PLANT SUPPORT PROTOTYPE

HARKNESS MEMORIAL QUADRANGLE, KILLINGWORTH COURT, 1940, PHOTO BY CHAMBERLAIN

DRAWING LIST

<table>
<thead>
<tr>
<th>DRAWING NUMBER</th>
<th>DRAWING TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1902</td>
<td>DBVW PROJECT NUMBER</td>
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<td>19050901</td>
<td>FOR REFERENCE ONLY NOT FOR CONSTRUCTION</td>
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</tbody>
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GENERAL NOTES:

1. THE SYSTEMS SHOWN IN THESE DRAWINGS ARE INTENDED TO BE PROTOTYPES FOR INSTALLATION IN STONE, COMPOSITE MASONRY BUILDINGS ON THE YALE CAMPUS. THE INFORMATION SHOWN IS FOR REFERENCE ONLY; THE SYSTEMS HAVE NOT BEEN DESIGNED FOR A SPECIFIC SIZE OR TYPE OF PLANT OR SPECIFIC INSTALLATION LOCATION. THE PROTOTYPES ARE BASED ON THE PARAMETERS NOTED BELOW.

2. ALL COMPONENTS FOR SUPPORT TYPE 1 SHALL BE FABRICATED FROM BRONZE EXTRUSIONS, ASTM B455, ALLOY UNS NO. C38500.

3. ALL COMPONENTS FOR SUPPORT TYPE 2 SHALL BE TYPE 316 STAINLESS STEEL. WIRE ROPE FITTINGS SHALL HAVE THE CAPABILITY TO SUSTAIN, WITHOUT FAILURE, A LOAD EQUAL TO THE MINIMUM BREAKING STRENGTH OF WIRE ROPE WITH WHICH THEY ARE USED.

4. TYPE 1 (BRONZE ROD) IS INTENDED FOR VERTICAL AND HORIZONTAL INSTALLATION.

5. TYPE 2 (STAINLESS STEEL CABLE) SHALL BE USED FOR VERTICAL INSTALLATION ONLY.

6. THE SUPPORTS SHALL BE INSTALLED IN STONE MASS MASONRY ASSEMBLIES WITH JOINTS WIDE ENOUGH TO ACCOMMODATE A 1/2-INCH THICK PLATE WITHOUT DAMAGING THE EXISTING MASONRY. IF A THINNER PLATE IS REQUIRED FOR ASSEMBLIES WITH NARROWER JOINTS, THE SYSTEM WILL REQUIRE SOME COMBINATION OF WIDER PLATE, SHORTER OFFSET, AND/OR SHORTER SPAN.

7. THE SUPPORTS ARE DESIGNED FOR INSTALLATION IN STONE MASONRY THAT CAN ADEQUATELY SUPPORT THE WEIGHT OF THE SYSTEM. INSTALLATION IN BRICK, AND SOME SOFTER VARIETIES OF STONE (SUCH AS BROWNSTONE), WILL REQUIRE COMPRESSIVE TESTING OF THE MATERIAL TO CONFIRM WHETHER IT CAN WITHSTAND THE STRESS AT EACH EMBEDDED ANCHOR.

8. THE SUPPORTS SHALL NOT BE INSTALLED IN CAVITY WALL CONSTRUCTION.

9. THE FOLLOWING DESIGN PARAMETERS WERE USED TO CALCULATE THE CAPACITY OF THE PROTOTYPE SYSTEMS (MAXIMUM LOADS - SEE SHEET A003):
   - WEIGHT OF THE PLANTS TO BE SUPPORTED: 5.5 POUNDS PER SQUARE FOOT
   - SPREAD OF PLANTS TO BE SUPPORTED: 3 FEET ON EACH SIDE, OR 6 FEET IN TOTAL WIDTH
   - WEIGHT OF SNOW OR ICE CARRIED BY THE PLANTS: 4 POUNDS PER SQUARE FOOT (IN ADDITION TO THE WEIGHT OF THE PLANT)
   - WIND LOAD CARRIED BY THE SUPPORT SYSTEM: 5 POUNDS PER SQUARE FOOT OF PLANT AREA

