A36 steel, 13
Accuracy of computations, 9
AISC (American Institute of Steel Construction), 5
AISC Manual, 2, 5
Allowable deflection, 112
Allowable stress design (ASD), 3, 50, 439
American Institute of Steel Construction (AISC), 5
American Society of Civil Engineers (ASCE), 6
American Society for Testing and Materials (ASTM), 6
Angles, 20
double, 178, 436
gage for, 281
properties of cross sections, 434, 436
single, 20, 434
in tension, 222
Approximate investigation, 68
Arc welding, 298
ASD (allowable stress design), 3, 50, 439
Assemblage of steel structures, 17, 31
Bar joist, 129
Bars and plates, 21
Base plate for column, 192
Beam bearing plate, 156
Beams:
  bearing plates, 156
  bending in, 76
buckling of, 85, 151
concentrated load effects in, 57, 144
cornered, 292
continuous, 58
crippling of web, 316
deflection of, 108
design aids (ASD), 439
design for buckling, 89
design factor for, 73
design procedure, general, 76
end support conditions, 55
fireproofing for, 30
fixed end in, 55
flexure in, 76
flitched, 215
framed connections, 292
with internal pins, 338
lateral support for, 85, 151
load-span values for, 118
multiple span, 58, 337
plastic behavior of, 78
restrained, 55
safe load tables for, 118
shear in, 103
shear center for, 148
simple, 55
torsion in, 85, 148
typical loadings, 442
web crippling in, 144
web shear in, 103
web stiffeners for, 146
web tearing in, 278
Bearing plates:
for beams, 156
for columns, 192
Bearing pressure, 156, 192
Bending in:
columns, 180
truss chords, 260
Bending factors for columns, 172, 173, 183, 186
Bents and frames, 196
Biaxial bending in columns, 186
Biaxial bracing for columns, 169
Block shear, 276
Bolted connections, 272
bearing in, 274
bending in, 275
block shear in, 276
capacities, 279
design of, 284
framed, for beams, 292
framing with, 290
layout of, 280, 289
net section in, 274
pitch and edge distance for, 280, 289
shear in, 273
tearing in, 276
for trusses, 295
Bolts:
angle gage for, 281
capacity, 279
edge distance for, 280
high strength, 278
pitch, 280
types, 278
unfinished, 278
Bounce of floors, 39, 364
Box system for lateral load, 339
Braced frame, 207
Buckling:
of beams, 85, 89, 151
of columns, 163
inelastic, 86
torsional, 86
Building codes, 315
Built-up sections, 162
C shapes, 19, 432
Cable structures, 224
Cantilever frame, 36, 61
Captive frame, 206
Casting, 16
Ceiling structure, 37
Centroid, 413
Channels, 19, 432
INDEX

