

## DYWIDAG Strand Anchors Systems





# Contents

---

|  |    |
|--|----|
| Soil and Rock Anchors .....                                | 4  |
| Soil Anchors .....   | 4  |
| Typical Uses for Soil Anchors .....                        | 4  |
| Rock Anchors .....   | 4  |
| Typical Uses for Rock Anchors.....                         | 4  |
| Fields of Applications .....                               | 4  |
| DYWIDAG Permanent (DCP) Strand Anchors .....               | 5  |
| Key Features .....   | 5  |
| Fields of Application.....                                 | 5  |
| DYWIDAG Temporary Strand Anchor.....                       | 5  |
| Key Features .....   | 5  |
| Fields of Application.....                                 | 5  |
| DYWIDAG Strand Anchor Design.....                          | 6  |
| Anchor Capacity .....                                      | 6  |
| Stress Levels.....   | 6  |
| Anchor Length .....  | 6  |
| Literature.....  | 6  |
| DYWIDAG Strand Anchors Properties .....                    | 7  |
| DYWIDAG DCP Strand Anchor and Wedge Plate Dimensions ..... | 7  |
| Anchor Types and Corrosion Protection.....                 | 8  |
| Installation Equipment .....                               | 10 |
| Stressing Equipment.....                                   | 10 |
| Load Monitoring Equipment .....                            | 10 |
| References .....   | 12 |
| DYWIDAG Permanent Strand Anchors .....                     | 12 |
| DYWIDAG Temporary Strand Anchors.....                      | 14 |
| DYWIDAG Tiedown Restressable Strand Anchors .....          | 15 |

## Soil and Rock Anchors

Prestressed rock and soil anchors have become an important tool for the geotechnical or structural design engineer. Their safe and reliable use

in both permanent and temporary applications is accepted throughout the world.

Anchors are most commonly referred to as tiebacks for installation angles of 15°-50° from horizontal or tiedowns (51°-90° installation angle).

## Soil Anchors

Soil anchors are pressure grouted tendons installed in either cohesive or non-cohesive soil or loose rock. The anchors transfer forces into the ground through the prestressing steel and grout body. In the free stressing length the anchor remains free to move.

### Typical Uses for Soil Anchors

- Anchoring of support structures for excavations such as sheet pile walls, soldier piles with lagging, drilled piles, slurry walls, and concrete retaining walls.
- Counteracting uplift forces in structures subjected to buoyancy and lateral loads.
- Stabilization of eccentrically loaded foundations.
- Stabilization of natural or excavated slopes.

## Rock Anchors

Rock anchors are post-tensioned tendons installed in drilled holes for which at least the entire bond length is located in rock. The anchor force is transmitted to the rock by bond between the grout body and the rock. Rock anchors can remain unbonded in the free stressing length allowing the anchor to be checked and re-tensioned at any time. In such cases, adequate

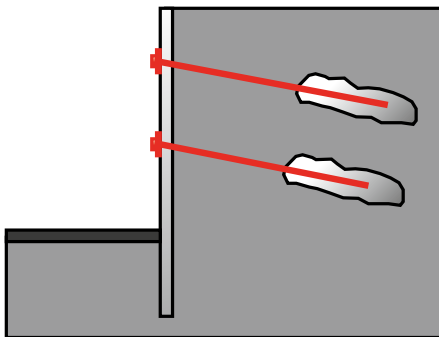
corrosion protection for the stressing anchorage and the free stressing length must be provided.

On the other hand, the free stressing length can also be fully grouted after the anchor has been stressed, in which case future load adjustment is no longer possible.

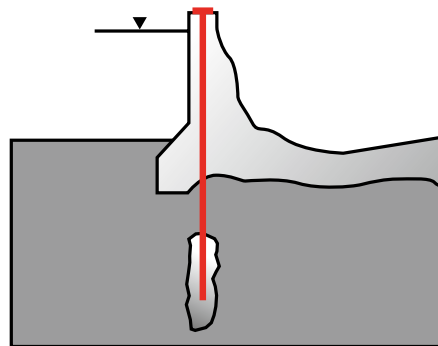
### Typical Uses for Rock Anchors

- Resist external and uplift forces caused by wind or seismic event.
- Tie back retaining walls.
- Stabilize eccentrically located foundations, slopes, rock walls, and cuts.
- Increase the stability of dams or large bridge foundations.

