

# REFERENCES

---

---

- [1] Basic Road Statistics of Government of India. Ministry of Road Transport and Highways, Transport Research Wing, New Delhi, 2004.
- [2] T.A. Pradyumna, A. Mittal, P.K. Jain, Characterization of Reclaimed Asphalt Pavement (RAP) for Use in Bituminous Road Construction. *Procedia, Social and Behavioural Sciences*, 104 (2013) 1149–1157. <https://doi.org/10.1016/j.sbspro.2013.11.211>.
- [3] ROADS, 2024. [www.ibef.org](http://www.ibef.org). India Brand Equity Foundation.
- [4] Subba, R. (2022). A Study on Surface Road Traffic Problems in the City of Guwahati North East India. *Pacific Business Review International*, 14(7).
- [5] S. Mukherjee, Statistical analysis of the road network of India. *Pramana*, 79 (2012) 483–491.
- [6] Y. Ahlawat, A. Bhardawaj, R. Bhardwaj, An experimental study on the stability and flow characteristics of mastic asphalt mix using cigarette butt additive. *Materials Today Proc*, 2022.
- [7] S.K. Sahdeo, G. Ransinchung, K.L. Rahul, S. Debbarma, Reclaimed Asphalt Pavement as a Substitution to Natural Coarse Aggregate for the Production of Sustainable Pervious Concrete Pavement Mixes. *Journal of Materials in Civil Engineering*, 33 (2021). [https://doi.org/10.1061/\(asce\)mt.1943-5533.0003555](https://doi.org/10.1061/(asce)mt.1943-5533.0003555).
- [8] A.K. Singh, J.P. Sahoo, Rutting prediction models for flexible pavement structures: A review of historical and recent developments. *Journal of Traffic and*

## References

- Transportation Engineering (English Edition), 8 (2021) 315–338. <https://doi.org/10.1016/j.jtte.2021.04.003>.
- [9] H. Akbulut, K. Aslantas, Finite element analysis of stress distribution on bituminous pavement and failure mechanism, *Materials and Design*, 26 (2005) 383–387. <https://doi.org/10.1016/j.matdes.2004.05.017>.
- [10] M. Thompson, R. Elliott, ILLI-PAVE-based Response Algorithms for Design of Conventional Flexible Pavements, *Transportation Research Record*, 1043 (1985) 50–57.
- [11] K.D. Hjelmstad, E. Taciroglu, Analysis and Implementation of Resilient Modulus Models for Granular Solids, *Journal of Engineering Mechanics*, 126 (2000) 821–830. [https://doi.org/10.1061/\(ASCE\)0733-9399\(2000\)126:8\(821\)](https://doi.org/10.1061/(ASCE)0733-9399(2000)126:8(821)).
- [12] M.S. Ranadive, A.B. Tapase, Parameter sensitive analysis of flexible pavement, *International Journal of Pavement Research and Technology*, 9 (2016) 466–472. <https://doi.org/10.1016/j.ijprt.2016.12.001>.
- [13] C.S. Desai, R. Whitenack, Review of Models and the Disturbed State Concept for Thermomechanical Analysis in Electronic Packaging, *Journal of Electronic Packaging* 123 (2001) 19–33. <https://doi.org/10.1115/1.1324675>.
- [14] Schofield, A. N., & Wroth, P. (1968). *Critical state soil mechanics* (Vol. 310). London: McGraw-hill.
- [15] Vermeer, P. A. (1982). A five-constant model unifying well-established concepts. *Constitutive relations for soils*, 175-197.
- [16] Y.H. Huang, *Pavement analysis and design*, Second, Pearson Prentice Hall, Upper Saddle River, NJ, 1993.

## References

- [17] J. Boussinesq, Application of potentials to the study of equilibrium and movement of elastic solids, 1885.
- [18] D.M. Burmister, L. Palmer, E. Barber, A.D. Casagrande, T. Middlebrooks, The Theory of Stress and Displacements in Layered Systems and Applications to the Design of Airport Runways, Highway Research Board Proceedings, 23 (1943) 126–148.
- [19] B. Chandrani Bodhinayake, B. Chandrani, A study on nonlinear behaviour of subgrades under cyclic loading for the development of a design chart for flexible pavements Recommended Citation, <http://ro.uow.edu.au/theses/868>.
- [20] IRC:37-2018, Guidelines for the design of flexible pavements (Fourth Revision), New Delhi, 2018.
- [21] C.S. Desai, R. Whitenack, Review of models and the disturbed state concept for thermomechanical analysis in electronic packaging, Journal of Electronic Packaging, Transactions of the ASME 123 (2001) 19–33. <https://doi.org/10.1115/1.1324675>.
- [22] G. Al-Khateeb, A. Shenoy, A Distinctive Fatigue Failure Criterion, Journal of the Association of Asphalt Paving Technologists, 73 (2004) 585–622.
- [23] S. Tangella, J. Craus, J.A. Deacon, C.L. Monismith, Summary report on fatigue response of asphalt mixtures, Transportation Research Board (1990).
- [24] A.A. Tayebali, G.M. Rowe, J.B. Sousa, Fatigue Response of Asphalt-aggregate Mixtures, Journal of the Association of Asphalt Paving Technologists, 61 (1992) 333–360.

## References

- [25] P. Pell, K. Cooper, The Effect of Testing and Mix Variables on the Fatigue Performance of Bituminous Materials, *Journal of the Association of Asphalt Paving Technologists* 44 (1975) 1–37.
- [26] G. Rowe, Performance of Asphalt Mixtures in the Trapezoidal Fatigue Test, *Asphalt Paving Technology* 62 (1993) 344–384.
- [27] K.A. Ghuzlan, S.H. Carpenter, Energy-derived, Damage-based Failure Criterion for Fatigue Testing, *Transportation Research Board*, 1723 (2000), 141–149.
- [28] A. Nega, H. Nikraz, C. Leek, B. Ghadimi, Evaluation and Validation of Characterization Methods for Fatigue Performance of Asphalt Mixes for Western Australia, *Advanced Material Research*, 723 (2013), 75–85. <https://doi.org/10.4028/www.scientific.net/AMR.723.75>.
- [29] L.S. Calvarano, R. Palamara, G. Leonardi, N. Moraci, 3D-FEM Analysis on Geogrid Reinforced Flexible Pavement Roads, *IOP Conference Series Earth and Environmental Science*, 95 (2017) 022024. <https://doi.org/10.1088/1755-1315/95/2/022024>.
- [30] Korkiala-Tantt, L.R. Laaksonen, J. Törnqvist, Effect of Spring and Overload to the Rutting of a Low-volume Road, *HVS-Nordic–Research, Finnra Reports* 22 (2003).
- [31] B.D. Pidwerbesky, *Fundamental Behaviour of Unbound Granular Pavements Subjected to Various Loading Conditions and Accelerated Trafficking*, Univ. of Canterbury, Christchurch, New Zealand, 1996.
- [32] P.H. Little, *The Design of Unsurfaced Roads Using Geosynthetics*, University of Nottingham, 1993.

## References

- [33] G. Arnold, D. Alabaster, B. Steven, Prediction of Pavement Performance from Repeat Load Tri-axial (RLT) Tests on Granular Materials, Transportation Research Board (2001) 1–120.
- [34] F.L. Roberts, P.S. Kandhal, E.R. Brown, D.-Y. Lee, T.W. Kennedy, Hot mix asphalt materials, mixture design and construction, Transportation Research Board (1996).
- [35] A. Graziani, F. Cardone, A. Virgili, Characterization of the three-dimensional linear viscoelastic behavior of asphalt concrete mixtures, Construction and Building Materials 105 (2016) 356–364. <https://doi.org/10.1016/j.conbuildmat.2015.12.094>.
- [36] R. Luo, H. Liu, Y. Zhang, Characterization of linear viscoelastic, nonlinear viscoelastic and damage stages of asphalt mixtures, Construction and Building Materials, 125 (2016) 72–80. <https://doi.org/10.1016/j.conbuildmat.2016.08.039>.
- [37] Y. Zhang, A.M. Asce, B. Birgisson, R.L. Lytton, F. Asce, Weak Form Equation-Based Finite-Element Modeling of Viscoelastic Asphalt Mixtures, Journal of Materials in Civil Engineering, 28(2), (2015). [https://doi.org/10.1061/\(ASCE\)MT.1943-5533](https://doi.org/10.1061/(ASCE)MT.1943-5533).
- [38] H. Di Benedetto, F. Olard, C. Sauzéat, B. Delaporte, Linear viscoelastic behaviour of bituminous materials: From binders to mixes, Road Materials and Pavement Design, 5 (2004) 163–202. <https://doi.org/10.1080/14680629.2004.9689992>.
- [39] G.D. Airey, B. Rahimzadeh, A.C. Collop, Viscoelastic linearity limits for bituminous materials, Materials and Structure, 36 (2003) 643–647. <https://doi.org/10.1007/BF02479495>.

