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EDITOR'S MESSGAE

With a decade of activity in the bitumen and petroleum derivatives industry in the field of printing and publishing specialized news and selected scientific articles from conferences, symposiums, research centers and universities, and introducing brands and companies producing petroleum and bitumen, the World of Petroleum and Bitumen Journal has been able to gain the trust of more than 6000 permanent audience in such a way that they would like to receive the print version of the journal every month.

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GADKARI HIGHLIGHTS URGENT FOCUS ON ROAD SAFETY AND SUSTAINABLE BITUMEN INNOVATIONS

Union Minister Nitin Gadkari highlighted the urgent need for enhancing road safety and advancing bitumen production techniques at the Indian Roads Congress. He underscored the alarming rise in road accidents, calling on engineers to create more effective Detailed Project Reports (DPRs) and adopt waste-to-wealth methods, including using paddy straw for bitumen and compressed natural gas (CNG) production.

During the 83rd annual session, Gadkari urged prioritization of safety in road construction across India, as the government aims to curb road accident rates. He praised the use of waste-to-energy solutions, especially innovations in generating bitumen and CNG from agricultural residue like paddy straw.

Gadkari announced several new road projects in Chhattisgarh, expressing confidence that its infrastructure will rival that of the United States in the coming two years. Taking responsibility for accidents linked to design flaws, he called on engineers to enhance their project documentation and maintain rigorous safety protocols.

Gadkari also encouraged Chhattisgarh to keep producing bio-based resources, which would boost the country's self-reliance and lessen dependence on fossil fuels.

"ROAD CONSTRUCTION STALLS AS FOREX FLUCTUATIONS DRIVE 150% INCREASE IN BITUMEN COSTS"

Many road construction projects in Nigeria are facing delays or have come to a halt, largely due to the sharp rise in bitumen prices spurred by foreign exchange (forex) instability. This situation has forced authorities to reconsider and adjust funding plans for these projects, with some timelines pushed back. Bitumen, a key ingredient in asphalt, has seen a 150% price increase over several months.

findings reveal that the price for 20 tonnes of bitumen, which was N854,375 in the recent past, has now surged past N2 million. Contractors also face challenges from fluctuating exchange rates and rising prices of other essentials, such as cement, diesel, granite, and crushed stones. As a result, some contractors have abandoned sites, while others are negotiating with clients to adjust contracts in line with the new material costs.

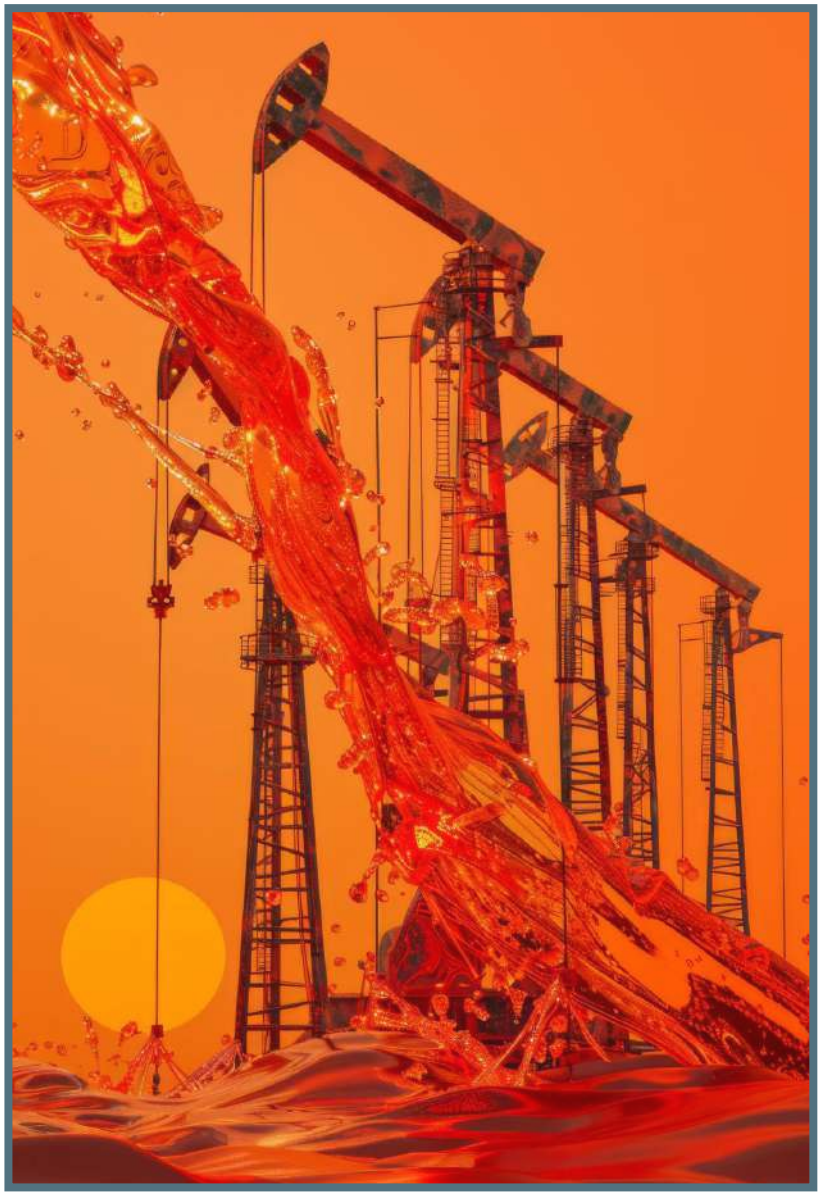
A source within Lagos Public Works reported that the cost of a tonne of asphalt rose from N70,000 to N155,000 over several months. The source outlined the steady price increases for 20 tonnes of bitumen, which climbed from N854,375 to over N2 million, reflecting ongoing inflation and a volatile foreign exchange environment.

Several issues, including inflation, fuel subsidy removal, government budget constraints, and dependence on imports, have been cited as contributors to the rising costs of bitumen and construction materials. In response, the Minister of Works, David Umahi, cautioned contractors working on federal road projects that they would not be compensated for delays resulting from their own setbacks. He reinforced the government's stance on using either asphalt or concrete, depending on specific criteria, for constructing federal roads.

Meanwhile, Saidu Hassan, the chairman of the Nigerian Institution of Highway and Transportation Engineers (NIHTE), emphasized that the surge in bitumen prices would inevitably drive up road construction costs. He urged the government, as a major bitumen consumer, to step in and help stabilize the supply of this material to ensure the continuation of road projects nationwide.

Vincent Barrah, president of the Federation of Construction Industry (FOCI), echoed these concerns, noting that relentless inflation in construction material costs—particularly bitumen, cement, steel, and diesel—has intensified financial pressures on the industry, endangering the viability of numerous projects and affecting countless jobs. Barrah stressed that the skyrocketing price of diesel, essential for operating construction equipment, has only worsened the already heavy financial load on construction firms.

CHINA SET TO REMAIN MAJOR CONTRIBUTOR TO GLOBAL OIL DEMAND GROWTH



Despite a peak in demand from its transport sector, China is expected to stay central to global oil demand trends, according to Vitol. The key factor behind this continued importance is the petrochemical industry, said Giovanni Serio, Vitol's head of research.

Serio, speaking at the FT Asia Commodity Summit, highlighted that growth in petrochemicals alone could soon meet the global demand for plastics, indicating it as a major force driving China's oil demand. "This segment is less impacted by decarbonization efforts, making it a core driver of oil demand both in China and worldwide," he noted.

The International Energy Agency reported earlier this year that up to 90% of China's oil demand growth between 2021 and 2024 stemmed from the petrochemical sector. In contrast, demand for transport fuels has been slowing as electric vehicle adoption accelerates in the world's largest EV market.

However, Vitol's Serio pointed out that China's gasoline demand is still seeing growth, adding around 22,000 barrels per day (bpd) this year—a modest increase compared to the 268,000 bpd growth seen in 2023.

For diesel, LNG trucks are gradually reducing demand, though price differentials remain influential. As LNG prices fluctuate with global demand, particularly during peak winter months, sales of LNG trucks in China have already dropped in September due to a price increase against diesel.

Over the medium term, Serio concluded that petrochemicals will continue to be the dominant driver behind global oil demand growth.

NIGERIA PROMOTED AS LEADING ENERGY INVESTMENT HUB — PETROLEUM MINISTER

Senator Heineken Lokpobiri, Nigeria's Minister of State for Petroleum Resources (Oil), has underscored Nigeria's substantial potential as a top energy investment destination in Africa.

During remarks at the Africa Energy Week held in Cape Town, Lokpobiri highlighted that Nigeria holds close to 30% of Africa's oil and gas reserves. This strategic advantage, he noted, is coupled with the government's commitment to creating a favorable investment climate through reforms in the oil and gas sector.

"Our abundant resources position Nigeria as a prime location for energy investments across Africa," Lokpobiri stated. He explained that the current reform initiatives under President Bola Tinubu aim to position Nigeria as a competitive player on the global energy stage. Lokpobiri outlined recent executive actions to attract investors, including the streamlining of licensing processes to eliminate bureaucratic delays.

"These efforts not only establish fair conditions for all participants but also reinforce Nigeria's image as a strategic and efficient market," he affirmed.

Lokpobiri also addressed the crucial contributions of independent operators within the energy industry. Despite persistent financing obstacles, these players are vital to advancing local development and capacity building within Nigeria's oil sector.

"The role of independent companies in our oil sector is essential. Yet, funding has been a longstanding challenge, and we're addressing this by creating stronger financial support frameworks for domestic producers," Lokpobiri added.

The minister described the launch of the Africa Energy Bank as a groundbreaking initiative. Formed through a partnership between the African Petroleum Producers Organisation and AfreximBank, this specialized financial institution is intended to close funding gaps in Africa's energy sector.

"With Nigeria chosen as its headquarters, the bank aims to open up new funding opportunities, boost investor confidence, and accelerate industry growth. The Africa Energy Bank will bring the financial security and support necessary for both local and international investors," Lokpobiri remarked.

He further stressed the benefits of Nigeria's deregulated oil sector, which allows free participation across the industry. He encouraged investors to seize opportunities in this open environment, which removes barriers and promotes healthy competition.

"Our industry is fully open for international collaborations. We invite all investors to explore Nigeria's remarkable potential in oil and gas. Together, we can advance the sector toward a sustainable and prosperous future," Lokpobiri concluded.

CONTAINERSHIP DELAYS FOR LATE ARRIVALS HIT HIGHEST LEVELS SINCE PANDEMIC

Containership delays have climbed in 2024, reaching levels not seen since the height of the pandemic and peak container volumes. Sea-Intelligence's latest monthly review of container carriers' performance across 34 trade routes highlights that disruptions have continued to impact the industry this year.

Sea-Intelligence CEO Alan Murphy notes that while schedule reliability has generally held steady between 50 and 55 percent this year, it has shown a slight decline since reaching a high in May. Murphy added, "Although 2024 has shown low volatility in schedule reliability, giving shippers a decent forecast month-to-month."

In September, the industry's schedule reliability dropped 1.2 percentage points, settling at 51.4 percent, the lowest point for 2024 and a two-year low. Although reliability had improved from a low in 2021, when only about a third of ships were on time, reaching over 50 percent by October 2022 and peaking at 64 percent in mid-2023, declines returned in late 2023 due to disruptions from Houthi activities in the Red Sea.

This current performance is a far cry from 2019 levels, before the pandemic, when containerships achieved 80 percent schedule reliability. Maersk and Hapag-Lloyd have set an ambitious goal of achieving 90 percent reliability on major routes with their upcoming Gemini Cooperation in 2025.

Maersk remains the most reliable carrier in September 2024, standing at 55.5 percent reliability, down from 70 percent the previous year. It was among just four major carriers, along with Zim, PIL, and Wan Hai, that managed to improve performance between August and September. Yet, compared to September 2023, major carriers saw a sharp drop, with an average reliability down from 60 percent to 47 percent. According to Sea-Intelligence, MSC, PIL, and Wan Hai each saw declines of over 20 percentage points year-over-year, and the average year-over-year drop was 13 percentage points.

Sea-Intelligence reports that the average delay for late containerships reached 5.67 days in September 2024, up 0.21 days from the previous month. This marks the third-worst September for delays, behind only the pandemic years of 2021 and 2022. The yearly average for 2024 has risen by half a day compared to 2023, though delays had briefly fallen below five days before recent rerouting.

According to Linerlytica, Asia remains the region most affected by port congestion, particularly in Chinese ports, Singapore, Hong Kong, and Korea. Increased congestion has also been seen at Savannah and major Northern European ports as of late October. With vessels rerouting around Africa and facing winter challenges off South Africa, individual ports have seen spikes in congestion due to vessel bunching, adding further delays.

Maersk warned that disruptions from the Red Sea rerouting may persist into 2025.

IPMAN Warns of Potential Fuel Supply Suspension to Ogun State Over Alleged Task Force Harassment

The Independent Petroleum Marketers Association of Nigeria (IPMAN) has warned that it may halt the supply of petroleum products to Ogun State. This announcement comes in response to what IPMAN claims is ongoing harassment by an "unlawful Task Force" established by the state government to address suspected manipulation of fuel prices.

Chief Solomon Ajayi, IPMAN's new chairman at Mosimi Depot, revealed this development while speaking to journalists in Abeokuta, the state capital. Ajayi highlighted that IPMAN members across Ogun State are frequently harassed by this Task Force, which was set up by the administration of Governor Dapo Abiodun.

The Task Force, chaired by Adeyemi Badejo, includes members of the Nigeria Police, personnel from the state's Traffic Compliance and Enforcement agency, and the state-owned television network. According to Ajayi, this Task Force operates in contradiction to Sections 48 and 309 of the Petroleum Industry Act 2021, which do not permit such bodies.

IPMAN has called on relevant government agencies to intervene, stating that if the Task Force's actions persist, members will stop supplying fuel to Ogun State, beginning in the near future. Ajayi added that IPMAN members are often unfairly targeted when government policies impact the public negatively and stressed that this Task Force's existence lacks legal grounds.

Furthermore, IPMAN's Mosimi Depot has filed a formal complaint with the Nigerian Midstream and Downstream Petroleum Regulatory Authority's state office, expressing disapproval of the Task Force's formation. In the letter, a copy of which was shared with journalists, IPMAN affirmed that its members are law-abiding and dedicated to operating within legal boundaries, refusing to tolerate coercion from state agents.

The letter stated that the Task Force has been visiting fueling stations, compelling staff to provide measuring cans for product checks, harassing workers, and demanding payments. IPMAN urged authorities to address what it described as illegal actions against its members, who are committed to lawful business practices.

UNION MINISTER NITIN GADKARI STATED THAT INDIA'S ROAD INFRASTRUCTURE IS POISED TO SURPASS THAT OF THE UNITED STATES IN THE NEAR FUTURE.

He emphasized that the development of efficient highways, waterways, and railways is essential for reducing logistics costs and enhancing economic growth.

Gadkari also criticized consultants who prepare detailed project reports (DPR) for road projects, claiming they often do so without proper field engagement.
Speaking at the opening session of a two-day seminar in Bhopal focused on 'Latest Emerging Trends and Technologies in Road and Bridge Construction,' Gadkari reflected on his time as a minister in Maharashtra.

He recalled a quote from former U.S. President John F. Kennedy that he had displayed in his office: "American roads are not good because America is rich, but America is rich because American roads are good." The senior BJP leader mentioned that his late friend Ratan Tata had frequently inquired about this quote during his visits to Gadkari's office.

"In the near future, Indian road infrastructure will surpass that of America. We are committed to achieving this," Gadkari asserted, encouraging seminar participants to contribute to this transformative vision.

During a helicopter survey of the Bangalore-Chennai highway, Gadkari recounted observing three to four significant towers obstructing the highway's alignment. He was informed that the removal of these structures would incur a cost of Rs 300-400 crore.

Gadkari remarked to an official that these towers could have been avoided during the highway's construction phase, thereby eliminating the need for their removal expenses. In a light-hearted manner, he noted that the official concurred with his assessment, attributing

the oversight to those responsible for preparing the Detailed Project Report (DPR).

Gadkari humorously suggested that the individuals who draft the DPRs are highly esteemed and worthy of a 'Padma' award, as they often compile their reports from home using Google. He further commented that such individuals tend to apologize when errors, such as incorrect alignments, are highlighted.

He criticized engineers for not visiting the project sites beforehand to identify potential conflicts with existing structures, such as mosques and temples, and for only approaching authorities when issues arise. Gadkari emphasized the need for a sense of ownership in these projects, encouraging state governments to involve engineering students in correcting the errors found in DPRs. He asserted that this approach could lead to the rectification of numerous mistakes. The Union minister also pointed out that India boasts the second-largest road network in the world, encompassing 63 lakh kilometers of roads.

