Traffic Highlights

**WHERE OUR PASSENGERS ARE FLYING?**
- UK: 32% (10.0m)
- Europe: 52% (16.3m)
- US & Canada: 13% (4.0m)
- Rest of world: 3% (1.0m)

**FLIGHTS**
- 233 thousand

**TOP 5 DESTINATIONS**
1. London
2. Amsterdam
3. Manchester
4. New York
5. Birmingham

**PASSENGER NUMBERS**
- 31.5 million
- 2.1 million

**DAILY AVERAGE TRAFFIC**
- 86 thousand passengers
- 639 flights

**BUSIEST DAY**
- June 29
- 116 thousand passengers

**CARGO**
- 151* thousand tonnes

**TERMINALS**
- TERMINAL 1
  - 61% of the passenger traffic
- TERMINAL 2
  - 39% of the passenger traffic

**TRAFFIC STATISTICS**
- Direct: 93%
- Transfers: 6%
- Transits: 1%

**SCHEDULED DESTINATIONS AND AIRLINES**
- 6 new airlines
- +16 routes & services
- 177 destinations
- 45 airlines
- 2,500+ departing flights per week in peak

* Subject to Change

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Rehabilitation and Enhancements of Runway 10-28 and Associated Taxiway Infrastructure at Dublin Airport
Historical Background

- December 1985 - Government approval to build Runway 10-28 at Dublin Airport
- 1986 - Design aircraft B747-400 (MTOW B747-400 was 387,000 Kg)
- Rigid pavement construction
  Long design life and low maintenance and ability to sustain repeated heavy wheel loading without surface deformation
- 1987 – 18 month construction programme commences
- 1989 - 21st June 1989 Runway 10-28 goes into service (2,637m)
- 4.5 Million aircraft movements over the life
- Peak of 223k movement in 2018 and growing
- Average daily movements in 2018 of 639 with a peak of 780 on 15th June 2018
Pavement Deterioration Observed

- In 2003 a pavement evaluation was carried out by consultants PMS. The evaluation indicated that the pavement was in very good condition, however, the structural life of the pavement was being consumed rapidly due to the increase in traffic and the change in traffic mix to much heavier aircraft.

- The report estimated that the remaining life of the pavement was about 9 years (up to 2012) based on the predicted traffic at the time.

- The evaluation also concluded that the runway friction values had also been dropping over the past few years and that additional runway grooving would be required in the short term.
Increased Maintenance/Serviceability Impact
Runway Rehabilitation Study Commissioned

- Fehily Timoney Ramboll (FTR) commissioned to carry out feasibility study to determine optimum rehabilitation options.

- Pavement evaluation confirmed the remaining life of the pavement to be in the region of 4 to 6 years (expiring 2011 to 2013).

- At the time Dublin Airport were planning to construct NR with an operational timeline of 2012.

- Option study carried to review best options available for the business with reference to cost, operational impact and extending the life of the pavement until such time that the new NR becomes operational.
# Pavement Rehabilitation Options Presented to Airlines

<table>
<thead>
<tr>
<th>Subject</th>
<th>Alternative 0</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Impact</td>
<td>Nothing will be done with the runway except the scheduled works in 2008 consisting of partial slab repairs, partial joint replacement and grooving of the surface.</td>
<td>The runway will receive a new wearing course having excellent friction. Existing thickness of bound layers will be maintained.</td>
<td>The runway will receive a new surface treatment having excellent friction. Existing thickness of bound layers will be slightly reduced.</td>
<td>The runway will receive a complete new 3 layers base, binder and wearing course with grooving reducing the likelihood of future runway closures to a minimum the next 10 to 15 years.</td>
<td>The runway will receive a complete new 3 layers base, binder and thin layer wearing course having excellent friction reducing the likelihood of future closures to a minimum the next 10 to 15 years.</td>
</tr>
<tr>
<td>Financial Impact</td>
<td>-</td>
<td>€ 5,586,000</td>
<td>€ 5,874,000</td>
<td>€ 16,160,000</td>
<td>€ 14,560,000</td>
</tr>
<tr>
<td>Estimated Functional Service Life</td>
<td>3 – 5 years</td>
<td>8 – 10 years</td>
<td>6 – 8 years</td>
<td>10 – 15 years</td>
<td>10 – 12 years</td>
</tr>
<tr>
<td>Estimated Structural Service Life</td>
<td>3 – 5 years</td>
<td>6 – 10 years</td>
<td>6 – 10 years</td>
<td>20 years</td>
<td>20 years</td>
</tr>
<tr>
<td>Work Programme</td>
<td>-</td>
<td>Approx. 80 working nights without closure (20 weeks)</td>
<td>Approx. 80 working nights without closure (24 weeks)</td>
<td>Approx. 180 working nights without closure (45 weeks)</td>
<td>Approx. 170 working nights without closure (42 weeks)</td>
</tr>
<tr>
<td>Maximum ICAO category while construction</td>
<td>CAT III</td>
<td>CAT III</td>
<td>CAT III</td>
<td>CAT I</td>
<td>CAT I</td>
</tr>
</tbody>
</table>

