

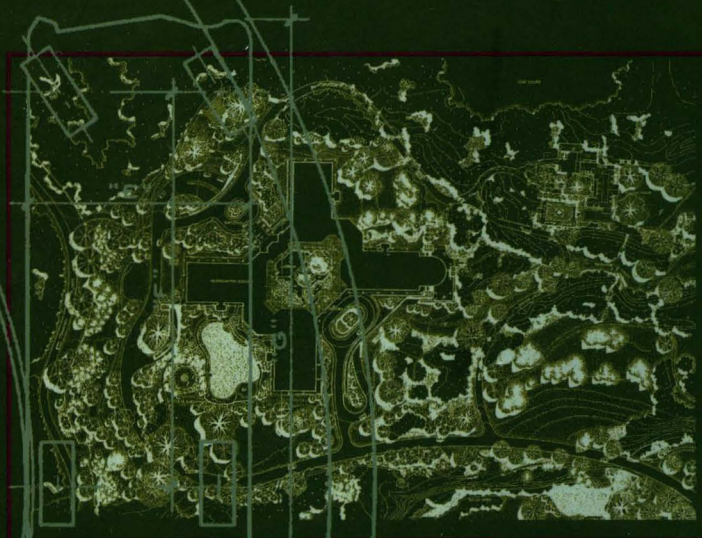
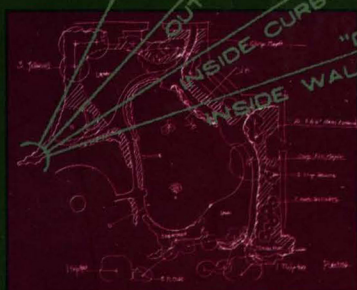
TIME-SAVER

STANDARDS

SECTION-3

**FOR
LANDSCAPE
ARCHITECTURE**

second edition



**CHARLES W. HARRIS
NICHOLAS T. DINES**

**EXTENDED LENGTH VEHICLES
DIMENSIONS AND TURNING RADII**

MAKE OF CAR	"A"	"B"	"C"	"D"	"E"	"F"	"G"
Cadillac	30'-0"	28'-6"	18'-11 1/2"	18'-9"	6'-11"	13'-0"	20'-10 1/4"
Dodge	23'-4"	21'-9"	13'-4 1/2"	12'-10 3/4"	6'-8"		18'-4"

TIME-SAVER STANDARDS

FOR LANDSCAPE ARCHITECTURE:

DESIGN AND CONSTRUCTION DATA

■ **Second Edition** ■



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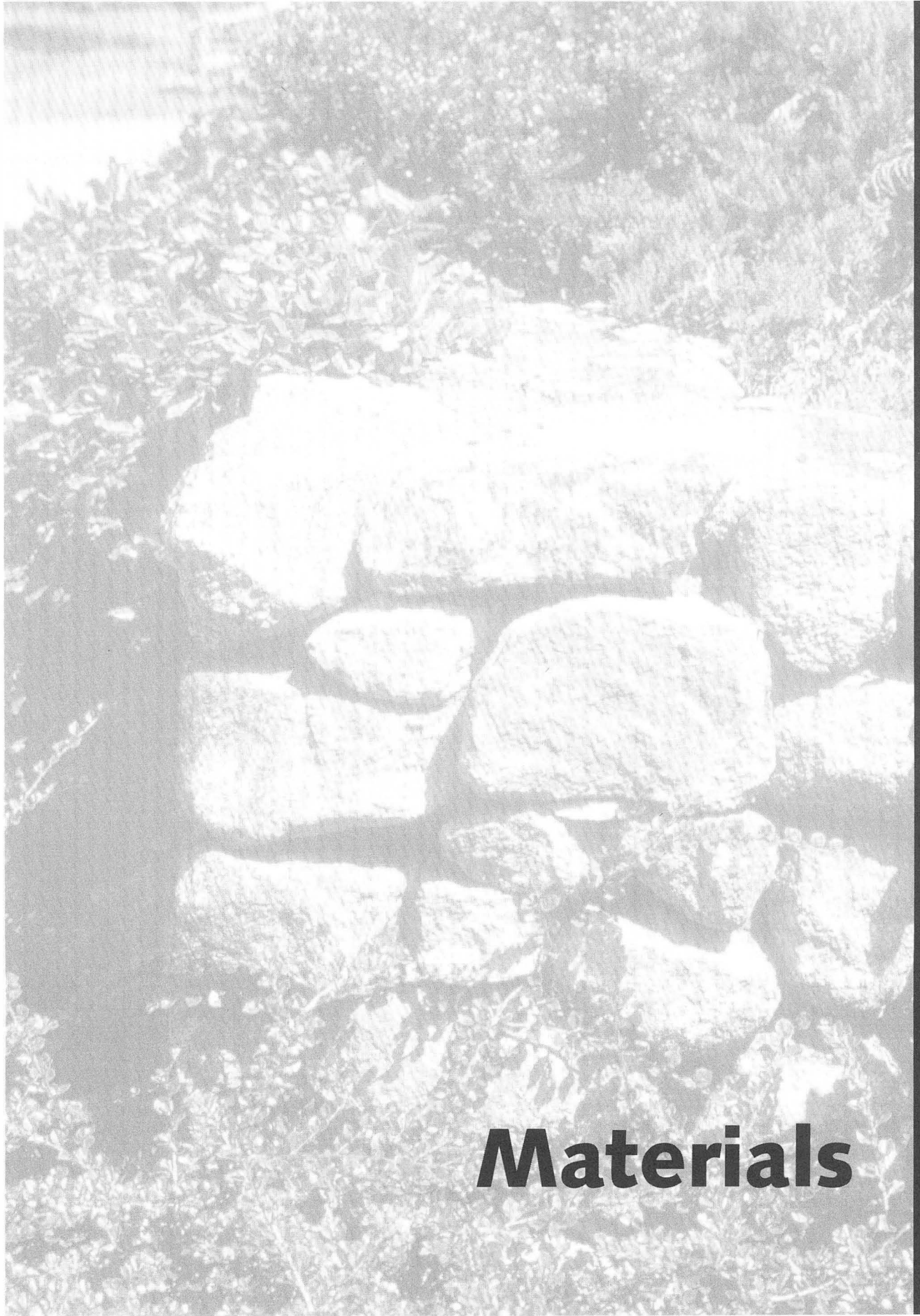
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Materials

DIVISION **800**

Soils and Aggregates

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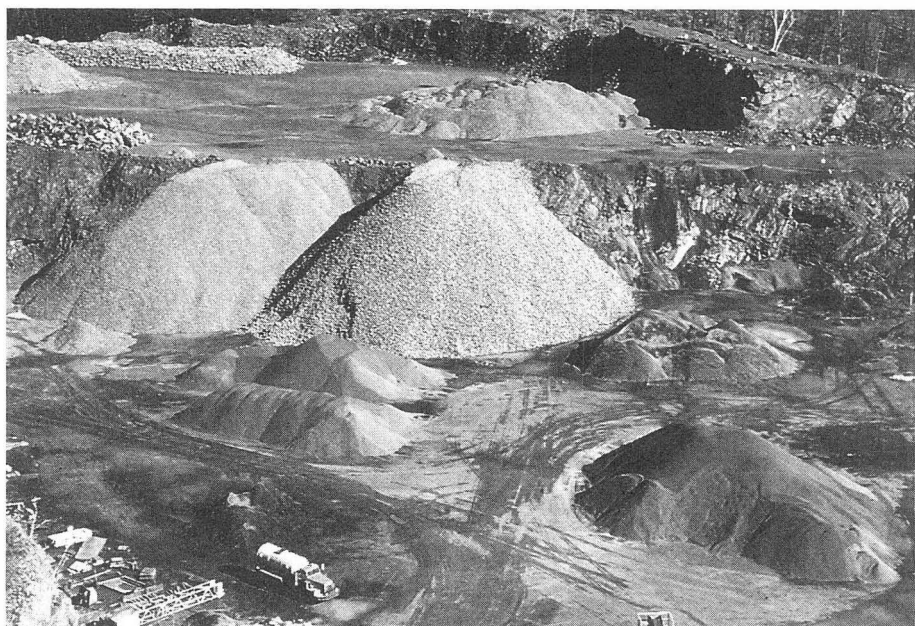
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CONTENTS

1.0 Introduction

1.1 Soils

1.2 Aggregates

2.0 Soil Classification Systems

2.1 Soil Profile

2.2 Classification of Soil by Origin

2.3 USDA System

2.4 AASHTO System

2.5 Unified System

3.0 Soil Properties

3.1 Physical properties

3.2 Properties Related to Site Engineering & Construction

3.3 Properties Related to Horticultural Applications

4.0 Aggregates

4.1 Relevant Properties of Aggregates

4.2 Common Applications

Agencies and Organizations

References

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CONTENTS

1.0 Introduction

- 1.1 General
- 1.2 Manufacturing Standards

2.0 Asphalt Cement or Binder

- 2.1 Properties of Asphalt Cement or Binder
- 2.2 Selection Criteria for Asphalt Cements or Binder

3.0 Aggregate for Asphalt Pavements

- 3.1 Sizes of Aggregate for Asphalt Pavements
- 3.2 Aggregate Gradations
- 3.3 Recycled Glass as Aggregate
- 3.4 Selection Criteria for Aggregates

4.0 Asphalt Paving Mixtures

- 4.1 Asphalt Concrete

4.2 Surface Treatments

- 4.3 Asphalt Paving Blocks
- 4.4 Asphalt-Treated Granular Base Courses
- 4.5 Less-Common Asphalt Mixtures

5.0 Principles of Asphalt Pavement Design

- 5.1 Typical Pavement Sections
- 5.2 Pavement Functions
- 5.3 Asphalt Pavement Construction
 - Type of Asphalt Pavement Construction
 - Expected Pavement Life

6.0 Thickness Design of Asphalt Pavements

- 6.1 Roads
 - Design Factors
 - Thickness Design Procedure

Design Examples

- 6.2 Driveways and Parking Areas
- 6.3 Bicycle, Pedestrian, and Golf Cart Paths
- 6.4 Tennis Courts
- 6.5 Playgrounds and Recreational Areas