Gadkari remarked with irony that potholes frequently appear on asphalt roads, requiring their reconstruction annually. "This brings great pleasure to certain individuals," he stated. "If this 'pleasure' is to be eliminated, we should implement a white concrete topping.

This would ensure that the road remains undamaged for 25 years. I have transformed the roads in my city (Nagpur) into concrete surfaces," he added. He also noted that asphalt roads are adversely affected if the drainage system is inadequate, as water poses a significant threat to bitumen.

Gadkari further emphasized the necessity of improving transport networks. "Our logistics costs account for 14 percent of GDP, compared to eight percent in China. During a program hosted by the American Chambers of Commerce, I spoke with prominent CEOs who indicated that their countries experience logistics costs of 12 percent," he explained.

To reduce logistics expenses, it is essential for the nation to enhance the efficiency of highways, waterways, and railways, according to Gadkari. The Lok Sabha MP from Nagpur asserted that if logistics costs could be reduced to nine percent, it would facilitate an increase in exports and stimulate economic growth. Highlighting the importance of promoting biofuels, Gadkari pointed out that India imports fossil fuels (petrol and diesel) worth Rs 22 lakh crore annually, and that pollution is a leading contributor to health issues in the country.

In discussing the transformation of 'parali' (paddy straw) into biofuel, Gadkari emphasized the role of farmers in energy production. He stated, "The diversification of agriculture into the energy and power sectors will revolutionize farming.

" The Union minister also promoted the use of segregated waste in road construction, proposing the incorporation of plastic with bitumen. "To date, we have utilized 80 lakh tonnes of waste in road projects," Gadkari noted, referencing initiatives in Chandigarh, Delhi, and Ahmedabad.

Additionally, Gadkari expressed alarm over the fatalities occurring on the nation's roads. He reported that approximately 1.78 lakh individuals, including professionals such as doctors and engineers, lose their lives in road accidents, a figure surpassing those lost during the COVID pandemic or in any conflict.

These incidents result in a 3 percent reduction in the country's GDP. He urged the public to cultivate social awareness, sensitivity, and responsibility, highlighting their significance for humanity. Gadkari called for the identification of accident-prone areas and improvements in road engineering. He asserted that enhancing road safety and environmental conditions is essential for improving the quality of life for citizens. The event was attended by Madhya Pradesh Chief Minister Mohan Yadav, Chief Secretary Anurag Jain, and other ministers.

Europe Bitumen Market Overview

The Europe Bitumen Market is projected to grow from an estimated 26.35 million tons to 31.62 million tons over the next five years, with a compound annual growth rate (CAGR) exceeding 3.71% during the forecast period. The COVID-19 pandemic had a detrimental impact on various industries, with lockdown measures across many European nations leading to interruptions in production, industrial operations, and freight transport, thereby disrupting the supply chain.

However, recovery began in 2021, allowing the market to regain its growth momentum. The primary drivers of growth in this market include the increasing number of road construction projects in Europe and the rising demand for bitumen in waterproofing applications. Conversely, environmental concerns related to bitumen and the preference for concrete in road construction may hinder market expansion. Nonetheless, ongoing research aimed at developing high-performance bitumen products is expected to present significant growth opportunities for the European market. Germany is anticipated to be the largest market throughout the forecast period, driven by heightened consumption related to expressway construction.

Europe Bitumen Market Trends

Road Construction Sector to Lead the Market

A significant portion of bitumen is utilized in the production of asphalt for road construction.

Asphalt, a combination of rock aggregates and bitumen, relies on bitumen as a binding agent, which is crucial for the stability of the asphalt. The suitability of asphalt roads varies based on the type of bitumen or the composition of the mixture, making them adaptable to different climatic conditions and operational demands.

Additionally, asphalt is employed in the construction of airport runways, parking structures, and port areas. The roadway sector plays a vital role in a nation's

economic development. Infrastructure such as roads, airport runways, and parking facilities are essential for facilitating trade and mobility, necessitating substantial investments for modernization and maintenance.

1. The infrastructure sector is witnessing consistent growth, driven by increased government investment aimed at enhancing local infrastructure. Notably, infrastructure activities are anticipated to rise significantly in Europe, particularly within the transportation domain, due to the establishment of a network reminiscent of China's Silk Road. As of February 2023, the Italian Government has allocated a budget for significant road development initiatives.
An investment of EUR 4.5 billion (approximately USD 4.93 billion) is earmarked for road projects in the regions of Sicily, Calabria, Puglia, and Lazio.

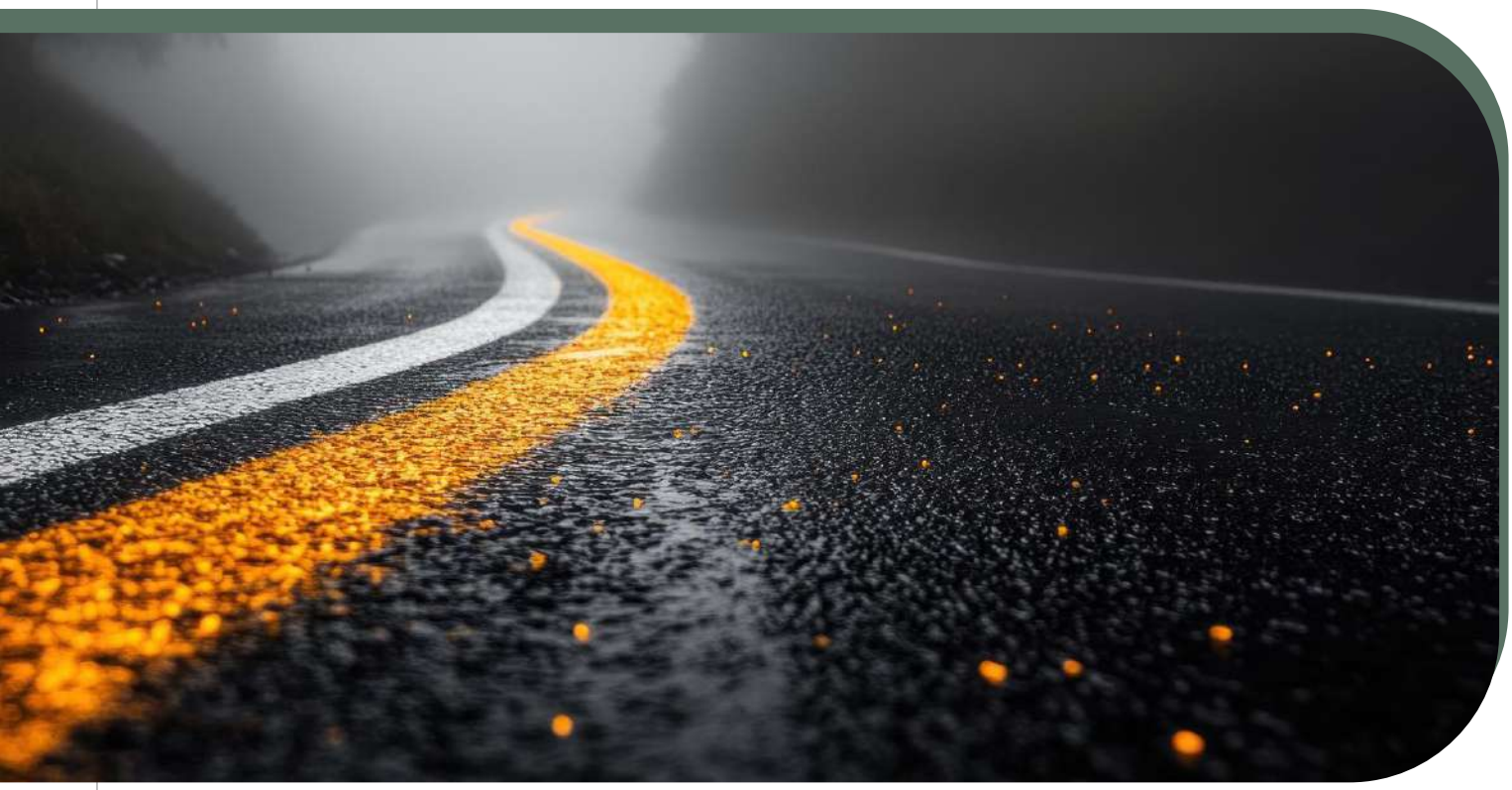
This funding has been approved by Italy's Interministerial Committee for Economic Planning and Sustainable Development (CIPESS) and will be utilized by the road and motorway concessionaire ANAS. Additionally, the Ministry of Infrastructure and Transport (MIT) has approved EUR 355.2 million (around USD 389.04 million) for maintenance and enhancement projects on the highway linking Umbro with Laziale.
This initiative aims to improve the connection between the highway and the port of Civitavecchia. In April 2022, Mostostal Warszawa and Acciona commenced construction on the S19 Rzeszów Południe-Babica expressway in Southeast Poland.

The contract, valued at approximately EUR 480 million (about USD 525.72 million), is set to last for 54 months, concluding in 2026. Upon completion, the S19 expressway will integrate into the international Via Carpatia route, which will span over 700 km, linking northern and southern Europe. In the United Kingdom, two significant road projects were announced in April 2022.

One project involves upgrading the A417, while the other focuses on establishing a new connection between the M6 and M54 motorways. The A417 upgrade is valued at GBP 460 million (approximately USD 585.59 million) and will enhance the route between Swindon and Gloucester. Given the array of development projects across key European nations, the demand for bitumen is projected to be highest for road construction endeavors.

Germany's Ascendancy in the Regional Market

The European Construction Industry Federation reports that Germany's new construction order value reached EUR 99 billion (approximately USD 108.43 billion) in 2022, reflecting a 4.8% increase compared to 2021. In 2022, the total number of building permits issued for residential construction was 354,403. However, from January to March 2023, only 68,700 residential building licenses were granted, marking a 25.7% decline from the same timeframe in the previous year (January to March 2022: 92,500 permits).
This reduction in construction activity is likely attributed to the elevated costs of building materials and the lingering impacts of the Russia-Ukraine conflict. Conversely, the construction of hotels in Germany is projected to experience significant growth during the forecast period. As of 2021, there were 360 new hotels planned, comprising 56,565 rooms. In 2022, 89 new hotels and 15,780 rooms were



launched. An additional 78 projects, featuring 13,073 keys, are anticipated for 2023.

The hotel development pipeline is expected to remain robust into 2024 and beyond, with 153 projects and 22,769 rooms already in progress. In 2022, the government earmarked over EUR 12 billion (approximately USD 13.14 billion) for investments in federal highways. Numerous road construction initiatives are currently underway, which will contribute to the demand for bitumen. * In March 2022, VINCI Highways commenced work on a contract to enhance the B247 road connecting Mühlhausen and Bad Langensalza in Germany.

This initiative marks the first federal road project in Germany developed under a public-private partnership (PPP) framework, with an investment of around EUR 500 million.

The B247 expansion represents the largest infrastructure project in Northern Thuringia, involving the construction of two to four new lanes over a distance of 22.2 km. The project includes two new bypasses, 31 structures, two road bridges, five railway bridges, eight junctions, and approximately 6 km of additional state and federal roads. Completion of the project is projected for mid-2025.

As of February 2023, significant road construction initiatives are underway in Germany, particularly in the Rhine-Main, Saarland, and Rhineland-Palatinate regions.

These initiatives encompass lane widening and maintenance activities. The project is allocated a budget of EUR 315 million (approximately USD 345.01 million) aimed at upgrading and reconstructing highways within the Rhine-Main area throughout 2023.

As a result, the demand for bitumen in Germany is expected to be primarily driven by road construction projects, with infrastructure development following closely in the projected period.

Overview of the Bitumen Industry in Europe

The European bitumen market is characterized by a high degree of fragmentation. Key players in this sector include Shell Plc, BP PLC, Nynas AB, Exxon Mobil Corporation, and Suncor Energy Inc., listed in no particular order.

AECI Sells Much Asphalt to Old Mutual Private Equity and Sphere in a R1.1 Billion Transaction

Old Mutual Private Equity (OMPE) and black-owned investment firm Sphere Investments have acquired Much Asphalt, South Africa's leading producer of asphalt and bitumen products, through a deal valued at R1.1 billion. This acquisition, which includes management participation, is funded via a mix of debt and equity financing.

Much Asphalt operates as the largest commercial supplier of asphalt, bituminous binders, and emulsions in South Africa, with a unique nationwide presence primarily serving the road surfacing market.

In a statement, AECI Group CEO Holger Riemensperger highlighted that OMPE and Sphere offer financial stability, market reach, and a sustainable future for Much Asphalt. He noted, "This sale represents an important milestone in AECI's strategic path, marking a critical part of the company's broader divestment strategy announced previously."

AECI's ongoing strategy focuses on doubling the profitability of its primary businesses—Mining and Chemicals—by 2026, with ambitions to become a top-three global player in Mining by 2030.

OMPE and Sphere emphasized that this acquisition aligns well with government priorities, as road infrastructure investment remains essential to driving economic growth and creating jobs in South Africa. "Together with Much Asphalt's competitive market positioning, this partnership equips the company to play a significant role in South Africa's road infrastructure projects in the coming years," they commented.

This transaction serves as the inaugural and flagship investment of OMPE's new OMPE Fund VI. OMPE and Sphere plan to collaborate closely with Much Asphalt's management team, aiming for transformative business growth throughout the investment period.

OMPE co-head Jacci Myburgh expressed optimism regarding infrastructure repairs led by the current government, and affirmed OMPE's commitment to investing in sectors they expect to return to stability over the medium to long term, following a volatile economic decade for South Africa. She stated, "A strong road network is crucial to South Africa's promising rebuild, which should drive economic expansion and job creation."

Burchert Johannes, investment principal at OMPE, praised Much Asphalt's management for effectively steering the company through various industry challenges and expressed enthusiasm about partnering with Sphere to support the company's growth goals.

Mohammed Sabi, a director at Sphere, stated that this acquisition builds on Sphere's 21-year history of investing in high-quality businesses that provide essential products and services.

Bennie Greyling, Managing Director of Much Asphalt, added that the company is well-positioned to capitalize on the backlog in road infrastructure spending within the country.

Old Mutual Private Equity, part of Old Mutual Alternative Investments, stands as one of South Africa's largest private equity firms, with a 24-year track record of substantial investments in private businesses across key sectors, including companies like Actom, Tourvest, Ti-Auto, Primedia, In2Food, and 10X Investments.

Sphere, founded in 2023, has a successful history of partnering with South African branches of major international corporations, including Babcock International Group, Honeywell International, and Pearson, and maintains a diversified asset portfolio across engineering, infrastructure, custom software, and industrial education sectors.

Container Shipping in 2025 - A Delayed Crisis?

BY WPB

Market predictions of a looming downturn hinge on the assumption that no sudden and severe events will disrupt the market again. Based on the fundamentals, freight rates are anticipated to fall significantly, as the balance between supply and demand has tilted toward the advantage of shippers, visible even with a basic review of recent data.

According to Darron Wadey, an analyst at Dynamar and author of the DynaLiners Trades Review 2024, fleet expansion is inevitable. Wadey notes that despite a historic rate of vessel deliveries through 2023 and into 2024, the scale of remaining orders points to further growth in capacity.

The DynaLiners Review reports that an additional 470 ships, representing approximately 3.2 million TEU, are set to join the market in the coming months. Even if ship scrapping were to resume, which remains a possibility, it would only have a minor impact compared to the incoming capacity. The average scrapping rate over the past decade is 247,000 TEU, suggesting the global container fleet could swell beyond 31.4 million TEU, an annual growth rate of 10%, substantially outpacing cargo growth.

Wadey told Seatrade Maritime News that, under typical market patterns, a downturn should have occurred already; previous capacity booms in 2008, 2010, and 2015 quickly led to market declines and heavy losses for carriers. Yet, this pattern has not materialized after the post-COVID boom, largely due to how shippers managed challenges like the Red Sea disruptions.

Despite these concerns, many shipping lines are op-

timistic about the current market's resilience. Wadey observes that some carriers have even raised their income forecasts for 2024, with both Hapag-Lloyd and Maersk revising annual projections upward due to strong third-quarter results. However, Linerlytica is doubtful that a November 1 general rate increase (GRI) will hold.

Wadey speculates that the current demand is driven more by shippers' efforts to mitigate potential disruptions, such as Red Sea diversions or U.S. dockworker strikes, rather than by an actual increase in demand. Additionally, he acknowledges that the upcoming U.S. election could impact cargo volumes, as shippers seek to avoid new tariffs promised by both presidential candidates. Donald Trump administration is expected to implement more restrictive import policies than those suggested by Kamala Harris.

