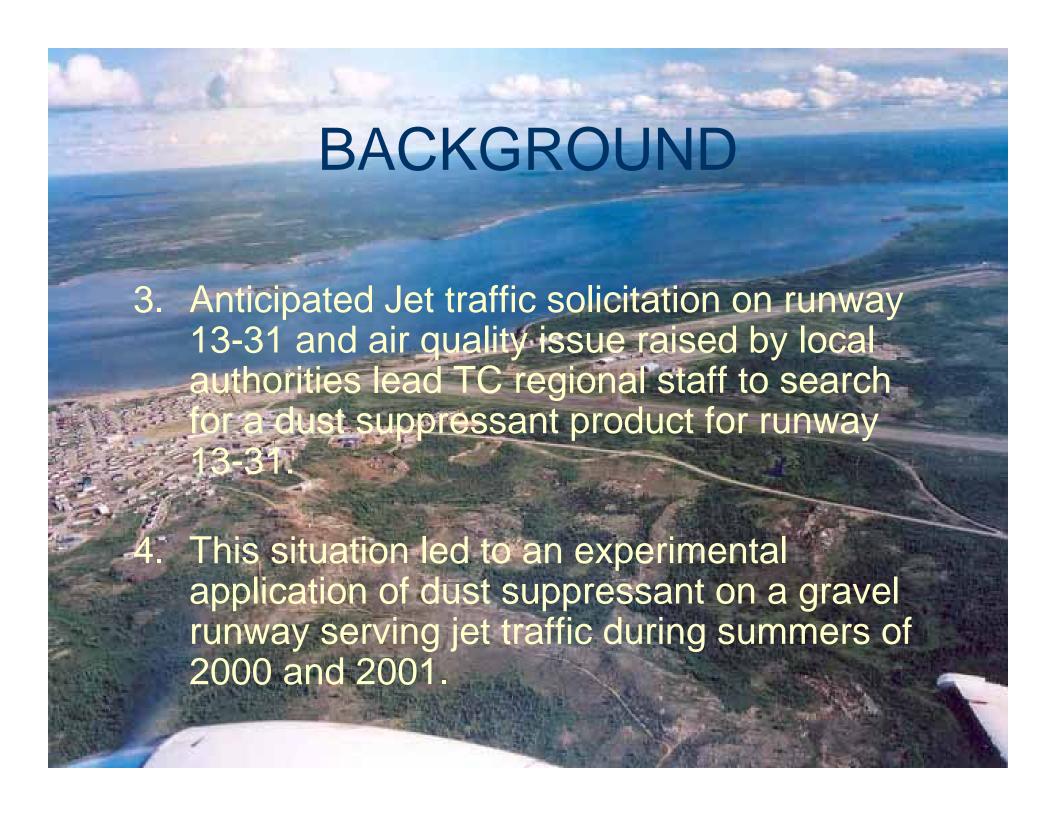
PERFORMANCE EVALUATION OF DUST SUPPRESSANT PRODUCT, KUUJJUAQ AIRPORT, QUEBEC

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Project Leader
Transport Canada
Quebec region, Programs

CASE STUDY — INTERIM OBSERVATIONS
SWIFT CONFERENCE
CALGARY — September 2002



- 1. Major construction project at Kuujjuaq airport, Quebec during summers of 1999, 2000 and 2001 (\$12 700 000 T.E.C.)
- 2. During reconstruction of the main runway (07-25), all traffic including daily B-737 traffic had to be transferred to secondary gravel runway (13-31) for 3 months in the summers of 2000 and 2001.





