

If 1:7 concrete is wanted there would be $* \frac{100}{7} = 14.3$ parts cement, and the proportions would be 14:23:23:18:36 or 1:1.6:1.6:1.3:2.5 by weight. This would give very nearly an ideal mix, and the resultant concrete would be impermeable and very strong.

INDEX

- Abrasion tests of mortar, 125
 Absolute volumes of sand, 145
 in mortar, 135, 146
 Abutments, design of, 583
 Accelerated tests of cements, 106
 See also Soundness
 Acids, effect upon concrete, 392
 Adath Israel Temple dome, 626
 Adhesion of cement, affected by regag-
 ing, 159
 mold for testing, 122
 tests of cement and mortar, 121
 Adhesion of concrete to steel, 456
 References, 728
 Adhesion of old and new concrete, 284
 Aggregate, definition, 20
 Aggregates. See also Broken stone
 See also Gravel
 See also Sand
 coarse, 34
 essentials, 2
 fine, 33
 laws of volumes and voids, 160
 properties of, 5
 selection, 12
 specification, 33, 34
 voids and density, 168
 Akron cement, definition, 20
 Alcohol, effect of. References, 741
 Alum and lye, waterproof wash, 342
 Alum and soap, waterproof mixture,
 344
 Am Soc. C. E., standard cement tests,
 63
 Analysis chemical. See Chemical
 analysis
 mechanical. See Mechanical
 analysis
 Angle of internal friction, 662
 Annealing, test for first-class steel, 40
 Apparatus for cement testing, 80
 Aqueducts. See Conduits
 Arches, 533
 References, 728
 abutments, design of, 583
 bridges. See Bridges
 centering, 587
 classification, 536
 Arches, concrete vs. steel, 534
 construction, method of, 586
 dead loads, 544
 earth pressure, 544
 erection, 586
 example of design, 574
 fixed or continuous, 548
 formulas, general 549
 formulas, moment, thrust and
 shear at crown, 553
 groined, 606, 608
 history of concrete arches 536
 loading to use in design, 580
 Melan system, 537
 moment at the crown, 551
 Monier system, 537
 notation, 545
 relation outer loads and reac-
 tions at supports, 545
 rib shortening, 558
 shape of ring, 540
 shear at the crown, 551
 steel reinforcements, 535
 strength. References, 739
 stress, allowable unit, 583
 temperature, effect of, 555
 thickness of ring at crown, 540
 three-hinged, 546
 thrust at the crown, 551
 two-hinged, 547
 Wünsch system, 537
 Ash pits, 703
 Asphalt for waterproofing, 344, 346
 Automatic concrete elevator, 268
 Automatic measurers for materials,
 264
 Bag of Natural cement, weight, 31
 Portland cement, weight, 29
 Bags for depositing concrete, 306
 Ball mill, 715
 Baltimore fire, 332
 Banded columns, 492
 Barrel of natural cement, weight, 31
 of Portland cement, weight, 29
 Barrel, volume of, 3, 218
 weight of, 2d

Barrow. See Wheelbarrow
 Bars, concrete splitting at, 459
 deformed, use, 2, 463, 500, 645, 670
 depth of concrete below, 460
 length to imbed in concrete, 464
 table of areas and weights, 507
 types of, 505.
 Basement walls, 619
 Batch mixers, 256
 Beams, plain. References, 739
 Fuller's tests, 376, 378
 strength, 378
 tests of cement, 120
 Beams reinforced, 416. See also T-beams
 References, 740
 analyses, 749
 bending moments to use, 439
 circular, 774
 concrete bearing tension, analysis, 760
 continuous at the support, 428, 471, 516
 cracks and corrosion, 336
 deformation and deflection curves, 409
 depths for different bending moments, 419
 diagonal tension, 443
 end reinforcement, 428
 examples of design, 419, 469, 476
 experiments, 477
 formulas for concrete bearing tension, 760
 formulas for parabola distribution, 762
 formulas for rectangular, 418, 751
 formulas for review, 420
 formulas for steel in top and bottom, 427, 757
 formulas for T-beams, 423, 754
 foundation, 649
 general principles, 400
 Hatt's method of stress distribution, 762
 haunch, 429
 horizontal shear, 443
 loads for different bending moments, 419
 modulus of elasticity, 406
 neutral axis, location of, 416
 plane section before and after bending, 402
 rectangular, 416
 repetitive loading tests, 481
 shearing forces, 441

