

# Subject Index

## A

Abrasion resistance, 120, 168-169  
 Apparent opening size, 7, 21, 29-30,  
     172-173  
     defined, 30  
     versus equivalent opening size, 9-  
     12  
 Apparent slope height, 96  
 Approved list, 21, 25, 28  
 Armored revetment, 46, 48  
 Armor stones, placement, 53-54  
 ASTM Committee D-35, 161-175  
     endurance property subcommit-  
     tee, 168-171  
     mechanical properties subcommit-  
     tee, 162-168  
     permeability and filtration sub-  
     committee, 171-175  
     standards, 162  
 ASTM D 76-77, 164  
 ASTM D 120-1, 120  
 ASTM D 737-75, 13  
 ASTM D 751-68, 129  
 ASTM D 751-79, 126, 166-167  
 ASTM D 854-83, 126  
 ASTM D 1117-80, 126, 129, 167  
 ASTM D 1175, 169  
 ASTM D 1388-64, 126  
 ASTM D 1652-73, 126  
 ASTM D 1682-64, 129, 163, 169  
 ASTM D 1777-64, 175  
 ASTM D 3786-80a, 168  
 ASTM D 3787-80a, 166  
 ASTM D 3884-80, 169  
 ASTM D 4354, 162  
 ASTM D 4355-84, 120, 162, 168  
 ASTM D 4429-84, 134  
 ASTM D 4491-85, 13, 162  
 ASTM D 4533-85, 167

ASTM D 4595-86, 28, 57, 63, 67, 83-  
     86, 98, 111, 163-166  
 ASTM D 4632-86, 57

## B

Bearing capacity, embankment,  
     112-113  
 Biogeoproducts, 153  
 Biological stability, 169-170  
 Burst test, circular or rectangular, 60

## C

California bearing ratio, 60  
 California Department of Transpor-  
     tation geotextile methods  
     generic specifications, 22-33  
     nonwoven, applications and ad-  
     vantages, 23-24  
     specification need for utilization  
     improvement, 24-25  
 Chemical stability, 169-170  
 Christopher clamp, 164-165  
 Clogging, 146  
     behavior, 7-8  
     ratio, 14, 173  
     soil-fabric test results, 16  
 Coherent gravity procedure, 100-101  
 Constant-head permeameter, 14  
 Construction  
     criteria, 125-137  
     construction-related problems,  
     125-126  
     drainage, 127-129  
     erosion control, 127, 130-131  
     reinforcement, 135-137  
     separation, 131-135  
     site damage, 85-86  
     resistance, 105

methods, 153-155  
 Cordrain, flow rate, 43  
 behavior, 37, 39  
 Creep, 84, 161, 170  
 test, 69, 85, 87-89  
 Crucifax biaxial test, 60  
 Cylindrical sleeve test, 60

## D

Darcy's equation, 149  
 Darcy's law, 12-13, 18  
 Darcy's permeability coefficient, 7,  
 12-13, 28  
 nominal, 30-31  
 Design, 145 (*See also* specific appli-  
 cations)  
 development of empirical and  
 semiempirical methods, 156  
 sophisticated analytical methods,  
 155-156  
 Diaphragm bursting strength test  
 method, 168  
 Direct shear test, 69, 88-90  
 Drainage, 17-19, 21-32, 125, 145  
 application areas, 34  
 California Department of Trans-  
 portation, geotextile meth-  
 ods, 22-25  
 construction criteria, 127-129  
 gravity flow on sloped embank-  
 ment, 40-41  
 in-plane, 36  
 lateral designs, 33-44  
 approaches, 33  
 hydraulic considerations, 34-36  
 required data base, 36-37  
 using bulky geotextiles, 37, 40-  
 42  
 using geocomposites, 42-43  
 pressure flow under surcharge fill,  
 41-42  
 transmissivity of drainage net, 150  
 Durability testing, 119-121

