



YVR Taxiway Delta Rehabilitation



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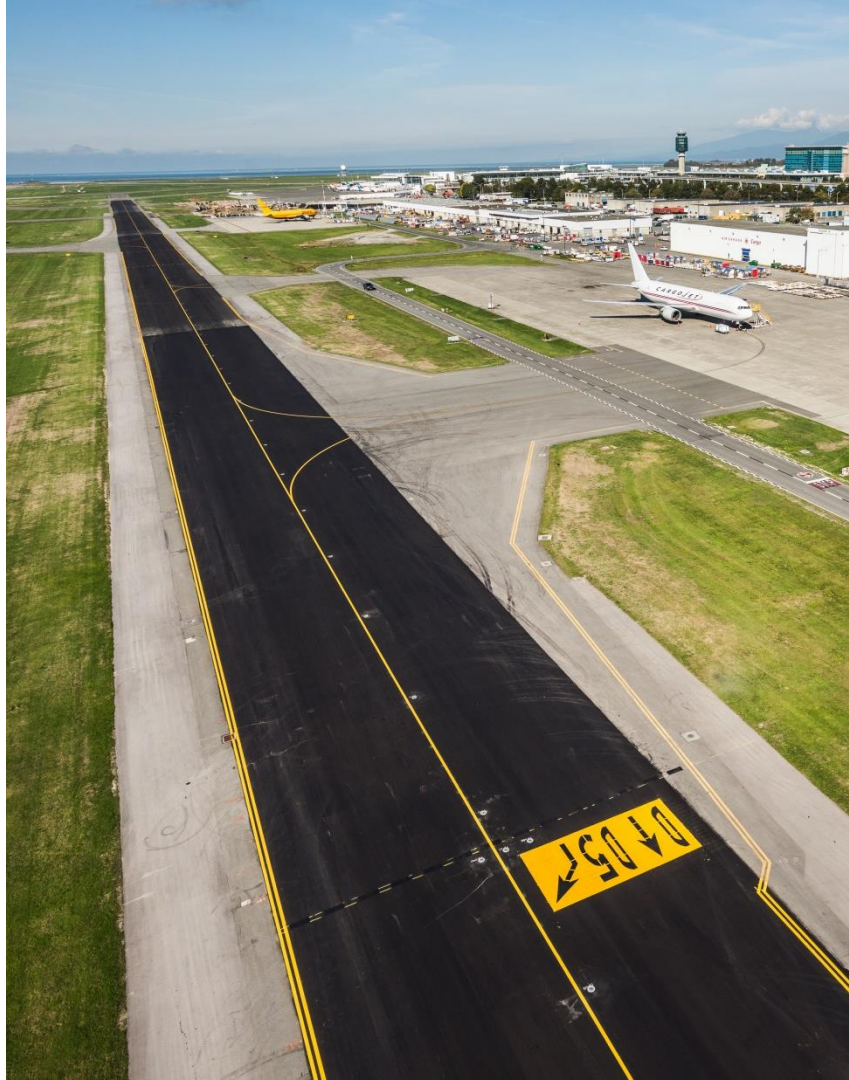
SWIFT September 22, 2016

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HATCH

Overview

1. YVR (Vancouver International Airport)
2. The Problems and Causes
3. Emergency Repair Plan
4. Methodology
5. Challenges
6. Results



YVR

- Canada's second busiest airport
- In Year 2015, served:
56 airlines
20 million+ passengers,
278,000+ aircraft movements, and
272,000 metric tonnes cargo
- North Runway: 9,940ft (3,030m) – used
mainly for arrivals.
- South Runway: 11,500ft (3,505m) –
departures
- Second only to LAX for international
traffic on west coast NA
- Voted by Skytrax as best airport in
North America for the 7th consecutive
year



Location at YVR

- South Runway -
Taxiway D
Repairs from
Taxiway H to
Taxiway Exit DV
(about 1500
metres)



