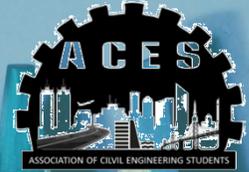




Vidya Vikas Education Trust's
Universal College Of Engineering
Kaman, Vasai - 401 212
Department of Civil Engineering



The Benchmark

Issue 006: January 2019 Edition

ACES InExCon

PATRONS

Dr. Jitendra B. Patil
- Campus Director

Dr. Ajoy Kumar
- Principal

Mr. Rajesh Dubey
- H.O.D., Civil

POST BEARERS

Mr. Ayush Kottari
- General Secretary

Mr. Mayur Chauhan
- Treasurer

Mr. Chirag Shetty
- Joint Secretary

Mr. Miraj Thaker
- Joint Treasurer

Mr. Ravi Kanojiya
- Technical Head

Mr. Vighnesh Pandit
- Event Head

Mr. Niraj Kholakia
- Public Relation Officer

EDITORS

Mr. Rudra Chauhan
- Chief Editor

Ms. Anushree Karalkar

FACULTY ADVISORS

Mr. Sagar Butle

Ms. Swapnali Onkar

Mr. Shreyans Dodia

Words of Wisdom

Drishti

Optimum use of required materials & methods can impact on various construction parameters, mainly time, cost & manpower. Precast Construction is one such efficient methods and to know its use in concrete pavements is must for every civil engineer.

- Mr. Vineet Gupta

A smart city isn't necessarily a good city. We need to remember that what politicians or industry players might call smart cities does not necessarily produce good cities. Technology can transform cities when policymakers and urban designers keep in mind the impacts on end-users.

- Drishti

Page 03

Saving energy is NOT always possible. But conserving it in a cheap and efficient manner is what we can strive for.

-BE students @ Avishkar 2018-19

It takes great efforts to achieve and win competitions in addition to curricular activities. Recently, the students of Civil Engineering Department have added to the pride after bagging first position in Avishkar'18

-From HOD's Desk

From General Secretary of ACES

Association of Civil Engineering Students (ACES), under The Institution of Engineers (India) (IEI), is the Student Chapter of the Civil Engineering Department which strives to enhance the academic and social environment of students by helping them discover hidden talents within themselves, familiarize them with the latest & recent trends in the field of civil engineering as well as allowing one to mingle with fellow peers and seniors. thus enabling fruitful networking.

“ This edition marks the start of a new year 2019. A fresh new page in the calendar year and a fresh start of the even semester. Bearing this in mind it is noted that seeds of research and development needs to be sown in the young minds of the students early on, and it is highlighted in Page 3 section....

-From Editor's Desk

”

Drishti

Analysis & Design of Precast Concrete Pavement

-by Mr. Vineet Gupta



About the Author: Author has pursued his Graduation in Civil Engineering and Masters with Specialization in Structural Engineering from G.H. Raisoni College of Engineering, Wagholi, Pune. He is currently serving as Assistant Professor in Civil Engineering Department.

Concrete pavements are widely used in road construction due to its long life and low maintenance cost. Precast pavement technology is a new and innovative construction method that can be used to meet the need for mass & rapid construction of roads. These panels are assembled off-site, transported at site and can be directly used soon after it is laid. This system requires minimal curing at site, gives the desired strength and are suitable for carrying high volume traffic. This study summarizes the various components of precast pavement, analysis of stresses acting over the pavement at different stages of production by using SAFE software. Design of joints, lifting anchors and precast panel.

INTRODUCTION

Over a period of last 20 years the traffic volumes have been drastically increased on highways. Also, use of multi-axle vehicles with heavy containers causes high maintenance of prevailed flexible pavement. Thus, up-gradation of highways with rigid pavement is very essential. Pavement reconstruction and rehabilitation have a significant impact on the resources and traffic disruption because of extensive and extended lane closures. Using a new method of 'Precast concrete pavement (PCP)' is an innovative and most efficient solution for the construction. PCP are fabricated at the factory under controlled conditions which ensures a better quality of product. This technology gives faster production, avoids delays in project and a durable pavement of desired quality. Its applications are in urban or congested areas or on major corridors where the traffic volumes are high and lane closures are critical for construction and maintenance PCP is the best possible solution. Also, in extreme climatic, site conditions, high altitudes and under-water where construction is very difficult PCP's can be used.