## E

Earth structure, 70  
 Effective opening size, 49  
 Embankments, weak foundations,  
 69, 74-75, 106-114  
 bearing capacity failure, 112-113  
 design principles, 106-107  
 lack of embankment internal sta-  
 bility, 106-107  
 lack of foundation stability, 107  
 lateral sliding, 107-109  
 performance criteria, 106  
 reinforcement elongation, 110-  
 111  
 reinforcement properties and rele-  
 vant test methods, 113-114  
 simplified design, 107-113  
 slip surface failure, 109-112  
 strain level, 111  
 Empirical, 21  
 Enkadrain, flow rate, 39, 43  
 Equivalent opening size, 172  
 versus apparent opening size, 9-12  
 versus port structure, 9-11  
 retention ability and, 8-9  
 Erosion control, 45, 125  
 applications, 46, 48  
 concept, 45-46  
 construction criteria, 53-54, 127,  
 130-131  
 design criteria for needle-punched  
 nonwovens, 50-53  
 filter, 45-54  
 geotextile functional design con-  
 siderations, 48-49  
 riprap slope protection, 47

## F

Fabrics, 45  
 Factor of safety, 35, 43, 80-82  
 Filter  
 criteria, 45  
 design, 146-149

mechanisms and properties, 146-147  
 nonclogging criterion, 148  
 permeability criterion, 147  
 retention criterion, 148  
 Filtration, 8-17, 21, 145  
 criteria, 8  
 permeability, 12-14  
 Flow rate, 33

**G**

Geocomposites, 33  
 drainage systems, 38  
 lateral drainage designs, 42-43  
 Geogrids, 69  
 properties, 82-83  
 Geosynthetics, 33, 145  
 drain design, 149-151  
 future, 153  
 properties, 151, 155  
 Geotechnical engineering, 145  
 Grab tensile strength, 163  
 Grab tension, 28-29  
 Grab test, 63  
 Gradient ratio, 7, 173-174  
 permeameter, 15  
 test, clogging resistance, 14-17  
 Granular soil, 45

**H**

Horizontal stress, 103-104  
 Hydraulic conductivity, 171-172  
 Hydraulic properties, 7-19 (*See also*  
 Filtration)  
 drainage, 17-19

**I**

Index test, 119  
 Initial tangent tensile stiffness, defined, 86  
 In-plane transmissivity, 174  
 Instrumentation, 141

**L**

Laboratory tests, 141  
 Laterally restrained tension test, 63  
 Lateral sliding, embankment on weak foundations, 107-109  
 Load supporting pads, 75-77  
 Load supporting structures, 70

**M**

Materials, range of, 152-153  
 Melt-bonded, 21  
 Microgeosynthetics, 153

**N**

Needle-formed, 21, 23-24  
 Needle-punched, 21, 149-150  
 New York State Department of Transportation, geotextile methods, 25-31  
 background, 25  
 critical designs, 30-31  
 slope protection, 26, 28  
 testing and acceptance, 28-30  
 underdrain, 26-27  
 Nonclogging criterion, 148  
 Nonwoven, 21, 148  
 applications and advantages, 23-24  
 drainage systems, 38  
 needle-punched, 149-150  
 design criteria, 50-53

**O**

On-site protection of handling, 170  
 Overlap, minimum, 134

**P**

Permeability, 7-8, 12-14, 21  
 criterion, 147  
 equivalent ratio, 52

- fabric compressibility effect, 13-14
- soil type and hydraulic gradient effect, 17
- Permeameter, 29
  - constant-head, 14
  - gradient ratio, 15
- Permittivity, 7, 21, 29, 171-172
  - defined, 13, 28
  - underload, 174-175
- Physical properties (*See* Properties)
- Pin spacing, 130
- Planar flow, 33
  - transmissivity, 17-18
- Polyfelt TS geotextiles, filter design criteria, 51
- Polymeric reinforcement material, idealized creep and stress relaxation behavior, 84
- Pore size, 7 (*See also* Apparent opening size; Equivalent opening size)
- Pretensioning, 153-154
- Properties, 82-83, 126, 141 (*See also* Filtration; Hydraulic properties)
  - current requirements, 143
  - geosynthetics, 151, 155
  - minimum, 129
  - soil-fabric, 141-142
- Pullout test, 69, 89-90
- Puncture test, 166-167

## R

- Railroad track structures, 77-78
- Reinforced slopes, 90-99
  - amount of reinforcement, 94-96
  - deformations under working conditions, 98
  - design principles, 91-94
  - distribution of reinforcement, 96
  - external stability, 93
  - failure modes, 91

