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Agenda Item 4: Presentations – State / Industry / ICAO / Focused Discussion

TITLE
Schedule-Optimized Runway Reconstruction with Safety Assurance under Operational Aerodrome Conditions at Jinnah International Airport

(Presented by Pakistan)

SUMMARY

This paper presents the implementation approach adopted by the Pakistan Airports Authority (PAA) for reconstruction and operational upgrade of Runway 07L/25R and associated taxiway infrastructure at Jinnah International Airport, Karachi, while maintaining continuous aerodrome operations under single-runway conditions. The project involved runway extension from 3,200 m to 3,500 m and upgrade from ICAO Code 4E to Code 4F standards.

The implementation framework was aligned with ICAO guidance relating to aerodrome works safety, operational risk management, and runway safety. A three-stage safety assurance framework was adopted into all stages of infrastructure development from planning and contractual definition through implementation and operational readiness within an active aerodrome environment.

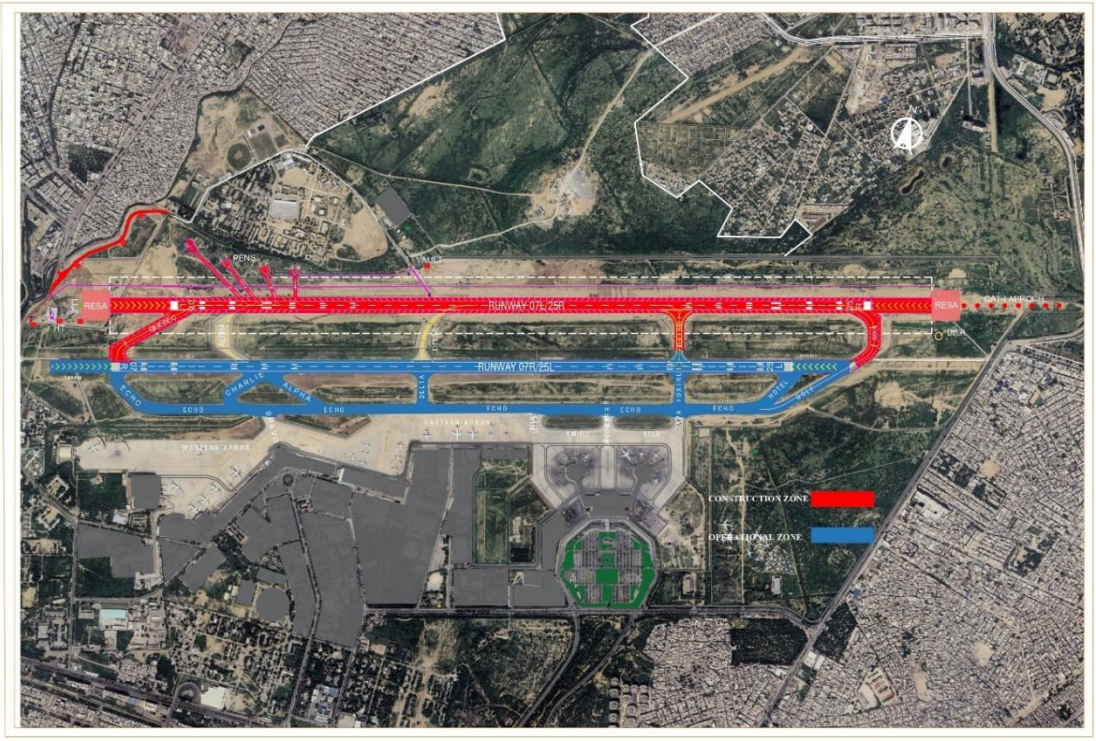
The paper highlights lessons relating to safety-led planning, construction–operations interface management, operational continuity, runway safety assurance, regulatory coordination, and SMS-based mitigation measures.

1. INTRODUCTION

1.1 Jinnah International Airport (JIAP), Karachi, is Pakistan's primary international gateway and one of the region's busiest operational aerodromes. Runway 07L/25R, originally constructed in 1961, had exceeded its design life and required major reconstruction and operational enhancement to support future traffic demand and Code 4F aircraft operations.

