Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
Bonifacio Drive, Port Area Manila

BAGONG PILIPINAS

097.13 DPWH
11.04.2024

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DEPARTMENT ORDER)
)
NO. 197)
Series of 2024)
dtd 11/4/2024

SUBJECT: DPWH Standard Specification for Item 423 – Stay Cable

In order to ensure uniformity in the application/adoption of the Pay Item of Work to be used/adopted by those who are involved in the preparation of the Design Plans and Quantities, Program of Works (POW) and Approved Budget for the Contract (ABC) for infrastructures Project Nationwide, the attached **DPWH Standard Specification for Item 423 – Stay Cable** is hereby prescribed for adoption in Government infrastructure projects that require the utilization of such on the Program of Works.

The Standard Specification shall form part of the DPWH Standard Specifications for Highways, Bridges and Airports, Volume II and is now included in the Project and Contract Management Application (PCMA).

This Order shall take effect immediately.

MANUEL M. BONOAN
Secretary

Department of Public Works and Highways
Office of the Secretary
WIN4U02051

DPWH Standard Specification for
Item 423 – Stay Cable

423.1 Description

This Item shall consist of furnishing, fabricating, and installing of the stay cable in accordance with the Plans and this Specification.

423.2 Material Requirements

423.2.1 Parallel Strand Cable (PSC)

423.2.1.1 Strand

It shall conform to ASTM A416M, Standard Specification for Low-Relaxation, Seven-wire Steel Strand for Prestressed Concrete or Post Tensioning Institute (PTI) DC 45.1, Recommendations for Stay Cable Design, Testing, and Installation.

Individual steel wires shall be hot dip galvanized which must cover the full length of the cable without a break in accordance with ASTM A416M.

423.2.1.2 Individual Sheath

Individual sheathing shall conform to The International Federation for Structural Concrete Bulletin 30 (fib Bulletin 30), Acceptance of Stay Cable Systems using Prestressing Steels or PTI DC 45.1.

423.2.1.3 Corrosion-Inhibiting Coating Material

Corrosion-inhibiting coating material shall conform to PTI DC 45.1.

423.2.1.4 Cable Sheath/Stay Pipe

The Cable Sheath/Stay Pipe shall conform to fib Bulletin 30 or PTI DC 45.1.

423.2.1.5 Anchorage

The anchorage system shall conform to PTI DC 45.1 and must individually anchor each strand using reversible means (such as conical steel wedges). Material for filling the void between the strand bundle and the anchors shall permit monitoring and replacement of individual strands during the entire service life of the bridge, use of hard material filling in the anchorage area is not allowed. The corrosion protective compound applied in the anchorage zone to safeguard the exposed galvanized strand must be flexible and removable, ensuring watertight encapsulation. All other components such as bearing plates, recess tubes, steel flanges, deviators, and tension rings shall be in accordance with the Plans.

423.2.2 Parallel Wire Cable (PWC)

423.2.2.1 Steel Wire

The steel wire shall be hot-dip galvanized and conform to the requirements of JIS G 3571, Hot-dip Galvanized and Zinc-Aluminum Coated High Tensile Steel Wire for Parallel Wire Cables or ISO 19203, Hot-dip Galvanized and Zinc-Aluminum Coated High Tensile Steel Wire for Bridge Cables – Specifications.

423.2.2.2 Filament Tape

Filament tape used to wrap and bind the parallel wire cables shall be wrapped around the surface of the aggregate of wires to keep the shape of the cable cross-section. Filament tape shall be tested in accordance with JIS Z 0237, Testing Methods of Pressure-Sensitive Adhesive Tapes and Sheets, or ISO 29864, Self Adhesive Tapes – Measurement of Breaking Strength and Elongation at Break.

423.2.2.3 Cable Sheath

It shall consist of continuous and seamless High-Density Polyethylene (HDPE) material with or without configuration of indent pattern surface depending on the design considerations. When the cable outer surface is modified to improve its dynamic behavior under the action of wind, or the combined action of wind and rain, its effects on dynamic excitation and the static drag coefficient shall be considered as per PTI DC 45.1. The drag coefficient for static aerodynamic loads shall conform to PTI DC 45.1. The HDPE material shall conform to the applicable requirements of the Japanese Society of Steel Construction (JSS) II 11, Parallel Wire Cables – Specifications.

423.2.2.4 Anchorage/Socket

The anchorage/socket shall be composed of hot dip-galvanized wire, zinc copper alloy filler, and epoxy resin filler. Zinc shall conform to the requirements of JIS H 2107, Zinc Ingots or ISO 752, Zinc Ingots, copper shall conform to the requirements of JIS H 2121, Electrolytic Cathode Copper or ISO 7583, Anodizing of aluminum and its alloys, and epoxy resin shall be tested in accordance to JIS K 7181 – Plastics – Determination of compressive properties or ISO 604, Plastics – Determination of compressive properties.