Different roads conditions have different pavement requirements. The challenge is to consider all these requirements and provide the most durable and economic PCP. These requirements are nothing but the parameters of design which should be very carefully selected. This requires careful investigation of traffic load and volume considering the future traffic over the design period. Further site conditions, type of road, selection of pavement size, analysis, calculation of forces, design of panels, Casting, transportation, placement on site and maintenance.

TECHNICAL CONSIDERATION

Several PCP systems are available for repair and continuous applications. Although these systems differ with respect to certain aspects of design, fabrication, and installation, they share many common features and requirements. These common features include the following:

Concrete requirements: Since the concrete pavement fails due to bending stresses it is designed for flexural stresses. The flexural strength should be determined by modulus of rupture under third point loading. It must be a minimum of 4.5 MPa. The w/c ratio must be in the range of 0.37 – 0.5. M30 and higher grade concrete is recommended for PCP.

Jointing and load transfer at joints: These two important design features for PCP it ensures that adequate load transfer will be available at all active longitudinal & lateral joint. Dowel bars are provided to transfer these loads it is selected on the basis of IRC:58-2002. A horn shaped dowel bar is provided for the economic and efficient placement of dowel bars as used in Kasugai city roads, Japan.

Support condition (bedding): IRC:58-2002 recommends a dry lean concrete (DLC) as a sub-base particularly for pavements with high intensity of traffic followed by granular sub- base course below it. The minimum value modulus of subgrade reaction (k) is taken as 8.4 kg/cm³ for CBR value 30% with untreated granular sub-base and maximum of 38.9 kg/cm³ for 100 mm of DLC as per IRC-58 and designed for the worst case.

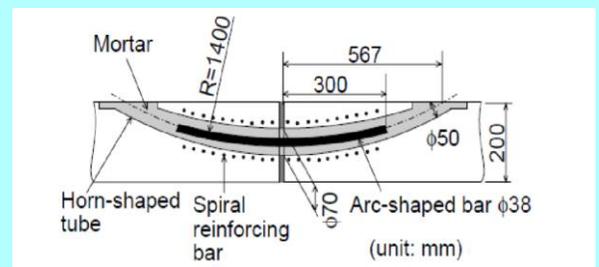


Fig. 1 Detail of Horn-shaped dowel bar

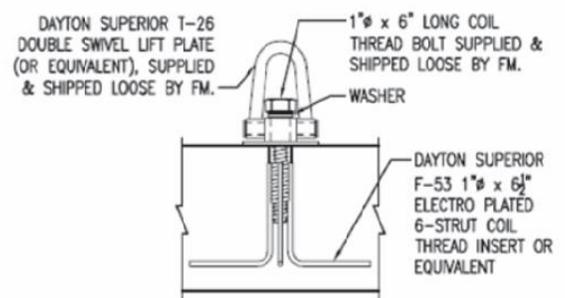


Fig. 2 Details of Anchor lifting

Contd...

Panel reinforcement: A double mat of reinforcement is typically used for jointed precast concrete panels to mitigate any cracking that may develop due to lifting and transporting operations. The amount of reinforcement is typically at least about 0.20% of the panel cross-sectional area in both directions, depending on the panel dimensions. An advantage of panel reinforcement is that if the PCP panels develop cracking over the long term due to traffic loading, the cracking can be expected to remain tight and not affect pavement serviceability.

Panel lifting, storage and shipping requirements: Panel lifting typically uses a four-point lifting method. The lifting anchors are embedded in each panel at four symmetrical points. It is calculated by lifting load calculation method.

Surface characteristics: The characteristics like ride smoothness, surface texture, tire noise while moving, co-efficient of friction between tires and pavement surface and safety due to erosion of pavement are included in surface characteristics. These characters are same as that for cast in place concrete. The controlled conditions of a precast plant also present the opportunity to imprint textures that will provide a smooth ride and adequate friction.