Beams, reinforced, slab load, distribution of to supporting beams, 431
 spacing of tension bars, 459
 steel in top and bottom, 427, 516, 757
 steel in top and bottom, example, 470, 471
 straight line theory, 415
 tables of constants, 519, 520
 tables of constants, beam with steel in top and bottom, 516
 table of depth of neutral axis, 521
 tables of safe loads, 509-511
 Talbot's tests, 477
 T-beam design. See T-Beams
 tensile resistance, 412
 vertical shear, 442
 weight of, 612
 working stress, 528
 Bellows Falls Canal Company washing plant, 250
 Belt conveyor for concrete machinery, 273
 Bending moment. See Moment
 Bending moment diagrams, 436, 522, 524
 Bending moments and shears, 433
 Bending tests for steel, 39, 415
 Bent bars, points to bend, 458
 Berry's repetitive loading tests of reinforced beams, 481
 Bertini system, 504
 Beton-coignet, definition, 2c
 Beton, definition, 2c
 Bin gates for sand and stone, 247
 Bins, for stone crushing plant, 245
 Blackwell's Is. bridge, mixing plant, 274
 Blocks, concrete building, 629
 in sidewalks, 599
 molded, 307
 Boiler settings, 703
 Boiling tests, 106. See also Soundness
 Bolts, foundation, 650
 Bonna system, 504
 Bond of concrete and steel, 456
 hooked bars, value of, 466
 working stress, 528
 to resist direct pull, 461
 Bonding old and new concrete, 284
 Boonton, N. J., dam, 300, 676
 Bottle kiln, 721
 Boulogne method of testing consistency of cement, 70
 Brand of cement, selection, 45

Breakwater, building, 307
 Brick, as a substitute for sand, 156
 Brick vs. concrete columns, 373
 Brick vs. concrete conduits, 680
 Bridge piers. See Piers
 Bridges. References, 728
 arch. See Arches.
 Granite Branch Bridge, 590
 Mystic River Bridge, 590
 Ross Drive Bridge, 590
 Walnut Lane Bridge, 532, 592
 Briquettes, for tensile tests, 72
 effect of eccentricity in placing, 93
 German standard, 92
 Broken stone, classification of, 161
 characteristics. References, 736
 compacting of, 179
 concrete vs. gravel concrete, 385
 cost of, 25
 cost of crushing, 246
 crushing, 241
 hauling, 249
 plant for, 245
 quality affecting concrete, 390
 screened vs. unscreened, 188
 screenings vs. sand, 153
 selection of, 12
 size affecting strength, 389
 size and shape, effect upon permeability, 351, 352
 specifications, 34
 tables of quantities for concrete, 231
 typical mechanical analyses, 198
 uniform vs. graded sizes, 15
 voids vs. gravel voids, 174
 weight, 249
 Buckets for depositing concrete, 305
 Building construction, 607
 References, 729
 advantages of concrete, 607
 cost, 607
 curtain walls, 627
 Ingalls building, 607, 611, 621
 mixing concrete, 267
 Pacific Coast Borax Co., 621
 typical illustration, 613
 walls, 621
 Burning Portland cement, 713
 over-burning and under-burning, 62
 Calcining Portland cement materials, 713
 Calcium chloride, 326
 Cambridge bridge, concrete machinery, 271
 Candlot's tests of concrete, 367

