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Imagine That! Look for our bold predictions throughout our special report. How accurate are our predictions? Only time will tell.
What will the future of transportation construction—and concrete pavement—look like in 20 years? For answers, we gathered a ‘blue ribbon’ panel of experts who created an exciting and bold vision for concrete pavement and its role in the rapidly changing world around us.
Twenty years ago, ACPA brought together a group of public officials, members of academia, and industry officials for a concrete pavement visioning session.

That effort was a catalyst for the “CP Road Map,” a successful plan that made concrete pavements better; answered agency challenges; and taught valuable lessons. Since then, 66 research & technology projects were identified under five goals, and more than 80% of those projects were advanced.

Projects focused on concrete pavement tech transfer, construction, design & materials, maintenance & rehab, and specifications.

Why is it time to look ahead?
As the voice of the concrete pavement industry, ACPA’s member-defined core values and business model has been effective and remains relevant for more than 50 years.

Transformational change is underway and we need to prepare for the future. Although we cannot predict the future, we can influence outcomes.

Two decades after our first visioning session, ACPA assembled a blue ribbon panel of 26 experts for a facilitated discussion. The group looked at the future of concrete pavements and their role in the world around us in 2040, all with four key questions in mind ....

1. What will transportation look like?
2. What are agencies’ needs for pavement solutions?
3. What role will concrete play?
4. How do we get there?
What will transportation look like in the future?

Highways, streets, airports, and other pavements of the future will feature electronics, sensors, and other devices that will transform the role of pavements beyond transporting vehicles, people, and freight.
The U.S. population is expected to grow by more than 70 million by 2045, increasing to 390 million people.

The majority of US population will live in mega regions, comprised of urban areas surrounded by growing suburban and exurban areas. Urban areas are reimagined as livable communities with open spaces, plazas, and greater and more flexible mobility options.

Driverless vehicle technology will continue, but will only be a means to an end. Look for road trains to emerge and evolve to include both trucks and passenger vehicles.

Trucks will remain the backbone of the freight system, and truck freight increase expected to increase by 43%.

Technology enhancements will enhance HOV lanes, electronic tolling, while emerging technologies will allow lane optimization and less traffic congestion.

Transportation construction will also evolve to build on developments in 3-D paving, the use of drones for project management, and automated paving equipment and other equipment.

Electric vehicle enhancements will increase dramatically as magnetic induction, wireless charging, and storage & distribution of electricity will be integrated into road designs.

Highways and streets will be safer in the future, thanks to safety-enhanced pavement designs that include highway/roadway communications, vehicle sensors, and possibly interactions between both the pavement and the vehicle.

IMAGINE THAT! Imagine a time when road and vehicle sensors can help avoid wrong way accidents by signaling oncoming traffic or even slowing offending vehicles.
What role will concrete pavement play?

Public agencies’ needs will reflect those of rapidly changing society, where advanced technologies, sustainability, and resilience will be essential. Concrete pavement will meet these needs, while also being cost-efficient and durable.
Adaptability - Agencies and other engineers, along with the industry, will have at their disposal improved pavement design options will allow pavements to serve multiple functions, to allow utility access; and accommodate the addition of emerging technologies.

PavementDesigner.org - PavementDesigner.org, being a dynamic concrete pavement design resource, is a major step in that direction.

Technology for Pavement Management - Owners and industry will rely more on building information modeling (BIM) strategies. As BIM becomes more common, there will be a complete understanding of what's in the right of way, including multiple generations of utilities.

Innovation - Rapidly evolving technology will play an increasing role in pavement management, including predictive pavement assessments, real time diagnostics (self-monitoring), and enhanced forensic analysis.

The use of drones, artificial intelligence, electronic tools, and other tech-based resources -- along with self-healing materials -- will not only allow early detection, but may also resolve problems before they become issues on the grade.

Funding - Look for increased competition and innovative funding approaches that focus on speed of construction, long-term durability, adaptability, technology inclusion, and more.

Imaginative that! Imagine a time when emerging technologies will detect issues before they appear, allowing agencies & owners to achieve even greater value with concrete pavements.
Performance engineered mixtures, optimized pavement designs, thin concrete overlays and other emerging technologies will advance, mature, and set standards for even more innovation in concrete pavements of the future.
Performance Engineered Mixtures – Concrete pavement mixtures must deliver the intended service life more reliably. In other words, contractors must be able to deliver durable concrete pavements, every time!

The Performance Engineered Mixtures (PEM) Program is focused on providing resources for agencies to specify and contractors to deliver concrete mixtures reliably and sustainably, according to research by Iowa State University.

The PEM program is supported through a Transportation Pooled Fund, with FHWA, state Departments of Transportation and industry each funding a third of the multi-year research effort. The effort revolves mostly around the ability to measure, predict and deliver concrete pavement mixture performance reliably.

The research effort is divided into three phases: 1) Developing a guide specification (completed), 2) Implementing technologies currently available (in progress), and 3) Refining existing test methods and starting new ones.

PEM will not only reduce pavement failures, but will also save maintenance costs and improve ride, ultimately protecting and enhancing concrete pavement markets (ISU, 2017).