Potential new U.S. tariffs on Chinese goods could prompt a surge in freight rates, with shippers accelerating imports. There may also be a continuation of shipments from China to Mexico as a route to bypass U.S. tariffs. Meanwhile, concerns of further strikes on the U.S. East and Gulf coasts at the start of the year add to the uncertain outlook, as noted by Xeneta's 2025 forecast, co-authored by chief analyst Peter Sand and senior shipping analyst Emily Staus-bøll.

Xeneta points to other potential risk factors, such as regional tensions in areas like the Taiwan Strait and Bangladesh, as well as the possibility of Middle Eastern conflicts spreading to the Persian Gulf. However, the firm emphasizes that shippers have a stronger position today compared to prior times of instability, thanks to extensive data availability that allows close monitoring of freight corridors and enhanced benchmarking of carrier reliability.

The question remains whether 2025 will turn container shipping into a buyers' market. Wadey suggests this outcome isn't guaranteed. While rates might decline in the absence of further supply chain disruptions, the oversupply problem could require a reduction in operational capacity. This could involve shrinking fleets or adopting measures like skipped sailings, staggered schedules, or even service cancellations.

"The result," Wadey cautions, "would be a decline in service quality. Shippers already cite service issues as a significant concern, so whether they—and potentially regulators or policymakers—will tolerate this after a period of substantial carrier profits is an open question."

Enhancing fatigue performance and self-healing properties in asphalt pavements

asphalt pavements

Fatigue cracking remains a primary issue impacting the durability and longevity of asphalt pavements, driven by constant vehicular loads and environmental conditions. Self-healing capabilities in asphalt binders offer potential to mitigate fatigue, although knowledge gaps remain in fully harnessing this property.

Research continues to advance, utilizing methods such as the Linear Amplitude Sweep (LAS) test and the Simplified Viscoelastic Continuum Damage (S-VECD) model to evaluate the fatigue and self-healing characteristics of asphalt.

Recent studies further explore various modifications to asphalt binders, such as the inclusion of polymer additives, and develop new frameworks aimed at achieving consistent fatigue performance measurements. This paper reviews advancements in evaluating fatigue performance and self-healing capacities in asphalt, presenting findings that underscore the need for a comprehensive framework to assess bitumen fatigue performance consistently, ultimately guiding engineers toward optimal material selection.

Introduction

Fatigue cracking is a common form of degradation in asphalt pavements, triggered by repetitive vehicle loading and climatic stressors. Over time, these stresses generate cracks, compromise structural integrity, and reduce pavement longevity. Fatigue cracking originates in the bituminous phase of asphalt mixtures and propagates through the pavement structure, thus placing significant emphasis on the fatigue behavior of bitumen-based materials in understanding pavement distress. A promising avenue for mitigating fatigue cracking lies in the self-healing properties of asphalt binders, which can slow down crack development through molecular interdiffusion and capillary flow mechanisms. High temperature further promotes self-healing by increasing the movement of bitumen molecules.

Despite potential benefits, the mechanisms behind asphalt's self-healing remain insufficiently understood, necessitating more precise assessment tools and frameworks. Current methods include the LAS test and the S-VECD model, which analyze parameters like complex shear modulus, shear strain, shear stress, and phase angle.

This data enables prediction of fatigue life and self-healing capacity in asphalt. However, further refinement is needed to ensure consistency in measuring fatigue performance across different bitumen types and modifications. This paper reviews experimental approaches and recent research that assess the fatigue behavior and self-healing performance of various asphalt mixtures, highlighting the need for a new, comprehensive framework for enhanced material selection.

Mechanisms of fatigue cracking and self-healing in asphalt binders

Fatigue cracking in asphalt pavements occurs mainly at the later stages of pavement life, where the bin-

der becomes rigid due to long-term aging. Cyclic loading, combined with temperature changes, leads to horizontal tensile strains that exceed the tensile strength at the base layer, inducing microcracks that expand over time. This ultimately results in pavement structural failure. The asphalt binder's long-term exposure to cyclic loading and environmental factors results in a brittle, less flexible material prone to cracking under stress.

Self-healing in asphalt binders is primarily governed by two mechanisms: molecular interdiffusion and capillary flow. The interdiffusion process, facilitated by elevated temperatures, enables bitumen molecules to move more freely, allowing cracks to close over time. Molecular characteristics such as binder density and glass transition temperature also play crucial roles in determining self-healing rates. These mechanisms underscore the importance of selecting binders with favorable self-healing properties to extend the pavement service life.

Assessment methods for fatigue performance and self-healing

The LAS test (AASHTO TP 101) and the S-VECD method are two widely used methods for evaluating the fatigue response and self-healing capability of asphalt binders. LAS testing measures parameters such as complex shear modulus, shear strain, shear stress, and phase angle. These values are then used in the S-VECD model to calculate parameters that represent the internal state of the binder, notably the integrity (C) and state condition (S) parameters. Plotting these values on a C vs. S curve produces the Damage Characteristic Curve (DCC), a key tool for predicting fatigue performance.

The S parameter, crucial in understanding binder fatigue behavior, aligns with Schapery's work potential theory of damage evolution. Consequently, these methods allow for a quantitative assessment of both fatigue resistance and self-healing potential. However, recent studies highlight inconsistencies in these metrics, suggesting that further improve-

ments to the evaluation frameworks are needed to ensure reliable assessments.

Recent advances in fatigue and self-healing studies of asphalt mixtures

A substantial body of research has emerged, exploring various asphalt modifications to improve fatigue performance and self-healing capacity. These studies often use the LAS and S-VECD frameworks to establish correlations between fatigue life and strain levels across different bitumen types and formulations.

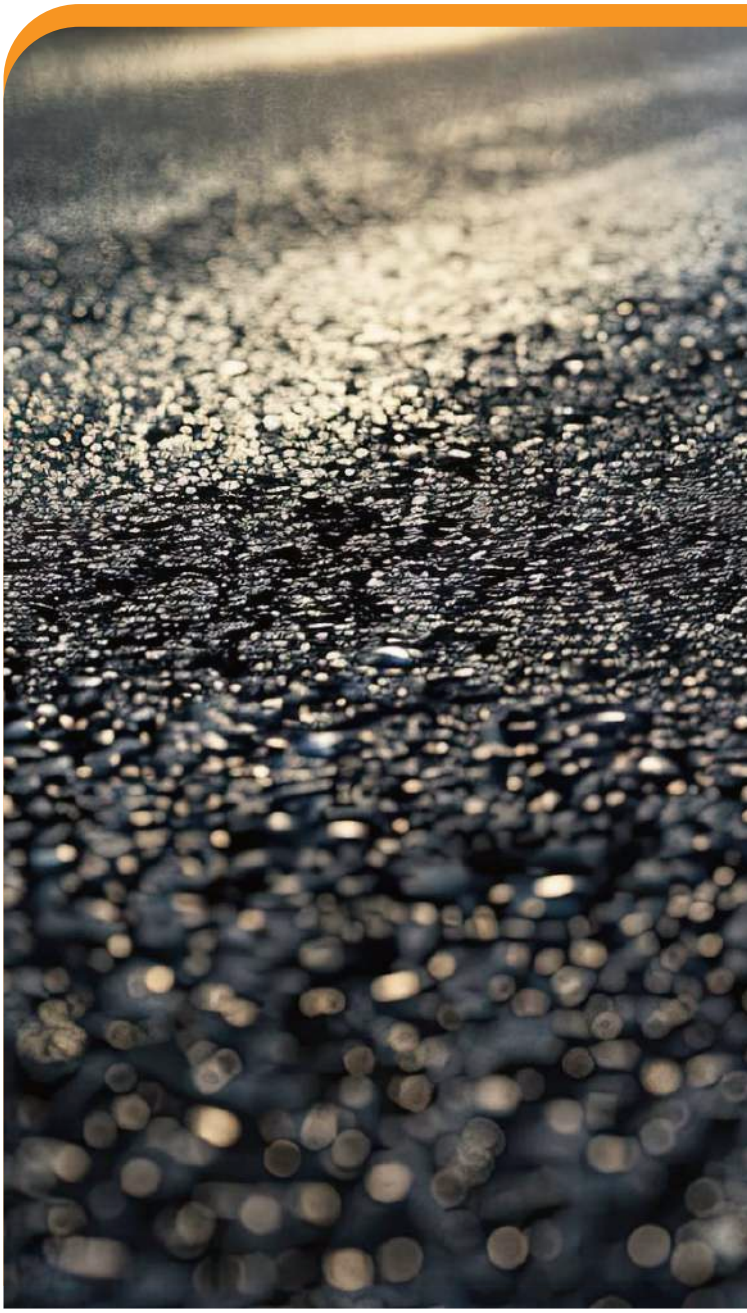
For example, Jiao et al. investigated the fatigue performance of asphalt mixtures containing reclaimed asphalt pavement (RAP). Their results demonstrated a strong correlation between LAS test data and fatigue life, validated by four-point beam fatigue tests. Muhammad et al. similarly explored relationships between LAS test results and other testing methods, finding that the LAS test effectively predicted results from the four-point bending beam test, offering a reliable measure of fatigue life.

In another study, Sabouri et al. established a link between LAS and four-point bending beam fatigue tests, concluding that the conventional fatigue index ($G^*\sin\delta$) was inadequate in predicting fatigue performance accurately. The Glover–Rowe parameter, as demonstrated by Ilyin and Yadykova, proved more effective in assessing polymer-modified asphalt, enabling rapid fatigue and rutting resistance evaluation under varied temperature conditions.

Modifications and additives in asphalt for enhanced self-healing

Several studies have investigated modifications to asphalt to boost self-healing, with mixed results regarding the impact of various additives on healing performance. Xie et al. and Wang et al. examined the influence of short- and long-term aging on the self-healing capabilities of neat asphalt (NA) and styrene-butadiene-styrene (SBS)-modified asphalt. Their findings showed that aging and SBS generally reduced healing efficiency, although certain molecular compositions helped retain self-healing potential.

Aurilio and Baaj tested self-healing polymer-modified bitumen (SPB) and found that while elastomeric additives enhanced bitumen properties, they did not significantly improve self-healing. In contrast, Lv et al. tested self-healing polymers (STPB and IPAB), finding that STPB promoted self-healing in asphalt at room temperature. They proposed a new framework based on stored potential cohesion (SPC) to address the inconsistencies observed in conventional fatigue metrics.



Challenges in existing frameworks and the need for a comprehensive model

The existing frameworks for fatigue performance assessment exhibit several limitations, often failing to provide consistent evaluations across various asphalt types and modifications. The reliance on the peak of stored pseudo-strain energy (PSE) as the failure criterion for assessing fatigue life (Nf) has proven inadequate, as discrepancies have been observed between Nf and fatigue performance as measured by the DCC. Lv et al. and Wang et al. have highlighted these inconsistencies, advocating for a new framework that incorporates SPC rather than Nf to provide a more reliable failure definition.

An ideal framework would address three main criteria: it would (1) ensure higher fatigue performance consistency in DCC analysis for bitumen with improved healing properties, (2) accurately define fatigue failure across varied bituminous materials, and (3) provide ranking consistency between failure definitions and fatigue performance. This comprehensive model would allow engineers to select the most suitable asphalt binder for specific applications with greater confidence in the material's durability and longevity.

Conclusion

The development of fatigue cracking in asphalt pavements poses a significant challenge to road infrastructure, driven by cyclic vehicular loads and environmental conditions. Self-healing properties in asphalt binders offer a promising solution, though their full potential remains underexplored. Existing frameworks, including the LAS and S-VECD models, provide essential insights into fatigue and self-healing performance but face limitations in delivering consistent evaluations across diverse asphalt formulations.

Recent research underscores the value of polymer modifications and additives in enhancing self-healing, though results remain mixed, and further studies are needed to establish a definitive correlation. The introduction of a new framework based on stored potential cohesion promises to address current inconsistencies, offering a more robust and consistent evaluation of fatigue performance across different asphalt binders.

In conclusion, advancing the methodologies and frameworks for evaluating fatigue and self-healing performance in asphalt pavements is crucial. A comprehensive framework incorporating these advancements would significantly enhance the selection process, guiding engineers toward optimal materials that balance durability, resilience, and self-healing potential, ultimately extending the service life of asphalt pavements.

Chemo-rheological deterioration of bitumen due to UV ageing: correlations between accelerated UV ageing tests and 1-year outdoor exposure

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ABSTRACT

Predicting the performance of asphalt roads after several years of service is complex due to multiple weather events that can contribute to road ageing. This study investigates the correlation between an accelerated ultraviolet (UV) ageing test and the ageing of polymer-modified binders after 1 year spent in outdoor conditions.

The impact of natural ageing on several bituminous binders was investigated by rheological and chemical analyses. Plastomer-modified (ethylene vinyl acetate) bitumen seemed to be the most affected by environmental ageing as evaluated through rheological and chemical testing.

Elastomer-modified (styrene butadiene styrene) bitumen appeared to be the most resistant to environmental ageing as expressed by non-load related cracking resistance and relaxation properties as well as low oxidation levels. The natural ageing test confirmed the results obtained via the accelerated UV ageing test considering the Glover-Rowe parameter (average R2 = 0.89). The 30- day accelerated UV test was estimated to fasten natural ageing of conventional and plastomer-modified bitumen by more than 10 times and up to 5 times for elastomer-modified bitumen compared to long-term outdoor exposure. If used with a suitable weather dataset, accelerated UV ageing is a promising method to predict the environmental-related ageing of conventional unmodified bitumen; however, adjustments are required for polymer-modified binders.

Keywords:

UV , Environmental ageing ,Bitumen ,Polymers ,Outdoor testing

1. Introduction

It is well known that the status of the road infrastructure deteriorates due to exposure to sunlight, rain, and temperature cycles, in addition to traffic loading [1]. The formation of cracks is one of the first visual markers revealing road surface ageing. Cracking can occur due to multiple causes, such as traffic load but also ultraviolet (UV) radiations and seasonal changes such as rain precipitation and temperature changes [2,3].

Heat and UV radiations are known to modify the bitumen's chemistry via thermo- and photo- oxidation processes which result in unbalanced colloidal systems (i.e. stiffer binders) that are more sensitive to external stresses and, therefore, less resistant to cracking [3–5].

Polymers of various nature are commonly used to improve the durability of bituminous binders, such as Ethylene Vinyl Acetate (EVA), Styrene Butadiene Styrene (SBS), and crumb rubber (CR), which derives

from waste tyres [6,7]. These polymers can swell in bitumen and form a 3D network that improves the rheological properties of the binders to a level that depends on the polymer being used and its content [8,9].

While the superior performance of polymer-modified binders against conventional binders is known [8], their resistance to cracking due to environmental effects – such as UV radiation – is not well understood. In fact, two main ageing tests are commonly conducted to assess bitumen ageing, however, none of them include natural weather events, such as UV radiations and rain precipitation.

Specifically, the rolling thin film oven (RTFO) test has been designed to reproduce the short-term thermal ageing of bitumen occurring during production of asphalt, while the pressure ageing vessel (PAV) is used to simulate the ageing occurring in
roads after 5–10 years of service [10].
Both tests are conducted at elevated temperatures and the PAV test is also conducted under pressure, which is not representative of the weather conditions asphalt pavements are exposed to during their service life.

Recent studies focusing on the role of UV on bitumen ageing revealed that binders can be severely damaged by UV radiations [11–14], however, no standard UV ageing test has been developed for bituminous materials yet, making the comparison of research studies on this topic complex.

The main reason for conducting accelerated ageing tests is to use a relatively short test for predicting the performance of the road in 2, 5 or even 10 years for a specific climate condition. However, the correlation between accelerated ageing and natural outdoor ageing is not straightforward, probably due to the variety of weather events that can happen in the field, such as varying sunlight, temperature changes, and rainfall.

Although recent weathering chambers can be equipped with moisture sprays and modulated light sources to reproduce precipitation and day/ night cycles [15], using such conditions would significantly increase the time needed to reproduce outdoor conditions. Acc lerated UV ageing tests are commonly performed without following day/night cycles.

This is done with the aim to shorten the time required to expose the samples to the same level of UV radiation that they would normally receive under natural conditions in months or years [12,16–18]. Calculations based on the solar exposure at a certain geographical location can be used to determine the duration of an accelerated ageing test in the laboratory [17]; however, the correlation between accelerated and outdoor testing is rarely assessed due to the time needed to expose samples to solar radiation in the field. A handful of studies conducted UV laboratory ageing and outdoor ageing tests on bitumen [13,19], and even fewer focused on polymer-modified bituminous binders although the presence of polymers is known to impact bitumen ageing [20].