Car for conveying concrete, 279
 Castings, concrete, 628
 Cast piles, concrete, 651
 Cellar walls, 619
 forms, 620
 Cement. See also Cement testing
 affected by sea water, 309
 affected by sulphate water, 310
 approximate quantity formula, 16
 barrel, volume, 3 218
 barrel, weight, 2d
 chemical analyses, 47
 choice, 41
 classification, 47, 54
 cost, 24
 determination of proportion in concrete, 186
 effect of freezing, 319
 effect of percentage upon strength of mortar, 392
 essentials, 2a
 fatigue, 381
 fineness, 82
 flash set, 2a
 manufacture, 705
 materials for manufacture, 55, 708
 method of analyzing, 745
 mixture with Puzzolan and slag, 317
 paint, 330
 percentages in concrete, 298
 per cu. yd. of concrete, curves, 228
 per cu. yd. of concrete, tables, 230
 production, 706
 proportion in concrete, 213
 Puzzolan. See Puzzolan cement
 quantity for concrete sidewalks, 596
 selection of, 12
 specifications, 28
 specific gravity, 81
 storage, 239
 to resist sea water, 312
 water for chemical combination, 85
 weight of, 114, 219
 Cement rock, 55, 709
 chemical analysis, 710
 Cement testing, abrasion, 125
 accelerated tests, 106
 adhesion, 121
 Am. Soc. C. E. standard methods, 63

- Cement testing, American *vs.* European sieves, 84
 apparatus for laboratory, 80
 cautions, 2a
 chimney test, 112
 color, 113
 compression machines, 116
 compression tests, 116, 136
 consistency, normal, 68
 effect of shape of specimen, 134
 elementary directions for testing soundness, 79
 fineness, 67
 fineness below No. 200 sieve, 85
 for small purchasers, 3
 mixing, 73
 moist closet, 75
 permeability, 128
 porosity, 125
 purity test, 4, 65
 rate of applying strain, 94
 rate of setting, 90
 relation of different tests, 134
 setting, 70
 shearing, 125, 136
 soundness, 77, 101
 specifications, 28
 specific gravity, 65
 standard sand, 71
 standard tests, 63
 steaming apparatus, 78
 tanks for briquettes, 76
 tensile briquette, 72
 tensile machines, 93
 tensile strength, 76
 tensile tests of cement and mortar, 97
 transverse tests, 120, 136
 water for normal consistency, 85
 weight, 114
 yield tests, 129
- Centigrade, to convert to Fahrenheit, 10
- Centimeter, English equivalents, 10
- Centers, arch, 587
 Chalmette docks at New Orleans, 275
- Chalk, chemical analysis, 710
- Charlestown bridge piers, 269, 303
- Chaudy and Degon system, 504
- Chemical analysis, cement testing, 64
 clay, 710
 lime, 47
 method for cement, 745
 method for raw materials, 745
 Natural cements, 47
 Portland cements, 47
 Puzzolan cement, 47, 724
- Chemical analysis, raw materials for cement, 710
 sand 159b
 slag, 724
- Chemistry of hydraulic cements, 54
- Chimney expansion test, 112
- Chimneys, reinforced concrete, 630
 analysis of stresses, 765
 construction, 630
 design, 632, 765
 Edison Electric Illuminating Co., 631
 example of design, 636
 formulas, 634, 765
 house, 704
 shear and diagonal tension, 772
 tables, 635, 636
- Chutes for depositing under water, 303
- Cinder, concrete, rust protection, 329
 slabs, table, 515
 strength and elasticity, 394
vs. stone concrete in fires, 333
 weight, 3, 611
- Cinder pits, 703
- Cinders, selection, 615
 specific gravity, 163
- Circular beams, 774
 reservoir, 701
- Classification of broken stone, 161
 of cements, 47, 54
- Clay, bearing power, 640
 chemical analyses, 710
 effect upon mortar, 154
 effect upon mortar. References, 741
 for Portland cement manufacture, 56
 water-tightness, effect upon, 343
- Clinker, microscopical tests, 115
- Clip, form for tensile briquette, 77
- Coal pockets, 703
- Coatings, 318
- Coatings for waterproofing, 342
- Coefficient of expansion, 287
- Coignet system, 504
- Cold. See Freezing
- Coloring concrete, 595
- Color of cement, 113
- Columbian system, 504
- Columns, 488, 623
 concrete *vs.* brick, 373
 deformation of plain and hooped, 494
 eccentric loading, 372, 558
 flexure, formulas, 558
 footings. See Footings, reinforced