ANALYSIS OF PAVEMENT

To accommodate a lane width of 3.5 m the size of pavement selected is 1.75m x 1.5m and 0.2m thick where 2 panels are placed so as to complete 1 complete lane. A horn-shaped dowel bas is provided in both longitudinal as well as lateral directions so as to transfer loads. This dowel bars also maintain the integrity of panels. The analysis of loads from vehicle and differential temperature are both taken into consideration for the purpose of design.

Loads on pavement is same for PCP as well as normal pavement and depends on the class of vehicle as described in IRC -006. While, the subgrade below the road varies along the length of the road depending on the site conditions and thus for design simplification the ranges of sub-grade modulus of soil are taken into consideration The ranges of subgrade are statistically selected based on parameters of economy, safety, durability and performance. First step is depth fixation for a particular pavement. The depth of pavement is found out by knowing the flexural strength of reinforced concrete and subgrade modulus. Thus the flexural strength comes out to 396kg/cm². A minimum depth of 150 mm is to be provided as per IRC – 58 Annexure A so as to provide a rigid pavement. The effective depth values for the different loading conditions are different and as shown in Table 1. The analysis had been done by SAFE as a tool to fasten he process and the repetitive work. The various forces acting on the slab are as shown in table 2.

Subgrade Modulus range for different conditions	Effective depth (d) in mm	
	Class A	Class 70R
8.4-16.4	175	175
16.41-24.4	175	175
24.41-30.6	175	175
30.6-39.6	175	175

Table 1: Effective depth as per IRC-58

Subgrade Modulus range for different conditions (kg/cm ²)	Class A		Class 70R	
	Max SFD N/mm ²	Max BMD KN.m	Max SFD N/mm ²	Max BMD KN.m
8.4-16.4	3.0	25.7	2.0	17.3
16.41-24.4	3.2	26.5	2.2	17.3
24.41-30.6	3.2	27.2	2.4	20.0
30.6-39.6	3.3	28.1	2.5	21.3

Table 2. SAFE output for SF and BM at bottom surface

CONCLUSION

1. The behavior of precast concrete pavement is same as that of caste in place pavement in terms of soil reaction. As the size changes the stresses in PCP changes. It is also dependent on modulus of soil sub-grade.
 - a. Grade of concrete – M40
 - b. Sub-grade Modulus - To economize the process the sub-grade modulus is divided into various ranges as shown in table 3.
 - c. Life period 40 years
 - d. Type of road traffic loadings – Class A and Class 70R.
 - e. Traffic Volume – Medium to Heavy
 - f. Expected number of repetitions during life cycle – Infinite.
 - g. The use of dowel bars for load transfer in longitudinal and transverse direction is effective in load transfer which results in increase in the stiffness at joints.
 - h. It also avoids failure due to mud pumping and remains even at joints, thereby increasing the quality of ride.
 - i. Due to use of reinforcement the flexural resistance of the pavement increases and cracks due to shrinkage, temperature difference is minimized.

Contd...

2. The forces acting on the panels for class A and Class 70R loadings on top and bottom surfaces are as shown in table 2.
3. The effective panel size selected is 1.75m x 1.5m x 0.25m for easier transportation and can be placed easily with light to medium hauling / lifting equipment.
4. Dowel bars of 32mm dia. are provided @350mm c/c in both transverse and longitudinal direction.

In Other NEWS... A smart city isn't necessarily a good city...

There is a lot of debate about particular qualities that distinguish smart urban environments from dumb ones. A number of planning scholars have critiqued the piecemeal and profit-oriented focus of smart city projects, which tend to over-promise smartness to whichever city can afford to buy them. They also tend to lack comprehensive visions about the broader built environment they produce and all too often confound marketing and sales strategies for urban management and policy solutions that should benefit everyone. Smart city technologies typically refer to urban services that rely on instrumented, interconnected, and intelligent devices. Despite such criticisms, this combination of "triple-I" technologies can nevertheless improve quality of life in cities, especially when implemented with public benefits in mind. These technologies can benefit the people of the city; regulators and policy makers of the city; and planners and designers of the city.