## References

- [40] Radovskiy, B., Teltayev, B., Radovskiy, B., & Teltayev, B. (2018). Relaxation modulus and complex modulus. Viscoelastic properties of asphalts based on penetration and softening point, 41-72. [41] J.D. Ferry, The viscoelastic properties of polymers, Third, John Wiley & Sons, Moscow, 1980.
- [42] Tschoegl, N. W. (2012). The phenomenological theory of linear viscoelastic behavior: an introduction. Springer Science & Business Media.
- [43] Maxwell, J. C. (1867). IV. On the dynamical theory of gases. Philosophical transactions of the Royal Society of London, (157), 49-88.
- [44] E. Starovoitov, F.B.O. Naghiyev, Foundations of the theory of elasticity, plasticity, and viscoelasticity, CRC Press, 2012.
- [45] S. Adamczak, J. Bochnia, Estimating the Approximation Uncertainty for Digital Materials Subjected to Stress Relaxation Tests, Metrology and Measurement Systems 23 (2016) 545–553. <https://doi.org/10.1515/mms-2016-0048>.
- [46] L. Wardle, A Computer Program for the Analysis of Multiple Complex Circular Loads on Layered Anisotropic Media, 1977.
- [47] M. Kim, E. Tutumluer, Modeling nonlinear, stress-dependent pavement foundation behavior using a general-purpose finite element program, Pavement Mechanics and Performance 154 (2006) 29–36.
- [48] B. Saad, H. Mitri, H. Poorooshab, Three-Dimensional Dynamic Analysis of Flexible Conventional Pavement Foundation, Journal of Transportation Engineering 131 (2005) 460–469. [https://doi.org/10.1061/\(ASCE\)0733-947X\(2005\)131:6\(460\)](https://doi.org/10.1061/(ASCE)0733-947X(2005)131:6(460)).

## References

- [49] Witczak, M. W., & Uzan, J. (1988). The universal airport pavement design system, Report I of IV: Granular material characterization. University of Maryland, College Park, MD.
- [50] H.S. Yu, M.Z. Hossain, Lower bound shakedown analysis of layered pavements using discontinuous stress fields, *Computer Methods in Applied Mechanics and Engineering* 167 (1998) 209–222. [https://doi.org/10.1016/S0045-7825\(98\)00120-0](https://doi.org/10.1016/S0045-7825(98)00120-0).
- [51] Foster, C. R., & Ahlvin, R. G. (1958). Development of multiple-wheel CBR design criteria. *Journal of the Soil Mechanics and Foundations Division*, 84(2), 1647-1.
- [52] L. Wardle, Program CIRCLY: A Computer Program for the Analysis of Multiple Complex Circular Loads on Layered Anisotropic Media, (1977).
- [53] R.G. Hicks, C.L. Monismith, Factors Influencing the Resilient Response of Granular Materials, *Highway Research Record* 345 (1971) 15–31.
- [54] S.B. Ahmed, H.G. Larew, Study of the Repeated Load Strength Moduli of Soils, in: *International Conference on the Structural Design of Asphalt Pavements*, 1962.
- [55] H.B. Seed, C. Chan, C. Lee, Resilience Characteristics of Subgrade Soils and their Relation to Fatigue Failures in Asphalt Pavements, in: *International Conference on the Structural Design of Asphalt Pavements. Supplement*, 1962.
- [56] E. Selig, Tensile Zone Effects on Performance of Layered Systems, *Geotechnique* 37 (1987) 247–254.

## References

- [57] S. Brown, P. Pell, Repeated Loading of Bituminous Materials, in: Proceedings of the Second International Conference on Asphalt Pavements for Southern Africa, 1974.
- [58] J. Boyce, S. Brown, P. Pell, The resilient behaviour of a granular material under repeated loading, in: Australian Road Research Board, 1976.
- [59] Harichandran, R. S., Yeh, M. S., & Baladi, G. Y. (1990). MICH-PAVE: A nonlinear finite element program for analysis of flexible pavements. Transportation research record, (1286).
- [60] H.B. Seed, C. Chan, C. Lee, Resilience Characteristics of Subgrade Soils and their Relation to Fatigue Failures in Asphalt Pavements, in: International Conference on the Structural Design of Asphalt Pavements. Supplement, 1962.
- [61] R.G. Hicks, C.L. Monismith, Factors Influencing the Resilient Response of Granular Materials, Highway Research Record 345 (1971) 15–31.
- [62] J. Uzan, Characterization of Granular Material, Transportation Research Record 1022 (1985) 52–59.
- [63] P. V. Lade, R.B. Nelson, Modelling the elastic behaviour of granular materials, International Journal for Numerical and Analytical Methods in Geomechanics 11 (1987) 521–542. <https://doi.org/10.1002/nag.1610110507>.
- [64] M.R. Thompson, Q.L. Robnett, Resilient Properties of Subgrade Soils, Transportation Engineering Journal of ASCE 105 (1979) 71–89. <https://doi.org/10.1061/TPEJAN.0000772>.

## References

- [65] M. Fahey, J.P. Carter, A finite element study of the pressuremeter test in sand using a nonlinear elastic plastic model, *Canadian Geotechnical Journal* 30 (1993) 348–362. <https://doi.org/10.1139/t93-029>.
- [66] A. González, M. Saleh, A. Ali, Evaluating Nonlinear Elastic Models for Unbound Granular Materials in Accelerated Testing Facility, *Transportation Research Record: Journal of the Transportation Research Board* 1990 (2007) 141–149. <https://doi.org/10.3141/1990-16>.
- [67] J. Lee, J. Kim, B. Kang, Normalized Resilient Modulus Model for Subbase and Subgrade Based on Stress-Dependent Modulus Degradation, *Journal of Transportation Engineering* 135 (2009) 600–610. [https://doi.org/10.1061/\(ASCE\)TE.1943-5436.0000019](https://doi.org/10.1061/(ASCE)TE.1943-5436.0000019).
- [68] M. Attia, M. Abdelrahman, Effect of State of Stress on the Resilient Modulus of Base Layer Containing Reclaimed Asphalt Pavement, *Road Materials and Pavement Design* 12 (2011) 79–97. <https://doi.org/10.1080/14680629.2011.9690353>.
- [69] A.A. Araya, M. Huurman, A.A.A. Molenaar, L.J.M. Houben, Investigation of the resilient behavior of granular base materials with simple test apparatus, *Materials and Structures* 45 (2012) 695–705. <https://doi.org/10.1617/s11527-011-9790-1>.
- [70] A.A. Araya, M. Huurman, L.J. Houben, A.A. Molenaar, Characterizing Mechanical Behavior of Unbound Granular Materials for Pavements, *Transportation Research Board* (2011).
- [71] D. Mishra, E. Tutumluer, Aggregate Physical Properties Affecting Modulus and Deformation Characteristics of Unsurfaced Pavements, *Journal of Materials in*

## References

- Civil Engineering 24 (2012) 1144–1152. [https://doi.org/10.1061/\(ASCE\)MT.1943-5533.0000498](https://doi.org/10.1061/(ASCE)MT.1943-5533.0000498).
- [72] A. Singh, A. Behl, A. Dhamaniya, Feasibility Study on the Use of Multilayer Plastic (MLP) Waste in the Construction of Asphalt Pavements, International Conference on Trends and Recent Advances in Civil Engineering: 2024: pp. 207–226. [https://doi.org/10.1007/978-981-99-2905-4\\_16](https://doi.org/10.1007/978-981-99-2905-4_16).
- [73] R.D. Barksdale, Laboratory Evaluation of Rutting in Base Course Materials, in: 3rd International Conference on the Structural Design of Asphalt Pavements, London, 1972: pp. 161–174.
- [74] G.T.H. Sweere, Unbound Granular Bases for Roads, Delft University of Technology, 1990.
- [75] J.L. Paute, P. Hornych, J.P. Benaben, Repeated load triaxial testing of granular materials in the French network of road and bridge laboratories, in: European Symposium on Flexible Pavements, Rotterdam, 1996: pp. 53–64.
- [76] H. Wolff, A.T. Visser, Incorporating elasto-plasticity in granular layer pavement design, Proceedings of the Institution of Civil Engineers - Transport 105 (1994) 259–272. <https://doi.org/10.1680/itrans.1994.27137>.
- [77] M. Huurman, Permanent Deformation in Concrete Block Pavements, Delft University of Technology, 1997.
- [78] M.J. Williamson, Finite element analysis of hot-mix asphalt layer interface bonding, Kansas State University, 2015.