- Columns, formulas for, 491
 hooped columns, formulas, 496
 hooped or banded, 492
 illustration of reinforcement, 613
 modulus of elasticity, 406
 molds at Harvard Stadium, 625
 plain concrete, strength of, 371
 reinforced, 488, 527, 624
 rich proportions of concrete, 489
 strength, 371, 488, 527
 structural steel reinforcement, 497
 table of working loads, 492
 vertical bar reinforcement, 489
 working stress, 527
- Combined footing, 647
- Compacting of broken stone and gravel, 179
- Composition, of cement mortars, 132
 chemical. See Chemical analysis
- Portland cement, 58
 various mortars, 136
- Compressive strength. References, 738
- Compressive strength of concrete, 355
 average table, 360, 361
 brief table for safe strength, 27
 cinder concrete, safe strength, 394
 columns, 371,
 concentrated loading, 367
 formula, 356
 growth, 374
 safe strength, 27, 373, 527
 short prisms, 369
 tests, 362
 various authorities, 363
vs. transverse strength, 381
 working, in extreme fiber, 528
- Compressive strength of mortar, 136
 Feret's formula, 140
 Feret's tests, 136, 146
 form of specimens, 117
 prisms, 406
 various, 136
vs. tensile strength, 119
- Compressive strength of stone, 392
- Compressive tests of cement, 116
- Concentrated loading, effect of, 367
 diagram for moments and shears in continuous beams, 436
- Concentrated *vs.* distributed loading, 368
- Concrete blocks, 629
- Concrete tile, 629
- Concrete, contract and specifications, 32
- Concrete, definition, 2c
 gravel *vs.* broken stone, 385
 mixers, 256
 mixing. See Mixing concrete
 plants, 266
 proportioning. See Proportioning
 rubble, 296
 rubble, definition, 2c
 strength. See Strength
 stretch, 408
 tables of quantities of materials, 230
 tables of volumes, 234
 theory of mixture, 186, 220
 uses, 11
vs. brick columns, 373
vs. brick conduits, 680
vs. terra-cotta, 333
 weight, 3
 working stresses, 527
- Concreting, elementary outline of process, 11
- Conductivity of concrete, 335
- Conduits, 679
 References, 737
 arch top, 694
 brick *vs.* concrete, 680
 construction, 685
 design, 682
 earth pressure on, 693
 forms, 688
 formulas for rectangular, 694
 in tunnel, 688
 Jersey City Water Supply Co., 683, 689
 rectangular, 694
 thickness of, 684
 water-tightness, 681
 Weston aqueduct, 682
- Conglomerate concrete, weight, 3
- Conglomerate, specific gravity, 163
- Consistency, Boulogne method, 70
- Consistency of concrete, 279
 depositing through trough, 278
 effect on modulus of elasticity, 406
 effect on strength, 383
 effect on water-tightness, 338
 specifications, 36
- Consistency of mortar, effect upon strength, 152
- Consistency of paste and mortar, normal, 68, 85
- Constancy of volume. See Soundness
- Continuous beams, bending moments to use, 439

