

# Index

- Accelerated air-drying, 12-6
- Acid copper chromate (ACC):  
  components, 14-10  
  effectiveness and leaching, 14-10  
  retention levels for various wood products, 14-6t  
  Southern pine sapwood stakes retention and life span test results, 14-13t  
  temperature for pressure treating, 14-21
- Adherends:  
  bond strength properties, 9-21  
  density and porosity, 9-6 to 9-7  
  ease of bonding by species, 9-8t  
  extractives on surface, effect on, 9-3  
  knife- and abrasive-planed surfaces, 9-3 to 9-4, 9-4fig  
  mechanical testing of bonded assemblies, 9-20 to 9-21  
  moisture content:  
    and dimensional change, 9-7  
    control, 9-15 to 9-16  
    U.S. averages, 9-16, 9-16fig  
  surface preparation, 9-16  
  surface properties, 9-2 to 9-3  
  veneer surfaces, 9-4 to 9-5  
  wettability, 9-3  
  wood and nonwood composites, 9-5 to 9-6
- Adhesives:  
  affected by:  
    physical properties, 9-6 to 9-9  
    surface properties, 9-2 to 9-5  
    wood density, 9-6 to 9-7  
    wood moisture content, 9-9  
    wood porosity, 9-7  
  analytic chemical and mechanical testing of polymers, 9-20  
  assembly and pressing, 9-16 to 9-18, 9-17fig  
  composition, 9-9 to 9-10  
  consistency, effect of, 9-16 to 9-17, 9-17fig  
  definition, 9-1  
  ease of bonding by species, 9-8t  
  form and color of types, 9-13t to 9-14t  
  health and safety, 9-10  
  mechanical testing of bonded assemblies, 9-20 to 9-21  
  post-cure conditioning, 9-18  
  preparation and application, 9-13t to 9-14t  
  quality assurance programs, 9-22 to 9-23  
  short- and long-term performance, 9-21 to 9-22, 9-22fig  
  selection, 9-12 to 9-15  
  spreading 9-16, 9-17fig  
  strength and durability, 9-10 to 9-12, 9-11t, 9-13t to 9-14t  
  strength properties, 9-21  
    used with fire-retardant-treated woods, 9-6  
    uses, 9-1, 9-13t to 9-14t  
    use on veneers, 9-4 to 9-5  
    use on wood and nonwood composites, 9-5 to 9-6  
    use with chemically modified wood, 9-6  
    used with preservative-treated wood, 9-6  
    working life, 9-12, 9-15
- Adjustment of properties for design use, 6-1 to 6-14
- Advantages of using wood for structures, 1-2
- Afara. *See* Limba
- Afromosia:  
  characteristics, 1-17  
  decay resistance, 1-17  
  ease of bonding, 9-8t  
  locality of growth, 1-17  
  mechanical properties, 4-16t, 4-20t  
  shrinkage values, 3-10t  
  uses, 1-17
- Air-drying advantages and limitations, 12-6
- Albarco:  
  characteristics, 1-17  
  locality of growth, 1-17  
  mechanical properties, 4-16t, 4-20t  
  shrinkage values, 3-10t  
  uses, 1-17  
  workability, 1-17
- Alder, red:  
  characteristics, 1-3  
  characteristics for painting, 15-3t  
  color and figure, 3-3t  
  decay resistance, 3-18t  
  dimensional change coefficient, 12-16t  
  ease of bonding, 9-8t  
  erosion of planed surfaces, 15-8t  
  locality of growth, 1-3  
  machining and related properties, 3-16t  
  moisture content, 3-6t  
  nomenclature, 5-5t  
  plywood stiffness and strength, 10-11t  
  shock resistance, 1-3  
  shrinkage values, 3-9t  
  size of pores, 15-31t  
  strength properties, 4-4t, 4-9t  
  uses, 1-3
- Alkyl ammonium compound:  
  effectiveness, 14-9  
  in ammoniacal copper quat, 14-11  
  solubility, 14-9
- Almon. *See* Lauans
- Alpha paper, 19-12
- Amaranth. *See* Purpleheart
- American Lumber Standard Committee (ALSC):  
  accepting design values for foreign species, 6-3, 6-4t  
  design properties, 6-3  
  stress grading, 6-2 to 6-3
- American Society of Testing and Materials (ASTM):  
  and AWPA standards, 17-12  
  calculating design properties, 6-3  
  calculating strength ratios, 6-3  
  calculating wood properties for visual stress grades, 6-3  
  critical radiant flux of floor-covering systems using a radiant heat energy source (ASTM E648), 17-4  
    related test methods, 17-9  
  cone calorimeter (ATSM 1354), 17-6, 17-8  
  fire tests of roof covering (ASTM E108), 17-4  
  fire-resistance test (ASTM E119), 17-4, 17-10, 17-11t  
  flame spread (ASTM E84), 17-2, 17-4, 17-8, 17-12  
  flame spread index for solid sawn lumber, 17-3t  
  NBS smoke chamber (ASTM E662), 17-9 to 17-10
- American Softwood Lumber Standard, 5-1,5-7, 6-2
- American standard lumber sizes, 5-10, 5-11t
- American Wood Preservers' Association:  
  fire-retardant-treated wood, 17-12, 17-13
- Ammonia for plasticizing wood, 19-2
- Ammoniacal copper citrate (CC):  
  retention levels for various wood products, 14-6t  
  solution percentages, 14-12  
  temperature for pressure treating, 14-21
- Ammoniacal copper quat (ACQ):  
  common types, 14-11  
  composition of common types, 14-11t  
  retention levels for various wood products, 14-6t  
  uses, 14-11
- Ammoniacal copper zinc arsenate (ACZA):  
  composition, 14-11  
  replacement for ACA, 14-11  
  retention levels for various wood products, 14-6t  
  temperature for pressure treating, 14-21  
  use, 14-10  
  use with Douglas-fir, 14-10 to 14-11
- Anani. *See* Manni
- Anaura. *See* Marishballi
- Andiroba:  
  characteristics, 1-18  
  characteristics affecting machining, 3-17t  
  decay resistance, 3-18t

- dimensional change coefficient, 12-17t
- durability, 1-18
- ease of bonding, 9-8t
- locality of growth, 1-17
- mechanical properties, 4-16t, 4-20t
- nomenclature, 1-17 to 1-18
- resistance to decay and insects, 1-18
- shrinkage values, 3-10t
- uses, 1-18
- workability, 1-18
- Angelin (*See also* Sucupira):
  - ease of bonding, 9-8t
  - mechanical properties, 4-16t, 4-20t
  - shrinkage values, 3-10t
- Angelique:
  - characteristics, 1-18
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - machining properties, 1-18
  - mechanical properties, 4-16t, 4-20t
  - resistance to decay and insects, 1-18
  - shrinkage values, 3-10t
  - uses, 1-18
- Animal adhesives:
  - structural performance, 9-11t
  - working and strength properties, and uses, 9-13t
- Ants, carpenter, 13-13
- Annual growth rings. *See* Growth rings
- Apa. *See* Wallaba
- Apamate. *See* Roble
- Apitong. (*See also* Keruing):
  - dimensional change coefficient, 12-17t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-10t
- Apple:
  - dimensional change coefficient, 12-16t
  - moisture content, 3-6t
- Ash:
  - decay resistance, 3-18t
  - for flooring, 5-6, 5-7
  - machining and related properties, 3-16t
  - size of pores, 15-31t
- Ash, black:
  - characteristics, 1-4
  - color and figure, 3-3t
  - dimensional change coefficient, 12-16t
  - locality of growth, 1-4
  - moisture content, 3-6t
  - nomenclature, 5-5t
  - shrinkage values, 3-9t
  - species, 1-4
  - specific gravity, 1-4
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
  - uses, 1-4
- Ash, blue:
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
- Ash, green:
  - dimensional change coefficient, 12-16t
  - moisture content, 3-6t
  - penetration, 14-16t
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
- Ash, Oregon:
  - color and figure, 3-6t
  - dimensional change coefficient, 12-16t
  - nomenclature, 5-5t
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
- Ash, pumpkin:
  - dimensional change coefficient, 12-16t
  - shrinkage values, 3-9t
- Ash, white:
  - characteristics, 1-3
  - characteristics for painting, 15-3t
  - color and figure, 3-3t
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - locality of growth, 1-3
  - moisture content, 3-6t, 4-34t
  - nomenclature, 5-5t
  - penetration, 14-16t
  - Poisson ratio, 4-3t
  - shrinkage values, 3-9t
  - shock resistance, 1-3
  - species, 1-3
  - thermal conductivity, 3-19t
  - uses, 1-3
- Aspen:
  - characteristics, 1-4
  - color and figure, 3-3t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - locality of growth, 1-4
  - machining and related properties, 3-16t
  - moisture content, 3-6t
  - nomenclature, 5-5t
  - shock resistance, 1-4
  - size of pores, 15-31t
  - species, 1-4
  - uses, 1-4
  - workability, 1-4
- Aspen, bigtooth:
  - characteristics for painting, 15-3t
  - mechanical properties, 4-14t, 4-15t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
- Aspen, quaking:
  - dimensional change coefficient, 12-16t
  - mechanical properties, 4-14t, 4-15t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
- Avodire:
  - characteristics, 1-18
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-18
  - mechanical properties, 4-16t, 4-20t
  - shrinkage values, 3-10t
  - shock resistance, 1-18
  - uses, 1-18
  - workability, 1-8
- Axial load, deformation, 8-1, 8-1eq
- Axial members, glulam combinations, 11-5
- Azobe:
  - characteristics, 1-18
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - locality of growth, 1-18
  - mechanical properties, 4-16t, 4-20t
  - resistance to decay and insects, 1-18
    - marine borers, 13-14
  - shrinkage values, 3-10t
  - workability, 1-18
  - uses, 1-18
- Bacteria causing decay, 13-8
- Back priming, 15-23
- Bagtikan. *See* Seraya, white
- Balata:
  - characteristics, 1-18
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - locality of growth, 1-18
  - resistance to decay and insects, 1-18
  - shrinkage values, 3-10t
  - uses, 1-19
  - workability, 1-18
- Balau:
  - characteristics, 1-19
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - locality of growth, 1-19
  - species, 1-19
  - uses, 1-19
- Baldcypress:
  - characteristics, 1-10
  - characteristics for painting, 15-3t
  - color and figure, 3-4t

- connector joint strength, 7-21t
- decay resistance, 3-18t
- dimensional change coefficient, 12-16t
- elastic ratio, 4-2t
- flame spread index, 17-3t
- locality of growth, 1-10
- moisture content, 3-6t
- nomenclature, 5-13t
- pecky cypress, 1-10
- penetration, 14-16t
- Poisson ratio, 4-3t
- tensile strength, 4-24t
- thermal conductivity, 3-20t
- uses, 1-10
- Balsa:**
  - characteristics, 1-19
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - locality of growth, 1-19
  - mechanical properties, 4-16t, 4-20t
  - Poisson ratio, 4-3t
  - shrinkage values, 3-10t
  - uses, 1-19
- Banak:**
  - characteristics, 1-19
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-19
  - machining properties, 1-19
  - mechanical properties, 4-16t, 4-20t
  - nomenclature, 1-19
  - resistance to decay and insects, 1-19
  - shrinkage values, 3-10t
  - uses, 1-19
- Bark:**
  - growth, 2-2
  - inner and outer, 2-1
- Basswood:**
  - characteristics, 1-4
  - characteristics for painting, 15-3t
  - charring rate data, 17-11t
  - color and figure, 3-3t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - flammability data, 17-7t
  - locality of growth, 1-4
  - machineability, 1-4
  - machining and related properties, 3-16t
  - moisture content, 3-6t
  - nomenclature, 5-5t
  - plywood stiffness and strength, 10-11t
  - size of pores, 15-31t
  - strength properties, 4-4t, 4-9t
  - in wood-polymer composites, 19-11t
  - thermal conductivity, American, 3-19t
  - uses, 1-4
  - workability, 1-4
- Basswood, American:**
  - dimensional change coefficient, 12-16t
  - penetration, 14-16t
  - shrinkage values, 3-9t
- Bastard sawn lumber, definition, 3-2**
- Beams:**
  - bending deflection, 8-3 to 8-4, 8-3eq, 8-3t, 8-4eq
  - bending stress, 8-5, 8-5eq, 8-9
  - combined bending and axial load, effect of, 8-7
  - compressive stress, 8-4
  - deformation, 8-1 to 8-4
  - end loading, effect of, 8-7
  - lateral buckling, 8-9 to 8-10, 8-9eq, 8-10t
  - modulus of rupture, 8-6, 8-6eq
  - notches and holes, effect of, 8-3, 8-6 to 8-7
  - shear deflection, 8-3, 8-3eq, 8-3t
  - shear stress, 8-5, 8-5eq
  - size, effect on strength, 8-6, 8-6eq
  - size, effects on modulus of rupture, 8-6, 8-6eq
  - stability, 8-8 to 8-11
  - tapered beams:
    - bending stress, 8-5 to 8-6, 8-5eq
    - deflections, 8-3, 8-3eq, 8-4fig
    - glulam combinations, 11-6, 11-4fig
    - shear stresses, 8-5 to 8-6, 8-5fig
  - tensile, stress, 8-4, 8-4eq
  - time, effect of, 8-3, 8-7
  - twist, 8-4, 8-4eq
  - waterponding, effect of, 8-3, 8-3eq, 8-7, 8-9, 8-9eq
- Beech:**
  - characteristics for painting, 15-3t
  - decay resistance, 3-18t
  - for flooring, 5-6, 5-7
  - machining and related properties, 3-16t
  - nomenclature, 5-5t
  - penetration, 14-16t
  - size of pores, 15-31t
- Beech, American:**
  - characteristics, 1-4
  - color and figure, 3-3t
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - locality of growth, 1-4
  - machineability, 1-4
  - moisture content, 3-6t
  - plywood stiffness and strength, 10-11t
  - shock resistance, 1-4
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
  - tensile strength, 4-24t
  - thermal conductivity, 3-19t
  - uses, 1-4
- Bees, carpenter, 13-13**
- Beetles:**
  - ambrosia beetles, 13-8, 13-10
  - damage cause by, 13-9t
  - bark beetles, 13-8
  - old house borers, 13-11
  - damage caused by, 13-9t
  - powder-post beetles, 13-10
  - damage caused by, 13-9fig, 13-10t
- Bending:**
  - creep, 4-37 to 4-39
  - strength and temperature, 4-37
- Bending of glulam, 11-4 to 11-5**
- Bending properties, affected by temperature, 4-37, 4-37t**
- Bending stiffness:**
  - of box and I beams, 11-12
  - of sandwich panels, 11-18
  - of stressed-skin panels, 11-14
- Bending strength, stress grading, 6-6**
- Bending stress:**
  - derivations for machine-graded lumber, 6-8 to 6-10, 6-9fig
  - stressed-skin panels, 11-15
- Bending of wood:**
  - apparatus, 19-4
  - chemicals used, 19-2
  - fixing the bend, 19-4
  - moisture content of stock, 19-3
  - principles of plasticizing and bending, 19-1
  - selection of stock, 19-3
  - solid members, 19-3, 19-4fig
  - steaming, 19-1
- Benge:**
  - characteristics, 1-19
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - mechanical properties, 4-16t, 4-20t
  - nomenclature, 1-19
  - sapwood, 2-2
  - shrinkage values, 3-10t
  - uses, 1-19
  - workability, 1-19
- Bent wood members:**
  - characteristics, 19-4
  - solid wood members, species used, 19-3
  - uses, 19-2
- Birch:**
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - for casing and base, 5-17
  - for flooring, 5-6, 5-7
  - heat release data, 17-9t
  - machining and related properties, 3-16t
  - nomenclature, 5-5t
  - Birch, gray, shrinkage values, 3-9t
  - Birch, paper:
    - characteristics, 1-4

- color and figure, 3-3t
- dimensional change coefficient, 12-16t
- locality of growth, 1-4
- machining and related properties, 3-16t
- moisture content, 3-6t
- shrinkage values, 3-9t
- strength properties, 4-4t, 4-9t
- uses, 1-5
- Birch, river:
  - dimensional change coefficient, 12-16t
  - penetration, 14-16t
  - shrinkage values, 3-9t
- Birch, sweet:
  - characteristics, 1-4
  - color and figure, 3-3t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - locality of growth, 1-4
  - moisture content, 3-6t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - shock resistance, 1-4
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
  - uses, 1-5
- Birch, yellow:
  - characteristics, 1-4
  - characteristics for painting, 15-3t
  - color and figure, 3-3t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - flame spread index, 17-3t
  - laminated:
    - strength properties, 19-7t to 19-8t
    - thermal expansion coefficients, 19-9t
  - locality of growth, 1-4
  - moisture content, 3-6t, 4-34t
  - Poisson ratio, 4-3t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - shock resistance, 1-4
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
  - toughness values, 4-24t
  - uses, 1-5
- Bird peck:
  - description, 4-33
  - effect on strength, 4-33
  - species involved, 4-33
- Bis(tri-n-butyltin) oxide:
  - concentration values, 14-8
  - inappropriate uses, 14-8
  - paintability, 14-8
  - recommended uses, 14-8
- toxicity, 14-8
- Black locust. *See* Locust, black
- Blood adhesive, working and strength properties, and uses, 9-13t
- Blue stain, description, 13-2
- Boats, wood:
  - control of decay in, 13-8
  - control of marine borers, 13-15
  - use of varnish on, 15-22
- Bolts:
  - bearing stress of wood under:
    - bolt diameter, effect
    - perpendicular to grain, 7-15fig
    - intermediate angle to grain
    - loading, 7-14, 7-13fig
    - L/D ratios, 7-14
    - parallel to grain loading, 7-14, 7-14fig
    - perpendicular to grain loading, 7-14, 7-14fig
  - bearing stress with steel side plates, 7-15
  - bolt holes, effect on, 7-16 to 7-17, 7-16fig
  - bolt quality, effect on joint strength, 7-15, 7-14fig, 7-15fig
  - drift, 7-9
  - member thickness, effect of, 7-15, 7-15fig
  - multiple bolt joints, 7-15 to 7-16
  - pre-1991 allowable loads:
    - parallel to grain, 7-17 to 7-18, 7-17t
    - perpendicular to grain, 7-18, 7-17t, 7-19t
  - post-1991 yield model, 7-18, 7-18eq, 7-19t
  - spacing, edge and end distance, 7-16
- Bondability:
  - of metals and plastics to wood, 9-5
  - of wood species, 9-7, 9-8t
- Bonded joints:
  - basic stress modes, 9-20 to 9-21
  - construction joints, 9-19 to 9-20, 9-20fig
  - edge-grain joints, 9-18, 9-18fig
  - end-grain joints, 9-18 to 9-19, 9-19fig
  - end-to-edge grain joints, 9-19, 9-19fig
  - mechanical testing of, 9-20 to 9-21
- Bonding:
  - adhesive selection, 9-12 to 9-15
  - assembly and pressing, 9-16 to 9-18, 9-17fig
  - effect of:
    - moisture content and dimensional change, 9-7 to 9-9
    - wood density, 9-6 to 9-7
    - wood porosity, 9-7
  - elements of, 9-1 to 9-2
  - moisture content control, 9-15 to 9-16
  - quality assurance programs, 9-22 to 9-23
- short- and long-term performance of adhesives, 9-21 to 9-22, 9-22fig
- strength and durability of adhesives, 9-11 to 9-12, 9-11t, 9-18
- strength properties of adhesives, 9-21
- surface preparation, 9-16
- with veneers, 9-4 to 9-5
- wettability of wood, 9-2, 9-3fig, 9-5
- wood and nonwood composites, 9-5 to 9-6
- Box beam, 11-12 to 11-13
- Box elder, nomenclature, 5-5t
- Box nails, 7-2, 7-2t
- Bridges, 16-9 to 16-10, 16-10fig
- Brown rot, 13-5
- Bubinga (*See also* Benge):
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - mechanical properties, 4-16t, 4-20t
  - shrinkage values, 3-10t
- Buckeye:
  - characteristics, 1-5
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - locality of growth, 1-5
  - machineability, 1-5
  - nomenclature, 5-5t
  - shock resistance, 1-5
  - species, 1-5
  - uses, 1-5
  - yellow, shrinkage values, 3-9t
- Buckling:
  - interaction of buckling modes, 8-10 to 8-11, 8-10eq, 8-11eq
  - of beams, 8-9 to 8-10, 8-9eq, 8-10t
  - of columns, 8-8 to 8-9, 8-8eq, 8-8fig
  - of deck beams, 8-10, 8-10fig
  - of glued-laminated beams, 11-13
  - of roof beams, 8-9
  - of sandwich panels, 11-18 to 11-19
  - of stressed-skin panels, 11-15
- Building codes:
  - classifications of construction, 17-2
  - fire safety:
    - containment to compartment of origin, 17-4 to 17-6
    - fire growth within compartments, 17-2 to 17-4
    - types of construction, 17-2
    - organizations producing, 17-2
- Buildings, control of decay in, 13-7
- Built-up columns, 8-9
- Bulletwood (*See also* Balata):
  - mechanical properties, 4-16t, 4-20t
  - shrinkage values, 3-10t
- Butternut:
  - characteristics, 1-5
  - characteristics for painting, 15-3t
  - color and figure, table, 3-3t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - locality of growth, 1-5