Users of the city

First and foremost, instrumented, interconnected and at least partially intelligent urban infrastructure can enable day-to-day users of a city to make more informed decisions about their time use, increasing urban productivity. Such gains are visible in many cities. Knowing the real-time arrival times of public transportation services from smartphone interfaces allows people to walk to stations at the right moment. Knowing traffic conditions enables drivers to avoid congested areas. Knowing the prices of vegetables at farmer's markets enables farmers to adjust their deliveries in real time. But even bigger possibilities open up when users can be identified and both the service provider and the user share location information with each other. The latter types of urban services include ride-hailing apps, such as Ola or Uber; mobile parking systems; e-tickets in public transport; emergency alert services; and a wide range of e-government services that can be used online.

Policymakers and regulators

Even though many of the above-mentioned services are operated privately, cities have also started offering their own services or stepped into regulate private services. For instance, if systems listing parking spaces in cities know the users' location, they can customize which location to suggest to which user, reducing search times and traffic on city streets. For example, interconnected electronic road pricing gantries and traffic counting sensors in Singapore have enabled the city's Land Transport Authority to establish a smart toll system, which adjusts the price of driving through each ERP gantry based on real-time traffic conditions in the city. The price of driving into congested areas is continuously updated based on current and predicted traffic flows in different parts of the city. Other cities with congestion-charging systems include Stockholm and London.

Role of urban designers

Studying the troves of data produced by sensors can reveal previously invisible patterns of urban mobility, people's time use and place preference. Much of urban design and planning practice has historically focused on the static, or relatively slowly changing elements of cities - urban form, land use patterns, business locations, fixed transportation networks, urban ecosystems, floras and faunas. How these elements of the city are used over time remains poorly known in most cities? But, the increasing availability of anonymized cell phone movement traces, geo-tagged social media posts and computer vision technology that is widely distributed in the built environment gives us new information. In New York City, former mayor Michael Bloomberg's ambitious Plan NYC converted more than 40 acres of roadway into 70 new pedestrian plazas in locations that included Times Square. Before definitive implementation, traffic impacts of the reconfigured Times Square were quantitatively evaluated during a relatively cheap six-month pilot project using GPS traces from a large fleet of yellow cabs. The city also monitored accident rates and pedestrian routes around the square to assess how reconfigured roadway allocation impacted traffic speeds, pedestrian throughput and accidents rates around Times Square. Department of Transportation recently released a data standard to require that all private mobility service operators connect their operations to the city's API. This will enable the city to see, in real time, where electric scooters and shared bikes are being dropped off or picked up and require service operators to alert users if vehicles are left in illegal areas. Quantitative approaches for predicting trip volumes, route choices and infrastructure utilization have been commonplace for motorized traffic modelling for decades. Cities use such analyses to inform transportation policy, land use policy, development rights as well as infrastructure investment decisions. But more recent modelling techniques also make quantitative modelling accessible for pedestrian and bicycle trips, helping rebalance urban transportation policy from its historic biases favouring car-oriented and capital-heavy systems, toward giving more priority, specificity and quantitative rigor to urban movement that takes place on foot or by bike. They provide a healthy living environment for all and encourage healthy lifestyles. Some technologies help cities move closer to these goals, but technology may also work against these aims or offer an inferior approach to problem-solving compared with other areas of investment, such as education, affordable housing, sustainable transportation or cultural development. Cities should devote taxpayer money toward smart technologies only if these get us closer to good city ideals faster than alternative approaches.

AVISHKAR 2018-19:

AVISHKAR research convection: 2018-19 is a 13th inter-collegiate / institution / department, district / zonal level research project competition held at RAIT college at 23rd December 2018. ACES and Department of Civil Engineering, UCOE, congratulating the students of B.E Final Year, for their valuable participation and remarkable win of securing *first position* in AVISHKAR 2018-19. The students named **Sumit A. Gupta, Kishan N. Das, Yash R. Tiwari, Ninad S. Kanekar, Mayor Yogesh Chauhan**, working on project titled, “GENERATION OF ELECTRICITY USING VERTICAL AXIS WIND TURBINE AT THE MEDIAN OF HIGHWAY” guided by Asst. Prof. Asir Khan.