- Continuous beams, design, 428, 471
 diagrams shear and bending moment, 435
 moment of inertia, effect upon bending moment, 430
 shear and bending moment diagrams, 435
 span, 431
 stirrups, method of placing, 450
- Continuous mixers, 256
- Contract, form for concrete, 32
- Contraction joints, 285
- Contraction. References, 732
- Conveyor belt. See Belt conveyor
- Copings, 674
- Core walls, 678
 rubble concrete, 678
 thickness, 678
- Corrosion of steel, 327
- Corrosion of steel in beams, tests, 336
- Cost, building construction, 607, 624
 cautions, 2b
 concrete, 24
 essentials in estimating, 2b
 facing concrete, 289
 labor laying concrete, 25
 materials for concrete, 24
 Portland *vs.* Natural cement mortar, 43
 ramming concrete, 283
 rubble concrete, 675
 screening sand and gravel, 239
 sidewalk construction, 604
 stone crushing, 246
- Cottacin system, 504
- Counterfort retaining walls, 671
- Cracks in reinforced beams, 413
 corrosion of steel, 336
- Cross reinforcement of slabs, 422
- Crushed stone. See Broken stone
- Crusher, gyratory, 244
- Crusher, jaw, 242
- Cubes *vs.* cylinders *vs.* columns, 370
- Culvert, Kalamazoo, Mich., 684
- Cummings system, 504
- Cup bar, 504
- Curbing, concrete sidewalk, 602
- Curves of cement per cubic yard, 228
- Dams, 659, 674
 References, 731
 arched, 677
 Boonton, N. J., 676
 building of rubble concrete, 300
 Chaudiere Falls, P. Q., 264
 Chicopee River, building, 269
 gravity design, 675
 Ogden, Utah, 678
- Dams, reinforced design, 677
 Schuylerville, N. Y., 677
- Dead loads, arches, 544
- Definitions, 2c
 See material in question
- Deformation and deflection curves of a reinforced beam, 409
- Deformation of hooped and plain columns, 494
- Deformed bars, use, 2, 463, 500, 645, 670
- Density, definition, 2c
 method of determining, 135
- Density of concrete, 354
 curves of maximum, 200
 relation to strength, 204
 studies of, 200
 table of tests, 376
- Density of mixed aggregates, 168
- Density of mortar, application of laws, 149
 relation to strength, 134
 tests of mortar, 138
 tests of mortars of coarse *vs.* fine sand, 149
- De Man rods, 506
- Depositing concrete, 276
 cautions, 2a
 specifications, 36
- Depositing concrete under water, 301
- Depth, concrete below rods, 460
- Depth of T-beam, diagram, 525
 economical, 425
 example, 470, 471
 minimum, 424
- Derrick for laying concrete, 305
- Design. See article in question
 cautions, 2b
- Destructive agencies, 392
- Diagonal tension. See Tension, diagonal
- Diagrams, for arch design, 569, 572
 bending moments, 436, 522-524
 mechanical analysis, 197
 T-beam design, 525
- Diamond bar system, 506
- Dietzsch kiln, 721
- Dikes. See also Core walls
 Metropolitan Water Works, 678
 Parsippany, laying, 273
- Distribution of beam and slab loads to girders, 432
- Distribution of slab load to supporting beams, 431
- Distribution of stress, diagrams, 569, 572, 573
 plain concrete, 562
 reinforced concrete, 565

