HIPERPAV

High Performance Concrete Paving Software

Q: How did HIPERPAV originate?

A: HIPERPAV (High Performance Paving) was developed to help answer a serious question: How **do** pavements perform in those critical first 72 hours of life? This question came as a result of FHWA's Special Project #201, *Fast-track Concrete Pavements*. This project employed the cooperation of state DOTs, industry, and FHWA. The goal was to accelerate the strength development of concrete pavement mixes through the use of either Type III cements or heavy dosed Type I mixes. The project, however, uncovered some startling problems.

We can <u>now</u> do what has <u>never</u> been done before.

Q: What problems were discovered in high strength mixes?

A: Special Project #201 included some 100 test projects around the country. Contractors covered the pavements with blankets, knowing that heat retention would accelerate the curing and concrete strength gain. And the blankets worked. But they quickly ran into what were soon coined "temperature management" issues. Some pavements reached temperatures that topped 160°F! Temperature differences from bottom to middle of slab sometimes exceeded 40°F! Accelerated strength gain was attained, but a new problem was created in the process.

Q: Did these temperature issues lead to the development of HIPERPAV?

A: Not directly. FHWA issued a contract to Transtec that asked for written guidelines on temperature control for these accelerated strength gain pavement mixes. Transtec engineers soon realized that to integrate all the necessary variables into some clear answers, computer modeling would be required. **Transtec then developed HIPERPAV to analyze these temperature issues, and soon discovered that it could be used as a revolutionary pavement optimization tool.**

What does HIPERPAV do?

We can now do what has never been done before. We can integrate **materials** with **pavement design** with **construction operations**. We can now capture all these elusive factors into one easy to use package. For decades, researchers have studied specific behaviors in concrete and developed independent models to characterize these early-age behavior patterns. HIPERPAV is the first software package that integrates all these models into one easy to use decision-making tool.

With HIPERPAV, you can input everything you know about a concrete project – mix design, joint design, subbase type, curing method, weather conditions, sawcut timing, everything – and accurately predict the stress and strength behavior of the concrete over the first critical 72 hours.

What's inside HIPERPAV?

HIPERPAV includes the following models.

PCC Temperature Development, including:
- Heat Generation (i.e. Heat of Hydration - Internal)
- Solar Insolation
- Surface Convection
- Irradiation
- Maturity Dependent Specific Heat
- Maturity Dependent Thermal Conductivity

PCC Mechanical Properties, including:
- Critical Stress Development
- Reliability
- Variability
- Age Dependent Thermal Coefficient of Expansion
- Drying Shrinkage
- Creep Relaxation
- Strength Development using Maturity Methods
- Modulus of Elasticity Development w/ Maturity Methods
- Bond Strength Development using Maturity Methods
- Very Early-Age Moisture Loss (Plastic Shrinkage)

Restraint to Free Movement, including:
- Restraint of Slab Temperature and Moisture Gradients
- Curling and Warping
- Axial Restraint due to Slab-Base Friction
- Overlay Bond Interface Restraint

How can HIPERPAV help?

Good concrete control during the critical first 72 hours can return long term success and high customer satisfaction. Poor control can spell disaster, and lead to costly delays or full replacement. So many elements directly impact the long term performance of concrete during this critical 72 hour period. HIPERPAV is the first successful attempt to capture all these variables and determine their interrelationships through a simple-to-use software program.

Who benefits from HIPERPAV?

- **Designers** who integrate pavement design into a specific construction environment,
- **Contractors** who work in design/build, A+B, and QA/QC environments,
- **Suppliers** who integrate the materials into specific designs and construction windows,
- **Specifiers** who determine if paving windows are indeed feasible and practical, and
- **Forensic engineers** who want to know when and why and how it cracked.

Where can I get more information?

For more information about HIPERPAV, visit our web site at **www.HIPERPAV.com**, or contact The Transtec Group at the address below.

THE TRANSTEC GROUP

The Transtec Group, Inc.
1012 East 38½ Street
Austin, Texas 78751

512.451.6233 *voice*
512.451.6234 *fax*
877.HIPERPAV *toll-free* (877.447.3772)

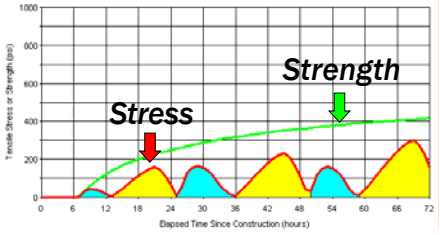
ask@hiperpav.com *e-mail*

HIPERPAV Principal Investigators
Mr. J. Mauricio Ruiz, P.E.
Dr. Robert O. Rasmussen, P.E.
Dr. B. Frank McCullough, P.E.

A HIPERPAV Case Study:
HIPERPAV saves thousands in repairs, protects contractor from a damaging cold front.

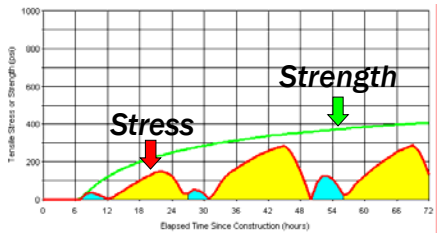
One of the most promising uses of HIPERPAV is risk aversion. Weather, for instance, is often the most unpredictable factor in construction. Poor weather can quickly turn an otherwise flawless pavement into a badly cracked one. HIPERPAV can help make the right decisions to counteract the effects of poor weather.

Case 1 shows a HIPERPAV output screen of an average placement with typical weather conditions. If a cold front were to unexpectedly move through the area 24 hours after placement, the results could be disastrous. Case 2 shows an output screen of what this scenario might look like. If the pavement is already placed, however, the options are limited. One solution: cotton mats. Case 3 demonstrates the effect of covering the same pavement as in Case 2 with cotton mats rather than leaving the surface exposed. HIPERPAV assists in this type of decision making which, in this case, might have saved the day!



***Case 1:** Typical weather conditions.*

***Case 2:** Cold front induces additional stress.*



***Case 3:** Cotton mats applied to protect slab from cold front.*

www.hiperpav.com