- machineability, 1-5
- nomenclature, 5-5t
- shock resistance, 1-5
- size of pores, 15-31t
- shrinkage values, 3-9t
- strength properties, 4-4t, 4-9t
- uses, 1-5
- Buttonwood. *See* Sycamore
- Cambium, 2-1, 2-2
- Carapa. *See* Andiroba
- Carbon monoxide, 17-10
- Carpenter ants:
  - damage caused by, 13-10fig, 13-10t
  - discussed, 13-13
- Carpenter bees:
  - damage caused by, 13-9t
  - discussed, 13-13
- Casing and base, availability, 5-17
- Casein adhesive:
  - structural performance, 9-11t
  - working and strength properties, and uses, 9-13t
- Catalpa:
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
- Catalysts and adhesion, 9-10
- Cativo:
  - characteristics, 1-19
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-19
  - mechanical properties, 4-16t, 4-20t
  - plywood stiffness and strength, 10-11t
  - resistance to decay and insects, 1-20
  - sapwood, 2-2
  - shrinkage values, 3-10t
  - uses, 1-20
- Cedar:
  - availability at retail yards, 5-16
  - for finish boards, 5-17
- Cedar, Atlantic-white:
  - characteristics, 1-17
  - color and figure, 3-4t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - locality of growth, 1-17
  - nomenclature, 5-13t
  - shock resistance, 1-17
  - shrinkage values, 3-9t
  - strength properties, 4-6t, 4-11t
  - thermal conductivity, 3-20t
  - uses, 1-17
- Cedar, eastern red:
  - characteristics, 1-15
  - color and figure, 3-4t
  - decay resistance, 3-18t
- dimensional change coefficient, 12-16t
- ease of bonding, 9-8t
- heat release data, 17-9t
- locality of growth, 1-15
- moisture content, 3-6t
- nomenclature, 5-13t
- shock resistance, 1-15
- shrinkage values, 3-9t
- strength properties, 4-6t, 4-11t
- thermal conductivity, 3-20t
- uses, 1-15
- Cedar, incense:
  - characteristics, 1-12
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - locality of growth, 1-12
  - moisture content, 3-6t
  - pecky, 1-12
  - plywood stiffness and strength, 10-11t
  - nomenclature, 5-13t
  - shock resistance, 1-12
  - shrinkage values, 3-9t
  - strength properties, 4-6t, 4-11t
  - uses, 1-12
- Cedar, northern white:
  - characteristics, 1-16
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - elastic ratio, 4-2t
  - for shingles, 5-17
  - locality of growth, 1-16
  - mechanical properties, 4-14t, 4-15t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - Poisson ratio, 4-3t
  - shock resistance, 1-17
  - shrinkage values, 3-9t
  - strength properties, 4-6t, 4-11t
  - thermal conductivity, 3-20t
  - uses, 1-17
- Cedar, Port-Orford:
  - characteristics, 1-15
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - locality of growth, 1-15
  - moisture content, 3-6t
  - nomenclature, 5-13t
  - plywood stiffness and strength, 10-11t
  - shock resistance, 1-15
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - tensile strength, 4-24t
- thermal conductivity, 3-20t
- uses, 1-15
- Cedar, western red:
  - characteristics, 1-20
  - characteristics for painting, 15-3t
  - charring rate data, 17-11t
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - erosion of planed surfaces, 15-8t
  - flame spread index, 17-3t
  - for shingles and shakes, 5-17
  - for siding, 5-17
  - locality of growth, 1-15
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - shock resistance, 1-15
  - shrinkage values, 3-9t
  - strength properties, 4-6t, 4-12t
  - tensile strength, 4-24t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
  - used for poles, 18-2, 18-4t, 18-6
  - uses, 1-15
- Cedar, yellow:
  - characteristics, 1-17
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - decay resistance, 12-16t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - flame spread index, 17-3t
  - locality of growth, 1-17
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t
  - nomenclature, 5-13t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - shock resistance, 1-17
  - strength properties, 4-7t, 4-12t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
  - uses, 1-17
- Cedro. *See* Spanish-cedar
- Cedro macho. *See* Andiroba
- Cedro-Rana. *See* Tornillo
- Ceiba:
  - characteristics, 1-20
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - locality of growth, 1-20
  - mechanical properties, 4-16t, 4-20t

- resistance to decay and insects, 1-20
- shrinkage values, 3-10t
- uses, 1-20
- workability, 1-20
- Cells of wood:
  - description, 2-3
  - fibers, 2-3
  - functions of various types, 2-3
  - length, 2-3
  - parenchyma, 2-3
  - rays, 2-3
  - tracheids, 2-3
  - vessels, 2-3
- Cellulose, discussion, 2-3
- Cellulose insulation, product safety standard, 17-4
- Cement-bonded composites, 10-24 to 10-26, 10-24fig, 10-26fig
- Cement-coated nails, 17-3 to 17-4
- Chalking, 15-26 to 15-27
- Checks:
  - development due to weathering, 15-7
  - during drying, 12-7, 12-9 to 12-10, 12-12fig
  - in decking boards, 15-10
  - in lumber stress grading, 6-4
  - in glued-laminated timbers, 11-10
  - in veneer adhesion, 9-4 to 9-5
- Chemical composition of wood, 2-3 to 2-4
- Chemical discolorations during drying, 12-10, 12-13fig
- Chemical stain, discussed, 3-13
- Chemicals, effect on wood:
  - discussion, 4-41
  - strength properties, 4-41
  - swelling liquids, 4-41
- Cherry:
  - characteristics for painting, 15-3t
  - ease of bonding, 9-8t
  - nomenclature, 5-5t
  - size of pores, 15-31t
- Cherry, black:
  - characteristics, 1-5
  - color and figure, 3-3t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - elastic ratio, 4-2t
  - locality of growth, 1-5
  - machineability, 1-5
  - machining and related properties, 3-16t
  - moisture content, 3-6t
  - Poisson ratio, 4-3t
  - shock resistance, 1-5
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
  - uses, 1-1, 1-5
- Cherry, pin, penetration, 14-16t
- Chestnut:
  - characteristics for painting, 15-3t
  - machining and related properties, 3-16t
  - nomenclature, 5-5t
- Chestnut, American:
  - availability, 1-5
  - characteristics, 1-5
  - color and figure, 3-3t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - locality of growth, 1-5
  - moisture content, 3-6t, 4-34t
  - penetration, 14-16t
  - shock resistance, 1-5
  - shrinkage values, 3-9t
  - size of pores, 15-31t
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
  - uses, 1-7
  - workability, 1-5
- Chewstick. *See* Manni
- Chlorothalonil:
  - effectiveness, 14-8
  - solubility, 14-8
  - stability, 14-8
- Chlorothalonil/chlorpyrifos:
  - component ratios, 14-8
  - effectiveness, 14-8
- Chlorpyrifos:
  - effectiveness, 14-9
  - in combination, 14-9
- Chromated copper arsenate (CCA):
  - common types, 14-11
  - component substitutions, 14-11
  - composition of common types, 14-11t
  - effectiveness of common types, 14-11
  - effect on adhesion, 9-6
  - finishing wood treated with, 15-22
  - resistance to marine borers, 14-11
  - retention levels for various wood products, 14-6t
  - Southern pine sapwood stakes retention and life span test results, 14-13t
  - temperature for pressure treating, 14-21
  - use with Douglas-fir, 14-11
- Coal-tar creosote. *See* Creosote
- Cocobolo, shrinkage values, 3-10t
- Coefficient of friction, 3-21, 3-22
- Coefficient of thermal expansion, 3-21
- Coefficient of variation, 4-23t
- Collapse during drying, 12-10, 12-12fig
- Columns:
  - built-up and spaced columns, 8-9
  - flanged columns, 8-9
  - long columns, compressive stress, 8-8, 8-8eq
  - short columns, compressive stress, 8-8 to 8-9, 8-8eq
- Composite products:
  - additives, 10-4
  - adhesive considerations, 10-3 to 10-4
  - classification, 10-2, 10-2t, 10-3fig
  - manufacturing issues, 10-4
  - particle and fiber composites 10-13 to 10-24
  - specialty composites:
    - flame retardant, 10-24
    - preservative treated, 10-24
    - moisture-resistant, 10-23 to 10-24
  - types, 10-3, 10-3fig
  - wood fiber-thermoplastic composites:
    - nonwoven textile-type:
      - applications, 10-29 to 10-30
      - density, 10-29 to 10-30
      - manufacture, 10-28 to 10-30
      - properties, 10-28 to 10-30, 10-29t
      - production, 10-26 to 10-27
      - with high thermoplastic content:
        - advantages, 10-27
        - compounding, 10-27 to 10-28
        - density, 10-27
        - disadvantages, 10-28
        - manufacture, 10-27
        - properties, 10-28, 10-28t
      - with low thermoplastic content, manufacture, 10-28
    - wood-based panels, 10-4 to 10-6
    - wood-nonwood composites:
      - advantages, 10-24
      - inorganic-bonded composites:
        - description, 10-24 to 10-25, 10-24fig
        - gypsum-bonded, 10-25
        - magnesia-cement-bonded, 10-25
        - portland-cement-bonded, 10-25 to 10-26, 10-26t
        - problems, 10-26
        - treatments, 10-26
- Compreg:
  - advantages, 19-5
  - dimensional stability, 19-9t
  - molding, 19-5, 19-8
  - plasticizers, 19-5
  - properties, 19-5, 19-6t
  - species used, 19-9
  - thermal expansion coefficients, 19-9t
  - uses, 19-8 to 19-9
- Compressed wood, untreated (staypak)
  - appearance, 19-10
  - dimensional stability, 19-9t
  - purpose, 19-7t to 19-8t
  - strength properties, 19-7 to 19-8t
  - uses, 19-10
- Compression failures:
  - causes, 4-33
  - description, 4-33, 4-33fig
  - effect on strength, 4-33
- Compression wood:
  - definition, 4-31
  - density increase, 4-31

- in juvenile wood, 4-32
- shrinkage, 3-8, 4-32
- Compression strength parallel to grain:
  - affected by temperature, 4-36t
  - coefficient of variation, 4-23t
  - defined, 4-3
- Compressive stress of stressed-skin panels, 11-14 to 11-15
- Compressive stress of columns, 8-8 to 8-9, 8-8eq
- Compression stress perpendicular to grain:
  - coefficient of variation, 4-23t
  - defined, 4-3
- Condensation in crawl spaces, 13-7
- Conductance meters and moisture content, 12-2 to 12-3
- Conductivity, thermal:
  - definition, 3-31
  - discussion, 3-31 to 3-32
- Cone calorimeter, 17-8
- Connector joints:
  - cross bolts, 7-24
  - design loads, 7-20, 7-20fig, 7-21fig
  - end distance and spacing, 7-23
  - multiple connectors, 7-23 to 7-24, 7-24fig
  - net section stress, 7-23
  - parallel to grain loading, 7-18, 7-20fig
  - perpendicular to grain loading, 7-18 to 7-20, 7-20fig
  - shear plate connector, 7-19fig
  - split-ring connector, 7-19fig
  - strength components, 7-18
  - strength ratios, 7-25t
  - working loads:
    - exposure and moisture condition, effect of, 7-21
    - grade and quality of lumber, 7-22
    - loads at angle with grain, 7-22, 7-7fig, 7-13eq,
    - species grouping, 7-21t, 7-22t
    - steel side plates, effect of, 7-21
    - thickness of member, effect of, 7-22, 7-22t, 7-23fig
    - width of member, effect of, 7-23
- Construction, design factors affecting dimensional change, 12-18
- Construction logs:
  - availability, 18-3
  - form, 18-4 to 18-5, 18-5fig
  - standards and specifications, 18-2t
  - strength properties, 18-7
  - uses, 18-3, 18-4fig
- Copper azole - Type A (CBA-Type A):
  - retention levels for various wood products, 14-6t
  - solution percentages, 14-12
  - temperature for pressure treating, 14-21
- Copper bis(dimethylthiocarbamate) (CDDC):
  - retention levels for various wood products, 14-6t
- solution percentages, 14-11 to 14-12
- temperature for pressure treating, 14-21
- uses, 14-12
- Copper naphthenate:
  - color transfer and changes, 14-8
  - effectiveness, 14-8
  - retention levels for various wood products, 14-5t
  - solution values, 14-8
  - Southern pine sapwood stakes retention and life span test results, 14-14t
  - treatment for cutting pretreated wood, 14-24
- Cotton linter paper, 19-12
- Cottonwood:
  - characteristics, 1-5
  - color and figure, 3-3t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - flame spread index, 17-3t
  - locality of growth, 1-5
  - machining and related properties, 3-16t
  - moisture content, 3-6t
  - nomenclature, 5-5t
  - penetration, 14-16t
  - shock resistance, 1-6
  - size of pores, 15-31t
  - species, 1-5
  - uses, 1-6
  - workability, 1-6
- Cottonwood, balsam poplar:
  - mechanical properties, 4-14t, 4-15t
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
- Cottonwood, black:
  - dimensional change coefficient, 12-16t
  - mechanical properties, 4-14t, 4-15t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
- Cottonwood, eastern:
  - dimensional change coefficient, 12-16t
  - elastic ratio, 4-2t
  - characteristics for painting, 15-3t
  - mechanical properties, 4-14t, 4-15t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
- Courbaril:
  - characteristics, 1-20
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
- ease of bonding, 9-8t
- locality of growth, 1-20
- machineability, 1-20
- mechanical properties, 4-16t, 4-20t
- resistance to decay and insects, 1-20
- sapwood, 2-2
- shrinkage values, 3-10t
- uses, 1-20
- Covalent chemical bonds, 9-2
- Crabwood. *See* Andiroba
- Crack propagation systems, 4-24 to 4-25
- Creep:
  - defined, 4-37
  - discussed, 4-37 to 4-39
  - influence of stress on, 4-39fig
- Creosote, coal-tar:
  - advantages, 14-2
  - appearance, 14-2
  - composition variability, 14-2
  - EPA-approved customer information sheet, 14-3t
  - effect on mechanical properties, 14-24
  - for non-pressure treatments, 14-7
  - handling precautions, 14-3t
  - in pressure treatment process, 14-19
  - odor and vapors, 14-2
  - retention levels for various wood products, 14-5t
  - standards, 14-2
  - temperature for pressure treating, 14-21
  - treatment for cutting pretreated wood, 14-25
  - use site precautions, 14-3t
  - volatility, 14-7
- Creosote-coal-tar solutions:
  - properties, 14-7
  - retention levels for various wood products, 14-5t
  - standards by volume, 14-7
  - temperature for pressure treating, 4-21
- Creosote-petroleum oil solutions:
  - retention levels for various wood products, 14-5t
- Cristobal. *See* Macawood
- Critical radiant flux test, 17-4
- Cross grain:
  - effect on mechanical properties, 4-29 to 4-30
  - types, 4-28 to 4-30
- Cuangare (*See also* Banak):
  - dimensional change coefficient, 12-17t
  - mechanical properties, 4-16t, 4-20t
  - shrinkage values, 3-10t
- Cucumber, nomenclature, 5-5t
- Curved members, glulam combinations, 11-5 to 11-6
- Cypress:
  - for siding, 5-17
  - plywood stiffness and strength, 10-11t

- Cypress, Arizona, decay resistance, 3-18t
- Cypress, Mexican
  - characteristics, 1-33
  - locality of growth, 1-33
  - machineability, 1-33
  - mechanical properties, 4-16t, 4-20t
  - uses, 1-33
- Dead trees, strength, 4-33 to 4-34
- Decay:
  - and exposure to weather, 15-13
  - appearance of fungi, 13-4
  - brown rot, 13-5
  - conditions favoring, 13-4, 13-15
  - control in:
    - boats, wood, 13-8
    - buildings, 13-7
    - logs, poles, piling, or ties, 13-6
    - lumber, 13-6
    - plywood, 13-8
  - cycle, 13-3fig
  - dead trees, 4-33 to 4-34
  - dry rot, 13-5
  - dry rot fungi, 13-5
  - effect on mechanical properties, 4-43
  - effect on strength, 4-43, 13-5, 13-6
  - fungal stain and molds, 13-3
  - heartwood, susceptibility to, 13-4
  - incipient, 13-5
  - sapwood, susceptibility to, 13-4
  - soft rot, 13-5
  - white rot, 13-5
- Decay hazard climate index, 13-2fig
- Decay resistance:
  - extractives, 2-2
  - heartwood, 2-2, 3-18t, 13-5
  - in visual stress grading, 6-5
- Decks:
  - discussed, 16-4
  - finishes, suitability and expected service life, 15-15t
  - finishing, 15-21
  - supports, 8-10, 8-10fig
  - use of cleaners, 15-33
- Deflections of beams:
  - effect of time, creep, 8-3
  - straight beams, 8-1 to 8-2, 8-2t, 8-2eq
  - tapered beams, 8-2, 8-2eq, 8-3fig
- Deformation equations:
  - axial load, 8-1, 8-1eq
  - bending:
    - effect of notches and holes, 8-2
    - effect of time, creep deflection, 8-3
    - straight beam deflection, 8-1 to 8-2, 8-2eq, 8-2t
    - tapered beam deflection, 8-2, 8-2eq, 8-3fig
    - water ponding, 8-3, 8-3eq
  - combined bending and axial load:
    - concentric load, 8-3 to 8-4, 8-4eq
    - eccentric load, 8-4, 8-4eq
    - torsion, 8-4, 8-4eq, 8-4fig
- Deformed shank nails, strength of, 7-7
- Degame:
  - characteristics, 1-20
  - locality of growth, 1-20
  - machineability, 1-20
  - mechanical properties, 4-16t, 4-20t
  - resistance to decay and insects, 1-20
  - shrinkage values, 3-10t
  - strength, 1-20
  - uses, 1-20
- Delamination and adhesive failure, 9-21
- Density:
  - as function of specific gravity and moisture content, 3-12, 3-13t, 3-14t
  - effect on adhesive bonding, 9-6 to 9-7
  - effect on withdrawal resistance of nails, 7-3
  - in sorting machine-graded lumber, 6-8
  - in visual stress grading, 6-5
  - variation, 3-11
- Design factors affecting dimensional change in structures:
  - flooring, 12-18
  - framing lumber in house construction, 12-18
  - heavy timber construction, 12-18
  - interior finish, 12-18
- Design properties:
  - and stress grading, 6-3
  - procedures for deriving, 6-5 to 6-7
- Design values:
  - for foreign species, approval process, 6-4t
  - for glulam, 11-9—11-10
- Determa:
  - characteristics, 1-21
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - locality of growth, 1-21
  - machineability, 1-21
  - mechanical properties, 4-16t, 4-20t
  - resistance to decay and insects, 1-21
  - uses, 1-21
- Diagonal grain, 4-29 to 4-30
- Dielectric constant, definition, 3-21, 3-22
- Dielectric meters and moisture content, 12-2 to 12-3
- Dielectric power factor, 3-21, 3-22
- Dimensional change and wood paintability, 15-4
- Dimensional changes in wood:
  - affected by design factors, 12-18
  - calculation based on green dimensions, 12-17, 12-17eq
  - care during construction 12-18 to 12-20
  - estimation using coefficients, 12-15 to 12-17, 12-15eq, 12-16t, 12-17t
- Dimpling of sandwich panel facings, 11-19
- Discoloration:
  - by mildew, 15-8, 15-27
  - by mold and fungal stains, 13-2
  - by nonmicrobial or chemical stains, 13-3
  - from water-soluble extractives, 15-28 to 15-29
  - of paint due to extractives, 15-2
  - use of wood cleaners, 15-33
- Discontinuous rings, definition, 2-2
- Dogwood, nomenclature, 5-5t
- Doors, fire resistance in frame construction, 17-5
- Douglas-fir:
  - availability at retail yards, 5-16
  - characteristics, 1-10
  - characteristics for painting, 15-3t
  - charring rate equation, 17-10
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - erosion of planed surfaces, 15-8t
  - flame spread index, 17-3t
  - for flooring, 5-17
  - for siding, 5-17
  - fracture toughness, 4-26t
  - kiln drying schedule, 12-11t
  - locality of growth, 1-10
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 4-34t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - preservative pressure and temperature, 14-21
  - preservative treatment to prevent marine borer attack on piles, 14-10t
  - preservatives used, 14-7, 14-11, 14-12
  - shrinkage, 3-8, 3-11fig
  - used for poles, 18-2, 18-4t
  - uses, 1-10
- Douglas-fir, coast:
  - dimensional change coefficient, 12-16t
  - moisture content, 3-6t
  - penetration, 14-16t
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
- Douglas-fir, interior north:
  - dimensional change coefficient, 12-16t
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - tensile strength, 4-24t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
- Douglas-fir, interior west