- Domes, 626
 Temple Adath Israel, 626
 Yale University, 626
- Dome kiln, 721
- Donath system of reinforcement, 506
- Driveways, 606
- Dry concrete, 280
 rammers for, 281
- Dry concrete under water, 308
- Dry dock, building of rubble concrete, 301
- Duplex paddle mixer, 258
- Durability, concrete inverts, 681
 concrete piers, 654
- Dwelling houses, 704
- Earth, bearing power, 639
 weight of, 662
- Earth pressure, 663
 arches, 544
 conduits, 693
 formulas, 664, 666
 inclined back of wall, 665, 666
 tables for, 663, 665
 vertical back of wall, 664
 wall with surcharge, 666
- East Boston Tunnel, 690
 mixing plant, 271
- Eccentric loading, 372
- Eccentric loads, diagrams, 569, 572
 distribution of stresses, plain concrete, 560
 distribution of stresses, reinforced concrete, 563
- Economical depth of T-beam, 425
 diagram for, 525
 example of, 470, 471
- Edison Electric Illuminating Co., chimney 631
- Elastic limit. See also Yield point
 Elastic limit required in mild steel, 34
- Elasticity. See Modulus
- Electrolytic action, effect upon concrete, 393
- Elementary volumes, 135
- Elevator, automatic concrete, 268
- Elevators, grain, 703
- Elongation in concrete, 408
- Elongation required in first-class steel, 38
- Elongation required in mild steel, 34
- Estimating, essentials, 2b
- Erection of arches, 586
- Expanded metal, 506
- Expansion joints. See Contraction joints
- Expansion of cement. See also Soundness
- Expansion of cement, measurement, 111
- Expansion of concrete, while hardening, 287
 coefficient for temperature, 287
- Experiments upon reinforced beams, 477
- Face cutter, 289
- Facing concrete walls, 288
 photographs of surfaces, 290
 specifications, 37a
- Factory construction, cost, 608
- Factory, Pacific Coast Borax Co., 621
- Fahrenheit, to convert to centigrade, 10
- Fatigue of cement, 381
- Felt, waterproofing, 344
- Fences, 704
- Feret, R. Effect of Sea Water, 309
- Feret's formula for normal consistency, 87
- Feret's formulas for strength of mortar, 140
- Feret's tests of strength of mortars, 136
- Feret's triangles, 144
- Ferrocement system, 506
- Fiber stress *vs.* tensile stress, 121, 134
- Fineness of cement, advantages of, 82
 brief tests, 4
 below No. 200 sieve, 85
 effect on weight, 114
 specifications Natural cement, 31
 specifications Portland cement, 30
 standard test, 67
 strength affected by, 82
- Fire, Baltimore, 332
 Pacific Coast Borax Co., 331
- Fire protection, cinder *vs.* stone concrete, 333
 concrete, 331
 concrete *vs.* terra-cotta, 333
 structural steel, 337
 theory, 334
 thickness concrete required, 333
- Fire resistance. References, 732
 Woolson's tests, 335
- Fire-resisting qualities of concrete, 327
- Flat slabs, 483
 foundation, 649
 tables of constants, 518
- Flexure and direct stress, diagram, 569, 572, 573
 plain concrete, formulas, 561
 reinforced concrete, formulas, 564

- Float, plasterers', 601
 Floors, construction, 608, 615
 design, 468, 609
 forms, 616
 illustration of reinforcement, 613
 Ingalls building, 611
 loads, 610
 materials for, 612
 proportions of concrete, 615
 reservoirs, 696
 slabs. See Slabs.
 weight of concrete in, 611
 Footings, design, 641
 combined, design of, 647
 I-beam, 643
 reinforced concrete, 644
 spread, 649
 square, design of, 644
 Forms. References, 732
 brief directions for constructing, 19
 cautions, 2a
 cellar wall, 620
 clamp for beam, 617
 conduit, 688
 floors, 616
 greasing, 296
 hollow walls, 623
 mass concrete, 293
 removing, 296
 specifications, 37
 time building, 9
 wall, 621
 Formulas. See article in question.
 Foundation bolts, 650
 Foundations, 639
 References, 733
 See also Footings
 beams and slabs, 649
 bearing power of soils and rock, 639
 column, 643
 flat slabs, 649
 safe loads, 643
 spread, reinforced, 649
 under water, 656
 under water, laying, 303
 Freezing. References, 742
 effect of, 8, 319
 effect of calcium chloride, 326
 effect of salt, 324
 effect upon sidewalks, 602
 experiments, 321
 protection from, 323
 Freezing weather, construction in, 323
 specifications for laying in, 37
 French commission, method of proportioning, 192
 French commission, permeability test, 128
 porosity test, 126
 setting tests for cement, 89
 sieves for cement, 84
 standard sand, 92
 yield tests, 129
 Friction, internal angle of, 662
 Frost. See Freezing
 Fuller's beam tests, 376
 Fuller's rule for quantities, 16
 Fuller, William B. Proportioning Concrete, 183
 Gabriel system, 506
 Gaging. See also Consistency
 water for sand, 179
 with sea water, 159b
 Gang for mixing concrete, 254
 Gates for sand and stone bins, 247
 German standard briquette, 92
 Gillmore *vs.* Vicat needles, 89
 Girders. See also Beams, reinforced
 typical illustration of, 453, 613
 Glycerine, effect of. References, 741
 Grain elevators, 703
 Gram, English equivalents, 10
 Granite Branch Bridge, 590
 Granite, specific gravity, 163
 Granolithic, definition, 2c
 Granolithic finish for water-tight work, 341
 Granulometric composition of sand, 142
 conversion to mechanical analysis, 151
 Grappiers cement, 50
 chemical analysis, 47
 definition, 2c
 Gravel, bearing power, 640
 characteristics. References, 736
 compacting of, 179
 cost of, 25
 cost of screening, 239
 screened *vs.* unscreened, 188
 selection of, 12
 size affecting strength of concrete, 389
 specifications, 34
 specific gravity, 163
 tables of quantities for concrete, 231
 voids *vs.* broken stone voids, 174
 weight of, 662
 Gravel concrete, *vs.* broken stone concrete, 385
 weight, 3
 Gravity mixers, 263

