

DAFTAR PUSTAKA

- Aboulayt, A., Jaafri, R., Samouh, H., El Idrissi, A.C., Roziere, E., Moussa, R. and Loukili, A. 2018, Stability of a New Geopolymer Grout: Rheological and Mechanical Performances of Metakaolin-Fly Ash Binary Mixtures, *Construction and Building Materials*, Vol. 181, pp. 420–436.
- Adam, A.A., Ramadhan, B.R. and Maricar, S. 2019, The Effects of Water to Solid Ratio, Activator to Binder Ratio, and Lime Proportion on the Compressive Strength of Ambient-Cured Geopolymer Concrete, *Journal of the Civil Engineering Forum*, Vol. 5 No.2, pp. 161–168.
- Adib, M.E. 2000, Slope Failure in Weathered Claystone and Siltstone, *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 126, pp. 787–797.
- Agustawijaya, D.S. 2003, Modelled Mechanisms in the Slake-Durability Test for Soft Rocks, *Civil Engineering Dimension*, Vol. 5 No.2, pp. 87–92.
- Ahvenainen, P., Kontro, I. and Svedström, K. 2016, Comparison of Sample Crystallinity Determination Methods by X-Ray Diffraction for Challenging Cellulose I Materials, *Cellulose*, Vol. 23 No.2, pp. 1073–1086.
- Alatas, I.M., Kamaruddin, S.A., Nazir, R. and Irsyam, M. 2016, Effect of Weathering on Disintegration and Shear Strength Reduction of Clay Shale, *Jurnal Teknologi*, Vol. 78, pp. 93–99.
- Alatas, I.M., Kamaruddin, S.A., Nazir, R., Irsyam, M. and Himawan, A. 2015, Shear Strength Degradation of Semarang Bawen Clay Shale Due to Weathering Process, *Jurnal Teknologi*, Vol. 77 No.11, pp. 109–118.
- Alatas, I.M., Nazir, R., Irsyam, M. and Simatupang, P.T. 2017, The Effect of Weathering Process to Determination of Residual Shear Strength of Clay Shale with Triaxial Multi-Stage System, In *Proceeding of the 19th International Conference on Soil Mechanics and Geotechnical Engineering*, Seoul, 17-22 Sept.
- Alatas, I.M. and Simatupang, P.T. 2017, Pengaruh Proses Pelapukan Clay Shale Terhadap Perubahan Parameter Rasio Disintegritas (DR), *Jurnal Teknik Sipil*, Vol. 24 No.1, pp. 77–82.
- Alhadar, S., Asrida, L., Wardani, S. and Hardiyati, S. 2014, Analisis Stabilitas Lereng Pada Tanah Clay Shale Proyek Jalan Tol Semarang-Solo Paket VI Sta 22+700 Sampai Sta 22+775, *Jurnal Karya Teknik Sipil*, Vol. 3 No.2, pp. 336–344.
- Alshkane, Y.M., Rashed, K.A. and Daoud, H.S. 2020, Unconfined Compressive Strength (UCS) and Compressibility Indices Predictions from Dynamic Cone Penetrometer Index (DCP) for Cohesive Soil in Kurdistan Region/Iraq, *Geotechnical and Geological Engineering*, Vol. 38 No.4, pp. 3683–3695.
- Amann, F., Button, E.A., Evans, K.F., Gischig, V.S. and Blümel, M. 2011, Experimental Study of the Brittle Behavior of Clay Shale in Rapid Unconfined Compression, *Rock Mechanics and Rock Engineering*, Vol. 44 No.4, pp. 415–430.
- Ankara, H., Çiçek, F., Deniz, I.T., Uçak, E. and Kandemir, S.Y. 2016, Determination of Slake Durability Index (Sdi) Values on Different Shape of Laminated Marl Samples, In *Proceeding of World Multidisciplinary Earth Sciences Symposium*, pp. 1–5. IOP Publishing, Vol. 55 No. 022006, pp. 1-5.
- Anovitz, L.M. and Cole, D.R. 2015, Characterization and Analysis of Porosity and Pore Structures, *Mineralogical Society of America*, Vol. 80, pp. 61–164.
- Arora, V. and Kumar, M. 2015, Application of Sandy Soil Development Using Grouting : A New Approach, *International Journal of Current Engineering and Technology*,

- Vol. 5 No.6, pp. 3926–3929.
- Arulrajah, A., Yaghoubi, M., Disfani, M.M., Horpibulsuk, S., Bo, M.W. and Leong, M. 2018, Evaluation of Fly Ash- and Slag-Based Geopolymers for the Improvement of a Soft Marine Clay by Deep Soil Mixing, *Soils and Foundations*, Vol. 58 No.6, pp. 1358–1370.
- Arun, E., Arumairaj, P.D. and Janaki Raman, S. 2019, Application of Geopolymer in Stabilization of Soft Clay, *International Journal of Recent Technology and Engineering*, Vol. 8 No.1, pp. 996–998.
- ASTM. 1998, D4644-04: Standard Test Method for Slake Durability of Shales and Similar Weak Rocks, USA.
- ASTM. 2000, D2166: Standard Test Method for Unconfined Compressive Strength of Cohesive Soil, USA.
- ASTM. 2005a, D1200: Standard Test Method for Viscosity by Ford Viscosity Cup, USA.
- ASTM. 2005b, D4212-99: Standard Test Method for Viscosity by Dip-Type Viscosity Cup, USA, USA.
- ASTM. 2015, D6951-03: Standard Test Method for Use of the Dynamic Cone Penetrometer in Shallow Pavement Applications, USA.
- ASTM. 2018, D6431-18: Standard Guide for Using the Direct Current Resistivity Method for Subsurface, USA, USA.
- Astuti, W., Wahyuni, E.T., Prasetya, A. and Bendiyasa, I.M. 2012, The Effect of Coal Fly Ash Treatment with NaOH on the Characters and Adsorption Mechanism toward Methyl Violet in The Solution, In *3rd International Conference on Chemistry and Chemical Engineering*, pp. 155–160. IACSIT Press, Singapore.