7.0 Miscellaneous

- 7.1 Asphalt Curbs and Gutters
- 7.2 Asphalt Underlayments
- 7.3 Colored Asphalt Pavements
- 7.4 Recycled Asphalt Granular Base Courses

Agencies and Organizations

References

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CONTENTS

1.0 Introduction

1.1 General

1.2 Properties of Concrete

Strength

Resistance to Freeze, Thaw, and
Deicing Chemicals

Resistance to Abrasion and Wear

Reduction of Water Penetration

Control of Setting Time for Concrete

1.3 Methods of Placement

1.4 Types of Concrete

2.0 Cement

2.1 Properties of Cement

Process of Hydration

Heat of Hydration

2.2 Types of Cement

3.0 Aggregate for Concrete

3.1 Types of Aggregate

3.2 Selection of Aggregate

4.0 Admixtures for Concrete

4.1 Purposes of Admixtures

4.2 Section Criteria for Admixtures

4.3 Types of Admixtures

5.0 Water

5.1 Water Quality

5.2 Water Quantity

6.0 Preparation and Placement of Concrete

6.1 Mixing Testing and Site Preparation for Concrete

Mixing Concrete

Testing Concrete

Site Preparation For Use of Concrete

6.2 Formwork for Concrete

Basic Function

Pattern Making

6.3 Reinforcement of Concrete

Placement of Reinforcement

Types of Reinforcement

6.4 Placing and Consolidating Concrete

6.5 Joints, Locations, and Fillers

Purpose of Joints

Types of Joints

Location of Joints

Joint Fillers

6.6 Finishing Concrete

Surface Finishing

Colored Concrete

Exposed Aggregate Finishes

Special Non-Slip Finishes

Patterned or Stamped Finishes

Finishing Tools

Edging

6.7 Curing

Moisture Control

Temperature Control

6.8 Sealers and Glaziers

6.9 Weathering Indexes in the

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6.10 Restoration and Repair of Concrete

Glossary

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References

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CONTENTS

1.0 Introduction

2.0 Clay Masonry

- 2.1 *General Classification and Properties*
 - Solid Masonry Units (Brick)
 - Properties of Clay Masonry Units

2.2 Brick

- Building Brick
- Facing Brick

2.3 Architectural Terra-Cotta

2.4 Brick Unit Positions

2.5 Jointing

3.0 Concrete Masonry

- 3.1 *General Classification and Properties*
- 3.2 Concrete Brick (Solid)
- 3.3 Concrete Block

3.4 Special Units

3.5 Concrete Pavers

3.6 Jointing

3.7 Typical Uses of Concrete Masonry Units

4.0 Stone Masonry

4.1 *General Classification and Properties*

4.2 Common Types of Stone

4.3 Common Finishes for Stone Masonry Units

4.4 Jointing

4.5 Typical Uses of Stone Masonry Units

5.0 Mortar and Reinforcement

5.1 Mortar

Sand Gradation Limits for Mortar

Plastic Properties

Hardened Properties

Color Additives

5.2 Reinforcement

6.0 Cleaning Masonry

Glossary

Industry Associations and Agencies

References

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CONTENTS

1.0 Introduction

1.1 General

1.2 Important Properties of Wood

Moisture Content

Weight

Strength

Appearance

Insect and Decay Resistance

Weatherability

1.3 Characteristics of Various Softwoods

2.0 Lumber Classification

2.1 Regional Production and Grading

Authorities

2.2 Sawing and Surfacing

Sawing

Surfacing

2.3 Lumber Grading Methods

Visually Graded Lumber

Machine Stress-Rated Lumber

3.0 Standard Lumber Dimensions

3.1 Nominal Sizing

3.2 Yard Lumber Sizes and Grading

3.3 Methods for Specifying Sizes and Quantities of Lumber

4.0 Special Products

4.1 Plywood

Properties

Grades

4.2 Particleboard

4.3 Wood Shingles and Shakes

Shingles

Shakes

4.4 Glue-Laminated Beams

5.0 Protective Treatments

5.1 Types of Preservatives

5.2 Fire Retardants

5.3 Methods of Application

5.4 Selection Criteria

Agencies and Organizations

References

Metals

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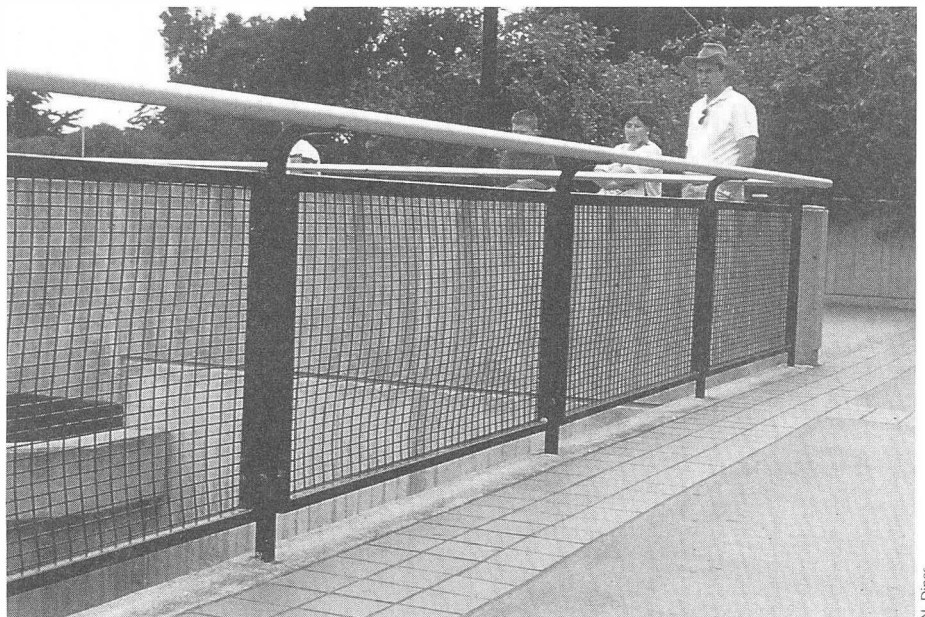
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CONTENTS

