapid technological advancements are pushing the sector to move beyond traditional like-for-like asset management, towards more innovative, safe and efficient solutions.

To best realise opportunities and manage risk, more active engagement between airport owners, consultants, industry specialists, and contractors is essential. Wider perspectives enable robust development, validation, and implementation of strategies and methodologies that leverage the full spectrum of industry expertise and experience.

This paper reflects on current challenges and emerging opportunities in the aviation sector. It highlights the critical role of greater collaboration and contractor involvement to unlock and deliver transformative solutions—to ensure the future success, sustainability, and resilience of airport assets and operations.

Experienced contractors bring valuable insight, tools and methods from the aviation sector and related industries. The contractor's ability to provide both conventional and cutting-edge solutions enables teams to more effectively address the unique challenges of the complex airport environment.





1. Supporting safety and regulatory compliance in construction and maintenance

Safety is paramount in the aviation sector, with airports needing to comply with stringent regulatory standards—both in day-to-day operations and throughout asset maintenance and upgrade activities, where the complexity of the operational landscape increases.

Advancements in technology offer innovative opportunities to enhance on-site safety and regulatory compliance. Contractors typically bring cross-sector experience and early development and application of emerging tools. This puts them in a unique position to adapt and introduce technologies into the aviation sector, driving improvements through wide expertise and fresh perspectives.

Contractor contribution to enhancing airport safety

By investing in emerging technologies and continuing to upskill our people, contractors are well-positioned to work with airports and consultants to meet regulatory requirements and deliver high-quality outcomes.

Current focus areas include:

• EMAS technology deployment in Australasia

By actively leveraging learnings from international implementations, Downer is supporting local airport clients to confidently invest in compliant, future-proof solutions. This includes our work as the sole Australasian contractor currently installing Engineered Materials Arrestor Systems (EMAS)—designed to safely decelerate aircraft in overrun situations. Our delivery of the first two EMAS projects in the region underscores our commitment to staying ahead of evolving safety standards.

Implementing advanced technology to optimise safety

Within live airport environments, we incorporate technologies such as advanced telematics, machine control (drawing on our award-winning technology),

and geofencing to enhance safety and minimise disruptions. These solutions help define no-go zones and ensure precise execution of tasks, significantly reducing risks when in close proximity to aircraft.

On RAAF Base Williamtown, Sydney, and Hobart Airports we have used AI machine control in conjunction with high definition video on mobile plant and equipment, for example, large steel drum rollers used to compact pavements. If a pedestrian breaches the safe working zone the machines will automatically slow or stop. On other sites, we use geofencing to reduce the risk of Foreign Object Debris (FOD) on runways by restricting unauthorised access, tracking assets, and providing real-time alerts to prevent debris hazards.

Cutting-edge data collection systems

We are currently working with airports in Australia and New Zealand to implement mobile data collection systems (such as Pegasus) to improve data accuracy and operational efficiency while optimising safety outcomes. By reducing the access time required on critical areas like airside pavements, this technology helps mitigate risks and optimise worker safety in high-traffic areas, while providing highly accurate and consistent data. (See case study on page 9.)

Maintaining surface friction and friction analysis
 Technologies such as grip testers provide critical
 data on runway surface friction, to enhance safety
 during take-off and landing operations. These insights
 are vital for maintaining compliance with safety
 regulations and optimising runway maintenance
 schedules. Products and techniques which maintain
 friction to mitigate the risk of runway excursions
 include the likes of Rhinophalt™, high textured
 asphalts, rubber removal, water blasting and grooving.

Overlaying the intrinsic safety culture of experienced contractors with the latest advances in technology supports adherence to regulatory requirements, while also ensuring operational efficiency and resilience in the airport environment.



Fostering a safety-first culture and approach which embeds safety at every touchpoint

A strong safety culture, embraced across all stakeholders, is vital for maintaining high safety standards and ensuring regulatory compliance—particularly during high-risk construction and maintenance activity.