OWNER/CLIENT:
YALE UNIVERSITY
LANDSCAPING & GROUNDS MANAGEMENT
2 WHITNEY AVENUE
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STRUCTURAL ENGINEER:
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333 SMITH STREET
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T: 401.751.2460  F: 401.274.7517
PLANT SUPPORT TYPE 1 - VERTICAL INSTALLATION

1/2" = 1'-0"

PLANT SUPPORT TYPE 1 - HORIZONTAL INSTALLATION

1" = 1'-0"

EMBEDDED PLATE ANCHOR, SEE DETAIL 1/A001

EXISTING STONE MASONRY
EXISTING MORTAR JOINT
1" DIAMETER BRONZE ROD THROUGH PIPE, FIX AT LOWER ANCHOR
1/4" FILLET WELD CONTINUOUS AROUND
BRONZE PIPE WELDED TO PLATE, TYP
1/4" FILLET WELD CONTINUOUS AROUND, TYP
1" DIAMETER BRONZE ROD SET INSIDE PIPE, DO NOT FIX AT UPPER ANCHOR
VERTICAL SECTION

1/2" THICK BRONZE PLATE

EXISTING STONE MASONRY
EXISTING MORTAR JOINT
1" DIAMETER BRONZE ROD SET INSIDE PIPE
1/4" FILLET WELD CONTINUOUS AT FULL WIDTH OF TOP AND BOTTOM OF PLATE
3" = 1'-0"

TYPE 1 ANCHOR - HORIZONTAL INSTALLATION

TYPE 1 ANCHOR - VERTICAL INSTALLATION

1/2" THICK BRONZE PLATE

VERTICAL SECTION

PLAN SECTION

PLAN VIEW

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PLANT SUPPORT PROTOTYPE

SUPPORT TYPE 1 - BRONZE ROD

4 PLANT SUPPORT TYPE 1 - VERTICAL INSTALLATION

3 PLANT SUPPORT TYPE 1 - HORIZONTAL INSTALLATION

SEPARATE SUPPORTS ABOVE AND BELOW OFFSET IN WALL, VINE MAY BE TIED TO ROD WITH WIRE OR OTHER NON-STRUCTURAL MEANS TO FACILITATE PLANT GROWTH BETWEEN UPPER AND LOWER SUPPORTS
PLANT SUPPORT TYPE 2 - VERTICAL INSTALLATION ONLY

EXISTING STONE MASONRY WALL, TYP FOR ALL INSTALLATIONS

EXISTING MORTAR JOINT

EMBEDDED PLATE ANCHOR, SEE DETAIL 1/A002

VERTICAL SECTION

EMBEDMENT PROJECTION

4" MIN 6" MAX

EXISTING STONE MASONRY

EXISTING MORTAR JOINT

1/2" THICK STAINLESS STEEL PLATE

1/4" FILLET WELD CONTINUOUS AROUND, TOP AND BOTTOM TAB

5/8" DIAMETER HOLE, TYP

NOTE: WIRE ROPE CONNECTION NOT SHOWN FOR CLARITY

1/2" DIAMETER STAINLESS STEEL SHACKLE THROUGH TAB, TYP

STAINLESS STEEL WIRE ROPE, TYP

STAINLESS STEEL THIMBLE AT LOOP, TYP

1/2" THICK STAINLESS STEEL PLATE, TYP

1/4" FILLET WELD CONTINUOUS AROUND, TOP AND BOTTOM TAB

VERTICAL SECTION

PLAN VIEW

ELEVATION

NOTE: WIRE ROPE CONNECTION NOT SHOWN FOR CLARITY

1/2" = 1'-0"

1" = 1'-0"

3" = 1'-0"