Mr. Yash Tiwari, Mr. Kishan Das & Mr. Sumit Gupta, have already acquired an “IEI R&D Grant-InAid” of Rs. 20,000 /- against the topic of their Final Year Project as described below.

Energy conservation is the cheapest new source of energy. The project mainly focusses on generating electricity using wind energy or turbines. The idea proposed is a new technique which uses wind produced by moving vehicle on the road and converting it to electricity. This can be used where the roads are properly divided. Implementation of turbine Mechanism is easy and also cost effective which can be done without disturbing the current road designs and disturbing the traffic. Wind power is extracted from air flow using wind turbines to produce mechanical or electrical power. This is one of the most recent power generation concepts. This device converts kinetic energy to electric energy by providing a rotating blade on road. wind turbine used here consist of a semi-circular rotating blade which is connected to a disk which is further connected to shaft. The wind creates movement in the blades which further transfers movement towards generator through shaft. The energy thus generated can be directly used for lighting highway or can be stored in batteries to be used later.



Campus Ambassador @ Technex’19, IIT, Varanasi:

Mr. Niraj Kholakia, a student of Second Year, Department of Civil Engineering, has been selected as a Campus Ambassador of Technex’19- The Techno-management festival of IIT(BHU), Varanasi. The role of campus ambassador is very vital for an event to be successful. Being a part of Technex’19, he has been provided with the opportunity of being a voice of UCOE.



Altitude...

ALUMNI

Alumni are those branches of a tree that have grown thick & bark; although are blooming and flourishing outward from the main bark of the tree (college), they still remain connected and prove to be a continuous testament of everything that is right about the way college is educating & training its students. Here is one such alumnus, **Mr. Kanan Sanjay Agrawal**, and his testament of how UCOE helped him to reach where he is right now



If I call my life a book, then graduating from Universal College of Engineering would be one beautiful chapter of it. A chapter, which still brings tear of joy and unforgettable memories. Those were the golden days when I used to travel along with my friends to college, which was 35kms away from my home. Travelling to college itself was a road trip for us. A trip full of joy, excitement, energy and a ray of hope to learn something new and make world a better place. Completing my Diploma in Civil Engineering from Thakur Polytechnic gave me an opportunity to enter UCOE in its second year i.e. in the academic year 2015-16. I still remember my first day, traveling to college in the college bus. The college which was located in the outskirts of the city. The moment I got down the bus, it felt like I have reached a place, where on all the four side it was covered with greenery and a glazing glass façade building been constructed in the center which was our college “Universal College Of Engineering”. The first day I was feeling lonely and completely annoyed but as the days cruised this place turned out to be my home of joy. College having an amalgamation of young as well as experienced faculties in their respective field resulted in bringing out the best in student. Promoting students to participate in technical competitions held at various IITs to winning them, faculties have always stood by us. Adding, for overall growth of the students in UCOE various extra-curricular

events such as SOUL, VYRO, TANTROTSAV, AURORA and many more are organized. I still cherish each and every moment spent in this college. This college has presented me various gifts such as friends that became family, teachers that became mentors and a life worth living. The skills which I have nurtured in this college have resulted me in the best possible way by making me able enough to get into National Institute of Construction Management and Research, Pune for my Post Graduation in Advance Construction Management. NICMAR, Pune being one of the leading colleges all over India for Civil Engineers. Studying here with students from different parts of our country and experienced faculties is a great experience, which helps in widening my horizon. The “icing on the cake” is that am *The Student Coordinator, Student Council 2018-19* of the whole college. The post, which demands leadership qualities which I have incurred over these years. Today with the blessing of my parents, teachers, friends and well-wishers am able to achieve certain milestones in my life and looking forward for many more. My sole goal is to make each and every one proud, those who have invested in me in some or the other way, bringing smile onto people’s face will be my greatest achievement and wealth.

-Mr. Kanan Sanjay Agarwal
Civil Department
2015-2018