

## REFERENCES

1. Nagabhushana, M. In *Right grade of bitumen for flexible pavements-Indian Perspective*, All India Seminar on Highway Development: Design, Construction operation and Repairs, Indian Concrete Institute & institution of engineers (India), Lucknow Nov, 2008: 2008.
2. Matade, S. P., Need to regulate end-of-life tyres market in India. *Rubber Asia* **2016**.
3. Way, G. B., OGFC meets CRM where the rubber meets the rubber 12 years of durable success. *Asphalt Rubber* **2000**, 2000, 15-31.
4. Jung, J.-S.; Kaloush, K. E.; Way, G. B., Life cycle cost analysis: conventional versus asphalt-rubber pavements. *Rubber Pavements Association* **2002**.
5. Appiah, J. K.; Berko-Boateng, V. N.; Tagbor, T. A., Use of waste plastic materials for road construction in Ghana. *Case Studies in Construction Materials* **2017**, 6, 1-7.
6. Zoorob, S.; Suparma, L., *Laboratory Design and Investigation of the Properties of Continuously Graded Asphaltic Concrete Containign Recycled Plastics Aggregate Replacement (Plastiphalt)*. 2000; Vol. 22, p 233-242.
7. Nkanga, U. J.; Joseph, J. A.; Adams, F. V.; Uche, O. U., Characterization of Bitumen/Plastic Blends for Flexible Pavement Application. *Procedia Manufacturing* **2017**, 7, 490-496.
8. Navarro, F.; Partal, P.; Martínez-Boza, F.; Gallegos, C., Thermo-rheological behaviour and storage stability of ground tire rubber-modified bitumens. *Fuel* **2004**, 83 (14), 2041-2049.
9. Ghaly, N., Effect of sulfur on the storage stability of tire rubber modified asphalt. *World Journal of Chemistry* **2008**, 3 (2), 42-50.
10. Shatanawi, K. M.; Biro, S.; Geiger, A.; Amirkhanian, S. N., Effects of furfural activated crumb rubber on the properties of rubberized asphalt. *Construction and Building Materials* **2012**, 28 (1), 96-103.

11. Pérez-Lepe, A.; Martínez-Boza, F.; Gallegos, C., High temperature stability of different polymer-modified bitumens: A rheological evaluation. *Journal of applied polymer science* **2007**, *103* (2), 1166-1174.
12. Yildirim, Y., Polymer modified asphalt binders. *Construction and Building Materials* **2007**, *21* (1), 66-72.
13. Abdelrahman, M. A., *Engineering characterization of the interaction of asphalt with crumb rubber modifier (CRM)*. University of Illinois at Urbana-Champaign: 1996.
14. Zhang, F.; Hu, C., The research for structural characteristics and modification mechanism of crumb rubber compound modified asphalts. *Construction and Building Materials* **2015**, *76*, 330-342.
15. Heitzman, M., Design and construction of asphalt paving materials with crumb rubber modifier. *Transportation Research Record* **1992**, *1339*.
16. Harvey, J.; Bejarano, M.; Popescu, L., Accelerated pavement testing of rutting and cracking performance of asphalt-rubber and conventional asphalt concrete overlay strategies. *Road Materials and Pavement Design* **2001**, *2* (3), 229-262.
17. Oliver, J., Rutting and fatigue properties of crumbed rubber hot mix asphalts. *Road Materials and Pavement Design* **2000**, *1* (2).
18. Takallou, H.; Hicks, R. G., *Development of improved mix and construction guidelines for rubber-modified asphalt pavements*. 1988.
19. Farina, A.; Zanetti, M. C.; Santagata, E.; Blengini, G. A., Life cycle assessment applied to bituminous mixtures containing recycled materials: Crumb rubber and reclaimed asphalt pavement. *Resources, Conservation and Recycling* **2017**, *117*, 204-212.
20. Li, P.; Ding, Z.; Zou, P.; Sun, A., Analysis of physico-chemical properties for crumb rubber in process of asphalt modification. *Construction and Building Materials* **2017**, *138*, 418-426.
21. Nejad, F. M.; Aghajani, P.; Modarres, A.; Firoozifar, H., Investigating the properties of crumb rubber modified bitumen using classic and SHRP testing methods. *Construction and Building Materials* **2012**, *26* (1), 481-489.