KUUJJUAQ AIRPORT LAYOUT

RUNWAY 13-31:

Length: 1524m (5000') Width: 46 m (150')

TORA = 5200 feet LDA = 5000 feet

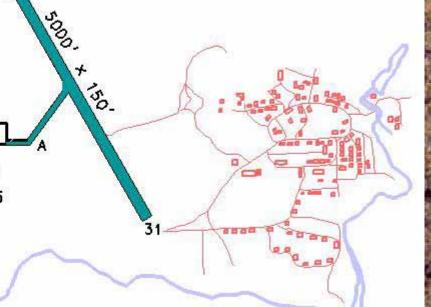
Slope 31 = +1.6%

6000' × 150'

Construction 1942-45 USAF

Take off and landing: Roughly 66% on runway 31 (river side)

Transport Canada Airport Managed by Kativik Regional Government



Riviere Koksoak River





LOSS OF GRANULAR MATERIAL

(B-737 Movements)



FACTORS INFLUENCING LOSS OF FINE PARTICULES

(Less than 75 um)





Surface hardness decreases rapidly Leads to loose coarse material problem

- ➤ Segregation
- > Rutting
- >Surface irregularities (ondulation, was boardy, etc)
- Loss of bearing strength (poor CBR value)



- Increased take off distance (Higher rolling resistance)
- > Handling problem
- Stone damage (props, flaps, wings, gears, dampers, tires)
- > Increased structural loading

GRAVEL RUNWAY MAINTENANCE

Runway has to be compacted almost on a daily basis to:

- Drive loose stone into the surface
- Reduce rolling resistance (reduce drag)
- Close the surface to prevent erosion(blast and water)
- Eliminate initial rutting



- Correct roughness and other surface problem
- Restore grade and gradation
- Add granular material (segragation problem, etc)



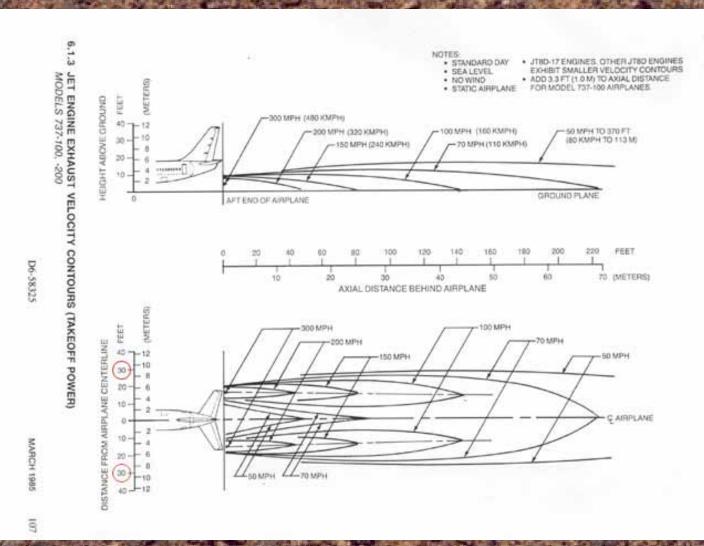




On alpha taxiway beside the apron to evaluate performance and impact on an operational surface. (Curing, stability, crust potential)

8 18 918

APPLICATION WIDTH



According to jet engine exhaust velocity contours at take off power (B-737-200)



