

QUANTIFYING THE SERVICE LIFE OF ASPHALT SURFACINGS CONTAINING HYDRATED LIME

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INTRODUCTION

1. The ADEPT/MPA document “*Service life of asphalt materials for asset management purposes*”^a is used by Highways Authorities responsible for the local road network as a means for lifecycle planning and asset valuation.
2. In response to requests from local authority stakeholders, the British Lime Association (BLA) has prepared the attached document to support Local Authority asset managers in assessing the potential benefits of hydrated lime modified asphalts through their lifecycle and maintenance management models, and their asset valuation approaches.
3. The information presented here is summarised from international literature where experience of hydrated lime modification is more widespread than in the UK (see [Annex 1](#)).
4. The BLA is working alongside highways authorities, road maintenance contractors, product suppliers and others with a view to supporting road trials to demonstrate these benefits in UK circumstances. For more information, please contact Rebecca Hooper, BLA Manager: rebecca.hooper@mineralproducts.org.

SERVICE LIFE OF HYDRATED LIME MODIFIED ASPHALTS

5. The BLA analysis of the source data (presented in Annex 1) shows a 25% median increase in service life - to provide a conservative approach, this median calculation excludes ‘high’ increases in service life but does not exclude ‘low’ increases. Applying this median improvement to the material service lives presented in the document “*Service life of asphalt materials for asset management purposes*” gives the potential service lives for lime modified asphalts tabulated below:

Material	Material service life in designed roads	Material service life in evolved roads	Potential hydrated lime modified material service life in designed roads	Potential hydrated lime modified material service life in evolved roads
Asphalt concrete	8 years	6 years	10 years	7.5 years
HRA	20 years	20 years	25 years	25 years
Thin surface course system	15 years	10 years	18.75 years	12.5 years
SMA - Low texture	20 years	20 years	25 years	25 years
SMA - Other	15 years	10 years	18.75 years	12.5 years

^a https://mineralproducts.org/documents/Asphalt_asset_management_15_06_15b.pdf

6. As with the data presented in the document “*Service life of asphalt materials for asset management purposes*” the actual service life of a highway will be affected by compromising factors such as:
- Night work
 - Wrong material in wrong place
 - Use of non-Sector Scheme registered contractor
 - Incorrect preparation of works
 - Inclement weather conditions
 - Surface conditions - such as no standing water; no residual salt; no detritus, and vegetation free
 - Application to planed surface
 - Compaction
 - Segregation
 - Poor substrate
 - Poor finish / longitudinal profile
 - Incorrect bond coat
7. If required, a ‘worst case’ improvement approach is achieved by using the lowest median service life increase for any group of highway data presented in Annex 1. In this ‘worst’ case, the median service life increase for US low volume roads that achieve the upper range of anticipated service life show a 10% increase in service life when using hydrated lime additions. Using this ‘worst case’ approach, this gives the potential service lives for hydrated lime modified asphalts tabulated below:

Material	Material service life in designed roads	Material service life in evolved roads	Conservative hydrated lime modified material service life in designed roads	Conservative hydrated lime modified material service life in evolved roads
Asphalt concrete	8 years	6 years	8.8 years	6.6 years
HRA	20 years	20 years	22 years	22 years
Thin surface course system	15 years	10 years	16.5 years	11 years
SMA - Low texture	20 years	20 years	22 years	22 years
SMA - Other	15 years	10 years	16.5 years	11 years

8. European information is limited in both the quantity of published data and the types of surfacing for which data has been made available. Nonetheless, the improvement is seen to be within similar levels to that experienced in the USA.

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ANNEX 1: DATA ON SERVICE LIVES OF ROADS CONTAINING HYDRATED LIME MODIFIED ASPHALT

9. The data used to derive the median increases in service life for hydrated lime modified asphalt mixtures are presented below. The reference sources are:
- [1] Hicks and Scholz, *Life Cycle Costs for Lime in Hot Mix Asphalt, Volume II - Appendices*, April 2003, National Lime Association: https://www.lime.org/documents/publications/free_downloads/lcca_vol-2.pdf
 - [2] Iwanski and Mazurek, *Durability of SMA Pavement with Hydrated Lime Additive*, Proceedings of the 5th Eurasphalt and Eurobitume Congress, Istanbul, June 2012: <https://www.eurasphalt.org/ee-congress-istanbul-2012/>
 - [3] Mabile, *The addition of hydrated lime in bituminous mixes* (in French), ChauxFlash, May 2009: <https://www.chauxflash.be/2015/11/18/l-ajout-de-chaux-hydratée-dans-les-enrobés-bitumineux/>
10. The data presented for the USA includes:
- The average life expectancy
 - The lower range life expectancy - 1 in 10 of projects fail to achieve this life
 - The upper range life expectancy - 1 in 10 of projects will exceed this life
11. The BLA analysis calculates the median as described in the table. The calculation only includes data from the original data source where comparison to a 'non-treated' road service life is possible. To avoid any skewing in the calculation of the median service lives and service life increase, the data for Utah were excluded as outliers. Similarly, the Oregon data was also excluded as an outlier in the median calculation for service life and service life increase for low volume road.

USA DATA [1]	Without Hydrated Lime			With Hydrated Lime			(service life data in years)			
	Lower Service Life	Average Service Life	Upper Service Life	Lower Service Life	Average Service Life	Upper Service Life	Increase in Average Service Life	% Increase in Average Service Life	Upper Service Life Increase	% Upper Service Life Increase
Interstate Roads										
Arizona	10	12	14	13	15	17	3	25%	3	21%
California	6	8	10	8	10	12	2	25%	2	20%
Colorado	6	8	10	8	10	12	2	25%	2	20%
Oregon	8	12	15	10	15	20	3	25%	5	33%
Texas	7	10	12	8	12	15	2	20%	3	25%
Utah	7	10	15	15	20	25	10	100%	10	67%
Median across Interstate Roads (excluding Utah data)							2.5	25%	3	21%
State and U.S. Highways										
Arizona	15	17	20	18	20	22	3	18%	2	10%
California	6	8	10	8	10	12	2	25%	2	20%
Nevada	6	8	10	10	12	14	4	50%	4	40%
Oregon	8	12	15	15	17	20	5	42%	5	33%
Texas	8	10	12	10	12	15	2	20%	3	25%
Utah	7	10	15	15	20	25	10	100%	10	67%
Median across State and U.S. Highways (excluding Utah data)							3.5	25%	3.5	25%
Low Volume Roads										
Arizona	15	20	25	20	25	30	5	25%	5	20%
Georgia	8	10	15	8	10	15	0	0%	0	0%
Nevada	12	15	18	18	20	22	5	33%	4	22%
Oregon	7	10	15	15	20	25	10	100%	10	67%
Texas	7	10	15	8	12	15	2	20%	0	0%
Utah	3	5	7	7	10	15	5	100%	8	114%
Median across Low Volume Roads (excluding Oregon and Utah data)							5	23%	4.5	10%

EUROPEAN CASE STUDIES				
Country	Reported Service Life Without Hydrated Lime	Reported Service Life With Hydrated Lime	Increase in Reported Service Life	% Increase in Reported Service Life
Poland [2]	8	10	2	25%
Denmark [3]	100%	120%		20%
SANEF [3]			2	20%
Median for European Case Studies				20%
Median across all roads (based on USA and European Data)				25%