Downer's safety culture is embedded in everything we do, and aligned to the strict safety standards of airport operations. For example, our Hawkins* teams work alongside airport clients to engage key stakeholders—regulatory bodies, airport management, designers, contractors and subcontractors—to understand safety and operational risk at every step of the process, from design receipt through to detailed construction planning, and daily on-site delivery.

One of the tools used by Hawkins to enhance safety is an on-site camera system, which provides real-time and retrospective time-lapsed views of site activity, and incorporates Al-powered analytics to report on site activity. The system, which can be accessed at any time by clients, consultants, our Head Office and on-site teams, provides valuable information across all stages of activity—through planning, monitoring and reporting.

The system can be used daily on our sites to brief delivery teams and subcontractors on site activity and requirements, including the likes of on-site hazards, safe access points, laydown areas, site-wide work activity and exclusion zones. It also keeps all parties up-to-date on key aspects of safety performance.

Together, our mix of operational collaboration supported by new technologies creates a foundation for safer, more efficient project execution, where everybody understands the part they play in maintaining high levels of safety in the complex airport environment.

*Hawkins is Downer's commercial construction arm in New Zealand.



2. Addressing ageing infrastructure through best practice asset management

As airports grapple with ageing infrastructure, the need for 'right-fit' maintenance and modernisation is more pressing than ever-to address wear and tear, accommodate growing passenger traffic, and improve operational efficiency. Effective asset management strategies are needed to prioritise and efficiently execute proactive maintenance activities, which minimise operational disruption and maximise asset longevity.

Traditional methods of asset inspection are often manual and labour-intensive, introducing safety risks and operational disruptions. This can lead to extended intervals between inspections, resulting in gaps in understanding of asset condition.

Many airports also face a loss of institutional knowledge due to high staff turnover, leading to fragmented asset management data. A lack of comprehensive asset registers and life cycle knowledge hinders effective decision-making, impacting long-term maintenance planning and investment strategies.

Greater integration of digital solutions can streamline asset inspections, improve data quality and efficiency,

and provide more robust, accessible data sources. Technology can also enhance the tracking and modelling of asset conditions over time, predicting asset deterioration and providing clearer insights for decision-making.

Leveraging contractor expertise to resolve asset management challenges

Contractors can play a pivotal role in addressing these challenges by introducing innovative asset management practices and technologies. Contractor solutions typically complement existing airport and consultant software and activity, providing a more comprehensive view of asset conditions aligned to established wider industry practice. Areas of input include:

Leveraging wider Transport-industry practices to support airport asset management

To complement consultant inputs, Downer can apply tools and methods (proven on our management of over 56,000 km of roading infrastructure in Australasia) such as digital asset registers and whole-of-life prediction models to enhance asset management in airports. These solutions, aligned to Airport Certification Manual (ACM) requirements, can provide a deeper understanding of assets and accurate tracking of asset condition-leading to more informed decisionmaking and optimised long-term capital funding.

· Mobile data collection

Mobile mapping systems (used by Downer on airports and roads in Australia and New Zealand) enable rapid, high-precision asset data collection. Improved data accuracy enables airport owners to make robust decisions regarding maintenance priorities and asset management. The additional benefit is the reduced need for worker on-foot inspections—optimising safety and minimising operational disruptions. (See Case Study on page 9.)

In-pavement monitoring for real-time condition assessment

Deploying in-pavement monitoring systems allows for continuous tracking and assessment of pavement condition. These systems provide real-time data on asset performance, enabling proactive maintenance interventions that extend pavement life and optimise maintenance schedules.



asset deterioration, supporting airports in planning long-term maintenance and capital investments. By using advanced deterioration models, airports can predict asset lifecycles more accurately, leading to better resource allocation, improved intervention maintenance planning and reduced downtime.

With airport-specific and transferable knowledge and tools, combined with specialist asset management teams, contractors play a valuable part in all stages of the asset management function—from data collection and analysis, through to complex decision making and prioritisation. There is untapped opportunity for contractors to more fully integrate into airport and consultant teams to optimise asset outcomes.







Transferring laser fault inspection from roads to runways

Downer is pioneering high-speed, in-motion airfield surveying with the Leica Pegasus Two Ultimate (P2U) Mobile Laser Scanner. This innovative technology enhances efficiency, safety, and precision in infrastructure surveys.