- dimensional change coefficient, 12-16t
- shrinkage values, 3-9t
- strength properties, 4-7t, 4-12t
- thermal conductivity, 3-20t
- toughness values, 4-25t
- Douglas-fir, interior south
  - strength properties, 4-7t, 4-12t
  - toughness values, 4-25t
- Draftstops, 17-5
- Dried wood, moisture control during transit and storage, 12-14 to 12-15, 12-14t
- Drift bolts, 7-9
- Dry kilns, 12-7 to 12-8, 12-8fig
- Drying of wood:
  - accelerated air drying and predrying, 12-6
  - advantages, 12-5
  - affect of properties, 12-5
  - air drying, 12-6
  - drying mechanism, 12-6 to 12-7, 12-6fig
  - drying defects:
    - discoloration, 12-10, 12-13fig, 12-14fig
    - fracture or distortion, 12-9 to 12-10, 12-12fig
    - warp, 12-10 to 12-12, 12-13fig
  - drying schedules, 12-8 to 12-9, 12-11t
  - drying stresses, 12-7, 12-7fig
  - kiln drying, 12-6
  - hardwood lumber targets, 12-5
  - softwood lumber targets, 12-5
- Duration of load:
  - adjustment of design properties, 6-12 to 6-13, 6-13t, 6-13fig
  - defined, 4-24, 4-39
  - effect on mechanical properties, 4-39 to 4-40
  - relationship to failure, 4-39fig
- Dutch elm disease, 1-6
- Earlywood:
  - effect on paintability, 15-4
  - description, 2-2
  - erosion of planed surfaces, 15-8t
  - properties, 2-3
- Ebony, shrinkage values, 3-10t
- Edge-grained lumber:
  - advantages, 3-2t
  - method of producing, 3-2
  - preferred for painting, 15-1
  - weathering and check development, 15-7
- Ehie (*See also* Bengé):
  - decay resistance, 3-18t
- Ekki. *See* Azobe
- Ekop:
  - characteristics, 1-21
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - locality of growth, 1-21
  - machineability, 1-21
  - mechanical properties, 4-16t, 4-20t
  - shrinkage values, 3-10t
  - uses, 1-21
- Elastic properties of clear wood:
  - discussion, 4-2
  - values of:
    - modulus of elasticity ratios, 4-2t
    - modulus of rigidity ratios, 4-3t
    - Poisson's ratio, 4-2
- Elastomeric adhesives:
  - in light-frame construction, 9-19 to 9-20, 9-20fig
  - performance over time, 9-21 to 9-22, 9-22fig
  - structural performance, 9-11t
  - working and strength properties, and uses, 9-13t
- Electrical properties of wood:
  - conductivity, 3-21, 3-22
  - dielectric constant, 3-21, 3-22
  - power factor, 3-21, 3-22
  - resistance and moisture content, 3-22fig
- Elm:
  - characteristics, 1-6
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - disease, 1-6
  - locality of growth, 1-6
  - moisture content, 3-6t
  - size of pores, 15-31t
  - species, 1-6
  - uses, 1-6
- Elm, American:
  - characteristics for painting, 15-3t
  - color and figure, 3-3t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - moisture content, 3-6t
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
- Elm, cedar:
  - dimensional change coefficient, 12-16t
  - moisture content, 3-6t
  - shrinkage values, 3-9t
  - tensile strength, 4-24t
- Elm, rock:
  - color and figure, 3-3t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - moisture content, 3-6t
  - nomenclature, 5-5t
  - penetration 14-16t
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
- Elm, slippery:
  - color and figure, 3-3t
  - dimensional change coefficient, 12-16t
  - penetration, 14-16t
  - shrinkage values, 3-9t
  - strength properties, 4-4t, 4-9t
  - thermal conductivity, 3-19t
- Encased knots, definition, 4-27
- Encino. *See* Oak
- End joints in glued laminated timber, 11-7 to 11-8
- Engineered trusses and light-frame construction, 16-4
- Epoxy:
  - performance over time, 9-22
  - structural performance, 9-11t
  - use with wood and nonwood composites, 9-5
  - working and strength properties, and uses, 9-14t
- Erosion:
  - of earlywood and latewood planed surfaces, 15-8t
  - of finishes, 15-9
  - of wood, discussed, 15-7
  - rates for hardwood and softwoods, 15-8t
- Equilibrium moisture content:
  - definition, 3-5, 15-9
  - relative humidity as related to, 3-7
  - values for U.S. cities, 12-2, 12-3t
- Extractives:
  - and mill glaze, 15-25
  - discoloration, water-soluble, 15-28 to 15-29
  - discussion, 2-2, 2-4, 4-33
  - effect on painting, 15-2, 15-6 to 15-7, 15-21
  - effect on strength, 4-33
  - heartwood, 2-2
  - species involved, 4-33
- Facing stresses, sandwich panels, 11-19
- Facing wrinkling, sandwich panels, 11-19 to 11-20
- Factory-finished wood products, 15-24
- Factory lumber (*See also* Hardwood lumber):
  - grades, 5-2
  - standard dimensions, 5-2
- False rings, definition, 2-2
- Fastener head embedment, 7-26, 7-27fig
- Fasteners:
  - and iron stain, 15-29
  - corrosion and fire-retardant treated wood, 17-12 to 17-13
  - fire resistance in frame construction, 17-5
  - multiple-fastener joints, 7-24 to 7-25

- Fatigue:
  - defined, 4-24, 4-40
  - discussed, 4-40 to 4-41
  - summary of fatigue studies, 4-40t
- Fences, finishing, 15-13, 15-21 to 15-22
- Fiberboard:
  - attrition milling or refining, 10-17 to 10-18
  - classification, 10-18, 10-3fig
  - distinguished from particleboard, 10-17
  - dry-process fiberboard, 10-19, 10-19fig
  - fibers used, 10-17, 10-19fig
  - finishing techniques, 10-23
  - hardboard:
    - heat treatment, 10-20
    - humidification, 10-20
    - physical and mechanical properties of hardboard siding, 10-22t
    - property requirements 10-20 to 10-22, 10-21t
    - siding grade stamps, 10-22fig
    - standards, 10-5t
    - tempering, 10-20
  - insulation board:
    - cold-pressing, 10-20
    - felting, 10-20
    - grade stamp example, 10-22fig
    - types of products, 10-23
    - sizing agents, 10-20
    - standards, 10-5t
  - medium-density fiberboard (MDF):
    - property requirement, 10-20, 10-21t
    - resins used, 10-4
    - standards, 10-5t
    - uses, 10-20
    - with veneer overlay, 10-23, 10-23fig
  - wet-process fiberboard, 10-19 to 10-20
- Fiber orientation, related to slope of grain, 4-28 to 4-30, 4-30fig
- Fibers:
  - description, 2-3
  - length, 2-3
  - shape, 2-3
- Fiber saturation point:
  - average, 3-5
  - definition, 3-5
- Fibrils, 2-3
- Figure of wood, discussion, 3-4
- Finger joints, in laminated members, 11-7 to 11-8, 11-9 to 11-10
- Finger-jointed lumber:
  - defined, 15-5
  - finishing, 15-5, 15-30
- Finish board, availability, 5-17
- Finish failure:
  - chalking, 15-26
  - cross-grain cracking, 15-26, 15-27fig
- discoloration from water-soluble extractives, 15-28 to 15-29
- intercoat peeling, 15-26
- mill glaze, 15-25 to 15-26
- moisture blisters, 15-25
- stain:
  - blue, 15-29
  - brown stain over knots, 15-29 to 15-30
  - iron, 15-23, 15-29
  - rust, 15-29
- Finishes:
  - application and maintenance, 15-14t
  - application of:
    - paint, 15-20 to 15-21
    - semitransparent penetrating stain, 15-20
      - caution in use, 15-20
    - solid-color stain, 15-20
    - water-repellant preservative, 15-19
  - cost, 15-20
  - drying oils, 15-32, 15-33
  - function, 15-1
  - factors affecting performance:
    - extractives, 15-2, 15-28 to 15-29
    - knots, 15-2
    - texture of wood, 15-5
    - weathering:
      - as a natural finish, 15-16
      - effect on paint adhesion, 15-8 to 15-9
      - effect on wood, 15-6 to 15-7
      - effect on wood finish, 15-9
  - wood moisture content, 15-9 to 15-10
    - backpriming, 15-23 to 15-24
  - wood product characteristics:
    - finger-jointed lumber, 15-5, 15-30
    - lumber, 15-4 to 15-5
    - plywood, 15-5
    - reconstituted wood products:
      - fiberboard, 15-6
      - particleboard, 15-6
    - treated wood:
      - fire-retardant treated, 15-6
      - preservative treated, 15-6
    - wood properties, 15-1 to 15-2, 15-30
  - moisture-excluding effectiveness of, 15-10 to 15-11
    - on ponderosa pine, 15-12t
  - nondrying oils, 15-32, 15-33
  - on:
    - butcher blocks and cutting boards, 15-33
    - floors, 15-32
    - glulam, 11-8 to 11-9
    - interior wood, 15-30
    - items used for food, 15-32 to 15-33
    - porches, decks, fences, 15-21 to 15-22
    - treated wood, 15-22
  - wood exposed to marine environments, 15-22
  - paintability values, 15-2, 15-4
  - paraffin wax, 15-32, 15-33
  - refinishing, 15-22 to 15-23
  - suitability and expected service life for exterior wood surfaces, 15-5t
  - types:
    - film-forming:
      - effect on water and vapor absorption, 15-11
      - fire-retardant coatings, 15-19
      - paint, 15-18 to 15-19
      - solid-color stain, 15-18
      - varnish:
        - clear, 15-18
        - pigmented, 15-18
    - opaque, 15-30
    - penetrating, 15-14, 15-16
      - lightly colored, 15-17
    - semitransparent stains, 15-17
    - transparent clear, 15-16
    - oils, 15-18
    - stains, 15-30 to 15-31
    - surface coats, 15-31
    - transparent, 15-30
    - use of fillers, 15-30, 15-31, 15-32
    - use of sealers, 15-30, 15-31, 15-32
    - VOC regulation compliance, 15-19
    - See also* Paint and Water-repellant preservatives
  - Fire performance characteristics of wood:
    - charring:
      - differences in wood species, 17-10
      - discussed, 17-10 to 17-11
      - equations for charring rates, 17-10, 17-11
      - moisture content, 17-11
    - flame spread:
      - and heat release rate, 17-9
      - configurations, 17-9
      - factors influencing, 17-8
    - flammability data for wood species, 17-7t
    - heat release rate:
      - discussed, 17-7 to 17-8
      - measuring, 17-8
    - ignition:
      - piloted, 17-6
      - unpiloted, 17-6, 17-7
    - smoke:
      - approaches for dealing with, 17-9
      - carbon monoxide, 17-10
      - defined, 17-9
      - release rate, 17-10
      - tests for determining yield, 17-9 to 17-10
      - toxicity, 17-10
      - smouldering, 17-6 to 17-7
      - stages of degradation, 17-6
  - Fire resistance:
    - calculating, 17-5
    - defined, 17-4

- failure criteria, 17-4
- in heavy timber construction, 17-4
- in light-frame construction, 17-5
- in glued laminated members, 17-5 ratings, 17-4
- Fire-retardant coatings, 15-19, 17-13
- Fire-retardant-treated wood:
  - and hygroscopicity, 17-12, 17-13
  - and mechanical properties, 17-12 discussed, 17-12
  - effect on adhesion, 9-6
  - fastener corrosion, 17-12 to 17-13
  - heat release rates, 17-8, 17-12
  - in high temperature applications, 17-12
  - paintability, 15-16
  - performance requirements, 17-12
  - uses, 17-12
- Fire-retardant treatments:
  - application methods, 17-12
  - chemical penetration, 17-13
  - inorganic salts, 17-13
- Fire safety design:
  - cellulosic insulation, 17-4
  - code organizations, 17-2
  - code requirements, 17-1
  - components, 17-1
  - containment to compartment of origin:
    - firestops and draftstops, 17-5
    - fire resistance, 17-4
    - of heavy timber construction, 17-4 to 17-5
    - in light-frame construction, 17-5
    - of glued-laminated members, 17-5
    - sandwich panels, 17-5
  - fire safety engineering, 17-6
  - flame spread index, 17-2 to 17-3
  - flashover, 17-4
  - flooring, 17-4
  - roof covering materials, 17-4
  - types of construction:
    - heavy timber, 17-2
    - light frame, 17-2
    - ordinary, 17-2
- Fire tests:
  - critical radiant flux, 17-4
  - flame spread index:
    - discussed, 17-2
    - values for solid lumber, 17-3t
  - roof coverings, 17-4
  - room/corner test, 17-4
  - tunnel test, 17-8
  - wood ignition, 17-6
- Firestops, 17-5
- Fir, balsam:
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-16t
  - mechanical properties, 4-14t, 4-15t
  - nomenclature, 5-13t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
- strength properties, 4-7t, 4-12t
- thermal conductivity, 3-20t
- Fir, California red:
  - dimensional change coefficient, 12-16t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - tensile strength, 4-24t
  - toughness values, 4-25t
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
- Fir, Grand:
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - moisture content, 3-6t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
- Fir, Noble:
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - moisture content, 3-6t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - toughness values, 4-25t
  - strength properties, 4-7t, 4-12t
- Fir, Pacific silver:
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - flame spread index, 17-3t
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t
  - nomenclature, 5-13t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - tensile strength, 4-24t
  - toughness values, 4-25t
- Fir, subalpine:
  - dimensional change coefficient, 12-17t
  - elastic ratio 4-2t
  - mechanical properties, 4-14t, 4-15t
  - nomenclature, 5-13t
  - plywood stiffness and strength, 10-11t
  - Poison ratio, 4-3t
  - shrinkage values, 3-9t
- Firs, true (Eastern species):
  - characteristics, 1-10
  - decay resistance, 3-18t
  - locality of growth, 1-10
  - shock resistance, 1-10
  - strength properties, 1-10
- uses, 1-10
- Firs, true (Western species):
  - decay resistance, 3-18t
  - locality of growth, 1-10
  - species, 1-10
  - uses, 1-11
- Fir, white:
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - moisture content, 3-6t
  - nomenclature, 5-5t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
- Flame-retardant composites, 10-24
- Flame spread index (FSI):
  - classes for, 17-2
  - discussed, 17-2
  - values for solid lumber, 17-3t
  - wood usage, 17-3
- Flat-sawn lumber:
  - advantages, 3-2t
  - and mill glaze, 15-25
  - disadvantages for finishing, 15-1, 15-7
  - method of producing, 3-2
- Flashover, discussed, 17-4
- Flooring:
  - care during construction, 12-19
  - design factors affecting dimensional change, 12-18
  - recommended moisture content, 12-5t
  - retail yard availability, 5-16, 5-17
- Formaldehyde adhesives:
  - performance over time, 9-21 to 9-22, 9-22fig
  - safety concerns, 9-10
  - structural performance, 9-11t
  - use with composite products, 10-4
  - used with particleboard, 10-16
- Formosan termite, 13-11
- Foundations for light-frame buildings, 16-2
- Fracture toughness, defined, 4-24
- Friction, coefficient of, 3-22
- Fungi:
  - appearance of, 13-4
  - conditions favorable to growth, 13-1
  - definition, 13-1
  - discoloration caused by, 13-2
  - effect on wood, 13-3
  - prevention of damage from, 13-6
- Fungus damage:
  - causes, 13-1 to 13-2
  - decay, 17-4
  - stains, 13-2

- Glue, shear stress, stressed-skin panels, 11-15
- Glued structural members:
- advantages, 11-2 to 11-3
  - box beams and I beams:
    - beam deflections, 11-12, 11-12eq
    - design, 11-12, 11-12fig
    - flange stresses, 11-12 to 11-13, 11-13eq
    - lateral buckling, 11-13, 11-13eq
    - stiffeners and load blocks, 11-13
    - web shear stress, 11-13, 11-13eq
  - glued-laminated timber, *see* Glued-laminated timber (Glulam)
  - laminated strand and oriented strand lumber, 11-2
  - laminated veneer lumber, 11-2, 11-2fig
  - parallel strand lumber, 11-2, 11-2fig
  - prefabricated wood I-joists, 11-13 to 11-14, 11-14fig
  - standards, 11-3
  - stressed-skin panels:
    - buckling, 11-15 to 11-16, 11-15eq
    - design, 11-14, 11-14eq, 11-15fig
    - glue shear stress, 11-15, 11-15eq
    - skin stresses, 11-14 to 11-15, 11-14eq
    - stringer bending stress, 11-15, 11-15eq
  - structural sandwich construction, *see* Sandwich panels
  - uses, 11-3
- Glued-laminated timber (Glulam):
- advantages, 11-3 to 11-4
  - architectural effects, 11-3
  - combinations:
    - axial members, 11-5
    - bending members, 11-4 to 11-5
    - curved members, 11-5 to 11-6
    - tapered straight members, 11-6, 11-4fig
  - cross section variation, 11-3, 11-4fig
  - design values, 11-6, 11-9, 11-10
  - effect of:
    - end joints on strength, 11-9 to 11-10
    - edge joints on strength, 11-10
    - shake, checks, and splits on shear strength, 11-10
  - end-use adjustment factors:
    - curvature, 11-11
    - flat use, 11-11
    - lateral stability, 11-12
    - loading, 11-11
    - moisture content, 11-11
    - tension lamination, 11-11
    - volume, 11-11
  - environmental effects, 11-4
  - finishes, suitability and expected service life, 15-15t
  - fire resistance, 17-5
  - grade variation, 11-3
  - history, 11-4
  - manufacture:
    - end jointing, 11-7 to 11-8, 11-7fig
    - face bonding, 11-8, 11-8fig
    - finishing and fabrication, 11-8 to 11-9
    - lumber drying and grading, 11-6 to 11-7
    - preservative treatment, 11-9
    - preservative retention levels, 14-5t to 14-6t
    - seasoning advantages, 11-3
    - standards 11-3, 11-6
    - used for poles, 18-3
    - species used, 11-3
    - size capabilities, 11-3
  - Glulam. *See* Glued-laminated timber (Glulam)
  - Glulam beam construction, 16-8
  - Glulam timber bridge, 16-10, 16-10fig
  - Gluing properties of different wood, classification of species, 9-8t
  - Gmelina, shrinkage values, 3-10t
  - Gola. *See* Ekop
  - Goncato alves:
    - characteristics, 1-21
    - characteristics affecting machining, 3-17t
    - decay resistance, 3-18t
    - locality of growth, 1-21
    - mechanical properties, 4-16t, 4-20t
    - resistance to fungus attack, 1-21
    - shrinkage values, 3-10t
    - species, 1-21
    - strength, 1-21
    - uses, 1-21
  - Grades and lumber, purchasing consideration, 5-17 to 5-18
  - Grading hardwood lumber, 5-2 to 5-4
  - Grading, machine, 6-7 to 6-11
  - Grading softwood lumber, 5-7 to 5-10
  - Grading, visual, 6-3 to 6-7
  - Grain and texture of wood:
    - and finish performance, 15-2t
    - and paintability, 15-4 to 15-5
    - discussion, 3-1 to 3-2
  - Greenheart:
    - characteristics, 1-21
    - decay resistance, 3-18t
    - dimensional change coefficient, 12-17t
    - ease of bonding, 9-8t
    - locality of growth, 1-21
    - machineability, 1-21
    - mechanical properties, 4-16t, 4-20t
    - shrinkage values, 3-10t
    - resistance to fungi and insects, 1-21
    - marine borers, 13-14
    - uses, 1-21
  - Green wood:
    - and clinched nails, 7-5
    - bending properties, 19-3
    - creep and relaxation under load, 4-38
    - definition, 3-5
    - relationship of mechanical properties to specific gravity, 4-28t
    - treatment with polyethylene glycol (PEG), 19-10
  - Growth of tree:
    - branching, 2-1
    - diameter, 2-2
    - fibrils, 2-3
  - Growth rings:
    - cross section showing, 2-3fig
    - determinations of tree age by, 2-2
    - discontinuous, definition, 2-2
    - discussion, 2-2, 2-3
    - effect on strength properties, 4-30 to 4-31
    - false, definition, 2-2
    - grain, 3-1
    - in sawn boards, 3-2, 3-4
    - principal axes with respect to, 4-2
    - shrinkage, 3-7 to 3-8, 3-8fig
  - Guatambu. *See* Pau marfim
  - Guayacan. *See* Ipe
  - Gum:
    - nomenclature, 5-5t
    - size of pores, 15-31t
  - Gurjun. *See* Apitong
  - Gypsum board, use in wood-frame construction to provide fire resistance, 17-5
  - Gypsum-bonded composites, 10-25
  - Hackberry:
    - characteristics, 1-6
    - color and figure, 3-3t
    - decay resistance, 3-18t
    - dimensional change coefficient, 12-16t
    - ease of bonding, 9-8t
    - locality of growth, 1-6
    - machining and related properties, 3-16t
    - moisture content, 3-6t
    - nomenclature, 5-5t
    - penetration, 14-16t
    - shock resistance, 1-6
    - shrinkage values, 3-9t
    - size of pores, 15-31t
    - strength properties, 4-4t, 4-9t
    - thermal conductivity, 3-19t
    - uses, 1-6
  - Hardness:
    - coefficient of variation 4-23t
    - definition, 4-3
  - Hardwood flooring, grading rules:
    - Maple Flooring Manufacturers Association, 5-6, 5-4t
    - National Oak Flooring Manufacturers Association, 5-6, 5-4t
  - Hardwood lumber:
    - drying targets, 12-5
    - finished market products:
      - flooring:
        - grading rules, 5-6 to 5-7
        - standard dimensions, 5-6 to 5-7

