

# Index

- Adaptable designs, 109
- African Development Bank (ADB), 126
- African Union (AU), 107
- Agenda 21, 11
- American Consulting Engineers Council (ACEC), 57, 59–60
- American Public Works Association (APWA), 57
- American Society of Civil Engineers (ASCE), 57
- Assessment, 66
- Assessment methodologies, 44
- Australian Public Service Commission (APSC), 27
  
- BE<sup>2</sup>ST-In-Highways Rating System, 56–57, 67–69
- Beneficiaries, 29
- Biodiversity, 75
- Blue carbon, 87
- Broward County in Florida, 89
- Brundtland Report, 161
- Building Research Establishment's Environmental Assessment Method (BREEAM), 56
  
- Carbon emissions, 4, 107
- Carbon offset markets, 86–87
- Carbon tax revenues, 85
- Carbon taxation, 85–86
- Certification
  - methodologies, 48–50
  - system, 58, 67
- CH2M Hill, 60
- Civil Engineering Environmental Quality and Assessment Scheme (CEEQUAL), 45, 49, 153, 170
- Certification System, 60–61
- Certification Tool, 67
- Clean Development Mechanism of Kyoto Protocol, 87
- Clean Renewable Energy Bonds, 84
- Climate change
  - adaptation measures into sustainable road infrastructure development, 108–110
  - in developing countries, 107–108
  - response, 98, 106–107, 144
  - road infrastructure and, 108
- Climate gentrification, 86
- Community participation, 99–100
- Compliance marketplaces, 87
- Compliance Offset Scheme, 87
- Comprehensive Assessment Systems for Building Environmental Efficiency (CASBEE), 56
- Concessions, 84
- Conseil International du Bâtiment (CIB), 27
- Considerate Constructors, 116
- Conventional public involvement mechanisms, 101
- Corporate social responsibility (CSR), 115
- Correlation qualities, 115
- Cost-benefit analysis (CBA), 46
- Credits, 49
- Criteria, 66–67
- Cultural legacy, 161
- Cultural sustainability, 161
- Culture, 161
- Customers, 29
  
- Deformation, 106
- Delphi analysis, 135

- Delphi study, 134
  - DSO, 148–155
  - findings from, 136–148
- Delphi survey, 134–136
- Demands for sustainability from
  - DPs, 128–129
- Department of Feeder Roads (DFR), 123
- Developing countries, 31–33
- Development, 15
- Development partners (DPs), 126
- Disclosure, 101
- Dissatisfaction, 99
- Distribution of resources, 70
- Downpours, likelihood of, 106
  
- E3 model, 85
- EA regulations and procedures, 128
- Ecological degradation, 10
- Ecological sustainability, 32
- Ecological/societal effects
  - life-cycle assessment, 47–48
  - methods for evaluating, 47
  - rating techniques and certification methodologies, 48–50
  - societal appraisal techniques, 48
- Economic development, 15
- Economic growth, 14–15, 22
- Economic sustainability, 11, 161–162
  - indicators, 137
- Educational programmes, 35
- Energy consumption, 67
- Engineering performance (EP), 163
  - indicators, 143
- Environmental and social assessment (ESA), 126
- Environmental and Social Management Framework (ESMF), 130
- Environmental Assessment (Amendment) Regulations, 126
- Environmental Assessment (EA), 126
- Environmental impact, 4
- Environmental Impact Assessment Procedures (EIAP), 127
- Environmental management (EM), 126
- Environmental protection, 14
- Environmental Protection Agency (EPA), 126
- Environmental Protection Agency Act of 1994, 126–128
- Environmental sustainability, 11
  - indicators, 137–139
- Envision Certification System, 57, 69–70
- Equity, 15
- Estuaries, 87
- Evaluation, 83
- Expert feedback, 135
- Expert views, 135
  
- Federal Highway Administration (FHWA), 60
- Financing models, 82
- 5-capital framework, 16
- Forestry Commission's Forest Services Division (FSD), 131
- Forestry Policy, 129
- Fossil fuels, 85
- Frequency counts, 135
- Funding models, 82
- Future uncertainty, 109
- 'Future We Want' The, 12
- Fuzzy set technique, 74
  
- GB Tool, 56
- Ghana Environmental Impact Assessment Procedures, 126
- Ghana Shared Growth Development Agenda (GSGDA), 129
- Ghana's Environmental Policy, 127
- Ghana's transportation sector, 122–123
- Governance of stakeholders and infrastructure development, 115–116