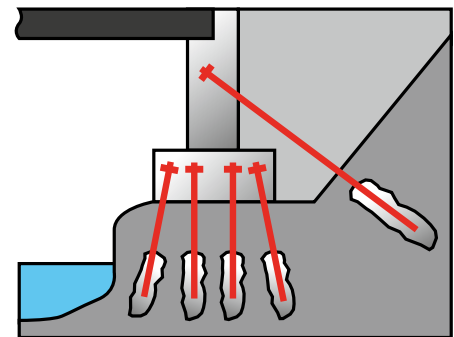
## Fields of Applications



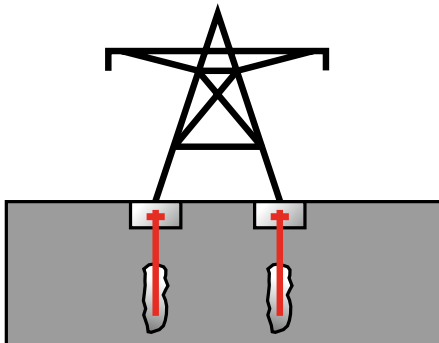
Retaining Walls



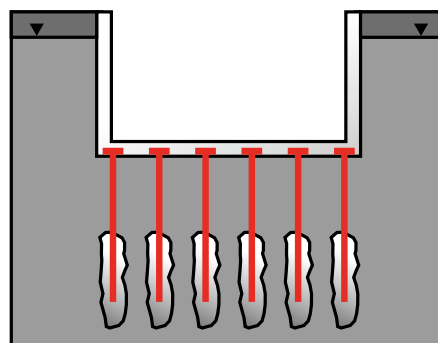
Dam Stabilizations



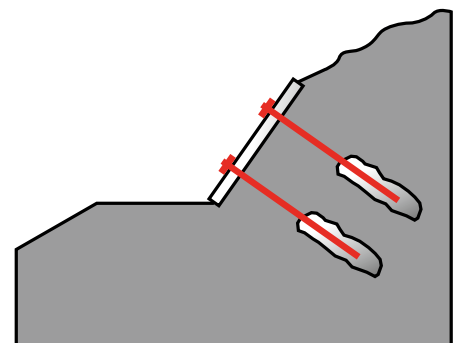
Bridges Structures



Tower Foundations



Foundation Uplift Anchors



Slope Stabilizations

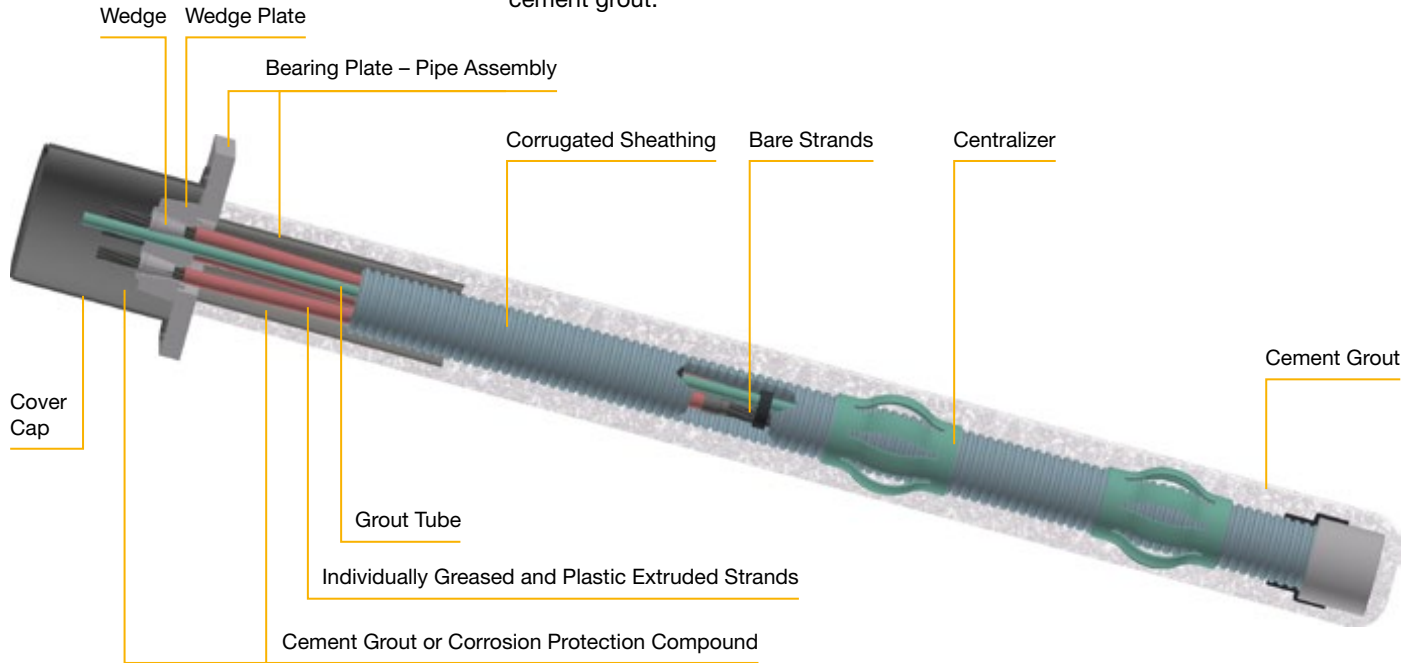
# DYWIDAG Permanent (DCP) Strand Anchors

## Key Features

- Long-lasting system for permanent use
- Variable anchor head and angle compensation designs
- Double Corrosion Protection (DCP) is achieved by protecting the strands with barrier against corrosion. It consists of a corrugated sheathing, a pipe welded to the bearing plate and a cover cap along with encasement in cement grout.

