

A photograph of an asphalt plant. A large, conical pile of dark, granular aggregate is the central focus. A red conveyor belt system is visible, with one section pouring material into the pile. The background shows a clear blue sky, some trees, and a utility pole. The overall scene is bright and clear.

TRH 21 Second Revision

**Sasheen Rajkumar
32nd Meeting of RPF
8 November 2016**



MOVEMBER

Knowledge is Power • Moustache is King

- Male Cancer Awareness
- Moustache is the ribbon
- Goal - "change the face of men's health"
- Increase early cancer detection, diagnosis and effective treatments
- In 2012 - Movember listed as one of the world's top 100 NGOs
- Grow a Mo and support a bro!



History of TRH 21

- TRH 21 appeared in 1996
- 1st Revision in 2009
- 2nd Revision in 2016/17
- Local asphalt recycling & associated research work began in 1980s

TECHNICAL RECOMMENDATIONS FOR
HIGHWAYS

TRH 21: **2017**

RECYCLED ASPHALT



July 2009



History of Asphalt Recycling in SA

Late '70s/early '80s:

- No milling machines - Jaw crusher used to crush the large asphalt slabs reclaimed from the pavement
- One of SA's first drum-type asphalt mixing plants - configuration of burner in mixing drum enabled the RA to be heated without much fuming
- Manufactured 100% RA mix – only added new bitumen
- Paved a residential road in Pietermaritzburg. Years later the road was still in a reasonable condition.
- No recovered binder testing was carried out in those days!



History of Asphalt Recycling in SA

Late '80s

- Vladis Servas - Developed the “Servicycler” which was advanced for its time - with separate drums for heating the aggregate and RA

Early '90s

- First Hot-In-Place recycling trial being championed by Emile Horak in Johannesburg (and also successfully used on a section of the Durban Outer Ring Road)
- The in situ asphalt was recycled 100% using a rejuvenator
- It was possible to add new mix during this process



History of Asphalt Recycling in SA

'93 to '95

- N3 rehab between Key Ridge and Cato Ridge
- 40% recycling of milled asphalt as “new” asphalt subbase supporting the JCP
- Those days ‘state-of-the-art’ Niigata batching plant

'96 - TRH 21 (First Publication)

GAP Period

- Problems associated with the recycled mixes on early projects – enough to cause a hiatus with asphalt recycling in the country
- Abundance of good quality new materials available – RA treated as waste
- Recycled mix thought of as inferior to virgin mix



History of Asphalt Recycling in SA

'07

- Sabita challenges industry not to treat RA as a waste material & acknowledge the value of RA and that of asphalt recycling
- Recognise the environmental and financial benefits
- International studies found recycled mixes as being no worse than the virgin mixes
- Earlier problems: general lack of proper handling and processing of RA
- Asphalt recycling start up again – risk assertive: 12 – 15% RA used in base during rehab of N3 (Marianhill to Key Ridge)

'09 - TRH 21 (First Revision): Guidance on the processing and quality control of RA added



History of Asphalt Recycling in SA

'08

- Warm Mix Asphalt (WMA) goes hand-in-hand with asphalt recycling
- First WMA trials involved recycling of 10, 20 & 30% RA content mixes

'10

- WMA trials with 40% RA (60% RA in 2011)

'11/'12

- First full scale HMA with 40% RA on N1



History of Asphalt Recycling in SA

'13 to Current















- Substantial research – well designed recycled asphalt is equivalent or better than virgin mixes
- Manufacturing plants can handle high RA contents
- Rejuvenators for high RA contents
- HMA with 40% RA – now standard practice

Future

- 100% RA?



Committee Members

NAME	ORGANISATION
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Overview of Comments

- Generally acceptable procedure for current RA recycling
- Clear guidelines and procedures required for high RA recycling
- Provide emphasis of up-cycling vs. down-cycling
- Identify & provide guidance on other recycling/ reuse streams of RA not used for HMA recycling
- Improve on some definitions and terminology (RAP, RA, RA Content, etc.)