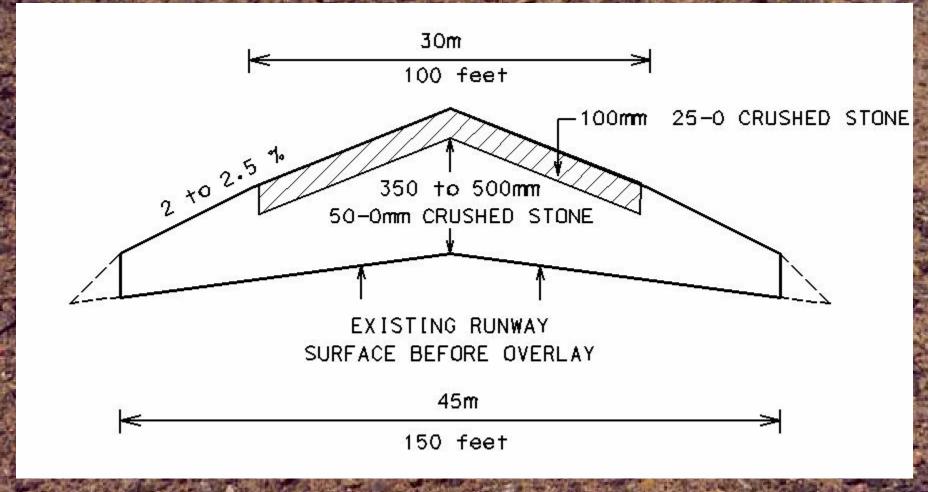
Surface preparation

- Complete grading and compaction
- ➤If necessary, new material addition to correct grade or gradation

Application rate

- Based on sieve analysis and special lab test performed by the supplier
- ➤ Based on a 75 mm (3") thickness treatment (0,75 l/sq.m)