22. Kök, B. V.; Çolak, H., Laboratory comparison of the crumb-rubber and SBS modified bitumen and hot mix asphalt. *Construction and Building Materials* **2011**, *25* (8), 3204-3212.
23. Xiao, F.; Amirkhanian, S. N.; Shen, J.; Putman, B., Influences of crumb rubber size and type on reclaimed asphalt pavement (RAP) mixtures. *Construction and Building Materials* **2009**, *23* (2), 1028-1034.
24. Wong, C. C.; Wong, W.-g., Effect of crumb rubber modifiers on high temperature susceptibility of wearing course mixtures. *Construction and Building Materials* **2007**, *21* (8), 1741-1745.
25. Pang, L.; Liu, K.; Wu, S.; Lei, M.; Chen, Z., Effect of LDHs on the aging resistance of crumb rubber modified asphalt. *Construction and Building Materials* **2014**, *67*, 239-243.
26. Wu, S.; Han, J.; Pang, L.; Yu, M.; Wang, T., Rheological properties for aged bitumen containing ultraviolet light resistant materials. *Construction and Building Materials* **2012**, *33*, 133-138.
27. Wulandari, P. S.; Tjandra, D., Use of Crumb Rubber as an Additive in Asphalt Concrete Mixture. *Procedia Engineering* **2017**, *171*, 1384-1389.
28. Rodríguez-Alloza, A. M.; Gallego, J.; Pérez, I.; Bonati, A.; Giuliani, F., High and low temperature properties of crumb rubber modified binders containing warm mix asphalt additives. *Construction and Building Materials* **2014**, *53*, 460-466.
29. Celik, O. N.; Atış, C. D., Compactibility of hot bituminous mixtures made with crumb rubber-modified binders. *Construction and Building Materials* **2008**, *22* (6), 1143-1147.
30. Al-Mehthel, M.; Parvez, M. A.; Wahhab, H. I. A.-A.; Hussein, I. A.; Al-Idi, S. H., Sulfur extended asphalt modified with crumb rubber for paving and roofing. Google Patents: 2015.
31. Sylvester, L. M., Rubber modified asphalt cement compositions and methods. Google Patents: 2006.

32. Presti, D. L., Recycled tyre rubber modified bitumens for road asphalt mixtures: a literature review. *Construction and Building Materials* **2013**, *49*, 863-881.
33. Shu, X.; Huang, B., Recycling of waste tire rubber in asphalt and Portland cement concrete: an overview. *Construction and Building Materials* **2014**, *67*, 217-224.
34. McDonald, C. In *Recollections of early asphalt-rubber history*, National Seminar on Asphalt-Rubber, 1981.
35. Singleton, T. M. Characterisation of impact absorbing asphalt. University of Nottingham, 2000.
36. Flory, P. J.; Rehner Jr, J., Statistical mechanics of cross-linked polymer networks I. Rubberlike elasticity. *The Journal of Chemical Physics* **1943**, *11* (11), 512-520.
37. Blow, C. M., Rubber technology and manufacture. **1971**.
38. Chehovits, J.; Dunning, R.; Morris, G. In *Characteristics of asphalt-rubber by the sliding plate microviscometer*, Proceedings, Association of Asphalt Paving Technologists, 1982; pp 240-261.
39. Shatanawi, K. M.; Thodesen, C. C.; Amirkhanian, S. N., Effects of crumb rubber variability on failure temperature of crumb rubber modified binders. *Road Materials and Pavement Design* **2008**, *9* (2), 291-309.
40. Green, E.; Tolonen, W. J. *The Chemical and Physical Properties of Asphalt Rubber Mixtures. Part I. Basic Material Behavior*; 1977.
41. Southern, E., Use of Rubber in Engineering. *MacLaren and Sons, London, 1967*) pp **1967**, 49-55.
42. Shen, J.; Amirkhanian, S.; Xiao, F.; Tang, B., Influence of surface area and size of crumb rubber on high temperature properties of crumb rubber modified binders. *Construction and Building Materials* **2009**, *23* (1), 304-310.
43. González, V.; Martínez-Boza, F.; Gallegos, C.; Pérez-Lepe, A.; Páez, A., A study into the processing of bitumen modified with tire crumb rubber and polymeric additives. *Fuel processing technology* **2012**, *95*, 137-143.

