Connections
Transport & ICT

The Broad Reach of Green Design

Incorporating Environmental Sustainability in Aviation Facilities

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A World Bank series of projects to improve aviation operations in four Pacific island countries is demonstrating that the concept of "green design" goes beyond energy efficiency to the wider goal of environmental sustainability. The aviation program is reducing impacts on a broad spectrum of concerns, including solid waste management and water quality, by designing with the full lifecycle of all project assets in mind.

8–10%

The estimated share of air transport's CO2 emissions coming from inefficiencies in airport infrastructure

The Pacific Aviation Investment Program

Begun in 2012, the Pacific Aviation Investment Program is financing improvements to the air transport infrastructure of four Pacific island countries—Kiribati, Samoa (except terminals), Tonga, and Tuvalu. The goal is to enhance aviation safety, security, and operations in an environmentally sensitive manner through runway rehabilitation and the redesign of terminals, navigation aids, runway lighting, and other elements of airport operations.

The islands import diesel fuel to generate electricity, so energy savings were especially important for their effect in reducing harmful emissions. But the broader aspects of environmental sustainability were also important. The principal opportunities for the project to advance these goals emerged in four areas:

- Design of the terminals
- Airfield lighting
- Paving
- Solid waste management during construction

Terminal Design

The project is refurbishing the terminals at Tarawa in Kiribati and at Fua'amotu and Vava'u in Tonga; and building new terminals at Kiritimati in Kiribati and at Funafuti in Tuvalu. The following elements were incorporated in the designs for all the terminals:

- Polypropylene, a nontoxic and completely recyclable plastic, for all internal plumbing and drainage pipes
- Energy efficient lighting
- Standard environmentally acceptable hydraulic fittings and piping to minimize maintenance
- Fitting the roofs for future additions of solar power panels (current grid capacity cannot support the use of solar power)

Existing terminals

Design for the existing terminals focused on adaptive re-use to extend their serviceable life and maximize the benefit of their embodied energy, as follows:

- Enhanced natural ventilation rather than mechanical air conditioning
- Translucent skylights to reduce energy demands for lighting

- New roofs and concrete slabs and blocks designed to reduce internal air temperatures

New terminals

Designing new terminals affords some additional opportunities:

- Rainfall collection for use at the terminal as well as for the rest of the island
- Water-saving bathroom fittings
- Use of recycled or sustainably sourced hardwoods

Airfield Lighting

Replacing incandescent lighting with light emitting diode (LED) lights for airfield ground lighting provides major energy savings. The advantages of LED lighting include

- Power savings of up to 75 percent;[1] and
- Average life expectancies of 35,000–50,000 hours versus only 5,000 hours for incandescents.[2]

The savings also boost the potential for solar power.

Paving

Runway paving imposes a significant carbon burden on the atmosphere. The airports' runways and ancillary areas are being repaved with asphalt that contains a special wax additive; and in Tonga, the aggregate being used in the asphalt is locally sourced coral instead of imported rock aggregate. These features reduce the carbon footprint of the paving in the following ways.

Wax additive

- Allows for manufacture of the asphalt at lower temperatures and with less energy.[3]
- Significantly improves the asphalt's water resistance and reduces oxidation, which in turn increase its service life and negate the need for sealers.

Coral aggregates

Aggregate, used in asphalt and concrete to provide strength and bulk, typically consists of gravel from rock. To obtain aggregate of sufficient quality, Tonga must import it over great distances by barge. The paving designs for the Tonga airports were therefore modified to instead allow use of coral aggregates from licensed quarries in the island's interior.

The coral, a carbonate material more porous than rock, produces a superior asphalt. Its porosity significantly increases the strength of its adhesion with the bitumen binder. The stronger bonding together with the greater oxidation resistance of carbonate material greatly improves the service life of the asphalt.

Solid Waste Management

Islands lack adequate land area for waste disposal. The project took an aggressive stance toward waste management, requiring suppliers to remove all packaging and contractors to remove their equipment at the end of the project. Further, all airports accumulate a significant amount of redundant, obsolete, or unserviceable equipment. The project thus also requires the export and safe disposal or recycling of such gear, whether or not it was present before the start of the project. Tuvalu presents a unique opportunity for disposing of waste during construction: Because all paving aggregates will be imported from Fiji by barge, the Tuvalu government is investigating how to use the returning barges for the removal of recyclable waste on the island, which has been uneconomic to export.

[1] http://energy.gov/energysaver/articles/lighting-choices-save-you-money
[2] http://emerald.ts.odu.edu/Apps/FAAUDCA.nsf/Nettey8472FullProposal.pdf?OpenFileResource
[3] http://www.fhwa.dot.gov/pavement/asphalt/wma.cfm

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