- Bakri, A.M.M., Kamarudin, H., Karem, O.A.K.A., Ruzaidi, C.M., Rafiza, A.R. and Norazian, M.N. 2012, Optimization of Alkaline Activator/Fly Ash Ratio on the Compressive Strength of Manufacturing Fly Ash-Based Geopolymer, *Applied Mechanics and Materials*, Vol. 110–116, pp. 734–739.
- Batayneh, A.T. 2001, Resistivity Imaging for Near-Surface Resistive Dyke Using Two-Dimensional DC Resistivity Techniques, *Journal of Applied Geophysics*, Vol. 48 No.1, pp. 25–32.
- Behnood, A. 2018, Soil and Clay Stabilization with Calcium- and Non-Calcium-Based Additives: A State-of-the-Art Review of Challenges, Approaches and Techniques, *Transportation Geotechnics*, Vol. 17 No. July, pp. 14–32.
- Bell, F.G. 1983, *Fundamentals of engineering geology, 1st edition*, Butterworth & Co., London.
- Berisavljević, Z., Berisavljević, D., Rakić, D. and Radić, Z. 2018, Application of Geological Strength Index for Characterization of Weathering-Induced Failures, *Gradjevinar*, Vol. 70 No.10, pp. 891–903.
- Boschi, K., di Prisco, C.G. and Ciantia, M.O. 2020, Micromechanical Investigation of Grouting in Soils, *International Journal of Solids and Structures*, Vol. 187, pp. 121–132.
- Briševac, Z., Hrženjak, P. and Buljan, R. 2016, Models for Estimating Uniaxial Compressive Strength and Elastic Modulus, *Gradjevinar*, Vol. 68 No.1, pp. 19–28.
- Bronk, T. Von, Haist, M. and Lohaus, L. 2020, The Influence of Bleeding of Cement Suspensions on Their Rheological Properties, *Materials*, Vol. 13 No.7, pp. 1–15.
- Bryson, L.S., Gomez-Gutierrez, I.C. and Hopkins, T.C. 2012, Development of a New Durability Index for Compacted Shale, *Engineering Geology*, Vol. 139–140 No. June 2012, pp. 66–75.

- BSN. 2004a, SNI 15-2049: Semen Portland, Indonesia.
- BSN. 2004b, SNI 15-7064: Semen Portland Komposit, Indonesia.
- BSN. 2004c, SNI 15-0302: Semen Portland Pozolan, Indonesia.
- BSN. 2008a, SNI 1964: Cara Uji Berat Jenis Tanah, Indonesia.
- BSN. 2008b, SNI 3423 : Cara Uji Analisis Ukuran Butir Tanah, Indonesia.
- BSN. 2008c, SNI 1966: Cara Uji Penentuan Batas Plastis dan Indeks Plastisitas Tanah, Indonesia.
- BSN. 2008d, SNI 1742: Cara Uji Kepadatan Ringan Untuk Tanah, Indonesia.
- BSN. 2012, SNI 3638: Metode Uji Kuat Tekan Bebas Tanah Kohesif, Indonesia.
- BSN. 2014, SNI 2460: Spesifikasi Abu Terbang Batubara Dan Pozolan Alam Mentah Atau Yang Telah Dikalsinasi Untuk Digunakan Dalam Beton, Indonesia.
- Cai, J., Pan, J., Li, X., Tan, J. and Li, J. 2020, Electrical Resistivity of Fly Ash and Metakaolin Based Geopolymers, *Construction and Building Materials*, Vol. 234 No.177868, pp. 1–9.
- Cambefort, H. 1977, The Principles and Applications of Grouting, *Quarterly Journal of Engineering Geology*, Vol. 10 No.2, pp. 57–95.
- Canakci, H., Güllü, H. and Alhashemy, A. 2019, Performances of Using Geopolymers Made with Various Stabilizers for Deep Mixing, *Materials*, Vol. 12 No.16, pp. 1–32.
- Carrasco, M.T. and Puertas, F. 2017, Alkaline Activation of Different Aluminosilicates as an Alternative to Portland Cement: Alkali Activated Cements or Geopolymers, *Revista Ingenieria de Construcción*, Vol. 32 No.2, pp. 5–12.
- Celik, F. 2019, The Observation of Permeation Grouting Method as Soil Improvement Technique with Different Grout Flow Models, *Geomechanics and Engineering*, Vol. 17 No.4, pp. 367–374.
- Chatterjee, S. and Hadi, A.S. 2012, *Regression Analysis By Example, 5th edition*, John Wiley & Sons, New Jersey. UK.
- Chen-Tan, N.W., Van Riessen, A., Ly, C. V. and Southam, D.C. 2009, Determining the Reactivity of a Fly Ash for Production of Geopolymer, *Journal of the American Ceramic Society*, Vol. 92 No.4, pp. 881–887.
- Chinchón-Payá, S., Andrade, C. and Chinchón, S. 2016, Indicator of Carbonation Front in Concrete as Substitute to Phenolphthalein, *Cement and Concrete Research*, Vol. 82, pp. 87–91.
- Choi, M.S., Lee, J.S., Ryu, K.S., Koh, K.T. and Kwon, S.H. 2016, Estimation of Rheological Properties of UHPC Using Mini Slump Test, *Construction and Building Materials*, Vol. 106, pp. 632–639.
- Cristelo, N., Glendinning, S., Fernandes, L. and Pinto, A.T. 2013, Effects of Alkaline-Activated Fly Ash and Portland Cement on Soft Soil Stabilisation, *Acta Geotechnica*, Vol. 8 No.4, pp. 395–405.
- Cristelo, N., Glendinning, S. and Pinto, A.T. 2011, Deep Soft Soil Improvement by Alkaline Activation, *Proceedings of the Institution of Civil Engineers: Ground Improvement*, Vol. 164 No.2, pp. 73–82.
- Dano, C., Hicher, P.-Y. and Tailliez, S. 2004, Engineering Properties of Grouted Sands, *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 130 No.3, pp. 328–338.
- Davidovits, J. 1994, Properties of Geopolymer Cements, In *Proceedings First International Conference on Alkaline Cements and Concretes*, pp. 131–149. Geopolymer Institute, Kiev, Ukraine.

- Dearman, W.R. 1974, Weathering Classification in the Characterisation of Rock for Engineering Purposes in British Practice, In *Bulletin of the International Association of Engineering Geology*, pp. 33–42.