Chevron bracing, 209
Choice of building construction, 312
Choosing design methods, 73
CMU (concrete masonry unit), 332, 379
Cold-formed steel products, 2, 22
Columns:
  base plates for, 192
  bending factor for, 172, 173, 183, 186
  bending in, 180, 183
  biaxial bending in, 186
  biaxial bracing for, 169
  buckling, 163
  built-up, 162
  connections, 188
  critical stress for, 166
  design of, 170, 367
  eccentrically loaded, 184
  effective length for, 163
  framing, 188
  interaction, 182
  K-factor, 163
  load determination for, 365
  multistory, 367
  P-delta effect, 183
  pipe shapes, 176, 437
  safe loads, 164
  sections, 161
  shapes, 163
  slenderness, 163
  splices for, 191
  structural tubing shapes, 178
  strut, 178
  W shapes, 170
Combined loads, 318, 326
Compact section, 84
Composite elements, 142, 214
Computations, structural, 9
Concentrated load, effect in beams, 57, 144
Concrete, strength in bearing, 156, 192
Connections, 25, 269
  basic considerations, 269
  beam, 292
  bolted, 272
  column, 188
  control joint, 307, 338
  field, 32, 271
  framed, for beams, 292
  moment-resisting, 61, 197
  shop, 32, 271
  special concerns, 271
  structural functions, 270
  tearing in, 276
  tension, 282
  for trusses, 295
  types of, 270
  welded, 298
Continuity of:
  beams, 58
  columns, 367
Continuous action of beams, 58
Conversion of units, 9
Core bracing systems, 358
Corrosion, 29
Cost factors for steel structures, 32, 329
Crippling of beam webs, 316
Cut section, 48
Dead load, 315
Decks:
  floor, 137
  formed sheet steel, 140
  roof, 139
Deck-beam-girder system, 35, 335, 359
Deflection:
  allowable, 112
  approximation graph for steel beams,
    of beams, 108, 364
    of column-beam bents, computations for, 112
    limits, 112
  Deformation limits, 29, 112
  Delta truss, 402
Design method, 3
choice of, 73
Design references, 5, 313
Designations for steel elements:
bolts, 278
formed sheet steel decks, 142
joist girders, 135
open web joists, 130
rolled shapes, 22
Double angles, 436
as struts, 178
as truss members, 296, 348
Double shear, 274
Dual bracing, 204
Ductility of steel, 13, 78
Dynamic behavior, 39
Earthquake load, 318
Eccentrically braced frames, 210
Eccentrically loaded columns, 184
Electric arc welding, 298
Equivalent loading:
   for approximation of deflection, 128
   axial, for column with bending, 183
Equivalent tabular loading, 128
Extrusion, 16
Fabricated steel products, 23
Factored load, 326
Field connection, 32
Fillet weld, 299
Fireproofing, 30, 318
Flitched beam, 215
Floor framing, 359
Floors:
   framing for, 359
   as horizontal diaphragms, 392
   loads on, 321
Forging, 16
Formed sheet steel, 2, 140
Forming processes, 16
Framed beam connections, 292
Frames and bents, 41, 60, 196
Framing:
   for beams, 292
   with bolts, 290
   for columns, 188
   for floors, 359, 384
   for roofs, 334
   with welds, 307
Free-body diagram, 47
Gabled roof:
   with rigid frame bent, 349, 394
   with truss, 346, 389
Gage lines for angles, 281
Geometric shapes. Properties, 427
Girders:
   in deck-beam systems, 362
   joist, 135, 352
   Grades of steel, 13
High-strength bolts, 278
Hinge, plastic, 81
Hole:
   in floors and roofs, 40
   in horizontal diaphragm, 393
Horizontal bracing, 211, 393
Hot-rolled products, 2
I-beams, 19
Indeterminate structures, approximate
   investigation of, 68
Inelastic:
   behavior, 77
   buckling, 86
   stresses, 78
Interaction in columns, 182
Internal forces in trusses, 242
Investigation of:
   beams, 53
   columns, 53, 164
   rigid frames, 60
   structures, general, 45
   trusses, 242, 346, 389
Joist:
  bar, 130
  open web, 129, 334, 350, 368
Joist girder, 135, 352, 370
K-bracing, 208
K factor for column, 163
Knee bracing, 208

Lateral bracing:
  for beams, 85, 151
  box system, 339
  for columns, 168
  rigid frame bents, 197, 397
  trussed bents, 207, 358, 372
  for trusses, 238
  for wind and earthquake forces, 339, 358
Lateral loads, 322
Laterally unbraced length, 85
Least weight selection, 77
Light-gage steel products, 140
Live load, 317, 318
  element factor, 320
  reduction of, 321
Load and resistance factor design (LRFD), 3, 51
Load sharing in lateral bracing, 202
Loads, 314
  building code, 315
  combinations, 318, 326
  computation, 326, 364
  dead, 315
  duration, 318
  earthquake, 318, 325
  equivalent axial, 184
  equivalent tabular, 128
  factored, 326
  floor, 321
  lateral, 322
  live, 317, 318
  movable partitions, 322
  periphery, 326, 364
ponding, 321
roof, 319
seismic, 318
service, 72
tributary, 327, 364
wind, 317, 322, 341, 373, 390
LRFD (load and resistance factor design), 3, 51

Manual of Steel Construction (AISC Manual), 2
Manufactured:
  systems, 213
  trusses, 129
Maxwell diagram for truss, 244
Measurement, units of, 6
Method of joints, 242, 249
Methods of investigation and design, 3, 50
Miscellaneous metals, 2
Mixed frame and wall systems, 44, 201
Modulus of elasticity, 417
Modulus, section, 425
  elastic, 425
  plastic, 426
Moment:
  connection, 61, 197
  elastic limit, 79
  plastic, 80
Moment of inertia, 417
Movable partitions, 322
Multistory structures, 354
  wind forces on, 358, 372
Net section in tension, 222, 274
Neutral axis, 414
Nomenclature, 10
Notation, standard, 10
Offset grid truss form, 402
Open web steel joist, 129, 334, 350, 368
  safe load table for, 131
INDEX