1.2 The airport operates with two runways; Runway (07L/25R) and a Runway (07R/25L). The project included complete reconstruction, extension by 300 metres of Runway (07L/25R), reconstruction and realignment of associated taxiways, replacement of airfield lighting systems, and relocation of the Runway 25R localizer system. Throughout implementation, aerodrome operations continued using the parallel runway configuration under operational constraints associated with active aircraft movement areas

1.3 Accordingly, the Pakistan Airports Authority (PAA), the State Aerodrome operator, initiated a major upgrade and reconstruction of Runway (07L/25R. The project was implemented while maintaining aerodrome operations using Runway (07R/25L).



2. DISCUSSION

Project Context

2.1 Runway reconstruction projects of comparable scope are typically implemented over extended timelines due to procurement, financing and operational constraints. At JIAP, however, the 3,500-metre runway upgrade was completed within an 18-month schedule under defined governance and safety arrangements, while operations continued under a single-runway configuration.

2.2 Maintaining the planned delivery window was integral to minimize construction interfaces within the aerodrome movement area and to restore full runway capacity at the earliest opportunity. Implementation was managed through structured planning, coordinated oversight, and application of risk-based measures within the aerodrome's Safety Management System (SMS).

2.3 The project indicates that a schedule-optimized runway upgrade delivery can be achieved alongside safety assurance through integrated planning, operational coordination, and systematic risk management. The implementation approach was aligned with applicable ICAO provisions and guidance material, including Annex 14 (Aerodromes), Annex 19 (Safety Management), and associated ICAO guidance relating to aerodrome works safety and operational risk management.

2.4 The project supported ICAO Global Aviation Safety Plan (GASP) objectives relating to proactive safety management, runway safety enhancement, infrastructure resilience, and implementation of risk-based safety oversight within operational aerodrome environments.

Operational and Environmental Constraints

2.5 The reconstruction and upgrade were implemented within an active aerodrome environment while aircraft operations continued on the Runway (07R/25L). This required careful management of the interfaces between construction activities and ongoing flight operations.

2.6 The reconstructed taxiways Golf, Quebec, and Foxtrot were operationally connected to the active runway used during the construction period. Consequently, portions of the works were undertaken within movement areas associated with active aircraft operations, requiring continuous coordination between construction teams and Air Traffic Control (ATC). Construction of Taxiway Quebec was particularly critical due to its location between the thresholds of Runways 07L and 07R, with activities being undertaken in close proximity to the active Runway 07R.

2.7 Construction sequencing was influenced by Karachi's climatic conditions. High ambient temperatures during peak summer months necessitated scheduling of major pavement works to night-time periods to ensure quality and workforce safety, with selected activities continuing during daytime hours. Critical phases included continuous double shifts to maintain schedule objectives.

2.8 These operational and environmental constraints required coordinated planning between engineering teams, aerodrome operations, and air traffic control—conditions commonly encountered during airside infrastructure upgrades at operational international airports. Existing underground and above-ground utilities, were identified, safeguarded, and continuously monitored throughout execution of the works.

2.9 The centreline separation between the two runways was approximately 305 metres, with several taxiways located in close proximity to operational movement surfaces. Accordingly, Foreign Object Debris (FOD) generated during construction activities was considered a potential hazard to aircraft operations.

Schedule Optimization and Progress Monitoring

2.10 Timely operationalization of upgraded facilities was essential for aerodrome normalization. Schedule optimization was achieved through a baseline implementation programme defining activity sequencing, milestones, and delivery benchmarks for the scheduled period. In parallel, procurement and supply-chain arrangements incorporated multiple approved sources. The ordering of long-lead imported items, their shipment and delivery, together with customs and regulatory clearances were closely coordinated to ensure their availability at the site.

2.11 Project progress was monitored through daily site reporting and consolidated weekly and monthly implementation reviews. Planned and actual progress were continuously assessed against the baseline programme through structured monitoring and progress evaluation mechanisms to identify deviations and support timely corrective actions.