In New Zealand, the effectiveness of the system has already been demonstrated at Queenstown Airport, where the data collected is providing a prime source to inform asset management decisions. And at Dunedin International Airport, outputs from a survey of the taxiway and aprons have informed design for the Taxiway Alpha and Bravo pavement rehabilitation works—with the same data also being used for the Runway 03/21 rehabilitation project.

In Australia, Brisbane Airport Corporation has partnered with us to trial the P2U to survey key elements of its airfield.

How it works

The P2U combines point cloud data (1,000,000 points per second) and photogrammetric imaging (360° coverage) to create high-resolution datasets. Two external cameras also assess pavement conditions such as cracking and roughness.

Our teams then analyse this data to guide long-term pavement maintenance and renewal programmes, enabling better planning and decision-making—a new standard for airport infrastructure monitoring and maintenance.

Key benefits of mobile data collection

- **Speed and efficiency:** High-speed surveying minimises operational disruption.
- Enhanced safety: Reduces on-site exposure for teams.
- **Precision:** Sub-centimetre accuracy with laser scanning and photogrammetry.





3. Technical solutions to extend asset life with minimal operational impact

Balancing asset preservation and maintenance delivery decisions with operational demand is a complex challenge. Traditional maintenance approaches can disrupt operations, leading to delays, passenger inconvenience, and potential revenue loss.

Innovative pavement treatments provide the potential to revolutionise airport maintenance practices—extending asset life while allowing airport operators to maintain high standards of operational performance.

Rigid pavements in many airports are reaching or exceeding their life expectancy. Elsewhere flexible pavements are often showing deep-set failures. Climate change is also impacting assets, with the need to respond to the risks to airport operations and infrastructure from extreme temperatures, stronger storms, and rising sea and groundwater levels causing flooding.

Despite the availability of advanced tools such as those highlighted in the previous section, technology and new products are not always fully exploited within the airport environment. This can result in missed opportunities to optimise maintenance decisions and solutions.

Leveraging contractor-driven innovation for optimised airport maintenance

Contractors bring valuable expertise in implementing technology solutions which address the unique challenges of airport maintenance—helping airport clients to achieve asset reliability and greater operational efficiency. Solutions include:

· Expedient high-strength pavement repairs

Many busy commercial airports have high-strength pavement repair challenges in areas such as terminal aprons and runway thresholds, where operational demand severely limits access to the pavement. Works must be completed in short windows—making traditional solutions for pavement reconstruction and rehabilitation not viable, and creating a need for new expedient methodologies and materials. Downer has developed and implemented specialist solutions which allow expedient excavation and reinstatement of pavements up to 500mm deep—providing certainty of safe return to service at the end of each shift.

• Flexible pavement preservation solutions

Increased rainfall and hotter average temperatures, along with increased aircraft traffic, requires looking beyond the traditional methods to prolong asset life. Advanced products such as Rhinophalt™ and Enviroshield provide mid-life preservation of flexible pavements—enhancing surface durability, reducing maintenance needs and prolonging pavement life.

Innovative pavement design and water management

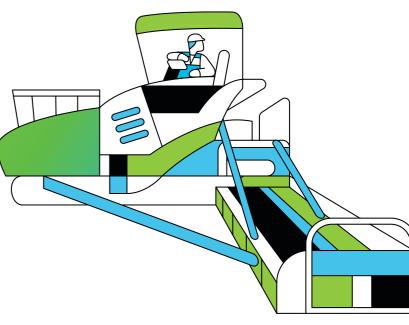
In collaboration with consultants, Downer continues to explore advanced pavement designs to improve water shedding and drainage, helping airports mitigate the impact of increased rainfall and flooding. These solutions are designed to enhance pavement resilience and extend service life under changing environmental conditions.

Digital engineering and 4D modelling to optimise project delivery

Using digital engineering and 4D modelling, we work alongside designers through specification development, to improve the accuracy and efficiency of construction and maintenance planning. This approach helps optimise constructability, productivity, and programming—potentially reducing project timelines, and minimising operational impact.