1.0 Introduction

1.1 General

1.2 Basic Properties of Metal

Finishes

Manufacturing and Fastening

Environmental Issues

2.0 Metals Used in Construction

2.1 Aluminum

Aluminum Alloys

Finishes

2.2 Copper and Alloys

Copper Alloys

Finishes

2.3 Iron

Cast Iron

Wrought Iron

2.4 Steel

Carbon Steels

High-Strength, Low Alloy Steels

Stainless Steel

2.5 Nickel

3.0 Metal Stock

4.0 Common Metal Products

4.1 Nails, Screws, and Bolts

Nails

Screws and Bolts

4.2 Concrete Reinforcing Bars

4.3 Welded Wire Fabric

4.4 Cable (Braided Wire)

4.5 Chain

5.0 Welded Joints & Symbols

Agencies and Organizations

References

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CONTENTS

1.0 Introduction

2.0 Plastics

2.1 Properties of Plastics

2.2 Basic Types of Plastics

2.3 Plastic Formats

2.4 Plastic Products

3.0 Glass

3.1 Properties of Glass

3.2 Basic Types and Sizes

3.3 Special Types of Glass

3.4 Surface Finishes

Agencies and Organizations

References

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CONTENTS

1.0 Introduction

2.0 Basic Functions of Geotextiles

2.1 Separation

2.2 Reinforcement

2.3 Filtration (Drainage)

2.4 Surface Protection (Erosion Control)

3.0 Geotextile Materials

3.1 Fibers

Basic Types of Fibers

Properties of Fibers

Properties of Plastics

3.2 Basic Types of Fabrics

Woven Fabrics

Nonwoven Fabrics

4.0 Properties of Geotextiles

4.1 Physical Properties

Thickness

Porosity

Roughness

4.2 Mechanical Properties

Elongation

Grab Strength

Burst Pressure

5.0 Criteria for Selection

6.0 Site Applications

6.1 Separation

Roadway or Railroad Bed

Earth Dam Design

Drainage Medium Separation in
Planters

Formwork

6.2 Reinforcement

Paving

Retaining Wall Support

Slope Reinforcement

Roadways

Turf Areas

6.3 Filtration

Permeability

Protection against Piping

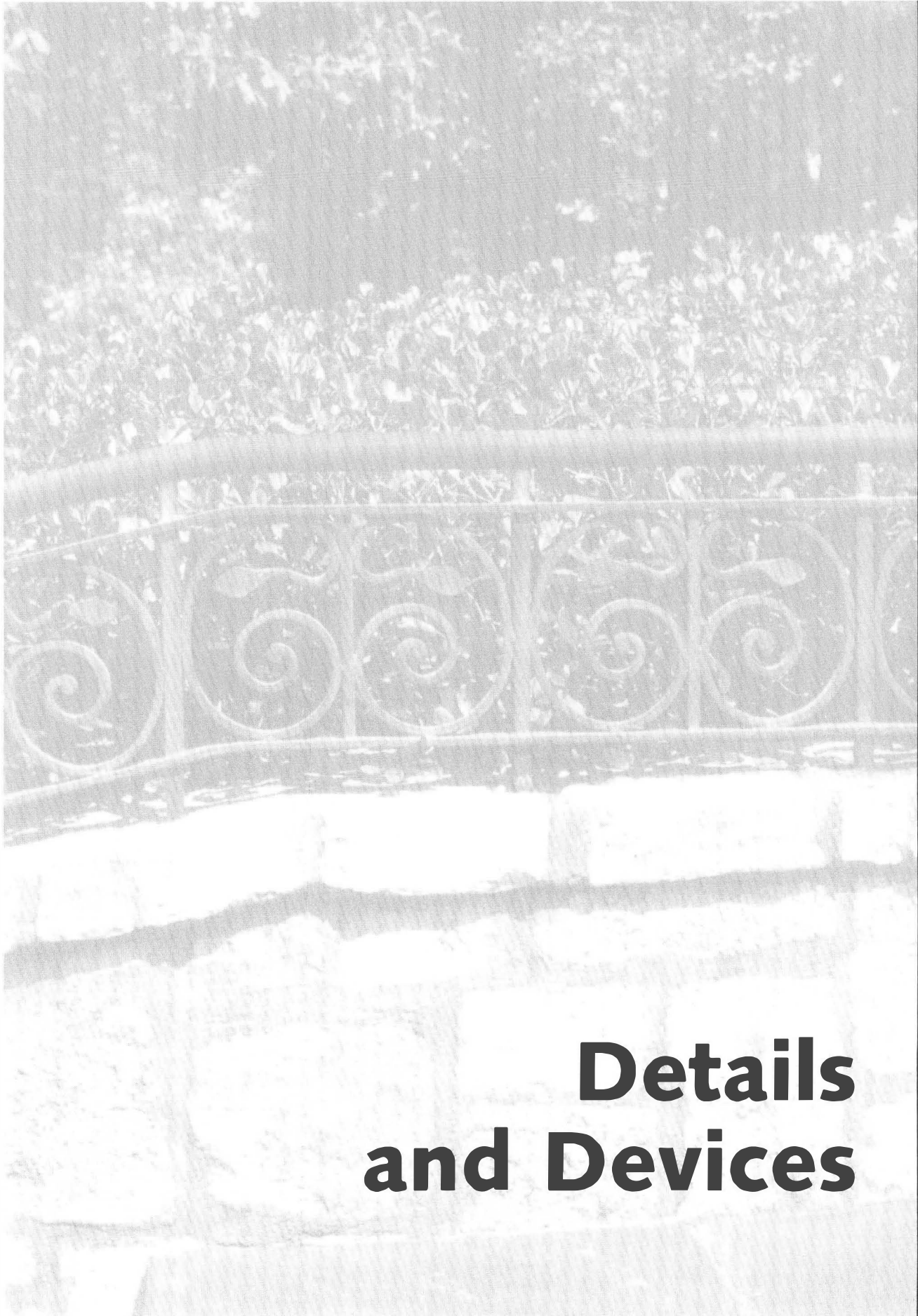
6.4 Erosion Control

Protection against Water Erosion

Protection against Wind Erosion

Sediment Traps

References



DIVISION **900**

Details and Devices

Details and Devices

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CONTENTS

1.0 Introduction	917: Ramps
2.0 Design Criteria	918: Fences
3.0 Unit Cost	919: Walls
4.0 Energy and Resource Conservation	920: Retaining Walls
5.0 Maintenance	921: Seatwalls
910: Paving	922: Lighting
911: Edges	923: Planting
912: Joints	924: Drains
913: Dividers	925: Swales
914: Athletic and Game Surfaces	926: Pools
915: Curbs	927: Ponds
916: Steps	

Edges

1.0 INTRODUCTION

Edge structures used in flexible pavement design serve to contain the pavement and prevent lateral creep. They also may provide additional support to prevent crushing due to loading at the edge. Rigid pavement edges are used primarily as reinforcement against edge loading. In both cases, edging may also serve to define a pavement and to separate two dif-

ferent materials. Selection of proper edging must consider site climate and maintenance practices. Details illustrate flexible and rigid pavement edges.

1.1 General Notes

Wood edges are temporary and require aggregate bases to prolong the life of the wood. Wood stakes securing wood edges will heave in clay soils and frost /thaw

zones. Metal stakes may prevent excessive heaving. Edging between materials must be handicapped accessible in most cases. Concrete edging may act as a grade beam for flexible pavements and as a reinforcement for rigid pavements. Many precast units are available for edging applications. Care should be taken to assess material compatibility with regard to maintenance requirements and durability when joining two materials.

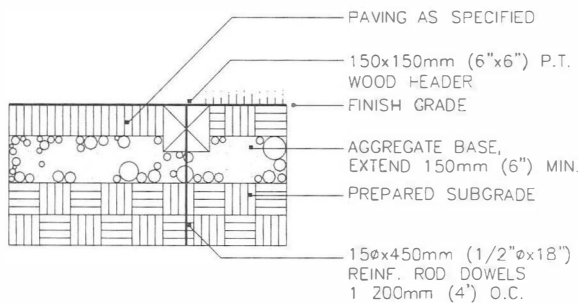


Figure 911-1. Wood edge with steel pins. Extend aggregate beyond edge. Smaller edging may use steel stakes on outer edge.

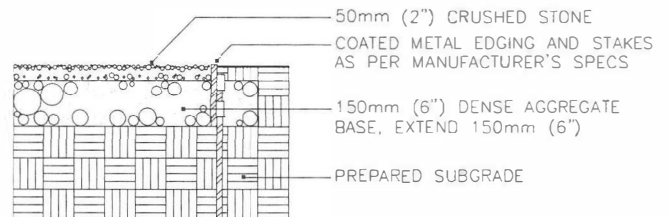


Figure 911-2. Aggregate paving with metal edge. Superior method for edging loose material when inconspicuous edge is required.

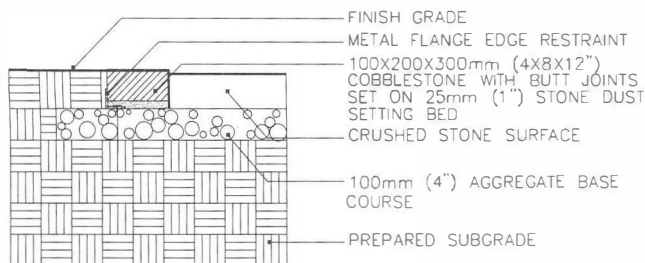


Figure 911-3. Cobblestone path with metal pins. Stone edge rides on top of edging for secure retention. Metal is not visible.

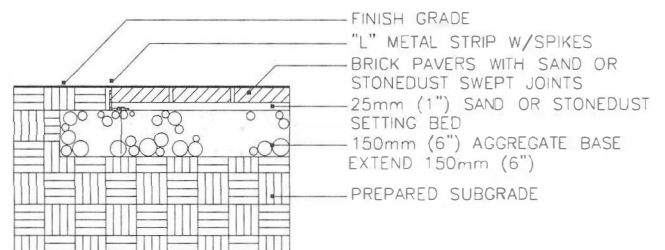


Figure 911-4. Brick pavers with metal "L" edge. Brick setting bed rests on metal flange for even appearance. Good for planting edge.

Joints

1.0 INTRODUCTION

Pavement joints allow for expansion and contraction in rigid pavements or join two different materials, or abutting slabs. The selected details illustrate a range of conditions and materials.

1.1 General Notes

Control joints in concrete are required to provide controlled break points in the event of swelling stresses. Expansion joints are typically required every 7 500 mm (25 ft) to allow for contraction and expansion due to temperature fluctuations. Expansion joints should be sealed in cold climates to prevent saturation and freezing within the joint. All

joints should be periodically cleaned and re-sealed. Unit pavers mortared onto slabs require sealed expansion joints to be aligned with slab joints. Metal pins and sleeves may be used in heavy duty concrete joints with care being taken to thicken the slab around the sleeve and pins for strength. Slab ends may also be keyed using pre-formed expansion joint fillers in standard slab thicknesses.

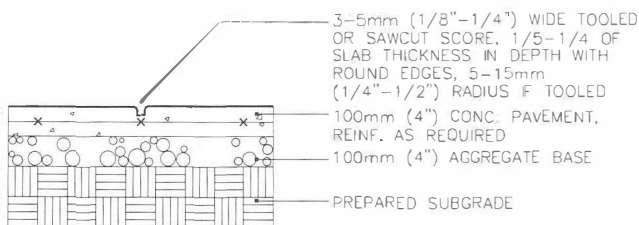


Figure 912-1. Concrete paving control joint. Control joints may be scored in wet concrete, or sawn in cured concrete.

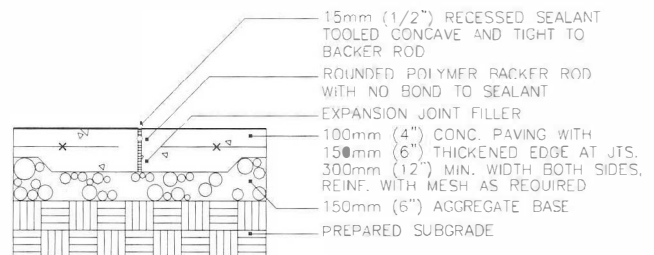


Figure 912-2. Concrete paving expansion joint with thickened edge. Used when vehicular loading may require extra support.

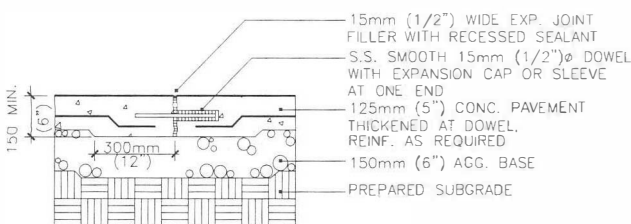


Figure 912-3. Concrete paving expansion joint with dowel. Used to tie one slab to the next and still allow movement. May corrode in cold zones.

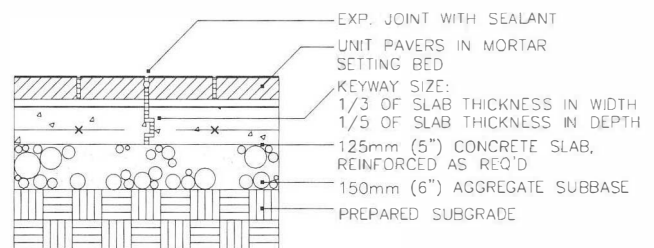


Figure 912-4. Keyed expansion joint in brick paving on concrete base. Formed with pre-molded expansion joint filler. Seal joint from water infiltration.