2.12 Manufacturing progress of long-lead items was monitored through periodic coordination and, where required, verification visits to production facilities to ensure compliance with project specifications and delivery schedules. Adequate stock of critical construction material was also maintained to mitigate unforeseen supply disruptions and support continuity of construction activities and early operationalization.

2.13 This pre-emptive approach enabled continuous comparison between planned and actual progress and allowed early identification of potential delays. Work sequencing was adjusted for deviations, and activities with scheduling flexibility were advanced to maintain programme momentum and ensure activities on the critical path were completed on time. This ensured continued alignment of project delivery with the approved implementation schedule while maintaining required safety and operational controls.

Safety Assurance and Risk Management

2.14 Safety assurance and risk management were integral part of the project lifecycle. The project adopted an integrated three-stage safety lifecycle framework embedded within the aerodrome Safety Management System (SMS). Safety assurance was treated as a continuous process governing

planning, implementation, operational readiness, and regulatory compliance throughout the project lifecycle. The integrated safety assurance framework adopted for the project is illustrated in **Appendix-A**. The framework comprised:

Stage 1 – Pre-Construction Safety Planning

2.15 During the pre-construction stage, prior to commencement of construction activities, a multidisciplinary safety risk assessment was undertaken prior to commencement of works to identify construction–operations interface risks, operational continuity requirements, hazard controls, and regulatory compliance obligations. Operational feasibility, runway safety implications, emergency response arrangements, access control requirements, utility protection measures, and operational coordination mechanisms were reviewed. The mitigation measures identified during the planning stage were incorporated into the project scope and contractual framework to ensure implementation consistency and avoid ambiguity during execution. Supporting documentation, including the Environmental Management Plan (EMP), Health and Safety Plan, safeguard documentation, emergency response arrangements, work methodology procedures, and equipment maintenance and training records, was developed to support systematic safety governance, compliance monitoring, and operational oversight. Safety management measures were integrated into daily implementation planning and operational decision-making throughout the project lifecycle.

Stage 2 – Construction / Implementation Safety Assurance

2.16 Construction activities were implemented under continuous operational coordination between engineering teams, air traffic control, aerodrome operations, and safety oversight personnel. Safety controls included controlled access arrangements, FOD management, movement-area protection, permit-to-work systems, inspections, audits, hazard monitoring, and operational clearances. Continuous monitoring and corrective-action mechanisms supported safe continuity of operations during construction within the active aerodrome environment.

2.17 During the implementation phase, the SMS framework emphasized proactive hazard identification and preventive risk control measures, Continuous HSE inspections, operational assessments, and task-specific risk assessments were conducted prior to high-risk activities. A structured Permit-to-Work system was enforced to ensure formal authorization of critical activities, supported by routine toolbox talks and pre-task briefings to communicate identified hazards, mitigation measures, and emergency procedures to all personnel.

2.18 Management of operational interface risks between construction activities and active aerodrome operations was treated as a principal safety priority. Construction of Taxiway Quebec in close proximity to the operational runway was executed under approved NOTAM arrangements, with continuous coordination among ATC, aerodrome operations, and construction teams in accordance with established SOPs. Safety measures including work instruction orders, barricading, temporary markings, obstruction lighting, controlled access, and maintenance of prescribed operational clearances from aircraft movement areas were implemented and sustained throughout.

2.19 Particular emphasis was placed on prevention of runway incursions and protection of operational surfaces through controlled access arrangements, authorization procedures, security verification, and continuous monitoring of personnel and vehicle movements, with RT-fitted inspection vehicles. Critically, CNS and power cables were jointly identified during the risk assessment stage and formally re-routed prior to execution to maintain uninterrupted aerodrome operations, with all arrangements documented within the construction planning framework. Hazardous zones and underground utilities were further protected through barricading, demarcation, and cable detection measures.

2.20 Given the approximately 305-metre centreline separation between the two runways, FOD prevention, Obstruction limitation surface (OLS) was maintained as a continuous priority consistent with ICAO Annex 14 requirements. Routine FOD walks, post-rainfall inspections, and debris-control measures including water sprinkling on machinery routes were sustained throughout to safeguard aircraft operating surfaces.