Table 13 Summary of impact on pavement refurbishment alternatives.
Preferred Options

- Options were presented to our airlines partners and our regulator in Q4 of 2009

- In December 2009 following the production of a Runway serviceability plan the following recommendations pertaining to the runway were made:
  - Major Slab Replacement works and joint replacement needed urgently
  - TPFC non structural overlay project should proceed as soon as possible
TPFC Overlay Commenced (Nov 2010 – April 2011)

- BBI Appointed in August 2010
- 19 Weeks Programme (23:00-05:00) Closure
- 22mm TPFC Overlay – “Novachip” Concept
- Thick Layer Polymer Modified Emulsion Sprayed in
- Emulsion Boils and Mixes into the Open Graded Asphalt and Secures the Aggregates into the Matrix
- Copenhagen Airport/Johannesburg Airport
- Replacement of c 130 PQC Slabs
- 142,000m2 of TPFC Overlay in 4 Phases
- 1 Year Maintenance Programme
Runway Serviceability Issues

- March 2012 – Runway Closure (FOD) contamination by overbanding Materials

- March 2012 – FTR visited Site and noted that the degree of reflective cracking was consistent with what they would have anticipated after 6yrs life

- May 2012 – August 2012 – Rephalt Temporary Repair Materials used by the Asset Care - Airfield Maintenance Teams. This short Term Solution (bought some time)

- August 2012 – FTR/daa agree joint remedial solution
Short/Medium Term Remedial Solution

- Joint-master IMP combined with Joint-master JMB – Rhino –UK Product (HAPAS Approved)

- FTR’s analyses of the anticipated horizontal and vertical movement of the existing slabs and comparison with the properties of the Joint-master IMP/JMB system and concluded that the joint repair method has sufficient flexibility to accommodate the anticipated movements

- October 2012 – FTR/daa/UCD/Sandberg Explore Joint-master Solution (FEA)

- OBS 45 and OBS 60 used for over-banding no contamination issues reported
Project Inception – Linked to Asset Life Cycle

- ISO 55001 and Risk Model
- 25 Million PAX Forecast 2017
- Funding Secured – CIP 2014-2018
- Pavement end of life - AGL systems end of life, serviceability and safety, maintainability challenges, escalating maintenance costs
- Second Runway - Runway 16-34 approaching end of life
- NR Runway considerations 2019 commencement

Value Delivery
- ISO 55000 Compliance
- Reliability Excellence
- Process Safety Management
- Mechanical Integrity
- ISO 31000 Risk Management
- Asset Management Plans
- Asset Criticality
Project Scope

- Structural Overlay to 10-28
- Runway AGL Upgrade Runway 10-28
- Structural Overlay to Taxiways Echo 3, Echo 6 and Bravo 7
- Taxiway B3 and B2 AGL upgrades
- Taxiway widening B7, E6, E1 and B1
- Taxiway Re-designation Project enabling Works
Key Project Timelines – D&B Contract

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>Condition Surveys of Runway - URS</td>
</tr>
<tr>
<td>Early 2015</td>
<td>Appointment of Consultants CH2M</td>
</tr>
<tr>
<td>March 2015 – July 2015</td>
<td>Feasibility Study</td>
</tr>
<tr>
<td>July 2015 – Sept 2015</td>
<td>Outline Design</td>
</tr>
<tr>
<td>Sept 2015 – Nov 2015</td>
<td>Preparation of Tender Documents (Employers Requirements Documents) – D&amp;B Contract</td>
</tr>
<tr>
<td>Nov 2015 – Mar 2016</td>
<td>Tender Stage</td>
</tr>
<tr>
<td>July 2016</td>
<td>Appointment of D&amp;B Contractor Lagan Clare JV</td>
</tr>
<tr>
<td>July 2016 – Oct 2016</td>
<td>Detailed Design and Mobilisation to Site</td>
</tr>
<tr>
<td>Nov 2016</td>
<td>Commencement of Runway Closures</td>
</tr>
</tbody>
</table>
Structural Overlay Employers Requirements

- Design Aircraft is the **B777-300ER** at (MTOW)
- Frequency of traffic is Medium (i.e. 100,000 coverages over the life)
- The surface course shall be **grooved Marshall Asphalt**
- The following should be used in the pavement design: Defence estates design and maintenance guidance **DMG 027 (pavement design)** and **DMG 033 (reflective cracking on airfield pavements)**
- Minimum overlay thickness to be **150mm** with a design Life of the new pavement to be **15 years** with life to first maintenance of **10 Years**
- Installation of a **glass grid reinforcing** layer between the base and binder layers
Existing Pavement Details