- Desiati, R.D., Sugiarti, E. and Ramandhany, S. 2018, Analisa Ukuran Partikel Serbuk Komposit Nicral Dengan Penambahan Reaktif Elemen Untuk Aplikasi Lapisan Tahan Panas, *Metalurgi*, Vol. 33 No.1, pp. 27–34.
- Dick, J.C. and Shakoor, A. 1992, Lithological Controls of Mudrock Durability, *Quarterly Journal of Engineering Geology*, Vol. 25 No.1, pp. 31–46.
- Ding, W., Duan, C. and Zhang, Q. 2020, Experimental and Numerical Study on a Grouting Diffusion Model of a Single Rough Fracture in Rock Mass, *Applied Sciences (Switzerland)*, Vol. 10 No.20, pp. 1–23.
- Djaha, S., Prayuda, H., Monika, F., Cahyati, M. and Saleh, F. 2019, 'Mechanical Properties of Geopolymer Grout with Bagasse Ash and Resin Catalyst, In *Proceedings of the 1st International Conference on Engineering, Science, and Commerce*, pp. 1–8. EAI, Labuhan Bajo, 18-19 Okt.
- Du, J., Zhou, A., Shen, S.L. and Bu, Y. 2022, Fractal-Based Model for Maximum Penetration Distance of Grout Slurry Flowing through Soils with Different Dry Densities, *Computers and Geotechnics*, Vol. 141 No.104526, pp. 1–15.
- Ekaputri, J.J. and Bari, M.S. Al. 2020, Perbandingan Regulasi Fly Ash Sebagai Limbah B3 Di Indonesia Dan Beberapa Negara, *Media Komunikasi Teknik Sipil*, Vol. 26 No.2, pp. 150–162.
- Ekaputri, J.J. and Triwulan, T. 2013, Sodium Sebagai Aktivator Fly Ash, Trass Dan Lumpur Sidoarjo Dalam Beton Geopolimer, *Jurnal Teknik Sipil*, Vol. 20 No.1, pp. 1–9.
- Embaby, A.A., Ramadan, M. and Halawa, A.A. 2020, Impact of Slaking Shale Behaviour on Damage of Engineering Structures, Saudi Arabia, *Geotechnical Research*, Vol. 7 No.2, pp. 117–131.
- Erguler, Z.A. and Shakoor, A. 2009, Quantification of Fragment Size Distribution of Clay-Bearing Rocks after Slake Durability Testing, *The Geological Society of America*, Vol. XV No.2, pp. 81–89.
- Faray and Rahayu, W. 2020, Durability and Strength Improvement of Clayshale Using Various Stabilized Materials, In *Proceeding of The 3rd International Conference on Eco Engineering Development*, IOP Publishing, Vol. 426 No.012028, pp. 1-10.
- Fathurrohman, A.M., Syahril, S. and Somantri, A.K. 2020, Repairment of Clay Shale Soil by Stabilization Method Using a Cement Binder, In *Proceeding of International Conference on Innovation in Engineering and Vocational Education*, IOP Publishing, Vol. 830 No. 022032, pp. 1-6.
- Favier, A., Hot, J., Habert, G., Roussel, N. and D'Espinose De Lacaillerie, J.B. 2014, Flow Properties of MK-Based Geopolymer Pastes. A Comparative Study with Standard Portland Cement Pastes, *Soft Matter*, Vol. 10 No.8, pp. 1134–1141.
- Franklin, J.A. 1981, Shale Rating System and Tentative Applications To Shale Performance., *Transportation Research Record*, Vol. 790, pp. 2–12.
- Fu, Y., Wang, X., Zhang, S. and Yang, Y. 2019, Modelling of Permeation Grouting Considering Grout Self-Gravity Effect: Theoretical and Experimental Study, *Advances in Materials Science and Engineering*, Vol. 2019, pp. 1–16.
- Garcia-Lodeiro, I., Donatello, S., Fernández-Jiménez, A. and Palomo, Á. 2016, Hydration of Hybrid Alkaline Cement Containing a Very Large Proportion of Fly Ash: A Descriptive Model, *Materials*, Vol. 9 No.8, pp. 1–16.

- Gautam, T.P. and Shakoor, A. 2013, Slaking Behavior of Clay-Bearing Rocks during a One-Year Exposure to Natural Climatic Conditions, *Engineering Geology*, Vol. 166, pp. 17–25.
- Gautam, T.P. and Shakoor, A. 2015, Comparing the Slaking of Clay-Bearing Rocks Under Laboratory Conditions to Slaking Under Natural Climatic Conditions, *Rock Mechanics and Rock Engineering*, Vol. 49 No.1, pp. 19–31.
- Gautam, T.P. and Shakoor, A. 2017, A Durability Classification of Clay-Bearing Rocks Based on Particle Size Distribution of Slaked Material, *Environmental & Engineering Geoscience*, Vol. 23 No.2, pp. 125–136.
- Ghadir, P. and Ranjbar, N. 2018, Clayey Soil Stabilization Using Geopolymer and Portland Cement, *Construction and Building Materials*, Vol. 188, pp. 361–371.
- Goodman, R.E. 1989, *Introduction to Rock Mechanics*, John Wiley & Sons, New York.
- Gunn, D.A., Chambers, J.E., Uhlemann, S., Wilkinson, P.B., Meldrum, P.I., Dijkstra, T.A., Haslam, E., Kirkham, M., Wragg, J., Holyoake, S., Hughes, P.N., Hen-Jones, R. and Glendinning, S. 2015, Moisture Monitoring in Clay Embankments Using Electrical Resistivity Tomography, *Construction and Building Materials*, Vol. 92 No. July, pp. 82–94.
- Guo, C., Cui, C. and Wang, F. 2020, Case Study on Quick Treatment of Voids under Airport Pavement by Polymer Grouting, *Journal of Materials in Civil Engineering*, Vol. 32 No.7, pp. 1–8.
- Hadi, M.N.S., Al-Azzawi, M. and Yu, T. 2018, Effects of Fly Ash Characteristics and Alkaline Activator Components on Compressive Strength of Fly Ash-Based Geopolymer Mortar, *Construction and Building Materials*, Vol. 175, pp. 41–54.