## References

- [79] Y.-R. Kim, D.N. Little, Linear Viscoelastic Analysis of Asphalt Mastics, *Journal of Materials in Civil Engineering* 16 (2004) 122–132. [https://doi.org/10.1061/\(ASCE\)0899-1561\(2004\)16:2\(122\)](https://doi.org/10.1061/(ASCE)0899-1561(2004)16:2(122)).
- [80] Cheung, C. Y., & Cebon, D. (1997). Experimental study of pure bitumens in tension, compression, and shear. *Journal of Rheology*, 41(1), 45-74. <https://doi.org/10.1122/1.550858>.
- [81] Y.T. Chou, H. Larew, Stresses and displacements in viscoelastic pavement systems under a moving load, *Transportation Research Record* (1969) 25–40.
- [82] J.F. Elliott, F. Moavenzadeh, Analysis of stresses and displacements in three-layer viscoelastic systems, *Highway Research Record* (1971).
- [83] Y.H. Huang, Stresses and strains in viscoelastic multilayer systems subjected to moving loads, *Highway Research Record* (1973) 60–71.
- [84] S.W. Park, Y.R. Kim, Analysis of Layered Viscoelastic System with Transient Temperatures, *Journal of Engineering Mechanics* 124 (1998) 223–231. [https://doi.org/10.1061/\(asce\)0733-9399\(1998\)124:2\(223\)](https://doi.org/10.1061/(asce)0733-9399(1998)124:2(223)).
- [85] R.A. Schapery, A method of viscoelastic stress analysis using elastic solutions, *Journal of Franklin Institute* 279 (1965) 268–289. [https://doi.org/10.1016/0016-0032\(65\)90339-X](https://doi.org/10.1016/0016-0032(65)90339-X).
- [86] P. Mackiewicz, A. Szydło, Viscoelastic parameters of asphalt mixtures identified in static and dynamic tests, *Materials* 12 (2019). <https://doi.org/10.3390/ma12132084>.

## References

- [87] M.A. Elseifi, I.L. Al-Qadi, P.J. Yoo, Viscoelastic Modeling and Field Validation of Flexible Pavements, *Journal of Engineering Mechanics* 132 (2006) 172–178. [https://doi.org/10.1061/\(ASCE\)0733-9399\(2006\)132:2\(172\)](https://doi.org/10.1061/(ASCE)0733-9399(2006)132:2(172)).
- [88] L. Zhang, X. Zhang, X. Liu, Y. Luo, Viscoelastic Model of Asphalt Mixtures under Repeated Load, *Journal of Materials in Civil Engineering* 27 (2015) 04015007. [https://doi.org/10.1061/\(asce\)mt.1943-5533.0001256](https://doi.org/10.1061/(asce)mt.1943-5533.0001256).
- [89] M.W. Witczak, T.K. Pellinen, M.M. El-Basyouny, Pursuit of the simple performance test for asphalt mixture rutting, in: *Asphalt Paving Technology 2002*, Association of Asphalt Paving Technologists (AAPT), Colorado, 2002: pp. 767–778.
- [90] Jeong, M. (2005). Comparison of creep compliance master curve models for hot mix asphalt (Doctoral dissertation, Virginia Tech).
- [91] D.N. Richardson, S.M. Lusher, Determination of Creep Compliance and Tensile Strength of Hot-Mix Asphalt for Wearing Courses in Missouri, 2008.
- [92] AASHTO: T 322-03, Determining the Creep Compliance and Strength of Hot-Mix Asphalt (HMA) Using the Indirect Tensile Test Device, American Association of State Highway and Transportation Officials, Washington D.C., USA (2005) 1–11.
- [93] Shell International Petroleum Company, Shell pavement design manual: Asphalt pavements and overlays for road traffic, 1978.
- [94] Thickness Design-Asphalt pavements for highways and streets, Asphalt Institute, 9th Ed, Lexington, KY, 1999.

## References

- [95] H.L. Theyse, M. De Beer, F.C. Rust, Overview of South African Mechanistic Pavement Design Method, *Transportation Research Record: Journal of the Transportation Research Board* 1539 (1996) 6–17. <https://doi.org/10.1177/0361198196153900102>.
- [96] A. Gupta, A. Kumar, Comparative Structural Analysis of Flexible Pavements Using Finite Element Method, *International Journal on Pavement Engineering & Asphalt Technology* 15 (2015) 11–19. <https://doi.org/10.2478/ijpeat-2013-0005>.
- [97] M.A. Elseifi, I.L. Al-Qadi, P.J. Yoo, Viscoelastic Modeling and Field Validation of Flexible Pavements, *Journal of Engineering Mechanics* 132 (2006) 172–178. [https://doi.org/10.1061/\(ASCE\)0733-9399\(2006\)132:2\(172\)](https://doi.org/10.1061/(ASCE)0733-9399(2006)132:2(172)).
- [98] I.L. Al-Qadi, M. Elseifi, P.J. Yoo, In-situ validation of mechanistic pavement finite element modeling, in: *International Conference on Accelerated Pavement Testing*, Minneapolis, Minnesota, USA, 2004.
- [99] S.W. Park, R.A. Schapery, Methods of interconversion between linear viscoelastic material functions. Part I—a numerical method based on Prony series, *International Journal of Solids and Structures* 36 (1999) 1653–1675. [https://doi.org/10.1016/S0020-7683\(98\)00055-9](https://doi.org/10.1016/S0020-7683(98)00055-9).
- [100] L. Zhang, X. Zhang, C. Hu, Deformation Prediction of Asphalt Mixtures under Repeated Load Base on Viscoelastic Mechanical Model, in: *Paving Materials and Pavement Analysis*, American Society of Civil Engineers, Reston, VA, 2010: pp. 116–125. [https://doi.org/10.1061/41104\(377\)15](https://doi.org/10.1061/41104(377)15).
- [101] Y. Zhao, Y. Ni, W. Zeng, A consistent approach for characterising asphalt concrete based on generalised Maxwell or Kelvin model, *Road Materials and*

## References

- Pavement Design 15 (2014) 674–690. <https://doi.org/10.1080/14680629.2014.889030>.
- [102] N.W. Tschoegl, The phenomenological theory of linear viscoelastic behavior: an introduction, Springer, Science & Business Media, 2012.
- [103] S.K. Srirangam, Numerical simulation of tyre pavement interaction, 2013.
- [104] H. Ozer, I.L. Al-Qadi, C.A. Duarte, A three-dimensional generalised finite element analysis for the near-surface cracking problem in flexible pavements, *International Journal of Pavement Engineering* 12 (2011) 407–419. <https://doi.org/10.1080/10298436.2011.575139>.
- [105] M. Saltan, H. Sezgin, Hybrid neural network and finite element modeling of sub-base layer material properties in flexible pavements, *Materials and Design* 28 (2007) 1725–1730. <https://doi.org/10.1016/j.matdes.2006.02.017>.
- [106] M.A. Mashrei, R. Seracino, M.S. Rahman, Application of artificial neural networks to predict the bond strength of FRP-to-concrete joints, *Construction and Building Materials* 40 (2013) 812–821. <https://doi.org/10.1016/j.conbuildmat.2012.11.109>.
- [107] Y. Liu, Z. You, Y. Zhao, Three-dimensional discrete element modeling of asphalt concrete: Size effects of elements, *Construction and Building Materials* 37 (2012) 775–782. <https://doi.org/10.1016/j.conbuildmat.2012.08.007>.
- [108] J. Chen, T. Pan, X. Huang, Numerical investigation into the stiffness anisotropy of asphalt concrete from a microstructural perspective, *Construction and Building Materials* 25 (2011) 3059–3065. <https://doi.org/10.1016/j.conbuildmat.2011.01.002>.