- friction between soil and reinforcement, 99
- internal stability, 91-93
- length of reinforcement, 96-97
- limit equilibrium design, 97-98
- performance criteria, 90-91
- reinforcement force effect, 92-93
- reinforcement orientation and length, 94
- simplified design, 94-97
- soil reinforcement, 70, 72
- wedge failure mechanism, 94
- Reinforced soil walls, 70, 72-73, 99-105
  - construction site damage, 105
  - design principles, 100
  - environmental exposure resistance, 105
  - external stability, 104-105
  - initial tangent stiffness, 105
  - internal stability, 102-104
  - performance criteria, 99-100
  - simplified design, 100-105
- Reinforcement, 125
  - construction criteria, 135-137
  - material types, 82
- Research, 141-143, 155-156
- Retaining walls, 69
- Retention criterion, 148
- Riprap slope protection, 47
- Roads, 77-78
- Rutting, repair, 134-135

## S

- Sanders clamp, 165-166
- Seaming techniques, 135-136
- Secant tensile stiffness, defined, 86
- Separation, 125
  - construction criteria, 131-135
  - construction problems, 132
- Sieving test, 172-173
- Silt fences, construction, 131-132
- Slip surface failure, embankment, 109-112

- Sloped soil layers, 73-74
- Slopes (*See also* Reinforced slopes)  
 protection, New York State Department of Transportation, geotextile methods, 26, 28  
 stability, 69
- Soil, 145  
 layers, nonuniform foundations, 74-76  
 permeability, 12  
 reinforcement, 69-114, 145 (*See also* Reinforced slopes; Reinforced soil walls)  
 categories, 79  
 construction site damage effects, 85-86  
 design approach, 79-80  
 discrete approach, 89  
 embankments on weak foundations, 74-75  
 factor of safety, 80-82  
 global approach, 80  
 influence of load duration on isochronous load-strain behavior, 89  
 interaction characteristics, 88-90  
 load supporting pads, 75-77  
 railroad track structures, 77-78  
 reinforced slopes, 70, 72  
 reinforced soil walls, 70, 72-73  
 reinforcement material types, 82  
 roads, 77-78  
 sloped soil layers, 73-74  
 soil layers on nonuniform foundations, 74-76  
 soil mass-reinforcement geometry, 79  
 temperature effects, 85-86  
 tensile characteristics, 82-89  
 time-dependent behavior, 84-85  
 types of structures, 70-80  
 retention, 21, 29-30
- Soil-fabric properties, 141-142
- Standardization, 141-142
- Standards, 161-162
- Strength, 21
- Stress relaxation, 84
- Strip tension test, 63
- Survivability, 125, 126-128
- T**
- Tabor test, 120, 169
- Tensile force, 104
- Tensile resistance, 87  
 defined, 82-86
- Tensile strength, 86, 161
- Tensioned membrane effect, 152
- Tension testing, 57-69  
 California bearing ratio, 60  
 choice, 63-64  
 circular or rectangular burst test, 60  
 criteria, 58  
 crucifax biaxial test, 60  
 cylindrical sleeve test, 60  
 existing tests, 58, 62  
 grab test, 63  
 in-soil, 82-83  
 jointing and seaming, 68  
 laterally restrained tension test, 63  
 load/extension envelope for differing rates of strain, 59  
 localized load results, 65, 67  
 results, 64-65  
 size specimen, 58-59  
 strip tension test, 63  
 unidirectional load results, 67  
 unidirectional test setup, 60  
 wide strip, 28-29, 83-84, 163-166
- Testing  
 current, 141-142  
 future, 141-144  
 New York State Department of Transportation, geotextile methods, 28-30
- Thermal stability, 121
- Thickness, 175
- Tieback wedge procedure, 100-101
- Tortuous path, 23

Transmissivity, 7, 33  
definition, 35  
drainage net, 150  
planar flow, 17-18  
response versus applied normal stress, 37  
tests, 18-19  
Trapezoid tear, 167

**U**

Ultraviolet  
degradation resistance, 170-171  
stability, 119-120

Underdrain, New York State Department of Transportation, geotextile methods, 26-27

Unpaved roads, 145  
geosynthetic-reinforced, 151-152

**V**

Vertical stress, maximum, 102-103

**W**

Woven, 21-22, 148