The novelty of this study relies on the use of an accelerated UV ageing test to predict and correlate, for the first time, with the ageing of polymer-modified binders exposed to natural outdoor conditions for an entire year in Melbourne, Australia. Outdoor samples were collected and analysed on a monthly basis, also considering the impact of the different seasons. The impact of environmental ageing on the performance of five conventional and polymer-modified bituminous binders was assessed by rheological and chemical analyses and compared to the performance of the same binders after a 30-day long accelerated UV ageing test in the laboratory.

2. Materials and methods

2.1. Materials

The binders used in this study were sourced from Australian bitumen suppliers and used as received. The following bitumen was received: unmodified C170 (penetration grade 60–80), A10E (≈ 6 wt% SBS), A15E (≈ 5 wt% SBS), A35P (≈ 5 wt% EVA) and S45R (≈ 15

wt% CR) grade bitumen. For more precise information about these industrial bitumens, the reader is referred to the Australian national standard,
Austroads ATS3110.

2.2. Ageing procedure

2.2.1. Sample preparation

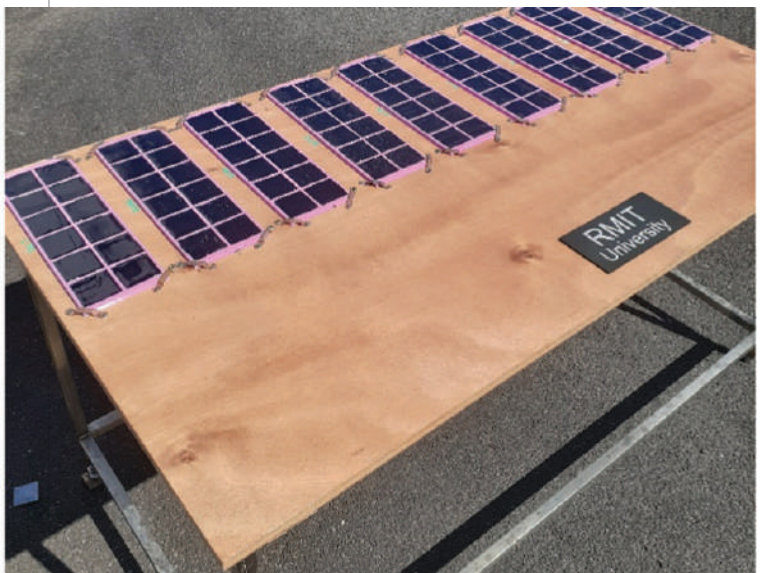
Each binder was heated for 2 h at 160 ◦C and poured into two moulds of twelve silicone shallow cavities each (1 ×50 x 50 mm) (Fig. 1). Each sample was trimmed off on the surface by using a spatula heated at 160◦C to remove any excess of bitumen. One mould was used for the outdoor ageing test and the other for the accelerated ageing test.

2.2.2. Outdoor ageing test

Each mould was placed on a table inclined at 3 % slope located outside in a shadow-free daylight area in Bundoora, VIC 3083, Australia. The inclination of the table ensures no water ponding was formed during raining events.

One sample of each binder was collected monthly for 1 year from September 2022 to September 2023 from the shallow cavities of the moulds. A Vantage Pro weather Station (Davis Instrument) equipped with a rain gauge as well as temperature, humidity, pressure, wind speed/direction, and UV/solar radiation sensors was used to monitor the weather throughout the year at a sampling interval of 30 minutes.

The weather station was located within 10 m away from the outdoor samples to accurately monitor the weather conditions at this location. The outdoor ageing test was used as a realistic baseline to confirm the results obtained via the accelerated ageing test on the same binders.



2.2.3. Accelerated ageing test in the laboratory

The properties of the naturally aged binders were compared to those of artificially aged binders that were exposed to Xenon light (765 W/m2 between 300 and 800 nm) for 30 days in a Suntest XLS+ Atlas weathering chamber equipped with a daylight filter. Due to the InfraRed (IR) wavelengths present in the xenon light irradiation, the temperature in the chamber reached 50◦C. No moisture or day/night cycle were used and the samples were continuously exposed to the Xenon light. Two samples of each binder were collected from the chamber after 10 days, 20 days and 30 days of exposure to Xenon lamp and were analysed by rheological and chemical tests.

The binders were prepared following the same proc dure as detailed in Section 2.2.1. More details of the accelerated ageing procedure and the impact of accelerated ageing on the binder properties can be found in a previous work conducted by the authors [14].

2.3. Binder characterisation

2.3.1. Rheological tests

The impact of natural ageing on the embrittlement, relaxation properties and non-load related environmental cracking of the binders were measured before and after ageing. A modular compact rheometer MCR 702e (Anton Paar, Austria) equipped with 8 mm and 25 mm parallel plates was used to perform all the tests following American Association of State Highway and Transportation Officials (AASHTO) T350 and T315.

The Glover-Rowe (GR) parameter of the binders before and after ageing was calculated after measuring the complex modulus G* and phase angle δ of the binder at 15◦C, 0.005 rad/s and 0.1 % strain (Eq. 1).

$$GR = \frac{G^* \cos(\delta)^2}{\sin(\delta)} \quad (1)$$

Frequency Sweep (FS) tests were conducted by measuring the complex shear modulus G* and phase angle δ, at 0.1 % strain varying the temperature (10–60◦C) and the frequency (0.1–15 Hz) according to AASTHO T315. Master curves were built for each bitumen sample by shifting the plots obtained at each temperatu-

re using the Williams- Landel-Ferry model [21]. The crossover frequency, ωc, and rheological value, R, of the sample were determined using the Christensen-Anderson-Marasteanu model considering the reduced frequency, ω, and the complex glass modulus, G*g (when δ = 0) [22] (Eqs. 2 and 3).

$$G^*(\omega)| = G_g^*\left[1+\left(\frac{\omega_c}{\omega}\right)^v\right]^{-\frac{w}{v}} \quad (2)$$

$$R = \frac{\log(2)}{v} \quad (3)$$

Where v and w are fitting parameters. The crossover frequency value was obtained when the rheological behaviour of the sample transitioned from the elastic to the viscous domain (G'=G").

2.3.2. FTIR

The oxidation of the binders due to natural ageing was assessed by Fourier Transformed InfraRed spectroscopy. A Frontier FTIR instrument (Bruker) equipped with an ATR accessory and a diamond crystal was used to analyse each binder from 400 to 4000 cm^{-1} using an accumulation of 16 scans at a resolution of 4 cm^{-1}.

A total of 5 scans was conducted on 5 different locations diagonally across of the sample and the average of the 5 scans was used to assess the level of oxidation of the sample. Only the surface of the bitumen samples was tested since, in real life, aggregates in asphalt roads are only covered by a very thin layer of bitumen (a few microns) and exposed to sunlight. This thin layer can be analysed by FTIR since the penetration depth of the FTIR beam is also of a few microns. Investigating the diffusion of the oxidation surface layer of bitumen across its entire thickness through more advanced techniques would provide additional insights about bitumen oxidation, however, this was out of the scope of this study.

The level of oxidation of the surface of the binders was quantified by calculating the carbonyl index of each binder, IC– –O, using the area below the characteristic vibration bands of carbonyl group, around 1700 cm^{-1} (Eq. 4).

$$I_{C=O} = \frac{A_{C=O}}{A_{ref}} \quad (4)$$

Where AC=O is the area below the carbonyl (1700 cm^{-1}) band and Aref refers to the area below the aliphatic vibration bands around 2920 and 2840 cm^{-1} which was used to consider any variation in absorbance between samples.

2.4. Statistical correlation between natural and outdoor ageing

The correlation between natural and accelerated ageing was assessed by comparing the properties of the binders after receiving the same UV radiation exposure (280 – 400 nm). The weathering chamber used for accelerated ageing was equipped with an irradiance sensor in the 300 – 800 nm range, whereas the solar sensor used to monitor the radiations received by the outdoor samples measured radiations in the 290 – 1100 nm range. Therefore, it was necessary to convert the irradiance measured in those ranges into a UV radiation range to compare the total UV radiation exposure of the samples after accelerated and natural ageing. The standard solar spectral distribution provided by ASTM G177 – 03 (2020) and ASTM G173 – 23 was used to calculate the radiations emitted by each wavelength range in the solar spectrum (Fig. 2, Table 1).

For instance, setting up the irradiance of the Xenon lamp used for accelerated ageing to 765 W/m2 in the 300–800 nm range exposed the samples to an irradiance of 79.7 W/m2 in the 280 – 400 nm range.

The rheological and chemical properties of the samples after receiving the same UV radiant exposure during natural and accelerated ageing were then plotted into a natural vs accelerated plane and a linear regression analysis was used to assess the accuracy of accelerated ageing in predicting natural ageing. The data obtained during the accelerated ageing test was extrapolated between the 4 available data points (0, 10, 20 and 30 days) to read the value corresponding to the same UV radiant exposure as received after each month of outdoor ageing test.

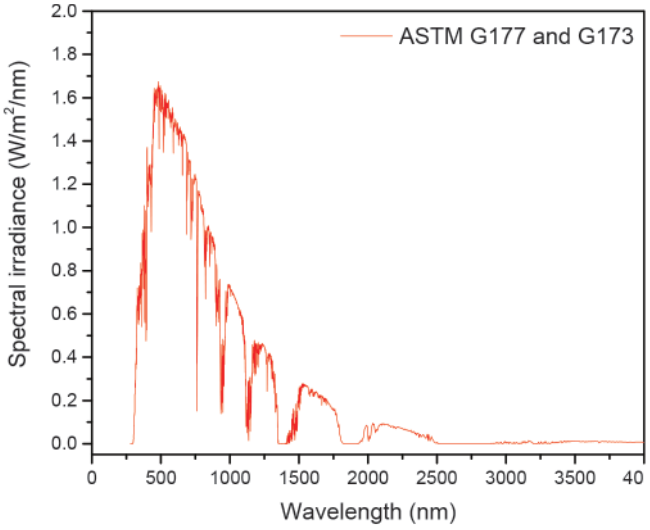


Fig. 2. Solar spectral irradiance based on ASTM G177 and G173.

Table 1
Irradiance of specific wavelength ranges in the solar spectrum.

	280 – 400 nm	300 – 800 nm	290 – 1100 nm	280 – 4000 nm
Irradiance (W/m²)	63.8	612.5	825.5	1019.0

2.5. Statistics

The ageing test was reproduced twice, and three replicate runs were completed for each rheological test. All the results are reported as mean +/- standard deviation.

3. Results and discussion

3.1. Physical aspect

The exposure of the binders to outdoor conditions for 12 months significantly impacted the physical aspect of the samples (Fig. 3). Within 3 and 6 months of exposure (spring and summer seasons in Melbourne, Australia) all the binders turned from a shiny to a matte surface. Wrinkles and corrugation appeared on all binders but were more pronounced on A35P (i.e. EVA-modified), which seemed to have shrunk, and pinholes were visible on A10E and A15E (i.e. SBS modified). C170 unmodified binder became brittle and cracked when removed from the mould contrary to the other binders which did not break. Such physical changes were due to the high level of UV radiations received by the samples during spring and summer (Fig. 4). After 9 and 12 months outdoor (autumn and winter seasons in Melbourne, Australia), C170 became so brittle that it shattered into multiple pieces, whereas blisters appeared on A10E and more pinholes were visible in A15E, A35P and S45R (i.e. rubber modified). The rainfall events that occurred in autumn could have also contributed to these changes (Fig. 4). The formation of pinholes and cracks in the binders due to accelerated UV ageing has been reported in a previous work [14], which confirms that UV radiations can lead to severe physical changes in bituminous binders.

However,comparing natural to accelerated ageing and understanding the differences observed between the PMBs requires a more thorough analysis; therefore, rheological and chemical tests were conducted to further assess the impact of natural ageing on C170, A10E, A15E, A35P, and S45R.

3.2. Impact of outdoor conditions on the performance of bitumen

Ageing can significantly impact the formation and propagation of cracks on asphalt roads, such as those due to cyclic thermal stresses which can cause block cracking [21]. This phenomenon which is not associated to load is referred to as non-load related (environmental) cracking and can be assessed by the Glover-Rowe (GR) parameter.

An increasing GR value shows that a binder is becoming more prone to cracking and that the formation and propagation of cracks in the material can lead to block cracking. Plotting the results of the GR test into a black diagram provides a good visualization of the impact of natural ageing on the cracking resistance of the binders (Fig. 5a). A35P seems more prone to cracking than the other binders, however, the difference between C170, S45R, A10E, and A15E is not obvious. A thorough analysis of the data revealed that the GR value of all binders increased throughout the year and reached a maximum in summer or autumn depending on the binder before decreasing during winter (Fig. 5b).

A35P appeared to be the most prone to cracking with a maximum GR value of 1000 kPa; this value was achieved after only 6 months of natural ageing, followed by C170 (448 kPa, after 9 months), A15E (317 kPa, after 8 months), S45R (203 kPa, after 11 months), and A10E (148 kPa, after 8 months). The reduction

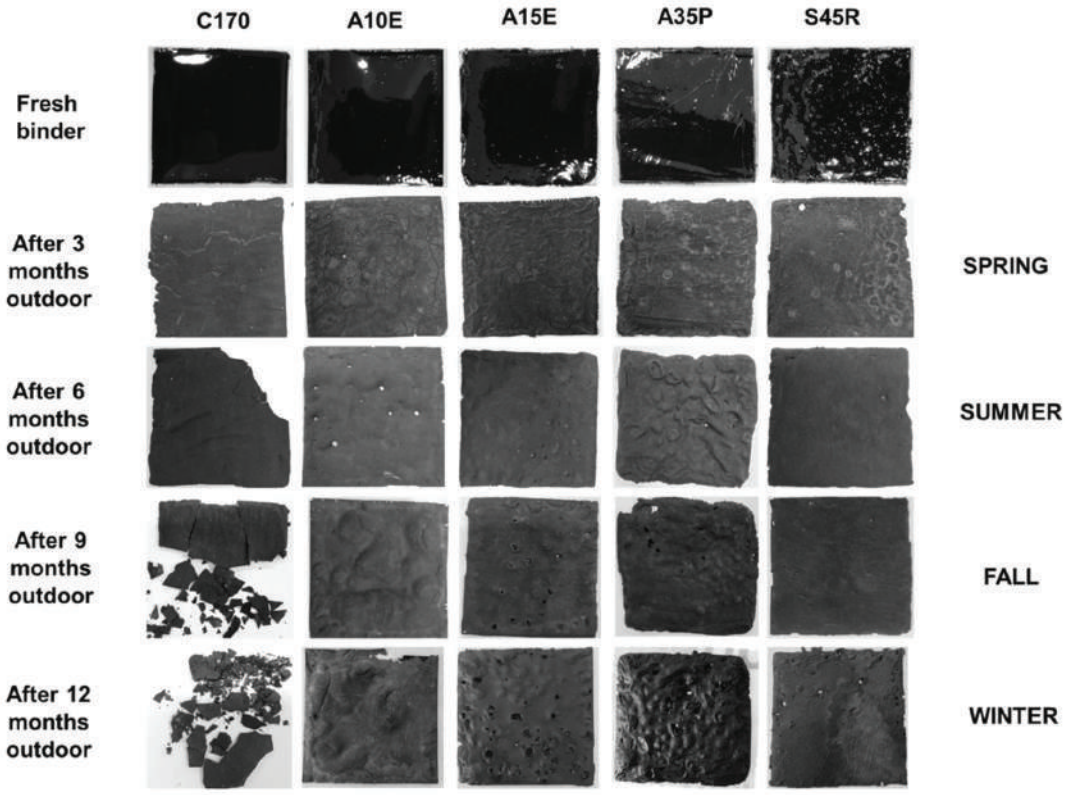


Fig. 3. Physical aspect of the binders before and after 3, 6, 9, and 12 months of exposure to outdoor conditions.

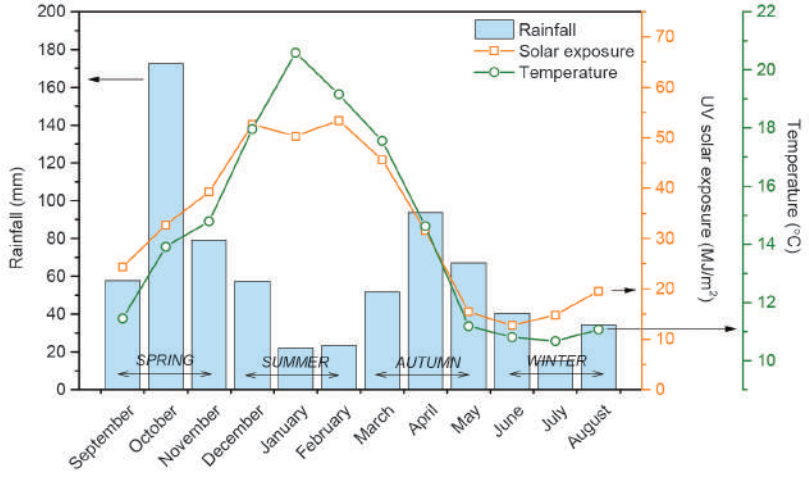


Fig. 4. Weather data collected monthly from September 2022 to August 2023.

in UV radiation during winter could be responsible for the apparent recovery observed for C170, A15E, and A10E. No clear recovery was observed for A35P while the GR value of S45R plateaued (Fig. 5b).