## References

- [109] M. Saltan, H. Sezgin, Hybrid neural network and finite element modeling of sub-base layer material properties in flexible pavements, *Materials and Design* 28 (2007) 1725–1730. <https://doi.org/10.1016/j.matdes.2006.02.017>.
- [110] Y. Liu, Z. You, Y. Zhao, Three-dimensional discrete element modeling of asphalt concrete: Size effects of elements, *Construction and Building Materials* 37 (2012) 775–782. <https://doi.org/10.1016/j.conbuildmat.2012.08.007>.
- [111] D. De Jong, M. Peatz, A. Korswagen, Computer program BISAR, layered systems under normal and tangential loads, Amsterdam, 1973.
- [112] M. Kim, Three-dimensional Finite Element Analysis of Flexible Pavements Considering Nonlinear Pavement Foundation Behavior, University of Illinois, 2007.
- [113] L. Wardle, A Computer Program for the Analysis of Multiple Complex Circular Loads on Layered Anisotropic Media, (1977).
- [114] M. Hadi, M. Symons, Computing Stresses in Road Pavements using CIRCLY, MSC/NASTRAN and STRAND6, *Australian Civil Engineering Transactions* 38 (1996) 89–93.
- [115] P. Ullidtz, Analytical Tools for Design of Flexible pavements, in: 9th International Conference on Asphalt Pavements, Copenhagen, 2002.
- [116] L. Wardle, G. Youdale, B. Rodway, Current Issues for Mechanistic Pavement Design, in: 21st ARRB and 11th REAAA Conference, ARRB Transport Research, Cairns, Australia, 2003.

## References

- [117] E. Tutumluer, D.N. Little, S.H. Kim, Validated Model for Predicting Field Performance of Aggregate Base Courses, Transportation Research Board 1837 (2003) 41–49.
- [118] M. Kim, E. Tutumluer, J. Kwon, Nonlinear Pavement Foundation Modeling for Three-Dimensional Finite-Element Analysis of Flexible Pavements, International Journal of Geomechanics 9 (2009) 195–208. [https://doi.org/10.1061/\(ASCE\)1532-3641\(2009\)9:5\(195\)](https://doi.org/10.1061/(ASCE)1532-3641(2009)9:5(195)).
- [119] D.S. Gedafa, Comparison of Flexible Pavement Performance Using Kenlayer and HDM-4, in: Transportation Scholars Conference, Ames, Iowa, U.S.A, 2006.
- [120] B. Ghadimi, H. Asadi, H. Nikraz, C. Leek, Effects of Geometrical Parameters on Numerical Modeling of Pavement Granular Material, in: Airfield and Highway Pavement 2013, American Society of Civil Engineers, Reston, VA, 2013: pp. 1291–1303. <https://doi.org/10.1061/9780784413005.109>.
- [121] Dassault Systemes Simulia Corp., (2010).
- [122] B. Ghadimi, H. Nikraz, C. Leek, A. Nega, A Comparison between Effects of Linear and Non-Linear Mechanistic Behaviour of Materials on the Layered Flexible Pavement Response, Advanced Material Research 723 (2013) 12–21. <https://doi.org/10.4028/www.scientific.net/AMR.723.12>.
- [123] Yu, H. S. (2007). Plasticity and geotechnics (Vol. 13). Springer Science & Business Media.
- [124] Y.H. Cho, B.F. McCullough, J. Weissmann, Considerations on Finite element Method Application in Pavement Structural Analysis, Transportation Research Board 1539 (1996) 96–101.

## References

- [125] Duncan, J. M., Monismith, C. L., & Wilson, E. L. (1968). Finite element analysis of pavements. *Highway Research Record*, 228(18-33), 157.
- [126] L.A. Myers, R. Roque, B. Birgisson, Use of Two-dimensional Finite Element Analysis to Represent Bending Response of Asphalt Pavement Structures, *International Journal of Pavement Engineering* 2 (2001) 201–214. <https://doi.org/10.1080/10298430108901727>.
- [127] Á. Holanda, E.P. Junior, T. Araújo, Finite element modeling of flexible pavements, (2006). <http://repositorio.ufc.br:8080/ri/handle/123456789/1380>.
- [128] M. Kim, Three-dimensional Finite Element Analysis of Flexible Pavements Considering Nonlinear Pavement Foundation Behavior, University of Illinois, 2007.
- [129] B. Ghadimi, H. Asadi, H. Nikraz, C. Leek, Effects of Geometrical Parameters on Numerical Modeling of Pavement Granular Material, in: *Airfield and Highway Pavement Conference: Sustainable and Efficient Pavements*, Los Angeles, 2013.
- [130] W. Uddin, Z. Pan, Finite-Element Analysis of Flexible Pavements with Discontinuities, *Transportation Congress 1 & 2* (1995) 410–423.
- [131] J. Mallela, K. George, Three-dimensional Dynamic Response Model for Rigid Pavements, *Transportation Research Board* 1448 (1994) 92–99.
- [132] B. Ghadimi, H. Nikraz, C. Leek, Effects of Asphalt Layer Thickness on the Dynamic Analysis of Flexible Pavement: A Numerical Study, in: *15th AAPA International Flexible Pavements Conference*, Brisbane, Australia, 2013.
- [133] J. Baek, H. Ozer, H. Wang, I.L. Al-Qadi, Effects of Interface Conditions on Reflective Cracking Development in Hot-Mix Asphalt Overlays, *Road Materials*

## References

- and Pavement Design 11 (2010) 307–334. <https://doi.org/10.1080/14680629.2010.9690278>.
- [134] H. Ozer, I.L. Al-Qadi, H. Wang, Z. Leng, Characterisation of interface bonding between hot-mix asphalt overlay and concrete pavements: modelling and in-situ response to accelerated loading, *International Journal of Pavement Engineering* 13 (2012) 181–196. <https://doi.org/10.1080/10298436.2011.596935>.
- [135] J.L. Pan, A.R. Selby, Simulation of dynamic compaction of loose granular soils, *Advances in Engineering Software* 33 (2002) 631–640. [https://doi.org/10.1016/S0965-9978\(02\)00067-4](https://doi.org/10.1016/S0965-9978(02)00067-4).
- [136] R. Motamed, K. Itoh, S. Hirose, A. Takahashi, O. Kusakabe, Evaluation of wave barriers on ground vibration reduction through numerical modeling in ABAQUS, in: *Proceedings of the SIMULIA Customer Conference, 2009*: pp. 402–441.
- [137] G. Kouroussis, O. Verlinden, C. Conti, On the interest of integrating vehicle dynamics for the ground propagation of vibrations: the case of urban railway traffic, *Vehicle System Dynamics* 48 (2010) 1553–1571. <https://doi.org/10.1080/00423111003602392>.
- [138] G. Kouroussis, O. Verlinden, C. Conti, Ground propagation of vibrations from railway vehicles using a finite/infinite-element model of the soil, *Proc Institution of the Mechanical Engineers, Part F: Journal of Rail and Rapid Transit* 223 (2009) 405–413. <https://doi.org/10.1243/09544097JRRT253>.
- [139] K. Hibbit, Sorenson, ABAQUS User's Manual, (2010).
- [140] J.M. Duncan, C.L. Monismith, E.L. Wilson, Finite Element Analyses of Pavements, *Highway Research Board* 38 (1968) 18–33.