44. Zhang, B.; Xi, M.; Zhang, D.; Zhang, H.; Zhang, B., The effect of styrene–butadiene–rubber/montmorillonite modification on the characteristics and properties of asphalt. *Construction and Building Materials* **2009**, *23* (10), 3112-3117.
45. Wang, S.; Yuan, C.; Jiaxi, D., Crumb tire rubber and polyethylene mutually stabilized in asphalt by screw extrusion. *Journal of Applied Polymer Science* **2014**, *131* (23).
46. Ouyang, C.; Gao, Q.; Shi, Y.; Shan, X., Compatibilizer in waste tire powder and low-density polyethylene blends and the blends modified asphalt. *Journal of Applied Polymer Science* **2012**, *123* (1), 485-492.
47. Kocevski, S.; Yagneswaran, S.; Xiao, F.; Punith, V.; Smith, D. W.; Amirkhanian, S., Surface modified ground rubber tire by grafting acrylic acid for paving applications. *Construction and Building Materials* **2012**, *34*, 83-90.
48. Liu, H.; Chen, Z.; Wang, W.; Wang, H.; Hao, P., Investigation of the rheological modification mechanism of crumb rubber modified asphalt (CRMA) containing TOR additive. *Construction and Building Materials* **2014**, *67*, 225-233.
49. Xiao, P.; Wu, M.; Zhou, X., Experiments on rheological properties of TOR asphalt rubber. *Journal of Jiangsu University(Natural Science Edition)* **2012**, *33* (4), 440-444.
50. XIAO, P.; CHEN, Y.-y.; WU, B.-w., Experimental research on performance of TOR asphalt rubber [J]. *Journal of Yangzhou University (Natural Science Edition)* **2010**, *4*, 018.
51. Memon, M., Homogeneous crumb rubber modified asphalt. Google Patents: 1998.
52. S Biro, L. B., G Deak, A Geiger, chemically stabilised asphalt rubber compositions and mechanochemical method for preparing the same. **2007**, *WO 2007/068990A1*.2007.
53. Perret, P.; Lebez, J.; Montignac, G., Mixtures of bitumen, of powdered rubber waste and of polymer, employed as road binder. Google Patents: 1999.
54. Moran, L. E., Method for improving the storage stability of polymer modified asphalt. Google Patents: 1991.

55. Martin, J.-V., Method for preparing an improved bitumen by addition of polyphosphoric acid and a cross-linkable polymer. Google Patents: 2011.
56. Formela, K.; Maslanka, M., Method for producing rubber powder modified asphalt and product of continuous asphalt modification. Google Patents: 2012.
57. Wang, S.; Wang, Q.; Wu, X.; Zhang, Y., Asphalt modified by thermoplastic elastomer based on recycled rubber. *Construction and Building Materials* **2015**, *93*, 678-684.
58. Ma, T.; Zhao, Y.; Huang, X.; Zhang, Y., Characteristics of desulfurized rubber asphalt and mixture. *KSCE Journal of Civil Engineering* **2016**, *20* (4), 1347-1355.
59. Navarro, F. J.; Partal, P.; Martínez-Boza, F.; Gallegos, C., Thermo-rheological behaviour and storage stability of ground tire rubber-modified bitumens. *Fuel* **2004**, *83* (14), 2041-2049.
60. Martin, J.-V., Modified asphalt binder material using crosslinked crumb rubber and methods of manufacturing the modified asphalt binder. Google Patents: 2008.
61. Partanen, J. E.; Ellis, S. W., Incorporation of heat-treated recycled tire rubber in asphalt compositions. Google Patents: 2010.
62. Zhigang, Y.; Yuzhen, Z.; Xianming, K., Modification of bitumen with desulfurized crumb rubber in the present of reactive additives. *Journal of Wuhan University of Technology--Materials Science Edition* **2005**, *20* (1), 95-97.
63. Read, J.; Whiteoak, D., *The shell bitumen handbook*. Thomas Telford: 2003.
64. Airey, G. Rheological characteristics of polymer modified and aged bitumens. University of Nottingham, 1997.
65. Krebs, R. D.; Walker, R. D., *Highway materials*. McGraw-Hill New York: 1971; Vol. 332.
66. Rahman, M. Characterisation of dry process crumb rubber modified asphalt mixtures. University of Nottingham, 2004.