RUNWAY 13-31

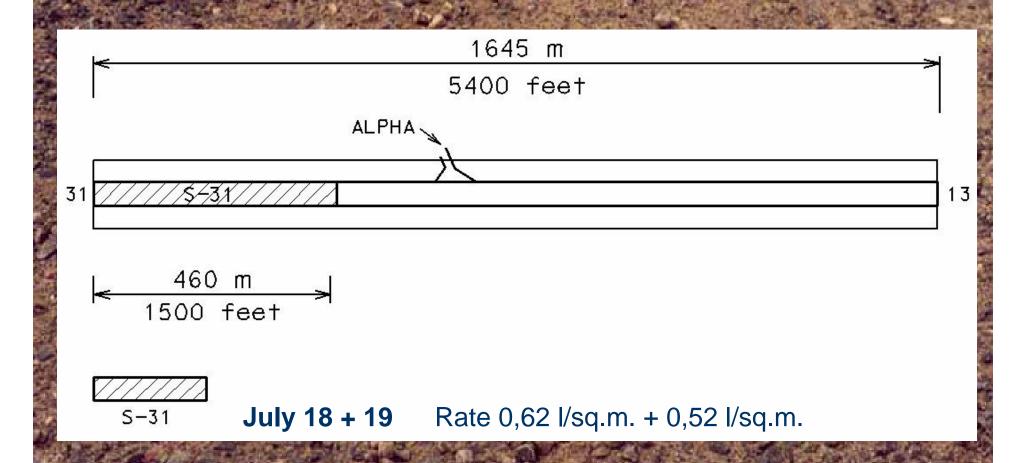


Regraveled during summer 1999 55 000 T

25 mm 5 mm

100 % passing 45 % passing 0,075 mm 5 to 7 % passing

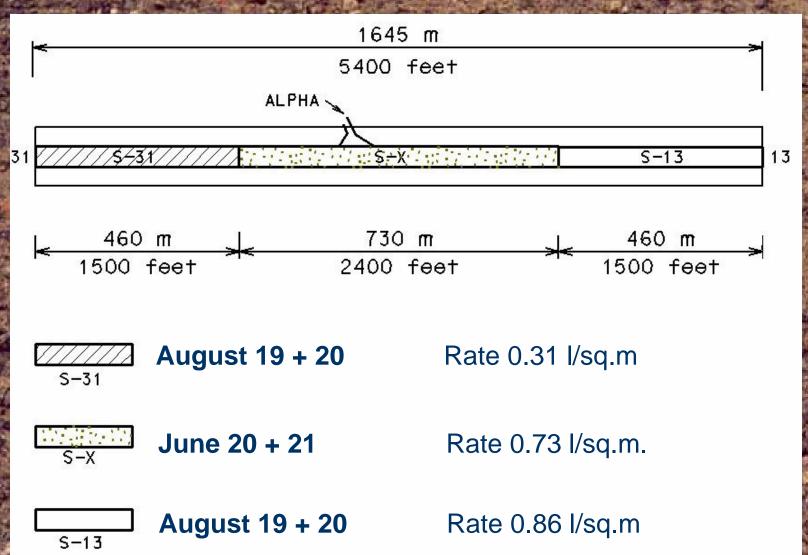
PRODUCT APPLICATION SUMMER 2000





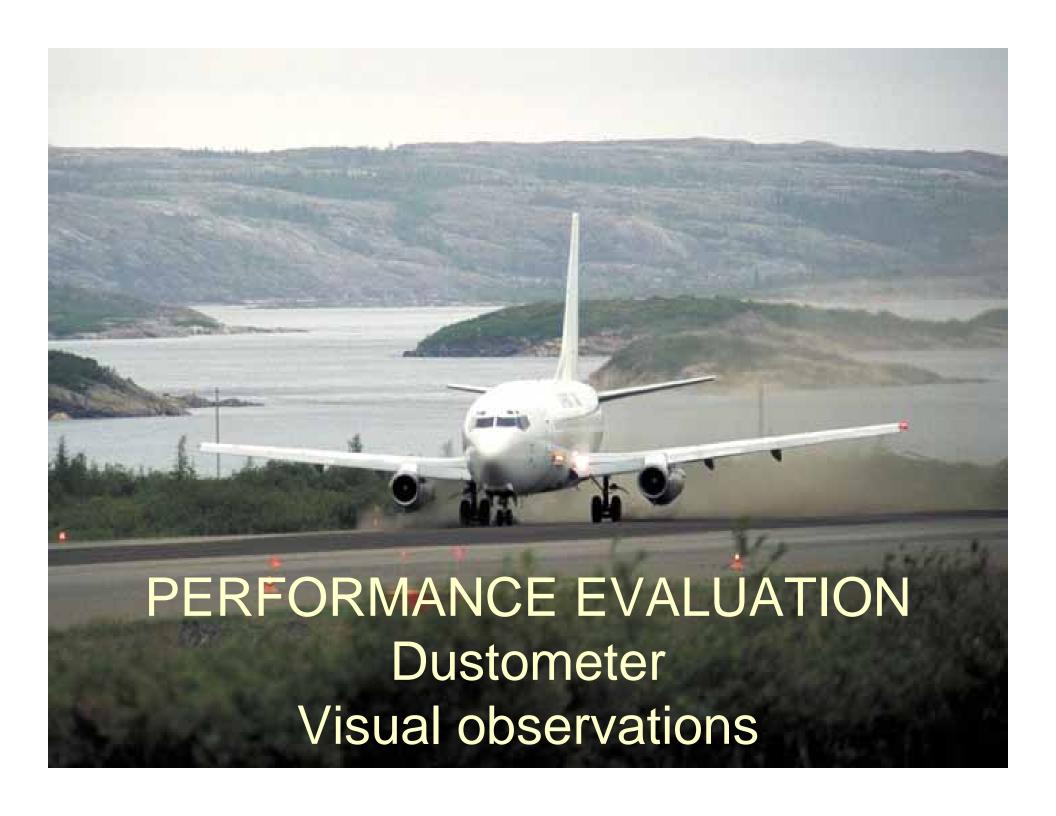


PRODUCT APPLICATION SUMMER 2001











The Colorado State University Dustometer is an experimental road dust measurement device.

The Dustometer is a simple quantitative dust measuring device:

- Easy and inexpensive to use
 - > Allows large data sampling in a short period
 - Proved to be a very quantative reproductive and precise for unpaved road dust measurements

We used the Dustometer in Kuujjuaq on runway 13-31 treated and untreated surfaces during summer 2001.