Technology-driven solutions are essential to improve efficiency, reduce downtime, and optimise maintenance schedules—supporting airport operators to maintain high standards of operational performance. Contractors have the experience and smarts to support asset integrity and longevity with minimal impact on operations.





4. Prioritising sustainability in runway solutions

Airports worldwide face mounting pressure to operate more sustainably, driven by regulatory requirements and stakeholder expectations. The expectation of net zero flights—and the likely upgrades required to infrastructure to accommodate alternate fuels and aircraft types—introduces further challenge and significant potential economic impact on airlines, airports and passengers.

Airports that fail to adapt, risk regulatory attention as well as reputational harm and loss of support from environmentally and ethically conscious, cost-sensitive consumers and investors.



As major transportation hubs, airports are major contributors to greenhouse gas emissions—from aircraft operations as well as through the construction, maintenance, and management of extensive airfield and landside infrastructure.

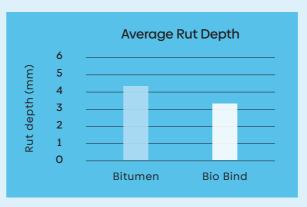
Many infrastructure projects fail to fully consider environmental impacts across the asset's lifecycle—from design and construction through to maintenance, operation, and decommissioning. Historically, airfield construction and maintenance has relied on virgin, high-carbon materials and processes, further exacerbating environmental challenges.

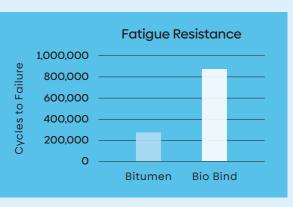
Bio Bind—contractor and consultant collaboration to prove application in the airfield environment

Bio Bind is a low carbon bitumen replacement derived from over 70 per cent renewable resources. The product offers a solution which reduces the embodied carbon emissions in asphalt while delivering uncompromised performance and resilience.

Bio Bind contains significantly less embodied carbon than traditional fossil fuel-based bitumen—mitigating the associated environmental impacts.

In collaboration with a consultant-partner and through our partnerships with local universities, we have been testing Bio Bind across a range of temperatures and loading conditions to prove its performance in the airfield environment. Results show that Bio Bind demonstrates superior low-temperature properties (better fatigue resistance) and high-temperature performance (less deformation) compared to standard grade binders. See results below. Testing is continuing, with the next step to move to trials in the airfield environment.





Bio Bind testing results show very favourable performance outcomes when compared to standard grade binders.

The absence of comprehensive R&D and asset management strategies often results in missed opportunities to optimise operations, incorporate recycled materials, and minimise the environmental impact.

Additionally, some airports have prioritised short-term outcomes, focusing on cost and immediate functionality over longer term sustainability. This approach often leads to more frequent repairs, higher operational costs, and increased resource consumption over time, undermining the potential for long-term environmental benefits.

Contractor contributions: driving sustainable solutions in airport infrastructure

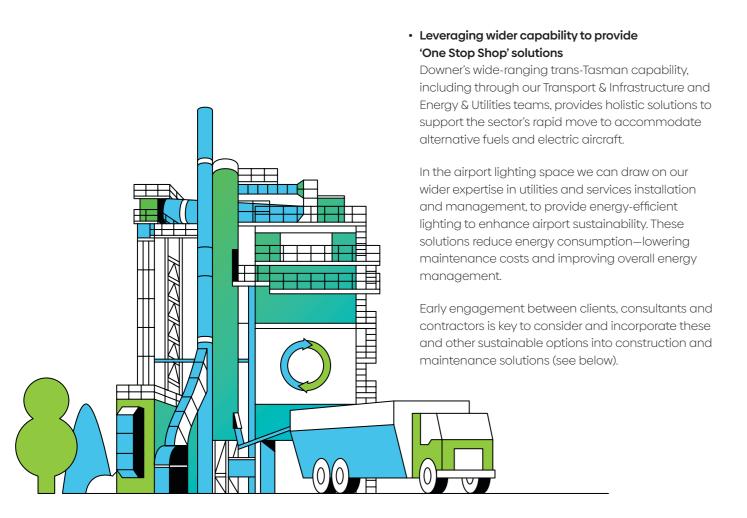
The shift towards greener practices demands the adoption of sustainable, cost-effective products and a long-term focus on asset resilience. By leveraging innovative materials, advanced technologies, and sustainable practices, contractors can support airports to reduce their carbon footprint and enhance long-term operational efficiency. Contributions include:

Sustainable pavement and surfacing solutions

Downer is at the forefront of developing advanced pavement solutions which enhance durability while lowering emissions. Products include Bio Bind, high recycled asphalt pavement (RAP) mixes, Reconophalt, production of low-temperature warm mixed asphalt, and EME2 (which improves sustainability outcomes via thinner pavements with long life expectancy, and can incorporate RAP). These products can make key contributions to reducing the asset owner's Scope 3 emissions.

Pavement preservation solutions for extended asset life

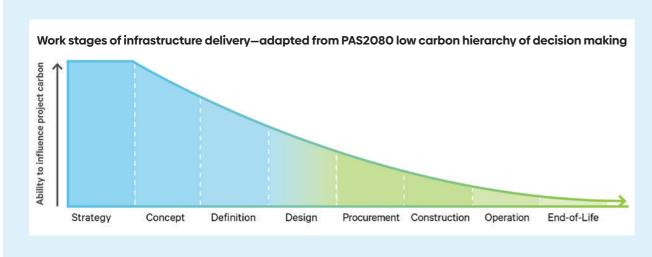
Products like Rhinophalt™ and Enviroshield allow airports to preserve and extend the life of pavements, prolonging the duration between resurfacing and resheeting works, and subsequently driving significant carbon reduction impacts. In comparison to intensive capital maintenance works these solutions offer many benefits, including: improved surface quality through reducing water permeability, ravelling and bitumen oxidation; more cost-effective maintenance; improved flexibility for maintenance planning; and minimised operational disruption.



Early engagement to optimise outcomes

The opportunity to impact carbon footprint diminishes the further a project progresses along its lifecycle. Early collaboration between airport clients, consultants and contractors, including through Early Contractor Involvement (ECI) models, allows for early integration of sustainable product options into project specifications (see our <u>Estimating Embodied Carbon</u> whitepaper). This supports airport operators and consultants to make informed decisions aligned to sustainability goals.

Additional benefits of early engagement and the ECI process include optimised innovation and constructability insights with input into potential product and technology solutions, more informed consideration and allocation of risk, and often better cost and programme outcomes.





Through application of Rhinophalt™, Sydney Airport has been able to delay planned runway resheet works by over five years so far—and hope to gain another two to three years through recent further treatment. That's around 23 years between resheet works on a critical airfield pavement!

In 2019 Sydney Airport engaged Downer to deliver a pavement preservation solution to the 07/25 Runway, to extend the pavement life and delay capital maintenance works. This allowed the airport to focus on higher priority major capital maintenance and infrastructure upgrade projects.

Last resurfaced in 2004, the 50,000m² runway was losing its fine asphalt matrix, exposing larger aggregates and creating an increased safety risk of FOD.

Following significant global research, we identified Rhinophalt™, a penetrative asphalt preservative (PAP) treatment, produced by ASI in the UK and used extensively on airfields and Defence airbases across Europe and the Middle East.

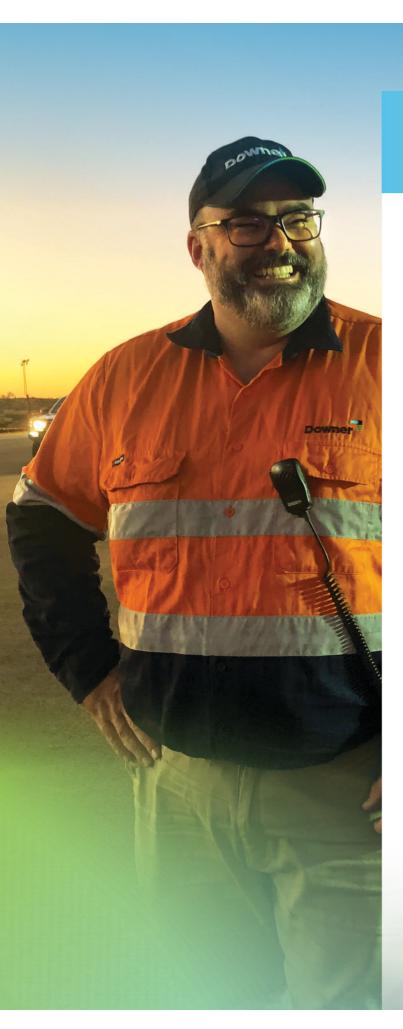
Rhinophalt™ is a preventative maintenance treatment which preserves, protects and extends the life of asphalt pavements by sealing and protecting the surface from weathering, oxidisation