- types, 5-6
- kiln drying schedules, 12-8 to 12-9, 12-11t
- grades, 5-2, 5-3t, 5-4fig
- grading associations and rules, 5-2, 5-4t
- minimum widths, 5-2
- standard dimensions, 5-2
- standard thicknesses, 5-6t
- uses, 5-1
- Hardwoods:
  - availability, 1-2, 1-3
  - bending properties, 19-3
  - charring rates, 17-11t
  - classification by size of pores, 15-31t
  - color and figure, domestic, 3-3t
  - definition, 1-2
  - figure, 3-4
  - flame spread index, 17-3t
  - flammability data, 17-7t
  - heat release data, 17-9t
  - imported, 1-17 to 1-33
  - locality of growth, 1-2
  - moisture content, heartwood and sapwood, 3-6t
  - preservative penetration, 14-16t
  - relationship of mechanical properties to specific gravity, 4-28t
  - species by region, 1-3t
  - uses, 1-2
  - vessels, 2-3
- Heartwood:
  - color, 2-2, 3-2
  - decay resistance in different species, 2-2, 3-18t
  - extractives content, 2-2
  - for shakes, 5-17
  - formation, 2-1
  - in visual stress grading, 6-5
  - moisture content and drying, 12-7
- Heat capacity:
  - defined, 3-17
  - discussed, 3-17
  - of solid wood, 3-21t
- Heat release rate:
  - and smoke release rate, 17-10
  - discussed, 17-7 to 17-8
- Heavy-timber construction:
  - fire resistance of, 17-2, 17-4 to 17-5
  - wood used in, 17-2
- Hemicellulose, 2-4
- Hemlock:
  - availability at retail yards, 5-16
  - for siding, 5-17
- Hemlock, eastern:
  - characteristics, 1-11
  - color and figure, 3-4t
  - dimensional change coefficient, 12-17t
  - connector joint strength, 7-21t
  - locality of growth, 1-11
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - shock resistance, 1-11
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - thermal conductivity, 3-20t
  - uses, 1-11
- Hemlock, mountain:
  - characteristics, 1-12
  - locality of growth, 1-12
  - nomenclature, 5-13t
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - toughness values, 4-25t
  - uses, 1-12
- Hemlock, western:
  - characteristics, 1-12
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-17t
  - elastic ratio, 4-2t
  - erosion of planed surfaces, 15-8t
  - flame spread index, 17-3t
  - fracture toughness, 4-26t
  - locality of growth, 1-12
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t, 4-34t
  - nomenclature, 5-13t
  - penetration, 4-16t
  - plywood stiffness and strength, 10-11t
  - Poisson ration, 4-3t
  - shock resistance, 1-12
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - tensile strength, 4-24t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
  - used for poles, 18-4t
  - uses, 1-12
- Hickory:
  - color and figure, 3-3t
  - decay resistance, 3-18t
  - machining and related properties, 3-16t
  - nomenclature, 5-5t
  - size of pores, 15-31t
- Hickory, bitternut:
  - moisture content, 3-6t
  - strength properties, 4-5t, 4-10t
- Hickory, mockernut:
  - moisture content, 3-6t
  - penetration, 14-16t
  - shrinkage values, 3-9t
  - strength properties, 4-5t, 4-10t
  - thermal conductivity, 3-19t
  - toughness values, 4-24t
- Hickory, nutmeg, strength properties, 4-5t, 4-10t
- Hickory, pecan:
  - characteristics, 1-6
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - for flooring, 5-6, 5-7
  - locality of growth, 1-6
  - shrinkage values, 3-9t
  - species, 1-6
  - strength properties, 4-5t, 4-10t
  - thermal conductivity, 3-19t
  - uses, 1-6
- Hickory, pignut:
  - moisture content, 3-6t
  - shrinkage values, 3-9t
  - strength properties, 4-5t, 4-10t
  - toughness values, 4-24t
- Hickory, red, moisture content, 3-6t
- Hickory, sand:
  - moisture content, 3-6t
  - toughness values, 4-24t
- Hickory, shagbark:
  - characteristics for painting, 15-3t
  - shrinkage values, 3-9t
  - strength properties, 4-5t, 4-10t
  - thermal conductivity, 3-19t
- Hickory, shellbark:
  - shrinkage values, 3-9t
  - strength properties, 4-5t, 4-10t
- Hickory, water:
  - moisture content, 3-6t
  - strength properties, 4-5t, 4-10t
- Hickory, true:
  - characteristics, 1-6
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - locality of growth, 1-6
  - shrinkage values, 3-9t
  - species, 1-6
  - strength properties, 4-5t, 4-10t
  - uses, 1-6
- Holly, nomenclature, 5-5t
- Holly, American:
  - dimensional change coefficient, 12-16t
  - shrinkage values, 3-9t
- Honeylocust:
  - availability, 1-6
  - characteristics, 1-7
  - color and figure, 3-3t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - locality of growth, 1-6
  - shock resistance, 1-7
  - shrinkage values, 3-9t
  - strength properties, 4-5t, 4-10t
  - uses, 1-7
- Hot melt adhesives:
  - bonding, 9-9
  - structural performance, 9-11t
  - working and strength properties, and uses, 9-13t to 9-14t
- Hot-press bonding, affect on moisture content, 9-15
- Hot pressing:
  - oriented strandboard, 10-14
  - particleboard, 10-16 to 10-17

- Hura:  
 characteristics, 1-21  
 characteristics affecting machining, 3-17t  
 locality of growth, 1-21  
 decay resistance, 3-18t  
 ease of bonding, 9-8t  
 machineability, 1-21 to 1-22  
 mechanical properties, 4-16t, 4-20t  
 resistance to fungi and insects, 1-22  
 shrinkage values, 3-10t  
 uses, 1-22
- Hydroxymethylated resorcinol (HMR), 9-6
- I-beams, 11-12 to 11-13
- I-joists, 11-13 to 11-14
- Identification of wood, 2-4
- Ignition of wood:  
 piloted, 17-6  
 unpiloted, 17-6, 17-7
- Ilomba:  
 characteristics, 1-22  
 locality of growth, 1-22  
 machineability, 1-22  
 mechanical properties, 4-17t, 4-21t  
 resistance to fungi and insects, 1-22  
 shrinkage values, 3-10t  
 uses, 1-22
- Imbuia, shrinkage values, 3-10t
- Imported woods, commercially important, 1-17 to 1-34
- Impact bending:  
 coefficient of variation, 4-23t  
 defined, 4-3
- Impreg:  
 bulking agents, 19-5  
 dimensional stability, 19-9t  
 process, 19-5  
 properties, 19-6t  
 species, 19-5  
 strength properties, 19-7t to 19-8t
- Incising:  
 and fire-retardant treatments, 17-13  
 effect on strength properties, 4-42
- Incense-cedar. *See* Cedar, Incense
- Inorganic boron (borax/boric acid):  
 acceptable compounds, 14-12  
 effectiveness, 14-12  
 solubility, 14-12  
 temperature for pressure treating, 14-21  
 uses, 14-12
- Insect damage and control:  
 beetles, 13-8 to 13-10  
 carpenter ants, 13-13  
 bees, 13-13  
 effect on strength, 4-45  
 naturally termite-resistant wood, 13-12 to 13-13  
 termites, 13-11 to 13-13  
 types of damage, 13-9t, 13-10fig
- Insulation board, cellulosic fiber:  
 exterior products, 10-23  
 industrial products, 10-23  
 interior products, 10-23
- properties, 10-22 to 10-23
- Insulation for sound control for wood buildings, 16-13, 16-13t
- Insulation in wood building, 16-11 to 16-12
- Intergrown knots, 2-3, 4-27
- Interlocked grain:  
 definition, 3-4  
 effect on strength, 4-30  
 in Sweetgum, 1-8  
 machining, 3-15
- Interior finishes, care during construction, 12-19
- Internal friction, 4-26
- Ipe:  
 characteristics affecting machining, 3-17t  
 decay resistance, 3-18t  
 locality of growth, 1-22  
 machineability, 1-22  
 mechanical properties, 4-17t, 4-21t  
 resistance to decay and insects, 1-22  
 shrinkage values, 3-10t  
 uses, 1-22
- Ipil. *See* Merbau
- Iroko:  
 characteristics, 1-22  
 characteristics affecting machining, 3-17t  
 decay resistance, 3-18t  
 dimensional change coefficient, 12-17t  
 ease of bonding, 9-8t  
 locality of growth, 1-22  
 mechanical properties, 4-17t, 4-21t  
 resistance to fungi and insects, 1-22  
 shrinkage values, 3-10t  
 species, 1-22  
 workability, 1-22  
 uses, 1-22
- Iron stain, 13-3, 15-23, 15-29, 15-32
- Ironwood, nomenclature, 5-5t
- Isocyanate adhesives:  
 performance over time, 9-22  
 structural performance, 9-11t  
 use with composite products, 10-4  
 use with particleboard, 10-16  
 working and strength properties, and uses, 9-14t
- Jacaranda. *See* Rosewood, Brazilian
- Jarah:  
 characteristics, 1-22  
 characteristics affecting machining, 3-17t  
 decay resistance, 3-18t  
 ease of bonding, 9-8t  
 locality of growth, 1-22  
 machineability, 1-22  
 mechanical properties, 4-17t, 4-21t  
 resistance to decay and insects, 1-22  
 marine borers, 13-14  
 shrinkage values, 3-10t  
 uses, 1-22 to 1-23
- Jatoba. *See* Courbaril
- Jelutong:  
 characteristics, 1-23  
 decay resistance, 3-18t  
 locality of growth, 1-23  
 mechanical properties, 4-17t, 4-21t  
 shrinkage values, 3-10t  
 uses, 1-23  
 workability, 1-23
- Jequitiba. *See* Albarco
- Joints, glued, strength, 9-4
- Joists and light-frame construction, 16-2 to 16-3
- Joists and rafter systems in light-frame construction, 16-4
- Juniper, decay resistance, 3-18t
- Juvenile wood:  
 effect on mechanical properties, 4-32  
 effect on strength properties, 4-32  
 properties, 4-32, 4-32fig  
 shrinkage of, 3-8, 4-32
- Kakaralli. *See* Manbarklak
- Kaneelhart:  
 characteristics, 1-23  
 ease of bonding, 9-8t  
 locality of growth, 1-23  
 mechanical properties, 4-17t, 4-21t  
 resistance to fungi and insects, 1-23  
 shrinkage values, 3-10t  
 uses, 1-23
- Kapur:  
 characteristics, 1-23  
 characteristics affecting machining, 3-17t  
 decay resistance, 3-18t  
 ease of bonding, 9-8t  
 locality of growth, 1-23  
 machineability, 1-23  
 mechanical properties, 4-17t, 4-21t  
 plywood stiffness and strength, 10-11t  
 resistance to fungi and insects, 1-23  
 shrinkage values, 3-10t  
 strength properties, 1-23  
 uses, 1-23
- Karri:  
 characteristics, 1-23  
 characteristics affecting machining, 3-17t  
 decay resistance, 3-18t  
 ease of bonding, 9-8t  
 locality of growth, 1-23  
 machineability, 1-23  
 mechanical properties, 4-17t, 4-21t  
 shrinkage values, 3-10t  
 uses, 1-23
- Kauta. *See* Marishballi
- Kempas:  
 characteristics, 1-23  
 characteristics affecting machining, 3-17t  
 decay resistance, 3-18t  
 locality of growth, 1-23  
 machineability, 1-23

- mechanical properties, 4-17t, 4-21t
- resistance to fungi and insects, 1-23
- shrinkage values, 3-10t
- uses, 1-24
- Keruing:
  - characteristics, 1-24
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - durability, 1-24
  - locality of growth, 1-24
  - machineability, 1-24
  - mechanical properties, 4-17t, 4-21t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-10t
  - uses, 1-24
- Khaya (*See* Mahogany, African):
  - dimensional change coefficient, 12-17t
- Kiln drying:
  - advantages, 12-6
  - importance of air circulation, 12-6
  - kiln schedules, 12-8 to 12-9, 12-11t
  - types of kilns, 12-7 to 12-8, 12-8fig
- Knots:
  - changes during drying, 12-10, 12-12fig
  - definition, 4-27
  - discoloration through paint, 15-2, 15-29 to 15-30
  - effect on:
    - in determining strength ratios, 6-5 to 6-6, 6-6fig
    - mechanical properties of wood, 4-27 to 4-28, 4-34
    - stiffness, 6-4
    - strength properties, 6-4
  - encased, 4-27, 6-4
  - in lumber stress grades, 6-4
  - intergrown, 4-27, 6-4
  - knotholes, 6-4
- Kokrodua (*See also* Afrormosia):
  - characteristics affecting machining, 3-17t
  - dimensional change coefficient, 12-17t
- Korina. *See* Limba
- Krabak. *See* Mersawa
- Kraft paper, 19-12
- Kwila. *See* Merbau
  
- Lag screws. *See* Screws, lag
- Laminated members, curved:
  - advantages, 19-2
  - species, choice of, 19-2
  - uses, 19-2
- Laminated members, glued. *See* Glued structural members
- Laminated wood, strength properties, 19-7t to 19-8t
  
- Laminates. *See* Paper-based plastic laminates
- Laminating grades, 5-8 to 5-9
- Lapacho (*See also* Ipe):
  - ease of bonding, 9-8t
- Lap marks, 15-20
- Lapuna. *See* Ceiba
- Larch, western:
  - characteristics, 1-12
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - for flooring, 5-17
  - locality of growth, 1-12
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t, 4-34t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - shock resistance, 1-12
  - strength properties, 4-7t, 4-12t
  - tensile strength, 4-24t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
  - used for poles, 18-2
  - uses, 1-12
- Lateral buckling, of beams, 8-9 to 8-10
- Lateral resistance:
  - and the National Design Specification for Wood Construction, 7-1
  - of lag screws, 7-12 to 7-14
  - of nails, 7-5
  - of wood screws, 7-10 to 7-11
- Latewood:
  - description, 2-2
  - erosion of planed surfaces, 15-8t
  - paintability, 15-4
  - properties, 2-3
- Lauans:
  - dimensional change coefficient, 12-17t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-10t
  - size of pores, 15-31t
- Lemonwood. *See* Degame
- Light-frame construction:
  - balloon framing, 16-1
  - ceiling and roof, 16-4
  - decks, 16-4
  - exterior walls, 16-3 to 16-4
  - fire resistance of, 17-2, 17-5
  - floors, 16-2 to 16-3, 16-2fig
  - foundations, 16-2
  - platform framing, 16-1 to 16-2
  - use of elastomeric adhesives, 9-19 to 9-20, 9-20fig
  - wood use in, 17-2
  
- Lignin:
  - discussion, 2-3 to 2-4
  - weathering, 15-7
- Lignumvitae:
  - characteristics, 1-24
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - locality of growth, 1-24
  - mechanical properties, 4-17t, 4-21t
  - species, 1-24
  - uses, 1-24
- Lignocellulosic adhesives:
  - in composite products, 10-4
  - working and strength properties, and uses, 9-13t
- Limba:
  - characteristics, 1-24
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-24
  - machineability, 1-24
  - mechanical properties, 4-17t, 4-21t
  - resistance to decay and insects, 1-24
  - shrinkage values, 3-10t
  - uses, 1-24
- Limnoria, 13-14
- Locust, black:
  - characteristics, 1-7
  - color and figure, 3-3t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - locality of growth, 1-7
  - nomenclature, 5-5t
  - penetration, 14-16t
  - sapwood, 2-2
  - shock resistance, 1-7
  - shrinkage values, 3-9t
  - strength properties, 4-5t
  - uses, 1-1, 1-7
- Lodgepole pine, used for poles, 18-2, 18-4t
- Log homes, 16-6, 16-7fig, 18-5
- Logs, control of mold, stain, decay, 13-6
- Longitudinal shrinkage of wood, 3-8
- Lumber:
  - commonly used abbreviations, 5-18 to 5-20
  - development of grading rules, 5-7
  - grading organization, 5-9t, 5-12
  - hardwood:
    - drying targets, 12-5
    - finished market products:
      - flooring:
        - grading rules, 5-6 to 5-7
        - standard dimensions, 5-6 to 5-7
      - types, 5-6