Dividers

1.0 INTRODUCTION

Dividers to create visual or textural transitions from one paving material to another, or to emphasize a visual band in a large pavement system. Maintenance required for the divider should not adversely affect surrounding materials. Care should be taken to avoid

differential settlement at junctions. The selected details illustrates various material combinations in a number of design circumstances.

1.1 General Notes

Decorative bands in pavements should create smooth joints with surrounding materi-

als and in most instances should be subject to the same accessibility standards as the main pavement. Avoid large differences between divider thickness and adjacent pavement thickness to allow for even subgrade conditions. Rigid bands are typically set before flexible infill pavements.

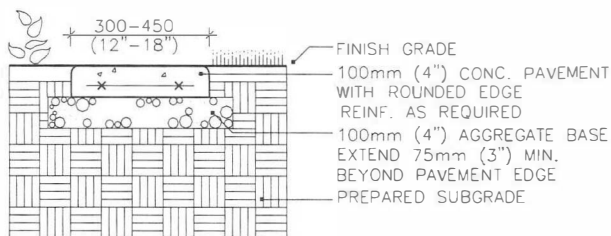


Figure 913-1. Concrete mowing strip. Concrete strips may be tinted or textured to create neat trim for turf and garden areas.

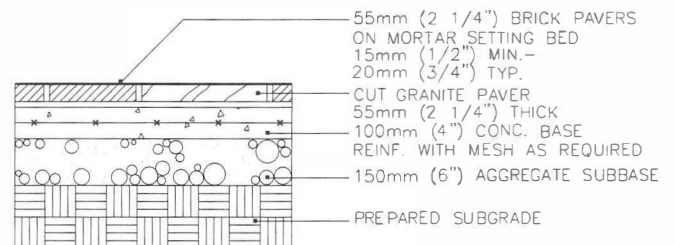


Figure 913-2. Granite band in brick paving. Granite band should be no thicker than the brick paver. If less, shim with mortar.

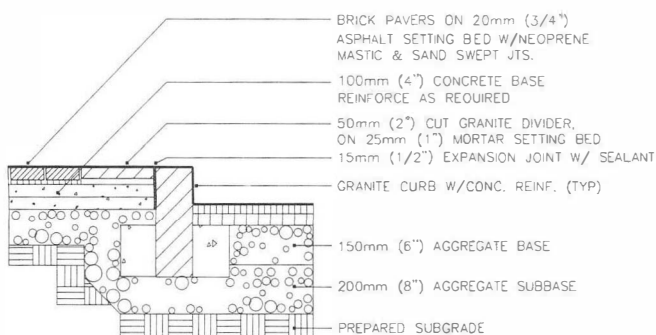


Figure 913-3. Granite band at granite curb. Extend expansion joint to granite band and seal. If thin veneer, shim with mortar.

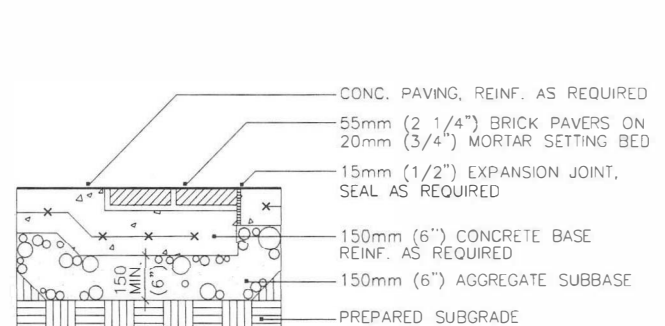


Figure 913-4. Brick band in concrete paving. Slab requires inset to allow for modular brick on mortar bed. Light vehicular loading.

Athletic and Game Surfaces

1.0 INTRODUCTION

Athletic and game surfaces typically include general field play, sanctioned games such as football, baseball, softball, and soccer, as well as specialized games such as lawn bowling, tennis, and croquet. The following details illustrate a sampling of reinforced natural turf and synthetic turf surfaces. All such surfaces require regular maintenance and grooming.

1.1 General Notes

All natural turf requires irrigation, and may be heated in cold climates for professional or collegiate play. Irrigation systems are often set within the growth horizon for direct root feeding. Heating tubes are commonly set below the soil horizon, and within the top layer of the aggregate base. Synthetic turf surfaces require minimal slope for outdoor installations. Modern

practice uses a monolithic resilient porous pad under the synthetic surface to absorb impacts for greater player protection and better internal drainage. The goal of these details is to provide a smooth uniform playing surface capable of supporting light service vehicle loading. It is common practice to carefully screen and amend soil to secure the best combination of structural bearing, infiltration, and capillarity.

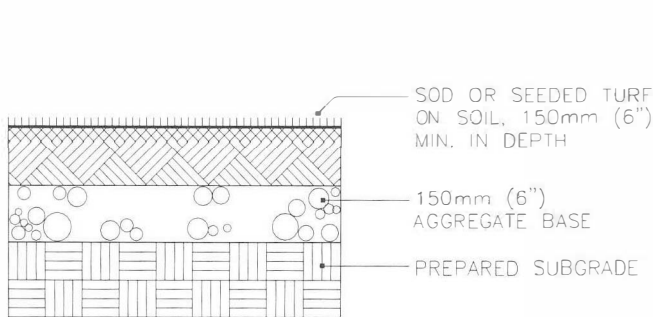


Figure 914-1. Game lawn on aggregate base. Fine aggregate base allows light vehicular loading. A 200 mm (8") soil depth is preferred

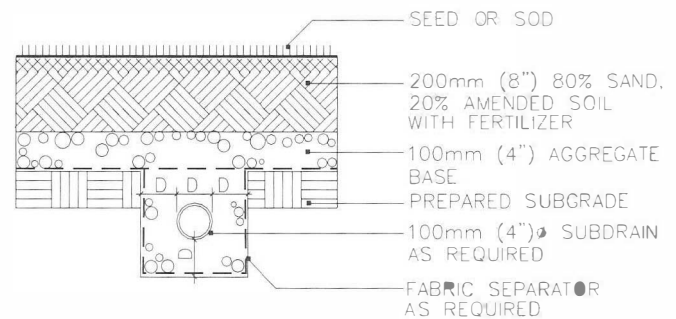


Figure 914-2. Natural turf athletic field. Dense grade aggregate base placed on a fabric separator. Sand amendment for to drainage.

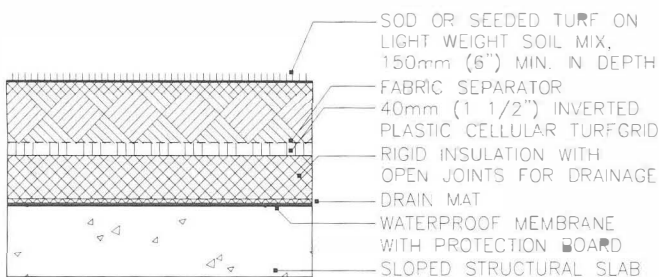


Figure 914-3. Game lawn with inverted cellular turfgrid on structure. A 300 mm (12") lightweight soil depth is preferred. Requires a soil separator as shown.

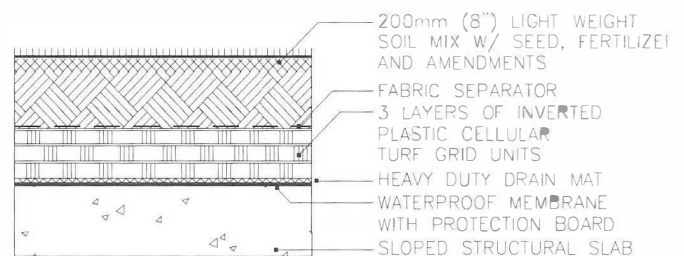


Figure 914-4. Natural turf athletic field- on structure. Fabric separator is required. A 300 mm (12") lightweight soil depth is preferred.

Curbs

1.0 INTRODUCTION

Pavement curbs allow road and path grades to be depressed and to act both as wheel barriers and stormwater runoff containment edges. Curbs are classified as vertical, sloped, mountable, or curb and gutter combination types. They range in height from 100-200 mm (4-8 in). Selected details illustrate a range of materials and curb configurations.

1.1 General Notes

Wood curbs should be used for informal or temporary conditions only. They require extended aggregate bases and periodic pins to secure them to the pavement base. Steel pins resist seasonal heaving and can be re-set easily. Brick and masonry curbs may serve as light duty curbs in pedestrian systems or light residential drives in warm climates. Stone curbs are more resistant to

plowing and general maintenance. Concrete curbs come in standard profiles and may be custom formed to provide ramp access. Slip form curbs in cold climates are often placed using high strength concrete without reinforcing. Curb and gutter configurations allow for free aggregate base drainage.

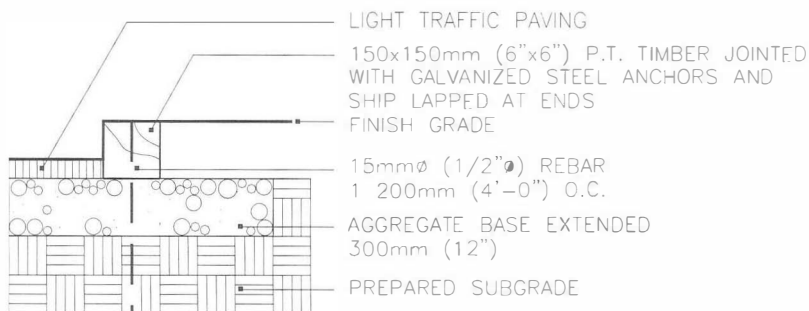


Figure 915-1. Wood curb with rebar pins at notched joint. Informal edge or parking area curb stop. May also be placed on asphalt base course.

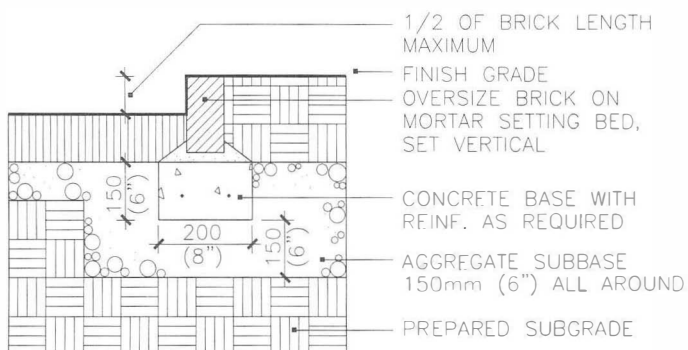


Figure 915-2. Vertical brick curb. Brick has mortar joints and requires concrete grade beam. Not used in cold climates.

