

Analysis and Design of Precast Air Lane by Using ANSYS

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ABSTRACT: This report portrays the innovation of utilizing precast solid boards for the fix of solid asphalts. The goal of the examination was to evaluate the condition of-innovation and to recognize execution challenges. The fix of solid asphalts utilizing precast solid boards might be a compelling choice to cast set up fixes, on the grounds that it can diminish development time and give strong asphalts. Development expenses of fixes utilizing precast boards are commonly higher than the expense of fixes utilizing cast set up clearing with high-early-quality cement. Be that as it may, the fixes utilizing precast boards can possibly be quicker and of higher caliber. The best potential for utilizing precast fixes is for circumstances where indistinguishable precast boards can be utilized at various fix areas. Fruitful asphalt fixes utilizing precast boards completed under time limitations require close collaboration between the office proprietor, the agreement executive, and the temporary worker. All components affecting the opening of the office to traffic must be considered and facilitated in like manner. Current advances for position of precast boards utilize cementations materials or polyurethane froth underneath the section to guarantee full contact/support with the hidden substrate. Fixes utilizing precast boards rely upon material and development quality. As usual, there is chance related with the utilization of new mechanical methods that are not in routine utilize and don't have a built up long haul history.

KEYWORDS: - Precast Airport, ANSYS, Airport runway, Fast track construction.

I. INTRODUCTION

Precast concrete construction methods have now become feasible alternatives in applications such as buildings, roads, metro rail, flyovers and bridges. The primary benefits of precast construction are the speed, improved durability, improved safety and all-weather construction. Precast elements can be cast and cured in controlled environment at a precast plant, providing greater control over consistency of the concrete mix, procedures of vibration and proper curing. Precast objects reduce or eliminate curling, strength and air-entrainment problems that are common with conventional concrete paving. Precast elements can be cast at a pre-casting yard far in advance of when they will be needed, stockpiled, and transported to the construction site. The structure can then simply be assembled using the precast elements. Time required for the concrete to be cured, which is critical in terms of operational time and long-term performance, particularly for Portland cement concrete pavements, would no longer be a factor. The use of precast elements eliminates the operational step and optimizes the curing time.

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. To 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. To Assesst of the performance of existing repairs of concrete pavement using precast panels.
3. To identify 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.

To meet these objectives, the tasks undertaken as a part of this project were as follows:

- 1) Determine the current state-of-the-art technology through a thorough review of available literature and through meetings with professionals in the precast and concrete paving industries.
- 2) Evaluate potential pavement types.
- 3) Identify possible concepts for a precast concrete pavement.
- 4) Perform a feasibility analysis for the identified concepts.
- 5) Make recommendations for further investigation and future implementation.
- 6) Make recommendations for performance monitoring of future test pavements.

II. PROPOSED CONCEPT

The proposed concept for utilizing precast concrete panels for construction and repair of runway have evolved from several key facets that are brought about in the feasibility project report. The proposed concept for a precast concrete pavement focuses on the use of full-depth precast panels. It is believed that a smooth enough riding surface can be obtained with proper alignment of individual panels and with occasional diamond grinding or bump cutting. The proposed concept consists of panels as shown in the figure below.

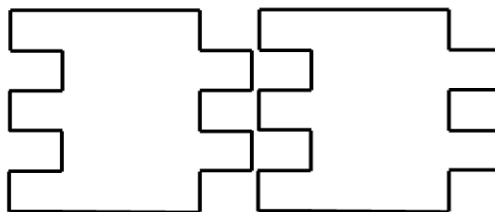


Fig 1. Proposed concept of precast slab

The details of this concept will be discussed over the course of this chapter. The discussion includes a description of the panels that will be used, joint details, panel assembly process and base preparation.