- Hamza, G., Cevik, A., Al-Ezzi, K.M. and Giilsan, M.E. 2019, On The Rheology Of Using Geopolymer For Grouting: A Comparative Study With Cement-Based Grout Included Fly Ash And Cold Bonded Fly Ash, *Construction and Building Materials*, Vol. 196, pp. 594–610.
- Hardiyatmo, H.C. 1992, *Mekanika Tanah 1*, Buku, PT Gramedia Utama Pustaka, Jakarta.
- Hartono, E., Wardani, S.P.R. and Muntohar, A.S. 2017, Pengaruh Campuran Semen Pada Tanah Shale Bawen Terhadap Rasio Disintegritas (DR) Dan Kuat Tekan Bebas, In *Proceeding of 21th National Conference on Geotechnical Engineering*, Jakarta, 7-8 Nov.
- Hartono, E., Wardani, S.P.R. and Muntohar, A.S. 2018, The Effect of Cement Stabilization on The Strength of The Bawen's Siltstone, *MATEC Web of Conferences*, Vol. 195, pp. 1–8.
- Hartono, E., Wardani, S.P.R. and Muntohar, A.S. 2019, Slake Durability Of The Compacted-Siltstone Fragment With Cement Stabilization, *International Journal of GEOMATE*, Vol. 17 No.64, pp. 123–130.
- Hashimoto, K., Nishihara, S., Oji, S., Kanazawa, T., Nishie, S., Seko, I., Hyodo, T. and Tsukamoto, Y. 2016, Field Testing of Permeation Grouting Using Microfine Cement, *Proceedings of the Institution of Civil Engineers: Ground Improvement*, Vol. 169 No.2, pp. 134–142.
- Hassan, A., Arif, M. and Shariq, M. 2019, Use of Geopolymer Concrete for a Cleaner and Sustainable Environment – A Review of Mechanical Properties and Microstructure, *Journal of Cleaner Production*, Vol. 223, pp. 704–728.
- Hicher, P.Y., Dano, C. and Chang, C.S. 2008, A Microstructural Model for Cemented Sand, In *Proceeding of The 12th International Conference of International Association for Computer Methods and Advances in Geomechanics (IACMAG)*,

- Goa, 1-6 Oct.
- Horpibulsuk, S., Rachan, R., Chinkulkijniwat, A., Raksachon, Y. and Suddeepong, A. 2010, Analysis of Strength Development in Cement-Stabilized Silty Clay from Microstructural Considerations, *Construction and Building Materials*, Vol. 24 No.10, pp. 2011–2021.
- Hou, F., Sun, K., Wu, Q., Xu, W. and Ren, S. 2019, Grout Diffusion Model in Porous Media Considering the Variation in Viscosity with Time, *Advances in Mechanical Engineering*, Vol. 11 No.1, pp. 1–9.
- Huat, B.B.K., Kazemian, S. and Kuang, W.L. 2011, Effect of Cement-Sodium Silicate Grout and Kaolinite on Undrained Shear Strength of Reinforced Peat, *Electronic Journal of Geotechnical Engineering*, Vol. 16 K, pp. 1221–1228.
- Hucka, V. and Das, B. 1974, Brittleness Determination of Rocks by Different Methods, *International Journal of Rock Mechanics and Mining Sciences and*, Vol. 11 No.10, pp. 389–392.
- Idrissi, A.C. El, Roziere, E., Loukili, A. and Darson, S. 2018, Design of Geopolymer Grouts: The Effects of Water Content and Mineral Precursor, *European Journal of Environmental and Civil Engineering*, Vol. 22 No.5, pp. 628–649.
- Ilori, A.O. 2016, Occurrence of Shale Soils along the Calabar-Itu Highway, Southeastern Nigeria and Their Implication for the Subgrade Construction, *SpringerPlus*, Vol. 5 No.209, pp. 1–13.
- Ingles, O.G. and Metcalf, J.B. 1972, *Soil Stabilization*, Butterworths, Sydney. Australia.
- Iqbal, M. and Budiman, A. 2013, Investigasi Bidang Gelincir Pada Lereng Menggunakan Metode Geolistrik Tahanan Jenis 2D (Studi Kasus: Kelurahan Lumbung Bukit Kecamatan Pauh Padang), *Jurnal Fisika Unand*, Vol. 2 No.2, pp. 88–93.
- Irawan, R.R. 2013, *Semen Portland di Indonesia untuk Aplikasi Beton Kinerja Tinggi*, ed-1., Pusat Penelitian Dan Pengembangan Jalan Dan Jembatan, Bandung. Indonesia.
- Irsyam, M., Susila, E. and Himawan, A. 2007, Slope Failure of An Embankment on Clay Shale at Km 97+500 of The Cipularang Toll Road and The Selected Solution, In *Proc. Int. Symp. on Geotechnical Engineering, Ground Improvement and Geosynthetics for Human Security and Environmental Preservation*, Bangkok.
- Jumaeri, Sutarno, Kunarti, Sri, E. and Santosa, Sri, J. 2009, Zeolit Dari Abu Layang Secara Alkali Hidrotermal, *Jurnal Zeolit Indonesia*, Vol. 8 No.1, pp. 22–32.
- Kaga, M. and Yonekura, R. 1992, Estimation of Strength of Silicate-Grouted Sand, *Soils and Foundations*, Vol. 31 No.3, pp. 43–59.
- Kanji, M.A. and Leao, M. 2020, Correlation of Soft Rock Properties, In Kanji, M.; He, M. and Soasa, L.R. (Eds), *Soft Rock Mechanics and Engineering*, pp. 407–421. Springer Nature, Cham.
- Karol, R.H. 2003, *Chemical Grouting and Soil Stabilization*, 3th edition, Marcel Dekker, Inc., New York.
- Kazemian, S., Prasad, A., Huat, B.B.K., Bazaz, J.B., Abdul Aziz, F.N.A. and Mohammad Ali, T.A. 2011, Influence of Cement - Sodium Silicate Grout Admixed with Calcium Chloride and Kaolinite on Sapric Peat, *Journal of Civil Engineering and Management*, Vol. 17 No.3, pp. 309–318.