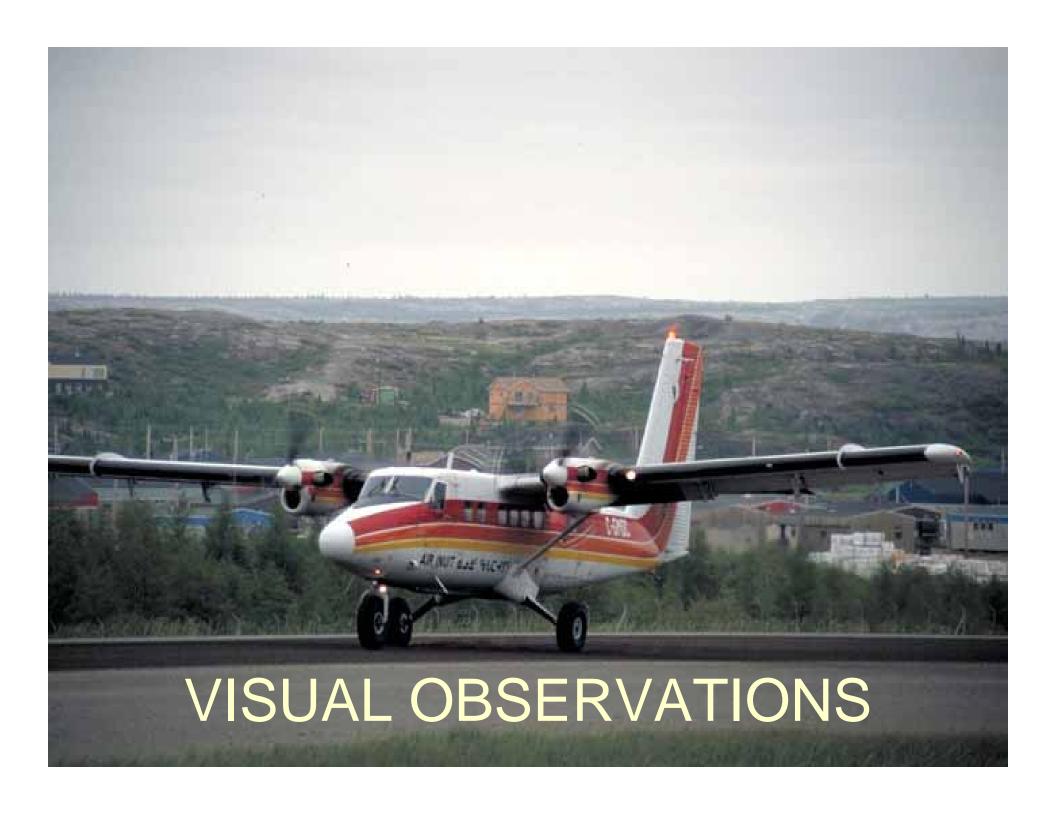
DUSTOMETER OBSERVATIONS

The Dustometer technique did not allow us to measure quantitatively the relative effectiveness of the dust suppressant.

Runway surface conditions were changing too rapidly compared to low traffic unpaved roads, and quite differently from one area of the runway to an another.

