CENTERLINE

A Sustainability First for Oregon Pavements

Klamath Falls-based Rocky Mountain Construction, the Oregon Department of Transportation, and the Asphalt Pavement Association of Oregon tested a new way to make pavements more sustainable by using renewable propane to fuel an asphalt plant.

Asphalt pavement requires coating aggregates with asphalt binder. The aggregates are dried in an asphalt plant with a burner that requires fuel, which for some plants is propane. Propane is typically a byproduct of processing natural gas and is therefore a fossil fuel. Renewable propane, on the other hand, is not a fossil fuel – it can be made from vegetable oils, animal fats, and even from cow manure.

Anyone who has used bio-derived fuels knows that – despite claims that they are molecularly identical to conventional fuels – there can be consistency and potency differences that create problems. Does renewable propane have any of those problems? Not according to this project.

That does not mean every asphalt producer should make the switch, as supply and cost hurdles remain (more on that below). But, the project confirmed that at least one renewable fuel can be used as a drop-in replacement and offers a positive example of an agency and industry working together to combat climate change.

Rocky Mountain Construction's plant set up in the Black Rock Quarry outside of Crescent, OR

Asking for a 10,000-gallon special order from a supplier used to dealing in hundreds of thousands of gallons was like trying to buy one potato chip at Costco.

Where did the idea come from?

In 2021, ODOT hired a consultant to analyze greenhouse gas emissions associated with its construction and maintenance operations. The analysis found that although most asphalt pavement in Oregon is produced from natural gas-fueled asphalt plants, in areas where natural gas is unavailable, a significant quantity is produced from asphalt plants burning propane or recycled fuel oil. Because those plants typically emit more greenhouse gases than their natural gas-fueled counterparts, the consultant recommended exploring renewable propane (rLPG).

There were questions, however, about rLPG's availability, cost, consistency, and potency – and it was unclear what counted as "renewable" for propane. In early 2022, ODOT and APAO challenged each other to answer those questions.

Where do you get it?

ODOT and APAO contacted Blue Star Gas ("Blue Star") because as part of ODOT's 2021 emissions analysis Blue Star said that it could get rLPG from Renewable Energy Group ("REG") in Louisiana. REG is one of only a few sources, and getting it to Oregon would require transporting it by rail to Blue Star's Eugene, Oregon facility.

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INSIDE:

A Sustainability First – continued

What counts as renewable?

The EPA Renewable Fuel Standards require suppliers to blend a certain volume of renewable fuel with conventional fuel. Under the Standards, the amount of conventional-to-renewable fuel may vary from tank to tank if a supplier's overall volume meets the minimum renewable percentage. Because suppliers deal in large volumes and big tanks, most renewable fuel is available only as a blend of uncertain proportions.

However, ODOT and APAO did not want to explore using a renewable propane blend that might not have much renewable propane in it – they wanted to test the viability of using 100% renewable propane. Their goal was to test its use in an amount that would not risk an entire project but that would give them a good comparison. With a shift typically using about 3,000 gallons of propane, they settled on 10,000 gallons as the test quantity. This was enough for multiple days of production, but not so much as to risk an entire project. But, asking for a 10,000-gallon special order from a supplier used to dealing in hundreds of thousands of gallons – with a product for which there is limited supply – was like trying to buy one potato chip at Costco.

Blue Star would need to convince REG to load at least 10,000 gallons of 100% renewable propane in a rail car and dedicate an entire tank (most usually holding at least 60,000 gallons of blended fuel) to the project. Because it saw the importance in testing the rLPG drop-in potential, and after some logistical acrobatics, Blue Star managed to get a rail car filled with 100% renewable propane and have it delivered to an empty tank in Eugene. The pressure then shifted to ODOT and APAO to

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>
> Mark Poe, Project Manager
> Rocky Mountain

Rocky Mountain Construction's plant burner running on 100 percent renewable propane

get the propane used ASAP, because Blue Star needed the tank for its regular business.

What project?