- Kestin, J., Sokolov, M. and Wakeham, W.A. 1978, Viscosity of Liquid Water in the Range -8 °C to 150 °C, *J. Phys. Chem. Ref. Data*, Vol. 7 No.3, pp. 941–948.
- Kim, B. and Lee, S. 2020, Review on Characteristics of Metakaolin-Based Geopolymer and Fast Setting, *Journal of the Korean Ceramic Society*, Vol. 57 No.4, pp. 368–

- 377.
- Kim, Y.J., Cho, B., Lee, S., Hu, J. and Wilde, J.W. 2018, Investigation of Rheological Properties of Blended Cement Pastes Using Rotational Viscometer and Dynamic Shear Rheometer, *Advances in Materials Science and Engineering*, Vol. 2018, pp. 1–6.
- Knappett, J.A. and Craig, R.F. 2012, *Soil Mechanics, 8th edition*, Spon Press, London and New York.
- Kordnaeij, A., Moayed, R.Z. and Soleimani, M. 2019, Shear Wave Velocity of Zeolite-Cement Grouted Sands, *Soil Dynamics and Earthquake Engineering*, Vol. 122, pp. 196–210.
- Kumar, S.T.G., Abraham, B.M., Sridharan, A. and Jose, B.T. 2015, Bearing Capacity Improvement of Loose Sandy Foundation Soils through Grouting, *International Journal of Engineering Research and Applications (IJERA)*, Vol. 1 No.3, pp. 1026–1033.
- Kuranchie, F.A., Shukla, S.K., Habibi, D., Zhao, X. and Kazi, M. 2014, Studies on Electrical Resistivity of Perth Sand, *International Journal of Geotechnical Engineering*, Vol. 8 No.4, pp. 449–457.
- Kwon, Y.S., Kim, J. and Lee, I.M. 2018, Clogging Theory-Based Real Time Grouting Management System for Underwater Tunnel, *Geomechanics and Engineering*, Vol. 16 No.2, pp. 159–168.
- Layssi, H., Ghods, P., Alizadeh, A. and Salehi, M. 2015, Electrical Resistivity of Concrete, *Concrete International*, Vol. 37 No. May, pp. 41–46.
- Leong, H.Y., Ong, D.E.L., Sanjayan, J.G. and Nazari, A. 2016, The Effect of Different Na₂O and K₂O Ratios of Alkali Activator on Compressive Strength of Fly Ash Based-Geopolymer, *Construction and Building Materials*, Vol. 106, pp. 500–511.
- Leong, H.Y., Ong, D.E.L., Sanjayan, J.G. and Nazari, A. 2018, Strength Development of Soil–Fly Ash Geopolymer: Assessment of Soil, Fly Ash, Alkali Activators, and Water, *Journal of Materials in Civil Engineering*, Vol. 30 No.8, pp. 1–15.
- Li, X., Snellings, R. and Scrivener, K.L. 2019, Quantification of Amorphous Siliceous Fly Ash in Hydrated Blended Cement Pastes by X-Ray Powder Diffraction, *Journal of Applied Crystallography*, Vol. 52, pp. 1358–1370.
- Li, X. and Zhang, L.M. 2009, Characterization of Dual-Structure Pore-Size Distribution of Soil, *Canadian Geotechnical Journal*, Vol. 46 No.2, pp. 129–141.
- LI, Z. and LI, S. 2018, Carbonation Resistance of Fly Ash and Blast Furnace Slag Based Geopolymer Concrete, *Construction and Building Materials*, Vol. 163, pp. 668–680.
- Liard, M., Oblak, L., Hachim, M., Vachon, M. and Lootens, D. 2015, Impact of Viscosity on Hydration Kinetics and Setting Properties of Cementitious Materials, *Advances in Civil Engineering Materials*, Vol. 3 No.2, pp. 117–126.
- Lin, L., Chen, J., Xu, Z., Yuan, S., Cao, M., Liu, H. and Lu, X. 2009, Removal of Ammonia Nitrogen in Wastewater by Microwave Radiation: A Pilot-Scale Study, *Journal of Hazardous Materials*, Vol. 168 No.2–3, pp. 862–867.
- Lv, G., Liu, J., Han, B., Zhang, T., Xie, Q. and Zhang, X. 2021, Influence of Water-Cement Ratio on Viscosity Variation of Cement Grout in Permeation Grouting, *Geofluids*, Vol. 2021, pp. 1–9.
- Mang, W.J. and Rafek, A.G.M. 2018, Durability Characterisation of Weathered Sedimentary Rocks Using Slake Durability Index and Jar Slake Test, *Bulletin of the Geological Society of Malaysia*, Vol. 66, pp. 81–88.
- Markou, I.N. and Atmatzidis, D.K. 2002, Development of a Pulverized Fly Ash

- Suspension Grout, *Geotechnical and Geological Engineering*, Vol. 20 No.2, pp. 123–147.
- McCarter, W.J. 1984, The Electrical Resistivity Characteristics of Compacted Clays, *Geotechnique*, Vol. 34 No.2, pp. 263–267.
- Meng, F., Wong, L.N.Y. and Zhou, H. 2020, Rock Brittleness Indices and Their Applications to Different Fields of Rock Engineering: A Review, *Journal of Rock Mechanics and Geotechnical Engineering*, Vol. 13 No.1, pp. 221–247.
- Mohamad, E.T., Saad, R. and Abad, S.V.A.N.K. 2011, Durability Assessment of Weak Rock by Using Jar Slaking Test, *Electronic Journal of Geotechnical Engineering*, Vol. 16 O No.March, pp. 1319–1335.
- Mohammed, M.H., Pusch, R., Al-Ansari, N., Knutsson, S., Jonasson, J.-E., Emborg, M. and Pourbakhthiar, A. 2013, Proportioning of Cement-Based Grout for Sealing Fractured Rock-Use of Packing Models, *Engineering*, Vol. 05 No.10, pp. 765–774.
- Mohammed, M.H., Pusch, R. and Knutsson, S. 2015, Study of Cement-Grout Penetration into Fractures under Static and Oscillatory Conditions, *Tunnelling and Underground Space Technology*, Vol. 45 No.January, pp. 10–19.