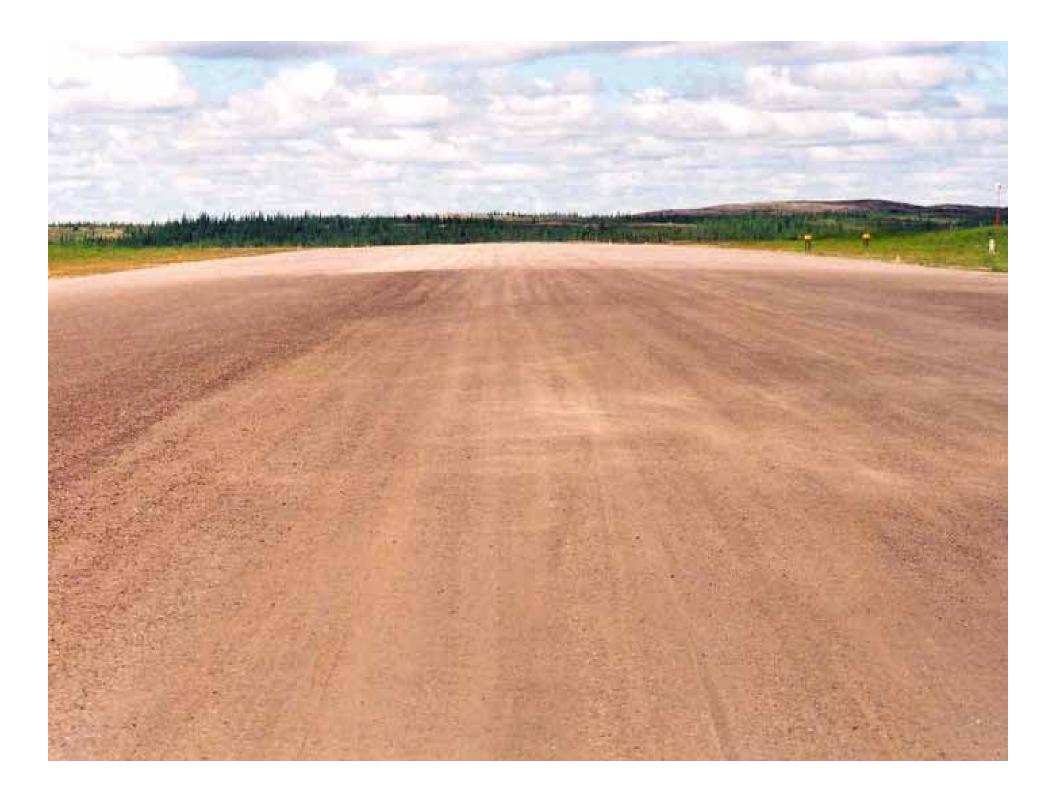
Moisture content constant variation was an important problematic preventing daily continuous data collection.

Impossible to offset the moisture content factor.