- Governments, 29
- Green Globes, 56
- Green Guide, 70
  - for Road Rating Tool, 58
- Green infrastructure financing
  - (GI financing), 81
  - carbon offset markets, 86–87
  - carbon taxation, 85–86
  - green/climate bonds, 84
  - impact development fees, 89–90
  - non\_ad valorem special assessments, 90–91
  - options, 83–91
  - PPP, 83–84
  - TDR, 87–89
  - TIF, 86
- Green/climate bonds, 84
- Greenhouse gas emissions (GHG emissions), 4, 67, 75
- GreenLITES Certification System, 58, 71
- Greenpave Certification Tool, 71–72
- Greenpave Rating Tool, 58–59
- Greenroads, 58
  - Certification Tool, 72–73
  - Rating System, 59
- Gross domestic product (GDP), 85
- Growth, 15
- Guide for Green Roads, 70–71
- Harvard Graduate School of Design, 57
- Hazardous chemical waste, 67
- Health and safety (HS), 162
- Heat waves, 107
- I-LAST Certification Tool, 59–60, 73
- Illinois Department of Transportation (IDOT), 59–60, 73
- Illinois Liveable and Sustainable Transportation (IRTBA), 59–60
- Impact development fees, 89–90
- Informal transition rate, 10–11
- Infrastructure, 31
  - upgrades, 86
  - vulnerability, 108
- Infrastructure development, 5, 22–23, 56, 66
  - sustainability implementation in, 23–25
- Infrastructure projects, 27, 116
  - frameworks, models, and guidelines, 50–51, 56
  - in Ghana’s current legal and administrative frameworks, 126–130
  - sustainability of, 44–45
- Institute for Sustainable Infrastructure (ISI), 57
- Institute of Public Works Engineering Australia (IPWEA), 23
- Institute of Resilient Infrastructure (IRI), 108
- Institution of Civil Engineers (ICE), 60
- Institutional arrangements for sustainability policies, 130–131
- Institutional sustainability, 162
  - indicators, 139–140
- Integrated sustainable road
  - infrastructure project implementation model (ISRPI model), 160
  - identifying constructs (criteria and indicators) for, 160–129
- International Council for Research and Innovation (CIB), 23
- International Federation of Consulting Engineers (FIDIC), 153
- International Institute for Sustainable Development (IISD), 33
- International organizations, 99
- International Roughness Index (IRI), 57
- Interquartile range (IQR), 135

- INVEST Certification Tool, 73–74
- Invest Rating Tool, 60
- Investors, 29
  
- Judicial appeal, 101
  
- Key performance indicators (KPI), 76
  
- Land value capture, 86
- Landowners, 88
- LCCA, 57
- Leadership style, 69–70
- LEED, 56
- Legitimacy, 115
- Liberty, 15
- Life-cycle assessment (LCA), 45, 47–48
- Life-cycle costing, 67
- Life-cycle costs, 75
- Low-impact development (LID) (*see* Green infrastructure financing (GI financing))
  
- Mangroves, 87
- Material usage, 75
- Mechanistic-Empirical Pavement Design Guide (MEPDG), 57
- Michigan roadways, 76
- Mitigation methods, 129
- Modelling techniques, 45
- MoT, 123
- Multi-criteria decision analysis (MCDA), 45–46
- Multiple organizations, 15
  
- National Environmental Action Plan (NEAP), 127
- National environmental requirements, 126–127
- Natural coasts, 87
- Natural resources, 26
- New York State Department of Transport (NYS-DOT), 71
  
- Noise management, 75
- Non\_ad valorem special assessments, 90–91
- Nongovernmental organizations (NGOs), 11
  
- Observational approach, 109–110
- Operational policies (OP), 128
- Organizational theory, 115
- ‘Our Common Future’, 11
  
- Participation, 27, 83
- Pavement Life-Cycle Assessment Tool for Environmental and Economic Impacts (PaLATE), 57
- People, planet, and profit (3Ps), 16
- Perception of SD, 15
- Planners, 29
- Pollution control, 75
- Population increase, 10
- Power, 115
- Primary stakeholders, 101
- Private funding, 82
- Private investment, 82
- Project administration, 75–76
- Project assessment techniques, 46
  - cost-benefit analysis, 46
- Project beneficiaries, 99
- Project management (PM), 162
  - indicators, 143
- Project Management Institute (PMI), 114
- Project managers, 29
- Project partners, 99
- Project risks, 75
- Property taxes, 91
- Public participation, 98, 101
  - best practices, 101–102
  - community participation, 99–100
  - essence, 101
  - gaps in research on sustainable road infrastructure development, 98