67. ASTM, D., Standard test method for penetration of bituminous materials. *Annual Book of ASTM Standards USA* **1992**.
68. Rhyner, C. R.; Schwartz, L. J.; Wenger, R. B.; Kohrell, M. G., *Waste management and resource recovery*. CRC Press: 1995.
69. Williams, P. T., *Waste treatment and disposal*. John Wiley & Sons: 2005.
70. Cong, P.; Xun, P.; Xing, M.; Chen, S., Investigation of asphalt binder containing various crumb rubbers and asphalts. *Construction and Building Materials* **2013**, *40*, 632-641.
71. Rodríguez-Alloza, A. M.; Gallego, J.; Perez, I., Study of the effect of four warm mix asphalt additives on bitumen modified with 15% crumb rubber. *Construction and building materials* **2013**, *43*, 300-308.
72. Kalantar, Z. N.; Karim, M. R.; Mahrez, A., A review of using waste and virgin polymer in pavement. *Construction and Building Materials* **2012**, *33*, 55-62.
73. Noferini, L.; Simone, A.; Sangiorgi, C.; Mazzotta, F., Investigation on performances of asphalt mixtures made with Reclaimed Asphalt Pavement: Effects of interaction between virgin and RAP bitumen. *International Journal of Pavement Research and Technology* **2017**, *10* (4), 322-332.
74. Oliviero Rossi, C.; Caputo, P.; Loise, V.; Miriello, D.; Teltayev, B.; Angelico, R., Role of a food grade additive in the high temperature performance of modified bitumens. *Colloids and Surfaces A: Physicochemical and Engineering Aspects* **2017**.
75. Sengoz, B.; Isikyakar, G., Evaluation of the properties and microstructure of SBS and EVA polymer modified bitumen. *Construction and Building Materials* **2008**, *22* (9), 1897-1905.
76. Chen, J.-S.; Liao, M.-C.; Shiah, M.-S., Asphalt modified by styrene-butadiene-styrene triblock copolymer: Morphology and model. *Journal of materials in civil engineering* **2002**, *14* (3), 224-229.

77. Hernández-Olivares, F.; Witoszek-Schultz, B.; Alonso-Fernández, M.; Benito-Moro, C., Rubber-modified hot-mix asphalt pavement by dry process. *International Journal of Pavement Engineering* **2009**, *10* (4), 277-288.
78. Cao, W., Study on properties of recycled tire rubber modified asphalt mixtures using dry process. *Construction and Building Materials* **2007**, *21* (5), 1011-1015.
79. Alboudwarej, H.; Akbarzadeh, K.; Beck, J.; Svrcek, W. Y.; Yarranton, H. W., Regular solution model for asphaltene precipitation from bitumens and solvents. *AICHE Journal* **2003**, *49* (11), 2948-2956.
80. Liang, Z.-Z., Bituminous compositions prepared with process treated vulcanized rubbers. Google Patents: 1999.
81. Planche, J.-P.; Lacour, C., Process for the preparation of bitumen-polymer compositions containing a crosslinked elastomer and a functionalized olefinic polymer. Google Patents: 2000.
82. Hendriks, H. E. J.; Steernberg, K.; Terlouw, T.; Vonk, W. C., Bitumen compositions and a process for their preparation. Google Patents: 1999.
83. Van Heystaeten, G. In *Rubber bitumens versus other modified bitumens*, Proceeding of the asphalt rubber 2000 conference, Lisbon, Portugal, 2000.
84. Bahia, H. U.; Davies, R., Effect of crumb rubber modifiers (CRM) on performance related properties of asphalt binders. *Asphalt paving technology* **1994**, *63*, 414-414.
85. Airey, G. D.; Rahman, M. M.; Collop, A. C., Absorption of bitumen into crumb rubber using the basket drainage method. *International Journal of Pavement Engineering* **2003**, *4* (2), 105-119.
86. Su, H.; Yang, J.; Ling, T.-C.; Ghataora, G. S.; Dirar, S., Properties of concrete prepared with waste tyre rubber particles of uniform and varying sizes. *Journal of Cleaner Production* **2015**, *91*, 288-296.
87. Sienkiewicz, M.; Kucinska-Lipka, J.; Janik, H.; Balas, A., Progress in used tyres management in the European Union: a review. *Waste Management* **2012**, *32* (10), 1742-1751.