Steps

1:0 INTRODUCTION

Steps and ramps (Section 917) allow vertical circulation within the site. It is common practice to eliminate steps where ever possible, especially at entrances to avoid dual ramp and stair construction. Steps should be proportioned to provide graceful exterior scale strides, typically at a flatter angle of attack than interior stairs. Climate and maintenance are important

considerations in site design with regard to placement of steps. The selected details illustrate typical materials and construction techniques used to build steps.

1.1 General Notes

Ramp steps should be spaced in multiples of human strides, typically 675 mm (27 in) riser to riser. Exterior steps have shorter risers than do interior steps, typically 125-150 mm (5-6 in). All treads should slope 2% for

positive drainage. Sheet runoff should not be allowed to cascade over steps from above, especially in cold climates. All expansion joints should be sealed to prevent moisture intrusion. Cheek walls must bear on frost-free soil in cold climates. Rigid pavement abutting top and bottom stairs should sit on footing sills to maintain alignment and finish elevation. Limit stair runs to multiples of eye-level for best human scale.

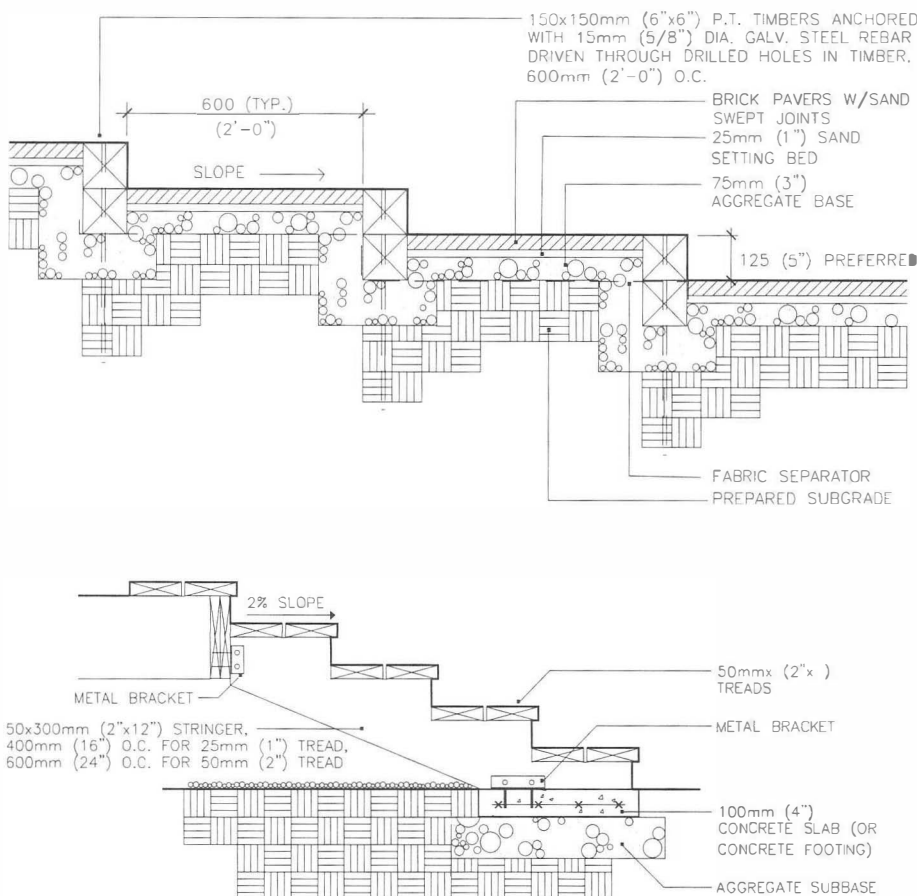


Figure 916-1. Wood/stone ramp steps. Pins and fabric ties stabilize wood risers. Stone may be substituted.

Figure 916-2. Wood steps with notched stringer. Flanges secure stringers. Codes may require closed risers.

Ramps

1.0 INTRODUCTION

Ramps are regulated by statute. The same restrictions that apply to steps apply to ramps (Refer to Section 916). Because of the necessity of entrance ramps, careful consideration should be given to site design and placement. Long ramps with landings should be adequately drained to avoid runoff accumulation at the

lower end. Selected details illustrate various materials and configurations used in ramp construction.

1.1 General Notes

Conservative estimates of structural loading on ramps should be used to anticipate pedestrian crowding and periodic furniture delivery. Typically, commercial loading val-

ues should apply. Ramp surface should provide traction, especially in cold climates. If a unit paver surface is used, an interlocking pattern provides better results due to its resistance to creeping along the slope. A secure base grade beam or other restraining device is recommended. Wood ramps should be secured to concrete footings and threshold blocks for longer service and structural integrity.

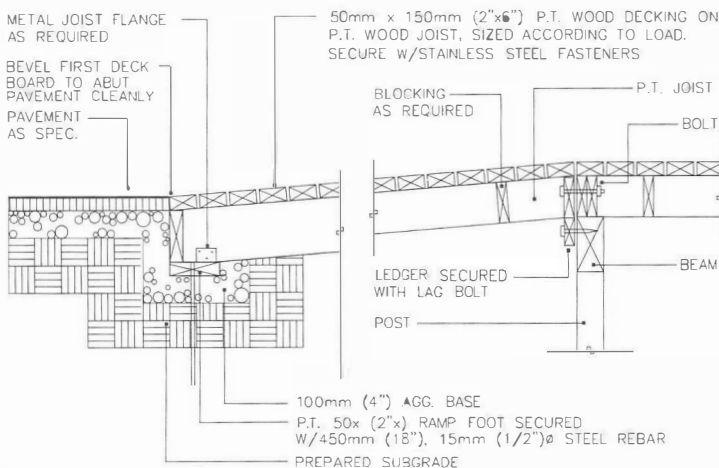


Figure 917-1. Wood ramp with flush pavement. Simple informal treatment in warm climate and well drained soils.

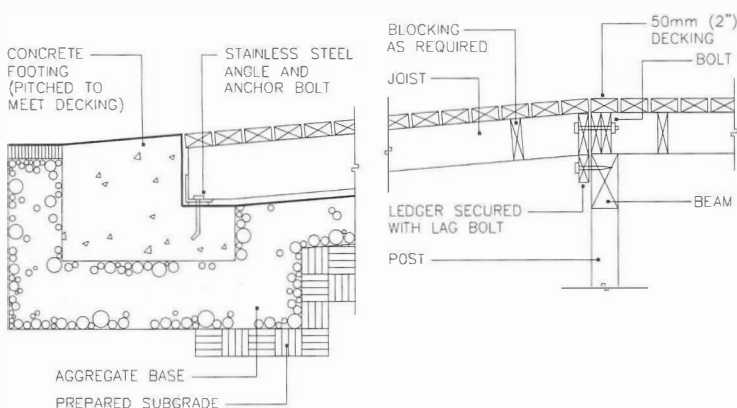


Figure 917-2. Wood pedestrian ramp with concrete apron. Used in more formal settings and in cold climates to insure longer wood service.

Fences

1.0 INTRODUCTION

Fences range in height from 900-2 400 mm (3-8 ft) and are constructed of wood, metal, plastics and combinations of each with masonry piers. Fences are characteristically composed of panels spanning between posts, and often contain gates and other associated structures. Structural design is determined by height and wind loads, and in the case of masonry pier, by soil bearing. The selected details illustrate a range of materials and applications.

1.1 General Notes

Simple wood fences may use direct burial posts which are either pressure treated or decay resistant wood. Long term fencing and commercial applications typically require concrete pier footings with metal attachment devices to secure posts to footings. Steel may be attached to the posts and set in set concrete, or steel may be set in concrete and attached to posts after the concrete cures. Steel may be routed into the wood for a more finished appearance. All exposed metal should be cleaned, primed, and coated prior

to attachment. All wood surfaces should be milled to shed water for longer service. Iron fences attached to masonry piers are typically attached to metal flanges set into the masonry piers during their construction. Footing depths range from 600-900 mm (2-3 ft) depending on wind loads and frost depth..

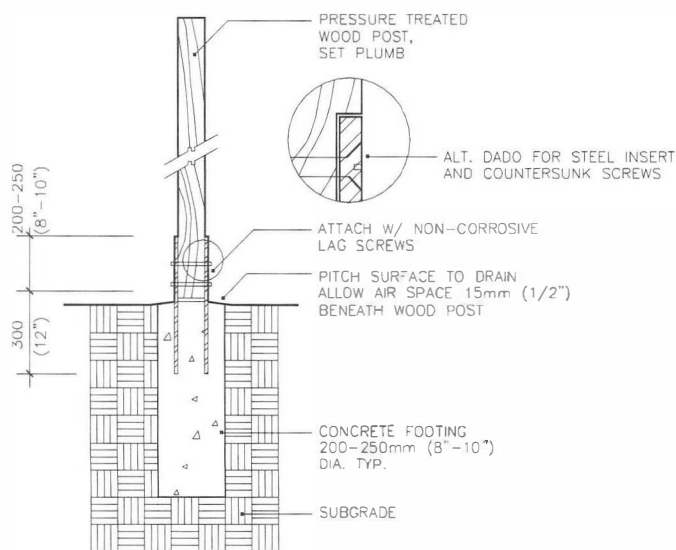


Figure 918-1. Wood fence post-metal anchor in concrete. Preferred method of attachment for long service life and ease of repair.