The Problems and Causes

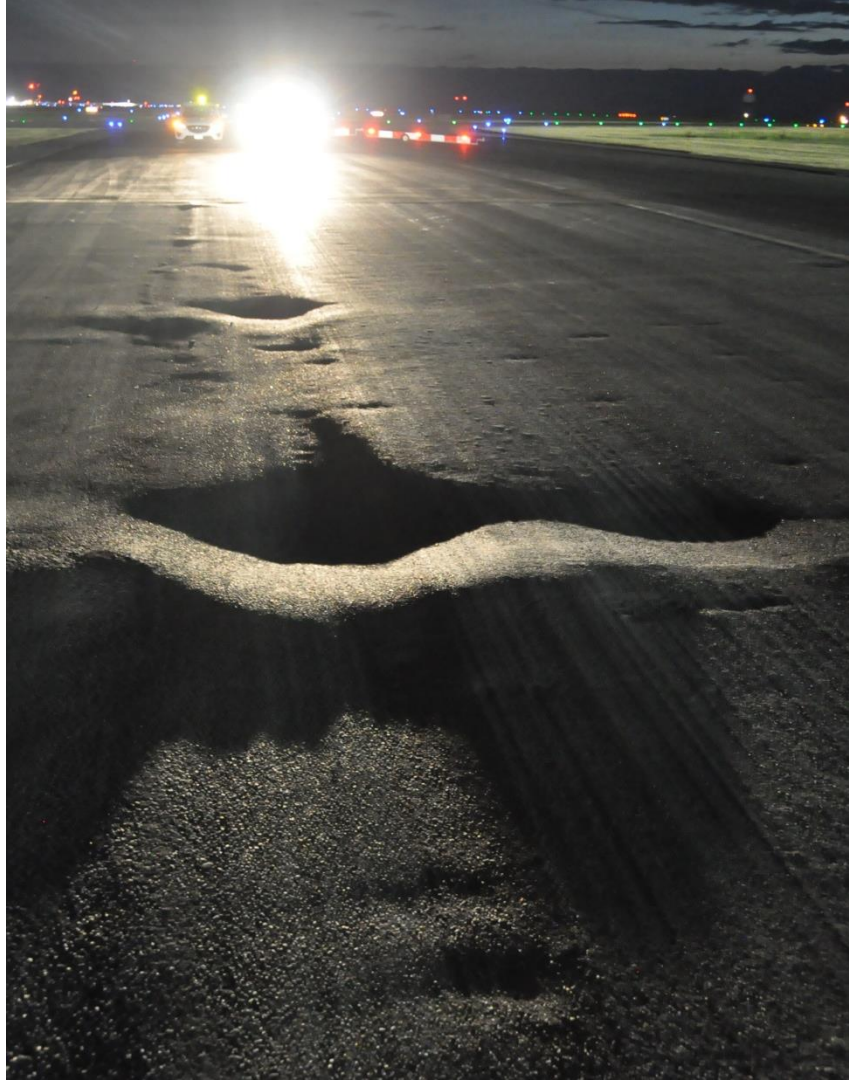
Taxiway Delta, one of YVR's most vital arteries, required an unexpected repair.

Major ruts in pavement causing maneuverability issues for aircraft.

B777 using breakaway thrust to get out of ruts. Q400 deflecting pavement.

Direct Causes:

- Record-breaking hot summer in 2015
- Increasingly demanding aircraft mixes over recent years (160 wide-bodies per day; 16 B777's per day on Taxiway D)



Pavement Loading and Hot Mix Ageing

- Pavement was not designed for increased heavy traffic (1960's vintage PCC: 360 mm + keyways , 150mm CGB, 460 mm river sand subbase, subgrade CBR=2-3% with 2+ HMA overlays)
- Select rigid ACN's : DC-8-62 (77), B747-400 (88), A380-800(110), B777-300ER (128) – for ICAO D Ultralow) - 66% increase.
- Extreme stripping in lower HMA layers

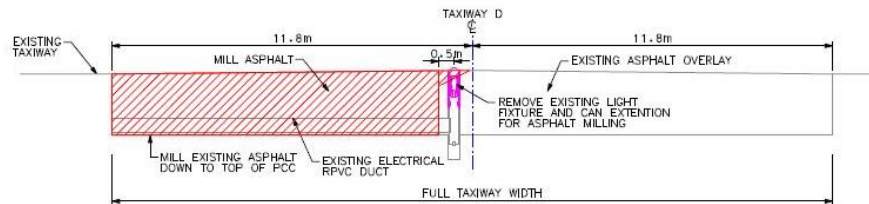


Emergency Repair Plan

- Hatch retained by YVR for immediate pavement design and selection of construction team.
- Design completed within 5 working days (15 drawings and specs - 24/7)
- Hatch selected contractors, YVR concurred – no bidding. Contract based on agreed unit prices.
- Taxiway required a completed asphalt remove/replace.
- 159 centreline light cans required to be removed and cored after paving.
- Hatch on site at all times to adjust design to suit site conditions.