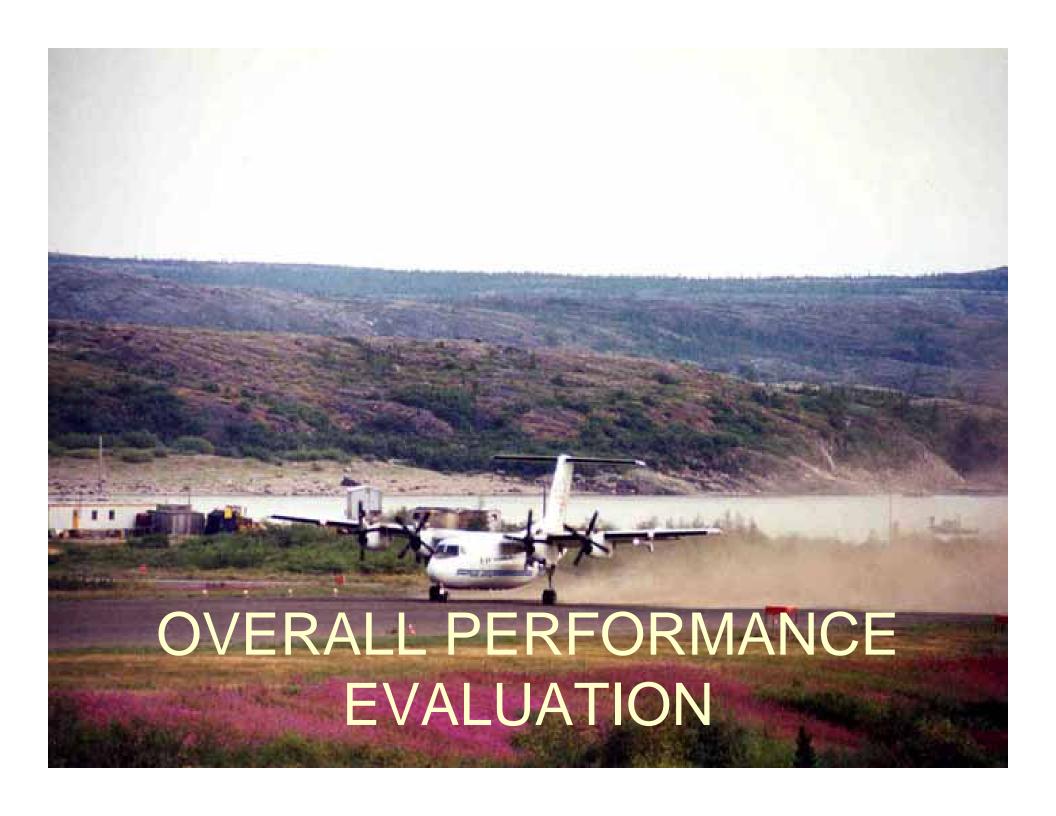












FUGITIVE DUST REDUCTION

Dust suppressant effect was very noticeable on S31 area compared to the type and amount of dust generated from untreated surfaces. Proximity of S31 from the village was one of the main concerns and the product obviously helped us avoid complaints from nearby residents. The product helped control unwanted fugitive air particles.

Dust was darker and deposited much more rapidly, thus avoiding reaching nearby residences and roads. Dust clouds formation was significantly less important.

The dust reduction effect was very noticeable in the early stages and decreased gradually over time.

After one year the effect was still visible but was reducing rapidly after each grading operation. (Contamination, erosion deeper than treatment thickness, rain wash-off??)

BINDING EFFECT AND IMPACT ON RUNWAY CONDITION

The binding proprieties of the product noticeably reduced the rate of aggregate loss.

Binding properties of the product were very useful, specially in dry runway conditions. Higher density, stronger cohesion and longer water content retention contribute to reduce the rate of loss of fine particles.

In high solicitation areas (S31) the binding effect reduced quite rapidly (low slung engines intense solicitation). Loose stones appeared gradually on the surface but cohesion was still noticeable in the under layer compared to untreated surfaces. This contributes to reduce the severity of rut formations.

BINDING EFFECT AND IMPACT ON RUNWAY CONDITION

After one year (S31) the binding effect was still noticeable in lower solicitation areas but not in high velocity areas such as the engines axis (0-2" layer was visible about 5% of the engines axis). The life cycle of the product on S31 was about 12 months.

Observations provided by resident (PWSGC) technical staff confirmed the overall contribution of the product in reducing dust emission and maintenance efforts (watering, grading, compacting and material replacement).

Considering high traffic level and jet traffic in Kuujjuaq on runway 13-31 during summers of 2000 and 2001 the product contribution was beneficial.

ECONOMIC CONSIDERATIONS

Service level was noticeably higher on S31 than on S13 untreated area over a annual period. Periods between grading operation was roughly twice as long on the treated surface over a one year period.

Even with a higher traffic solicitation (2/3 of take off and landing occurring on S31), the cost of treatment and maintenance of S31 area was more or less equal to what we had to pay under the construction project to maintain service levels and replace gravel lost on S13 based on an annual evaluation period.

S13

n/a

\$8 800

S31
Treatment 7800 sq.m. (2000) \$10 600
Granular material replacement n/a

RECOMMENDATION FOR FUTURE APPLICATIONS

Application width should be at least 75 feet with B-737 regular traffic.

With intense jet traffic dust abatement must be applied every year at least in high solicitation areas.

Application should be considered twice a year in very critical area of the runway to reduce jet blast digging effect (rotation, initial reverse thrust and at maximum takeoff power).

Application rate must be reduced on thin layers of gravel to avoid crust formation.

Complete grading before application in order to establish the fines content and gradation uniformity is very important before application. (Product performance is much lower when applied on gravel already exposed to traffic.)

