Runway cleaning

Potential for cost reduction and increased efficiency

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The reason why...
Runway Excursions

Landing incidents on wet or contaminated (reduced friction) runways are the second largest cause of incidents and accidents in aviation.

* http://www.skybrary.aero/index.php/Portal:Runway_Excursion
The build up of rubber deposits affects the friction level of the runway.

- The number of landings
- The size of the aircraft
- The period between runway surface cleanings.

>>> Slippery surface in wet conditions.
Aquaplaning speed is calculated if you multiply the square root of the tire pressure by 9 i.e:

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Aquapl. Speed</th>
<th>Touch down speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 727</td>
<td>117 kts.</td>
<td>111 – 122 kts.</td>
</tr>
<tr>
<td>Airbus 380</td>
<td>127 kts.</td>
<td>138 – 144 kts.</td>
</tr>
</tbody>
</table>

If the friction value is decreased by rubber by 0.01

you reduce...

...the runway available length by 70 meters

( LFV Teknik, Sweden )
Frequent Rubber Removal

is recommended by FAA-USA+ICAO

<table>
<thead>
<tr>
<th>Number of daily turbojet aircraft landing per runway end</th>
<th>Suggested rubber deposit removal frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 15</td>
<td>2 years</td>
</tr>
<tr>
<td>16 to 30</td>
<td>1 year</td>
</tr>
<tr>
<td>31 to 90</td>
<td>6 months</td>
</tr>
<tr>
<td>91 to 150</td>
<td>4 months</td>
</tr>
<tr>
<td>151 to 210</td>
<td>3 months</td>
</tr>
<tr>
<td>Greater than 210</td>
<td>2 months</td>
</tr>
</tbody>
</table>

In their advisory circular 150/5320-12C the U.S. Department of Transportation / Federal Aviation Administration recommends frequent rubber removal.
HOW TO REMOVE RUBBER FROM A RUNWAY?
Chemical Removal Method

Chemical removal was the standard till environmental awakening of the 1960s

**Advantages**

- Min. potential for pavement damage due to softened rubber before removal
- Ability to use inhouse maintenance equipment and personnel
- Process speed (750 to 1600 m²/hour)
- Biogradable / environmentally-friendly chemicals

**Disadvantages**

- Possible pavement damage to asphalt pavement and grooves when “soap” is removed
- Paint loss during rubber removal
- AGL damaged (UK CAA report)
- Environmental issues regarding disposal of waste water and dangerous influence on staff
- Damage to in-house equipment hoses, increased mechanical breakdowns
- Inability to reopen rwy in case of an emergency (6-8 hours closure reported)
Steel brushes

Advantages

- Improves surface friction by removing existing polished surface contaminants
- Can use existing sweepers with steel tipped brushes

Disadvantages

- Possible groove damage
- Damage to AGL
- Damage to paint markings
- Polishing of runway texture
- Environmental issues with appropriate disposal of residues
- Slow production rate
- FOD risk
Shot peening

**Advantages**

- Retextures the pavement in addition to removing rubber
- Process speed (900 – 2700 m²/hour)
- Ease of getting rubber removal equipment off the runway
- Environmentally compatible

**Disadvantages**

- Possible pavement/groove/paint damage to asphalt pavements
- Possible AGL damage
- FOD hazard owing to in asphalt embedded shots (USAF statement)
- Environmental issues with appropriate disposal of residue
- Process cannot be used in wet conditions
- Process cannot be used at high temperatures
**High pressure water blasting**

[600 – 1,500 bar]

### Advantages
- Improved pavement friction
- Improved micro texture
- Retexturing possibility
- Environmental compatibility
- Equipment maneuverability i.e. RWY clearance below 3 minutes

### Disadvantages
- Risk of pavement damage
- Damage to grooves
- No AGL cleaning
- No center line cleaning
- High water consumption
- High number of vehicles and personnel on runway
**Advantages**

- Improved micro texture
- Retexturing possibility
- Multiple applications
- Equipment maneuverability i.e. RWY clearance below 3 minutes

**Disadvantages**

- Possible pavement damage
- Damage to grooves
- No center line cleaning
- No AGL cleaning
- Ambient air temperature limitations
- Reduced working width
RISK / COST ANALYSIS
USUAL ULTRA HIGH PRESSURE WATER JETTING
Air traffic disturbance

- Break down of equipment on RWY
- Equipment with long runway evacuation period
- Several vehicles on RWY
Safety risk

FOD risk, due to
- equipment, not produced by experienced manufacturers
- insufficiently educated staff
- high number of components
Risk Usual Ultra High Pressure Water Jetting

Damages to runway pavement

Use of equipment

- Limited working width → multiple cleaning track overlaps → double stress of RWY
- Large diameter fixed nozzle rotor → different impact of inner and outer nozzles
- Low number of nozzles and uneven nozzle configuration
- No computer controlled working parameters
Risk Usual Ultra High Pressure Water Jetting

Damages to runway installations

- Damage to AGL-Prism and sealing
- Unwanted removal of runway markings
Cost

Working cost (contracting)

Direct cost for cleaning operation

Analysis of different contracting offers
Working cost (own equipment)

Direct cost for cleaning operation

Analysis of total cost, e.g. cost for:
• Amortization
• Spare parts / Maintenance
• Staff
• Fuel
• ...