## Fields of Application

- Retaining Walls
- Rock and Slope Stabilization
- Tiedown Anchors
- Excavations



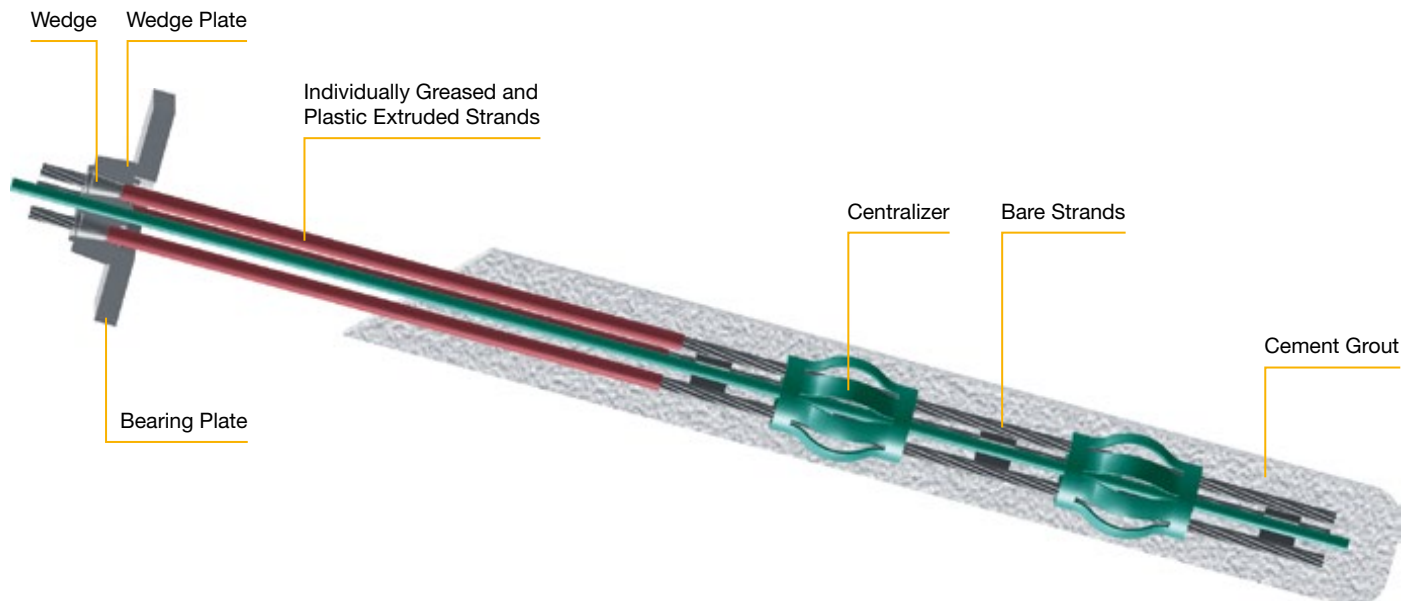
# DYWIDAG Temporary Strand Anchor

## Key Features

- Temporary System for a service life of up to two years
- Variable anchor head and angle compensation designs

## Fields of Application

- Excavations
- Temporary Structures



# DYWIDAG Strand Anchor Design

## Anchor Capacity

Although there is no theoretical limit to the capacity of a multistrand anchor, practical considerations such as drill hole size and the availability of material handling equipment limit the size of an anchor to 91-0.6" (15.2 mm) dia. strands in most cases. Larger anchors can be manufactured, but the practicality and economics of their use should be thoroughly evaluated before they are incorporated into a design.

## Stress Levels

DYWIDAG Strand Anchor Systems may be stressed to the allowable limits of the American Concrete Institute Code No. ACI 318. The maximum jacking stress (test load) for anchors shall not exceed  $0.80 f_{pu}$  of the prestressing steel. The lock off load depends on the specific requirements of the project. Initial load transfer force at lock-off shall not exceed  $0.70 f_{pu}$ .

Wedges shall always be seated at a load that is greater than  $0.50 f_{pu}$ . The final (working) prestress level is dependent on:

- Application
- Installation procedure
- Stressing sequence
- Rigidity of the structural system
- Seating losses

## Anchor Length

No theoretical length limit exists, however, considerations should be made to allow for practical drilling and material handling.

The unbonded length of an anchor is determined by the location of the failure plane and/or the location of competent ground capable of resisting the anchor force. A minimum unbonded length of 15 ft is recommended for strand anchors, so that load losses associated with seating of the wedges will not result in major decrease of prestress force.

The bond length of the anchor depends on:

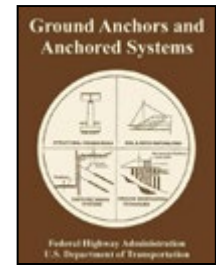
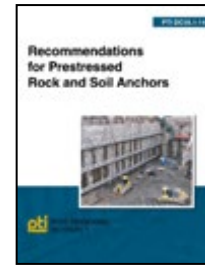
- Capacity of the ground (ground conditions)
- Hole diameter
- Installation practices
- Drilling method
- Grouting method

Post Grouting can significantly improve the holding capacities of anchors in soil and reduce the bond length.