- Greasing forms, 296
 Greenhouses, 704
 Griffin mill, 716
 Grinding cement, 712, 715
 See also Fineness
 Groined arches, 696, 698
 Groover for sidewalks, 601
 Grout for water-tight surfaces, 342
 Grouting, sand cement for, 42
 Growth in strength of cement mortar, 99
 Growth in strength of concrete, 374
 Gutter, concrete, 603
 Gypsum, effect in sea water, 310
 effect on time of setting, 90
 Gyrotory crushers, 244
 Habrich and Düsing system, 506
 Handling concrete, 276
 data, 9
 Hand mixing of concrete, 251
 vs. machine, 251, 372
 Harvard Stadium. Frontispiece
 mixing machinery, 269
 pouring seat slabs, 628
 Haunch, design, 429
 length, 430, 472
 Heat. See also Temperature
 effect upon concrete, 335
 References, 742
 Heater for concrete materials, 324
 Heating concrete materials, 323
 Hennebique system, 506
 Herringbone frame, 506
 High carbon steel, specifications for, 38
 vs. mild, 413
 Highway bridges, live loads, 541
 Hinges for arches, 539
 Historical notes, 705
 Holzer system, 506
 Hooked bars, value in bond, 466
 Hooped columns, 492
 Hot tests, 106
 See also Soundness
 Houses, 704
 House chimneys, 704
 Hyatt system, 506
 Hydrated lime, 53
 added for water tightness, 342
 use with Portland cement, 43
 Hydraulic lime, 52
 chemical analysis, 47
 definition, 2c
 where used, 42
 Hydraulic modulus, 57
 Impermeable concrete. See Water-tight concrete
 Impermeability. See Water-tightness
 Impurities of sand, character, 154b
 effect upon strength of mortar, 154a
 vegetable or organic, 154b
 washing tests for organic, 159a
 Inertia, moment of. See Moment of inertia
 Ingalls building, 607, 611, 621
 Internal friction, angle of, 662
 Inverts, durability of concrete, 681
 James River cement, definition, 2c
 Jaw crushers, 242
 Jerome park reservoir, 275
 Jersey City Water Co. conduit, 683, 689
 Johnson ring kiln, 721
 Johnson rods, 506
 Joints. See also Contraction joints
 construction of, 284
 in reinforced concrete, 284
 old and new concrete, 284
 specifications, 37
 Kahn bars, 506
 Kent mill, 717
 Kilns, rotary. See Rotary kilns
 Kilns, stationary, 721
 Kilograms per sq. cm., ratio to lb. per sq. in., 9, 93
 Kilograms, ratio to pounds, 10
 Kimball's tests of concrete, 365
 Labor. See Time
 Laboratory, cement testing apparatus, 80
 Laitance, chemical analysis, 302
 definition, 2c
 effect on strength, 384
 Laitier cement, definition, 2d
 Lath, metal, plastered walls, 627
 Laying concrete, elementary outline, 11
 methods, 276
 specifications, 36
 time, 9
 Laying rubble concrete, 300
 Laying waterproofing felt, 345
 Leaks, closing, 691
 Length to embed bars, 464
 Lime and cement mortar, where used, 42
 Lime, added for water-tightness, 342
 chemical analysis, 47
 effect of. References, 741
 effect upon strength of mortar, 154d
 hydrated. See Hydrated lime