A. Precast Concrete Panels

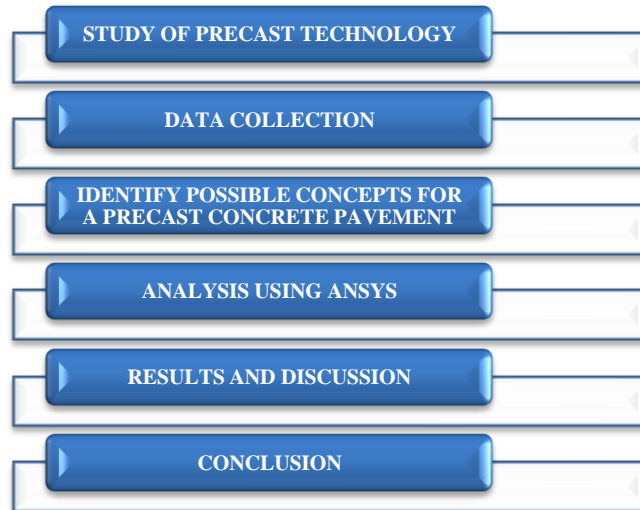
Proper alignment of the individual precast concrete panels is essential for providing a smooth riding surface. The most effective method for ensuring proper alignment appears to be one that uses continuous keyed edges cast which are locked with the adjacent panels. According to this arrangement, a male key will be cast into one side and a female keyed edge into the opposite side of the panel. These keys will interlock the panels together, such that there is a tight fit and exact vertical alignment between adjacent panels. All of the panels will be of the same length to simplify the casting and assembly processes. The panel width will depend on the panel type and on the limitations of the fabrication and handling equipment. A panel width of two meter will probably be the maximum width owing to the transportation limitations.



Fig 2. Proposed Panel Design

III. 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. Materials Properties.

Sr.No.	Material	Property	Value
1	Structural steel	Yield stress f_{sy} (MPa)	265
		Ultimate strength f_{su} (MPa)	410
		Young's modulus E_s (MPa)	205×10^3
		Poisson's ratio μ	0.3
		Ultimate tensile strain e_t	0.25
2	Reinforcing bar	Yield stress f_{sy} (MPa)	250
		Ultimate strength f_{su} (MPa)	350
		Young's modulus E_s (MPa)	200×10^3
		Poisson's ratio μ	0.3
		Ultimate tensile strain e_t	0.25
3	Concrete	Compressive strength f_{sc} (MPa)	42.5
		Tensile strength f_{st} (MPa)	3.553
		Young's modulus E_c (MPa)	32920
		Poisson's ratio μ	0.15
		Ultimate compressive strain e_s	0.045
4	Stud shear connector	Spacing (mm)	110
		Number of rows	2
		Numbers of connectors	68
		Yield stress f_{sy} (MPa)	435
		Ultimate strength f_{su} (MPa)	565
		Young's modulus E_s (MPa)	200×10^3
		Poisson's ratio μ	0.15
Ultimate strain e	0.045		

IV. COMPARING RCC RUNWAY AND PRECAST RUNWAY

Roller compacted concrete (RCC) may be a tough, durable sort of concrete pavement that's compatible for heavy industrial applications, also as low-speed runways and arterial runways. Roller compacted concrete draws its name from the development practices won't to place and finish the fabric. Almost like what the industry knows as conventional concrete (stone, sand, cement, and water), RCC however, was composed from different proportions and placing methods. Roller compacted concrete pavement (RCCP) may be a dry mix that's rigid enough in touch the load of 20 ton rollers and stiff enough to be compacted by high density pavers. the quality means of placing RCCP is by first being placed through a typical or high density paver and subsequently compacted by a non-vibratory or vibratory roller. Most of the time, RCC is made without joints, formwork, finishing, steel reinforcement, or dowels. Making a big economic impact in those areas for the work at hand. The model of RCC runway is prepared in ANSYS.