## Literature

Publications below are useful guides for selecting and designing temporary and permanent ground anchor systems.

- Recommendations for Prestressed Rock and Soil Anchors, published by the PTI (Post-Tensioning Institute), [www.post-tensioning.org](http://www.post-tensioning.org)
- Ground Anchors and Anchored Systems, published by the Federal Highway Administration (FHWA), [www.fhwa.dot.gov](http://www.fhwa.dot.gov)



# DYWIDAG Strand Anchors

## DYWIDAG Strand Anchors Properties

DYWIDAG Strand Anchors utilize 0.6" dia. 7-wire, low relaxation 270 ksi Strand conforming to ASTM A416 (bare strand) or ASTM A882 (epoxy coated strand).

| Number of Strands<br>[ea] | Nominal Cross Section Area (A <sub>ps</sub> ) |                    | Ultimate Strength (F <sub>pu</sub> x A <sub>ps</sub> ) |        | Prestressing Force                     |        |  |        |  |       | Nominal Weight (bare steel only) |        |
|---------------------------|---|--------------------|--|--------|--|--------|--|--------|--|-------|----------------------------------|--------|
|                           | [in <sup>2</sup> ]                            | [mm <sup>2</sup> ] | [kips]   | [kN]   | 0.80 F <sub>pu</sub> x A <sub>ps</sub> |        | 0.70 F <sub>pu</sub> x A <sub>ps</sub> |        | 0.60 F <sub>pu</sub> x A <sub>ps</sub> |       | [lbs/ft]                         | [kg/m] |
|                           |   |                    |  |        | [kips]                                 | [kN]   | [kips]                                 | [kN]   | [kips]                                 | [kN]  |                                  |        |
| 1                         | 0.217   | 140                | 58.6   | 261    | 46.9                                   | 208    | 41                                     | 182    | 35.2                                   | 156   | 0.74                             | 1.09   |
| 2                         | 0.434   | 280                | 117.2  | 521    | 93.7                                   | 417    | 82                                     | 365    | 70.3                                   | 313   | 1.48                             | 1.64   |
| 3                         | 0.651   | 420                | 175.8  | 782    | 140.6                                  | 625    | 123                                    | 547    | 105.5                                  | 469   | 2.22                             | 3.27   |
| 4                         | 0.868   | 560                | 234.4  | 1,043  | 187.5                                  | 834    | 164.1                                  | 730    | 140.6                                  | 626   | 2.96                             | 4.46   |
| 5                         | 1.085   | 700                | 293.0  | 1,303  | 234.4                                  | 1,043  | 205.1                                  | 912    | 175.8                                  | 782   | 3.70                             | 5.51   |
| 6                         | 1.302   | 840                | 351.6  | 1,564  | 281.3                                  | 1,251  | 246.1                                  | 1,095  | 210.9                                  | 938   | 4.44                             | 6.55   |
| 7                         | 1.519   | 980                | 410.2  | 1,825  | 328.2                                  | 1,460  | 287.2                                  | 1,277  | 246.2                                  | 1,095 | 5.18                             | 7.74   |
| 8                         | 1.736   | 1,120              | 468.8  | 2,085  | 375.0                                  | 1,668  | 328.1                                  | 1,460  | 281.3                                  | 1,251 | 5.92                             | 8.78   |
| 9                         | 1.953   | 1,260              | 527.4  | 2,346  | 421.9                                  | 1,877  | 369.2                                  | 1,642  | 316.4                                  | 1,408 | 6.66                             | 9.97   |
| 12                        | 2.604   | 1,680              | 703.2  | 3,128  | 562.6                                  | 2,503  | 492.3                                  | 2,190  | 422.0                                  | 1,877 | 8.88                             | 13.24  |
| 15                        | 3.255   | 2,100              | 879.0  | 3,910  | 703.2                                  | 3,128  | 615.3                                  | 2,737  | 527.4                                  | 2,346 | 11.10                            | 16.52  |
| 19                        | 4.123   | 2,660              | 1,113.4  | 4,953  | 890.7                                  | 3,962  | 779.4                                  | 3,467  | 668.0                                  | 2,972 | 14.06                            | 20.98  |
| 27                        | 5.859   | 3,780              | 1,582.2  | 7,038  | 1,265.8                                | 5,631  | 1,107.6                                | 4,927  | 949.4                                  | 4,223 | 19.98                            | 29.76  |
| 37                        | 8.029   | 5,180              | 2,168.2  | 9,645  | 1,734.6                                | 7,716  | 1,517.8                                | 6,751  | 1,301.0                                | 5,787 | 27.38                            | 40.78  |
| 48                        | 10.416  | 6,720              | 2,812.8  | 12,512 | 2,250.2                                | 10,009 | 1,968.9                                | 8,758  | 1,687.7                                | 7,507 | 35.52                            | 52.83  |
| 54                        | 11.718  | 7,560              | 3,164.4  | 14,076 | 2,531.5                                | 11,261 | 2,215.1                                | 9,853  | 1,898.6                                | 8,446 | 39.96                            | 59.38  |
| 61                        | 13.237  | 8,540              | 3,574.6  | 15,901 | 2,859.7                                | 12,721 | 2,502.2                                | 11,131 | 2,144.8                                | 9,540 | 45.14                            | 67.12  |