and trafficking. The product can be applied in a single shift, cures quickly and requires no post application aftercare.

Following trials, Downer successfully delivered the 2019 program of works over five shifts during curfew hours—with no interruption to airfield operations, and scheduled flights resuming at 5am after each shift. Runway friction characteristics were retained, without impacting grooves.

Sydney Airport expected the application of Rhinophalt™ would delay the costly resurfacing of the runway for three to four years.

In 2024, based on the success of the treatment in 2019 and the continued good condition of the pavement, the Airport sought further preservation treatment of the 07/25 Runway along with Taxiway Delta, and the Domestic Aprons DOMs 3a, 3B, 4 and 5—a total of 144,000m². This work was completed by Downer in December 2024.



5. Industry capacity: working together to maintain and grow expertise

As many airports face mounting pressure to address ageing infrastructure, undertake more intensive maintenance, and construct new assets, the sector is grappling with a shortage of skilled professionals.

With extensive work programmes across multiple airports, the high demand for experienced consultants and contractors has stretched available resources. This shortage extends to the airports themselves, with ever-increasing competition to secure internal project management and engineering staff capable of managing the works.

The current talent shortage poses several risks to the successful delivery of airport projects, including poorly scoped or considered projects being released to market, potential compromises in work quality, programme delays, and increased project specific and long-term airfield operational costs.

The industry has typically also struggled with a lack of coordinated planning and engagement, hindering the ability to effectively deliver concurrent projects. The absence of a more unified approach to project procurement and execution has led to missed opportunities for resource sharing, more strategic recruitment efforts, and better workforce management.

Enhancing capacity: a multi-faceted collaborative approach

We all play a role in addressing the sector's capacity challenges. By investing in people, fostering innovation, and adopting proactive workforce strategies, together we can more effectively meet the demand for skilled professionals and stay on top of keeping airport assets fit-for-purpose. Practical strategies include:

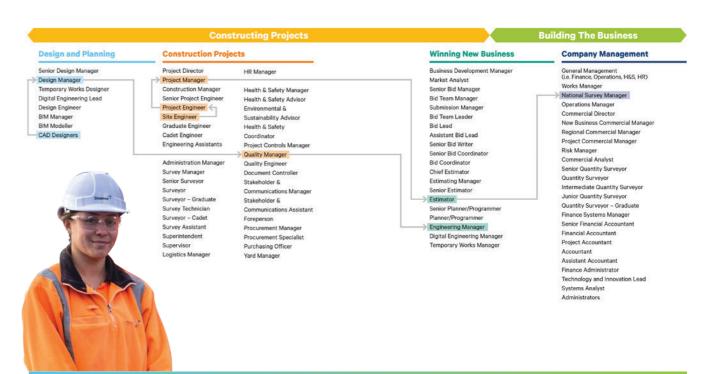
• Training and upskilling programs

Continuous learning and development is crucial to keep employees up-to-date with industry advancements. Airports, consultants and contractors must invest in ongoing training initiatives, including knowledge sharing workshops, higher education programs, and mentorship opportunities, to help staff grow their skills and enable career progression.

As airport projects grow ever more complex, Downer's ability to leverage our trans-Tasman business portfolio—vertical and horizontal construction, surfacing, utilities, asset management, digital engineering and technology—provides significant inhouse capability and cross-skilling to address interlinking challenges.

