New Mexico DEPARTMENT OF TRANSPORTATION
MOBILITY FOR EVERYONE

On behalf of the New Mexico Department of Transportation, I am pleased to introduce to the FHWA "Every Day Counts Program" what appears to be a significant breakthrough and alternative to Cement Treated Base (CMT). It has been successfully used in new construction and Full Depth Reclamation (FDR) projects with New Mexico Counties for over four years.

It is a high ductile, customizable cement that achieves unprecedented geotechnical numbers across a wide spectrum of soil classifications. Because of the high ductility, unlike traditional cement, micro fracturing is not recommended, which eliminates the cracks and openings for water to enter the base. The load bearing capacity and resilient modulus numbers for high ductile cement achieves the same structural numbers as asphalt for a fraction of the price, without the risk of becoming brittle, resulting in shrinkage cracks and reflective cracking in the surface.

Each of the NM Counties that used it, applied a chip seal surface on top of the treated base due to the budget constraints, however it has provided them with a long lasting, affordable paved road.

Case Studies: Quay County, Tucumcari New Mexico installed 4 miles with this material on Airport road, which is the access road to I 40. Previously they did a FDR with 3' of asphalt on this road that failed in less than one year, due to the high number of 40-ton trucks that use this road. After 4 years, with only a chip seal surface, airport road remains in very good condition with the exception of an isolated area where a 40-ton truck turned over and damaged the road.

Chavez County, Roswell, New Mexico did a FDR with this material on Omaha Road, where Ruan Transport is based. Each day over 450, 40-ton trucks drive on this road and after 4 years, there is no evidence of potholes or cracks in the chip seal surface on Omaha road. The Public Works Director, Joe West said the only maintenance that has been done on the road was to install a concrete apron at the two entrances leading into an out of the trucking company's dirt parking lot, as the chip seal was getting torn up in those areas. He also stated that they had 15" of rain and the road was completely under water for several days and the road is in very good condition.

We are aware of the number of FDR and new products and materials coming on the market to meet our reconstruction needs and we are encouraging EDC to select this category as an innovative topic. We feel that this high ductile, customizable cement is worthy of review by FHWA and EDC for all the reasons stated above. We at NMDOT, support this initiative.

Sincerely,

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FHWA Response

1. **Innovation category or name:**
   An innovative process and material for treatment of road base for Full Depth Reclamation (FDR) and new road construction. Category Name: Portland and Blended Cement Category (PBC)

2. **Brief description of the proven innovation or process:**
   High strength and high ductility have never coexisted before in Cement Treated Base (CTB). The process produces a fully customizable high ductile cement that can be used in a wide spectrum of soil classifications, to optimizes the performance in road base materials and in situ soils ranging from a zero Plasticity Index (PI) such as blow sand to expansive clays. The high ductility in this material achieves extreme strength in the treated base course and keeps the water from entering. As a result you can match the strength asphalt without the risk of being too brittle which causes reflective cracking and shrinkage cracks. With this material, micro-fracturing is not recommended, which eliminates creating all of the openings for water to infiltrate into the base.

3. **National Impact: How will it <u>benefit</u> the transportation system nationally?**
   This innovative material and process is an alternative to Cement Treated Base (CTB), as it provides a much higher load bearing capacity without causing cracking in the asphalt surface and it is an alternative to mill and overlay projects that are a short-term cosmetic solutions as the same issues in the base that caused the asphalt to fail will resurface within a few years until the problems have not been addressed in the road's foundation. The life cycle of this type of "perpetual road base" eliminates the need to reconstruct the base in the future and the maintenance will be limited to maintaining the surface. A base that has high strength, high ductility and is resistant to water addresses the top two reasons that roads fail, which are the result of an insufficient loadbearing capacity and or water infiltration into the base of the road, causing erosion, cracks, potholes, frost heave and freeze thaw.

4. **Game Changing: How is it <u>transformative</u> in making our transportation system adaptable, sustainable, resilient, equitable, and safer for all?**
   A high ductile, high strength customizable cement treated base increases the resilient modulus of untreated base course from 25,000 psi modulus to 500,000 psi modulus, which is the same strength as asphalt. Through Value Engineering the structural credits can be transferred from the asphalt surface into the base layer for a fraction of the cost of asphalt and the pavement design thickness can be reduced by 50% to 67%. This saves the entire project a minimum of 25% to 50% and also reduces the carbon footprint road construction dramatically. The efficiency of the new innovation is safer, allowing traffic to get on the road twice as fast, resulting in less traffic disruption, and getting road construction crews in and out twice as fast, reducing the risk of an safety incident. This combination of factors produces a longer lasting, safer road, that cost less to build and maintain.