$P$-delta effect, 183
Partitions, movable, 322
Perimeter (peripheral) bracing, 358
Peripheral load, 326, 366
Pin connection in beam, 338
Pipe, steel, 437
Pipe column, 176, 437
Pitch, of bolts, 280
Planning of framing, 33, 328
Plastic:
  hinge, 81
  moment, 80
  range of stress and strain, 78
section modulus, 81
Plates and bars, 21
Plug weld, 306
Ponding, on flat roof, 111
Properties for designing:
  angles, 434
  double angles, 436
  geometric shapes, 427
  pipe, 437
  W shapes, 429
Properties of sections: 413
  centroid, 413
  moment of inertia, 417
  neutral axis, 414
  radius of gyration, 426
  section modulus, 425
  statical moment, 414
Properties of steel, 12
Radius of gyration, 426
Reactions, 47
Reduction of live load, 321
Reference sources for design, 5, 313
Relative stiffness of bracing elements, 202
Resistance factor, 52, 73
Response values for beams, 56 to 60, 442
Restrainted beams, 55
Rigid frame, 43, 60, 197, 397
Rolled shapes, 16

as beams, 75
  in built-up sections, 162, 422
as columns, 161
Roof framing, 334
Roof live load, 319
Roofs,
  drainage for, 39
  loads on, 319
Roof trusses, 346, 389
Rust, 29
S shapes, 19
Safe load tables:
  beams, 118
  bolts, 279
  columns:
    double angle struts, 181
    pipe, 177
    tubes, 179
    W shapes, 172
  fillet welds, 301
  open web joists, 131
  roof deck, 139
  struts, double angle, 181
  W shape beams, 120
Safety, 46
Section, cut, 48
Section modulus, 425
  elastic, 425
  plastic, 81, 426
Section properties, see Properties of sections
Service conditions versus limit states, 72
Service load, 72
Shapes, structural:
  cold-formed, 22
  designations for, 21
  rolled, 17
Shear:
  in beams, 103
  in bolts, 273
  center, 148
  double, 274
single, 274
stud, 214
Sheet steel, 2, 140
Shop assemblage, 32
Sidesway, 69
Simple beam, 55
Single shear, 274
Single-span bent, 69
Slenderness of columns, 163
Slot weld, 306
Sources of information, 5, 313
Splice, of column, 191
Stability, 28
S shapes, 19
Staggered bolts, 283
Standard channels, 19
Statistical moment, 414
Steel:
A36, 13
bolted connections, 272
cold-formed, 2
corrosion resistance, 29
deck, 140
grade, 13
light gage, 2
properties of, 12
sheet, 2
stress-strain behavior, 13
uses of, 1
Steel Deck Institute, (SDI), 6
Steel Joist Institute (SJI), 6
Steel products, 16
Stiffeners for beam webs, 146
Strain hardening, 79
Strength method, 51
Stress-strain behavior of steel, 13,
26
Stress-strain diagram, 14
Structural:
design standards, 313
investigation and design, 50
planning, 33, 328
tees, 20
tubing, 178
Struts, 178
Symbols, standard, 10
Tearing in bolted connections, 276
Tees, structural, 20
Tension:
and bending, 231
cable, 224
connections, 282
effective area in, 222
elements, 220
on net section of members, 222,
274
Three-dimensional frames, 41, 199
Torsion, 148
Torsional buckling, 85, 152
Tributary area, for load, 327
Trussed bent bracing system, 207,
372
Trusses, 234
algebraic analysis, 249
bolted connections for, 295
bracing for, 238
coefficients for internal forces, 257
combined stress in truss chords,
260
delta, 402
design considerations for, 257, 260,
389
graphical analysis, 242
gusset plate, 296
internal forces in, 242
joints in, 295
joist girder, 135
as lateral bracing, 207, 358, 372
loads on, 239
manufactured, 129
Maxwell diagram for, 244
member design, 348, 392
offset grid, 402
open web joist, 129
roof, 346, 389
two-way, 262, 394
types, 237
Trusses (Continued)
  use of, 234
  weight, 241
  welded connections for, 296
Truss systems, 43
Tubular steel members, 178
Two-way trusses, 262, 394

Ultimate strength, 79
  method, 3
Unfinished bolt, 278
Units of measurement, 6
  conversion of, 9
Upset end, on rod, 280
Use of steel for structures, 1, 26

V-bracing, 209

W shapes, 18, 429
Web crippling of beams, 144
Weight of building materials, 316
Welded connections, 298
  design of, 303
  electric arc, 298
  framing, 307
  for trusses, 296
Welding, 298
Welds:
  boxing of, 302
  butt, 299
  fillet, 299
  groove, 299
  penetration of, 299
  plug and slot, 306
  size limits, 302
  strength of, fillet, 301
  stress in, 299
Wide flange (W) shapes, 18, 429
Wind loads, 317, 322, 341, 373, 390
Wire, 16
Working stress method, 3

X-brace, 208

Yield point, 13, 78