**1989 Construction**

**2011 Construction**
LCJV Pavement Design Solution

- RPS and Unihorn commissioned on behalf of LCJV to design the pavement to meet the Employer Requirements

- RPS demonstrate that 150mm Marshall Asphalt overlay of existing concrete pavement (following the removal of the 22mm TPFC) will meet the requirements of DMG 027

- RPS conclude that 150mm overlay of existing concrete slabs in un-modified Marshall Asphalt would lead to reflective cracking in excess of that permitted in the ER’s and DMG 033 this is validated by Unihorn modelling

- Unihorn commissioned to model the impact of the introduction of SealOflex 5-50 (HT) in the 50mm base course.

- The report concludes that the incorporation of Sealoflex in the base course of the 150mm overlay negates the need for reinforcement in the underlying concrete pavement. They did state however that it would have a positive effect if included.

- Unihorn model the proposed pavement design 150mm structural overlay, SealOflex 5-50 (HT) in base course and model with reference to the life to 1st maintenance requirements as set out in the employers requirements
Unihorn Analysis and Recommendations

- The analysis focused on controlling the percentage of reflective cracking during the first 3 years of life (reflective cracking less than 1%) and during the first 10 years (reflective cracking less than 15%).

- Reflective cracking can be due to two major mechanisms: 1) thermally induced cracking and 2) traffic related cracking.

- From the analysis it was concluded that 150mm thick with a 5% polymer modified sealOflex asphalt concrete meets the employers requirements and DMG 033.

- It also concluded that at locations with a load transfer capacity of less than 70% CompoGrid CG200 should be applied on the milled PQC.
Pavement Design Details
## Typical Daily Construction Timeline

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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</thead>
<tbody>
<tr>
<td>17:15</td>
<td>Concall between ADM, ATC, Met Eireann and OIM</td>
</tr>
<tr>
<td>17:30</td>
<td>Go/No Go Decision</td>
</tr>
<tr>
<td>18:00</td>
<td>Batching Commences</td>
</tr>
<tr>
<td>20:00</td>
<td>Workers arrive to site</td>
</tr>
<tr>
<td>21:30</td>
<td>Nightly Briefing</td>
</tr>
<tr>
<td>23:00</td>
<td>Runway Possession Granted</td>
</tr>
<tr>
<td>23:10</td>
<td>A-Frames in place and work commences</td>
</tr>
<tr>
<td>23:10 – 23:30</td>
<td>Contractor mobilises</td>
</tr>
<tr>
<td>23:30 – 00:00</td>
<td>Removal of lights and planing off TPFC</td>
</tr>
<tr>
<td>00:00 – 01:30</td>
<td>Repairs to Concrete/Install Glass Grid</td>
</tr>
</tbody>
</table>
## Time Table

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>01:30 – 03:00</td>
<td>Laying of Asphalt</td>
</tr>
<tr>
<td>02:00</td>
<td>Mid Shift Briefing</td>
</tr>
<tr>
<td>03:00 – 03:30</td>
<td>Re-install lights and Line marking</td>
</tr>
<tr>
<td>03:00 – 04:00</td>
<td>Tidy of work areas and removal of plant/equip</td>
</tr>
<tr>
<td>04:00</td>
<td>Friction Testing coefficient of friction confirmed/AGL</td>
</tr>
<tr>
<td></td>
<td>Lighting Checks/Compliance validation</td>
</tr>
<tr>
<td>04:15</td>
<td>Commence FOD Sweep</td>
</tr>
<tr>
<td>04:15 – 04:55</td>
<td>FOD Sweep</td>
</tr>
<tr>
<td>05:00</td>
<td>Reinstatement of Runway</td>
</tr>
<tr>
<td>05:00 – 06:00</td>
<td>Post Shift Briefing and Planning next shift works</td>
</tr>
</tbody>
</table>
Delivery Challenges

- Weather
- Stakeholder (IAA/Airlines/Community)
- Safety – Operational and Occupational
- Noise
- Security
- Design
- Quality
- Scope Creep
- Un-grooved Runway constraint
- Maintain CAT III AGL Services
- Cost
Pavement Maintenance 2019

- Rubber Quantities Removed to-date:
  - July - 2.02 T
  - Sept - 1.86 T
  - Oct - 1.82 T
  - Dec - 2.1 T

- All waste rubber removed and disposed of in accordance with Contractor’s environmental management plan (EMP) at a licenced waste facility (AES, Bord na Mona)

- Contractor currently investigating options for re-use of the waste rubber as a continuous improvement
Before and After Treatment
- Typical weight of a B737 Tyre is 72KGS. The rubber removal in 6 months since July 2018 is equivalent to 110 B737 Tyres
THANK YOU