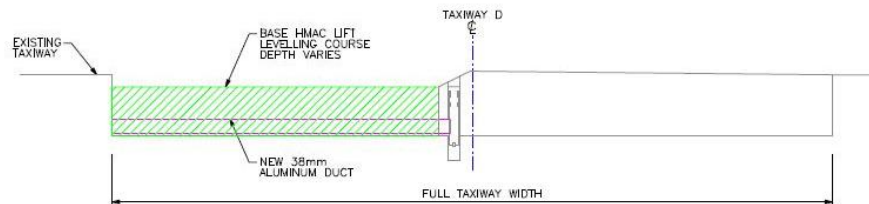
Methodology



Night 1 North

STEP 1 - MILLING

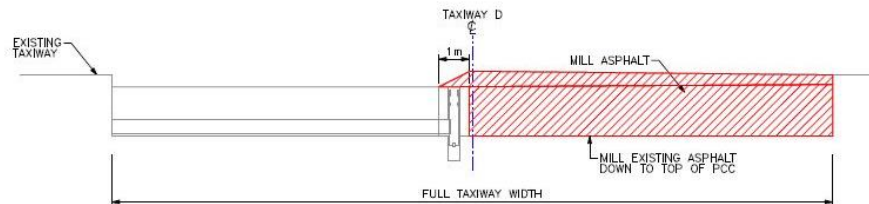
100 m per night



Night 1 North

STEP 2 - PAVING

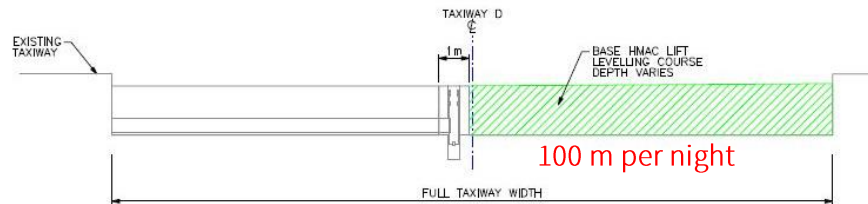
100 m per night



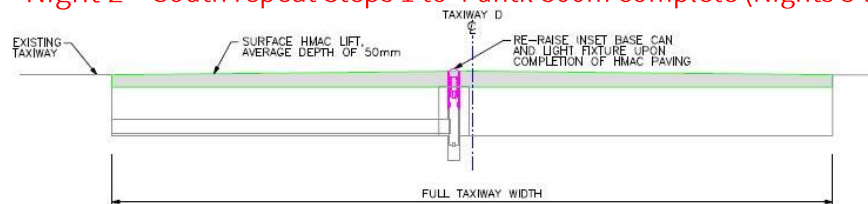
Night 2 South

STEP 3 - MILLING

100 m per night



Night 2 – South repeat Steps 1 to 4 until 300m complete (Nights 3 to 6)



Night 7 – Full width three asphalt spreaders with final coring and inset light installation in later nights (cores and wiring completed for about 15 lights a night)

Asphalt Mix Designs

Lower Course (PG 64-22)

Marshall Property	Mix Design Results	Specifications
A.C. Content (%by wt. of mix)	4.40	
V.M.A. (%)	13.3	13.0 min
Voids Filled (%)	69.9	
Air Voids (%)	4.0	3 to 5
Density (kg/m ³)	2461	
Max Density (kg/m ³)	2564	
Marshall Stability (kN)	25.6	12.5 min
Flow (mm)	2.6	2 – 4
TSR (%)	98.5	80% min
Retained Stability (%)	93.4	80% min

Surface Course (PG 64-22)