The presence of polymer in bitumen provides the binder with a more elastic behaviour, thus the GR value of the PMBs is naturally higher than conventional C170. For this reason, it is useful to also assess the relative increase in GR value during the 1-year period spent outdoor. As a comparison, C170 appeared to be the most impacted by natural ageing with a 211-fold increase, whereas S45R with crumb rubber increased by 30 times. Overall, the pr sence of elastomers in A10E, A15E, and S45R seemed to slow down bitumen ageing and its susceptibility to environmental cracking, which is consistent with a previous work conducted on the accelerated ageing of the same binders [14].

The apparent superior performance of elastomer-based binders can be explained by investigating the impact of ageing on the relaxation properties and stiffness of the binders and comparing their rheological value R and crossover frequency ωc [22]. Ageing impacted the relaxation properties of the binders following a seasonal trend whereby the R value of the binders increased during spring and/or summer before being reduced in autumn and/or winter (Fig. 6a). The maximum R value of A35P (R = 2.99) was reached after 5 months outdoor (mid-summer), whereas the maximum R value of the other binders was reached in 6 months (end of summer) for A15E (R = 2.02), 7 months (beginning of autumn) for C170 (R = 1.89), and 8 months (mid-autumn) for both S45R (R = 1.74) and A10E (R=1.9). In terms of stiffness, the crossover frequency ωc of all binders was significantly reduced during ageing, showing an increase of stiffness of the binders that occurred as soon as

the ageing test started. Specifically, after only 1 month outdoor (spring season), ωc dropped by 99 % for A35P, 92 % for C170, 87 % for A15E, 47 % for S45R and 40 % for A10E (Fig. 6b and c).

The presence of elastomers in A10E, A15E and S45R provided the binders with better relaxation properties than C170 and A35P, hence naturally providing a better resistance to cracking to the binders during their exposure to outdoor conditions.

Microcracks can be easily formed and propagate in a stiffer binder with longer relaxation time, resulting in the embrittlement of the binder over time, which can explain why A35P was less resistant to environmental cracking (Fig. 5b) than the other binders. On the contrary, A10E and S45R appear to be the most resistant to cracking due to their superior relaxation properties and lower tendency to stiffen during ageing, followed by A15E and C170. These results can explain the trend observed when conducting the GR test (Fig. 5b) whereby the elastomers present in A10E, A15E and S45R provided superior ageing resistance to a conventional binder while plastomers (A35P) worsened the ageing resistance of bitumen.

The rheological changes occurring in bitumen due to ageing are known to be related to the oxidation of bitumen and subsequent formation of new functional groups, such as carbonyls (C−−O), which enhance the intermolecular interactions in bitumen therefore resulting in stiffer binders [4,23]. The level of oxidation of a binder can be quantified by calculating the carbonyl index based on the FTIR spectrum of this binder [24].

During the early stages of natural ageing (spring season), the carbonyl index of all binders increased, with C170 and A35P showing the highest indices (Fig. 7). Different trends are then observed during summer since the carbonyl index of C170 and S45R increased from 0.46 to 1.69 (C170) and from 0.16 to 1.43 (S45R), whereas the indices of the other binders reached a maximum value of 0.89 for A35P, 0.67 for A15E and 0.52 for A10E, all below those of C170 and S45R.

Although C170 and S45R appeared to be more prone to oxidation than the other binders during summer, such a difference was no longer observed during autumn and winter since the carbonyl indices of all binders reduced during these periods.

The oxidised surface layer of bitumen can diffuse through the thickness of the material over time [18], hence reducing or slowing down the apparent oxidation measured on the surface of the binders in autumn and winter due to reduced UV solar radiations (Fig. 4). Overall, the significant surface oxidation of the binders during the spring and summer seasons can explain the reduced cracking resistance of the binders during this period, as observed in Figs. 5 and 6.

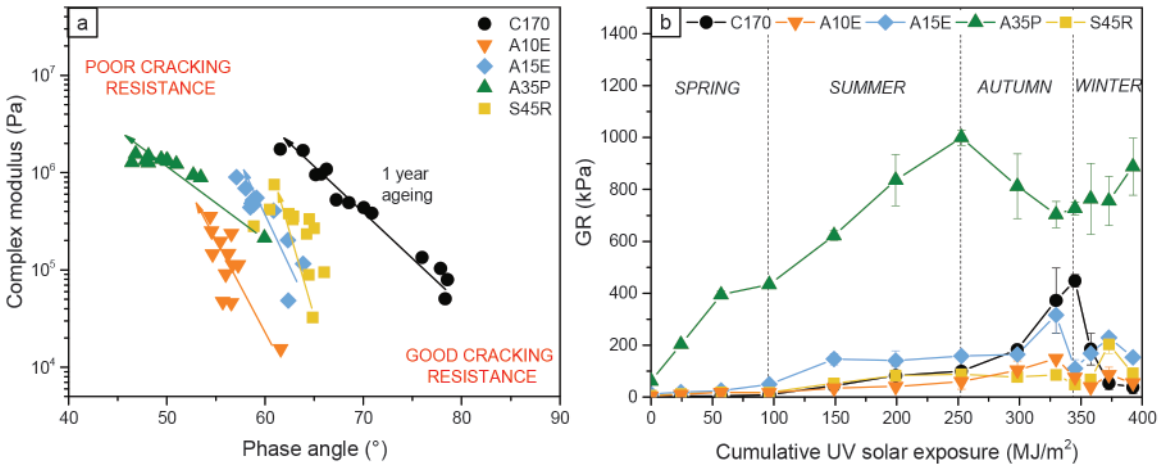


Fig. 5. a) Black diagram and b) GR values of C170, A10E, A15E, A35P, and S45R when exposed to outdoor conditions for 1 year. GR values were obtained at 15 °C, 0.005 rad/s frequency and 0.1 % strain.

A similar trend was observed during the accelerated ageing of polymer-modified binders for 30 days [14]. C170 was the most susceptible to oxidation followed by S45R and A35P, for which no significant difference was observed, then A15E and A10E. The SBS elastomers present in A15E and A10E seemed to provide a superior resistance against oxidation to the binder. This can be due to the 3D network formed by SBS polymer chains in bitumen, which,despite being damaged by UV radiations, can still retain their network shape. Hence, providing A15E and A10E with a superior cracking resistance compared to C170, A35P, and S45R [14].

Assessing the rheological and chemical properties of the binders throughout 1 year in outdoor conditions revealed that the performance of the binder varies seasonally and is not linear, as highlighted by another study on the field ageing of asphalt [25].

3.3. Statistical correlation between accelerated and natural ageing

The impact of UV radiations on bitumen ageing is known to be severe [12,13,18]; however, this study shows that the physical and chemical changes occurring in bituminous binders throughout their service life may not be linear due to climate seasonality, including varying UV radiations, day/night cycles, and occurrence of rainfall events.

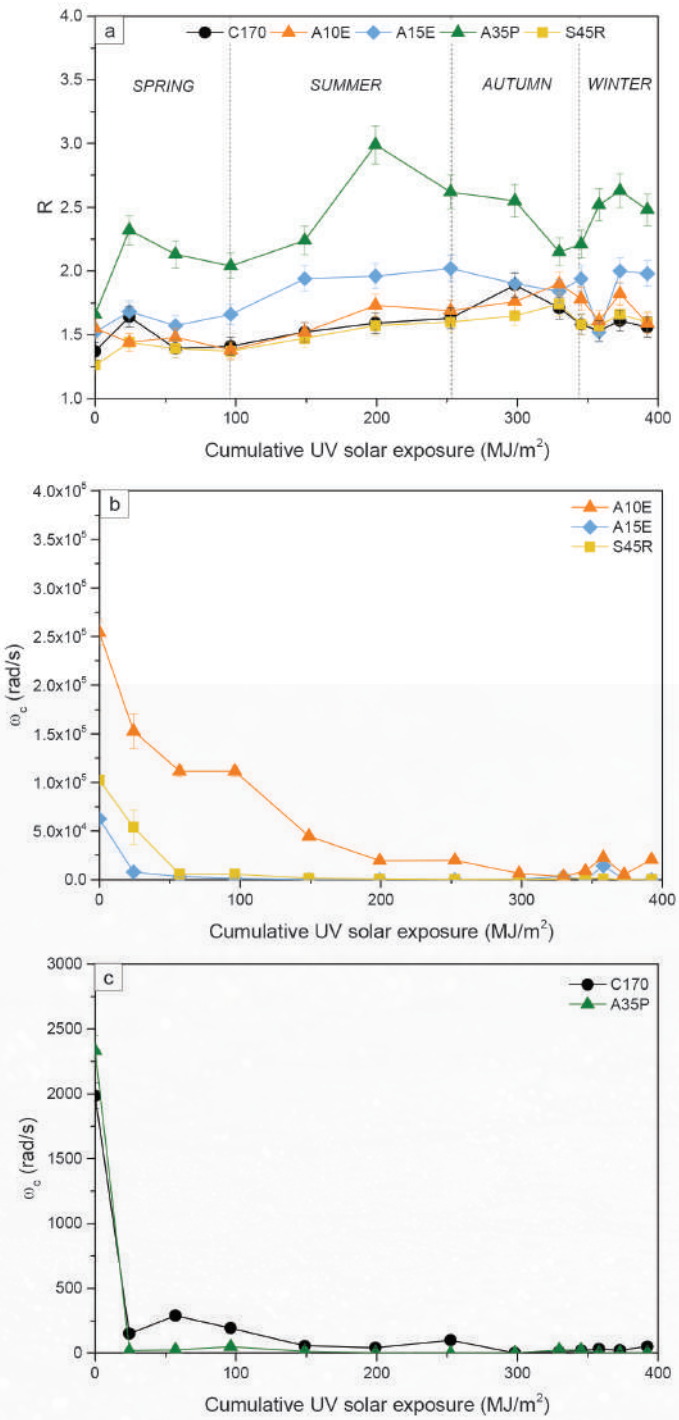


Fig. 6. a) Rheological value of all binders, b) crossover frequency of A10E, A15E, S45R and c) crossover frequency of A35P and C170.

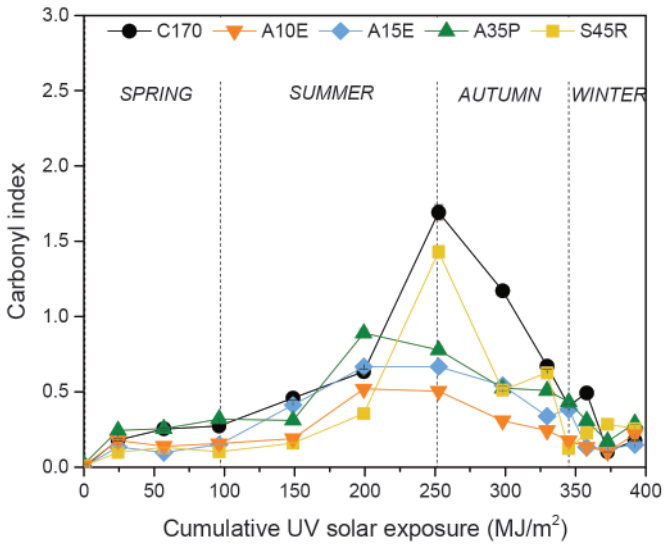


Fig. 7. Carbonyl index of C170, A10E, A15E, A35P, and S45R when exposed to outdoor conditions for 1 year.

Hence, astatistical analysis was conducted to compare how a 30-day long accelerated UV ageing test can be statistically correlated to a 1-year long outdoor ageing using the same batches of C170, A10E, A15E, A35P, and S45R binders. The GR parameter, rheological value, crossover frequency and carbonyl index of the binders were compared after receiving the same UV radiation exposure via a 30-day accelerated laboratory ageing
test and 1 year of outdoor ageing test and plotted into a predicted vs measured graph.

The R-squared value and slope of the linear fitting curve were used to assess the accuracy of the accelerated ageing test to predict the outdoor (natural) ageing of the binders (Figs. 8 -12 and Tables 2 and 3).

The best correlation between accelerated and outdoor ageing was obtained for GR values, with R2 values ranging between 0.78 and 0.96 for all binders, which is consistent with a previous study who also found the best accelerated/outdoor ageing correlation with the GR parameter [26]. R2 values of 1 were obtained for the ωc values of A15E, A35P, and S45R, however, this is likely due to the high initial value of ωc, which reduced the variation of the other ωc values in the fitting curve.

A poor correlation was obtained for both the R-value and carbonyl index with R2 values as low as 0.04 for A10E. Due to the low penetration of UV radiations in bitumen, oxidation occurs via a surface reaction between the top layer of bitumen and the surrounding oxygen to form oxidised molecules, which then diffuse through the various sublayers of bitumen [18].

Since no day/night cycles were used during the accelerated laboratory ageing test, the rate of formation of oxidised molecules and their diffusion through the binders was assumed to follow a different mechanism compared to the outdoor ageing, which could explain the lack of correlation between the predicted and measured carbonyl index values.

The same rationale can be applied to the R-value. Day/night cycles in the outdoor ageing allowed the binders to partially recover thanks to the known self-healing capability of bitumen [27,28], whereas the continuous exposure to UV radiations for 30 consecutive days with no interruption prevented the binders from recovering during the accelerated laboratory ageing test. Due to this recovery time, the relaxation properties of the binders in the outdoor worsened and improved in a cyclic manner with time, whereas the relaxation properties of the binders exposed to continuous UV radiations constantly reduced over time.

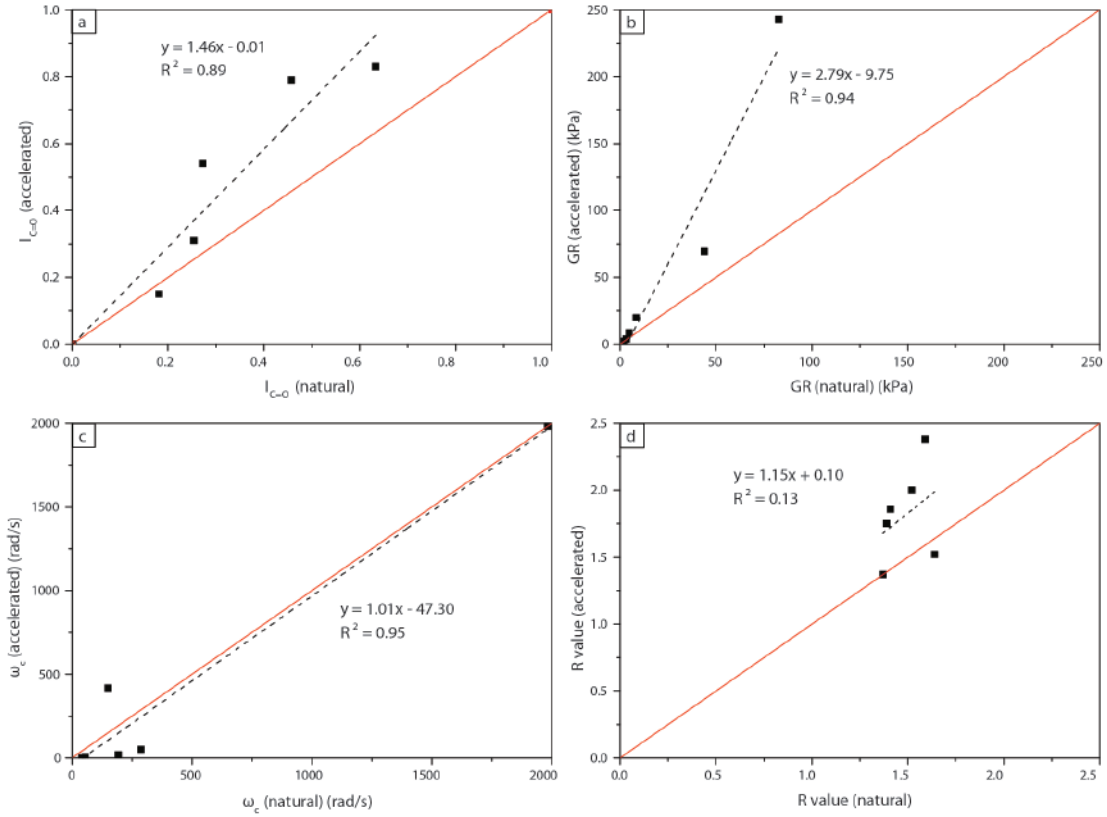


Fig. 8. Accelerated vs outdoor (natural) ageing values of a) carbonyl index, b) GR parameter, c) crossover frequency, and d) rheological value of conventional C170 binder.