- Mohammed, M.H., Pusch, R., Knutsson, S. and Hellström, G. 2014, Rheological Properties of Cement-Based Grouts Determined by Different Techniques, *Engineering*, Vol. 06 No.05, pp. 217–229.
- Montes, C., Zang, D. and Allouche, E.N. 2012, Rheological Behavior of Fly Ash-Based Geopolymers with the Addition of Superplasticizers, *Journal of Sustainable Cement-Based Materials*, Vol. 1 No.4, pp. 179–185.
- Montgomery, D.C. and Runger, G.C. 2014, *Applied Statistics and Probability for Engineers, 6th edition*, John Wiley & Sons, Inc., Arizona. USA.
- Mostafa, M., Anwar, M.B. and Radwan, A. 2018, Application of Electrical Resistivity Measurement as Quality Control Test for Calcareous Soil, *HBRC Journal*, Vol. 14 No.3, pp. 379–384.
- Mulyana, F., Yolanda, T., Nurhuda, I. and Nuroji. 2017, Studi Beton Geopolimer Sebagai Substitusi Beton Konvensional, In *Konferensi Nasional Teknik Sipil 11*, Jakarta.
- Murmu, A.L., Jain, A., Patel, A. and Petel, A. 2019, Mechanical Properties of Alkali Activated Fly Ash Geopolymer Stabilized Expansive Clay, *KSCCE Journal of Civil Engineering*, Vol. 23 No.9, pp. 3875–3888.
- Murray, H.H. 2000, Traditional and New Applications for Kaolin, Smectite, and Palygorskite: A General Overview, *Applied Clay Science*, Vol. 17 No.5–6, pp. 207–221.
- Nakarai, K. and Yoshida, T. 2015, Effect of Carbonation on Strength Development of Cement-Treated Toyoura Silica Sand, *Soils and Foundations*, Vol. 55 No.4, pp. 857–865.
- Neville, A.M. 2011, *Properties of Concrete, 5th edition*, Pearson Education Limited, London. UK.
- Ni, J.C. and Cheng, W.C. 2012, Trial Grouting under Rigid Pavement: A Case History in Magong Airport, Penghu, *Journal of Testing and Evaluation*, Vol. 40 No.1, pp. 1–12.
- Nickmann, M., Spaun, G. and Thuro, K. 2006, Engineering Geological Classification of Weak Rocks, *International Association for Engineering Geology and the Environment*, Vol. 492 No.492, pp. 1–9.
- Njock, P.G.A., Chen, J., Modoni, G., Arulrajah, A. and Kim, Y.H. 2018, A Review of Jet Grouting Practice and Development, *Arabian Journal of Geosciences*, Vol. 11

- No.459, pp. 1–31.
- Nunes, L.M.G., Da Silva, C.C.N. and De Lucena, L.R.F. 2016, Application of the Electrical Resistivity Method to Identify Karst Features: Geotechnical and/or Geoenvironmental Implications for Hydrocarbon Exploration Areas, *Revista Brasileira de Geofisica*, Vol. 34 No.1, pp. 49–63.
- Palomo, A., Grutzeck, M.W. and Blanco, M.T. 1999, Alkali-Activated Fly Ashes: A Cement for the Future, *Cement and Concrete Research*, Vol. 29 No.8, pp. 1323–1329.
- Pan, D., Zhang, N., Xie, Z., Feng, X. and Kong, Y. 2016, Laboratory Testing of Silica Sol Grout in Coal Measure Mudstones, *Materials*, Vol. 9 No.11, pp. 2–13.
- Papadakis, V.G. 2000, Effect of Supplementary Cementing Materials on Concrete Resistance against Carbonation and Chloride Ingress, *Cement and Concrete Research*, Vol. 30 No.2, pp. 291–299.
- Park, D. and Oh, J. 2018, Permeation Grouting for Remediation Fi Dam Cores, *Engineering Geology*, Vol. 233, pp. 63–75.
- Perret, S., Khayat, K.H. and Ballivy, G. 2000, The Effect of Degree of Saturation of Sand on Groutability-Experimental Simulation, *Ground Improvement*, Vol. 4 No.1, pp. 13–22.
- Phetchuay, C., Horpibulsuk, S., Arulrajah, A., Suksiripattanapong, C. and Udomchai, A. 2016, Strength Development in Soft Marine Clay Stabilized by Fly Ash and Calcium Carbide Residue Based Geopolymer, *Applied Clay Science*, Vol. 127–128, pp. 134–142.
- Picard, M.D. 1971, Classification of Fine-Grained Sedimentary Rock, *Journal of Sedimentary Petrology*, Vol. 41 No.1, pp. 179–195.
- Ping, Y., Zhen-bin, P., Yi-qun, T., Wen-xiang, P. and Zhong-ming, H. 2008, Penetration Grouting Reinforced of Sandy Gravel, *Journal of Central South University of Technology*, Vol. 15, pp. 280–284.
- Qomaruddin, M. 2018, *Pemanfaatan Limbah Batubara untuk Bahan Konstruksi, 1st edition*, CV. MARKUMI, Boyolali. Indonesia.
- Qomaruddin, M., Umam, K. and Adi, Y. 2019, Effect of Calcium Oxide Material on The Setting Time of Geopolymer and Conventional Concrete Pastes, *Eksakta: Jurnal Ilmu-ilmu MIPA*, Vol. 19 No.02, pp. 182–192.
- Raju, V.R. and Valluri, S. 2008, Practical Applications of Ground Improvement, In *Proceeding of Symposium on Engineering of Ground & Environmental Geotechniques*, Hyderabad, 29 Feb - 1 Marc.
- Ranjbar, N., Kuenzel, C., Spangenberg, J. and Mehrali, M. 2020, Hardening Evolution of Geopolymers from Setting to Equilibrium: A Review, *Cement and Concrete Composites*, Vol. 114, pp. 1–19.
- Rawlings, C.G., Hellowell, E.E. and Kilkenny, W.. M. 2000, *Grouting for Ground Engineering*, CIRIA, London.
- Revert, A.B., De Weerd, K., Hornbostel, K. and Geiker, M.R. 2018, Carbonation-Induced Corrosion: Investigation of the Corrosion Onset, *Construction and Building Materials*, Vol. 162, pp. 847–856.