- indicators, 144–146
- ladder, 100
- Public school impact fees, 89
- Public–private partnership (PPP), 83–84
- Rating
  - techniques, 48–50
  - tools, 58
- Recycled Materials Resource Centre (RMRC), 56–57
- Resettlement Policy Framework (RPF), 129–130
- Resilience, 108
- Resource management, 75
- Resource utilization and management
  - indicators, 143, 162–163
- Rio+20 conference, 11
- Risk assessment, 109
- Road construction, 31
- Road infrastructure and climate change, 108
- Road infrastructure development
  - (RID), 5, 98
  - in Ghana, 123–124
  - size and condition of Ghana's road network, 124
- Road infrastructure projects, criteria and indicators of existing sustainability rating system for, 66–67
- Road Traffic Act, 2004 (Act 683), 130
- Road Traffic Regulations (LI 953), 130
- Roads and Ministry of Highways (MRH), 123
- Salt marshes, 87
- Scorecards, 60
- Scottish Transport Appraisal Guidance (STAG), 50
- Seagrasses, 87
- Sector medium-term development plan (SMTDP), 129
- Social activists, 99
- Social cost of carbon savings, 67
- Social life-cycle assessments (SLCA), 45
- Social qualities, 161
- Social sustainability, 11, 161
- Societal appraisal techniques, 48
- Socio-cultural sustainability
  - indicators, 127
- Socioeconomic sustainability, 32
- Stakeholders, 27, 29–30, 109, 114
  - engagement, 101
  - identification, 116
  - impact assessment, 116
  - management, 98, 114–115, 146–148
- Standards, 26
- Stars Rating Tool, 61
- Stockholm Conference in 1972, 11
- Strategic planning, 115
- Strong sustainability, 12, 24–25
- Subcontractors, 29
- Subsidence, 106
- Summary tables, 51
- Sustainability, 14, 99
  - of infrastructure projects, 44–45
- Sustainability implementation
  - in infrastructure development, 23
  - strong sustainability, 24–25
  - weak sustainability, 23–24
- Sustainable construction (SC), 25
- Sustainable development (SD), 5, 10
  - concept and definition, 12–16
  - economic growth *vs.*, 14–15
  - environmental protection *vs.*, 14
  - geneses and progression, 10–12
  - models, 16
  - pillars, 13
  - principles, 5
  - sustainability *vs.*, 14
  - varied perceptions and criticisms, 15–16
- Sustainable development, 60

- Sustainable development goals (SDGs), 4, 6, 12
- Sustainable Development Research Network (SDRN), 10
- Sustainable economic development, 5
- Sustainable growth, 15
- Sustainable infrastructure, lessons from Ghana's development of, 131
- Sustainable infrastructure development (SID), 4–5, 25, 98
  - benefits of implementing, 34–35
  - critical factors, 33–34
  - factors encouraging adoption of, 35–37
  - principles, 27–28
- Sustainable infrastructure financing, 81–83
  - GI finance options, 83–91
- Sustainable infrastructure project (SIP), 29
  - existing approaches and systems for assessing, 45–51
  - review of research works on criteria and indicators for implementation of, 74–77
- Sustainable road construction, key parties involved in, 116–117
- Sustainable road infrastructure development (SRID), 5, 27, 98
  - background, 4–5
  - in developing countries, 31–33
  - gaps in research on, 98
  - incorporating climate change adaptation measures into, 108–110
  - managing stakeholders' interest and sustainability requirements, 30
  - motivation, 6
  - objectives, 7
  - problem statement, 5–6
  - processes, 31–32
  - project stakeholders in road infrastructure sector, 29
  - purpose, 6
  - significance, 7
- Sustainable road infrastructure project implementation model (SRIPi model), 129
  - measurement components, 171–172
  - requirement and rationalization of model, 169–170
  - structural component, 170–171
- Sustainable road infrastructure projects (SRIPs), 6, 98
  - main criteria, 136–137
- Sustainable road network development in Ghana, 124–126
- Sustainable society, 11
- Swedish carbon tax, 85–86
- Systems theory, 115
- Tappan Zee Bridge in New York, 84
- Tax Incremental Financing (TIF), 86
- Technological improvement, 10
- Three-legged ideology, 13
- Traffic congestion, 67
- Traffic Noise Model Look Up (TNM-Look), 57
- Transfer of Development Rights (TDR), 87–88
- Transport Division of New South Wales, 75
- Transport Integration Plan's SEA, 129
- Transportation, 5–6
- Triple bottom line (TBL), 16
- Twofold reasonable nexus test, 89
- UK Department of Transport Analysis Guidance (WebTAG), 50
- UK's Institution of Civil Engineers (ICE), 49
- United Kingdom (UK), 49
- United Nations (UN), 4, 12

- United Nations Environmental Programme International Environmental Technology Centre (UNEP-IETC), 23
- United Nations Framework Convention on Climate Change (UNFCCC), 11, 107
- United States of America (USA), 4, 49
- Urgency, 115
- Utilities, 6
- Waste management, 75
- Waste reduction, 67
- Water, 75
  - usage, 67
- Water Resources Commission (WRC), 131
- WCED, 11
- Weak sustainability, 12, 23–24
- Wildlife Division (WD), 131
- World Bank (WB), 49s, 99, 126
- World summit on SD (WSSD), 11
- Zofnass Program for Sustainable Infrastructure, 57