With the limited window, ODOT and APAO had to find a paving project near Eugene that would be paved with asphalt pavement produced by a propane-fueled asphalt plant. The asphalt plants in and around Eugene all use natural gas. Luckily, Rocky Mountain Construction was paving OR58 from Salt Creek Tunnel up over Willamette Pass and had set up a portable propane-fueled asphalt plant just outside of Crescent (about 85 miles from Eugene). Although the perfect test project would have allowed for producing asphalt pavement for shoulders and rest areas (i.e., areas for which performance is less critical) with the renewable propane and then switching back to conventional propane for mainline paving, the OR58 project was all mainline paving in a location where high-quality paving is critical (on a mountain pass). Making matters more tenuous, Rocky Mountain's asphalt plant was operating at a rock source known for its challenges.

"When they first mentioned the idea, I thought 'we have enough problems to manage on this project already,' but the reality is that every job already has enough problems, and if we want to make progress on these sorts of things, someone has to step up and take the risk," says Mark Poe, Project Manager for Rocky Mountain. "I have to say, I would have felt better about it if they hadn't told me that this could be the first time ever for this sort of thing."

Results?

The project served as a perfect comparison since Rocky Mountain used conventional propane before and after the test section, weather was consistent, and the paving type and tonnage was identical among the shifts. Rocky Mountain reported no noticeable differences between conventional and renewable propane – except for price.

- **Fuel Consumption:** There was no difference between renewable and conventional propane, with consumption for both averaging 2.1 gallons per ton.

- **Asphalt Production Temperature:** Rocky Mountain was ready to adjust production temperature if necessary, but did not change it during the renewable propane shifts because density tests and the look and feel of the material remained consistent with the prior conventional propane shifts. Production temperatures for the project ranged from 305 to 320 degrees Fahrenheit.

By capturing the data and being able to trace the fuel back to the feedstock, projects such as this one can be used to improve upstream information.

- **Volumetrics:** The aggregate specific gravity remained consistent throughout the project and Rocky Mountain credited its crushing subcontractor with exceptionally consistent aggregate crushing and stockpiling, both of which help explain why mix volumetrics remained consistent throughout the entire project. The mix design was based on 4.0 percent air voids (Va), and specified 14.6 as the target Voids in Mineral Aggregate (VMA), and 8.0 percent passing the number 200 sieve. During production, Va averaged 3.6, VMA averaged 15.9, and the percent passing the number 200 sieve was 8.1. The result was a stable mix with better than expected consistency.

- **Density on the Grade:** Density tests averaged 93.4 percent over the renewable propane shifts, and 93.1 percent for the project overall. Although different, the difference is likely due to some conventional propane shifts having a thinner lift (2.5 inches instead of 3 inches) and typical statistical variation.

- **Price:** Renewable propane was 45% more costly than conventional propane, which for the project would translate into about a 1% increase in asphalt pavement cost.

What does the project mean?

A barrier to accurately estimating greenhouse gas emissions for asphalt pavement production is acquiring accurate upstream information on the emissions from the fuels used. The upstream information is used to complete life-cycle assessments, the results of which get used to publish Environmental Product Declarations (EPDs). Although there may be good information for most typical scenarios (e.g., using conventional natural gas or propane to fuel a burner), there is often limited information for new scenarios. In those scenarios, either the best available or the most conservative information is used, the result being EPDs that don't represent the true benefit of the new fuel or process.

However, by capturing the data and being able to trace the fuel back to the feedstock, projects such as this one can be used to improve that upstream information. According to Amlan Mukherjee, a professor at Michigan Tech University and part of the FHWA Climate Challenge team, "This project will be a significant contribution to helping develop a suitable background inventory for renewable propane for the NAPA Emerald Eco Label tool as well as the FHWA LCA Commons database."

For APAO, this project was an exciting step along the way to a sustainable future for pavement in Oregon.