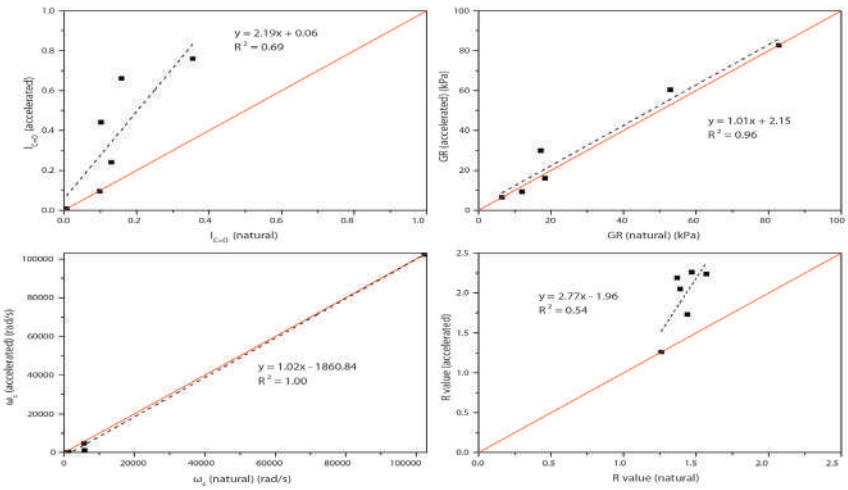


Fig. 9. Accelerated vs outdoor (natural) ageing values of carbonyl index, GR parameter, crossover frequency, and rheological value of S45R binder.

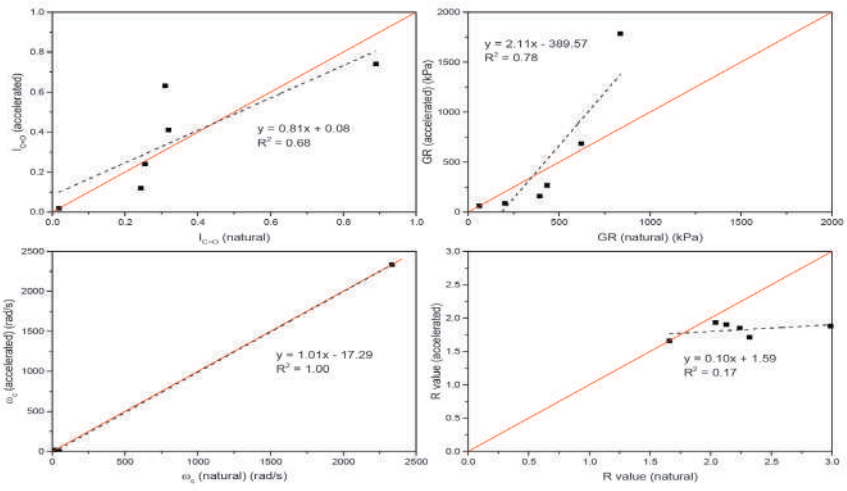


Fig. 10. Accelerated vs outdoor (natural) ageing values of carbonyl index, GR parameter, crossover frequency, and rheological value of A35P binder.

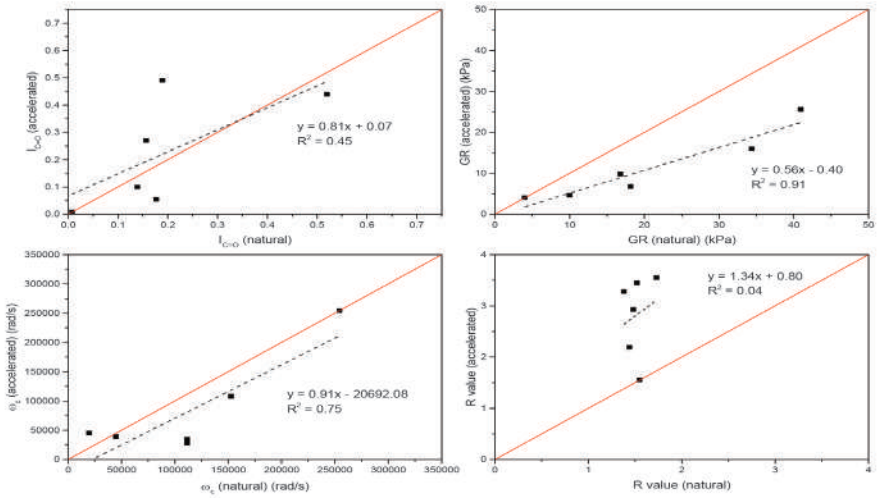


Fig. 11. Accelerated vs outdoor (natural) ageing values of carbonyl index, GR parameter, crossover frequency, and rheological value of A10E binder.

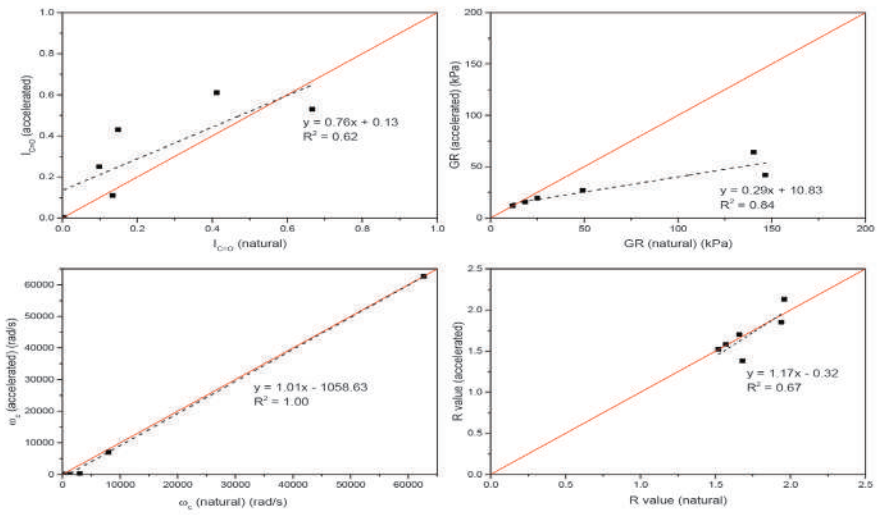


Fig. 12. Accelerated vs outdoor (natural) ageing values of carbonyl index, GR parameter, crossover frequency, and rheological value of A15E binder.

Table 2
R^2 values of the linear fitting between outdoor and laboratory accelerated experiments.

	C170	A10E	A15E	A35P	S45R
GR	0.94	0.91	0.84	0.78	0.96
R	0.13	0.04	0.67	0.17	0.54
ω_c	0.95	0.75	1.00	1.00	1.00
$I_{C=O}$	0.89	0.45	0.62	0.68	0.69

Table 3
Slope of the linear fitting between outdoor and laboratory accelerated experiments.

	C170	A10E	A15E	A35P	S45R
GR	2.79	0.56	0.29	2.11	1.01
R	1.15	1.34	1.17	0.10	2.77
ω_c	1.01	0.91	1.01	1.01	1.02
$I_{C=O}$	1.46	0.81	0.76	0.81	2.19

The GR values predicted via laboratory accelerated ageing test appeared to be well correlated to the GR values obtained via outdoor ageing. The values obtained for S45R (outdoor) were perfectly corre lated with the laboratory accelerated test (slope of 1.01); they were underestimated for A10E (slope of 0.56) and A15E (slope of 0.29) and were overestimated for C170 (slope of 2.79) and A35P (slope of 2.11). These varying slope values could be due to the sensitivity of the binders to day/night and temperature cycles in addition to UV radiations, which slowed down/fastened the susceptibility of the binders to non-load related cracking. A10E and A15E both contain SBS polymers and the accelerated ageing in the laboratory underestimated the cracking resistance of A10E and A15E compared to outdoor ageing, showing that cyclic temperatures may have contributed more to the cracking tance properties of these binders than UV radiations. SBS polymers are known to provide superior UV and temperature resistance to bitumen thanks to the 3D network formed in bitumen [29–31]. However, the outside temperature varied from -0.2 to +39.5 ◦C during the outdoor ageing test (Fig. 4), whereas the temperature in the UV chamber was kept constant at 50 ◦C, which could have prevented the non-load cracking resistance of the binders (due to fluctuating weather conditions) from decreasing as fast as during the outdoor ageing for the same UV exposure.

On the contrary, C170 and A35P were much more tive to UV radiations than A10E and A15E. By running the accelerated test at 50 ◦C, the effect of UV damage could have been enhanced by increasing the mobility of the bitumen/polymer chains, thus resulting in a faster reduction of the cracking resistance of the binders compared

to outdoor ageing. For S45R binder, only the UV radiation seemed to produce an impact on the cracking resistance of the binder, hence a similar performance was recorded through both ageing tests.

The 30 days of exposure in the weathering chamber exposed the binders to 207 MJ/m2 of UV radiations, which was naturally emitted by the sun during the first 5 months (spring and most of the summer) ac cording to the weather station data for the outdoor conditions. Hence, considering the value of the slope of the predicted vs measured plot for the GR parameter, the laboratory accelerated test reproduced the ageing of C170 14 times faster than what happened in the outdoor conditions, 11 times faster for A35P, 5 times faster for S45R, 3 times faster for A10E and 1.5 times faster for A15E. It is clear that understanding the role of polymers in bitumen ageing is crucial to successfully predict the bility of a polymer modified binder in the field since different polymers do not have the same sensitivity to UV, temperature, radiation cycles and temperature cycles. Using a relevant weather dataset is also crucial since the solar exposure can vary even within the same geographic area.

For instance, according to the Australian Radiation Protection and clear Safety Agency (ARPANSA), the total solar exposure in Melbourne reached 332 MJ/m2 in 2019 and 274 MJ/m2 in 2021, with an historical mean of 348 MJ/m2. The weather station data used in this study measured a total solar exposure of 394 MJ/m2 at the exact location of the outdoor ageing test, showing that an accurate correlation between accelerated and outdoor ageing tests relies on the use of a relevant weather dataset that is specific to the geographic location where the test is being conducted.

4.Conclusion

This study investigated the impact of natural outdoor ageing on the performance of five different conventional and polymer modified binders after 1 year of exposure in the field. The results were compared and correlated with the laboratory accelerated ageing of the same series of binders. The exposure to UV radiations led to an overall decreased in cracking resistance for all binders. A35P was the least resistant to UV ageing followed by C170, S45R, A15E, and A10E, respectively. The presence of plastomers (EVA) in A35P is sought to have fastened the ageing phenomena in the bitumen due to UV, whereas elastomers (SBS and rubber) like those present in A10E, A15E and S45R slowed down ageing. The same trend was obtained when the binders were continu ously exposed to UV radiation in the laboratory for 30 consecutive days. A statistical analysis revealed that not all the rheological parameters commonly used to assess the performance of bitumen could be used to predict the outdoor ageing of the binders.

The rheological value and carbonyl indexes obtained after laboratory accelerated ageing did not follow the same trend as those obtained via outdoor ageing, probably due to the impact of day/night cycles (i.e. periods of rest from UV diation) on the oxidation and relaxation properties of the binders. The GR parameter values predicted by accelerated ageing, however, lowed a similar trend to that of the outdoor ageing. Due to the varying sensitivity of the binders and polymers to UV radiations, accelerated ageing was found to successfully predict the GR values of C170 and A35P more than 10 times faster than outdoor (natural) ageing, but only 5, 3, and 1.5 times faster for S45R, A10E and A15E, respectively.

Therefore, predicting the service life of roads can be achieved by using a laboratory accelerated ageing test provided that a robust weather dataset is available and that the sensitivity of the binder to UV radiations is known. CRediT authorship contribution statement marie enfrin: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptu alization. Filippo Giustozzi: Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization. Declaration of Competing Interest The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1]R. Tauste, et al., Understanding the bitumen...
[2]G. Cuciniello, et al., Effects of ageing on the...
[3]R. Jing, et al., Ageing effect... AND ...

Algerian Bitumen Importers Prepare to Revive Trade with Spain

After more than two years, Algerian bitumen importers are gearing up to restart shipments from Spain, following a recent green light from the Algerian government to resume trade relations.

The suspension of trade stemmed from a diplomatic fallout in June 2022, when Algeria halted a friendship and cooperation agreement with Spain. The dispute arose after Spain publicly backed Morocco's autonomy proposal for Western Sahara, resulting in the immediate termination of planned bitumen shipments between the two nations.

On November 6, Algeria's central bank issued a directive permitting local companies to engage in transactions with Spanish counterparts under standard trade guidelines. This has allowed both public and private bitumen importers in Algeria to reopen discussions on sourcing Spanish bitumen cargoes for distribution within the domestic market.

Although no agreements have been finalized yet, private Algerian importers operating at ports such as Ghazaouet, Oran, and Arzew stand to benefit due to their proximity to Spanish export hubs in Tarragona, Huelva, and Cadiz. These locations offer logistical advantages over existing suppliers in Italy, Greece, and Turkey. For example, shipping costs for a 5,000-tonne bitumen tanker from Tarragona to Ghazaouet hover around $35 per tonne, significantly lower than the $50 per tonne required for transport from Augusta, Italy.

Industry stakeholders, including Spanish and international suppliers, remain cautious as they seek further assurance from relevant authorities before proceeding with cargo negotiations. Some anticipate that shipments between Spain and Algeria might not fully resume until early 2025, especially as winter conditions slow road construction and other bitumen-intensive activities in Algeria.

State-owned energy company Sonatrach, which manages imports for numerous Mediterranean terminals in Algeria, is less likely to prioritize Spanish bitumen. Since 2020, Sonatrach has relied heavily on shipments from its Augusta refinery in Sicily, acquired from ExxonMobil in 2018. Occasional cargoes from Greece's Motor Oil Hellas refinery at Corinth also supplement its supply.

Market dynamics further support the possibility of renewed imports from Spain. Falling Mediterranean high-sulphur fuel oil (HSFO) prices and weakening seasonal bitumen price differentials have made Spanish cargoes increasingly attractive. Premiums for Spanish bitumen over Mediterranean HSFO have dropped significantly, from $10 per tonne in mid-October to $2-3 per tonne in early November. Meanwhile, Spanish bitumen export prices have declined from $498-499 per tonne to $458 per tonne during the same timeframe.

As economic and logistical conditions align, Algerian importers appear well-positioned to reestablish trade ties with Spanish suppliers, potentially revitalizing the flow of bitumen between the two countries.

US Oil Industry Urges Trump to Revoke Biden's Climate Policies

The US oil and gas industry has called on President-elect Trump to repeal many of Joe Biden's climate policies, arguing that these measures threaten jobs, consumer choice, and energy security.

The American Petroleum Institute (API), the largest trade association for the US oil and gas industry, urged the incoming Trump administration to roll back vehicle emissions standards designed to push the auto industry toward producing more electric vehicles. The API also requested the resumption of permits for liquefied natural gas (LNG) export facilities and cooperation with Congress to eliminate methane emission fees associated with drilling operations.

These requests were outlined in a policy document released to the media.

During his campaign, Trump pledged to reverse dozens of environmental laws and policies that he claimed hinder oil and gas drilling. Despite stricter regulations under Biden aimed at transitioning the US economy toward clean energy sources, the country's energy sector produced more oil and gas than at any point in history.

The API also seeks to overturn California's greenhouse gas emissions rules, which are stricter than federal standards. It supports LNG exports, increased oil and gas drilling auctions in the Gulf of Mexico, and the repeal of regulations limiting oil and gas development on federal lands.

The group has called on Trump to amend the Clean Water Act and the National Environmental Policy Act to simplify the permitting process for drilling and implement tax incentives for infrastructure and overseas investments.

The API unveiled its policy priorities just hours after Darren Woods, CEO of ExxonMobil, stated at the COP29 UN Climate Summit that the US should remain in the Paris Agreement, contrary to Trump's promise to withdraw. ExxonMobil had previously advocated for staying in the agreement before Trump withdrew the US from it in 2017.

What signals did Trump's victory send to the energy industry?

Donald Trump's re-election as US president has sparked a surge in petroleum and gas stocks while renewable energy shares experienced declines.