Objectives

- To update the TRH 21 to current best industry practises
- To provide recommendations for further industry development in the near future
- Define processes more clearly (tendering for consultant services)
- Improve readability and provide examples



Most Significant Changes to Date

Processing of RA

- Crush the RA for consistency
- Optimising the useable RA in mix designs by mandatory fractioning
- Not specifying the sieve sizes of RA fractions
- The crusher should serve to lightly crush the large agglomerations apart and not break the aggregates.



Most Significant Changes to Date

RA Proportioning

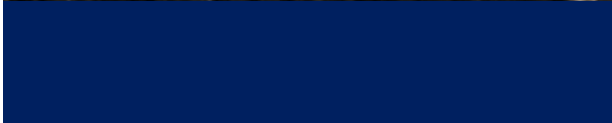
- Recycled asphalt design – more risk in the binder than in the aggregate of RA.
- Risk to Client – increases with less new binder in the mix.
- Move from specifying “RA Content” to “RA Binder Replacement”
- New tiers defined for mix design



RA



New Binder



New Aggregate



RA Content (%)

$$= \frac{\text{Total RA Mass (kg)}}{\text{Total Asphalt Mix Mass (kg)}} \times 100$$

RA Aggregate



RA Binder



New Binder



New Aggregate



RA Binder Replacement (%)

$$= \frac{\text{Total RA Binder in Mix (\%)}}{\text{Total Binder in Mix (\%)}} \times 100$$



RA Binder Replacement – Simple Example

- RA Content in mix: 20%
- RA BC = 3.0%
 - Total RA Binder in mix = $20 \times 0.03 = 0.6\%$
- Target Binder Content = 4.5%
 - RA Binder Replacement = $0.6 / 4.5 = 13.3\%$

- RA Content in mix: 20%
- RA BC = 6.0%
 - Total RA Binder in mix = $20 \times 0.06 = 1.2\%$
- Target Binder Content = 4.5%
 - RA Binder Replacement = $1.2 / 4.5 = 26.7\%$



Most Significant Changes to Date

Rejuvenators

- For asphalt recycling – different from rejuvenator fog spray application
- Provide a generic definition of a ‘rejuvenator’.
- Rejuvenators cannot be specified as they are proprietary products.
- Purpose of rejuvenators in asphalt recycling...