## References

- [141] L. Raad, J.L. Figueroa, Load Response of Transportation Support Systems, *Transportation Engineering Journal of ASCE* 106 (1980) 111–128. <https://doi.org/10.1061/TPEJAN.0000830>.
- [142] R. Harichandran, M. Yeh, G. Baladi, A Nonlinear Finite Element Program for Analysis of Flexible Pavements, *Transportation Research Record* 1286 (1990) 123–131.
- [143] E. Tutumluer, D.N. Little, S.H. Kim, Validated Model for Predicting Field Performance of Aggregate Base Courses, *Transportation Research Board* 1837 (2003) 41–49.
- [144] Y.R. Kim, H.J. Lee, D.N. Little, Fatigue Characterization of Asphalt Concrete Using Viscoelasticity and Continuum Damage Theory (with Discussion), *Journal of the Association of Asphalt Paving Technologists* 66 (1997) 520–569.
- [145] T. Habiballah, C. Chazallon, An elastoplastic model based on the shakedown concept for flexible pavements unbound granular materials, *International Journal of Numerical and Analytical Methods, Geomechanics* 29(6), (2005) 577–596. <https://doi.org/10.1002/nag.426>.
- [146] C. Chazallon, G. Koval, S. Mouhoubi, A two-mechanism elastoplastic model for shakedown of unbound granular materials and DEM simulations, *International Journal of Numerical and Analytical Methods, Geomechanics* 36 (2012) 1847–1868. <https://doi.org/10.1002/nag.1070>.
- [147] C. Chazallon, P. Hornych, S. Mouhoubi, Elastoplastic Model for the Long-Term Behavior Modeling of Unbound Granular Materials in Flexible Pavements, *International Journal of Geomechanics* 6 (2006) 279–289. [https://doi.org/10.1061/\(ASCE\)1532-3641\(2006\)6:4\(279\)](https://doi.org/10.1061/(ASCE)1532-3641(2006)6:4(279)).

## References

- [148] C. Chazallon, F. Allou, P. Hornych, S. Mouhoubi, Finite elements modelling of the long-term behaviour of a full-scale flexible pavement with the shakedown theory, *International Journal of Numerical and Analytical Methods, Geomechanics* 33 (2009) 45–70. <https://doi.org/10.1002/nag.702>.
- [149] F. Allou, C. Petit, C. Chazallon, P. Hornych, Influence of The Macroscopic Cohesion on the 3D FE Modeling of A Flexible Pavement Rut Depth, in: *Bearing Capacity of Roads, Railways and Airfields. 8th International Conference, 2009*.
- [150] F. Allou, C. Chazallon, P. Hornych, A numerical model for flexible pavements rut depth evolution with time, *International Journal of Numerical and Analytical Methods, Geomechanics* 31 (2007) 1–22. <https://doi.org/10.1002/nag.521>.
- [151] S. Zaghoul, T. White, Use of a Three-dimensional, Dynamic Finite Element Program for Analysis of Flexible Pavement, *Transportation Research Record* 1388 (1993) 60–69.
- [152] C.S. Desai, Unified DSC Constitutive Model for Pavement Materials with Numerical Implementation, *International Journal of Geomechanics* 7 (2007) 83–101. [https://doi.org/10.1061/\(ASCE\)1532-3641\(2007\)7:2\(83\)](https://doi.org/10.1061/(ASCE)1532-3641(2007)7:2(83)).
- [153] N.D. Beskou, D.D. Theodorakopoulos, Dynamic effects of moving loads on road pavements: A review, *Soil Dynamics and Earthquake Engineering* 31 (2011) 547–567. <https://doi.org/10.1016/j.soildyn.2010.11.002>.
- [154] G. Pan, H. Okada, S.N. Atluri, Nonlinear transient dynamic analysis of soil-pavement interaction under moving load: a coupled BEM-FEM approach, *Engineering Analysis with Boundary Elements* 14 (1994) 99–112. [https://doi.org/10.1016/0955-7997\(94\)90085-X](https://doi.org/10.1016/0955-7997(94)90085-X).

## References

- [155] W. Perloff, F. Moavenzadeh, Deflection of Viscoelastic Medium Due to a Moving Load, in: International Conference on Structural Design of Asphalt Pavements, 1967: pp. 212–222.
- [156] J. Shook, F. Finn, M. Witzczak, C. Monismith, Thickness Design of Asphalt Pavements—The Asphalt Institute Method, in: 5th International Conference on the Structural Design of Asphalt Pavements, Delft Univ. of Technology, Delft, 1982: pp. 17–44.
- [157] J.M. Duncan, C.-Y. Chang, Nonlinear Analysis of Stress and Strain in Soils, *Journal of the Soil Mechanics and Foundations Division* 96 (1970) 1629–1653. [https://doi.org/ 10.1061/JSFEAQ.0001458](https://doi.org/10.1061/JSFEAQ.0001458).
- [158] H. Fang, J.E. Haddock, T.D. White, A.J. Hand, On the characterization of flexible pavement rutting using creep model-based finite element analysis, *Finite Elements in Analysis and Design* 41 (2004) 49–73. <https://doi.org/10.1016/j.finel.2004.03.002>.
- [159] C. Vale, Influence of vertical load models on flexible pavement response—an investigation, *International Journal of Pavement Engineering* 9 (2008) 247–255. [https:// doi.org/ 10.1080/10298430701444977](https://doi.org/10.1080/10298430701444977).
- [160] M.N.S. Hadi, B.C. Bodhinayake, Non-linear finite element analysis of flexible pavements, in: *Advances in Engineering Software*, Elsevier Ltd, 2003: pp. 657–662. [https://doi.org/ 10.1016/S0965-9978\(03\)00109-1](https://doi.org/10.1016/S0965-9978(03)00109-1).
- [161] X. Jiang, C. Zeng, X. Gao, Z. Liu, Y. Qiu, 3D FEM analysis of flexible base asphalt pavement structure under non-uniform tyre contact pressure, *International Journal of Pavement Engineering* 20 (2019) 999–1011. <https://doi.org/10.1080/10298436.2017.1380803>.

## References

- [162] Dwyer-Joyce, R. S., & Drinkwater, B. W. (2003). In situ measurement of contact area and pressure distribution in machine elements. *Tribology letters*, 14(1), 41-52.
- [163] Y. Oubahdou, E.R. Wallace, P. Reynaud, B. Picoux, J. Dopeux, C. Petit, D. Nélias, Effect of the tire – Pavement contact at the surface layer when the tire is tilted in bend, *Construction and Building Materials* 305 (2021). <https://doi.org/10.1016/j.conbuildmat.2021.124765>.
- [164] De Beer, M., Fisher, C., & Jooste, F. J. (2002, August). Evaluation of non-uniform tyre contact stresses on thin asphalt pavements. In *Ninth international conference on asphalt pavements* (Vol. 5, pp. 19-22).
- [165] Siddharthan, R. V., Krishnamenon, N., El-Mously, M., & Sebaaly, P. E. (2002). Investigation of tire contact stress distributions on pavement response. *Journal of Transportation Engineering*, 128(2), 136-144. <https://doi.org/10.1061/ASCE0733-947X2002128:2136>.
- [166] J. Phromjan, C. Suvanjumrat, A Suitable Constitutive Model for Solid Tire Analysis under Quasi-Static Loads using Finite Element Method, *Engineering Journal* 22 (2018) 141–155. <https://doi.org/10.4186/ej.2018.22.2.141>.
- [167] J. Phromjan, C. Suvanjumrat, A suitable constitutive model for solid tire analysis under quasi-static loads using finite element method, *Engineering Journal* 22 (2018) 141–155. <https://doi.org/10.4186/ej.2018.22.2.141>.
- [168] W. Premarathna, J. Jayasinghe, K. Wijesundara, R. Ranatunga, C. Senanayake, Performance Comparison of Solid Tires and Non-Pneumatic Tires Using Finite Element Method: Application to Military Vehicles (2020).