88. Yu, H.; Leng, Z.; Zhou, Z.; Shih, K.; Xiao, F.; Gao, Z., Optimization of preparation procedure of liquid warm mix additive modified asphalt rubber. *Journal of Cleaner Production* **2017**, *141*, 336-345.
89. Padhan, R. K.; Gupta, A.; Badoni, R.; Bhatnagar, A., Poly (ethylene terephthalate) waste derived chemicals as an antistripping additive for bitumen—An environment friendly approach for disposal of environmentally hazardous material. *Polymer degradation and stability* **2013**, *98* (12), 2592-2601.
90. Zhang, F.; Hu, C., Physical and rheological properties of crumb rubber/styrene–butadiene–styrene compound modified asphalts. *Polymer Composites* **2015**.
91. Padhan, R. K.; Gupta, A.; Mohanta, C. S.; Badoni, R.; Bhatnagar, A., Performance improvement of a crumb rubber modified bitumen using polyoctenamer and cross linking agent. *Road Materials and Pavement Design* **2017**, *18* (4), 999-1006.
92. Xiang, L.; Cheng, J.; Que, G., Microstructure and performance of crumb rubber modified asphalt. *Construction and Building Materials* **2009**, *23* (12), 3586-3590.
93. Kim, H.; Lee, S.-J., Laboratory investigation of different standards of phase separation in crumb rubber modified asphalt binders. *Journal of Materials in Civil Engineering* **2012**, *25* (12), 1975-1978.
94. Bocoum, A.; Hosseinezhad, S.; Fini, E. H. In *Investigating effect of amine based additives on asphalt rubber rheological properties*, Taylor and Francis-Balkema, 2014.
95. Hefer, A. W.; Bhasin, A.; Little, D. N., Bitumen surface energy characterization using a contact angle approach. *Journal of Materials in Civil Engineering* **2006**, *18* (6), 759-767.
96. Association, E. E. T. R. M., European tyre and rubber industry—Statistics. 2014.
97. Kop, Y.; Genevois, M. E.; ULUKAN, H., End-of-Life Tyres Recovery Method Selection by Using a Two Step Methodology. *Journal of Multiple-Valued Logic & Soft Computing* **2014**, *22*.
98. Takallou, H.; Takallou, M. B., Recycling tires in rubber asphalt paving yields cost, disposal benefits. *Elastomerics* **1991**, *123* (7), 19-24.

99. Dantas Neto, S. A.; Farias, M. M. d.; Pais, J. C.; Pereira, P. A.; Santos, L. P. In *Behavior of asphalt-rubber hot mixes obtained with high crumb rubber contents*, Asphalt Rubber 2003 Conference, 2003; pp 147-166.
100. Way, G. In *The rubber pavements association, technical advisory board leading the way in asphalt rubber research*, Proceedings of the asphalt rubber 2003 conference, Brasilia, Brazil, 2003; pp 17-33.
101. Amirkhanian, S.; Franzese, W. In *Establishment of an Asphalt Rubber Technology Service (ARTS)*, Beneficial Use of Recycled Materials in Transportation Applications, 2001.
102. Xiao, F.; Amirkhanian, S.; Juang, C. H., Rutting resistance of rubberized asphalt concrete pavements containing reclaimed asphalt pavement mixtures. *Journal of Materials in Civil Engineering* **2007**, 19 (6), 475-483.
103. Lee, S.-J.; Amirkhanian, S.; Shatanawi, K., Effects of crumb rubber on aging of asphalt binders. *Proceedings of Asphalt Rubber* **2006**, 779-795.
104. Leung, F.; Tighe, S.; Macdonald, G.; Penton, S. In *Noise reducing asphalt pavements: a Canadian case study*, 10TH INTERNATIONAL CONFERENCE ON ASPHALT PAVEMENTS-AUGUST 12 TO 17, 2006, QUEBEC CITY, CANADA, 2006.
105. Antunes, I.; Way, G.; Sousa, J.; Kaloush, K. In *The successful world wide use of asphalt rubber*, 16th Convegno Nazionale SIIIV, Cosenza, 2006a. Antunes I., Giuliani F., Sousa JB, "Chemical Modification of Asphalt Rubber with Polyphosphoric Acid" Asphalt Rubber 2006 Conference, San Diego, 2006.
106. Pasquini, E. Advanced characterization of innovative environmentally friendly bituminous mixtures. PhD Thesis, Istituto di Idraulica e Infrastrutture Viarie, Università Politecnica delle Marche, Agraria, 2009.
107. Antunes, I.; Giuliani, F.; Sousa, J. B.; Way, G. In *Asphalt Rubber: Il Bitume Modificato con Polverino di Gomma di Pneumatico Riciclata*, L'Aquila: sn Varirei-V International Congress of Valorisation and Recycling of Industrial Waste, 2005.