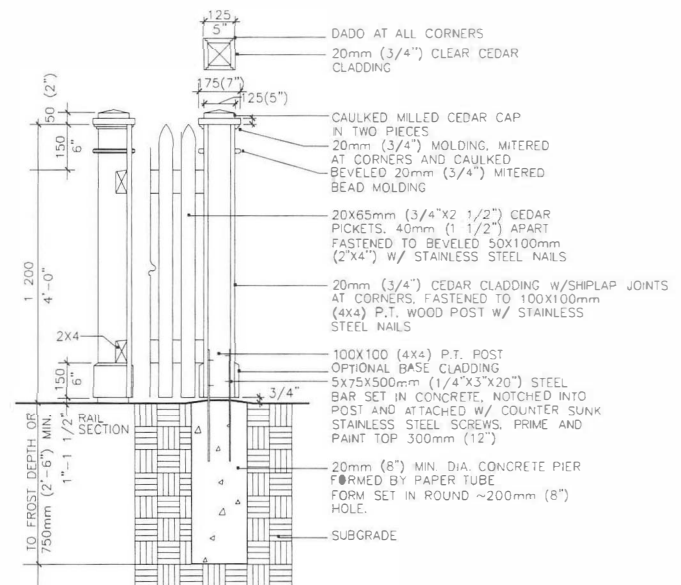


Figure 918-2. Wood clad picket fence with concrete pier. Classic built-up post and wood trim. Requires periodic coating to retain integrity.

Walls

1.0 INTRODUCTION

Free standing barrier walls may vary in height from 900-2 400 mm (3-8 ft). They are typically constructed from masonry, stone, or concrete. Design is governed by porosity and bearing capacity of site soils, and wind load conditions. With the exception of dry laid stone walls, all such barrier walls require footings and tensile reinforcement. Selected details illustrate typical applications of these walls and materials.

1.1 General Notes

Stone walls should be built of stones from the local region. Larger stones are typically laid in bottom courses. Periodic single course tie stones are useful for holding dry laid walls together, especially in cold climates. Mortared stone walls require footing below frost line in cold regions. Rake and tool all joints to avoid moisture penetration, especially at top of wall. Single width cap stone is preferred over small fitted pieces. Cap stone thickness is typically

50-100 mm (2-4 in) minimum. Avoid thin veneer caps. Small concrete walls may not require a spread footing. All walls subject to wind loads typically require a spread footing, with depth calculated for lateral shear, or frost depth (which ever is greater). Masonry walls require steel reinforcing and fully grouted cavities, sealed with a cut cap stone or precast coping sloped to drain.

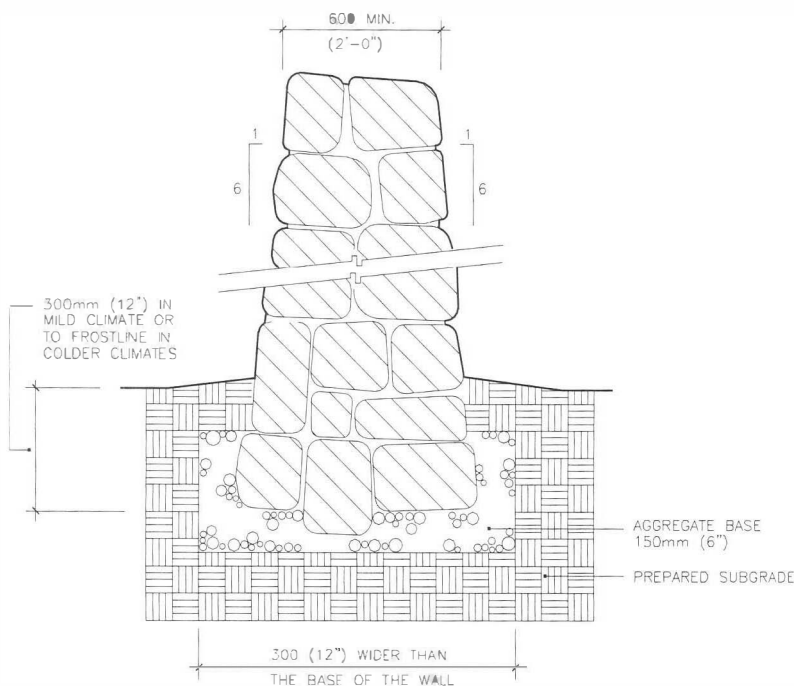


Figure 919-1. Dry laid stone wall. Lay stone on aggregate base below frost in cold climates. Batter both sides.

Retaining Walls

1.0 INTRODUCTION

Retaining walls and embankment stabilizing structures are designed to hold back vertical cuts and steep embankments required by designs in sloping terrain. The principle structural systems employ static equilibrium achieved through gravitational weight (gravity walls and rip-rap), tensile reinforcement and friction (Horizontal fabric and controlled aggregate lifts), and a combination of steel reinforcement and weight (reinforced concrete cantilevered wall). All systems are derived from soil mechanics of specific soil groups. Final proportions and dimensions are determined from such structural soil properties as cubic weight, bearing capacity, shearing or internal friction angle, friction coefficient, and

permeability. Soils are divided into colloidal and granular types for the purpose of design. The selected details in this section display examples of these common structural systems.

1.1 General Notes

Embankments greater than 1:1.5 typically exceed the natural angle of repose of most soils. Bank reinforcement in such circumstances usually consists of aggregates, stone, or masonry units of sufficient weight to counteract the slope's tendency to slip along its shearing plane. The top of slope should be graded to prevent sheet flow runoff from washing across the slope. The toe of slope often requires a grade beam or stone reinforcement to withstand the accu-

mulated embankment surface weight. Vegetative reinforcement may require irrigation. Dry soil plants are recommended. Gravity wall base is typically 0.45 to 0.60 H, depending on soil type. Stone walls typically require a 600 mm (2 ft) top width. Dry stone walls usually require no footings. Mortared or concrete gravity walls require footings below local frost depth. Most codes require at least a 300 mm (12 in) soil cover over top of footing in warm climates. Cantilevered walls and all rigid construction require weep hole and back drains to relieve hydrostatic pressure when applicable. Tops of walls should slope back away from the face to prevent staining. Some conditions may require an impermeable swale at top of wall to prevent infiltration in cold or colloidal soil conditions.

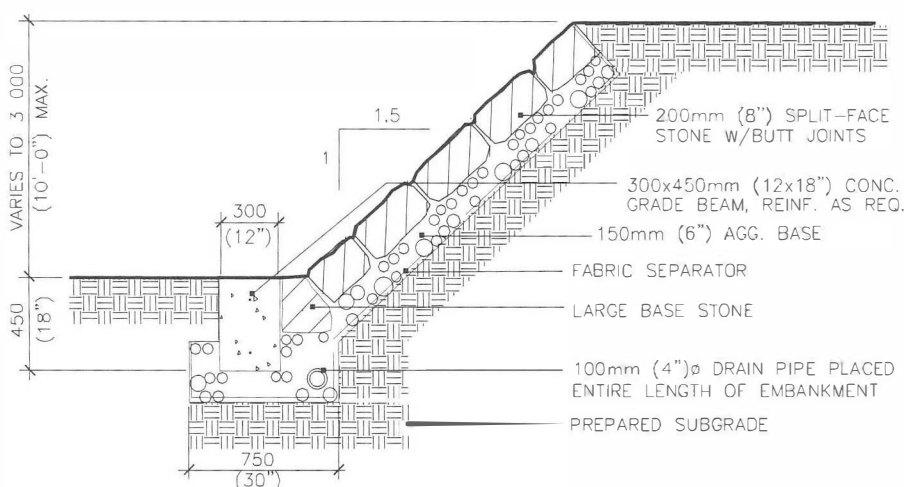


Figure 920-1. Stone retaining embankment. Stone thickness and weight are determined by soil pressure. Non-porous stone preferred.

Seatwalls

1.0 INTRODUCTION

Seatwalls are typically integrated into a design and serve multiple purposes, such as containing plantings, acting as barriers, or providing transitional level changes. To act as seating walls, the height is restricted to a range of 400-600 mm (16-24 in) with 450 mm (18 in) preferred. Material finishes should respect the design vocabulary and the local climate. Seatwalls

are high maintenance elements due to the continuous human contact. Surfaces should be smooth to avoid abrasions and snagging of clothing. Selected details illustrate design expressions using a range of finish materials.

1.1 General Notes

Except for informal garden walls, most seatwalls require footings and careful back-

filling to account for dampness and drainage. Top of wall may range in width from 400-600 mm (16-24 in), but 600 mm (24 in) is more accommodating to a broader population of users. Slope top of wall back from face to drain for better appearance and anatomical fit. Damp proof masonry block walls if containing irrigated planting areas. Provide weep holes or back drains in poorly drained soils.

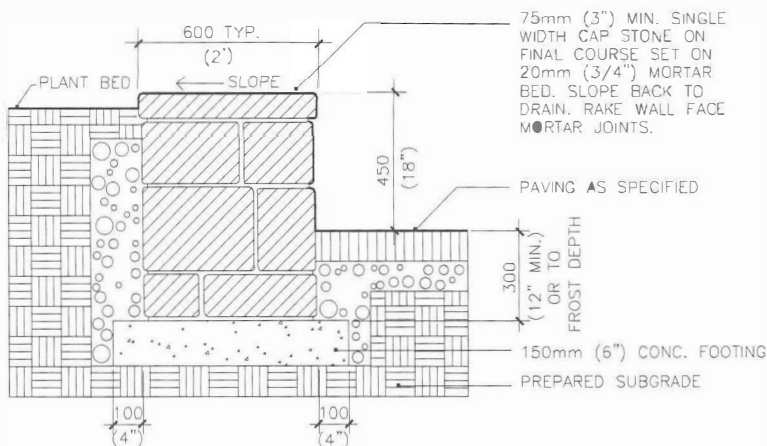


Figure 921-1. Mortared stone seat-wall. May be laid loose with no footing, but use gauged ground top stone with mortar shims.