On the day following Trump's election victory, the energy sector saw significant gains, with the SPDR Energy Select Sector Fund (representing energy stocks in the S&P 500 index) rising by approximately 4%. This reflected market optimism for fossil fuel investments under Trump's administration, known for its pro-petroleum and gas policies. In contrast, renewable energy companies faced setbacks, with shares of US solar giant First Solar plunging more than 10%.

Market reactions and policy expectations

These market reactions indicate that Trump's second term is expected to prioritize traditional energy sectors, likely limiting support for renewables while advancing petroleum and gas development.

Trump's vision for US petroleum and gas

In his victory speech, Trump emphasized plans to further expand US petroleum and natural gas production, which had already reached record levels. He underscored that the US holds more "liquid gold" than countries like Saudi Arabia and Russia. His re-election places him in a position to make significant energy policy changes aimed at bolstering fossil fuel production.

Pressure on states and the private sector

Trump has criticized green technologies, such

as wind turbines and electric vehicles, pledging to eliminate unused climate budgets. However, private businesses are expected to continue investing in clean energy technologies. Many states are also likely to maintain their clean energy initiatives regardless of federal policy changes. Over the past decade, even during Trump's first term, the renewable energy sector experienced significant growth due to private investments, though federal spending might now face cuts.

Proposed reductions in climate and environmental programs

Key figures in Trump's circle advocate dismantling federal climate initiatives, including repealing tax incentives under Biden's Inflation Reduction Act. Some have proposed eliminating the Department of Energy's Loan Programs Office and sections of the Environmental Protection Agency focused on climate-related activities.

Impact on clean energy credits and loans

The Trump administration may attempt to limit clean energy tax credits and scale back support for projects like green hydrogen production. Additionally, Trump could target the Department of Energy's Green Technology Loan Program, which currently provides substantial funding for new technologies. Some stakeholders support redirecting this funding to fossil fuel investments.

Key energy sector implications

- Electric vehicles (EVs): Trump plans to reduce federal support for EVs and may target EPA greenhouse gas regulations that encourage their adoption. Refinery advocates are lobbying for changes to EV tax credit conditions.
- Petroleum and gas production: Trump has pledged to expand drilling on federal lands and reopen offshore petroleum and gas leasing. This could help develop new oil fields and lower energy costs.
- Liquefied natural gas (LNG) exports: Trump has committed to resuming approvals for new LNG export permits, benefiting natural gas companies and midstream industries.
- Offshore wind energy: Trump, a critic of offshore wind, may halt licensing processes, impacting projects along the US East Coast.

Broader implications for US energy policy

According to Oil Price, Trump's victory signals a return to prioritizing fossil fuels while challenging climate programs, potentially reshaping US energy policy. While federal approaches may shift, state-level and private-sector efforts to invest in renewable energy are expected to persist, reflecting the ongoing tension between environmental goals and economic interests.

Russia in talks to merge its largest petroleum companies

An American newspaper has claimed that Russian government officials and business executives have been negotiating the merger of the country's largest petroleum companies to create a single producer.

citing a report from The Wall Street Journal, under a potential plan, the state-owned company Rosneft would take control of Gazprom Neft and Lukoil. These negotiations have reportedly been ongoing for several months, but there is no guarantee of a final agreement, and the plans could still undergo changes.

A spokesperson for Rosneft told The Wall Street Journal that, to their knowledge, the report is inaccurate and suggested that the article might be aimed at fostering a competitive market to benefit other market players.

Similarly, a Lukoil spokesperson stated that neither the company nor its shareholders have participated in any merger discussions. Gazprom Neft and Gazprom declined to comment on the matter.
The Kremlin's spokesperson also told The Wall Street Journal that they had no knowledge of the reported negotiations.

According to Bloomberg, if such a deal were to materialize, Rosneft would become the world's second-largest petroelum producer, after Saudi Aramco.

Turkey sets record in petroleum and gas production

Turkey achieved record-breaking daily and monthly petroleum and natural gas production in October.

The Turkish Ministry of Energy and Natural Resources announced that daily petroleum and natural gas production in October reached 111,280 barrels and 7.9 million cubic meters, respectively—the highest daily production levels in the country's history.

Petroleum production from the Gabar region reached 1.6 million barrels, accounting for 46.6% of Turkey's total petroleum output last month.

Natural gas production at the Sakarya field amounted to 196.7 million cubic meters, contributing 84% of Turkey's total natural gas production.

In discussing the latest figures, Turkey's Energy Minister Alparslan Bayraktar stated that the country is focusing on increasing petroleum and gas production in 2024. "we will further increase our production with new drilling and hopefully new discoveries," Bayraktar said. He added that regarding the exploration vessel Oruç Reis, we aim to discover new reserves and conduct new explorations across various continents, and our goal is Turkey's complete energy self-sufficiency.

The exploration vessel Oruç Reis arrived in Somalia last month to conduct seismic studies for petroleum and natural gas. Earlier this year, Turkey and Somalia signed a defense and economic cooperation agreement during the Somali Defense Minister's visit to Ankara. In recent years, Turkey has become a close ally of Somalia, building schools, hospitals, and infrastructure while also providing scholarships for Somali citizens to study in Turkey.

According to the Hürriyet Daily, during a ceremony welcoming the vessel to Mogadishu Port, Bayraktar announced that the Turkish Petroleum Corporation and Somalia's National Petroleum Agency had signed a new agreement for hydrocarbon exploration in Somalia.

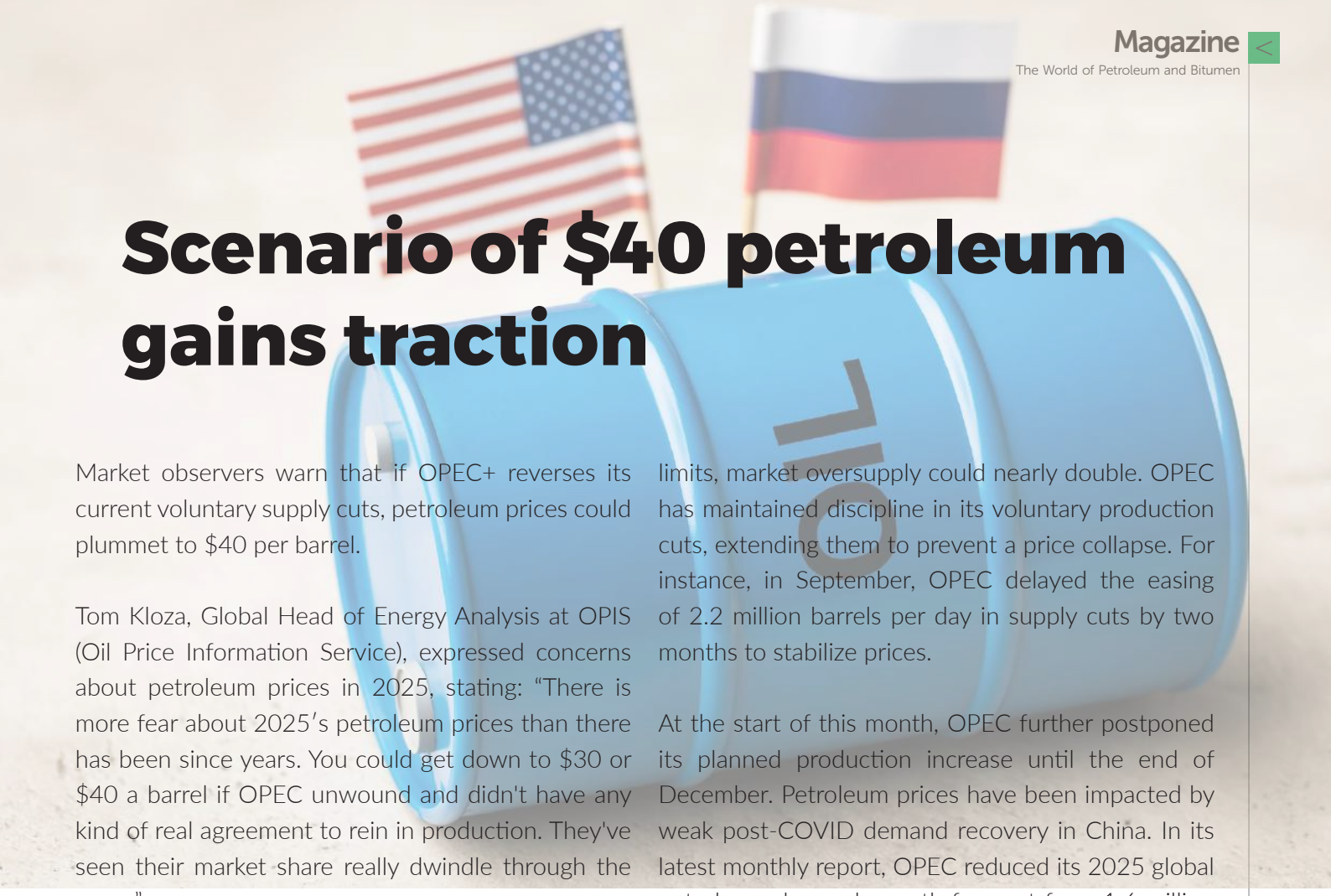
India claims credit for stabilizing global petroleum prices by buying Russian petroleum

India's Petroleum Minister, Hardeep Singh Puri, has stated that if India had not purchased petroleum from Russia after the start of the Ukraine war, global petroleum prices would have skyrocketed.

India, the world's third-largest petroleum importer and consumer, became the largest buyer of discounted Russian petroleum following Western sanctions on Moscow in response to the Ukraine conflict. Before the war, India imported only a small volume of petroleum from Russia.

Defending its decision to buy Russian petroleum to manage prices in the nation of 1.42 billion people, Puri wrote on social media platform X late Friday: "What many around the world don't seem to realise is that global oil prices would have hit the roof if India had not bought oil from Russia. We owe it to our citizens - India will buy oil from wherever our companies get the best rates."

According to a Reuters report, India's crude oil imports from Russia rose by 11.7% in September, reaching approximately 1.9 million barrels per day. This accounted for about 40% of the South Asian nation's total crude imports that month. After Russia, Iraq and Saudi Arabia were the next largest petroleum suppliers to India.



Scenario of $40 petroleum gains traction

Market observers warn that if OPEC+ reverses its current voluntary supply cuts, petroleum prices could plummet to $40 per barrel.

Tom Kloza, Global Head of Energy Analysis at OPIS (Oil Price Information Service), expressed concerns about petroleum prices in 2025, stating: "There is more fear about 2025's petroleum prices than there has been since years. You could get down to $30 or $40 a barrel if OPEC unwound and didn't have any kind of real agreement to rein in production. They've seen their market share really dwindle through the years."

Currently, Brent crude is trading at $72 per barrel, and US West Texas Intermediate (WTI) is around $68 per barrel.

Henning Gloystein, Director of Energy, Climate, and Resources at Eurasia Group, told CNBC that with petroleum demand growth next year unlikely to exceed 1 million barrels per day, the complete removal of OPEC+ supply restrictions by 2025 would undoubtedly trigger a sharp price collapse, potentially driving crude down to $40 per barrel.

Saul Kavonic, Senior Energy Analyst at MST Marquee, echoed this sentiment: "If OPEC+ removes its supply restrictions without regard to demand, it would essentially spark a price war over market share, which could drag petroleum prices to their lowest levels since the COVID-19 pandemic."

Despite these warnings, analysts believe OPEC+ is more likely to adjust supply gradually rather than completely lifting restrictions abruptly.
If the group proceeds with plans to remove supply limits, market oversupply could nearly double. OPEC has maintained discipline in its voluntary production cuts, extending them to prevent a price collapse. For instance, in September, OPEC delayed the easing of 2.2 million barrels per day in supply cuts by two months to stabilize prices.

At the start of this month, OPEC further postponed its planned production increase until the end of December. Petroleum prices have been impacted by weak post-COVID demand recovery in China. In its latest monthly report, OPEC reduced its 2025 global petroleum demand growth forecast from 1.6 million barrels per day to 1.5 million barrels per day.
Gloystein noted that another factor putting downward pressure on prices is oversupply in the market, especially as major non-OPEC+ producers like the US, Canada, Guyana, and Brazil are planning to ramp up production.

According to Martocchia Francesco, Energy Strategist at Citibank, the consensus is that significant petroleum inventories will accumulate next year. If production increases persist, the market surplus could nearly double, reaching 1.6 million barrels per day.
Even if OPEC+ maintains its supply restrictions, analysts foresee a bearish price trend. Citibank predicts Brent crude will average $60 per barrel next year.

Analysts told CNBC that the possibility of Donald Trump winning the US presidential election strengthens this pessimistic scenario. Trump's presidency could bring trade wars and energy policies aimed at maximizing production, which would halve petroleum prices.

World bank warns of petroleum prices dropping below $60

The World Bank has predicted that a significant oversupply of petroleum in the coming years could lead to prices falling below $60 per barrel.

We are approaching a historic gap between supply and demand in petroleum markets, comparable only to two instances since the mid-19th century when the petroleum industry was born. A report released this week by the World Bank highlights the risks of a potential surplus in petroleum supply, which could severely disrupt the global economy and trade patterns.

The World Bank's latest Commodity Markets Outlook projects that in the coming year, global petroleum supply will exceed demand by an average of 1.2 million barrels per day. The scale of this surplus is significant, having been seen only twice before—in 1998 and 2020. As a result, the price of petroleum per barrel is expected to remain under $60 for the next six years.

A blog post accompanying the report attributes this oversupply to a combination of factors, including China's stagnant economic growth, increased electric vehicle sales (expected to surpass 23% of new car sales this year and reach 40 million vehicles annually by 2030), greater use of gas-powered trucks, anticipated production growth from non-OPEC+ countries, and persistent overproduction by OPEC+ members, currently producing seven million barrels per day in excess.

While this situation implies economic uncertainty and disruption in the coming year, it could also act as a significant market-correcting force. Earlier this week, Axios reported that this new reality might help keep energy prices constrained for consumers, even amidst escalating geopolitical tensions, but could severely undermine the economic factors underpinning petroleum production.

This outlook might be welcomed by average citizens in developed nations, but it is less optimistic for those in poorer countries. Indermit Gill, the World Bank Group's Chief Economist and Senior Vice President, noted: "Falling commodity prices and better supply conditions can provide a buffer against geopolitical shocks. But they will do little to alleviate the pain of high food prices in developing countries where food-price inflation is double the norm in advanced economies. High prices, conflict, extreme weather, and other shocks have made more than 725 million people food insecure in 2024."

Petroleum and gas companies, meanwhile, face a decade of uncertainty, volatility, and reduced revenues. Fatih Birol, Executive Director of the International Energy Agency, stated that the World Bank's forecasts, based on the latest data, suggest a major surplus this decade. Petroleum companies may need to ensure their strategies and business plans are prepared for these coming changes.

According to a Reuters report, the outlook is bleak even for major corporations that have made significant efforts to diversify their assets and prepare for such a downturn.

IEA Revises Oil Demand Growth Forecast for 2024, Lowers Next Year's Estimate

The International Energy Agency (IEA) has adjusted its predictions for global oil demand, increasing its estimate for 2024 but lowering expectations for the following year, attributing the change to a weakening Chinese economy.

According to the Paris-based agency, "China's significant economic deceleration has been the primary factor restraining demand. This year's growth is projected to be only one-tenth of the 1.4 million barrels per day (mb/d) rise recorded in 2023."

The IEA now anticipates global oil consumption to increase by roughly 920,000 barrels per day (B/D) in 2024, a slight rise from its October projection, which was "just under" 900,000 B/D.

For 2025, the agency predicts growth of "slightly below" 1 million B/D, revising down its earlier estimate of "approximately" 1 million B/D.

"China's marked slowdown has been the main drag on demand, with its growth this year expected to average just a tenth of the 1.4 mb/d increase in 2023," the Paris-based organization said.

Types of Bitumen Packaging and a Review on Iran FOB Bitumen vs. India Ex. Mumbai Bitumen Prices in New Steel Drum (Sep. – Nov. 2024)

Ahmad Reza Yousefi, managing director of Infinity Galaxy and a PhD candidate in international entrepreneurship, has more than a decade of experience in exporting bitumen and petrochemicals. He leads a passionate team dedicated to boosting his country's economy through exports. His focus on fostering trust with clients and providing outstanding service is paramount. For the last four years, he has ensured his clients remain informed about industry changes, trends, and market insights to facilitate sound business decisions.

Infinity Galaxy also boasts a specialized team focused on Asian markets exclusively India, offering tailored support to importers to help them make timely and informed decisions.

Razieh Gilani, the export manager at Infinity Galaxy, brings over eight years of experience in the bitumen market and shipping industries. Her expertise lies in the export, trade, and shipping of bitumen and petrochemicals, particularly in markets throughout Africa, China, India, and East Asia. For over past 200 weeks, she has been providing valuable market analysis to assist industry stakeholders in making informed decisions based on the latest trends. Collaborating with a skilled team of professionals with significant commercial knowledge, she effectively tackles market challenges by delivering in-depth insights and strategic advice.