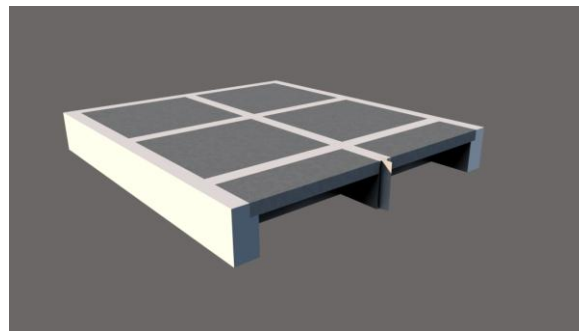


Fig 3RCC Runway

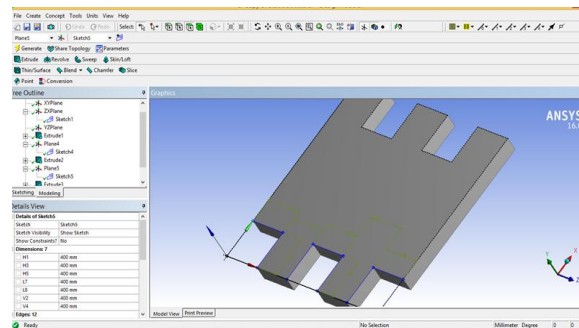


Fig 4 Precast Runway

Table 1 Total Deformations Mm

TIME	TOTAL DEFORMATION mm	
	R.C.C. RUNWAY	PRECAST RUNWAY
1	5.19E-13	6.65795E-13
2	3.73E-06	4.77642E-06
3	5.79E-07	7.42896E-07
4	3.06E-07	3.92132E-07
5	1.16E-06	1.49107E-06
6	6.83E-08	8.75345E-08
7	7.30E-08	9.35946E-08
8	3.97E-07	5.08913E-07
9	6.10E-07	7.82377E-07

10	1.31E-07	1.68168E-07
11	1.88E-07	2.40874E-07
12	1.01E-06	1.29693E-06
13	5.18E-07	6.63498E-07
14	1.75E-06	2.24519E-06
15	1.79E-07	2.3001E-07
16	9.59E-07	1.22903E-06
17	1.01E-06	1.29588E-06
18	1.97E-08	2.52793E-08
19	2.45E-07	3.142E-07
20	3.54E-07	4.53961E-07
21	4.93E-07	6.32584E-07
22	5.98E-07	7.67118E-07
23	3.80E-07	4.87608E-07
24	6.16E-07	7.89268E-07
25	9.43E-07	1.2096E-06
26	1.02E-06	1.30737E-06
27	2.94E-07	3.77507E-07
28	1.23E-07	1.57938E-07
29	1.08E-07	1.38085E-07
30	6.09E-08	7.81348E-08
31	9.29E-09	1.19072E-08

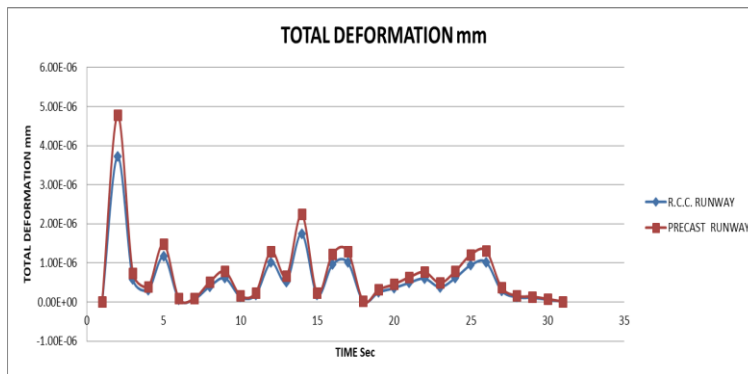


Fig 5 Total Deformations Mm

Above graph shows results of total deformation for the RCC Runway and precast runway. From the graph its conclude that total deformation for the precast runway is less than RCC runway by 10-20%

Table 2 Shear stress Mpa

SHEAR STRESS Mpa		
TIME	R.C.C. RUNWAY	PRECAST RUNWAY
1	0.00E+00	0
2	1.75E-06	2.23753E-06
3	2.71E-07	3.48018E-07
4	1.43E-07	1.83704E-07
5	5.40E-07	6.92155E-07
6	3.17E-08	4.06349E-08

7	3.39E-08	4.34465E-08
8	1.84E-07	2.3624E-07
9	2.83E-07	3.63198E-07
10	6.09E-08	7.80688E-08
11	8.80E-08	1.12842E-07
12	4.70E-07	6.02065E-07
13	2.40E-07	3.08009E-07
14	8.20E-07	1.05179E-06
15	8.33E-08	1.06776E-07
16	4.45E-07	5.70544E-07
17	4.69E-07	6.01577E-07
18	9.24E-09	1.18407E-08
19	1.15E-07	1.47193E-07
20	1.66E-07	2.12665E-07
21	2.31E-07	2.9634E-07
22	2.80E-07	3.5937E-07
23	1.77E-07	2.26354E-07
24	2.88E-07	3.69745E-07
25	4.42E-07	5.66663E-07
26	4.78E-07	6.12454E-07
27	1.38E-07	1.76854E-07
28	5.72E-08	7.33181E-08
29	5.00E-08	6.41045E-08
30	2.85E-08	3.6601E-08
31	4.35E-09	5.577E-09