Optimized Pavement Design – Structural design of concrete pavement also must be refined.

The emphasis will continue to be on design & construction of efficient pavement structures. State-of-the-art mechanistic-empirical design methods will build on the successes of AASHTOWare’s Pavement ME Design, OptiPave2, BCOA-ME and PavementDesigner.org.

Thin Concrete Overlays – Thin, concrete resurfacing technology will be continually improved. With more than 2.5 million miles of roadway candidates presently, this represents a major market opportunity.

New materials, including opportunities for new or modified cements, structural fibers, and polymer modifiers will be developed to allow thinner concrete resurfacing to perform long-term for roadways under a variety of traffic and environmental loadings.

IMAGINE THAT! Imagine a time when technology transforms pavements to multifunctional systems that transport, communicate, and generate energy.
Construction Efficiencies and Quality – Speed of construction will continue to be a major factor in project/material selection. This will require the refinement and further improvement of accelerated concrete mixtures (including specialty cements) that have demonstrated long-term performance.

Equipment innovations will also help accelerate paving operations and improve overall construction quality. Enhanced modeling for 3D paving and improved sensors for machine guidance will improve construction accuracy. Innovations for rapid one-pass reconstruction and auto-pilot pavers will ultimately improve consistency of paving, leading to ultra-smooth surfaces.

One pass paving is envisioned as the removal, processing and placement of the concrete and base/subbase layers in one single pass of a paving operation (whether one or more machines in a single train).

Auto-pilot paving machines are envisioned as slipform paving machines equipped with sensors linking the paver speed, vibration frequency and concrete rheology sensors that will allow for the machine to adjust to mixture variations, to maintain a constant extrusion pressure.

History has taught us that the goal should not be to eliminate humans from the paving process. Instead, the goal should be to use automation and emerging technologies to make people work more efficiently.

In addition to greater machine controls, innovative traffic control procedures can significantly help minimize impact to users during construction.

Durability – Pavements must deliver on durability and performance every time. Performance engineered mixtures will hold the key to improved durability, high quality, and adaption to specific needs. Look for a steady increase in demand for maintenance-free pavements based on self-healing concrete.
Sustainability – Although recycling and reuse will continue to play a role in sustainability strategies, look for greater awareness of use-phase sustainability benefits, which will be driven by industry and agencies. Increasing emphasis on sustainable construction, combined with concerns about availability (and cost) of virgin aggregates, demand will be higher for recycled concrete aggregate, reclaimed asphalt pavement, and industrial co-generated products such as slag and fly-ash. Ternary mixtures and fractionated recycled asphalt pavement as concrete aggregate are already opportunities being used, and advances in materials science will be essential to the future of concrete pavements. The result will be improved performance and greater allowance for more of these materials in concrete pavement mixtures.

Safety – Look for a steady decrease in highway fatalities as agencies and industry co-develop pavement designs that augment technology-driven safety features of vehicles, as of vehicles, as well as compatible safety systems that become part of the highway/roadway network. Safety in the workzone and plant environments also will be enhanced by the increased use of technology, including machine automation and monitoring.

Resilience – Look for a greater emphasis on resilience, as the scale and severity of natural disaster increase, particularly in the increasingly populated areas. Concrete will play an ever increasing role as the public demands reliable pavements for disaster planning, evacuation, equally important, post-event returns to stricken areas.

IMAGINE THAT! Imagine the use of nanotechnology in performance-engineered mixtures to produce durable concrete pavements that also are flexible, conductive, and have built-in safety features.
As we saw following the first visioning session in 1998, advancement will only happen by design.

So what is needed to get there? The future is in the hands of the concrete pavement industry if we demonstrate the intention and focus, if we dare to take risks, and if we invest and collaborate along the way.

We will drive technology, lead change, and optimize materials, equipment, and paving processes to meet the challenges that lie ahead in our journey to 2040 and beyond!
In urban settings, concrete pavements will fit livable community and smart city/future city strategies. Within those strategies, concrete pavements will serve a vital role in connecting vehicles, people, and cargo through the use of the “Internet of Things” and advanced navigation and communications systems.

Pavements will fit sustainability strategies (value of land and other resources)

Pavements will serve multiple functions. Examples include precast pavements that can charge electric vehicles, pavements that can charge electric vehicles, assist in autonomous vehicle navigation, and serve other functions.

In rural settings, highway sections will require extended life and quality to match!

Very thin concrete overlays (1 in. to 3 in. thick), performance engineered materials will allow quick and cost-efficient rehab and preservation. Improved machine controls and creative design strategies also will be important to construction, rehab, and preservation strategies.

Concrete pavements will play an increasingly important role as population shifts, increased vehicle loads, and emerging technologies come into focus.

Advancements in material science will include self-healing materials, advancements at the molecular level, and advancements in PEM’s, additives, and other value-added materials.

Concrete pavements will easily accommodate technologies that will enhance QA measures implemented by agencies and QC methods driven by industry.

Imagine a time when technology transforms pavements to multifunctional systems that transport, communicate, and generate energy.