## References

- [169] Y. Li, W.Y. Liu, S. Frimpong, Effect of ambient temperature on stress, deformation and temperature of dump truck tire, *Engineering Failure Analysis* 23 (2012) 55–62. <https://doi.org/10.1016/j.engfailanal.2012.02.004>.
- [170] X. Yan, Non-linear three-dimensional finite element modeling of radial tires, *Mathematics and Computers in Simulation* 58 (2001) 51–70. [https://doi.org/10.1016/S0378-4754\(01\)00320-2](https://doi.org/10.1016/S0378-4754(01)00320-2).
- [171] C.F. Zorowski, Mathematical Prediction of Dynamic Tire Behavior, *Tire Science and Technology* 1 (1973) 99–117. <https://doi.org/10.2346/1.2167157>.
- [172] R.A. Ridha, Analysis for Tire Mold Design, *Tire Science and Technology* 2 (1974) 195–210. <https://doi.org/10.2346/1.2167186>.
- [173] F. Farroni, A. Sakhnevych, F. Timpone, A three-dimensional multibody tire model for research comfort and handling analysis as a structural framework for a multi-physical integrated system, *Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering* 233 (2019) 136–146. <https://doi.org/10.1177/0954407018799006>.
- [174] Padovan, J., & Kennedy, R. (1986). Three-Dimensional Traveling Load Finite Element. *SAE Transactions*, 203-212.
- [175] S. Kumar Srirangam, Numerical Simulation of Tire-Pavement Interaction (2013).
- [176] S.K. Srirangam, K. Anupam, C. Kasbergen, A. Scarpas, V. Cerezo, Study of Influence of Operating Parameters on Braking Friction and Rolling Resistance, *Transportation Research Record: Journal of the Transportation Research Board* 2525 (2015) 79–90. <https://doi.org/10.3141/2525-09>.

## References

- [177] Bathe, K. J., & Wilson, E. L. (1973). Solution methods for eigenvalue problems in structural mechanics. *International Journal for Numerical Methods in Engineering*, 6(2), 213-226.
- [178] W.E. Haisler, J.A. Stricklin, J.E. Key, Displacement incrementation in non-linear structural analysis by the self-correcting method, *International Journal of Numerical Methods in Engineering* 11 (1977) 3–10. <https://doi.org/10.1002/nme.1620110103>.
- [179] T.Y.Kim. and S.H. Lee, Combustion and Emission Characteristics of Wood Pyrolysis Oil-Butanol Blended Fuels in a Di Diesel Engine, *International Journal of Automative Technology* 13 (2012) 293–300. <https://doi.org/10.1007/s12239>.
- [180] Davis, P. A. (1997). Quasi-Static and Dynamic Response Characteristics of F-4 Bias-Ply and Radial-Belted Main Gear Tires (Vol. 3586). NASA, Langley Research Center.
- [181] Johnson, A. R., Tanner, J. A., & Mason, A. J. (1999). Quasi-static viscoelastic finite element model of an aircraft tire (No. NAS 1.15: 209141).
- [182] Meng, L. (2002). Truck tire/pavement interaction analysis by the finite element method. Michigan State University.
- [183] A. John, Methods for Frictional Contact with Applications to the Space Shuttle Orbiter Nose-Gear Tire-Comparisons of Experimental Measurements and Analytical Predictions, (1996).
- [184] J.R. Cho, H.W. Lee, J.S. Sohn, G.J. Kim, J.S. Woo, Numerical investigation of hydroplaning characteristics of three-dimensional patterned tire, *European*

## References

- Journal of Mechanics, A/Solids 25 (2006) 914–926. <https://doi.org/10.1016/j.euromechsol.2006.02.007>.
- [185] T.F. Fwa, G.P. Ong, Wet-pavement hydroplaning risk and skid resistance: Analysis, *Journal of Transportation Engineering* 134 (2008) 182–190. [https://doi.org/10.1061/\(ASCE\)0733-947X\(2008\)134:5\(182\)](https://doi.org/10.1061/(ASCE)0733-947X(2008)134:5(182)).
- [186] T.F. Fwa, S.S. Kumar, K. Anupam, G.P. Ong, Effectiveness of tire-tread patterns in reducing the risk of hydroplaning, *Transportation Research Record* (2009) 91–102. <https://doi.org/10.3141/2094-10>.
- [187] T. Tang, K. Anupam, C. Kasbergen, A. Scarpas, S. Erkens, A finite element study of rain intensity on skid resistance for permeable asphalt concrete mixes, *Construction and Building Materials* 220 (2019) 464–475. <https://doi.org/10.1016/j.conbuildmat.2019.05.185>.
- [188] Wang, H., Al-Qadi, I. L., & Stanciulescu, I. (2012). Simulation of tyre–pavement interaction for predicting contact stresses at static and various rolling conditions. *International Journal of Pavement Engineering*, 13(4), 310-321.
- [189] Wollny, I., Behnke, R., Villaret, K., & Kaliske, M. (2016). Numerical modelling of tyre–pavement interaction phenomena: coupled structural investigations. *Road Materials and Pavement Design*, 17(3), 563-578.
- [190] Tang, T., Anupam, K., Kasbergen, C., Scarpas, A., & Erkens, S. (2019). A finite element study of rain intensity on skid resistance for permeable asphalt concrete mixes. *Construction and Building Materials*, 220, 464-475.
- [191] Wang, H., Zhao, J., Hu, X., & Zhang, X. (2020). Flexible pavement response analysis under dynamic loading at different vehicle speeds and pavement surface

## References

- roughness conditions. *Journal of Transportation Engineering, Part B: Pavements*, 146(3), 04020040.
- [192] A. El Ayadi, B. Picoux, G. Lefeuve-Mesgouez, A. Mesgouez, C. Petit, An improved dynamic model for the study of a flexible pavement, *Advances in Engineering Software* 44 (2012) 44–53. <https://doi.org/10.1016/j.advengsoft.2011.05.038>.
- [193] C. Houser, S. Hamilton, Sensitivity of post-hurricane beach, *Earth Surface Processes and Landforms* 34 (2009) 613–628. <https://doi.org/10.1002/esp>.
- [194] R. Kumar, J. Kuttippurath, G.S. Gopikrishnan, P. Kumar, H. Varikoden, Enhanced surface temperature over India during 1980–2020 and future projections: causal links of the drivers and trends, *NPJ Clim Atmos Sci* 6 (2023) 164. <https://doi.org/10.1038/s41612-023-00494-0>.
- [195] Samer W. Katicha, *Analysis of Hot Mix Asphalt (HMA) Linear Viscoelastic and Bimodular Properties Using Uniaxial Compression and Indirect Tension (IDT) Tests*, Virginia Polytechnic Institute and State University, 2007.
- [196] Y.R. Kim, J.S. Daniel, H. Wen, *Fatigue performance evaluation of WesTrack asphalt mixtures using viscoelastic continuum damage approach*, 2002.
- [197] Park, S. W., & Schapery, R. (1999). Methods of interconversion between linear viscoelastic material functions. Part I-A numerical method based on Prony series. *International journal of solids and structures*, 36(11), 1653-1675.
- [198] A. Kumar, T. Tang, A. Gupta, K. Anupam, A state-of-the-art review of measurement and modelling of skid resistance: The perspective of developing

## References

- nation, *Case Studies in Construction Materials* 18 (2023). <https://doi.org/10.1016/j.cscm.2023.e02126>.
- [199] M. Hossain, P. Steinmann, More hyperelastic models for rubber-like materials: consistent tangent operators and comparative study, *Journal of Mechanical Behaviour of Materials* 22 (2013) 27–50. <https://doi.org/10.1515/jmbm-2012-0007>.
- [200] K. Anupam, T. Tang, C. Kasbergen, A. Scarpas, S. Erkens, 3-D Thermomechanical Tire–Pavement Interaction Model for Evaluation of Pavement Skid Resistance, *Transportation Research Record* 2675 (2020) 65–80. <https://doi.org/10.1177/0361198120963101>.
- [201] W.A.A.S. Premarathna, J.A.S.C. Jayasinghe, K.K. Wijesundara, P. Gamage, R.R.M.S.K. Ranatunga, C.D. Senanayake, Investigation of design and performance improvements on solid resilient tires through numerical simulation, *Engineering Failure Analysis* 128 (2021). <https://doi.org/10.1016/j.engfailanal.2021.105618>.
- [202] Shoop, S. A. (2001). Finite element modeling of tire-terrain interaction. University of Michigan.
- [203] H. Wang, I.L. Al-Qadi, I. Stanciulescu, Simulation of tyre-pavement interaction for predicting contact stresses at static and various rolling conditions, *International Journal of Pavement Engineering* 13 (2012) 310–321. <https://doi.org/10.1080/10298436.2011.565767>.
- [204] A. Gupta, S.K. Pradhan, L. Bajpai, V. Jain, Numerical analysis of rubber tire/rail contact behavior in road cum rail vehicle under different inflation pressure values