Marshall Property	Mix Design Results	Specifications
A.C. Content (%by wt. of mix)	5.60	
V.M.A. (%)	15.2	15.0 min
Voids Filled (%)	74.9	
Air Voids (%)	3.8	3 to 5
Density (kg/m ³)	2433	
Max Density (kg/m ³)	2530	
Marshall Stability (kN)	19.4	12.5 min
Flow (mm)	3.2	2 – 4
TSR (%)	96.3	80% min
Retained Stability (%)	97.1	80% min

Proven Mixes, Actual Field results: Avg. Marshall Stabilities – 16kN; Average compaction 98%+

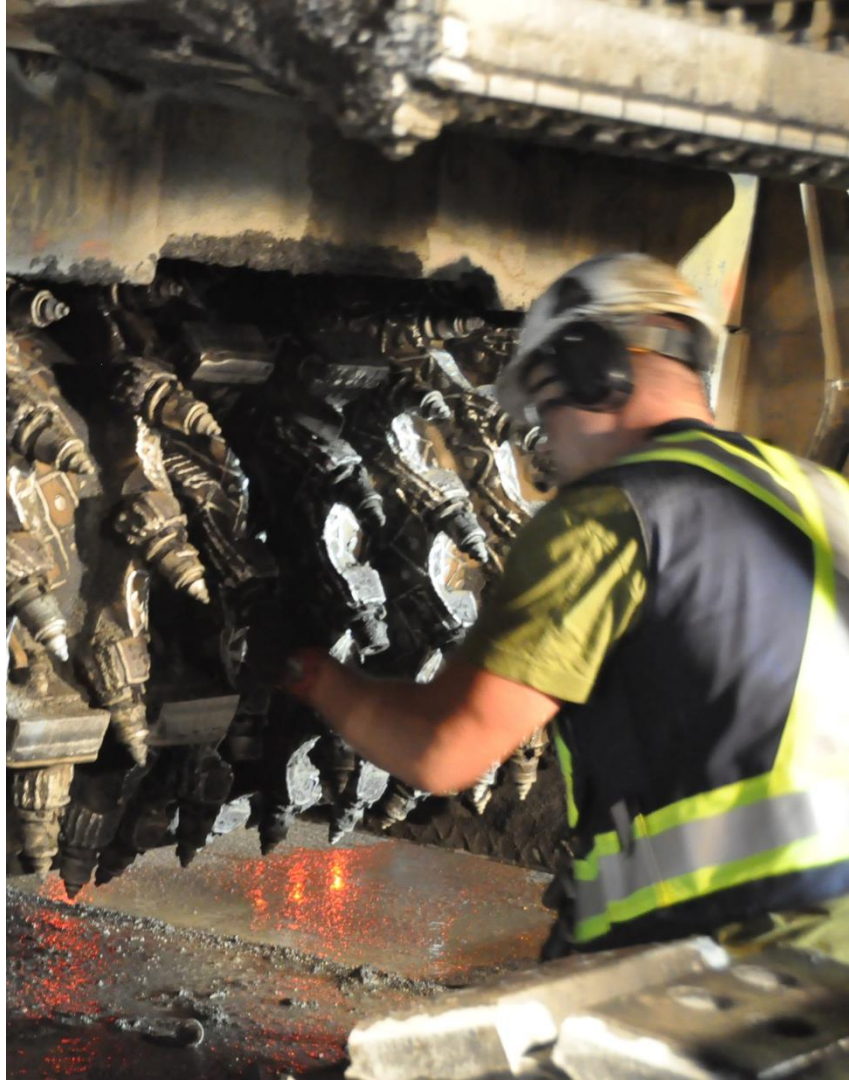
Challenges

- Working around tenants' aircraft schedules at night
 - 'Pullbacks' of crews and equipment were required before tenants' aircraft arriving and departing
- Returning operation of Taxiway D at the end of every night
 - Asphalt ramps were built to the milled surface every night to allow for aircraft to travel during the day
- Working with an excessive amount of equipment and crew within limited space (avg. 46 people and 31 pieces of equipment in a 23m x 300m area)



Challenges (2)

- Maintaining taxiway centreline paint markings
- Working around electrical infrastructure
- Constant adjustments to the milling depth was required to avoid grinding against the PCC surface below the asphalt overlay; this caused slower productivity.