FINAL REMARKS

Performance evaluation of dust suppressant should be undertaken on a normal traffic gravel runway to evaluate the product life cycle.

Half length runway treatment evaluation programs should be considered in order to evaluate impact on service levels, maintenance efforts and to measure rate of loss of fine particles.

Dust abatement application product on gravel runways seems to have a certain potential in improving overall service levels, reducing maintenance cost and increasing the life expectancy of construction and rehabilitation works.

Considering the great number of gravel runways in Northern Canada and their important operation and construction costs, research leading to solutions to gravel erosion problems or alternative maintenance strategies could lead to great savings for the tax payer and private operators.

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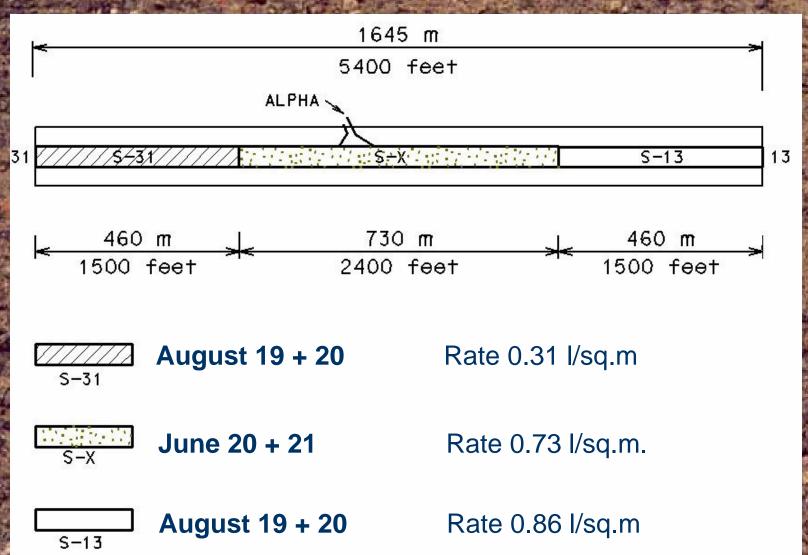
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Transport Canada

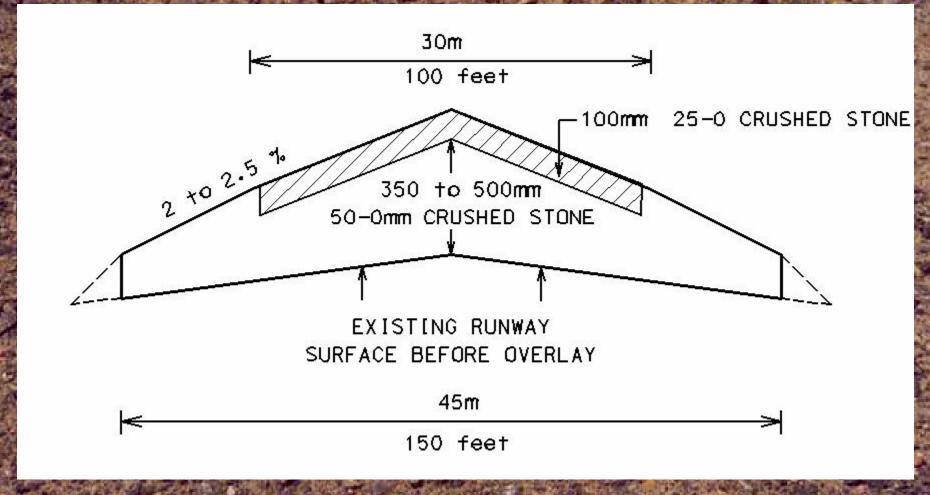
Adrianna Peisajovich Gilkstein, Mahmoud Farha, Robert Hotte, Lynn Daoust



PRODUCT APPLICATION SUMMER 2001



RUNWAY 13-31



Regraveled during summer 1999 55 000 T

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