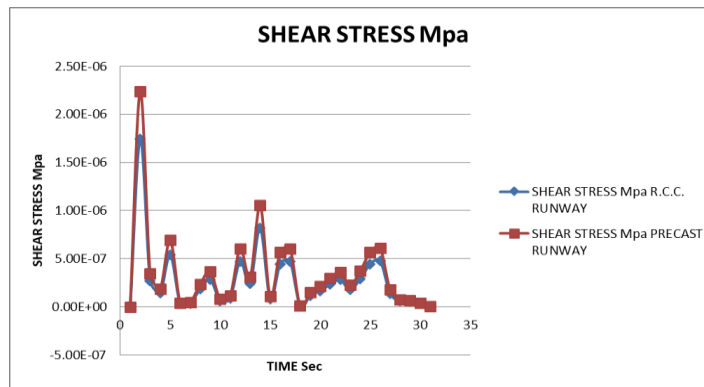


Fig 6 Shear stress Mpa

Above graph shows results of Shear stress for the RCC Runway and precast runway. From the graph its conclude that Shear stress for the precast runway is less than RCC runway by 15-20%

Table 3 Maximum Principal Stress

MAX. PRINCIPAL STRESS Mpa		
TIME	R.C.C. RUNWAY	PRECAST RUNWAY
1	2.74E-12	3.50975E-12
2	1.85E-05	2.37692E-05
3	2.88E-06	3.69706E-06
4	1.52E-06	1.95136E-06

5	5.79E-06	7.42012E-06
6	3.40E-07	4.35626E-07
7	3.63E-07	4.65841E-07
8	1.98E-06	2.53268E-06
9	3.04E-06	3.8936E-06
10	6.53E-07	8.36959E-07
11	9.35E-07	1.19865E-06
12	5.03E-06	6.45427E-06
13	2.58E-06	3.30198E-06
14	8.72E-06	1.11733E-05
15	8.93E-07	1.14474E-06
16	4.77E-06	6.11635E-06
17	5.03E-06	6.44912E-06
18	9.81E-08	1.25763E-07
19	1.22E-06	1.56367E-06
20	1.76E-06	2.25918E-06
21	2.46E-06	3.14807E-06
22	2.98E-06	3.8177E-06
23	1.89E-06	2.42656E-06
24	3.06E-06	3.92779E-06
25	4.70E-06	6.0196E-06
26	5.07E-06	6.50615E-06
27	1.47E-06	1.87862E-06
28	6.13E-07	7.86034E-07
29	5.36E-07	6.87298E-07
30	3.03E-07	3.88766E-07
31	4.62E-08	5.92192E-08

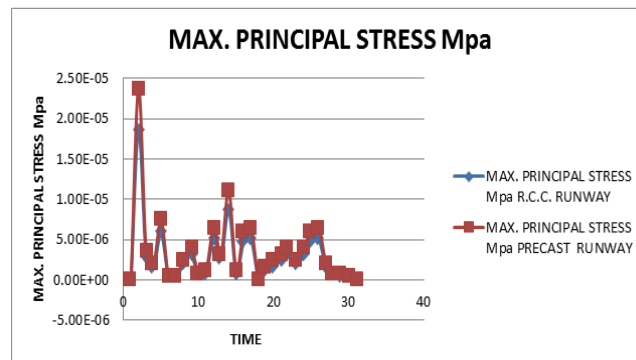


Fig 7 Maximum Principal Stress

Above graph shows results of Maximum Principal Stress for the RCC Runway and precast runway. From the graph its conclude that Maximum Principal Stress for the precast runway is less than RCC runway by 15-25%

V. CONCLUSION

1. Construction professionals prefer the use of precast concrete construction mainly because of low life cycle cost, reduction of on-site waste, speed of construction and quality of work done.
2. Precast Construction Methodology has been found to be very effective and efficient as compared with Conventional Construction of Large Construction Projects.

3. Results of Maximum Principal Stress for the RCC Runway and precast runway. From the graph its conclude that Maximum Principal Stress for the precast runway is less than RCC runway by 15-25%
4. Results of Shear stress for the RCC Runway and precast runway. From the graph its conclude that Shear stress for the precast runway is less than RCC runway by 15-20%
5. Results of total deformation for the RCC Runway and precast runway. From the graph its conclude that total deformation for the precast runway is less than RCC runway by 10-20%

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