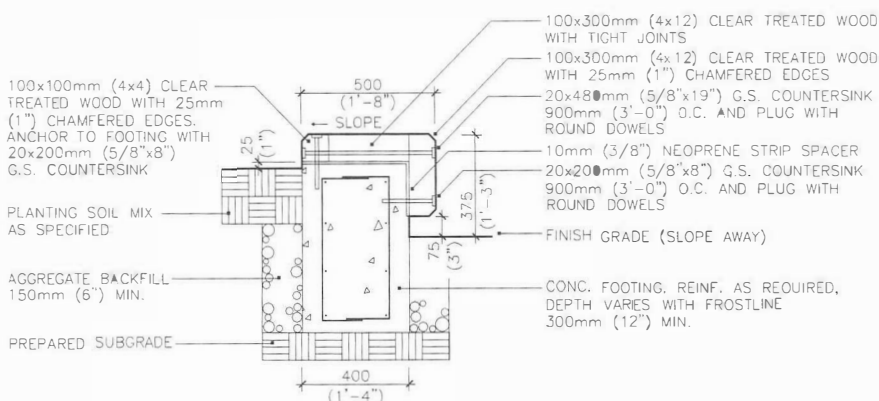


Figure 921-2. Wood veneered seat-wall. Built-up seat using treated planks. Use shims to separate wood from concrete base.

Lighting

1.0 INTRODUCTION

Site lighting includes accent ornamental lighting for plantings and buildings, pedestrian circulation lighting, vehicular lighting, and large area lighting associated with athletic events or major facilities and industrial plants. Site lighting requires organization of fixtures to create the specified coverage and light intensities, and organization of conduits to avoid conflicts with other utility systems. Fixture designs

are specific for glare control and illumination pattern to comply with code restrictions and should be selected accordingly. Low voltage systems should be used whenever possible to reduce energy consumption. The following selected details illustrate examples from these categories.

1.1 General Notes

Small fixtures are typically direct burial systems. Commercial grade fixtures are typically mounted on a concrete pier with cast-

in-place conduit feeds. Most conduits under paved surfaces require at least 600 mm (2 ft) of soil cover. Residential wiring may allow direct burial in non-paved areas. Conduits are recommended for high quality site work. Post and pole piers are typically 10% of the pole height plus 600 mm (2 ft) in depth. Clay soils and windy sites may require deeper and thicker piers. In cold climates, all pier footings are set below frost line to prevent heaving and to maintain plumb alignment.

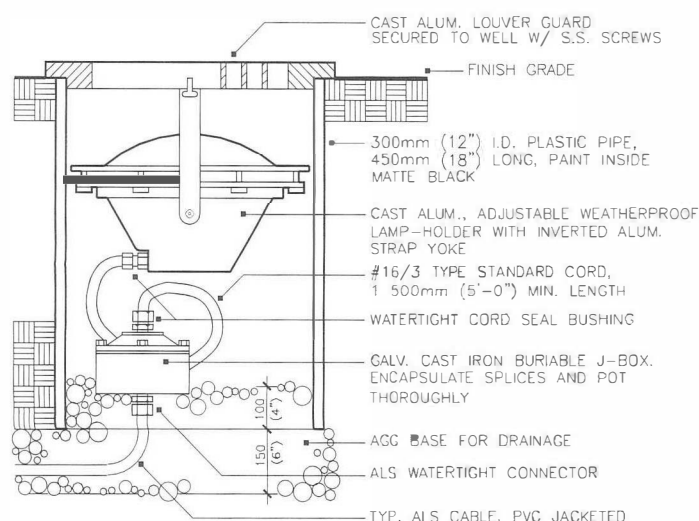


Figure 922-1. Up light-below grade in planting bed.
Pre-formed casings are set on aggregate base to house waterproof junction and fixture.

Planting

1.0 INTRODUCTION

Planting typically encompasses large, medium, and small trees, shrubs, ground covers, grasses and turf, herbaceous perennials, bulbs, corms, and annuals. American practices are guided by the American Nurseryman's Association Standards with regard to plant material sizes and planting procedures. The planting details presented in this section refer to selected large trees and shrubs.

1.1 General Notes

Successful tree planting begins with healthy plant material which has been protected from transportation stress. Tree pits should be at least twice the size of the container or tree ball, but three to four times the diameter is recommended where space permits. Large trees should be placed directly on prepared subgrade at the tree pit center to avoid settlement. Inorganic containers and wrappings should be removed, while the top third of cloth wraps should be cleanly cut and removed before back filling. Backfill soil should be screened and prepared to

specification as per species requirements, and placed in controlled 150 mm (6 in) lifts to avoid air pockets and to anchor the root-ball to prevent lateral shifting. Palms may require water jet saturation for proper seating. It is common practice to place the root crown level with, or slightly above finish grade. In all cases except pavement plantings, a tamped soil saucer rim should be formed around the tree pit surface to retain water. Mulching is recommended for lowering root temperature and preventing evaporation. Staking and guying are only recommended for windy sites. Trunk wrapping is not generally recommended.

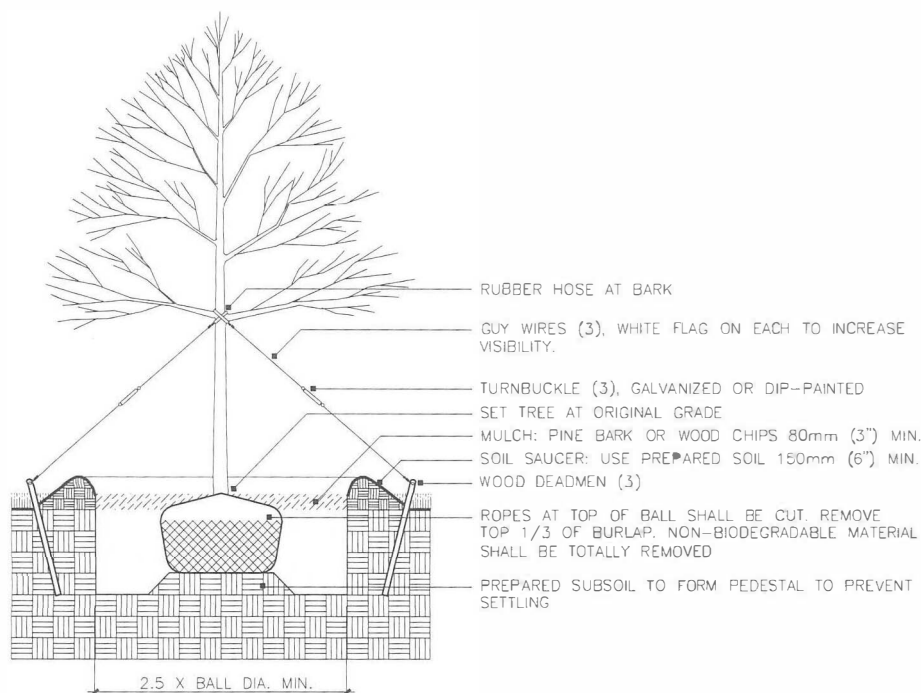


Figure 923-1. Deciduous tree planting.
Large tree staked and guyed for windy site.

Drains

1.0 INTRODUCTION

Site drains receive water at low points for infiltration, diversion, or disposal to site outfalls. Drain inlets should be durable and appropriate for the climate zone. Infiltration devices should only be used in sufficiently porous soils. Long term care requires periodic cleaning and sealing of joints and re-setting of grates and finish pavements or turf grades due to settlement

or silting. Selected details illustrate a range of drain types for various applications.

1.1 General Notes

Locate drains at the edge of use areas. Drain pavements onto turf areas before collecting if possible. Avoid discharging sheet flow runoff from turf areas onto pavements to avoid silting and staining, especially in freeze/thaw regions. Allow 750 mm (2 ft-6 in) soil cover over pipes

subject to vehicular loading. Set inlet footings below frost in cold regions. Plastic grates and frames should be confined to turf areas in cold regions. Warm regions may set drain pipes at shallow depths, but care should be taken to guard against crushing in pedestrian walking zones. When joining a small pipe to a large pipe, the crown of the small pipe can be set no lower than the crown of the large discharge pipe within a basin.

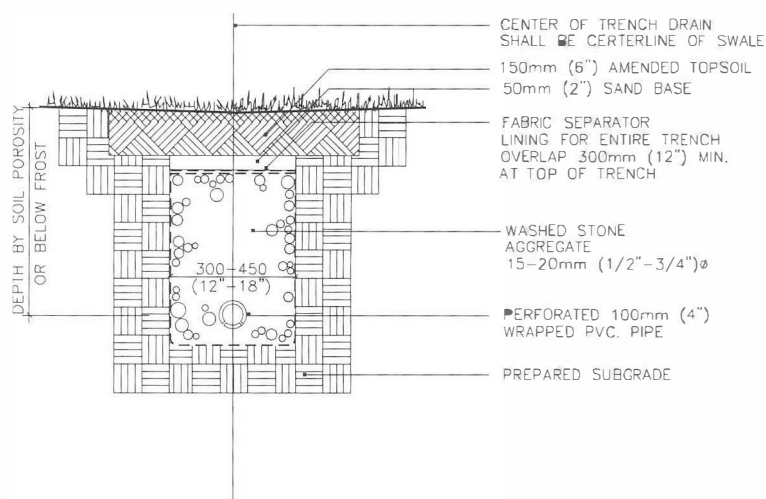


Figure 924-1. Perforated pipe curtain drain. For infiltration and for draining moist soils. Sand filter required for fine soils.

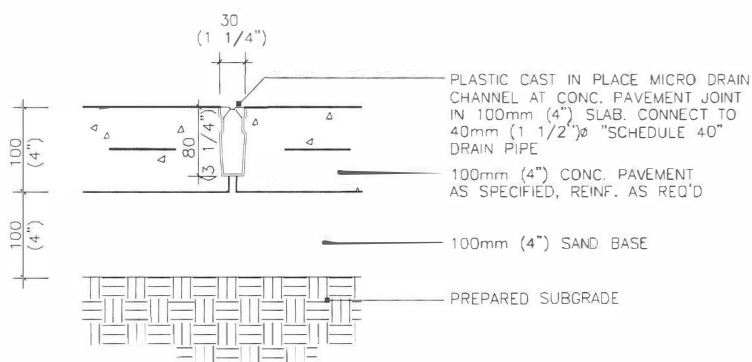


Figure 924-2. Polymer pavement strip drain. Various sizes for cast slab applications available. Warm climates only.