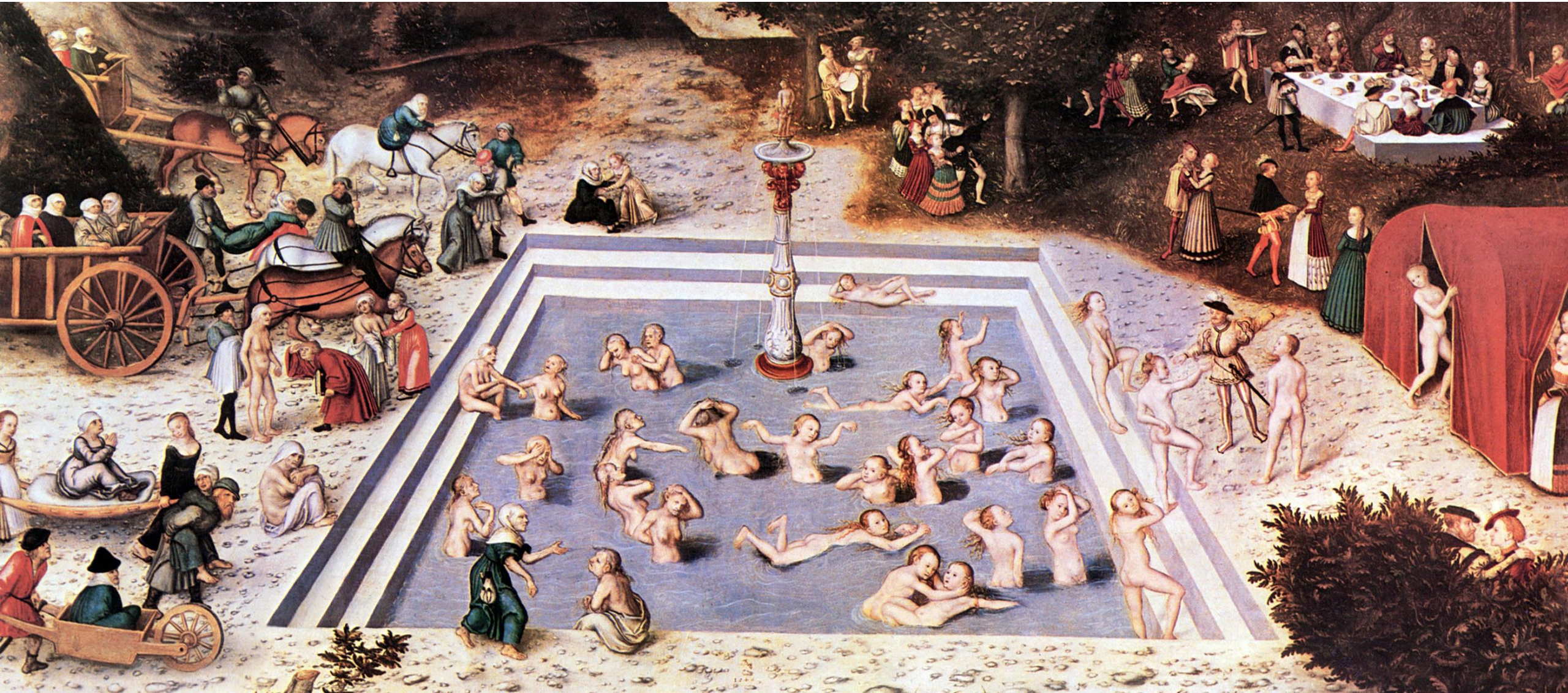


Rejuvenators

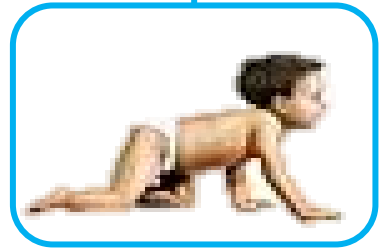
- *“The fountain of youth...for asphalt”*



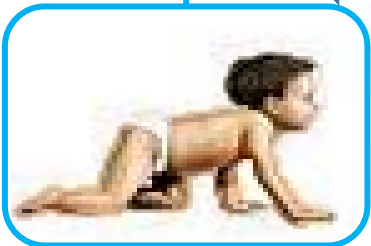
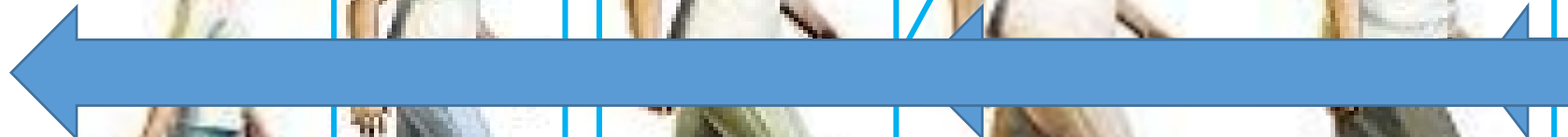
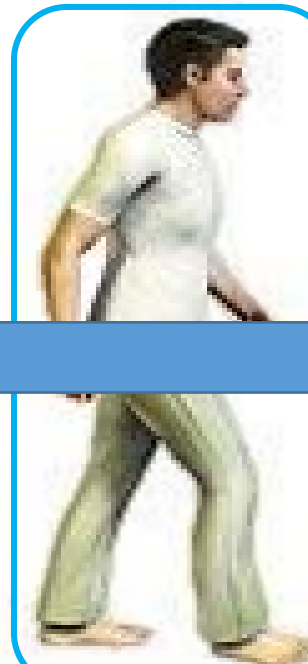
The Fountain of Youth, by Lucas Cranach the Elder, 1546.



Asphalt – from Birth to Death



Rejuvenator Dosage Rate!



Revision Process

- Three step approach:
 1. Based on comments received prepare first draft
 - Review first draft
 2. Based on review prepare second draft
 - Review second draft
 3. Prepare third draft
 - Final review and finalisation

Thank you!