- kiln drying schedules, 12-8 to 12-9, 12-11t
- grades, 5-2, 5-3t, 5-4fig
- grading associations and rules, 5-2, 5-4t
- minimum widths, 5-2
- standard dimensions, 5-2
- standard thicknesses, 5-6t
- uses, 5-1
- purchase:
  - distribution yards, 5-13
  - primary manufacturers
  - customers, 5-12 to 5-13
  - retail yard inventory:
    - availability of hardwood and softwoods, 5-16
    - boards and yard lumber, 5-16
    - casing and base, 5-17
    - dimension and structural lumber stocked, 5-16
    - finish boards, 5-17
    - flooring, 5-17
    - shingles and shakes, 5-17
    - siding, 5-17
    - purchase consideration, 5-17 to 5-18
- softwood:
  - American Lumber Standards, 5-7
  - classification by grades:
    - factory and shop lumber:
      - factory (shop) grades, 5-10
      - industrial clears, 5-10
      - ladder and pole stock, 5-10
      - moulding stock, 5-10
      - pencil stock, 5-10
      - tank stock, 5-10
    - structural lumber:
      - dimension lumber, 5-8
      - structural laminations, 5-8 to 5-9
    - yard lumber:
      - select lumber, 5-7 to 5-8
      - common lumber, 5-8, 5-8fig
  - development of grading rules, 5-7
  - drying targets, 12-5
  - grading organizations, 5-9t, 5-12
  - kiln drying schedules, 12-8 to 12-9, 12-11t
  - manufacture:
    - size, 5-10 to 5-11, 5-11t
    - surfacing, 5-11 to 5-12
    - patterns, 5-12, 5-12fig
    - species, 5-12
  - transportation, 5-16
- Macacauba. *See* Macawood
- Macawood:
  - characteristics, 1-24
  - common names, 1-24
  - locality of growth, 1-24
  - mechanical properties, 4-17t, 4-21t
  - resistance to fungi and insects, 1-24
  - shrinkage values, 3-10t
  - uses, 1-24
  - workability, 1-24
- Machine-graded structural lumber:
  - common grades, 6-7, 6-8t
  - components of system, 6-7
  - design stresses for other properties, 6-10
  - machine sorting criteria, 6-7 to 6-8
  - procedures for deriving allowable stress for bending, 6-8 to 6-10
  - quality control, 6-10 to 6-11
- Machining of wood, factors affecting, 3-15
- Machinmango. *See* Manbarklak
- Madrone, Pacific:
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - nomenclature, 5-5t
  - shrinkage values, 3-9t
- Magnesia-cement-bonded composites, 10-25
- Magnolia:
  - characteristics, 1-7
  - characteristics for painting, southern, 15-3t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - locality of growth, 1-7
  - machining and related properties, 3-16t
  - moisture content, 3-6t
  - nomenclature, 5-5t
  - shock resistance, 1-7
  - shrinkage values, 3-9t
  - size of pores, 15-31t
  - species, 1-7
  - strength properties, 4-5t, 4-10t
  - thermal conductivity, 3-19t
  - uses, 1-7
- Mahogany:
  - color and figure, 3-3t
  - size of pores, 15-31t
  - species, 1-25
- Mahogany, African:
  - characteristics, 1-25
  - characteristics affecting machining, 3-17t
  - dimensional change coefficients, 12-17t
  - decay resistance, 1-25, 3-18t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - locality of growth, 1-25
  - machineability, 1-25
  - mechanical properties, 4-17t, 4-21t
  - Poisson ratio, 4-3t
  - shrinkage values, 3-10t
  - size of pores, 15-31t
  - species, 1-25
  - uses, 1-25
- Mahogany, American (Swietenia, mahagoni):
  - characteristics, 1-25
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - locality of growth, 1-25
  - machineability, 1-25
  - mechanical properties, 4-17t, 4-21t
  - uses, 1-25
- Mahogany, Honduran:
  - elastic ratio, 4-2t
  - Poisson ratio, 4-3t
- Mahogany, Philippine, availability at retail yards, 5-16
- Manbarklak:
  - characteristics, 1-25
  - characteristics affecting machining, 3-17t
  - locality of growth, 1-25
  - mechanical properties, 4-17t, 4-21t
  - nomenclature, 1-25
  - shrinkage values, 3-10t
  - resistance to fungi and insects, 1-25
  - marine borers, 13-14
  - uses, 1-25
  - workability, 1-25
- Manni:
  - characteristics, 1-25
  - decay resistance 3-18t
  - locality of growth, 1-25
  - machineability, 1-25
  - mechanical properties, 4-17t, 4-21t
  - resistance to insects, 1-25
  - shrinkage values, 3-10t
  - uses, 1-25
- Maple, size of pores, 15-31t
- Maple, black:
  - color and figure, 3-3t
  - dimensional change coefficients, 12-16t
  - shrinkage values, 3-9t
  - strength properties, 4-5t, 4-10t
  - thermal conductivity, 3-19t
- Maple, bigleaf:
  - color and figure, 3-3t
  - dimensional change coefficients, 12-16t
  - machining and related properties, 3-16t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - strength properties, 4-5t, 4-10t
- Maple, hard:
  - characteristics, 1-7
  - charring rate data, 17-11t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - heat release data, 17-9t
  - locality of growth, 1-7
  - machining and related properties, 3-16t
  - nomenclature, 5-5t
  - shock resistance, 1-7
  - species, 1-7
  - uses, 1-7



- Maple, Oregon, nomenclature, 5-5t
- Maple, red:
- color and figure, 3-3t
  - dimensional change coefficients, 12-16t
  - elastic ratio, 4-2t
  - Poisson ratio, 4-3t
  - shrinkage values, 3-9t
  - strength properties, 4-5t, 4-10t
  - thermal conductivity, 3-19t
- Maple, silver:
- color and figure, 3-3t
  - dimensional change coefficients, 12-16t
  - moisture content, 3-6t
  - penetration, 14-16t
  - shrinkage values, 3-9t
  - strength properties, 4-5t, 4-10t
  - thermal conductivity, 3-19t
- Maple, soft:
- connector joint strength, 7-21t
  - ease of bonding, 9-8t
  - locality of growth, 1-7
  - machining and related properties, 3-16t
  - nomenclature, 5-5t
  - species, 1-7
  - uses, 1-7
- Maple, sugar:
- characteristics for painting, 15-3t
  - color and figure, 3-3t
  - dimensional change coefficients, 12-16t
  - elastic ratio, 4-2t
  - fracture toughness, 4-26t
  - moisture content, 3-6t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - shrinkage values, 3-9t
  - strength properties, 4-5t, 4-10t
  - thermal conductivity, 3-19t
  - toughness values, 4-24t
- Maple flooring:
- availability, 5-17
  - grading, 5-6
- Maple Flooring Manufacturers, Association, grading rules, 5-6
- Marishballi:
- characteristics, 1-26
  - characteristics affecting machining, 3-17t
  - locality of growth, 1-26
  - mechanical properties, 4-17t, 4-21t
  - resistance to fungi and insects, 1-26
  - shrinkage values, 3-10t
  - uses, 1-26
- Marine borer damage and control, 13-13
- Malayapis. *See* Lauans
- Mata-mata. *See* Manbarklak
- Mayflower. *See* Roble
- Mecanical interlocking and adhesives, 9-2
- Mechanical properties of wood
- adjusted for design use, 6-11 to 6-14
  - affected by:
    - adhesion to metals, 9-5
    - age, 4-41
    - changes in moisture content, 4-34
    - chemicals:
      - exposure to, 4-41
      - treatment, 4-41 to 4-43
    - cross grain, 4-29 to 4-30
    - decay, 4-43
    - duration of load, 4-39 to 4-40
    - fire-retardant treatments, 17-12
    - insect damage, 4-43
    - knots, 4-27
    - juvenile wood, 4-32
    - mold and stain fungi, 4-43
    - rate of loading, 4-37
    - slope of grain, 4-29t
    - temperature, 4-35 to 4-37
    - waterborne preservatives, 4-42
  - relation to specific gravity, 4-27, 4-28t
  - relation to stress grades, 6-1
- Medium-density fiberboard:
- property requirement, 10-20, 10-21t
  - resins used, 10-4
  - standards, 10-5t
  - uses, 10-20
  - with veneer overlay, 10-23, 10-23fig
- Medium-density hardboard, finishes, suitability and expected service life, 15-15t
- Medium density overlays:
- finishes, suitability and expected service life, 15-15t
  - to improve paintability of plywood, 15-5
- Melamine adhesives:
- performance over time, 9-21 to 9-22
  - use with composite products, 10-4
  - working and strength properties, and uses, 9-14t
- Meranti:
- characteristics, 1-26
  - characteristics affecting machining, 3-17t
  - color, 1-26t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-26
  - machineability, 1-26
  - mechanical properties, 4-19t, 4-23t
  - uses, 1-26
- Merbau:
- characteristics, 1-26
  - locality of growth, 1-26
  - machineability, 1-26
  - mechanical properties, 4-17t, 4-21t
  - resistance to insects, 1-26
  - shrinkage values, 3-10t
  - uses, 1-27
- Mersawa:
- characteristics, 1-27
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - locality of growth, 1-27
  - machineability, 1-27
  - mechanical properties, 4-17t, 4-21t
  - plywood stiffness and strength, 10-11t
  - resistance to fungi and insects, 1-27
  - shrinkage values, 3-10t
  - uses, 1-27
- Metal bonding, 9-6
- Metal plate connectors, 7-25, 7-26fig
- Mildew:
- discoloration of wood, 15-8, 15-27, 15-27fig
  - removal, 15-27 to 15-28
- Mill glaze, 15-25 to 15-26
- Mill work, finishes, suitability and expected service life, 15-15t
- Modified woods:
- formaldehyde-treated wood:
    - dimensional stability, 19-9t, 12-12
    - mechanical properties, 19-11 to 19-12
    - resistance to fungi, 19-11
  - chemical modification:
    - antishrink efficiency
    - calculations, 19-11
    - conditions for, 19-11
    - chemicals used, 19-11
    - dimensional stability, 19-9t, 19-11
    - mechanical properties, 19-11 to 19-12
  - cost, 19-5
  - dimensional stability, 19-9t
  - purposes, 19-4 to 19-5
  - resin-treated compressed wood (Compreg):
    - advantages, 19-5
    - dimensional stability, 19-9t
    - molding, 19-5, 19-8
    - plasticizers, 19-5
    - properties, 19-5, 19-6t
    - species used, 19-9
    - strength properties, 19-7t to 19-8t
    - thermal expansion coefficients, 19-9t
    - uses, 19-9
  - resin-treated wood (Impreg):
    - bulking agents, 19-5
    - dimensional stability, 19-9t
    - process, 19-5
    - properties, 19-6t
    - species used, 19-5
    - strength properties, 19-7t to 19-8t
  - untreated compressed wood (Staypak):
    - appearance, 19-10
    - dimensional stability, 19-9t

- properties, 19-9 to 19-10, 19-6t
  - purpose, 19-9
  - strength properties, 19-7t, 19-8t
  - uses, 19-10
  - untreated heated wood
  - (Staybwood):
    - loss of mechanical and strength properties, 19-10
    - purpose, 19-10
  - wood-polymer composites:
    - advantages, 19-10 to 19-11
    - changing characteristics, 19-10 to 19-11
    - monomers, 19-10 to 19-11
    - species used, 19-11
    - strength properties, 19-11t
    - uses, 19-11
  - wood treated with polyethylene glycol (PEG):
    - dimensional stability, 19-9t
    - finishing, 19-10
    - process, 19-10
    - uses, 19-10
  - Modulus of elasticity:
    - and columns with flanges, 8-9
    - coefficient of variation, 4-23t
    - discussed, 4-3
    - effect of temperature, 4-36, 4-36fig, 4-38fig
    - of machine graded lumber, 6-7 to 6-8
    - of sandwich panels, 11-18
    - of visually graded lumber, 6-6
    - values, 4-2t
  - Modulus of rigidity:
    - discussion, 4-3
    - ratios, 4-3t
  - Modulus of rupture:
    - and moisture content, 6-12, 6-12t, 6-12fig
    - coefficient of variation, 4-23t
    - defined, 4-3
    - effect of temperature, 4-36fig, 4-38fig, 4-39fig
    - of beams, 8-5, 8-6
    - temperature effect, 4-36
  - Moisture blisters, 15-25
  - Moisture content:
    - adsorption/desorption curve, 3-8fig
    - adjustment for, 6-12
    - and decay, 13-4
    - and electrical resistance 3-22t
    - and heat capacity, 3-21t
    - changes in finished ponderosa pine sapwood, 15-13fig
    - definition, 3-5, 15-9
    - determined by:
      - electrical method, 12-2 to 12-3
      - ovendrying method, 12-2, 12-2eq
    - dimensional changes, 9-7 to 9-9
    - effect on bonded joints, 9-9
    - effect of strength properties, 4-34, 4-35fig
    - equilibrium:
      - discussion, 3-5
      - relative humidity as related to, 3-7t
    - green wood, 3-6t
    - heartwood, 3-6t
    - in wood exposed outdoors, 15-10
    - range in trees, 3-5
    - recommended for:
      - exterior siding, 12-5t
      - flooring, 12-5t
      - furniture, 12-5t
      - interior woodwork, 12-5t
      - laminated members, 12-5, 12-5t
      - lumber, 12-3, 12-4t, 12-5t
      - plywood, 12-3, 12-5, 12-5t
      - sheathing, 12-5t
      - timbers, 12-3
      - trim, 12-5t
      - veneer, 12-3
    - sapwood, 3-6t
    - shrinkage as related to, 3-8 to 3-9, 3-21
    - shrinkage curves, 3-11fig
    - specific gravity, 3-5, 3-12fig
    - wood sinkage, 3-5
  - Moisture content of dried lumber:
    - air-dry, 12-11
    - kiln dry, 12-12
    - shipping dry, 12-10
  - Moisture content during transit and storage:
    - finish and factory lumber, 12-15
    - general, 12-14, 12-14t
    - plywood and structural items, 12-14
  - Moisture-gradient, typical in lumber, 12-6, 12-6fig
  - Molding resin-treated compressed wood (Compreg), 19-5, 19-8
  - Molds:
    - appearance of, 13-2
    - distinction from stain, 13-2
    - effect on wood, 13-3
  - Moment capacity, 8-6, 8-6eq
  - Mora:
    - characteristics, 1-27
    - locality of growth, 1-27
    - mechanical properties, 4-17t, 4-21t
    - resistance to fungi and insects, 1-27
    - shrinkage values, 3-10t
    - uses, 1-27
    - workability, 1-27
  - Multiple-fastener joints, 7-24 to 7-25, 7-24eq
  - Nails:
    - lateral resistance of common wire nails:
      - pre-1991:
        - equations, 7-5
        - lateral load coefficients, 7-6t
        - load-slip curve, 7-6, 7-6fig
      - post-1991:
        - direction of driving, effect of, 7-6
        - load-slip curves, 7-7, 7-7eq, 7-8eq, 7-8fig
    - moisture content, effect of, 7-7
    - seasoning, effect of, 7-7
    - shank form, effect of, 7-7
    - spacing, 7-6
    - yield model theory, 7-6, 7-6eq, 7-7fig, 7-8t
  - sizes:
    - box nails, 7-2t
    - common, 7-2fig
    - helically and annularly threaded, 7-2, 7-2t
    - penny size, 7-2
    - wire nails, 7-2, 7-2t
  - toenailed joints, strength of, 7-5
  - withdrawal resistance:
    - affected by, 7-2, 7-3
    - allowable loads, 7-5
    - clinched nails, 7-5
    - corrosion, 7-4
    - density of wood, effect of, 7-3
    - direction of driving, 7-4 to 7-5
    - etched nails, 7-4
    - load displacement curve, 7-3, 7-3fig
    - moisture content, effect of, 7-3, 7-3eq, 7-4
    - nail heads, 7-4
    - nail points, effect of, 7-4
    - plywood, 7-5
    - prebored lead holes, effect of, 7-5
    - seasoning, effect of, 7-3
    - shank form, effect of, 7-4
    - surface coatings, effect of, 7-3 to 7-4
    - surface coating, used for 7-4
- Naphtenate, copper:
  - color transfer and changes, 14-8
  - effectiveness, 14-8
  - retention levels for various wood products, 14-5t
  - solution values, 14-8
- Southern pine sapwood stakes retention and life span test results, 14-14t
- treatment for cutting pretreated wood, 14-24
- Naphtenate, zinc:
  - effectiveness, 14-8
  - inappropriate uses, 14-8
  - properties, 14-8
- National Grading Rule, 6-2, 6-3, 6-3t
- National Fire Protection Association, 17-2, 17-6, 17-7
- National Hardwood Lumber Association, 5-2, 5-4t
- National Oak, Flooring Manufacturers Association, grading rules, 5-5 to 5-7
- Nomenclature, 5-5t, 5-13t
- Nuclear radiation:
  - discussion, 3-23
  - effect on wood strength, 4-43
- Oak:
  - for casing and base, 5-17
  - size of pores, 15-31t
  - used in piles, 18-5

- Oak, black:
  - strength properties, 4-5t, 4-10t
  - thermal conductivity
- Oak, bur:
  - strength properties, 4-6t, 4-11t
  - thermal conductivity, 3-19t
- Oak, California black, moisture content, 3-6t
- Oak, cherrybark, strength properties, 4-5t, 4-10t
- Oak, chestnut, strength properties, 4-6t, 4-11t
- Oak, laurel, strength properties, 4-5t, 4-10t
- Oak, live, strength properties, 4-6t, 4-11t
- Oak, northern red:
  - characteristics for painting, 15-3t
  - fracture toughness, 4-26t
  - strength properties, 4-5t, 4-10t
- Oak, overcup:
  - strength properties, 4-6t, 4-11t
  - tensile strength, 4-24t
  - toughness values, 4-24t
- Oak, pin:
  - strength properties, 4-5t, 4-10t
  - tensile strength, 4-24t
  - toughness values, 4-24t
- Oak, post, strength properties, 4-6t, 4-11t
- Oak, red:
  - availability for purchase, 5-17
  - characteristics, 1-7, 1-8
  - charring rate data, 17-11t
  - color and figure, 3-3t
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - erosion of planed surfaces, 15-8t
  - flame spread index, 17-3t
  - flammability data, 17-7t
  - heat release data, 17-9t
  - locality of growth, 1-7
  - machining and related properties, 3-16t
  - mechanical properties, 4-17t, 4-21t
  - nomenclature, 5-5t
  - Poisson ratio, 4-3t
  - penetration, 14-16t
  - shrinkage values, 3-9t
  - species, 1-7
  - uses, 1-1, 1-8
- Oak, scarlet:
  - strength properties, 4-5t, 4-10t
  - toughness values, 4-24t
- Oak, southern red:
  - moisture content, 3-6t
  - strength properties, 4-5t, 4-10t
  - thermal conductivity, 3-19t
- Oak, swamp chestnut, strength properties, 4-6t, 4-11t
- Oak, swamp white, strength properties, 4-6t, 4-11t
- Oak, tropical:
  - characteristics, 1-27
  - locality of growth, 1-27
  - resistance to fungi, 1-27
  - specific gravity, 1-27
  - uses, 1-27
- Oak, water:
  - moisture content, 3-6t
  - strength properties, 4-5t, 4-10t
- Oak, white:
  - characteristics, 1-8
  - characteristics for painting, 14-16t
  - charring rate equation, 17-10
  - color and figure, 3-3t
  - connector joint strength, 7-21t
  - decay resistance, 1-8, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - flame spread index, 17-3t
  - locality of growth, 1-7
  - machining and related properties, 3-16t
  - nomenclature, 5-5t
  - Poisson ratio, 4-3t
  - penetration, 14-16t
  - shrinkage values, 3-9t
  - species, 1-8
  - strength properties, 4-6t, 4-11t
  - uses, 1-8
- Oak, willow, moisture content, 3-6t
- Oak flooring, 5-6
- Obeche:
  - characteristics, 1-27
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-27
  - machineability, 1-27
  - mechanical properties, 4-17t, 4-21t
  - shrinkage values, 3-10t
  - uses, 1-27
- Ofram. *See* Limba
- Oilborne preservatives. *See* preservatives, oilborne
- Oil-type preservatives, strength loss, 4-41
- Okoume:
  - characteristics, 1-27, 1-28
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-27
  - machineability, 1-28
  - mechanical properties, 4-18t, 4-22t
  - shrinkage values, 3-10t
  - uses, 1-28
- Old house borer, 13-11
- Opaque finishes, 15-30
- Opepe:
  - characteristics, 1-28
  - ease of bonding, 9-8t
  - locality of growth, 1-28
  - mechanical properties, 4-18t, 4-21t
  - resistance to decay and insects, 1-28
  - shrinkage values, 3-10t
  - uses, 1-28
- Ordinary construction:
  - code requirements for fire protection, 17-2
  - description, 17-2
- Oriented strandboard:
  - adhesive application or blending, 10-13
  - adhesives used, 10-4
  - certification, 10-14, 10-16fig
  - defined, 10-13
  - design capacities, 10-14
  - drying process, 10-13
  - finishes, suitability and expected service life, 15-15t
  - hot pressing, 10-14
  - manufacturing process, 10-13, 10-14fig
  - mat formation, 10-13
  - sheathing grade, property values, 10-15t
  - species used, 10-13
  - standards, 10-5 to 10-6, 10-5t, 10-8
  - stranding process, 10-13
- Orthotropic nature of wood, 4-1
- Osage-orange:
  - decay resistance, 3-17t
  - ease of bonding, 9-8t
  - nomenclature, 5-5t
- Ossol. *See* Manni
- Otie. *See* Ilomba
- Ovangkol (*See also* Benge):
  - mechanical properties, 4-18t, 4-22t
  - shrinkage values, 3-10t
- Ovendry weight, specific gravity, 3-12
- Oxine copper:
  - composition, 14-8
  - corrosiveness, 14-8
  - retention levels for various wood products, 14-5t
  - Southern pine sapwood stakes
  - retention and life span test results, 14-13t
  - toxicity, 14-8
- Pacific yew, nomenclature, 5-13t
- Paint:
  - adhesion bandage test, 15-23
  - application and maintenance, 15-14t, 15-20 to 15-21
  - characteristics of wood, 15-3t
  - cost, 15-18 to 15-19
  - cracking, 15-11, 15-26
  - discussed, 15-18 to 15-19
  - disposal, 15-34
  - failure caused by:
    - dimensional changes in wood, 15-4