Challenges (3)

- Asphalt needed to be cooled quickly at the end of every night to allow for immediate aircraft traffic.
 - Water trucks sprayed water throughout the day to cool the asphalt under the hot weather.
- Extensive planning was required to allow paving and electrical to occur concurrently and/or keep up with each other.



Results

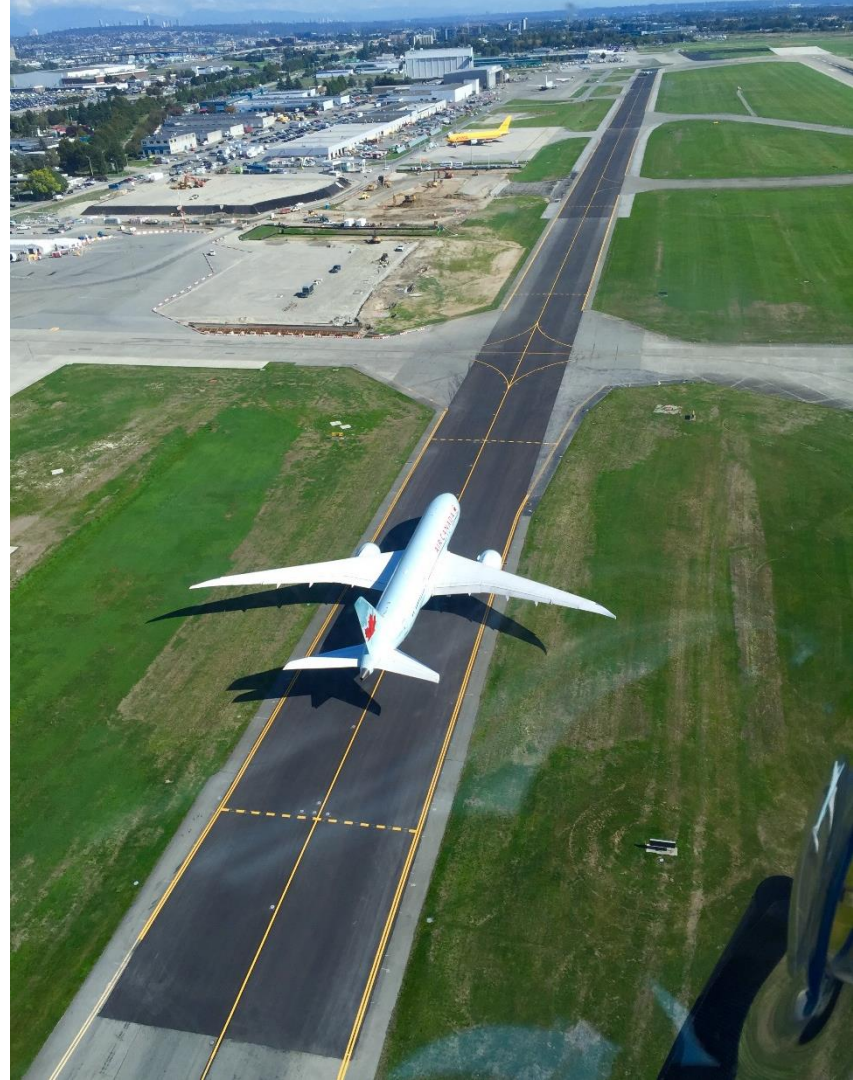
- 45,500m² of surface area milled (depths range from 90mm along taxiway edges up to 320mm along the centre)
- 16,900 metric tonnes of asphalt paved
- 159 centreline lights cored and replaced
- 31 nights of paving between July 15 – September 11, 2015

Epilogue: Taxiway D is understrength for existing/future traffic. Temporary repairs will last about 2 years. Full reconstruction required. Taxiway may be shifted toward runway for more apron area (YVRAA to release new master plan in 2017).



Acknowledgements

- Vancouver International Airport Authority (YVRAA)
- Jacob Bros Construction (GC)
- Columbia Bithulithic (Lafarge Canada) (milling and paving)
- Bay Hill (airfield lighting)
- CanWest (sawcutting and coring)
- Sketch Projects (pavement markings)
- Metro Surveys
- Securiguard
- Levelton Consultants Ltd. (QA)



Questions