## References

- using finite element method, in: *Materials Today Proc*, Elsevier Ltd, 2020: pp. 6628–6635. <https://doi.org/10.1016/j.matpr.2021.05.100>.
- [205] M. Nasimifar, S. Thyagarajan, N. Sivaneswaran, Backcalculation of Flexible Pavement Layer Moduli from Traffic Speed Deflectometer Data, *Transportation Research Record: Journal of the Transportation Research Board* 2641 (2017) 66–74. <https://doi.org/10.3141/2641-09>.
- [206] Liang, R. Y., & Zhu, J. X. (1995). Dynamic analysis of infinite beam on modified Vlasov subgrade. *Journal of transportation engineering*, 121(5), 434-442.
- [207] W. Uddin, D. Zhang, F. Fernandez, Finite element simulation of pavement discontinuities and dynamic load response, *Transportation Research Record* (1994) 100–106.
- [208] R.M. Christensen, *Theory of viscoelasticity*, 2nd ed., Academic press, New York, 1982.
- [209] E.F. Denby, A note on the interconversion of creep, relaxation and recovery, *Rheologica Acta* 14 (1975) 591–593. <https://doi.org/10.1007/BF01520810>.
- [210] H. Leaderman, *Viscoelasticity phenomena in amorphous high polymeric systems*, *Rheology*, Academic Press, New York 2 (1958) 1–61.
- [211] Y.R. Kim, Y. Lee, Interrelationships among stiffnesses of asphalt-aggregate mixtures, *Association of Asphalt Paving Technologists Technical Sessions*, Oregon, USA 64 (1995) 575–609.
- [212] S.W. Park, Y.R. Kim, Interconversion between Relaxation Modulus and Creep Compliance for Viscoelastic Solids, *Journal of Materials in Civil Engineering* 11 (1999) 76–82. [https://doi.org/10.1061/\(ASCE\)0899-1561\(1999\)11:1\(76\)](https://doi.org/10.1061/(ASCE)0899-1561(1999)11:1(76)).

## References

- [213] S. Helwany, J. Dyer, J. Leidy, Finite-element analyses of flexible pavements, *Journal of Transportation Engineering* 124 (1998) 491–499. [https://doi.org/10.1061/\(ASCE\)0733-947X\(1998\)124:5\(491\)](https://doi.org/10.1061/(ASCE)0733-947X(1998)124:5(491)).
- [214] A. Ghosh, A. Padmarekha, J.M. Krishnan, Implementation and Proof-checking of Mechanistic-empirical Pavement Design for Indian Highways Using AASHTOWARE Pavement ME Design Software, *Procedia Social and Behavioural Sciences* 104 (2013) 119–128. <https://doi.org/10.1016/j.sbspro.2013.11.104>.
- [215] P.K. Akarsh, G.O. Ganesh, S. Marathe, R. Rai, Incorporation of Sugarcane Bagasse Ash to investigate the mechanical behavior of Stone Mastic Asphalt, *Construction and Building Materials* 353 (2022). <https://doi.org/10.1016/j.conbuildmat.2022.129089>.
- [216] MoRTH, Specifications for road and bridge work (Fifth revision), New Delhi, 2013.
- [217] 1995 ASTM D, Standard Test Method for Indirect Tension Test for Resilient Modulus of Bituminous Mixtures.
- [218] Bureau of Indian Standards, IS 1206: 1978: Methods for Testing Tar and Bituminous Materials, Viscosity Test, New Delhi, 1978.
- [219] A. Mittal, K. Arora, G. Kumar, P.K. Jain, Comparative Studies on Performance of Bituminous Mixes Containing Laboratory Developed Hard Grade Bitumen, *Advances in Civil Engineering Materials* 7 (2018) 92–104. <https://doi.org/10.1520/ACEM20170039>.

## References

- [220] IS: 73, Paving bitumen – specification. New Delhi, India, Bureau of Indian Standards (2013) 1–4.
- [221] A. Singh, A. Gupta, M. Miljković, Intermediate- and high-temperature damage of bitumen modified by HDPE from various sources, *Road Materials and Pavement Design* 24 (2023) 640–653. <https://doi.org/10.1080/14680629.2023.2181017>.
- [222] ASTM: D6373, Standard Specification for Performance-Graded Asphalt Binder, West Conshohocken.
- [223] IS: 1203-2022, Methods for Testing Tar and Bituminous Materials — Determination of Penetration, India, 2022.
- [224] Bureau of Indian Standards, IS 1205: 1978: Methods for Testing Tar and Bituminous Materials, Softening Point Test, New Delhi, 1978.
- [225] Bureau of Indian Standards, IS 2386-1 (1963): Methods of Test for Aggregates for Concrete, Part I: Particle Size and Shape.
- [226] Bureau of Indian Standards, IS 2386-4 (1963): Methods of test for aggregates for concrete, Part 4: Mechanical properties.
- [227] G.C. Wang, Slag use in asphalt paving, in: *The Utilization of Slag in Civil Infrastructure Construction*, Elsevier, 2016: pp. 201–238. <https://doi.org/10.1016/B978-0-08-100381-7.00010-0>.
- [228] Standard Test Method for Indirect Tensile (IDT) Strength of Bituminous Mixtures, 2017.
- [229] M. Karami, H. Nikraz, S. Sebayang, L. Irianti, Laboratory experiment on resilient modulus of BRA modified asphalt mixtures, *International Journal of Pavement*

## References

- Research and Technology 11 (2018) 38–46. <https://doi.org/10.1016/j.ijprt.2017.08.005>.
- [230] N. Usman, M.I.M. Masirin, Performance of asphalt concrete with plastic fibres, in: *Use of Recycled Plastics in Eco-Efficient Concrete*, Elsevier, 2019: pp. 427–440. <https://doi.org/10.1016/B978-0-08-102676-2.00020-7>.
- [231] Standard Test Method for Determining the Resilient Modulus of Bituminous Mixtures by Indirect Tension Test. <https://doi.org/10.1520/D7369-09>.
- [232] J.S. Carvajal Munoz, F. Kaseer, E. Arambula, A.E. Martin, Use of the resilient modulus test to characterize asphalt mixtures with recycled materials and recycling agents, *Transportation Research Record* 2506 (2015) 45–53. <https://doi.org/10.3141/2506-05>.
- [233] ASTM: D6931-17, Standard Test Method for Indirect Tensile (IDT) Strength of Bituminous Mixtures 1, 2017. <https://doi.org/10.1520/D6931-17.2>.
- [234] IRC: SP-135 (2022), Manual for the design of hot bituminous mixes: overview of bituminous mix design.
- [235] N. Thom, J.P. Edwards, A. Dawson, A Practical Test for Laboratory Characterization of Pavement Foundation Materials, in: *International Center for Aggregate Research Conference (ICAR)*, Austin, Texas, 2005: pp. 1–14.
- [236] S.F. Brown, Soil mechanics in pavement engineering, *Géotechnique* 46 (1996) 383–426. <https://doi.org/10.1680/geot.1996.46.3.383>.
- [237] F. Lekarp, Resilient and permanent deformation behaviour of unbound aggregates under repeated loading, *Kungliga Tekniska Hogskolan (KTH)*, Stockholm, 1999.