- earlywood/latewood band, 15-4, 15-24
- face checks in plywood, 15-5
- grain orientation, 15-4
- moisture content of wood, 15-10
- temperature at time of painting, 15-21
- texture of wood, 15-5
- water soluble extractives, 15-28 to 15-29
- weathering, 15-8, 15-24
- failure in finger-jointed lumber, 15-5
- lead-based:
  - dust from, 15-36
  - health effects, 15-36
  - removal of, 15-36
  - use of, 15-35
- mildew removal, 15-27 to 15-28
- moisture blisters, 15-25
- on treated wood, 15-6
- on preweathered panels, 15-9
- peeling:
  - avoiding with proper painting, 15-21
  - caused by water, 15-10
  - intercoat, 15-26
  - moisture movement, 15-25fig
- protection against moisture, 15-11, 15-13, 15-16, 15-24
- preweathering before painting, 15-9
- repainting, 15-22 to 15-23, 15-33
- removal, 15-33 to 15-34, 15-35
- service life, 15-24
- strippers:
  - chemical:
    - alkali-based, 15-35
    - solvent-based, 15-34
  - mechanical, 15-34
  - “safe”, 15-35
- VOC regulation compliance, 15-19
- Palosapis. *See* Mersawa
- Panel products:
  - performance standards, 10-5 to 10-6, 10-6fig
  - plywood, 10-6 to 10-13
  - product standards, 10-5, 10-5t
  - wood elements, 10-2fig
- Paper-based plastic laminates:
  - decorative laminates:
    - process, 19-12 to 19-13
    - thicknesses, 19-12 to 19-13
    - uses, 19-12 to 19-13
  - industrial laminates:
    - cost advantage, 19-12
    - papreg, 19-12
    - resins used, 19-12
    - strength, 19-12, 19-7t to 19-8t
    - uses, 19-12
  - lignin-filled laminates:
    - strength properties, 19-13
  - resins used, 10-4
  - shrinking and swelling, 19-13
- Paper-faced overlays:
  - manufacture, 19-13
  - types:
    - decoratives, 19-13
    - masking, 19-13
    - structural, 19-13
    - uses, 19-13
- Papreg, 19-12
- Para-Angelim (*See also* Sucupira):
  - mechanical properties, 4-18t, 4-22t
  - shrinkage values, 3-10t
- Parana pine:
  - characteristics, 1-33
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-33
  - mechanical properties, 4-18t, 4-22t
  - shrinkage values, 3-10t
  - uses, 1-33
- Parenchyma cells, function, 2-3
- Particle and fiberboard, 10-13 to 10-24
- Particleboard:
  - adhesives, 10-4
  - certification, 10-17, 10-18fig
  - finishing, 10-17
  - hot pressing, 10-16 to 10-17
  - mat formation, 10-16
  - particle classifications and conveying, 10-16
  - particle drying, 10-16
  - production, 10-14 to 10-15, 10-15fig, 10-16
  - properties and grades, 10-17, 10-17t, 10-18t
  - resins and wax, 10-4, 10-16
  - screw withdrawal, 7-10
  - standards, 10-5t
  - uses, 10-15
- Pau marfim:
  - characteristics, 1-28
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-28
  - machineability, 1-28
  - mechanical properties, 4-22t
  - resistance to decay, 1-28
  - shrinkage values, 3-10t
  - specific gravity, 1-28
  - strength values, 1-28
  - uses, 1-28
- Pecan (*See also* Hickory, pecan):
  - machining and related properties, 3-16t
  - nomenclature, 5-5t
- Pecky cypress, 1-10
- Peeling logs for veneer, 10-7 to 10-8
- Pentachlorophenol solutions:
  - and nonpressure treatments, 14-24
  - solution standards, 14-7
  - solution performance, 14-7
- Pentachlorophenol:
  - approved uses, 14-7
  - effect on mechanical properties of wood, 14-24
  - effectiveness, 14-8
- EPA-approved consumer information sheet, 14-3t
- handling precautions, 14-3t, 14-8
- ineffective against marine borers, 14-8
- paintability, 14-7
- retentions for various wood products, 14-5t
- use site precautions, 14-4t
- Peroba, white. *See* Peroba de Campos
- Peroba de Campos:
  - characteristics, 1-28
  - locality of growth, 1-28
  - machineability, 1-28
  - mechanical properties, 4-18t, 4-22t
  - resistance to decay, 1-28
  - shrinkage values, 3-10t
  - uses, 1-28
- Peroba Rosa:
  - characteristics, 1-28
  - ease of bonding, 4-18t, 4-22t
  - locality of growth, 1-28
  - mechanical properties, 4-18t, 4-22t
  - resistance to fungi and insects, 1-28
  - shrinkage values, 3-10t
  - uses, 1-29
- Persimmon:
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - nomenclature, 5-5t
  - shrinkage values, 3-9t
- Phenolic adhesives:
  - performance over time, 9-22, 9-22fig
  - structural performance, 9-11t
  - use with composite products, 10-4
  - working and strength properties, and uses, 9-14t
- Phenolic resins:
  - for laminates, 19-12 to 19-13
  - in sandwich construction, 11-17
- Pholads, 13-14
- Photodegradation. *See* Weathering
- Piles:
  - knots, effect on strength, 4-27 to 4-28
  - marine, protection against insects, 13-14 to 13-15
  - preservative retention levels, 14-5t to 14-6t
  - preservative treatments, 18-6
  - service life, 18-6
  - straightness, 18-4
  - standards and specifications, 18-2t, 18-3, 18-7
  - standards for end-bearing piles, 18-4
    - for friction piles, 18-4
  - strength properties, 18-7
  - timber availability, 18-3
  - weight and volume, 18-5
- Pilon:
  - characteristics, 1-29
  - locality of growth, 1-29
  - mechanical properties, 4-18t, 4-22t
  - resistance to insects, 1-20

- uses, 1-29
- workability, 1-29
- Pine, Caribbean:
  - characteristics, 1-33
  - ease of bonding, 9-8t
  - locality of growth, 1-33
  - machineability, 1-33
  - mechanical properties, 4-18t, 4-22t
  - plywood stiffness and strength, 10-11t
  - resistance to insects, 1-33
  - shrinkage values, 3-10t
  - uses, 1-33
- Pine, eastern white:
  - characteristics, 1-12
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - flame spread index, 17-3t
  - locality of growth, 1-12
  - mechanical properties, 4-14t, 4-15t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - shock resistance, 1-12
  - shrinkage values, 3-9t
  - tensile strength, 4-24t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
  - uses, 1-12
  - workability, 1-12
- Pine, jack:
  - characteristics, 1-13
  - decay resistance, 13-18t
  - dimensional change coefficient, 12-16t
  - locality of growth, 1-12
  - mechanical properties, 4-14t, 4-15t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - shock resistance, 1-13
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
  - used for poles, 18-4t
  - uses, 1-13
- Pine, loblolly:
  - color and figure, 3-4t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - elastic ratio, 4-2t
  - erosion of planed surfaces, 15-8t
  - moisture content, 3-6t, 4-34t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - shock resistance, 1-13
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
  - used for poles, 18-4t
  - uses, 1-13
- Pine, longleaf:
  - color and figure, 3-4t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - elastic ratio, 4-2t
  - moisture content, 3-6t, 4-34t
  - nomenclature, 5-13t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - thermal conductivity, 3-20t
- Pine, lodgepole:
  - characteristics, 1-13
  - color and figure, 3-4t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - elastic ratio, 4-2t
  - flame spread index, 17-3t
  - locality of growth, 1-13
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - shock resistance, 1-13
  - shrinkage values, 1-13, 3-9t
  - strength properties, 4-7t, 4-21t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
  - used for poles, 18-2, 18-4t
  - workability, 1-13
  - uses, 1-13
- Pine, longleaf:
  - color and figure, 3-4t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - elastic ratio, 4-2t
  - moisture content, 3-6t, 4-34t
  - nomenclature, 5-13t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - thermal conductivity, 3-20t
- Pine, ocote:
  - characteristics, 1-33
  - locality of growth, 1-33
  - mechanical properties, 4-18t, 4-22t
  - plywood stiffness and strength, 10-11t
  - resistance to fungi, 1-34
  - shrinkage values, 3-10t
  - strength properties, 1-33
  - uses, 1-33
- Pine, pitch:
  - characteristics, 1-13
  - decay resistance, 3-18t
  - locality of growth, 1-13
  - nomenclature, 5-13t
  - plywood stiffness and strength, 10-11t
  - shock resistance, 1-13
  - shrinkage values, 1-13, 3-9t
  - strength properties, 4-7t, 4-12t
  - thermal conductivity, 3-20t
  - uses, 1-13
- Pine, pond:
  - shrinkage values, 3-9t
  - strength properties, 4-7t, 4-12t
  - tensile strength, 4-24t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
- characteristics, 1-13
- decay resistance, 3-18t
- dimensional change coefficient, 12-16t
- locality of growth, 1-13
- elastic ratio, 4-2t
- plywood stiffness and strength, 10-11t
- Poisson ratio, 4-3t
- shock resistance, 1-13
- shrinkage values, 1-13, 3-9t
- strength properties, 4-8t, 4-13t
- uses, 1-13
- Pine, ponderosa:
  - characteristics, 1-13
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - erosion of planed surfaces, 15-8t
  - flame spread index, 17-3t
  - for siding, 5-17
  - fracture toughness, 4-26t
  - Jeffrey, 1-13
  - locality of growth, 1-13
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t
    - changes in finished sapwood samples, 15-13fig
  - moisture-excluding effectiveness of finishes on, 15-12t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - sapwood, 2-2
  - shock resistance, 1-13
  - shrinkage values, 3-9t
  - strength properties, 4-8t, 4-13t
  - tensile strength, 3-20t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
  - used for poles, 18-2, 18-4t
  - uses, 1-13
- Pine, radiata:
  - characteristics, 1-34
  - ease of bonding, 9-8t
  - locality of growth, 1-34
  - machineability, 1-34
  - mechanical properties, 4-18t, 4-22t
  - uses, 1-34
- Pine, red:
  - characteristics, 1-14
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - flame spread index, 17-3t
  - heat release index, 17-9t
  - locality of growth, 1-14

- mechanical properties, 4-14t, 4-15t
- moisture content, 3-6t, 4-34t
- penetration, 14-16t
- preservative treatments to prevent marine borer attacks on piles, 14-10t
- plywood stiffness and strength, 10-11t
- Poisson ratio, 4-3t
- shock resistance, 1-14
- shrinkage values, 3-9t
- strength properties, 4-8t, 4-13t
- thermal conductivity, 3-20t
- toughness values, 4-25t
- used for poles, 18-4t, 18-5
- uses, 1-14
- Pine, sand, strength properties, 4-8t, 4-13t
- Pine, scots, fracture toughness, 4-26t
- Pine, shortleaf:
  - color and figure, 3-4t
  - dimensional change coefficient, 12-16t
  - elastic ratio, 4-2t
  - moisture content, 3-6t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - strength properties, 4-8t, 4-13t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
- Pine, slash:
  - color and figure, 3-4t
  - dimensional change coefficient, 12-16t
  - decay resistance, 3-18t
  - elastic ratio, 4-2t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - shrinkage values, 3-9t
  - strength properties, 4-8t, 4-13t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
- Pine, southern:
  - characteristics, 1-14
  - characteristics for painting, 15-3t
  - charring rate data, 17-11t
  - charring rate equation, 17-10
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - ease of bonding, 9-7, 9-8t
  - erosion of planed surfaces, 15-8t
  - flame spread index, 17-3t
  - flammability data, 17-7t
  - for flooring, 5-17
  - fracture toughness, 4-26t
  - grading, 5-8
  - kiln drying schedule, 12-8, 12-11t
  - moisture content and property values, 4-35t
  - nomenclature, 5-13t
  - plywood stiffness and strength, 10-11t
  - preservative retention and life span tests, 14-13t to 14-15t
  - preservative treatments to prevent marine borer attacks on piles, 14-10t
  - shock resistance, 1-14
  - shrinkage values, 1-14, 3-9t
  - species, 1-14
  - used for piles, 18-5
  - used for poles, 18-2, 18-4t, 18-5
  - uses, 1-14
- Pine, spruce:
  - characteristics, 1-14
  - decay resistance, 3-18t
  - locality of growth, 1-14
  - plywood stiffness and strength, 10-11t
  - strength properties, 4-8t, 4-13t
  - uses, 1-14
- Pine, sugar:
  - characteristics, 1-14
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - connector joint strength, 7-12t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - locality of growth, 1-14
  - moisture content, 3-6t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - Poisson ratio, 4-3t
  - shock resistance, 1-14
  - shrinkage values, 1-14, 3-9t
  - strength properties, 4-8t, 4-13t
  - thermal conductivity, 3-20t
  - uses, 1-14
  - workability, 1-14, 1-15
- Pine, Virginia:
  - characteristics, 1-15
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - locality of growth, 1-15
  - plywood stiffness and strength, 10-11t
  - shock resistance, 1-15
  - shrinkage values, 3-9t
  - strength properties, 4-8t, 4-13t
  - tensile strength, 4-24t
  - toughness values, 4-25t
  - uses, 1-15
- Pine, western white:
  - characteristics, 1-15
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - flame spread index, 17-3t
  - for siding, 5-17
  - fracture toughness, 4-26t
  - heat release data, 17-9t
  - locality of growth, 1-15
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t
  - paintability rating, 15-4
  - Poisson ratio, 4-3t
  - shock resistance, 1-15
  - shrinkage values, 3-9t
  - strength properties, 4-8t, 4-13t
  - thermal conductivity, 3-20t
  - uses, 1-15
  - workability, 1-15
- Pitch pockets:
  - description, 4-33
  - effect on strength, 4-33
  - in lumber stress grading, 6-5
  - species involved, 4-33
- Pith, 2-1, 2-2fig
- Piquia:
  - characteristics, 1-29
  - locality of growth, 1-29
  - machineability, 1-29
  - mechanical properties, 4-18t, 4-22t
  - shrinkage values, 3-10t
  - resistance to fungi and insects, 1-29
  - uses, 1-29
- Plainsawn lumber:
  - advantages, 3-2t
  - color and figure:
    - hardwoods, 3-3t
    - softwoods, 3-4t
  - method of producing, 3-2
  - shrinkage, 3-11
- Plasticizing adhesive polymers, 9-10
- Plasticizing wood:
  - bent wood members, 19-2
  - bending operation and apparatus, 19-4
  - characteristics of bent wood, 19-4
  - chemicals used, 19-2
  - fixing the bend, 19-4
  - laminated members, 19-2 to 19-3
  - moisture content of bending stock, 19-3
  - principles of plasticizing and bending, 19-1
  - resin-treated compressed wood, 19-5
  - selection of stock, 19-3
  - steaming, 19-1
  - veneered curved members, 19-3
- Plastering, care during construction, 12-19 to 12-20
- Plastic bonding, 9-5
- Plastic-coated nails, 7-4
- Port-Orford Cedar, *See* Cedar, Port-Orford
- Plywood:
  - adhesives, 10-4, 10-8
  - advantages over solid wood, 10-7
  - assembly, 10-8
  - classification by:
    - exposure durability, 10-9
    - grades, 10-9 to 10-10, 10-10t
    - span rating, 10-10 to 10-11

strength and stiffness, 10-10 to 10-12, 10-11t  
 cores, 10-6  
 description, 10-6 to 10-7  
 dimensional stability, 10-12  
     and grain direction, 10-6  
 edge swelling, 10-12  
 erosion of planed surfaced, 15-8t  
 finishes, suitability and expected service life, 15-15t  
 finishing, 15-5  
 fire-retardant treated, 17-12  
 grain, 10-6  
 HPVA grade stamp, 10-8, 10-9fig  
 in light-frame construction, 16-3  
 plies, 10-6  
 preservative retention levels, 14-5t to 14-6t  
 product standard, 10-5 to 10-6, 10-5t, 10-6fig, 10-7  
 protecting form decay, 13-8  
 shear strength, 10-12  
 sheathing-grade, property values, 10-12t  
 specialty panels, 10-13  
 specifications, 10-8 to 10-9  
 softwood logs, processing, 10-7  
 standards, 10-8  
 splitting resistance, 10-12  
 strength and stiffness, 10-11t, 10-12  
 types:  
     construction and industrial, 10-7  
     hardwood and decorative, 10-7  
     veneers, 10-7 to 10-8  
     weathering of, 15-16fig  
 Plywood curved members:  
     bent after gluing:  
         common hardwoods for, 19-3  
         procedure for, 19-2  
     bent and glued simultaneously:  
         advantages, 19-2 to 19-3  
         procedure for, 19-2  
 Poisson's ratio:  
     discussion, 4-2  
     values, 4-3t  
 Pole buildings, 16-4 to 16-6, 16-5fig, 16-6fig, 18-3  
 Poles:  
     availability, 18-2  
     characteristics relating to:  
         Douglas-fir, 18-2, 18-4t  
         glued-laminated, 18-3  
         jack pine, 18-4t  
         lodgepole pine, 18-2, 18-4t  
         ponderosa pine, 18-2, 18-4t  
         red pine, 18-4t, 18-5  
         southern pine, 18-2, 18-4t, 18-5  
         western hemlock, 18-4t  
         western larch, 18-2  
         western red cedar, 18-2, 18-4t, 18-6  
     control of mold, stain, and decay, 13-6  
     form and taper, 18-3 to 18-4  
     preservation and seasoning, 18-2  
     preservative treatment:  
         and sapwood, 18-4  
         retention levels, 14-5t to 14-6t  
         specifications, 18-6  
     service life, 18-6  
     species selection, 18-2  
     standards and specifications, 18-2t, 18-7  
     strength properties, 18-7  
     uses, 18-3fig  
     weight and volume, 18-5  
 Polymeric methylene diphenyl diisocyanate (PMDI) adhesives, 9-10  
 Polymerization, effect on mechanical properties, 4-43  
 Polymers, organic and synthetic, and adhesion, 9-9 to 9-10  
 Polymers, analytic chemical and mechanical testing, 9-20  
 Polyurethane bonding with wood and nonwood composites, 9-5  
 Polyurethane adhesives:  
     performance over time, 9-22  
     structural performance, 9-11t  
     working and strength properties, and uses, 9-14t  
 Polyvinyl adhesives:  
     structural performance, 9-11t  
     working and strength properties, and uses, 9-13t to 9-14t  
 Porches:  
     cleaning before refinishing, 15-23  
     finishing, 15-21  
     pests, 13-13  
 Pores. *See* Vessels  
 Portland-cement-bonded composites, 10-25 to 10-26, 10-26t  
 Post-frame buildings, 16-4 to 16-6, 16-5fig, 16-6fig  
 Posts, preservative retention levels, 14-5t to 14-6t  
 Pre-drying, 12-6  
 Prefinished wood products, 15-24  
 Preservative penetration:  
     heartwood, 14-12, 14-16t, 14-21, 14-24  
     incising, effect of, 14-21  
     sapwood, 14-12, 14-21, 14-24  
     softwoods, 14-16t  
 Preservative-pressure-treated wood, EPA-approved customer information sheets, 14-3t to 14-4t  
 Preservative retention tests, pressure-treated, 14-13t to 14-15t  
 Preservatives:  
     copper-containing, control of marine borers with, 13-15  
     finishing, 15-6  
     effect on mechanical properties, 14-24  
     effect on paintability, 15-22  
     effect on strength of oil-type, 4-41  
     EPA regulations 14-1 to 14-2  
     inorganic arsenicals:  
         EPA-approved information sheet, 14-3t  
         handling precautions, 14-3t  
         use site precautions, 14-4t  
     oilborne, various types:  
         alkyl ammonium compound:  
             effectiveness, 14-9  
             in ammoniacal copper quat, 14-11  
             solubility, 14-9  
         bis(tri-n-butyltin) oxide:  
             concentration values, 14-8  
             inappropriate uses, 14-8  
             paintability, 14-8  
             recommended uses, 14-8  
             toxicity, 14-8  
         chlorothalonil:  
             effectiveness, 14-8  
             solubility, 14-8  
             stability, 14-8  
         chlorothalonil/chlorpyrifos:  
             component ratios, 14-8  
             effectiveness, 14-8  
         chlorpyrifos:  
             effectiveness, 14-9  
             in combination, 14-9  
         copper naphthenate:  
             color transfer and changes, 14-8  
             effectiveness, 14-8  
             retention levels for various wood products, 14-5t  
             solution values, 14-8  
             Southern pine sapwood stakes retention and life span test results, 14-14t  
             treatment for cutting pretreated wood, 14-24  
     creosote, coal-tar:  
         advantages, 14-2  
         appearance, 14-2  
         composition variability, 14-2  
         EPA-approved customer information sheet, 14-3t  
         effect on mechanical properties, 14-24  
         for non-pressure treatments, 14-7  
         handling precautions, 14-3t  
         in pressure treatment process, 14-19  
         odor and vapors, 14-2  
         retention levels for various wood products, 14-5t  
         standards, 14-2  
         temperature for pressure treating, 14-21  
         treatment for cutting pretreated wood, 14-25  
         use site precautions, 14-3t  
         volatility, 14-7  
     creosote-coal-tar solutions:  
         properties, 14-7  
         retention levels for various wood products, 14-5t  
         standards by volume, 14-7