- Rukzon, S. and Chindaprasirt, P. 2010, Strength and Carbonation Model of Rice Husk Ash Cement Mortar with Different Fineness, *Journal of Materials in Civil Engineering*, Vol. 22 No.3, pp. 253–259.
- Sabnis, G.M., Harris, H.G., White, R.N. and Mirza, M.S. 1983, *Structural Modeling and Experimental Techniques*, Prentice-Hall Inc., Englewood Cliffs.

- Sadisun, I.A., Bandonno, B., Shimada, H., Ichinose, M. and Matsui, K. 2010, Physical Disintegration Characterization of Mudrocks Subjected to Slaking Exposure and Immersion Tests, *Indonesian Journal on Geoscience*, Vol. 5 No.4, pp. 219–225.
- Sanalkumar, K.U.A., Lahoti, M. and Yang, E.H. 2019, Investigating the Potential Reactivity of Fly Ash for Geopolymerization, *Construction and Building Materials*, Vol. 225, pp. 283–291.
- Santi, P.M. 1998, Improving the Jar Slake, Slake Index, and Slake Durability Tests for Shales, *Environmental & Engineering Geoscience*, Vol. IV No.3, pp. 385–396.
- Santi, P.M. 2006, Field Methods for Characterizing Weak Rock for Engineering, *Environmental and Engineering Geoscience*, Vol. 12 No.1, pp. 1–11.
- Santoso, B. 2016, Penerapan Metode Geolistrik-2D untuk Identifikasi Amblas Tanah Dan Longsor Di Jalan Tol Semarang – Solo Km 5+400 – Km 5+800, *Spektra: Jurnal Fisika dan Aplikasinya*, Vol. 1 No.2, pp. 179–186.
- Sasri, R., Nurlina, Lia Destiarti, L. and Syahbanu, I. 2018, Analisis Ukuran Partikel Silika Hasil Ekstraksi Dari Batu Padas Asal Kabupaten Ketapang Kalimantan Barat, *Indonesian Journal of Pure and Applied Chemistry journal*, Vol. 1 No.1, pp. 39–43.
- Šavija, B. and Luković, M. 2016, Carbonation of Cement Paste: Understanding, Challenges, and Opportunities, *Construction and Building Materials*, Vol. 117, pp. 285–301.
- Shahriar, A. and Nehdi, M.L. 2012, Rheological Properties of Oil Well Cement Slurries, *Proceedings of Institution of Civil Engineers: Construction Materials*, Vol. 165 No.1, pp. 25–44.
- Shakoor, A. and Gautam, T.P. 2015, Influence of Geologic and Index Properties on Disintegration Behavior of Clay-Bearing Rocks, *The Geological Society of America*, Vol. XXI No.3, pp. 197–209.
- Singh, R.P., Upadhyay, V.K. and Das, A. 1987, Weathering Potential Index for Rocks Based on Density and Porosity Measurements, *Earth Planet Sci.*, Vol. 96 No.3, pp. 239–247.
- Singhi, B., Laskar, A.I. and Ahmed, M.A. 2016, Investigation on Soil–Geopolymer with Slag, Fly Ash and Their Blending, *Arabian Journal for Science and Engineering*, Vol. 41 No.2, pp. 393–400.
- Siregar, S., Fatnanta, F. and Muhandi. 2018, Pengaruh Perubahan Kadar Air Terhadap Nilai Kuat Tekan Bebas Stabilisasi Tanah Cl-MI Dengan Semen, *SIKLUS*, Vol. 4 No.2, pp. 111–122.
- Skempton, A.W. 1964, Long-Term Stability of Clay Slopes, *Géotechnique*, Vol. 14 No.2, pp. 77–102.
- Skempton, A.W. 1977, Slope Stability of Cuttings in Brown London Clay, In *Proc. 9th Int. Conf. Soil Mech. and Found. Engrg*, pp. 261–270. International Society of Soil Mechanics and Foundation Engineering.
- Soga, K., Au, K.A., Jafari, M.R. and Bolton, M.D. 2004, Discussion: Laboratory Investigation of Multiple Grout Injections into Clay, *Géotechnique*, Vol. 55 No.3, pp. 257–258.
- Stappen, J.F.V., De Kock, T., De Schutter, G. and Cnudde, V. 2019, Uniaxial Compressive Strength Measurements of Limestone Plugs and Cores: A Size Comparison and X-Ray CT Study, *Bulletin of Engineering Geology and the Environment*, Vol. 78 No.7, pp. 5301–5310.
- Stark, T.D. and Duncan, J.M. 1991, Mechanisms of Strength Loss in Stiff Clays, *Journal of Geotechnical Engineering*, Vol. 117 No.1, pp. 139–154.

- Struble, L. and Sun, G.-K. 1995, Viscosity of Portland Cement Paste as a Function of Concentration, *Advanced Cement Based Materials*, Vol. 2, pp. 62–69.
- Sumirin and Arief, R.B. 2017, Analisis Efektivitas Model Perkuatan Dengan Injeksi Semen Untuk Peningkatan Angka Keamanan Lereng, *Media Komunikasi Teknik Sipil*, Vol. 23 No.1, pp. 23–28.
- Supandi, Zakaria, Z., Sukiyah, E. and Sudradjat, A. 2018, The Correlation of Exposure Time and Claystone Properties at the Warukin Formation Indonesia, *International Journal of Geomate*, Vol. 15 No.52, pp. 160–167.
- Szwedzicki, T. and Shamu, W. 1999, The Effect of Discontinuities on Strength of Rock Samples, In *Proceedings., Australasian institute of mining an metallurgy*, pp. 23–28.
- Takano, S., Hayashi, K., Zen, K. and Rasouli, R. 2016, Controlled Curved Drilling Technique in the Permeation Grouting Method for Improvement Works of an Airport in Operation, *Procedia Engineering*, Vol. 143 No.1ctg, pp. 539–547.
- Telford, W.M., Geldart, L.P. and Sheriff, R.E. 1990, *Applied Geophysics, 2nd edition*, Cambridge University Press, Cambridge.
- Thapa, V.B. and Waldmann, D. 2018, A Short Review on Alkali-Activated Binders And Geopolymer Binders, In *Pahn, M., Thiele, C. and Glock, C. Vielfalt im Massivbau*, pp. 576–591. Ernst & Sohn, Berlin. Germany.