5. **Urgency and Scale: How will it positively impact the environment, safety, congestion, freight movement, construction techniques, contracting methods, maintenance, preservation, or emergency response?**
   The customizable high strength, high ductile cement is very effective in in situ soils and pulverized base course which can greatly reduce or even eliminate the need to import and export materials to a project, saving money and the fuel required in hauling. The result is dramatically reduced carbon emissions and greenhouse gases. With FDR projects the customized formulations encapsulate the oils in recycled asphalt (RAP) preventing oils from leaching into the environmental. In place recycling of the failing asphalt eliminating the need to haul it away to a recycle plant or landfill. This new innovation uses an average of 7 truckloads (175 tons) per mile, saving transportation costs and fuel from what traditionally would be 180 truckloads of base course per mile x 24' wide x 6" deep, saving time, money and fuel.

6. **Identify locations where the innovation was successfully applied in a transportation application and a description of the quantifiable performance benefits of the innovation in those applications.**

The new innovation of high ductile customizable cement completed a one-year independent study with extensive testing by Los Alamos National Laboratory (LANL). A 38-page white paper is available upon request. The material has already been approved by UDOT as an alternative to FDR and CMT.

NMDOT will be installing it in Santa Rosa NM in the next 3-4 months. The geotechnical test results after treatment of the base course show an Unconfined Compressive Strength (UCS) of 1000.6 psi and a Resilient Modulus of 889,772 psi, using only a 3% dosage of this material. (See attached test results).

A number of Counties and private sector companies have also used this material over the past four years and have testimonies to their results. Below are just a few that have used this material and most have done multiple projects as they are happy with the results.

Sandoval County, NM, Quay County, NM, Chaves County, NM, San Juan County UT, Archuleta County CO, Stanislaus County CA, Union Pacific Railroad CA, North American Coal Farmington NM, Rio Tinto – Kennecott, Magna UT and the Southern Ute Tribe, Ignacio CO.

Responders are encouraged to comment on the EDC-7 Innovations of Interest if applicable

The proposed solution addresses 13 of the 15 FHWA's EDC-7 Innovations of Interest points, as articulated below.

1. **Accelerating the Deployment of Electric Vehicle, Alternative Fuel, and Renewable Energy Infrastructure**

The proposed process uses approximately 7 truckloads (175 tons) of material per mile, while traditional methods use 187 truckloads of base course per mile, saving the fuel emissions of 180 truckloads.

2. **Complete Streets - Safety Transformations**

The improved process installs roads in half the time, improving traffic flow and reducing time onsite of installation crews, lessening the risk of a safety incident and creating quicker completed streets.

3. **Enhanced Visibility for Safety**

Dirt and gravel roads can be treated using the new innovative material and FDR process with a chip seal or asphalt surface, eliminating dust, improving visibility and creating a safer, high quality, longer lasting road.

4. **Environmental Product Declarations for Sustainable Pavements**

The proposed material can be used in new construction or FDR treating native soils and base course reducing the need to import and export along with an innovative approach through value engineering to reduces the thickness of an asphalt overlay by 50% to 67% and therefore a significant reduction in greenhouse gas emissions.

5. **Digital Twins: Leveraging Digital As-builts, GIS, and Enterprise Data for Asset Management and Improved Decision-Making –** N/A.

6. **Integrating Greenhouse Gas Analysis and Targets in Transportation Planning**

This new process reduces the quantities of asphalt and cement used for pavement overlays, while achieving required road base strength, load bearing capacity and ductility. These major reductions in materials used minimizes material truckload trips, reducing greenhouse gas emissions.

7. **Internal Curing for Concrete Bridge Decks, Pavements, and Repairs**

NA

8. **Level Up in the Digital A-GaME**
Certified technicians perform geotechnical testing on every project and utilize computerized systems to monitor spread rate, moisture content, and lab testing of the road material using the proposed process.

9. **Next Generation TIM: Technology to Transform Response**
This innovative process is a next-generation approach used in new construction and Full Depth Reclamation to create a base layer with the same strength as surface asphalt, saving time, money and fuel through value engineering.

10. **Preserving and Reconnecting Communities**
Yes, through significant savings of our core state of good repair road preservation, significant budget dollars can be repurposed to address community reconnection.

11. **Putting Work Zones on the Map**
The improved process creates a safer work zone and enables the job to be done faster.

12. **Reduce Wildlife-Vehicle Conflicts –** N/A

13. **River and Road Connections**
This new process for treating bases greatly improves our road network's ability to minimize pavement damage caused by increasing water and flooding impacts in a cost-effective way.

14. **Strategic Workforce Development**
This new, straight forward construction process does not require an extensively experienced workforce to successfully execute an FDR/new construction project.

15. **Supporting Equity in Federal Contracts: Effective DBE Program Practices in Design-Build**
Given the opportunity to do more projects better, faster and cheaper, the improved process and standardized, simple method will create the opportunity for new DBE's to enter the market and create a new, successful business in partnership with public road agencies.