- temperature for pressure treating, 4-21
- creosote-petroleum oil solutions:
  - retention levels for various wood products, 14-5t
- naphthalene:
  - Southern pine sapwood stakes retention and life span test results, 14-14t
- oxine copper:
  - composition, 14-8
  - corrosiveness, 14-8
  - retention levels for various wood products, 14-5t
  - Southern pine sapwood stakes retention and life span test results, 14-13t
  - toxicity, 14-8
- pentachlorophenol solutions:
  - and nonpressure treatments, 14-24
  - solution standards, 14-7
  - solution performance, 14-7
- pentachlorophenol:
  - approved uses, 14-7
  - effect on mechanical properties of wood, 14-24
  - effectiveness, 14-8
  - EPA-approved consumer information sheet, 14-3t
  - handling precautions, 14-3t, 14-8
  - ineffective against marine borers, 14-8
  - paintability, 14-7
  - retention levels for various wood products, 14-5t
  - Southern pine sapwood stakes retention and life span test results, 14-15t
  - use site precautions, 14-4t
- propiconazole:
  - effectiveness, 14-9
  - solubility, 14-9
  - uses, 14-9
- tebuconazole:
  - effectiveness, 14-9
  - solubility, 14-9
- zinc naphthenate:
  - effectiveness, 14-8
  - inappropriate uses, 14-8
  - properties, 14-8
- 3-iodo-2-propynyl butyl carbamate:
  - effectiveness, 14-8
  - paintability, 14-8
  - retail marketing, 14-8
  - use in combination, 14-9
  - uses, 14-8
- 4, 5-dichloro-2-N-octyl-4-isothiazolin-3-one:
  - effectiveness, 14-9
  - inappropriate uses, 14-9
  - solubility, 14-9
- waterborne, general:
  - and non-pressure treatment, 14-24
  - application and maintenance of exterior wood finish, 15-14t
  - effectiveness, 14-9 to 14-10
  - effect on mechanical properties, 4-41 to 4-43
  - effect on strength, 4-41 to 4-43
  - finishing, 15-6
  - for marine piles, 14-10
  - initial kiln-drying temperature, 4-42
  - paintability, 14-10
  - post-treatment kiln drying temperatures, 4-42 to 4-43
  - retention levels effect of strength, 4-24
  - retention levels for various wood products, 14-6t
  - retentions necessary for marine borer protection, 14-10t
  - temperature considerations, 14-10
- waterborne, various types:
  - acid copper chromate (ACC):
    - components, 14-10
    - effectiveness and leaching, 14-10
    - retention levels for various wood products, 14-6t
    - Southern pine sapwood stakes retention and life span test results, 14-13t
    - temperature for pressure treating, 14-21
  - ammoniacal copper citrate (CC):
    - retention levels for various wood products, 14-6t
    - solution percentages, 14-12
    - temperature for pressure treating, 14-21
  - ammoniacal copper quat (ACQ):
    - common types, 14-11
    - composition of common types, 14-11t
    - retention levels for various wood products, 14-6t
    - uses, 14-11
  - ammoniacal copper zinc arsenate (ACZA):
    - composition, 14-11
    - replacement for ACA, 14-11
    - retention levels for various wood products, 14-6t
    - temperature for pressure treating, 14-21
    - use, 14-10
    - use with Douglas-fir, 14-10 to 14-11
  - chromated copper arsenate (CCA):
    - common types, 14-11
    - component substitutions, 14-11
    - composition of common types, 14-11t
- effectiveness of common types, 14-11
- effect on adhesion, 9-6
- finishing wood treated with, 15-22
- resistance to marine borers, 14-11
- retention levels for various wood products, 14-6t
- Southern pine sapwood stakes retention and life span test results, 14-13t
- temperature for pressure treating, 14-21
- use with Douglas-fir, 14-11
- copper azole - Type A (CBA-Type A):
  - retention levels for various wood products, 14-6t
  - solution percentages, 14-12
  - temperature for pressure treating, 14-21
- copper
  - bis(dimethyldithiocarbamate) (CDDC):
    - retention levels for various wood products, 14-6t
    - solution percentages, 14-11 to 14-12
    - temperature for pressure treating, 14-21
    - uses, 14-12
  - inorganic boron (borax/boric acid):
    - acceptable compounds, 14-12
    - effectiveness, 14-12
    - solubility, 14-12
    - temperature for pressure treating, 14-21
    - uses, 14-12
- Preservatives, recommended retentions, 14-21, 14-5t
- Preservatives, water-repellant, and non-pressure treatments:
  - effectiveness, 14-9
  - federal specifications, 14-9
  - uses, 14-9
- Preservative-treated wood:
  - best management practices, 14-25
  - cut surfaces, protection of, 14-24 to 14-25
  - effect on adhesion, 9-6
  - finishing, 15-6, 15-25
  - handling, 14-24
  - inspection, 14-25, 14-26fig
  - quality assurance, 14-25 to 14-26, 14-26fig
  - seasoning required, 14-25
  - service life, 15-22
  - specifications, 14-25
  - strength as affected by preservatives, 14-24
  - timing of use, 14-24
- Preservative treatment for:
  - composite products, 1-24
  - light-frame construction 16-2



- Preservative treatment, effect on strength, 6-13
- Preservative treatment, preparing for:
  - air-drying practices, 14-17 to 14-18
  - conditioning green lumber, 14-18
    - Boulton or boiling-under-vacuum process, 14-18
    - steaming-and-vacuum process, 14-18
  - cutting and framing:
    - common uses, 14-19
    - potential size changes, 14-19
    - timing, 14-18
  - drying, 14-17 to 14-18
  - incising:
    - method, 14-18, 14-18fig
    - purpose, 14-18
    - primary species, 14-18
  - peeling, 14-17, 14-17fig
  - preventing decay while drying, 14-18
- Preservative treatments, nonpressure:
  - Boucherie process for green unpeeled poles, 14-24
  - brushing:
    - application, 14-22
    - choice of preservative, 14-22
    - effectiveness, 14-22
    - penetration obtained, 14-22
  - cold-soaking process:
    - effectiveness, 14-22
    - method, 14-22
    - retentions and penetrations, 14-22
  - compared to pressure treatment, 14-21
  - diffusion processes:
    - butt or groundline treatment of poles or posts, 14-23, 14-23fig
    - double diffusion, 14-22, 14-22fig
    - wood used, 14-22
  - dipping:
    - effectiveness, 14-22
    - method, 14-22
    - penetration obtained, 14-22
  - steeping process:
    - effectiveness, 14-22
    - method, 14-22
    - wood used, 14-22
  - tire-tube method for green, unpeeled fencepost, 14-24
  - vacuum processes:
    - contrasted to pressure treating, 14-24
    - effectiveness, 14-23
    - methods, 14-23 to 14-24
    - uses, 14-23
- Preservative treatments, pressure:
  - advantages, 14-10
  - and preservative temperature, 14-21
  - empty-cell processes:
    - Lowry process, 14-20
    - Rueping process, 14-19 to 14-20
  - full-cell process:
    - description, 14-19
    - following other conditioning, 14-19
    - modified full-cell, 14-19
    - penetration and retention levels, 14-21
    - pressures used, 14-21
- Primavera:
  - availability, 1-29
  - characteristics, 1-29
  - dimensional change coefficient, 12-17t
  - locality of growth, 1-29
  - machineability, 1-29
  - mechanical properties, 4-18t, 4-22t
  - resistance to fungi, 1-29
  - shrinkage values, 3-10t
  - uses, 1-29
- Propiconazole:
  - effectiveness, 14-9
  - solubility, 14-9
  - uses, 14-9
- Purlins and glulam beam construction, 16-8
- Purpleheart:
  - characteristics, 1-29
  - decay resistance, 9-8t
  - ease of bonding, 9-8t
  - locality of growth, 1-29
  - machineability, 1-29
  - mechanical properties, 4-18t, 4-22t
  - shrinkage values, 3-10t
  - uses, 1-29
- Pycnanthus. *See* Ilomba
- Quartersawn lumber:
  - advantages, 3-2t
  - color and figure:
    - hardwoods, 3-3t
    - softwoods, 3-4t
  - method of producing, 3-2
  - shrinkage, 3-11
- Quality control in preservative-treated wood, 14-25 to 14-26, 14-26fig
- Rafters in light-frame construction 16-4
- Ramin:
  - characteristics, 1-29 to 1-30
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-29
  - mechanical properties, 4-18t, 4-22t
  - resistance to decay, 1-30
  - shrinkage values, 3-10t
  - uses, 1-30
  - workability, 1-30
- Rays:
  - definition, 2-1
  - discussion, 2-3
  - effect on figure, 3-4
  - function, 2-1, 2-3
- Reaction wood:
  - compression wood, 4-31
  - increase in density, 4-31
  - machining, 3-15
  - shrinkage, 3-8, 4-32
  - tension wood, 4-31
- Redcedar, eastern. *See* Cedar, Eastern red
- Redcedar, western. *See* Cedar, Western red
- Redwood:
  - characteristics, 1-16
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - charring rate date, 17-11t
  - connector joint strength, 7-21t
  - decay resistance, 1-16, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - erosion of planed surfaces, 15-8t
  - flame spread index, 17-3t
  - flammability data, 17-7t
  - for finish board, 5-17
  - for siding, 5-17
  - heat release data, 17-9t
  - locality of growth, 1-16
  - moisture content, 3-6t, 4-34t
  - nomenclature, 5-13t
  - paintability rating, 15-4
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - preservative pressure and temperature, 14-21
  - shrinkage values, 3-9t
  - strength properties, 4-8t, 4-13t
  - tensile strength, 4-24t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
  - uses, 1-16
  - workability, 1-16
- Relative humidity:
  - equilibrium moisture content, 3-5
  - moisture content of wood, 3-7t, 15-9 to 15-10
- Remedial treatment, 13-8
- Resorcinol adhesives:
  - performance over time, 9-21 to 9-22, 9-22fig
  - structural performance, 9-11t
  - working and strength properties, and uses, 9-14t
- Roble:
  - characteristics, 1-30
  - ease of bonding, 9-8t
  - locality of growth, 1-30
  - machineability, 1-30
  - mechanical properties, 4-18t, 4-22t
  - resistance to decay, 1-30
  - shrinkage values, 1-30
  - uses, 1-30
- Rolling shear strength, defined, 4-24
- Roof beams and water ponding, 8-9
- Rosewood, ease of bonding, 9-8t
- Rosewood, Brazilian:
  - characteristics, 1-30
  - locality of growth, 1-30

- machineability, 1-30
- mechanical properties, 4-18t, 4-22t
- resistance to fungi and insects, 1-30
- shrinkage values, 3-10t
- uses, 1-30
- Rosewood, Indian:
  - characteristics, 1-30
  - characteristics affecting machining, 3-17t
  - locality of growth, 1-30
  - machineability, 1-30
  - mechanical properties, 4-18t, 4-22t
  - shrinkage values, 3-10t
  - uses, 1-30
- Round timber and ties:
  - availability, 18-2 to 18-3
  - durability, 18-6 to 18-7
  - efficient use, 18-1
  - form, 18-3 to 18-5
  - material requirements, 18-1
  - standards and specifications, 18-1, 18-2t
  - strength properties, 18-7 to 18-8
  - weight and volume, 18-5
- Sande:
  - characteristics, 1-30
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - locality of growth, 1-30
  - machineability, 1-30
  - mechanical properties, 4-18t, 4-22t
  - resistance to decay and insects, 1-30
  - shrinkage values, 3-10t
  - uses, 1-30
- Sandwich panels:
  - advantage, 11-16
  - construction:
    - adhesives, 11-17
    - cores, 11-16 to 11-17, 11-17fig
    - core configurations, 11-17fig
    - description, 11-16, 11-16fig
    - manufacture, 11-17
    - resin treatment, 11-17
    - showthrough, 11-17
  - design:
    - bending stiffness, 11-18, 11-18fig
    - bond strength, 11-19
    - buckling load, 11-18, 11-19, 11-18eq, 11-19eq
    - core modulus, 11-18
    - deflection and beam loading, 11-18, 11-18eq, 11-18t
    - dimpling of facings, 11-19, 11-19eq, 11-19fig
    - facing stress, 11-19, 11-19fig
    - failure modes, 11-19, 11-19fig
    - minimum weight, 11-20, 11-20fig
    - shear instability, 11-19
    - shear stiffness, 11-18, 11-18fig
    - wrinkling of facings, 11-19, 11-19eq, 11-19fig, 11-20
- dimensional stability:
  - bowing, 11-20
  - durability, 11-20
  - fire resistance, 11-21, 17-5
  - thermal insulation, 11-20 to 11-21
- Santa Maria:
  - characteristics, 1-31
  - characteristics affecting machining, 3-17t
  - dimensional change coefficient, 12-17t
  - locality of growth, 1-31
  - machineability, 1-31
  - mechanical properties, 4-18t, 4-22t
  - resistance to insects, 1-31
  - uses, 1-31
- Sapele:
  - characteristics, 1-31
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - locality of growth, 1-31
  - machineability, 1-31
  - mechanical properties, 4-18t, 4-22t
  - shrinkage values, 3-10t
  - uses, 1-31
- Sap stain, 12-10, 12-13fig, 13-2
- Sapwood:
  - color, 3-2
  - decay resistance, 2-2
  - function, 2-2
  - in visual stress grading, 6-5
  - location, 2-2
  - moisture content, 3-6t
  - moisture content and drying, 12-7
  - preservative retention and stake lifespan, 14-13t to 14-15t
  - thickness, 2-2
- Sassafras:
  - characteristics, 1-8
  - decay resistance, 1-8, 3-18t
  - dimensional change coefficient, 12-16t
  - locality of growth, 1-8
  - nomenclature, 5-5t
  - shock resistance, 1-8
  - shrinkage values, 3-9t
  - strength properties, 4-6t, 4-11t
  - uses, 1-8
- Screws, lag:
  - description, 7-11
  - post-1991 lateral load, yield model theory, 7-13 to 7-14, 7-6t, 7-13t, pre-1991 lateral loads, 7-12 to 7-13, 7-12eq, 7-12t, 7-13fig
  - lateral resistance, 7-12, 7-13, 7-13t
  - lubrication, 7-12, 7-13
  - prebored lead hole, size required, 7-11, 7-12fig
  - spacing, 7-13
  - withdrawal resistance, 7-11 to 7-12, 7-11eq
- Screws, tapping:
  - described, 7-9
  - use in particleboard, 7-10
- withdrawal loads, 7-10, 7-10eq
- withdrawal resistance, 7-10
- Screws, wood
  - gauges, 7-11t
  - lateral load coefficients, 7-6t
  - lateral resistance, 7-10 to 7-11, 7-10eq
  - lead hole and load, 7-11
  - lubrication, 7-10
  - penetration depth and load, 7-11
  - sizes, 7-10t
  - types, 7-9, 7-9fig
  - withdrawal loads for particleboard, 7-10, 7-10eq
  - withdrawal resistance, 7-9 to 7-10, 7-10eq
  - yield model theory, 7-8t, 7-11
- Seasoning and lumber purchasing considerations, 5-18
- Selangan Batu. *See* Balau
- Select lumber availability, 5-16 to 5-17
- Sepetir:
  - characteristics, 1-31
  - decay resistance, 3-18t
  - locality of growth, 1-31
  - mechanical properties, 4-18t, 4-22t
  - shrinkage values, 3-10t
  - uses, 1-31
  - workability, 1-31
- Seraya, white:
  - characteristics, 1-31
  - decay resistance, 3-18t
  - locality of growth, 1-31
  - machineability, 1-31
  - uses, 1-31
- Shakes:
  - in glued structural members, 11-10
  - in lumber stress grading, 6-4 to 6-5
- Shear deflection, of sandwich panels, 11-18
- Shear stiffness:
  - of box and I beams, 11-12
  - of sandwich panels, 11-18
  - of stressed-skin panels, 11-14
- Shear strength parallel to grain:
  - coefficient of variation, 4-23t
  - defined, 4-3,
- Shear stress of beams, 8-6
- Sheathing and light-frame construction, 16-3, 16-4fig
- Shingles and shakes, availability, 5-17
- Shingles, finishes, suitability and expected service life, 15-15t
- Shipworms, 13-13
- Shrinkage:
  - adjustment for design use, 6-11
  - affect on painting, 15-4
  - coefficients for changing moisture content by species, 12-16t, 12-17t
  - coefficient of variation, 3-8, 3-11
  - compression wood, 3-8
  - discussion, 3-7 to 3-11
  - fiber saturation point as related to, 3-8

- longitudinal, 3-8
- moisture content curves, 3-11fig
- of domestic woods, 3-9
- of imported woods, 3-9, 3-10
- radial, 3-9, 3-10
- reaction wood, 3-8
- species, 3-9, 3-10
- tangential, 3-9, 3-10
- tension wood, 3-8
- volumetric, 3-9, 3-10
- Siding:
  - and mill glaze, 15-26
  - availability, 5-17
  - backpriming, 15-23
  - finishes, suitability and expected service life, 15-15t
  - lumber finishing, 15-4, 15-13, 15-20
  - prefinished at the factory, 15-24
  - removing weathered surface, 15-9
  - use of plywood, 15-5
- Silverballi, brown, *See* Kaneelhart
- Size factor:
  - for design use, 6-11 to 6-12
  - procedures for design use:
    - in-grade test, 6-11 to 6-12
    - small clear, 6-11
- Skin stresses, stressed-skin panels, 11-14 to 11-15
- Slash-grained lumber. *See* Flat-grained
- Slope of grain:
  - determination, 4-29 to 4-30, 4-29eq
  - in visual sorting, 6-4
  - relationship to fiber orientation, 4-30fig
  - types, 4-29 to 4-30
- Smoke:
  - approaches for dealing with, 17-9
  - carbon monoxide, 17-10
  - defined, 17-9
  - release rate, 17-10
  - tests for determining yield, 17-9 to 17-10
  - toxicity, 17-10
- Soft rot, 13-5
- Softwood lumber:
  - American Lumber Standard, 5-7
  - classification by grades:
    - factory and shop lumber:
      - factory (shop) grades, 5-10
      - industrial clears, 5-10
      - ladder and pole stock, 5-10
      - moulding stock, 5-10
      - tank stock, 5-10
    - structural lumber:
      - dimension lumber, 5-8
      - structural laminations, 5-8 to 5-9
    - yard lumber:
      - select lumber, 5-7 to 5-8
      - common lumber, 5-8, 5-8fig
  - development of grading rules, 5-7
  - drying targets, 12-5
  - grading organizations, 5-9t, 5-12
  - kiln drying schedules, 12-8 to 12-9, 12-11t
  - manufacture:
    - size, 5-10 to 5-11, 5-11t
    - surfacing, 5-11 to 5-12
    - patterns, 5-12, 5-12fig
    - species, 5-12
- Softwoods:
  - availability, 1-2
  - bending properties, 19-3
  - charring rates, 17-11t
  - color and figure, 3-4t
  - definition, 1-2
  - flame spread index, 17-3t
  - flammability data, 17-7t
  - heat release data, 17-9t
  - imported, 1-33 to 1-34
  - moisture content, heartwood and sapwood, 3-6t
  - preservative penetration, 14-16t
  - relationship of mechanical properties to specific gravity, 4-28t
  - species by region, 1-2t
  - stained, 3-4fig
  - thermal conductivity, 3-20t
  - uses, 1-2
- Sorption hysteresis, discussed, 3-7
- Solvents and adhesion, 9-10
- Sound, speed of, 4-25 to 4-26
- Southern pine sapwood stakes, preservative retention and life span tests, 14-13t to 14-15t
- Soybean adhesives:
  - structural performance, 9-11t
  - working and strength properties, and uses, 9-13t
- Spanish-cedar:
  - characteristics, 1-31
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-31
  - mechanical properties, 4-19t, 4-23t
  - shrinkage values, 3-10t
  - uses, 1-32
  - workability, 1-32
- Specific gravity:
  - and paintability of wood, 15-1, 15-4
  - and weathering of wood, 15-7
  - coefficient of variation, 3-11, 4-23t
  - definition, 3-11
  - density as a function of, 3-13t, 3-14t
  - influence on mechanical properties, 4-27, 4-28t
  - moisture content, 3-5, 3-12fig
  - of reaction wood, 4-31
  - workability of wood, 3-15
- Speed of sound, 4-25 to 4-26
- Sphaeroma, 13-14
- Spikes, 7-8
- Spiral grain, 4-29 to 4-30, 4-32fig
- Splits:
  - in glued structural members, 11-10
  - in lumber stress grading, 6-4
- Spruce, black:
  - color and figure, 3-4t
  - dimensional change coefficient, 12-17t
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - strength properties, 4-8t, 4-13t
  - thermal conductivity, 3-20t
- Spruce, Eastern:
  - characteristics, 1-16
  - flame spread index, 17-3t
  - locality of growth, 1-16
  - nomenclature, 5-13t
  - species, 1-16
  - uses, 1-16
  - workability, 1-16
- Spruce, Engelmann:
  - characteristics, 1-16
  - characteristics for painting, 15-3t
  - charring rate data, 17-11t
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-17t
  - elastic ratio, 4-2t
  - erosion of planed surfaces, 15-8t
  - locality of growth, 1-16
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - Poisson ration, 4-3t
  - shock resistance, 1-16
  - shrinkage values, 3-9t
  - strength properties, 4-8t, 4-13t
  - tensile strength, 4-24t
  - thermal conductivity, 3-20t
  - toughness values, 4-25t
  - uses, 1-16
- Spruce, red:
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-17t
  - fracture toughness, 4-26t
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 4-34t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - strength properties, 4-8t, 4-13t
  - thermal conductivity, 3-20t
- Spruce, Sitka:
  - characteristics, 1-16
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t