A<sub>ps</sub> = Area Prestressing Steel  
F<sub>pu</sub> = Minimum Ultimate Strength

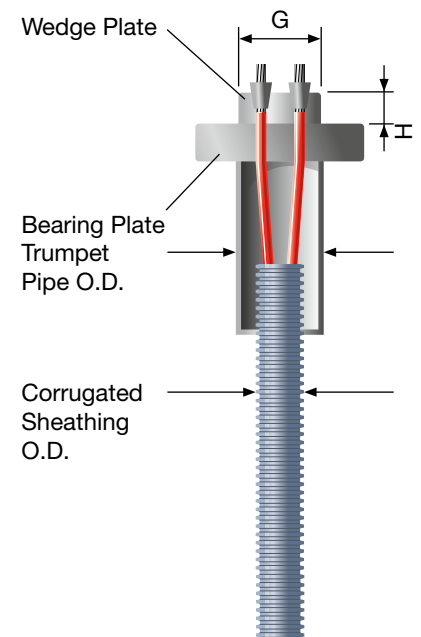
Please consult your local sales office for systems exceeding 61 strands.

## DYWIDAG DCP Strand Anchor and Wedge Plate Dimensions

| Strand Range Inside Sheathing* | HDPE Corrugated Sheathing Outside Diameter |      | Trumpet Pipe Outside Diameter |      | Wedge Plate Dimensions |         |         |        |        |
|--------------------------------|--|------|-------------------------------|------|------------------------|---------|---------|--------|--------|
|                                | Nom. Size [in]                             | [in] | [mm]                          | [in] | [mm]                   | ØG [in] | ØG [mm] | H [in] | H [mm] |
| 1-3                            | 2  | 2.44 | 62                            | 4.5  | 114                    | 4.69    | 119     | 1.8    | 46     |
| 4                              | 2.5  | 2.92 | 74                            | 4.5  | 114                    | 4.69    | 119     | 1.8    | 46     |
| 5-6                            | 2.5  | 2.92 | 74                            | 4.5  | 114                    | 5.61    | 142     | 2.2    | 56     |
| 7                              | 3  | 3.60 | 91                            | 4.5  | 114                    | 5.61    | 142     | 2.2    | 56     |
| 8-9                            | 3  | 3.60 | 91                            | 5.63 | 143                    | 5.75    | 146     | 1.69   | 43     |
| 10-12                          | 4  | 4.60 | 117                           | 5.63 | 143                    | 6.75    | 171     | 1.95   | 50     |
| 13-15                          | 4  | 4.60 | 117                           | 6.63 | 168                    | 7.09    | 180     | 1.97   | 50     |
| 16-17                          | 4  | 4.60 | 117                           | 8.63 | 219                    | 7.87    | 200     | 2.17   | 55     |
| 18-19                          | 5  | 5.85 | 149                           | 8.63 | 219                    | 7.87    | 200     | 2.17   | 55     |
| 20-24                          | 5  | 5.85 | 149                           | 8.63 | 219                    | 9.45    | 240     | 2.95   | 75     |
| 25-27                          | 6  | 6.8  | 173                           | 8.63 | 219                    | 9.45    | 240     | 2.95   | 75     |

\* Based on the use of a single 0.5" ID x 0.75" OD internal grout tube. Bearing plate sizes subject to project specific requirements.

Strand anchors larger than 27 strand systems also available.



# Anchor Types and Corrosion Protection

| Temporary Anchor   | Anchor with Single Corrosion Protection (PTI-Class II)   | Anchor with Double Corrosion Protection (PTI-Class I)   |
|--|--|---|
| <ul style="list-style-type: none"> <li>Grout Protected Bond Length</li> <li>Greased &amp; PE Extruded Unbonded Length</li> </ul>   | <ul style="list-style-type: none"> <li>Grout Protected Bond Length</li> <li>Greased &amp; PE Extruded Unbonded Length</li> </ul>   | <ul style="list-style-type: none"> <li>Grout Filled Bond Length Encapsulated</li> <li>Greased &amp; PE Extruded Unbonded Length</li> </ul>  |
| <p>Labels: Wedge, Wedge Plate, Bearing Plate, Unbonded Length, Greased &amp; PE or PP Extruded Strand in Unbonded Length, Spacers along Bond Length, Bond Length, Bare Strand in Bond Length, Centralizer.</p> | <p>Labels: Cover Cap, Wedge, Wedge Plate, Bearing Plate, Trumpet, Unbonded Length, Greased &amp; PE or PP Extruded Strand in Unbonded Length, Spacers along Bond Length, Bond Length, Bare Strand in Bond Length, Centralizer.</p> | <p>Labels: Cover Cap, Wedge, Wedge Plate, Bearing Plate, Trumpet, Unbonded Length, Greased &amp; PE or PP Extruded Strand in Unbonded Length, Corrugated Sheathing, Spacers along Bond Length, Bond Length, Bare Strand in Bond Length, Centralizer, End Cap.</p> |
| <p><b>Typical Uses</b><br/>Temporary Applications with a service life of <math>\leq 24</math> Month</p>  | <p><b>Typical Uses</b><br/>Anchor in known non-aggressive ground (refer to PTI Recommendations)</p>  | <p><b>Typical Uses</b><br/>Permanent Application where a pre-grouted sheathing is an advantage</p>  |