Review on the Different Types of Bitumen Packing

Given the high demand for Bitumen in India, the superior quality of Iranian Bitumen, and its reasonable and acceptable price in global markets, particularly India, the Iranian Bitumen market has always been attractive to Indian buyers.

Bitumen is a liquid product with high viscosity; therefore, its packaging is very important considering factors such as cost, environmental conditions, storage, and transportation. Bitumen packaging is mainly divided into four different types: bulk, jumbo bags, flexitanks, and new steel drums. The best type of packaging is chosen based on buyers' needs and factors such as target market, transportation conditions, and the volume and weight of the bitumen.

1. Bulk Bitumen:

Bulk bitumen refers to bitumen that is supplied in large quantities without specific packaging like drums or jumbo bags and is mainly used in large construction and civil engineering projects. Purchasing bitumen in bulk typically incurs lower costs compared to buying it in drums because packaging and transportation costs are reduced. Using bulk bitumen decreases the need for additional packaging, which helps reduce waste

and environmental impact. This type of bitumen can be easily transferred to the consumption site through pumps, increasing work efficiency.

The bulk bitumen is mainly exported from the Persian Gulf to the different ports of India such as Karwar, Mumbai, Pipapavav, and Mundra. The minimum reasonable quantity of bulk bitumen should be 5,000 tons so that the finished costs are economical enough.

New Steel Drums Specification

Specification	Long New Steel Drum 180 kg	Short New Steel Drum 150 kg	Short New Steel Drum-big lid 156 kg
Material	New Cold Rolled Steel	New Cold Rolled Steel	New Cold Rolled Steel
Height (mm)	980	860	890
Diameter (mm)	500	500	500
Body thickness (mm)	6	6	6
Top/Base thickness (mm)	6	6	6
Net weight (kg) ± 2.5	182	150	156
Gross weight (kg) ±2.5	192	158	164
Empty drum weight(kg) ±1	9.5	8.5	8.5
Lid (a removable cover on the top of a drum)	11	11	17

2. New Steel Drums:

The other popular packaging option is new steel drums, which are among the most common due to their safety and consistent quality.

In India, the steel drum has emerged as a popular and efficient packaging solution for bitumen, a vital material in the construction and road-making industries. These drums come in various sizes and types, including both long and short configurations, catering to diverse transportation and storage needs. The robust design of steel drums ensures the safe containment of bitumen, protecting it from environmental factors while facilitating easy handling and transport. Their durability and reusability make them an economical choice for manufacturers and suppliers alike. As the demand for quality infrastructure continues to rise in India, the use of steel drums for bitumen packaging is likely to grow, reflecting the industry's commitment to efficiency and sustainability

The most common type is 180KG long and 156KG short drum, which typically accommodates 110 new steel drums per 20-foot container, with a total loading capacity of about 20 tons and 16.5 tons for this number of drums respectively.

The specifications of various types of new steel drums are shown in the table below:

3. Jumbo Bags:

The 1MT jumbo bag packaging, which encloses the bitumen with a wooden pallet and metal cage, is not a popular type of bitumen packaging in India. This packaging is considered one of the effective and

economical methods for transporting and storing bitumen in some of the markets in Southeast Asia. Unlike drums, using jumbo bags reduces bitumen waste by about 3 to 4 percent.

In each 20-foot container, 20 1MT jumbo bags are loaded in two tiers. The metal frame of the jumbo bags on the lower tier is more robust than those on the upper tier to withstand pressure without tearing or leaking.

The specification of different sizes of jumbo bags can be seen in the below table:

Jumbo Bag Specification

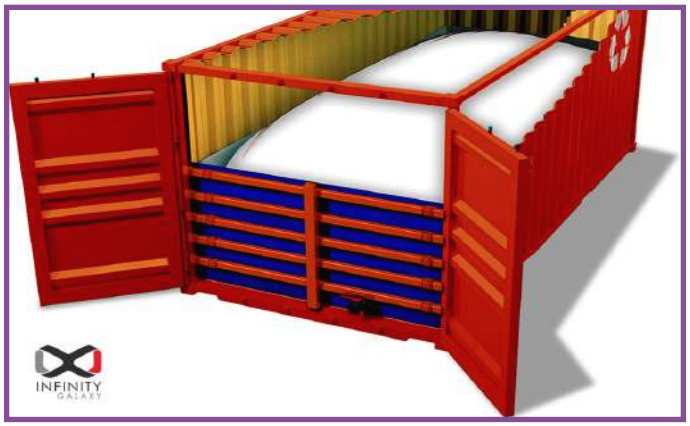
Type of Jumbo Bag	Dimensions	Height	Description
Bag 300 kg	100*55*55 cm	55 cm	–
Bag 1 MT	100*105*105 cm	100 cm	Placed in a steel cage on a wooden pallet, with dimensions of 100*105*105 cm.
Bag 1.3 MT	140*101*101 cm	140 cm	Placed on a wooden pallet and contains an interior metal frame.

4. Flexitank

A flexitank is a type of flexible container used for transporting non-corrosive liquids, such as bitumen. This type of packaging is not highly demanded among Indian buyers.

Flexitanks are typically made from multi-layer plastic materials that offer good resistance to the heat of bitumen and can withstand high temperatures. To unload this packaging at its destination, special facilities are required to ensure complete unloading without any bitumen wastage.

As a result, choosing the appropriate type of packaging for bitumen not only affects the quality of transportation but also impacts costs and customer satisfaction. Thus, accurately understanding market needs and selecting suitable packaging is of particular importance.



A Review on Iran FOB Bitumen vs. India Ex. Mumbai Bitumen Prices in New Steel Drum (Sep. – Nov. 2024)

In the past three months, the bitumen price trend in India has been influenced by various factors including fluctuating crude oil prices, changes in import duty, and domestic demand from the construction sector.

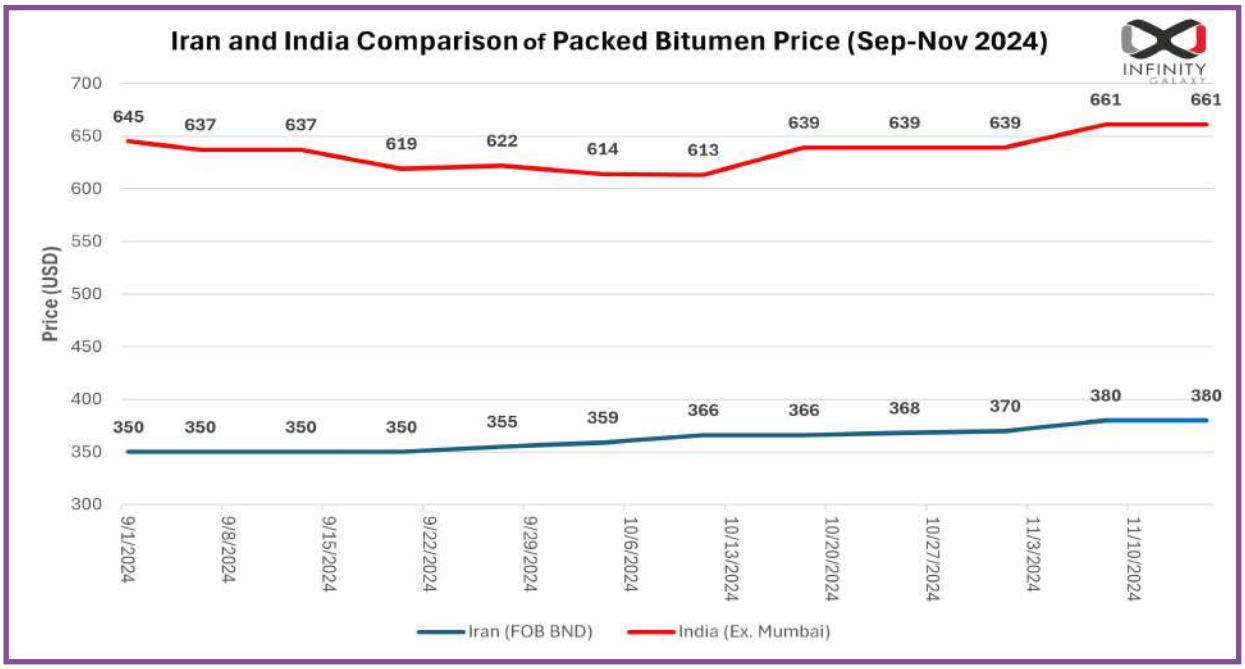
India, being one of the largest consumers of bitumen, has seen prices rise due to increased infrastructure development projects and road construction initiatives. Government investments aimed at enhancing transportation networks have led to a surge in demand for bitumen, which in turn has contributed to a steady price increase. Additionally, the weakening of the Indian Rupee against the US Dollar has further exacerbated the situation, making imports more expensive and pushing domestic bitumen prices upward.

Despite the large volume of Iraqi bitumen being exported to India, Iran bitumen prices were quite feasible for India as well. It is predicted that the upward trend of Iran bitumen prices will continue till the end of 2024. However, Iran is still a reliable source of bitumen supply for the eastern ports of India with feasible prices and premium quality of popular grades like bitumen VG40 with a high viscosity.

Conversely, in Iran, bitumen prices have remained relatively stable over the last three months despite the volatile global oil market. As a major producer and exporter of bitumen, Iran benefits from lower production costs due to its abundant oil resources. The Iranian government's focus on boosting exports, especially to neighboring countries, has also played a role in maintaining competitive pricing. However, challenges such as international sanctions and limited access to global markets have affected Iran's overall export capabilities.

The below table has a brief look at the trend of packed

bitumen price within the last 3 months:



As a result, while India experiences upward pressure on prices driven by demand and currency fluctuations, Iran's pricing remains more stable, reflecting its position as a key player in the bitumen market despite external challenges.

For more information on various packaging types and pricing, you can visit the Infinity Galaxy website at **www.infinitygalaxy.org.**

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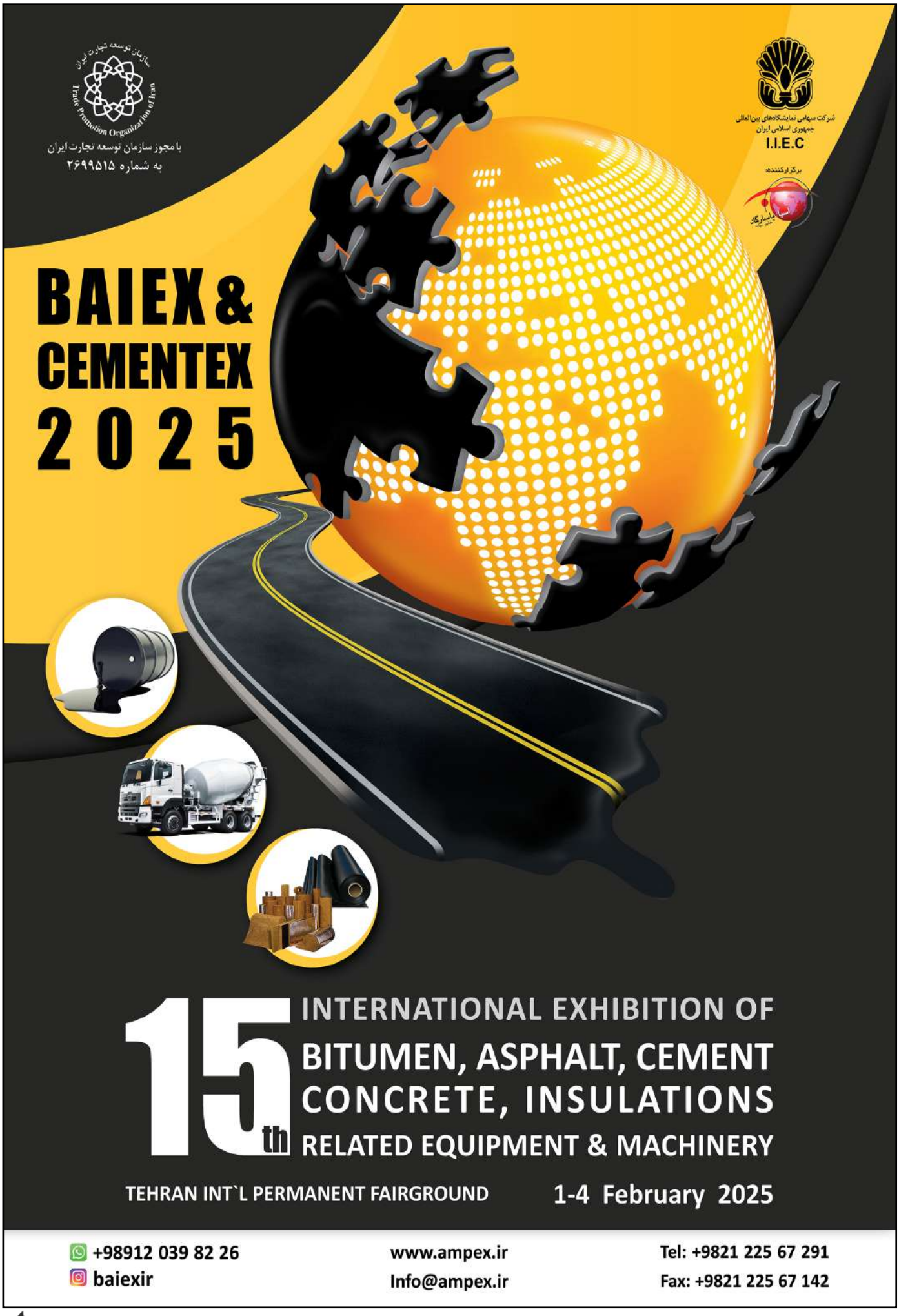
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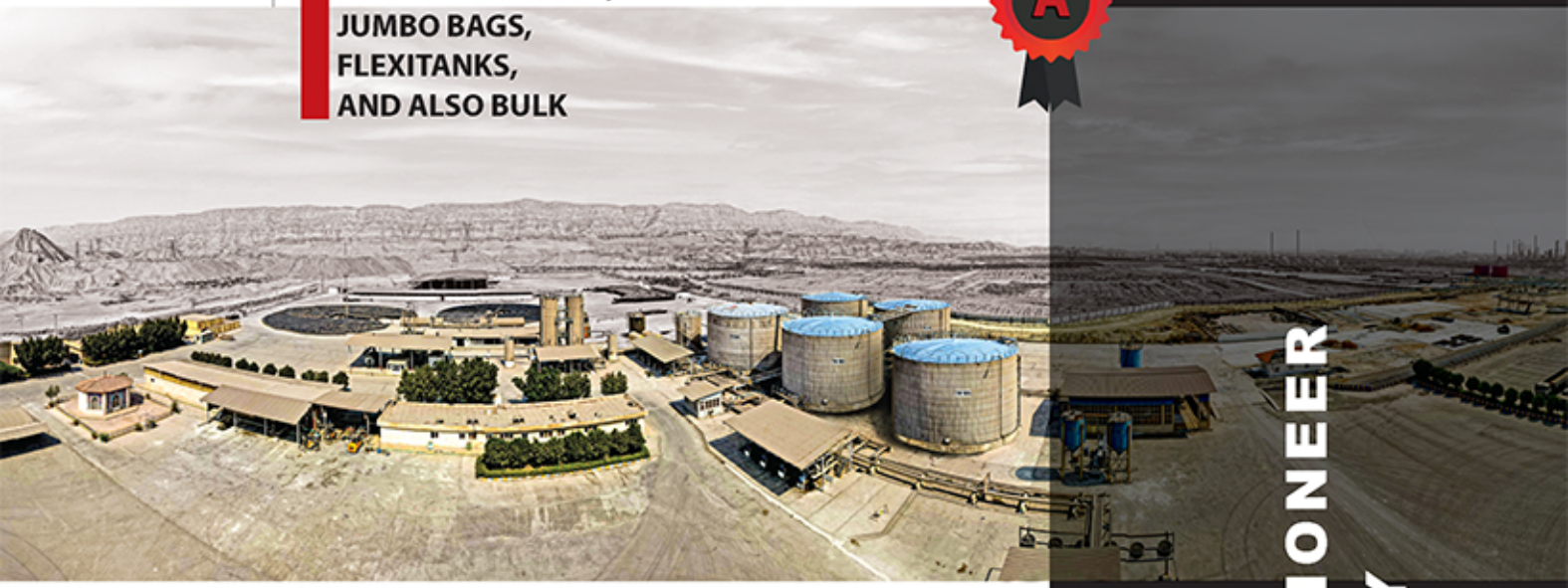

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