# COMPARATIVE ANALYSIS OF PRECAST AIR LANE

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***Abstract:*** *The ability to rapidly repair damaged airfield sections is of paramount importance. It is imperative to restore flight operations in the shortest possible time. Currently, there are several methods that pertain to expedient airfield damage repair. One method uses cast-in-place, high early- strength concrete. The cast-in-place procedure entails completely removing the damaged portion of airfield pavement and subsequently placing fresh concrete into the resulting void. A second method involves the use of precast concrete panels. The precast concrete panel procedure requires removing a damaged section of runway and replacing the damaged section with one or more precast panels. Obviously, the removed damaged section and the precast section must be Congruent.*

## I. INTRODUCTION

Repair of concrete pavements using precast concrete panels is considered a rapid repair methodology. Rapid repair techniques for concrete pavements (alternatively known as fast track construction) have become part of common pavement engineering practice. Fast track repair techniques can reduce operational delays by shortening construction schedules. Applications that can benefit from the use of fast track repair techniques to restore operational readiness include the replacement of distressed slabs that have become severe enough to affect the safe operation of aircraft and maintenance vehicles using the facilities. The best-known feature of the fast track repair of concrete pavements is the use of high-early strength concrete mixes. Recently, the use of precast concrete panels has shown potential as an alternative rehabilitation treatment to fast track repairs using high-early-strength concrete mixes. Fast track is more than just using precast concrete panels or high-early-strength concrete. It is an overall process that includes all aspects of planning, design, and construction that can influence the early opening of facilities to traffic. This report is focused on one of the aspects of this Process the use of precast panels for the repair of airfield pavements.

Repair of concrete pavements using precast concrete panels is considered rapid repair methodology which is not being followed in India. Rapid repair techniques for concrete pavements (alternatively known as fast track construction) have become part of common pavement engineering practice, mostly in Highway Engineering. Fast track repair techniques can reduce operational delays by short ending construction schedules. Applications that can benefit from the use of fast track repair techniques to restore operational readiness include the replacement of distressed slabs that have become severe enough to affect the safe operation of aircraft and maintenance vehicles using the facilities

### A. Problem Statement and Project Objectives

The objective of this report is to assess the application of precast concrete panels for construction and repair of precast concrete air field pavements. Specific and concomitant objectives of their port include the following:

1. Develop a feasible method for expediting construction of a Greenfield Runway and repair of Portland Cement Concrete pavements through the use of precast technology.
2. Assessment of the performance of existing repairs of concrete pavement using precast panels.
3. Identification of main challenges for the successful implementation of the precast technology.
4. Documentation of the major findings.

The goal of this project, therefore, was to develop a concept for a precast concrete pavement one that meets the requirements for expedited construction and that is feasible from the standpoint of design, construction, economics, and durability. The proposed concept should have a design life of 30 or more years to make it comparable to conventional cast-in-place pavements currently being constructed.

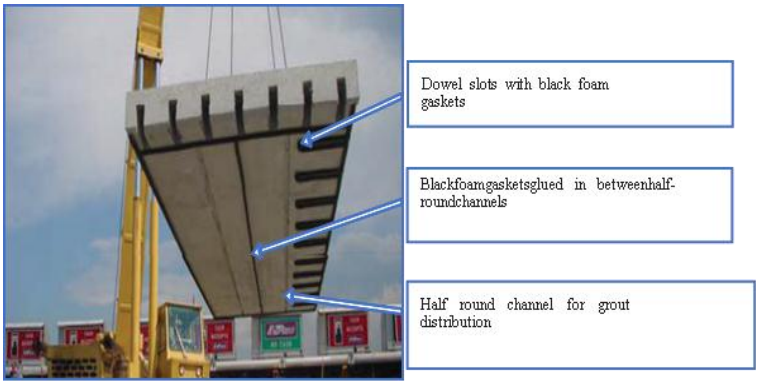


**Fig 1.** View of Fort Miller Super-Slab from Underneath

### B. Objectives

1. Determination of possible ways of construction of airport runways speedily in case of war situations.
2. Evaluate potential pavement types for airport runways.
3. Identify potential ideas for a precast concrete pavement i.e. interlocking systems
4. To check strength analysis and validation of experiment models are done with finite element analysis software ANSYS.
5. Perform a Perform a feasibility analysis for the recognized concepts.
6. Make suggestions for further examination and future implementation.Coming up next is an outline of the rest of the sections contained in this report to meet these targets:

## II. METHODOLOGY

The experience of the researchers and a comprehensive literature review were used to generate ideas and preliminary concepts prior to the first expert panel meeting. These ideas, along with input from the first expert panel, led to the development of the proposed concept. A strategy evaluation was used to further select a pavement type and possible cross section strategies for the proposed concept. The feasibility of the proposed concept was then evaluated with respect to design, construction, economics, and durability, based on design considerations

### A. Placement of Panels

Precast slabs are guided into position using guide bars to align slabs during setting. The vertical differential between adjacent slabs should be less than a specified amount, typically6mm, when tested with a 3-m-(10-ft)-long straight edge placed in the longitudinal direction. If the vertical differential exceeds the specified amount, the panel should be removed, the baser- graded, and the slab reset until the differential is less than the specified amount. The method of placing the slabs for construction of a new runway is explained in Chapter 7 as a concept to this project as new construction has never been done anywhere using the precast panels.

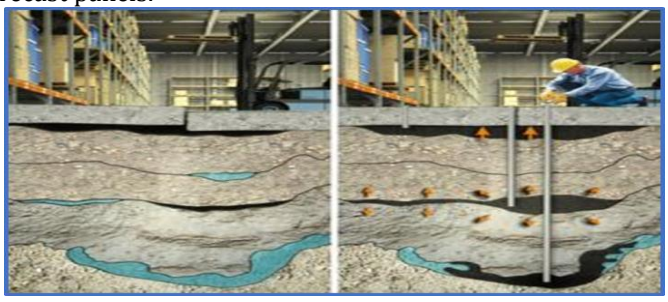

**Fig2** Side view Slab: Uretek Method

**Fig3** Proposed Panel Design

### B. Joint Requirements

The primary requirement of the joints between panels is that they ensure that the precast pavement acts as a continuous pavement. This entails that load transfer and a smooth riding surface is provided across these joints there are several requirements for the joints. The first requirement is that they are able to withstand the expansion and contraction movements of the pavement. The second requirement is that the joints provide adequate load transfer between the slabs on either side of the joint. This requirement will necessitate hardware and a structure that is not susceptible to fatigue; constructability and economic feasibility must also be maintained.

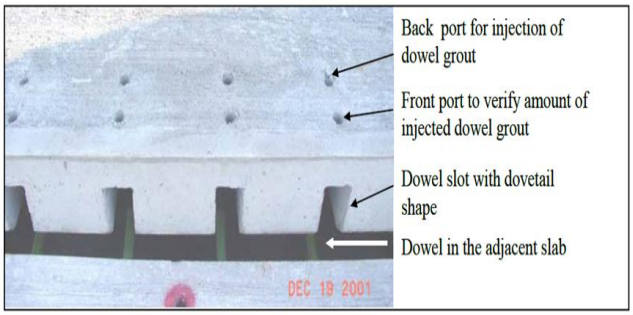


**Fig4** Joint details of the Fort Miller Super-Slab

## III. LITERATURE REVIEW

An essential part of the precast pavement feasibility project was the literature review. The literature review was used in conjunction with the expert panel meetings to determine the current state of the art in the precast and concrete paving industries. It was also used to investigate any previous precast concrete pavements that have been constructed.

What follows is a summary of information from relevant articles/reports obtained from the literature review. This appendix contains a review of available literature describing he use of precast concrete panels for the construction and

| | By Cast In Place Concrete | By Precast Concrete | |
|---|---|---|---|
| **Quantity of Concrete (in $m^2$)** | Rs 63135 | Rs 63135 | |
| **Unit Cost (in Rs/$m^2$)** | Rs 3100 | Rs 1500 | |
| **Total Cost** | Rs 19,57,18500 | Rs 9,47,02,500 | |
| **Transportation** | - | Rs 5,14,80,000 | 18000 (No of Panels) x 520 (Km) x 5.50 (Rs/Km) |
| **Cumulative Costs** | Rs 19,57,18500 | Rs 14,61,82,500 | |

repair of PCC pavements. The review is organized under the following topics:

1. Airfield applications
2. Highway Applications Using Single Precast Panels and/or few Connected Precast Panels
3. Miscellaneous Review-Type Papers
4. Construction and Repair of Concrete Pavements
5. Manuals and Specifications

Literature review of previously published studies further empirical study can be undertaken using these six identified practices which may allow the validation and generalization of results. The utilization of precast slabs in high traffic areas is feasible as a repair technique for small groups of distressed slabs. The first type was a precast PCC slab 304 mm (12in) thick. The second type was a conventionally precast reinforced PCC slab406 mm (16in) thick. Lessons learnt: Cuts done in advance for measurement purposes may result in slab creep. Technology now exists to allow for expansion in transverse joints using the fiberglass reinforced polymeric inserts. During each overnight working session, a square section of the existing runway intersection, 7.6mx7.6m, was cut out using concrete saw. The size of the PCPUs being related to the load capacity of the available crane (225kN). Wade This series of three papers describes the results of a project sponsored by the Innovative Pavement Research Foundation. The high-early-strength, rapid-setting cement used for Charleston (South Carolina) International Airport had been typically used only for small patch sand repairs before the project.

## IV. RESULTS AND DISCUSSION

Table 1. Duration of Concrete Precast vs. Cast-in-Place

| Type of Construction | Cast-In-Place | Precast |
|---|---|---|
| Duration of Project(Days) | 500 | 150 |

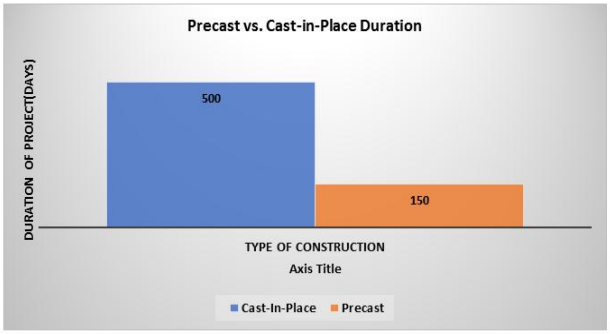


Fig 5 Duration of Concrete Precast vs. Cast-in-Place

Table 2.Quantities of Concrete Works by Structural Members

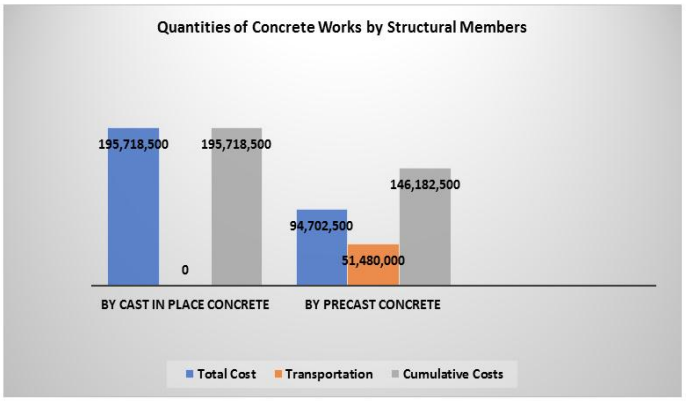


Fig 6 Quantities of Concrete Works by Structural Members

## V. CONCLUSIONS

1. This project has established that it is conceivable to expedite the construction of Greenfield Portland Cement Concrete Pavements through the use of Precast Concrete Panels.
2. The building progression is quite dissimilar from that of conventional pavements, the perceptions should be easily compliant to contemporary practices.
3. The literature review proved very beneficial for examining previous precast pavements constructed around the world, and for determining the current state of the art techniques in the precast industry.
4. The literature should also be beneficial for future implementation.
5. The significant techniques of the Precast Construction that are presently being adopted by the various countries.
6. It is very beneficial for generating and refining the proposed concept to make it practical for construction.
7. The proposed concept for a precast concrete pavement was presented. The concept consists of

placing the precast panels on a compacted soil layer.

8. The panels have continuous keyed edges for interlocking, to aid with alignment of the panels during assembly and load transfer.
9. The design considerations include factors affecting the design, such as aircraft loads, load repetitions, sub grade restraint and joint movement, as well as design variables, such as foundation strength and pavement thickness.

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