108. Mull, M.; Stuart, K.; Yehia, A., Fracture resistance characterization of chemically modified crumb rubber asphalt pavement. *Journal of Materials Science* **2002**, *37* (3), 557-566.
109. Yadollahi, G.; Mollahosseini, H. S., Improving the performance of Crumb Rubber bitumen by means of Poly Phosphoric Acid (PPA) and Vestenamer additives. *Construction and Building Materials* **2011**, *25* (7), 3108-3116.
110. Cheng, G.; Shen, B.; Zhang, J., A study on the performance and storage stability of crumb rubber-modified asphalts. *Petroleum Science and Technology* **2011**, *29* (2), 192-200.
111. Mudgal, S. *PLASTIC WASTE IN THE ENVIRONMENT*; European Commission (DG Environment): France, 2011.
112. Europe, P., Plastics—the Facts 2014/2015 An analysis of European plastics production, demand and waste data. *Plastic Europe, Brussels Google Scholar* **2015**.
113. Santagata, F.; Antunes, I.; Canestrari, F.; Pasquini, E. In *Asphalt Rubber: Primeiros Resultados em Itália*, V Congresso Rodoviário Português “Estradas 2008, 2008.
114. Sousa, J., Experiences with use of reclaimed rubber in asphalt within Europe. *Birmingham: sn Rubber in Roads* **2005**.
115. Bertollo, S.; Bernucci, L. B.; Fernandes, J. L.; Leite, L. M. In *Mechanical properties of asphalt mixtures using recycled tire rubber produced in Brazil—A laboratory evaluation*, Proceedings of the TRB Annual Meeting, 2004.
116. Potgieter, C. In *BITUMEN RUBBER ASPHALT IN SOUTH AFRICA: CONVENTIONAL TECHNIQUES*, PROCEEDINGS OF THE 3RD EURASPHALT AND EUROBITUME CONGRESS HELD VIENNA, MAY 2004, 2004.
117. Kaloush, K. E.; Witczak, M.; Sotil, A.; Way, G. In *Laboratory evaluation of asphalt rubber mixtures using the dynamic modulus ( $E^*$ ) test*, 82th Transportation Research Board Annual Meeting, Washington DC, 2003.

118. Memon, G. M., Crumb rubber modified asphalt with improved settling properties. Google Patents: 1998.
119. Memon, M., Activated method for treating crumb rubber particles. Google Patents: 1999.
120. Shatanawi, K.; Biro, S.; Thodesen, C.; Amirkhanian, S., Effects of water activation of crumb rubber on the properties of crumb rubber-modified binders. *International Journal of Pavement Engineering* **2009**, *10* (4), 289-297.
121. Padhan, R. K.; Gupta, A. A.; Badoni, R. P.; Bhatnagar, A. K., Poly(ethylene terephthalate) waste derived chemicals as an antistripping additive for bitumen – An environment friendly approach for disposal of environmentally hazardous material. *Polymer Degradation and Stability* **2013**, *98* (12), 2592-2601.