Considering:
• Availability
• Local after sales service
• ...

Cost
Security and escort

Cost for inspection and approval of equipment and staff

Choosing a system with low equipment and staff number
Waste removal

Cost for waste treatment and disposal

Optimization by selecting a system with low water consumption and internal liquid / solid waste separation
Cost

Water

Cost for fresh water

Optimization by selecting a system with low water consumption
Cost

Repair Cost

In case using an insufficient system, cost for
- runway renovation
- applying new marking
- replacing damaged AGL

Optimization by selecting a appropriate system
### Ideal rubber removal system

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><strong>99% Rubber removal</strong></td>
<td>99% Rubber removal ensures effective removal of rubber.</td>
</tr>
<tr>
<td><strong>Friction Values</strong></td>
<td>Higher than 0.7 (Saab CFME) after rubber removal mission.</td>
</tr>
<tr>
<td><strong>Extreme low water consumption</strong></td>
<td>2.5 ltrs/m² (protecting the environment).</td>
</tr>
<tr>
<td><strong>No Damage to any type of Surface texture</strong></td>
<td>No Damage to grooving, joint sealing.</td>
</tr>
<tr>
<td><strong>AGL are cleaned during Rubber Removal mission without damage</strong></td>
<td>AGL are cleaned during rubber removal mission without damage to lenses or sealing</td>
</tr>
<tr>
<td><strong>Frequency of rubber removal</strong></td>
<td>Frequency of rubber removal required per annum can be reduced.</td>
</tr>
<tr>
<td><strong>Cleaning Output level</strong></td>
<td>Output level up to 1000 m²/hour.</td>
</tr>
<tr>
<td><strong>99% removal of waste water</strong></td>
<td>99% removal of waste water for efficient water management.</td>
</tr>
<tr>
<td><strong>Computer controlled cleaning process</strong></td>
<td>One man operation ensures efficiency and safety.</td>
</tr>
<tr>
<td><strong>One man operation</strong></td>
<td>Runway vacation time for incoming emergency flight is about 3 minutes.</td>
</tr>
<tr>
<td><strong>Runway life time increase</strong></td>
<td>Runway life time can be prolonged.</td>
</tr>
</tbody>
</table>
TrackJet meets these requirements
Optimum adjustment – No overlaps
Rubber and Paint removal at AMS, ATH, BRU Airport

NO DAMAGE TO ANTI-SKID STONE LAYER!
Centre line cleaning
No damage to grooves
No damage to joint sealings
Apron and hangar cleaning
Paint marking removal
AIRPORTS RELY ON TRACKJET®

- Aberdeen
- Abu Dhabi
- Amsterdam Schiphol
- Al Ain
- Athens
- Bangalore
- Bari
- Bergen
- Birmingham
- Bologna
- Brescia
- Bristol Filton
- Brussels
- Brussels South Charlerois
- Cagliari Elmas
- Cape Verde
- Cardiff
- Cheju
- Chennai
- Doncaster Robin Hood
- Edinburgh
- Faro
- Frankfurt-Hahn
- Funchal Madeira
- Geneva
- Glasgow International
- Glasgow Prestwick
- Göteborg Landvetter
- Hamburg
- Hanover
- Hyderabad
- Ho Chi Minh City
- Inverness
- Incheon Seoul
- Kimpo Seoul
- Kolkata
- Lask
- Leeds Bradford
- Liège
- Lisbon
- London Heathrow
- London City
- London Gatwick
- London Stansted
- Manchester
- Moscow, Domodedovo
- Munich FJS
- Naples
- Nato Airbase Hohn
- Newcastle
- New Delhi
- Paderborn–Lippstadt
- Paris Orly
- Oporto
- Prague
- Pusan Kimhae
- Rome Fiumicino
- Rome Ciampino
- Rotterdam
- Saarbrücken-Ensheim
- Salzburg
- Skopje, Macedonia
- Stockholm Arlanda
- St. Petersburg, Pulkovo
- Tirana
- Treviso
- Turin
- US Air Force Base Mildenhall
- US Air Force Base Bagram
- US Air Force Base Incirlik
- US Air Force RAF Lakenheath
- US Air Force Base Moron
- Venice Marco Polo
- Vienna
- Vigo
- Zurich Unique
Thank you for your Attention!

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