# Anchor Types and Corrosion Protection

| <b>Anchor with Double Corrosion Protection (PTI-Class I)</b>                                 | <b>Anchor with Epoxy Coated Strand (PTI-Class I)</b>   | <b>Anchor with Epoxy Coated Strand (PTI-Class I)</b>  |
|--|--|---|
| <ul style="list-style-type: none"> <li>Grout Filled Corrugated Sheath Full Length</li> </ul> | <ul style="list-style-type: none"> <li>Two Stage Grouted Hole</li> <li>Optional: Corrugated Sheathing (not shown)</li> </ul> | <ul style="list-style-type: none"> <li>Greased &amp; PE Extruded Unbonded Length</li> <li>Optional: Corrugated Sheathing</li> </ul> |
|  |  |   |
| <p><b>Typical Uses</b><br/>All Permanent Applications</p>                                    | <p><b>Typical Uses</b><br/>Large Capacity Permanent Anchors</p>  | <p><b>Typical Uses</b><br/>Large Capacity Permanent Anchors</p>   |

# Anchor Installation, Stressing and Monitoring Equipment

## Installation Equipment

Uncoiling equipment is utilized to ensure efficient and safe installation of anchors while minimizing the risk of damage to the corrosion protection system. Various manual and motorized styles of uncoilers are available for rent to meet your project specific needs.



## Stressing Equipment

DSI has a large fleet of stressing equipment that enables our customers to test and lock off anchors of any size. The stressing jacks are complemented by stressing chairs, pulling heads and hydraulic pumps for safe and efficient stressing operations.

Customized equipment has been provided for many jobs with difficult access or for high capacity anchors. Our in house engineering staff is well equipped to work with you on your job specific details and requirements.



## Load Monitoring Equipment

Our DYNA Force® Elasto-Magnetic Sensor allows for short and long term monitoring of anchor loads through calibrated sensors and a Power Stress Unit (read out box) that displays loads in kips with an accuracy of +/- 1 %.

Sensors can also be utilized in the bond length of the anchor to verify its performance.

Please refer to our DYNA Force® Elasto-Magnetic Sensor brochure for further technical information.



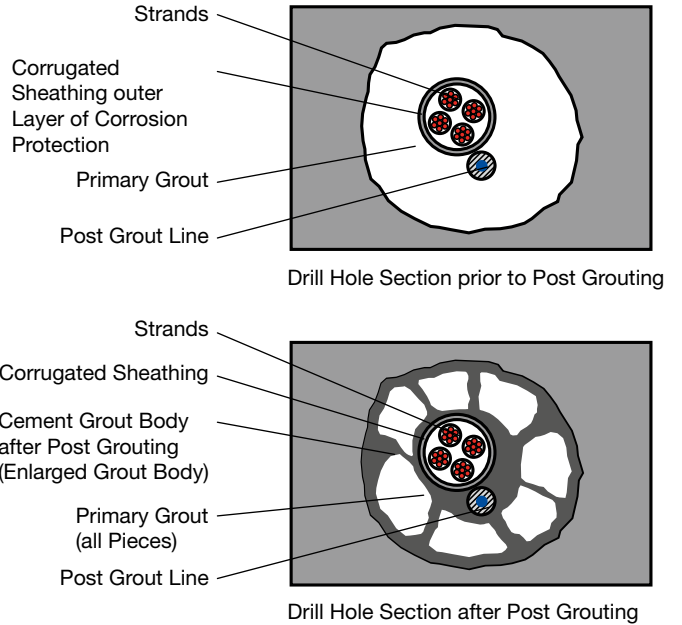
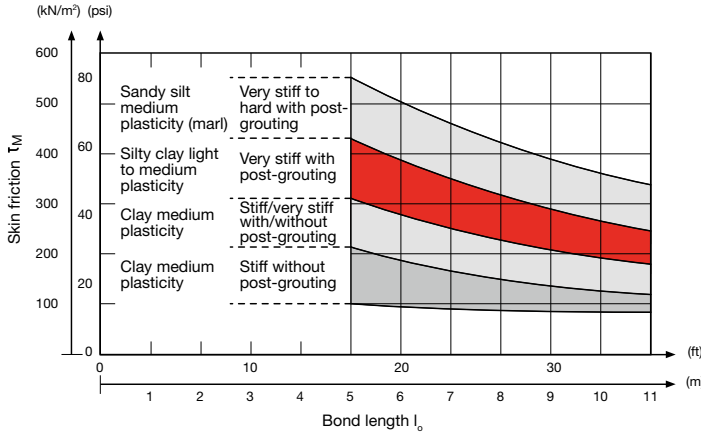
# Post Grouting of Anchors

Post Grouting of anchors can significantly improve the load carrying capacity of anchors in cohesive soils by increasing the skin friction of the anchor grout body with the soil.