Swales

1.0 INTRODUCTION

Drainage swales vary in design by lining type, cross section shape, volume, and velocity potential. It is a general practice to create broad low velocity swales with high infiltration capacity to reduce over-all runoff volume when ever possible. Some swales serve as channels to deposit large volumes of water into detention or retention ponds and require impermeable or erosion resistant linings. The details selected illustrate heavy duty appli-

cations using various lining and cross section strategies.

1.1 General Notes

A parabolic turf swale is ideal for achieving low velocity moderate volume runoff capacity. Generally, a swale velocity of a given slope, for a given volume may be reduced by broadening its cross section and reducing its full flowing depth. High velocity swales require durable lining to withstand the scouring potential of moving

water. Deposition of fines occur at about .75 m/sec (2.5 ft/sec), and severe scouring of structural linings can occur at 3-4.5 m/sec (10-15 ft/sec). Maintain swale velocity approaching an outfall to prevent silt deposition. Infiltration swales usually require a fabric separator under stone to prevent upward migration of fines into the water stream when at full capacity. Fiber matting, hydro-seeding, or sodding help to hold the swale channel while seeding germinates.

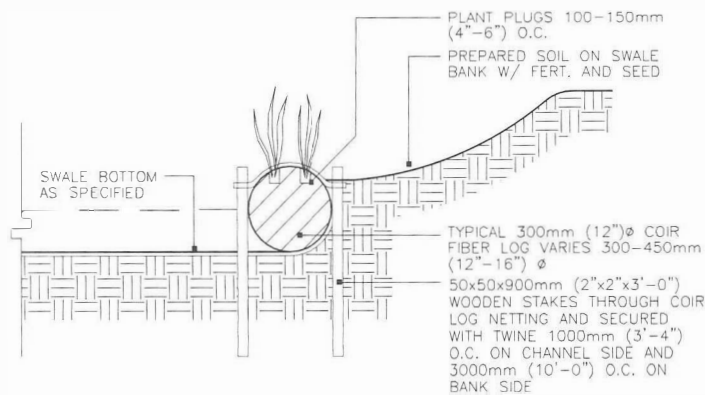


Figure 925-1. Swale with fiber-log channel edge. Swale channel requires permanent pool level to support initial plant growth in fiber log.

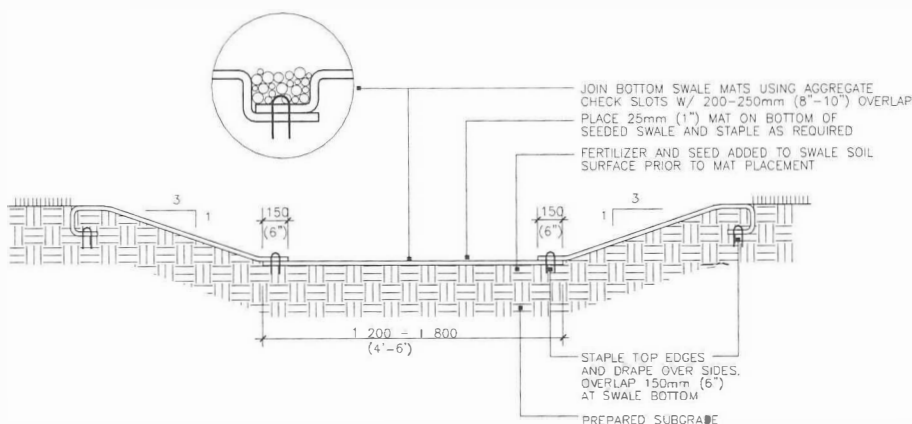


Figure 925-2. Fiber-mat swale reinforcing. Used in highly erodable soils to protect swale banks during seed germination.

Pools

1.0 INTRODUCTION

Pools typically require full filtration and circulatory systems to regulate particulate matter, pH, temperature, algae, and bacterial organisms. Pools may accommodate swimming, may be ornamental, or may support aquatic life. In each case they must be of water proof construction and be adapted to the local climate and soils. All types require provisions for periodic draining, cleaning, and sealing or coating to maintain structural integrity, appearance, and operation.

1.1 General Notes

Flexible liners may be used on-grade for temporary installations using submersible pumps and exposed pipes to protect the liner integrity. Stones placed on liners must rest on a drain mat or sand cushion. Heavy stones may require a sand base beneath the liner as well. Custom built liners may be used in conjunction with rigid structures to allow for circulation intake and drain hardware to be bonded on-site. Rigid construction requires provision for draining of aggregate base to relieve hydro-static soil

pressure, especially during seasonal draw-down or cleaning periods. Footings must extend to undisturbed earth or below frost lines. If placed in segments, all joints must be fully keyed and gasketed. All reinforcing steel must be covered with at least 50 mm (2 in) of concrete. Waterlines are usually vertical surfaces finished with tile or polished stone for ease of cleaning.

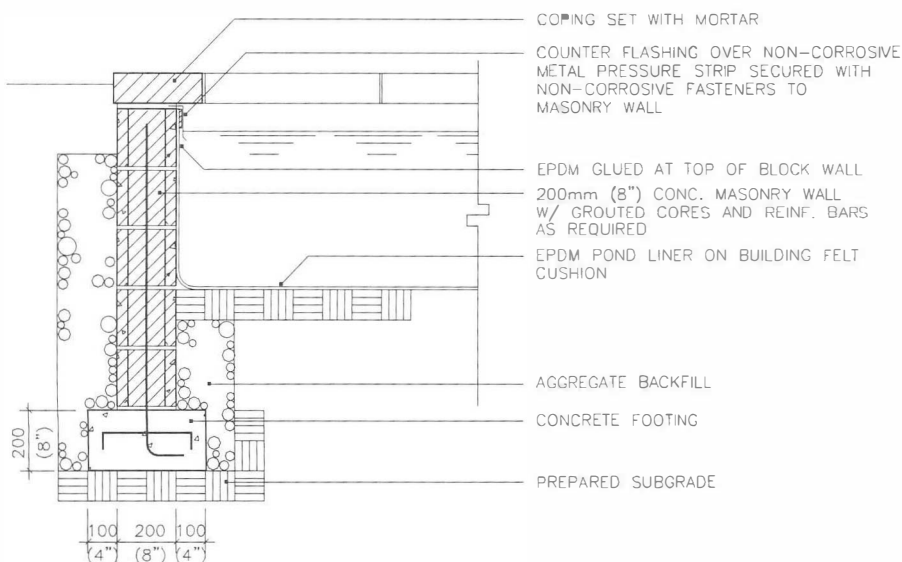


Figure 926-1. Concrete masonry garden pool. Grouted reinforced concrete block walls. Membrane glued to top of wall at pressure bar.

Ponds

1.0 INTRODUCTION

Ponds refer to augmented or constructed wetlands designed to retain, detain, settle, or infiltrate site stormwater runoff. The selected details assembled below illustrate augmented wetland edges, selected liners for both retention and detention, and erosion protection edges for infiltration.

1.1 General Notes

All wetland plants have specific soil, moisture, and depth tolerances. Use local native species for best results. Cut embankments are commonly seeded and covered with protective matting. Planted waterline slopes are graded to a gradual depth of 450 mm (18 in) to receive cattail or other local aquatic plants. Infiltration ponds and clay lined retention ponds, typically use a fabric separator over subgrade before filtering, or

ballast aggregates are placed to reduce turbidity during stormwater infusion. Single ply EPDM or other polymer liners may require a sand cushion prior to placement if subgrade is too coarse. A permanent pool depth of 2 100-3 000 mm (7-10 ft) is required to attain temperature stratification and support biological cycles. All such construction is subject to local and federal permitting processes, which may prescribe regionally specific construction procedures.

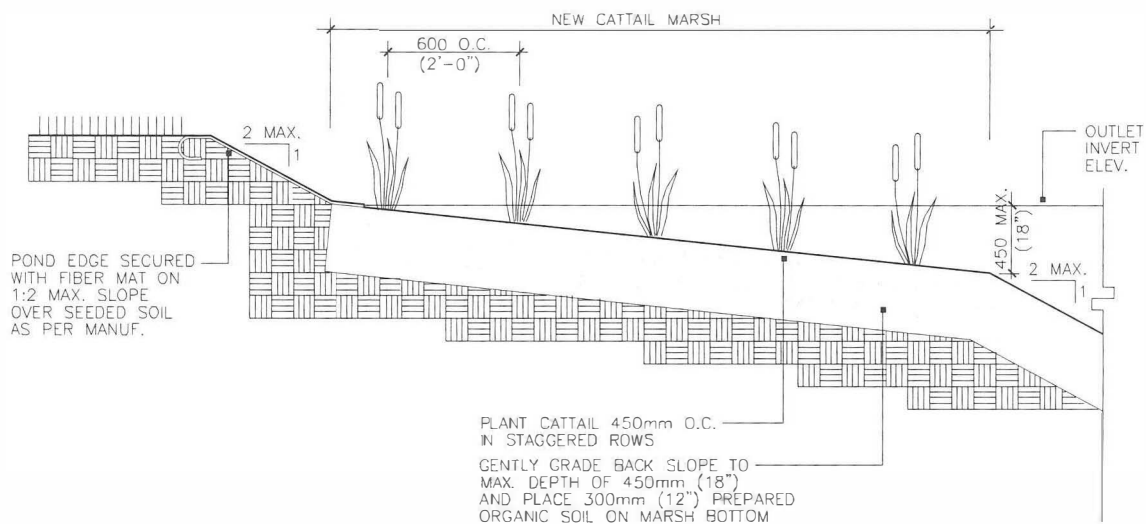


Figure 927-1. Augmented wetland pond edge. Augmented existing wetland edge using prepared planting soil and fiber mat stabilization.

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