2.21 To ensure safe and smooth transition from construction to operations, comprehensive Human resource trainings, awareness sessions, safety drills etc. were imparted to all concerned operations and maintenance team. Beside technical trainings, airline and ground-handling stakeholders were also engaged with familiarization process and joint surface FOD walks were conducted.

Stage 3 – Post-Construction Operational Readiness and Safety Validation

2.22 Prior to operational restoration, a post-construction safety assessment was conducted to validate operational readiness, regulatory compliance, revised flight procedures, navigational aid calibration, AIRAC synchronization, and certification requirements. The operational readiness framework enabled timely flight validation, commissioning, and safe operationalization of the upgraded runway infrastructure.

2.23 The post-construction operational readiness phase, focused on validation, regulatory coordination, regulatory inspection and certification, restoration of safe aerodrome operations from the upgraded runway facility. The 300-metre runway extension and associated displacement of the Runway 07L threshold required relocation and re-installation of the Runway 25R localizer with associated equipment shelters. The major infrastructure change necessitated review and redesign of the previously published flight procedures for Runway (07L/25R).

2.24 Operational readiness phase required coordination for redesign and validation of revised instrument flight procedures, their regulatory approval and subsequent promulgation in AIP synchronized with applicable AIRAC cycles. The State Survey Department (Survey of Pakistan) was engaged approximately five months prior to the completion deadline for provision of updated aerodrome operational data and physical characteristics, including runway elevations, bearings, and threshold coordinates, for incorporation into the revised flight procedures and aeronautical information publications.

2.25 Updated operational characteristics and revised flight Procedures were communicated to the relevant operational units and subsequently validated by the Flight Inspection Unit prior to regulatory approval and promulgation through the applicable AIRAC cycle.

Project Completion and Operational Outcome

2.26 The following are project completion and operational outcome:

a) Runway reconstruction and Code 4F upgrade completed within an 18-month implementation period commencing on 4th July 2024 and concluding on 3rd January 2026.

b) Continuous aerodrome operations were maintained for approximately 18 months under single-runway operational configuration.

c) Approximately 60,000–65,000 aircraft movements were safely handled and 9–10 million passenger movements were facilitated during the implementation period without major operational disruption.

d) Approximately 0.99 million safe man-hours achieved without Lost Time Injury (LTI).

e) No operational safety occurrences recorded during implementation.

f) Timely AIRAC synchronization, flight validation, calibration, certification, and operational commissioning achieved and commercial operations formally commenced on 19th February 2026.

3. TRANSFERABLE LESSONS FOR ICAO MEMBER STATES

3.1 The experience at JIAP indicates that major airside infrastructure upgrades can be implemented within operational aerodrome environments through integrated planning, safety governance, and continuous operational coordination.

3.2 The following practices may provide useful reference for ICAO Member States undertaking similar projects under operational or resource constraints.

a) Safety risk management should be integrated into all stages (Planning, execution and operationalization) of infrastructure development within the framework of the aerodrome SMS.

b) Early-stage multidisciplinary safety assessments support, effective operational continuity planning and reduce implementation uncertainty.

Integration of mitigation measures into contractual and operational frameworks improves implementation consistency and governance.

c) Continuous coordination between ATC, aerodrome operations, safety personnel, and construction teams is essential during airside works.

d) Construction sequencing should be aligned with aerodrome operating configurations to minimize operational disruption and interface risks.

e) Operational readiness planning, including AIRAC synchronization and regulatory coordination, should commence well before commissioning.

f) Risk-based runway safety measures and operational interface governance arrangements support project delivery under operational and environmental constraints.

4. ACTION BY THE MEETING

4.1 The Meeting is invited to:

a) note the information contained in this paper;

b) recognize the importance of integrated safety management and operational coordination during major airside infrastructure works undertaken within operational aerodrome environments;

c) encourage Member states and aerodrome operators to share similar experiences and best practices relating to management of runway construction–operations interface risks, runway safety, and SMS-based risk mitigation measures; and

d) consider a focused discussion under APRAST on operational safety management during airside infrastructure upgrades, including coordination mechanisms, risk mitigation practices, and lessons learned from implementation within active aerodrome environments.