- flame spread index, 17-3t
- locality of growth, 1-16
- mechanical properties, 4-14t, 4-15t
- moisture content, 3-6t, 4-34t
- nomenclature, 5-13t
- penetration, 14-16t
- plywood stiffness and strength, 10-11t
- Poisson ration, 4-3t
- shock resistance, 1-16
- shrinkage values, 3-9t
- strength properties, 1-16, 4-8t
- tensile strength, 4-24t
- thermal conductivity, 3-20t
- uses, 1-16
- Spruce, white:
  - color and figure, 3-4t
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-17t
  - mechanical properties, 4-14t, 4-15t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - strength properties, 4-8t, 4-13t
  - thermal conductivity, 3-20t
- Stability:
  - beams:
    - water ponding, 8-9, 8-9eq
    - lateral-torsion buckling, 8-9 to 8-10, 8-9eq, 8-10t
    - deck support, effect of, 8-10, 8-10eq, 8-10fig
  - built-up and spaced columns, 8-9, 8-9eq
  - column flanges, 8-9, 8-9eq
  - long columns, 8-8, 8-8eq
  - interaction of buckling modes, 8-10 to 8-11, 8-10eq, 8-11eq
  - short columns, 8-8 to 8-9, 8-8eq, 8-8fig
- Stain:
  - penetrating:
    - use on exterior plywood, 15-5
  - semi-transparent:
    - application and maintenance, 15-14t, 15-20
    - discussed, 15-17
    - refinishing, 15-23
  - solid color:
    - and mill glaze, 15-26
    - application and maintenance, 15-14t, 15-20
    - discussed, 15-18
    - reconstituted wood products, 15-6
    - refinishing, 15-23
    - use on floors, 15-32
- Stains. *See also* Discoloration
- Stains, chemical, discussed 13-3
- Stains, fungal:
  - blue, 15-29
  - discussed, 13-2
  - distinction from mold, 13-2
  - during drying, 12-10, 12-13fig
  - effect on wood, 13-3
- Stains, iron, 15-23, 15-29, 15-32
- Stake tests with preservatives, pressure-treated, 14-13t to 14-15t
- Standard lengths of lumber, 5-2
- Standard lumber abbreviations, Standard thicknesses of lumber:
  - for flooring, 5-5
  - table, 5-4
- Standard widths of lumber, 5-4
- Staples, 7-8 to 7-9
- Starch adhesive, structural performance, 9-11t
- Staybwood, 19-10
- Staypak:
  - appearance, 19-10
  - dimensional stability, 19-9t
  - properties, 19-6t, 19-9 to 19-10
  - purpose, 19-10
  - strength properties, 19-7t to 19-8t
  - uses, 19-10
- Sticker stain during drying, 12-10, 12-14fig
- Stiffeners and glued members, 11-13
- Stiffeners and glulam beam construction, 16-8
- Stiffeners, wood-plywood glued structural members, 11-13
- Stiffness, affected by knots, 6-4
- Storage of lumber:
  - care in yards, 12-14 to 12-15, 13-7
  - green or partially seasoned, 12-14
  - storage shed temperature, 12-14t
- Storing lumber:
  - finish and factory items, 12-15
  - sheathing and structural items, 12-14
- Strength and duration of load adjustments, 6-13
- Strength ratio:
  - definition, 6-3
  - equations, 6-5, 6-6fig
  - estimating, 6-5
  - ranges in visual grading, 6-6
- Strength properties:
  - bird pecks, effect of, 4-33
  - compression failures, effect of, 4-33
  - creep, 4-37 to 4-39
  - dead trees, 4-33 to 4-34
  - derived for small clear wood, 6-5 to 6-6
  - duration of load, effect, 4-39 to 4-40
  - extractives, effect of, 4-33
  - fire-retardant treatments, 4-41
  - for commercially important woods, 4-3t to 4-8t
  - insect damage, effect of, 4-43
  - juvenile wood, 4-32
  - knots, effect of, 4-27 to 4-28, 4-34
  - moisture content as related to, 4-34
  - nuclear radiation, 4-43
  - pitch pockets, effect of, 4-33
  - rate of loading, 4-37
  - slope of grain, 4-28 to 4-30
  - treatment, effect of 6-13
- Strength, related to slope, 4-30fig
- Stress equations:
  - axial load:
    - tensile stress, 8-4, 8-4eq
    - short-block compressive stress, 8-4, 8-4eq
  - bending:
    - notches, slits and holes, effect 8-6 to 8-7
    - size effect, 8-6, 8-6eq
    - straight beam stresses, 8-5
    - tapered beam stresses, 8-5 to 8-6, 8-5fig, 8-5eq, 8-6eq
    - time effects, 8-7
    - water ponding, 8-7
  - combined bending and axial load:
    - concentric load, 8-7, 8-7eq
    - eccentric load, 8-7, 8-7eq
    - torsion, 8-8, 8-8fig, 8-8eq
- Stress-graded lumber, American Standard lumber sizes, 5-5t
- Stress grading:
  - American Lumber Standard Committee (ALSC):
    - accredited rules-writing and independent agencies, 6-2t
    - American Softwood Standard, 6-2
    - National Grading Rule, 6-2, 6-3, 6-3t
  - American Society of Testing and Materials (ASTM):
    - calculating clear wood properties for visual stress grades, 6-3
    - design properties, 6-1
    - strength ratio, 6-3
    - U.S. responsibility structure, 6-2, 6-2fig
- Stress, relationship between constant load and failure, 4-39 to 4-40, 4-39fig
- Structural composite lumber (SCL) in bridges, 16-10
- Structural flakeboard and light-frame construction, 16-3
- Sucupira:
  - characteristics, 1-32
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - locality of growth, 1-32
  - mechanical properties, 4-19t, 4-23t
  - resistance to fungi and insects, 1-32
  - shrinkage values, 3-10t
  - uses, 1-32
  - workability, 1-32
- Sugarberry (*See also* Hackberry):
  - size of pores, 15-31t
- Suradan. *See* Pilon
- Sweetgum:
  - characteristics, 1-8
  - characteristics for painting, 15-3t
  - color and figure, 3-3t
  - connector joint strength, 7-21t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t

- flame spread index, 17-3t
- interlocked grain, 1-8
- locality of growth, 1-8
- machining and related properties, 3-16t
- moisture content, 3-6t
- penetration, 14-16t
- plywood stiffness and strength, 10-11t
- shock resistance, 1-8
- shrinkage values, 3-9t
- strength properties, 4-6t, 4-11t
- thermal conductivity, 3-19t
- toughness values, 4-24t
- uses, 1-8
- Swelling, coefficient for changing moisture content, by species, 12-16t to 12-17t
- Sycamore:
  - characteristics for painting, 15-3t
  - color and figure, 3-3t
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - machining and related properties, 3-16t
  - nomenclature, 5-5t
  - size of pores, 15-31t
- Sycamore, American:
  - characteristics, 1-8
  - connector joint strength, 7-21t
  - dimensional change coefficient, 12-16t
  - locality of growth, 1-8
  - moisture content, 3-6t
  - penetration, 14-16t
  - shock resistance, 1-8
  - shrinkage values, 3-9t
  - strength properties, 4-6t, 4-11t
  - thermal conductivity, 3-19t
  - uses, 1-8
- Tamarack:
  - characteristics, 1-16
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - locality of growth, 1-16
  - mechanical properties, 4-14t, 4-15t
  - moisture content, 3-6t, 4-34t
  - nomenclature, 5-13t
  - penetration, 14-16t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - strength properties, 4-8t, 4-13t
  - uses, 1-16, 1-17
- Tangare. *See* Andiroba
- Tanoak:
  - characteristics, 1-32
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - locality of growth, 1-8
  - machineability, 1-9
  - machining and related properties, 3-16t
  - nomenclature, 5-5t
  - plywood stiffness and strength, 10-11t
  - shrinkage values, 3-9t
  - strength properties, 1-9, 4-6t, 4-11t
  - uses, 1-9
- Teak:
  - characteristics, 1-32
  - characteristics affecting machining, 3-17t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-17t
  - ease of bonding, 9-8t
  - locality of growth, 1-32
  - machinability, 1-32
  - mechanical properties, 4-19t, 4-23t
  - shrinkage values, 3-10t
  - uses, 1-32
- Tebuconazole:
  - effectiveness, 14-9
  - solubility, 14-9
- Temperature blisters, avoiding while painting, 15-21
- Temperature, effect on:
  - fatigue strength, 4-40 to 4-41
  - mechanical properties:
    - irreversible effects, 4-36 to 4-37, 4-38fig
    - reversible effects, 4-35 to 4-36, 4-36fig
  - properties, 6-14, 6-14t
  - relative humidity and moisture content, 3-7t
- Tensile strength, end-grain bonded joints, 9-18 to 9-19
- Tensile strength parallel to grain:
  - average values, 4-24
  - coefficient of variation, 4-23t
  - defined, 4-3
- Tensile strength perpendicular to grain, 4-3
- Tension wood:
  - definition, 4-31
  - density increase, 4-31
  - description, 4-31
  - effect on strength, 4-31
  - machining, 3-15
  - shrinkage, 4-32
- Texture of wood, 3-1 to 3-2
- Texture, effect on paintability, 15-5
- Termites:
  - damage caused by, 13-9t, 13-10fig
  - nonsubterranean, 13-12
  - subterranean, 13-11 to 13-12
  - termite-resistant wood, 13-12 to 13-13
- Thermal, conductivity of wood:
  - definition, 3-15
  - determination, 3-17
  - factors affecting, 3-17
  - selected species, 3-19t to 3-20t
- Thermal diffusivity of wood, 3-17
- Thermal expansion, 3-21
- Thermal properties of wood, 3-15
- Thermoplastics and adhesion, 9-9 to 9-10
- Ties:
  - availability, 18-3
  - preservative penetration levels, 14-5t to 14-6t
  - service life, 18-6 to 18-7
  - sizes, 18-5
  - standards and specifications, 18-2t
  - strength properties, 18-8
  - weight and volume, 18-5
- Timber:
  - inventory, 1-2
  - resources, 1-2
- Timber bridges:
  - glulam, 16-10, 16-10fig
  - log stringer, 16-9
  - sawn lumber, 16-9
  - structural composite lumber, 16-10
- Timber buildings:
  - arch structure, 16-8
  - dome, 16-8 to 16-9, 16-8fig
  - glulam beam, 16-8
  - mill-type construction:
    - fire resistance, 16-7
    - specifications, 16-7
  - timber frame houses, 16-6 to 16-7, 16-8fig
- Timbers, recommended moisture content, 12-3
- Timber from dead trees, properties of, 4-33 to 4-34
- Time, effect on strength:
  - creep, 4-37 to 4-39
  - duration of load, 4-39 to 4-40
- Tornillo:
  - characteristics, 1-32
  - decay resistance, 3-18t
  - locality of growth, 1-32
  - mechanical properties, 4-19t, 4-23t
  - uses, 1-32
  - workability, 1-32
- Torsion, strength, 4-24
- Toughness:
  - average values, 4-24t, 4-25
  - coefficient of variation, 4-23t
  - defined, 4-24
- Tracheids, description and function, 2-3
- Transverse and volumetric shrinkage of wood, 3-7 to 3-8
- Trebol. *See* Macawood
- Trim, exterior:
  - care during construction, 12-19
  - recommended moisture content, 12-5t
- Trusses:
  - care during construction, 12-8 to 12-19
  - in light-frame construction, 16-4
  - in pole and post-frame construction, 16-6
- Truss plates, 7-25, 7-26fig
- Tupelo:
  - characteristics, 1-9

- connector joint strength, 7-21t
- locality of growth,
- nomenclature, 5-5t
- shock resistance, 1-9
- species, 1-9
- uses, 1-9
- Tupelo, black:
  - color and figure, 3-3t
  - dimensional change coefficient, 12-16t
  - machining and related properties, 3-16t
  - moisture content, 3-6t
  - shrinkage values, 3-9t
  - strength properties, 4-6t, 4-11t
  - thermal conductivity, 3-19t
- Tupelo, swamp, moisture content, 3-6t
- Tupelo, water:
  - color and figure, 3-3t
  - dimensional change coefficient, 12-16t
  - machining and related properties, 3-16t
  - moisture content, 3-6t
  - shrinkage values, 3-9t
  - strength properties, 4-6t, 4-11t
  - thermal conductivity, 3-19t
- Tupelo, white, color and figure, 3-3t
- Urea and dimethylol urea for plasticizing wood, 19-2
- Urea adhesives:
  - performance over time, 9-21 to 9-22, 9-22fig
  - structural performance, 9-11t
  - use with composite products, 10-4
  - working and strength properties, and uses, 9-14t
- Van der Waal's forces, 9-2
- Varnish:
  - application and maintenance, 15-14t
  - clear, 15-18
  - use on boats, 15-22
  - use on floors, 15-22
- Veneer:
  - and adhesion, 9-4 to 9-5, 10-8
  - drying, 10-8
  - grading, 10-9, 10-10t
  - HPVA grade stamps, 10-8, 10-9fig
  - use with plywood, 10-7 to 10-8
- Veneered curved members, 19-3
- Ventilation and anobiids, 13-10
- Vertical-grained lumber. *See* Edge-grained lumber
- Vessel:
  - definition, 1-2
  - function, 2-3
  - texture, 3-1 to 3-2
- Vibration properties, 4-25
- Virola. *See* Banak
- Visual grades in the National Grading Rule, 6-3t
- Visual grading:
  - deriving strength properties for small clear wood, 6-5 to 6-6, 6-6fig
  - deriving modulus of elasticity for small clear wood, 6-6, 6-7fig
  - in-grade procedures, 6-6 to 6-7
  - sorting criteria, 6-3 to 6-4
- Visual sorting criteria in lumber stress grading:
  - checks and splits, 6-4
  - decay, 6-5
  - density, 6-5
  - explanation, 6-3
  - heartwood and sapwood, 6-5
  - knots, 6-4
  - pitch pockets, 6-5
  - shakes, 6-4 to 6-5
  - slope of grain, 6-4
  - wane, 6-5
- Waferboard, obsolescence, 10-5
- Waika. *See* Manni
- Walele. *See* Ilomba
- Wallaba:
  - characteristics, 1-33
  - decay resistance, 3-18t
  - ease of bonding, 9-8t
  - locality of growth, 1-32 to 1-33
  - machinability, 1-33
  - mechanical properties, 4-19t, 4-23t
  - resistance to insects, 1-33
  - shrinkage values, 3-10t
  - uses, 1-33
- Walnut, black:
  - availability at retail yards, 5-16
  - characteristics, 1-9
  - characteristics for painting, 15-3t
  - color and figure, 3-4t
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - elastic ratio, 4-2t
  - kiln drying schedule, 12-11t
  - locality of growth, 1-9
  - moisture content, 3-6t
  - nomenclature, 5-5t
  - Poisson ratio, 4-3t
  - shock resistance, 1-9
  - shrinkage values, 3-9t
  - size of pores, 15-31t
  - strength properties, 4-6t, 4-11t
  - uses, 1-1, 1-9
  - workability, 1-9
- Wane in lumber stress grading, 6-5
- Wapa. *See* Wallaba
- Warp:
  - and finishing, 15-13
  - and weathering, 15-7
  - during drying, 12-7
- Waterborne preservatives. *See* Preservatives, waterborne
- Waterponding, effect on bending stress, 8-7
- Water repellants (*See also* water repellent preservative):
  - application and maintenance, 15-14t, 15-20
  - discussed, 15-10
  - moisture-excluding coatings, different from, 15-11
  - used as a finish, 15-18
- Water-repellant preservatives:
  - application and maintenance, 15-14t, 15-19 to 15-20
  - as a first step in finishing, 15-11, 15-20
  - backpriming, 15-23 to 15-24
  - caution in use, 15-18
  - effect of use on window sash and frame, 15-17fig
  - on wood exposed to marine environments, 15-22
  - paintability, 15-6, 15-16
  - refinishing, 15-23
  - used as a finish, 15-16
  - use on edges of reconstituted wood products, 15-6
  - use on end grain, 15-13
- Wax in composite products, 10-4
- Weathering of wood:
  - effect on extractives, 15-6
  - effect on lignin, 15-7
  - effect on paint adhesion, 15-8 to 15-9
  - and mill glaze, 15-25
  - artist's rendition of, 15-7fig
  - as a natural finish, 15-16
  - erosion rates for hardwoods and softwoods, 15-8t
  - in marine environments, 15-22
  - of finishes, 15-9
  - process, 15-6
  - warp, 15-8
- Web stresses, glued members, 11-13
- Western redcedar, used for poles, 18-2, 18-4t, 18-6
- White-cedar:
  - Atlantic. *See* Cedar, Atlantic white
  - Northern. *See* Cedar, Northern white
- White rot, 13-5
- Willow, black:
  - characteristics, 1-9
  - decay resistance, 3-18t
  - dimensional change coefficient, 12-16t
  - ease of bonding, 9-8t
  - locality of growth, 1-9
  - machining and related properties, 3-16t
  - nomenclature, 5-5t
  - penetration, 14-16t
  - shock resistance, 1-9
  - shrinkage values, 3-9t
  - strength properties, 4-6t, 4-11t
  - toughness values, 4-24t
  - uses, 1-9
- Withdrawal resistance:
  - of lag screws, 7-11 to 7-14
  - of nails, 7-2 to 7-5
  - of wood screws, 7-9 to 7-11

Wood buildings, consideration:  
moisture control:  
    effect on heat flow, 16-12  
    mold, mildew, mites and health,  
    16-12  
    moisture control strategies, 16-  
    12 to 16-13  
    paint failure and appearance  
    problems, 16-12  
    structural failure, 16-12  
sound control, 16-13, 16-13t  
structural performance and  
servicability, 16-10 to 16-11  
thermal insulation and air  
infiltration control, 16-11 to 16-12  
Wood cells. *See* cells of wood  
Wood cleaners and brighteners, 15-33  
Wood Components Manufacturers  
Association, 5-2, 5-4t  
Wood fillers, 15-30, 15-31  
Wood identification, 2-4  
Wood screws. *See* screws, wood  
Work to maximum load in bending, 4-3  
Working qualities of wood, 3-15

Yang. *See* Keruing

Yellow-cedar. *See* Cedar, yellow

Yellow-poplar:

    characteristics, 1-9  
    characteristics for painting, 15-3t  
    charring rate data, 17-11t  
    color and figure, 3-4t  
    connector joint strength, 7-21t  
    decay resistance, 3-18t  
    dimensional change coefficient, 12-  
    16t  
    ease of bonding, 9-8t  
    elastic ratio, 4-2t  
    erosion of planed surfaces, 15-8t  
    flame spread index, 17-3t  
    fracture toughness, 4-26t  
    locality of growth, 1-9  
    machining and related properties, 3-  
    16t  
    moisture content, 3-6t  
    penetration, 14-16t  
    plywood stiffness and strength, 10-  
    11t  
    Poisson ratio, 4-3t  
    shock resistance, 1-9  
    shrinkage values, 3-9t  
    size of pores, 15-31t  
    strength properties, 4-6t, 4-11t  
    thermal conductivity, 3-19t  
    toughness values, 4-24t  
    uses, 1-9

Zinc-coated nails, 7-4,

Zinc naphthenate:

    effectiveness, 14-8  
    inappropriate uses, 14-8  
    properties, 14-8