Quantification of Changes in Surface Conditions of Airport Pavements in Japan

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Introduction (I)

- Some subsystems of a complete pavement management system for airports (APMS) have come into practical use in Japan. As a systematic method of surface condition evaluation, a method based on a Pavement Rehabilitation Index (PRI) was developed, and has now been employed for periodic surveys of pavement condition over a period of about 25 years.
- The pavement evaluation subsystem of Japan’s APMS is focused on.

Introduction (II)

- An outline of the evaluation subsystem
  - Details of the method used to evaluate surface condition using the PRI
  - Experiences in applying the evaluation method to airport asphalt pavements
    - The present surface condition of airport asphalt pavements
    - A comparison with the survey conducted about 20 years ago
    - An annual change in the surface condition at Osaka Itami Airport

Evaluation and rehabilitation subsystems of APMS in Japan
Surface condition evaluation

- The surface condition is surveyed every three years.
- The PRI system is applied to determine a suitable time for rehabilitation works.

PRI (Pavement Rehabilitation Index)

- PRI = 10 - 0.450CR - 0.0511RD - 0.655SV
  - CR: Crack ratio (%)
  - RD: Rutting (mm)
  - SV: Roughness (mm)

Rehabilitation needs judgment criteria
- A: unnecessary,
- B: necessary in the near future
- C: necessary immediately

<table>
<thead>
<tr>
<th>Facility</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runway</td>
<td>8.0</td>
<td>3.8 – 8.0</td>
<td>&lt; 3.8</td>
</tr>
<tr>
<td>Taxiway</td>
<td>6.9</td>
<td>3.0 – 6.9</td>
<td>&lt; 3.0</td>
</tr>
<tr>
<td>Apron</td>
<td>5.9</td>
<td>0.0 – 5.9</td>
<td>-</td>
</tr>
</tbody>
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Pavement surface distress condition at Osaka Itami Airport

- Osaka Itami International Airport
- Is one of the large-sized international airports in Japan
- Was selected, because
  - its plan has not largely changed,
  - various kinds of pavement structures have been constructed,
  - large-sized aircraft have been introduced, and
  - PRI has been measured for about twenty years.

Framework of data analysis

- Analysis of PRI date for 20 years
  - Annual change of PRI
  - Recovery of PRI due to M&R

Evaluation in small units

Summary in rehabilitation procedure
- Overlay (4 types)
- Inlay (5 types)
- Overlay with partial milling (3 types)

Storage in Database of APMS
Units and groups (I)

- Runways, taxiways and aprons were evaluated in 163, 273, 101 units, respectively.
- The units are summed into several groups.
  - Runways A and B were separated into three blocks (two end parts and one intermediate part) in each.
  - Taxiways were divided into perpendicular taxiways, high-speed exit taxiways and the properly separated parallel taxiways.
  - Aprons were divided into nine blocks in consideration of the running lines.

Units and groups (II)

Units and groups (III)

Definitions of annual change and recovery of PRI

- Suitable rehabilitation procedures are selected based on their intervals and costs.
- Rehabilitation costs are calculated both in pavement blocks and rehabilitation procedures.
An example of recovered PRI due to rehabilitation works

- For asphalt pavements, the average annual changes in PRI for runways, taxiways are 0.1 - 0.2, 0.1 - 1.2, respectively.
- For concrete pavements, the change in PRI of jointed concrete pavements is very small in comparison with asphalt pavements. Especially, PRI of prestressed precast concrete slab pavements scarcely changes with time.
- The recovered amount of PRI depends on the rehabilitation works conducted.

Budget optimization system for airport pavement rehabilitations

- Database tool
  - Provides Annual change of PRI,
  - Recovery of PRI due to rehabilitation works and
  - Cost of rehabilitation work

- Optimal rehabilitation procedure selection tool
  - Satisfies the acceptable PRI

- Rehabilitation cost prediction tool
  - Calculates annual rehabilitation cost for selected service duration

- Rehabilitation budget allocation tool
  - Levels the annual rehabilitation budget for selected service duration in consideration of the max.

Conclusions

- The condition of runway surfaces is better than that of taxiways. This results in runways having a higher PRI value.
- The proportion judged as not needing rehabilitation is about 60% for both runways and taxiways, which means that airport pavements are, as a whole, maintained well.
- A smaller proportion of pavements are judged as not needing rehabilitation work in the latest survey as compared with a survey carried out 20 years ago.
- The annual rates of change in PRI and the recovery of PRI due to the rehabilitation works were quantified at Osaka Itami Airport.