- Tsitouras, A., Perraki, T., Perraki, M., Tsivilis, S. and Kakali, G. 2010, The Effect of Synthesis Parameters on the Structure and Properties of Metakaolin Based Geopolymers, *Materials Science Forum*, Vol. 636–637, pp. 149–154.
- Uteau, D., Pagenkemper, S.K., Peth, S. and Horn, R. 2013, Aggregate and Soil Clod Volume Measurement: A Method Comparison, *Soil Science Society of America Journal*, Vol. 77 No.1, pp. 60–63.
- Verhoef, P.N.. 1989, *Geologi Untuk Indonesia*, Penerbit Erlangga, Jakarta. Indonesia.
- Vincent, N.A., Shivashankar, R., Lokesh, K.N. and Jacob, J.M. 2017, Laboratory Electrical Resistivity Studies on Cement Stabilized Soil, *International Scholarly Research Notices*, Vol. 2017, pp. 1–15.
- Vipulanandan, C. and Ozgurel, H.G. 2009, Simplified Relationships for Particle-Size Distribution and Permeation Groutability Limits for Soils, *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 135 No.9, pp. 1190–1197.
- Wan, J., Tokunaga, T.K., Williams, K.H., Dong, W., Brown, W., Henderson, A.N., Newman, A.W. and Hubbard, S.S. 2019, Predicting Sedimentary Bedrock Subsurface Weathering Fronts and Weathering Rates, *Scientific Reports*, Vol. 9 No.1, pp. 1–10.
- Wang, Q., Wang, S., Sloan, S.W., Sheng, D. and Pakzad, R. 2016, Experimental Investigation of Pressure Grouting in Sand, *Soils and Foundations*, Vol. 56 No.2, pp. 161–173.
- Wang, X.Q., Wen, P.H., Gao, Z.W. and Wang, C.H. 2018, “Research on Influence of Water-Cement Ratio on Workability and Mechanical Properties of Geopolymer Grouting Material,” In *Proceeding of 2nd International Conference on New Material and Chemical Industry*, Materials Science and Engineering, Vol. 292, pp. 1-5.
- Warner, J.P.E. 2004, *Practical Handbook of Grouting: Soil, Rock, and Structures*, John Wiley & Sons, Inc., New Jersey.
- Wen, S. and Chung, D.D.L. 2001, Electric Polarization in Carbon Fiber-Reinforced Cement, *Cement and Concrete Research*, Vol. 31 No.1, pp. 141–147.

- Wijaya, A.L., Jaya Ekaputri, J. and Triwulan. 2017, Factors Influencing Strength and Setting Time of Fly Ash Based-Geopolymer Paste, *MATEC Web of Conferences*, Vol. 138, pp. 1–9.
- Wong, B.Y.F., Wong, K.S. and Phang, I.R.K. 2019, A Review on Geopolymerisation in Soil Stabilization, In *IOP Conference Series: Materials Science and Engineering*.
- Yang, J., Cheng, Y. and Chen, W. 2019, Experimental Study on Diffusion Law of Post-Grouting Slurry in Sandy Soil, *Advances in Civil Engineering*, Vol. 2019 No.1, pp. 1–11.
- Yin, B., Kang, T., Kang, J. and Chen, Y. 2018, Analysis of Active Ion-Leaching Behavior and the Reaction Mechanism During Alkali Activation of Low-Calcium Fly Ash, *International Journal of Concrete Structures and Materials*, Vol. 12 No.50, pp. 1–13.
- Yoshida, N. and Hosokawa, K. 2004, Compression and Shear Behavior of Mudstone Aggregates, *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 130 No.5, pp. 519–525.
- Yunsheng, Z., Wei, S. and Zongjin, L. 2010, Composition Design and Microstructural Characterization of Calcined Kaolin-Based Geopolymer Cement, *Applied Clay Science*, Vol. 47 No.3–4, pp. 271–275.
- Yusuf, A., Dio, I., Hadiyanti, S. and Wikan, K. 2017, Perilaku Clay Shale Terhadap Kuat Geser Residual Pada Lokasi Banyumeneg, Penawangan, Dan Wonosegoro, *Jurnal Karya Teknik Sipil*, Vol. 6 No.1994, pp. 81–92.
- Zhang, C., Gamage, R.P., Perera, M.S.A. and Zhao, J. 2017, Characteristics of Clay-Abundant Shale Formations: Use of CO₂ for Production Enhancement, *Energies*, Vol. 10 No.11, pp. 1–27.
- Zhang, C., Yang, J., Ou, X., Fu, J., Xie, Y. and Liang, X. 2018, Clay Dosage and Water/Cement Ratio of Clay-Cement Grout for Optimal Engineering Performance, *Applied Clay Science*, Vol. 163 No.April, pp. 312–318.
- Zhang, J., Li, S., Li, Z., Yang, L., Zhang, Q., Wang, K., Qi, Y., Du, J. and Li, H. 2020, Effect of Particle Size Distribution on the Grout Diffusion Pattern in Completely and Strongly Weathered Granite, *Indian Geotechnical Journal*, Vol. 50 No.4, pp. 531–539.
- Zhang, J., Li, S., Li, Z., Zhang, Q., Li, H., Du, J. and Qi, Y. 2019, Properties of Fresh and Hardened Geopolymer-Based Grouts, *Ceramics - Silikat*, Vol. 63 No.2, pp. 164–173.
- Zhang, S., Xu, Q. and Hu, Z. 2016, Effects of Rainwater Softening on Red Mudstone of Deep-Seated Landslide, Southwest China, *Engineering Geology*, Vol. 204, pp. 1–13.
- Zhou, Z., Du, X., Wang, S. and Zang, H. 2018, Analysis and Engineering Application Investigation of Multiple-Hole Grouting Injections into Porous Media Considering Filtration Effects, *Construction and Building Materials*, Vol. 186, pp. 871–883.
- Zohra-Hadjadj, F., Laredj, N., Maliki, M., Missoum, H. and Bendani, K. 2019, Laboratory Evaluation of Soil Geotechnical Properties via Electrical Conductivity, *Revista Facultad de Ingenieria*, No.90, pp. 101–112.