The primary grout body in the bond length of the anchor is fractured by introducing additional grout through a post grout line with pressures up to 1,200 PSI [8 MPa].

Post grouting of anchors that initially failed load test acceptance criterion can improve the capacity of the anchor and result in a passing subsequent test. Anchors can be installed with a single or multiple post grout lines.

Benefits of post-grouting are illustrated in the table below. This table was developed by Dr. Helmut Ostermayer of the Technical University of Munich based on actual test results.



DYWIDAG Permanent Strand Anchors

---

## The Elephant Trunk, Hwy 1: Stabilization of a Steep Coast-line Using Permanent DYWIDAG Strand Anchors, CA, USA



**Owner** Caltrans (California Department of Transportation), USA +++ **General Contractor** John Madonna Construction Co., Inc., USA +++ **Subcontractor** Drill Tech Drilling & Shoring Inc., USA +++ **Engineering** Caltrans (California Department of Transportation), USA



**DSI Unit** DYWIDAG-Systems International USA Inc., BU Geotechnics, USA  
**DSI Scope** Production, supply  
**DYWIDAG Products** 259 Type 5-0.6" and 6-0.6" permanent DYWIDAG Strand Anchors

## DYWIDAG Strand Anchors Prevent Settlements at a Large Retail Center, AL, USA

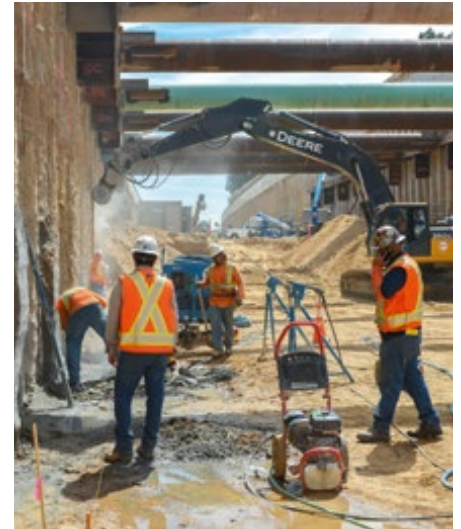


**General Contractor** Hayward Baker, Inc., USA +++ **Engineering** Burns Cooley Dennis, Inc., USA

**DSI Unit** DYWIDAG-Systems International USA Inc., BU Geotechnics, USA  
**DSI Scope** Production and Supply  
**DYWIDAG Products** 80 permanent 12-0.6" DYWIDAG Strand Anchors; 6 DYNA Force® Sensors; rental of equipments

DYWIDAG Permanent Strand Anchors

## Large Scale Use of DYWIDAG Anchors: The San Gabriel Trench in California, USA



**Owner** Alameda Corridor-East Construction Authority (ACE), USA +++ **General Contractor** Walsh Construction Co., USA +++  
**Subcontractor** Malcolm Drilling Company, Inc., USA +++ **Consulting Engineers** Moffat & Nichol, Pirooz Barar & Associates, Inc. (PB&A),  
BMA Construction Engineers, Inc., all of them USA



**DSI Unit** DYWIDAG-Systems International USA Inc., BU Geotechnics, USA

**DSI Scope** Production and Supply

**DYWIDAG Products** 202 temporary, 3-6 Type 0.6" strand DYWIDAG Strand Anchors, 2,206 permanent, 4-10 Type 0.6" strand,  
DCP DYWIDAG Strand Anchors, 433 permanent, 26mm Ø DCP DYWIDAG Bar Anchors

## DYWIDAG Strand Tendons Stabilize Challenging Pier Footings for Motorway 73 in Quebec, Canada



**Owner** Department of Transportation Quebec, Canada +++ **General Contractor** Construction Couillard Ltée., Canada +++  
**Subcontractor** Entreprises Michel Beaupied Inc (Les), Canada +++ **Architect** WSP Canada Inc., Canada +++  
**Consulting** WSP Canada Inc. and Roche ltée, Groupe-conseil, both Canada



**DSI Unit** DYWIDAG-Systems International Canada Ltd., Eastern Division, Canada

**DSI Scope** Design, production, supply, engineering services, technical support, supervision

**DYWIDAG Products** 80 double corrosion protected Type 27-0.6" DYWIDAG Strand Anchors

DYWIDAG Temporary Strand Anchors

---

## The Vancouver House Project: Impressive Architecture with DYWIDAG Systems, BC, Canada



**Owner** Westbank Projects Corp., Canada +++ **Contractor** Southwest Contracting Ltd., Canada +++ **Architects** BIG, USA, DIALOG and James K.M. Cheng Architects Inc., both Canada +++ **Consulting Engineers** GeoPacific Consultants Ltd., Canada