Thinlays Help Fill the Gap to Extend Pavement Life

by John Hickey

Seals or thick inlays? Pavement managers often think they need to choose between the two. Seals are an affordable but short-term solution. Inlays, on the other hand, last longer, improve smoothness, reduce noise, and increase structural strength and service life, but the downside is they cost more. To help fill the gap, the asphalt pavement industry developed Thinlays, providing new pavement benefits at less cost than thicker inlays. To understand the effectiveness of Thinlays in different scenarios, below are several examples of placements around Oregon and how they've performed.

Murray Boulevard: The first Thinlay generation in Oregon was placed by Washington County on Beaverton's Murray Boulevard in 2001 and 2002, and another followed in 2007. (A chip seal would not work due to heavy traffic, but the County did not have sufficient funding for a major rehabilitation.) The County utilized a 3/8-inch NMAS mix with PG 64-22 asphalt binder (target asphalt binder content was 6.1%) and no RAP, placed at 1-inch in thickness. The 2001 and 2002 sections performed exceptionally through 2016, but started to show distress in 2017. The County replaced the sections in 2019 as part of a larger rehabilitation plan for Murray Boulevard. Overall, each of the three sections performed exceptionally, lasting for 12 to 18 years.

Polk County: The next Thinlay generation was placed in Polk County in 2010. The County placed ¾-inch thick Thinlays using a ¼-inch NMAS mix, and 1-inch thick Thinlays using a 3/8-inch NMAS mix, at an $81- and $77-per-ton furnish and place cost, respectively. (The ¼-inch NMAS mix cost slightly more due to a higher asphalt binder content.) In 2017, I inspected the Thinlays and saw that all were performing as expected with no noticeable distresses. I inspected them again this year – 12 years after they were placed – and noticed the Thinlays were still performing exceptionally.

Wigrich Road & Wells Landing Road: On these two roads, ¼-inch NMAS Thinlays were placed at ¾-inch in thickness. Asphalt binder content was 7%, with a PG 64-22 asphalt binder and no RAP. As of the 2022 summer, there is minor cracking at the longitudinal joint and in the wheel path, but no other noticeable distresses. The ride is smooth and quiet, and the Thinlay clearly kept moisture out of the structure. The County will likely get another few seasons out of the surface.

Bethel Heights Road: A quarry and numerous farms use Bethel Heights Road, which increases the loading significantly compared to a typical rural county road. The same Thinlay mix was used as for Wigrich Road and Wells Landing Road. The County chip sealed the road in 2020 pursuant to its pavement management system. Although the chip seal covered most of the surface, sections that have lost chips showed no distress in the underlying surface. The ride is obviously louder with the chip seal, but it is still smooth and enjoyable. Despite being covered, the Thinlay still provides smoothness and adds to the structural strength of the section. This is a significant outcome, considering the heavy (by weight) traffic.

Halls Ferry Road: Halls Ferry Road was chip sealed in 2019 and has performance identical to Bethel Heights Road. Again, there is significant agricultural traffic, and the Thinlay continues to provide underlying smoothness and structural strength.

No other preservation treatment would have provided the same benefits – and few could match the life cycle cost. Even though the Thinlays will remain part of the underlying structure and will provide perpetual benefits, if we use a 14-year expected life (two more years), the cost would be $0.36 per square yard per year. Overall, Oregon's experience confirms that Thinlays are reliable, cost-effective, and provide many performance advantages over other preservation treatments.

APAO Education Foundation award recipients
L to R: Jonathon Stark, Vikas Kumar and Serena Moha
Not pictured: Conor Roark

Supporting the Industry's Future

At its Annual Meeting for 2022, the APAO Education Foundation awarded four $2,500 scholarships to students with a demonstrated interest in asphalt pavement.

- **Mike Huddleston Memorial Scholarship:** Vikas Kumar is a civil engineering PhD candidate at Oregon State University and specializes in asphalt and construction materials. Growing up in a developing country showed Vikas the importance of surface transportation infrastructure. Vikas manages the Oregon State University Asphalt Materials and Pavements Laboratory, has worked on numerous asphalt materials research projects, and has significant experience in evaluating and designing asphalt pavements. In other words, anyone looking to hire a pavements engineer should make Vikas an offer ASAP!