2 PLANT SUPPORT TYPE 2 - VERTICAL INSTALLATION ONLY

1 TYPE 2 ANCHOR - VERTICAL INSTALLATION ONLY

3/4" DIAMETER STAINLESS STEEL WIRE ROPE, TYP

STAINLESS STEEL THIMBLE AT LOOP, TYP

1/2" DIAMETER STAINLESS STEEL SHACKLE THROUGH TAB, TYP

1/2" DIAMETER STAINLESS STEEL WIRE ROPE, TYP

STAINLESS STEEL THIMBLE AT LOOP, TYP

1/2" DIAMETER STAINLESS STEEL SHACKLE THROUGH TAB, TYP

1/2" DIAMETER STAINLESS STEEL WIRE ROPE, TYP

STAINLESS STEEL THIMBLE AT LOOP, TYP

1/2" DIAMETER STAINLESS STEEL SHACKLE THROUGH TAB, TYP

1/2" DIAMETER STAINLESS STEEL WIRE ROPE, TYP

STAINLESS STEEL THIMBLE AT LOOP, TYP

1/2" DIAMETER STAINLESS STEEL SHACKLE THROUGH TAB, TYP

1/2" = 1'-0"

PLANT SUPPORT TYPE 2 - VERTICAL INSTALLATION ONLY

1/2" = 1'-0"
### Plant Support Prototype Calculations

#### Type 1: Bronze Rod (Vertical and Horizontal)

**Design Variables:**
- Contributing Width of Vine Spread: 6.0 ft
- Dead Weight of Vines: 5.5 psf
- Snow/Ice Surcharge on Vines: 4.0 psf
- Wind Load on Vines: 5.0 psf

**Material Properties:**
- Yield Strength of Bronze (Fy): 35.0 ksi
- Elasticity of Bronze (E): 14000 ksi

**Vertical Installations:**
- Vertical Spacing Between Supports: 6.0 ft
- Offset from face of Wall: 6.0 in

**Flat Plate Bracket:**
- Thickness of Plate: 0.500 in
- Width of Plate: 3.000 in
- Moment of Inertia (Ix): 0.031 in^4
- Section Modulus (Sx): 0.125 in^3
- Material Yield Strength (Fy): 35.0 ksi Bronze
- Material Elasticity E: 140000.0 ksi Bronze
- Load on Bracket: 342.0 lbs
- Bending Moment on Bracket: 2052.0 in*lbs Due to Vertical Load
- Stress in Bracket: 16416.0 psi OK
- Allowable Material Stress: 21000.0 psi
- Deflection of Bracket: 0.06 in
- Embedment Depth in Masonry: 4000.0 in
- Stress in Masonry: 256.5 psi

**Horizontal Installations:**
- Horizontal Spacing Between Supports: 4.5 ft
- Offset from face of Wall: 6.0 in

#### Type 2: Stainless Steel Cable (Vertical Only)

**Design Variables:**
- Contributing Width of Vine Spread: 6.0 ft
- Dead Weight of Vines: 5.5 psf
- Snow/Ice Surcharge on Vines: 4.0 psf
- Wind Load on Vines: 5.0 psf

**Material Properties:**
- Yield Strength of Stainless Steel (Fy): 30.0 ksi
- Elasticity of Stainless Steel (E): 280000.0 ksi

**Vertical Installations:**
- Vertical Spacing Between Supports: 6.0 ft
- Offset from face of Wall: 6.0 in

**Flat Plate Bracket:**
- Thickness of Plate: 0.500 in
- Width of Plate: 3.000 in
- Moment of Inertia (Ix): 0.031 in^4
- Section Modulus (Sx): 0.125 in^3
- Material Yield Strength (Fy): 30.0 ksi Stainless
- Material Elasticity E: 280000.0 ksi Stainless
- Load on Bracket: 342.0 lbs
- Bending Moment on Bracket: 2052.0 in*lbs Due to Vertical Load
- Stress in Bracket: 16416.0 psi OK
- Allowable Material Stress: 18000.0 psi
- Deflection of Bracket: 0.03 in
- Embedment Depth in Masonry: 4000.0 in
- Stress in Masonry: 256.5 psi