**DSI Unit** DSI Canada Civil Ltd., Canada

**DSI Scope** Production, supply

**DYWIDAG Products** 1,200 Type 3-0.6" and 4-0.6" DYWIDAG Strand Anchors, 200 R51 DYWI® Drill Hollow Bar Anchors

## Expansion of Lucile Packard Children's Hospital with DYWIDAG Systems, CA, USA



**Owner** DPR Construction, USA +++ **Subcontractor** Malcolm Drilling Company, Inc., USA +++ **Architect** Hammel, Green and Abrahamson, Inc., USA +++ **Engineering** Degenkolb Engineers, USA



**DSI Unit** DYWIDAG-Systems International USA Inc., BU Geotechnics, USA

**DSI Scope** Production, supply

**DYWIDAG Products** 282 temporary DYWIDAG Strand Anchors with 4 to 7 strands, 230 temporary DYWIDAG THREADBAR® Anchors, stressing and coiling equipment

### DYWIDAG Tiedown Restressable Strand Anchors

## Permanent DYWIDAG Strand Anchors for Changuinola Dam, Panama



**Owner** AES Changuinola S.A., Panama +++ **General Contractor** Changuinola Civil Works Joint Venture CCWJV, consisting of: E. Pihl & Søn A.S. and MT Højgaard A/S, both Denmark; Alstom GmbH, Germany +++ **Anchor Designer** MD & G Engineers, South Africa

**DSI Unit** DYWIDAG-Systems International USA Inc., BU Geotechnics, USA

**DSI Services** Production, Supply and Technical Support

**DSI Products** supplied 43, restressable, double corrosion protected (DCP) 12-0.6" DYWIDAG Strand Anchors; 48, DYNA Force® Sensors; equipment

## Strengthening of Roanoke Rapids Dam Using DYWIDAG Strand Anchors and DYNA Force® Sensors, NC, USA



**Owner** Dominion North Carolina Power, USA +++ **General Contractor** Brayman Construction Corporation, USA +++ **Engineers** HDR/DTA, Inc., USA

**DSI Unit** DYWIDAG-Systems International USA Inc., BU Geotechnics, USA

**DSI Scope** Production and Supply

**DYWIDAG Products** restressable, epoxy coated 30-0.6" DYWIDAG Strand Anchors; 15 DYNA Force® Sensors

**DYWIDAG-Systems  
International USA Inc.**

320 Marmon Drive  
Bolingbrook, IL 60440  
Phone (630) 739-1100

Toughkenamon, PA  
Phone (610) 268-2221

Washington, D.C.  
Phone (302) 293-2377

Pompano Beach, FL  
Phone (954) 532-1326

Mansfield, TX  
Phone (817) 473-6161

Long Beach, CA  
Phone (562) 531-6161

Tucker, GA  
Phone (770) 491-3790

Kent, WA  
Phone (253) 859-9995

E-Mail [dsiamerica@dsiamerica.com](mailto:dsiamerica@dsiamerica.com)

**DSI Canada  
Civil Ltd.**

**Eastern Division**  
37 Cardico Drive  
Stouffville, ON L4A 2G5  
Phone (905) 888-8988

St. Bruno, QC  
Phone (450) 653-0935

E-Mail [ecd@dsiamerica.com](mailto:ecd@dsiamerica.com)

**Western Division**  
19433 96<sup>th</sup> Av. Suite 103  
Surrey, BC V4N 4C4  
Phone (604) 888-8818

Calgary, AB  
Phone (403) 291-4414

E-Mail [wcd@dsiamerica.com](mailto:wcd@dsiamerica.com)

ARGENTINA  
AUSTRALIA  
AUSTRIA  
BELGIUM  
BOSNIA AND HERZEGOVINA  
BRAZIL  
CANADA  
CHILE  
CHINA  
COLOMBIA  
COSTA RICA  
CROATIA  
CZECH REPUBLIC  
DENMARK  
EGYPT  
ESTONIA  
FINLAND  
FRANCE  
GERMANY  
GREECE  
GUATEMALA  
HONDURAS  
HONG KONG  
INDIA  
INDONESIA  
IRAN  
ITALY  
JAPAN  
KOREA  
LEBANON  
LUXEMBOURG  
MALAYSIA  
MEXICO  
NETHERLANDS  
NIGERIA  
NORWAY  
OMAN  
PANAMA  
PARAGUAY  
PERU  
POLAND  
PORTUGAL  
QATAR  
RUSSIA  
SAUDI ARABIA  
SINGAPORE  
SOUTH AFRICA  
SPAIN  
SWEDEN  
SWITZERLAND  
TAIWAN  
THAILAND  
TURKEY  
UNITED ARAB EMIRATES  
UNITED KINGDOM  
URUGUAY  
USA  
VENEZUELA

**Please Note:**

This brochure serves basic information purposes only. Technical data and information provided herein shall be considered non-binding and may be subject to change without notice. We do not assume any liability for losses or damages attributed to the use of this technical data and any improper use of our products. Should you require further information on particular products, please do not hesitate to contact us.

[www.dsiamerica.com](http://www.dsiamerica.com)  
[www.dsicanada.ca](http://www.dsicanada.ca)