- **Dawn Lindeman Memorial Scholarship:** Serena Moha is a junior in the civil engineering program at the Oregon Institute of Technology. Serena went from thinking that asphalt pavement was just rocks stuck together with something that smelled weird to understanding the importance of smooth and durable asphalt pavement for communities. She was an Oregon Department of Transportation intern in 2022 and plans to become a design engineer after graduation.

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MISSION STATEMENT

The Asphalt Pavement Association of Oregon, Inc., (APAO) is dedicated to promoting the use of asphalt concrete by developing customer driven programs to enhance quality and excellence in all aspects of asphalt technology. We believe that the key to growth and prosperity in the industry is continuous quality improvement obtained through active association membership, positive customer relationships, education, and training.

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Supporting the Industry's Future – continued

- **Baker Rock Resources Scholarship:** Jonathon Stark is a junior in the civil engineering program at Oregon State University. Jonathon was a high school physics teacher and went back to school out of a desire to apply science to real life –and there is no better real-life science application than infrastructure.

- **APAOEF Scholarship:** Conor Roark is a senior in the civil engineering program at the Oregon Institute of Technology. Conor's experience as a Peace Corps volunteer in Zambia showed him the importance of good infrastructure. He has had internships with the Bureau of Land Management and the Oregon Department of Transportation and is looking forward to working in the infrastructure industry upon graduation.

As part of a new program to introduce high school students to the industry, APAO created a competition where student groups form construction companies and prepare proposals for the concrete and asphalt pavement work associated with a multi-family housing project on the Oregon Coast. The APAO Education Foundation awards scholarships of up to $250 per student to the winning teams. In 2022, the APAO Education Foundation awarded 10 such scholarships to high school students from Salem and Beaverton.

The APAO Education Foundation also continued to support the Scholastic Foundation of the Oregon Chapter of the American Public Works Association under an agreement where the organizations contribute up to $2,500 per year to award two scholarships through the APWA scholarship program to students interested in public infrastructure.

John Hickey, APAO Executive Director, presenting scholarships to Mountainside High School students who competed in APAO's work-based learning competition - Dec 2022

Want to support the industry's future? All you need to do to support the APAO Education Foundation is drink wine! Ordering ***Roads Scholar Red*** from ***Watermill Winery*** in Milton-Freewater supports scholarships for deserving students. Order forms are available on the APAO website. One hundred percent of proceeds go toward scholarships.

MEMBERS

For quality asphalt projects, call one of our members.

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Industry Partners: Northwest Utility Contractors Association; Oregon Chapter of the American Public Works Association; Oregon-Columbia Chapter of the AGC; Oregon Concrete & Aggregate Producers Association; Oregon Department of Transportation; Oregon Institute of Technology; Oregon State University; Portland State University

SAVE THE DATES

Jan 26-27, 2023

Asphalt Plant Operations Training
Chemeketa Center for Business & Industry, Salem:

This two-day training is for plant operators and managers, and anyone else who works in and around asphalt plants. The training will focus on the essential asphalt pavement production principles and the best practices for asphalt plant operation.

Feb 16 & 17, 2023

Asphalt Materials for Managers
Asphalt Pavement Association of Oregon, Salem:

This is a single-day training offered on two separate days that is for people who work with asphalt materials, but whose job duties do not require significant laboratory and hands-on asphalt knowledge. The training will cover essential topics presented in a simple to understand way to enable managers to make better pavement decisions.

Feb 28, 2023

Annual Oregon Asphalt Pavement Conference & Paving Awards
Salem Convention Center:

This is the best opportunity in Oregon to get training on asphalt paving fundamentals. Workmanship, specifications, recruiting, and other topics will be covered by nationally recognized experts. The best projects from 2022 will be recognized at the Conference Banquet at the event's conclusion.

Mar 1, 2023

ODOT/Industry Construction Safety Symposium:

Speakers and demonstrations will highlight trends and advancements in roadway work zone safety. Topics will include ODOT safety policies, dealing with distracted and drunk drivers, new technologies to keep workers and inspectors safe, and mental health.