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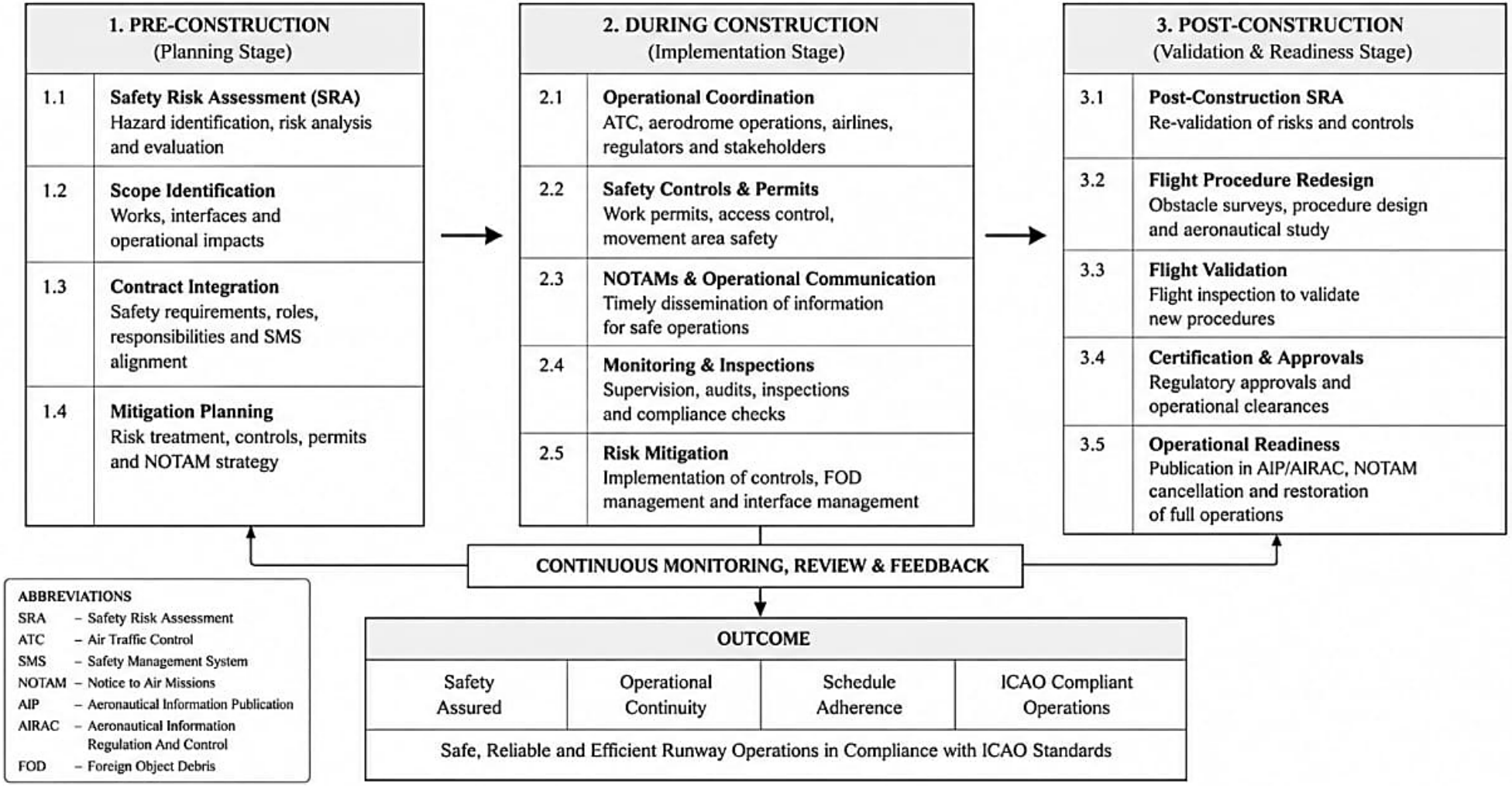
APPENDIX – A

Integrated Safety Assurance Framework

Runway Reconstruction under Operational Aerodrome Conditions



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