## References

- [238] G.T.H. Sweere, Unbound Granular Base for Roads, Delft University of Technology, 1990.
- [239] H.B. Seed, C.K. Chan, C.E. Lee, Resilient Characteristics of Subgrade Soils and Their Relation to Fatigue Failures in Asphalt Pavements, in: International Conference on the Structural Design of Asphalt Pavements, University of Michigan, 1962: pp. 77–113.
- [240] N.H. Thom, S.F. Brown, The effect of grading and density on the mechanical properties of a crushed dolomitic limestone, in: 14th ARRB Conference, 1988: pp. 94–100.
- [241] A. Adu-Osei, D.N. Little, R.L. Lytton, Structural Characteristics of Unbound Aggregate Bases to Meet AASHTO 2002 Design Requirements, 2001.
- [242] S.-H. Kim, K. McFall, J. Kwon, J. Yang, J.-H. Jeong, Use of linear viscoelastic theory to predict resilient behavior of unbound granular materials, *KSCE Journal of Civil Engineering* 20 (2016) 1806–1812. <https://doi.org/10.1007/s12205-015-0129-2>.
- [243] R.G. Hicks, C.L. Monismith, Factors Influencing the Resilient Response of Granular Materials, *Highway Research Record* 354 (1971) 15–31.
- [244] J. Uzan, Characterization of Granular Material, *Transportation Research Records* 1022 (1985).
- [245] A.A. Van Niekerk, Mechanical Behavior and Performance of Granular Bases and Subbases in Pavements, Delft University of Technology, 2002.
- [246] P. Kolisoja, Resilient Deformation Characteristics of Granular Materials, Tampere University of Technology, 1997.

## References

- [247] D. Kuttah, Using Repeated Light-Weight Deflectometer Test Data to Predict Flexible Pavement Responses Based on the Mechanistic–Empirical Design Method, *Construction Materials* 4 (2024) 216–237. <https://doi.org/10.3390/constrmater4010012>.
- [248] Ragaa Abd El-Hakim, Sherif El-Badawy, Alaa Gabr, Abdelhalim Moawad Azam, Influence of MEPDG Unbound Material Type and Material Characterization Input Level on Pavement Performance, in: *The Transportation Research Board 95th Annual Meeting*, Washington D.C. USA, 2016: pp. 1–21.
- [249] Indian standard IS: 1498, Classification and identification of soils for general engineering purposes, India, 2000.
- [250] Asphalt Institute, MS-2: Asphalt mix design methods, 7th ed., Asphalt Institute, 2014.
- [251] J.K. Andrews, V. Radhakrishnan, R.Z. Koshy, V. Chowdary, T.K. Subhash, Field investigation of material layer properties for emulsion-treated base layer application in low-volume roads, *International Journal of Pavement Engineering* 24 (2023). <https://doi.org/10.1080/10298436.2023.2190117>.
- [252] I. Pérez, L. Medina, M.Á. del Val, Mechanical properties and behaviour of in situ materials which are stabilised with bitumen emulsion, *Road Materials and Pavement Design* 14 (2013) 221–238. <https://doi.org/10.1080/14680629.2013.779301>.
- [253] K. Chelelgo, Z.C.A. Gariy, S.M. Shitote, Laboratory mix design of cold bitumen emulsion mixtures incorporating reclaimed asphalt and virgin aggregates, *Buildings* 8 (2018). <https://doi.org/10.3390/buildings8120177>.

## References

- [254] M. Moaveni, I. Abuawad, K. Hasiba, D. Zhang, E. Tutumluer, Characterization of Emulsion Bitumen Stabilized Aggregate Base, in: 2nd International Conference on Transportation Geotechnics (2nd ICTG), Sapporo, Japan, 2012: pp. 1–5.
- [255] R.J. Anderson, R.M. Thompson, Characterization of Emulsion Aggregate Mixtures, Transportation Research Board 1492 (1995) 18–20.
- [256] Southern African Bitumen Association (Sabita), 2002.
- [257] IRC 37, Tentative guidelines for the design of flexible pavements, New Delhi, 2012.
- [258] IS 8887, Bitumen emulsion for roads (cationic type) specification, New Delhi, 2018.
- [259] 2017 ASTM D6931, Standard Test Method for Indirect Tensile (IDT) Strength of Asphalt Mixtures, (n.d.). <https://doi.org/10.1520/D6931-12>.
- [260] IS 2720 (Part 8), Determination of water content-dry density relation using heavy compaction, New Delhi, 1983.
- [261] AASHTO T307-99, Determining the resilient modulus of soils and aggregate materials, 2007.
- [262] R. Ji, N. Siddiki, T. Nantung, D. Kim, Evaluation of Resilient Modulus of Subgrade and Base Materials in Indiana and Its Implementation in MEPDG, The Scientific World Journal 2014 (2014) 1–14. <https://doi.org/10.1155/2014/372838>.
- [263] Kolisoja P, Resilient deformation characteristics of granular materials, Tampere University of Technology, 1997.

## References

- [264] NCHRP, Guide for Mechanistic-Empirical Design of New and Rehabilitated Pavement Structures, Part2, Washington, DC, USA, 2004.
- [265] J.C. Pais, S.I.R. Amorim, M.J.C. Minhoto, Impact of traffic overload on road pavement performance, *Journal of Transportation Engineering* 139 (2013) 873–879. [https://doi.org/10.1061/\(ASCE\)TE.1943-5436.0000571](https://doi.org/10.1061/(ASCE)TE.1943-5436.0000571).
- [266] Q. xue Pan, C. ce Zheng, S. tao Lü, G. ping Qian, J. hui Zhang, P. hua Wen, B.C. Milkos, H. de Zhou, Field measurement of strain response for typical asphalt pavement, *Journal of Central South University* 28 (2021) 618–632. <https://doi.org/10.1007/s11771-021-4626-9>.
- [267] K. Yao, X. Jiang, J. Jiang, Z. Yang, Y. Qiu, INFLUENCE OF MODULUS OF BASE LAYER ON THE STRAIN DISTRIBUTION FOR ASPHALT PAVEMENT, *Baltic Journal of Road and Bridge Engineering* 16 (2021) 126–152. <https://doi.org/10.7250/bjrbe.2021-16.542>.
- [268] A.E.A.E.-M. Behiry, Fatigue and rutting lives in flexible pavement, *Ain Shams Engineering Journal* 3 (2012) 367–374. <https://doi.org/10.1016/j.asej.2012.04.008>.
- [269] ABAQUS User's Manual, Version 6.17 (2017).



# LIST OF PUBLICATIONS

---

---

## Journal Publications (Published)

- 1) **Kumar, A., & Gupta, A.** (2021). Review of factors controlling skid resistance at tire-pavement interface. *Advances in Civil Engineering*, Wiley, 2021(1), 2733054.
- 2) **Kumar, A., Tang, T., Gupta, A., & Anupam, K.** (2023). A state-of-the-art review of measurement and modelling of skid resistance: The perspective of developing nation. *Case Studies in Construction Materials*, Elsevier, 18, e02126.
- 3) **Kumar, A., Gupta, A., Anupam, K., & Wagh, V. P.** (2024). Finite element-based framework to study the response of bituminous concrete pavements under different conditions. *Construction and Building Materials*, Elsevier, 417, 135368.

## Journal Publications (Under review)

- 1) **Kumar, A., Gupta, A., Anupam, K., Singh, A., & Premarathna, S.** Mechanistic empirical studies demonstrating potential benefits of emulsion stabilized bases using finite element analysis, *Mechanics Based Design of Structures and Machines*, Taylor & Francis.
- 2) **Kumar, A., Gupta, A., Anupam, K., & Premarathna, S.** Analysis of nonlinear responses of asphalt pavements under overloading and tropical climate temperature conditions, *Case Studies in Construction Material*, Elsevier.

## Conferences and Book Chapters

- 1) **Kumar, A., Gupta, A., Anupam, K., & Jha, Neeraj** (2023). FE Based Contact Modeling of Tire Pavement Interaction for Linear Viscoelastic Response of Asphalt Concrete. *Advances in Material and Pavement Performance Prediction*, Hong Kong.
- 2) **Kumar, A., Gupta, A., and Anupam, K.** (2021). Measurement, modelling, and validation of skid resistance of asphalt concrete pavement: Laboratory to field

literature review. Green and Intelligent technologies for sustainable and smart asphalt pavements.