Strategic industry partnerships

Ongoing engagement with wider industry partners and networks can provide access to a broader talent pool to address the shortage of skilled professionals. These strategic collaborations allow teams to stay informed on emerging industry trends and potentially attract talent from a wider pool.



Snakes and Ladders! The many paths of career progression.

There are numerous career paths within the aviation industry. By creating detailed career maps for critical roles (which could span experience across airports, consultants and contractors), employees ca clearly see a growth trajectory. This motivates and helps retain talent by demonstrating long-term career opportunities within the sector.

· Cross-functional cross-organisational teams

There are opportunities to create cross-functional teams by rotating members from different departments and potentially seconding into other companies to expand skillsets and expose more people to frontline airport works. This builds a versatile workforce and provides greater insights into the challenges faced by airport operators, consultants and contractors—leading to more informed input and outcomes.

Client feedback loops

Regular feedback sessions between contractors, consultants and clients drive greater understanding of needs, plans, risks, challenges, and opportunities. This supports tailored workforce development and project strategies to align with work pipelines, emerging technologies, and wider innovation. Ideally, we would see airports sharing work pipelines more readily, to allow consultants and contractors to optimise resource planning and address emerging skills gaps—and also potentially allow airports to coordinate and/or stage works to better smooth overall worker demand.

• Changing the approach to procurement

Airports have a key role to play in smoothing workforce demand. Careful consideration of procurement strategies and the approach to market is fundamental to enable suppliers to prepare for the release of works. Strategies for preparing the market and reducing supply chain stress include:

- careful scoping and development of works packages
- engagement and market sounding with key contractors on works being considered
- early notices of intent to procure
- use of an EOI phase to provide information to the market on upcoming procurement activities and the scope of works under consideration; and to shortlist suppliers
- adoption of ECI models where the solution needs rapid development and greater certainty of delivery
- use of industry association meetings to outline upcoming short, medium and long term works to constructors and other airports alike—providing confidence in pipeline and capability investment.

By fostering deeper collaboration and aligning efforts across the sector, we can collectively address work planning and workforce challenges, and build a resilient talent pipeline. We are eager to further engage in meaningful partnerships to drive these initiatives forward.

Conclusion: Contractors play a valuable role in responding to aviation challenges

Airports face mounting challenges—from ageing infrastructure and increasing operational demands to evolving regulations and sustainability goals.

Addressing these requires a more coordinated and collaborative approach among airport operators, consultants, and contractors.

Contractors play a pivotal role by leveraging advanced technologies, sustainable practices, and comprehensive asset management to deliver innovative, long-term solutions. Whether enhancing safety and regulatory compliance through the likes of EMAS and advanced telematics, optimising operations with predictive analytics, or championing sustainable construction practices, contractors provide the expertise, tools and resources needed to meet immediate challenges and future-proof airport infrastructure.

By fostering collaboration and investing in workforce development, contractors also help address industry capacity constraints, to continue to meet the demands of a growing and evolving aviation sector. With greater certainty and visibility of work pipelines, we are able to more confidently invest in workforce development and capability building. Together, these efforts ensure safer, more resilient, efficient and sustainable airport assets and operations.

As the aviation sector continues to navigate these complex challenges, we invite airport operators and consultants to deepen their collaboration with contractors. By working more closely, we can unlock innovative solutions that drive resilience, sustainability, and success for the airports of tomorrow. Let's build the future of aviation—together!

We'd love to hear your thoughts. Please contact us to discuss any of the points covered in this paper.

Author bios



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As Downer's Head of Airports (Transport & Infrastructure), George has been instrumental in uniting capability across our trans-Tasman Transport & Infrastructure business and our NZ Hawkins commercial construction team, to deliver innovative, end-to-end solutions that enhance airport operations of all sizes. George sets a visionary course for Downer's future with airports, through fostering strong relationships, embracing technological advancements, and continuing to develop our people with a focus on quality project delivery.

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Project (to upgrade the airfield to accommodate
Code E international aircraft), RAAF Base
Richmond Runway upgrade, and Sydney Airport
Domestic 2 and Domestic 3 Taxiway and Apron
Reconstruction works.

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