

## *Questions at ReLIXER – Market Leader in RAP Rejuvenation Technology Commercial Session*

**1. Are high RAP mixes more or less sensitive to oxidative aging?**

This is one of the key features of rejuvenation versus softening. A good rejuvenator must confer adequate long term aging properties to the mix. This is a matter of exhaustive research at Sripath. We adjust the composition of ReLIXER® to ensure that the aging properties of high RAP mixes with ReLIXER provide similar aging properties as no-RAP, or low-RAP mixes. We have plenty of data from world-wide customers to buttress this argument, please email/call us for more information. We want to ensure that the high RAP mixes treated with ReLIXER® are at least equal, if not better than, mixes conventionally employed in the past.

**2. What is the maximum percentage of RAP that can be used in Europe? Is rejuvenation being applied in UK? Europe?**

The amount of RAP in a mix varies by jurisdiction. It is different in different countries, and even within a country by producer, process etc. Yes, rejuvenation is being employed in Europe, Asia and North America today in high RAP mixes.

**3. Where is the best place in the process to add rejuvenator? Can it be added directly to the RAP? Advantages and limitations of each method?**

Sripath research has demonstrated that as long as there is good mixing, and suitable storage times (at common process/silo temperatures), it does not matter when ReLIXER® is added to achieve satisfactory rejuvenation and properties. It can be added to the binder storage tank. It can be added to the RAP. It can also be co-injected with the binder feed line to the drum or pug mill.

**4. There are several rejuvenators being presented in the E&E Conference? Why should we consider ReLIXER®?**

There is some really fine competition out there; so this answer is about Sripath ReLIXER®, not about anyone else. With ReLIXER's unique chemistry, we pride ourselves on best-in-class rejuvenation and dosage efficiency. ReLIXER® is proven in its universality – across different bitumen & RAP around the world. We have exhaustive performance history in a variety of climates and traffic conditions. It is easy and safe to handle, dispense, mix and use. It is based on sustainable, environmentally responsible chemistry and has no VOC. Behind the product, is a company and philosophy of seamless, effective technical, customer and logistical support – world-wide. These are attributes that others don't share.

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**5. What are the advantages of ReLIXER® over “Softer Binders”?**

Softer binders were employed early on in rejuvenation, but they have some drawbacks, particularly regarding high RAP mixes. Firstly, these work only up to a certain point. In the case of higher RAP percentages, they don't work. Certainly, in the case of 100 % RAP (no virgin binder addition), these cannot work. Secondly, softer binders may prove to be more expensive, since all the virgin binder is now a “special grade” binder, versus rejuvenation with ReLIXER®, where conventional bitumen are used. Sometimes, the aging performance of mixes with softer binders is not acceptable, i.e. the method of “Softening” by a refiner may lead to undesirable results. For all these reasons, mix producers are gravitating towards Bio-Based rejuvenators like ReLIXER®

**6. If rutting is a persistent problem, will ReLIXER® take care of it? What about fatigue and crack resistance of such mixes?**

Rutting issue must be addressed by selection of suitable binder grades and mix designs for the particular climate and traffic conditions. In general, high RAP mixes provide better rutting resistance, albeit, at the expense of fracture toughness/fatigue/crack resistance. ReLIXER® provides for suitable balance of these properties in the mix, so that both rutting and fracture toughness properties are adequate and the mix is durable on the pavement.

**7. What is the highest percentage of RAP that has been used with ReLIXER®? What is the most common percentage?**

We do have roads laid down with 100 % RAP and ReLIXER®. More commonly, producers employ 30 – 60 % RAP in their mixes. The percentage used depends on various factors – RAP availability, jurisdiction specifications, RAP quality, process limitations etc.

**8. How do the economics of ReLIXER® work with petroleum-based rejuvenators?**

Very favorably. Petroleum-based agents are not as dosage efficient as ReLIXER®. Plus, the aging behavior of petroleum-based agents is not as good as ReLIXER®, so customers and specifying agencies prefer bio-oil based materials. In addition, bio-oil is preferred when considering environmental-friendliness sourcing. Customers also prefer the fact that ReLIXER® does not have to be stored and used hot, like many petroleum-based agents.

**9. How long is ReLIXER® stable and effective in hot mixes? How long can it be stored in the hot mix?**

This is not a function of ReLIXER® stability, rather other ingredients in the mix. ReLIXER® is very stable for extended periods at conventional mix and use temperatures. Plus, it is a free-flowing material that does not have to be stored hot.

**10. Where is ReLIXER® being tested in Europe?**

We have a number of research reports available from several leading academics and labs in Europe, please call / email us for details.

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**11. Can you comment on the source of bio-oils in ReLIXER®? Have they been responsibly sourced?**

All components of ReLIXER® blend are from responsible sources. We do not infringe upon food-based oil sources. These are all industrial-grade materials.

**12. Have you studied chemical and spectroscopic effects of ReLIXER® in bitumen?**

Yes, we have studied ReLIXER® interactions with bitumen, using FTIR. Please call / email us for details.

**13. In the data presented, what was the conditions of the Aging Regimen?**

Lab aging of liquid samples is standard PAV aging. Mix samples are aged in forced-air, 165 C hot ovens; loose laid in thin layers and turned over once during the aging regimen (4, 8, 12 or 16 hours).

**14. In the case of very hard RAP, pretreatment of RAP is an option. Can it be done with ReLIXER®? How long must this pre-treatment be for it to be effective?**

Yes, RAP can be pre-treated with ReLIXER® prior to leading it into the mix chamber. Mixing time should be adjusted based on temperature of the RAP that is being pretreated; however, this method lends itself well to industrial-scale processes. More details cannot be given, due to confidentiality considerations with existing customers. We can provide technical help to arrive at the optimum conditions.

**15. Is it better to treat the RAP with ReLIXER® instead of the bitumen?**

Our studies have determined that as long as certain time-temperature requirements are met, the final result (mix properties, coating uniformity) is insensitive to the method of introduction of ReLIXER® into the mix – addition to RAP, blending in-line with bitumen, or dosing the bitumen tank.

**16. How do you adjust ReLIXER® dosage? Is it based on softening point / pen adjustment?**

To achieve this, Sripath works with the customer to meet specifications with a few mixes. From the results of these, we give the customer blending charts based on feed rates of the various raw materials, RAP content etc. This is part of the technical service we are happy to provide to customers.

**17. What are the common challenges to rejuvenator usage around the world?**

Typically, what we have seen around the world is that the process employed imposes restrictions on RAP content. ReLIXER® use is not the limiting step in all these situations.

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**18. What is the flash point of ReLIXER®? Will it cause problems in single drum plants where superheated aggregate (300 C) is used in the process?**

Published Flash Point of ReLIXER® is > 250 C We do have several customers, who do not have separate heating arrangement for RAP, so use superheated aggregate in the process, like the process mentioned above. ReLIXER® works well, without any problems in these situations. We may also be able to offer specific technical advice based on what we have learnt about such processes.

**19. In the case of 100 % ReLIXER®, did you have to preheat the ReLIXER®?**

Yes, in general, it is a good idea to heat the RAP to avoid problems of heat-sink and moisture-induced steam generation. Beyond that, we must be careful about what we say to preserve confidential information of customers. We can provide technical help in these situations, so please give us a call / email and put us to the challenge.