The level of corrosion protection within the anchorage assembly devices shall be consistent with the level of corrosion protection required for the design life of the stay cables.

423.2.3 Saddle

When necessary, the dimension of the saddle and, the number of wire strands or cables shall be based on the design calculations as per PTI DC 45.1 and as shown on the Plans. The saddle zone in the extradosed bridge is crucial for transmitting cable forces to the pylon. The system must allow for individual installation and replacement of each strand. It should accommodate flexibility in the number of strands based on the calculated tension requirements. Each strand must pass through a dedicated hole in the saddle to prevent fretting from radial forces. The minimum radius of curvature on the saddle must exceed 400 times the diameter of the wire inside the strand.

423.2.4 Tie-Down Cable

If necessary, it shall conform to the requirements of Subsection 423.2.1.1 Strand or Subsection 423.2.2.1 Steel Wire.

423.3 Construction Requirements

423.3.1 Submittals

Before the start of the construction and/or installation, the following shall be submitted to the Engineer for evaluation and approval, which shall include but not limited to:

1. Manufacturer's specifications and manuals (installation and maintenance);
2. Calibration records of jacks and gauges for stressing and destressing operations;
3. Detailed fabrication procedure of the stay cables;
4. Shop drawings of stay cable components, anchorage, and damping devices, if necessary;
5. A complete report on the tests (materials tests, performance tests, and original mill certificates);
6. Erection Stage Analysis Report/Construction Sequence Loading Analysis Report;
7. Schedule of manufacture, testing, and delivery, including name and address of testing laboratory; and,
8. Warranty/Guarantee from the manufacturer/supplier.

423.3.2 Handling and Storage

Handling and storage of stay cables assemblies shall be done so that the assemblies are not damaged in any way. Stay cables shall be protected from corrosives, heat, abrasion, salt water and other harmful effects through handling, and installation.

Stay cable materials shall not be stored in direct contact with the ground.

423.3.3 Installation

Before commencement of the stay cable installation, the Contractor shall carry out an erection stage analysis for all erection stages based on the actual erection loads to determine the geometry of the completed structure.

The stay cables and if necessary, tie-down cables, shall be marked clearly with their types, numbers, and their intended locations based on the Plans. Installation, fixing, and tensioning of the stay cable considering the proper sequence of procedures shall be in accordance with the Plans and as per the manufacturer's recommendation subject to the approval of the Engineer. Wire cables shall be prefabricated into fixed-length cables before installation.

Jacks and gauges for stay cable installation shall be calibrated using a load cell or calibrated static load machine within 6 months before the beginning of stay cable installation, and every 6 months thereafter for the duration of the stay cable installation.

Cable saddles when necessary, shall be designed to provide continuity of the wire cable through the pylon and individually anchor each cable. The wire cable transfer capacity across

the saddle shall be sufficient to prevent from slipping under any load case which emphasizes that the cable saddle shall be able to resist both primary and secondary forces that affect the cable element, cable pipe, pylon, and appurtenances in the saddle region.

In all stages of construction, stay cable vibration shall be monitored. Any harmful vibrations induced by rain and wind during erection shall be evaluated by the Contractor regarding the significance of these vibrations on the stay cable and bridge performance. Upon identifying the necessity to control these vibrations, the Contractor shall submit the Shop Drawings with full details of proposed mitigating measures to minimize cable vibrations such as damping devices and their attachment to stay cables and anchors to the bridge deck for the Engineer's approval.

423.3.4 Performance Test

423.3.4.1 Fatigue Test

Acceptance of the anchorage and saddle (if necessary) shall be based on the fatigue tests carried out in accordance with PTI DC 45.1, or fib Bulletin 30. The system shall have no damage or breakage considering the required number of force cycles.

423.3.4.2 Leak Test

A leak tightness test must be performed on one full-size specimen to verify that the anchorage is watertight. This test should encompass the complete corrosion protection system and adhere to the procedures and acceptance criteria specified in PTI DC 45.1 or fib Bulletin 30.

423.3.4.3 Ultimate Strength Test/Breaking Load Test

The ultimate strength/breaking load of the cable shall be calculated from the results of the tensile tests carried out in accordance with PTI DC 45.1 for Parallel Strand Cable (PSC) and Annex 1 of JSS II 11 for Parallel Wire Cable (PWC).

423.4 Method of Measurement

Stay cable and tie-down cable shall be measured by lump sum basis or kilograms of installed cable, which includes steel wire, strand, filament tape, sheath, corrosion-inhibiting coating material, stay pipe, anchorage, saddle, and other accessories as subsidiary items and deemed included in the Contract Unit Price of the stay cable.

Damping devices, if necessary, shall be measured and paid separately.

423.5 Basis of Payment

The accepted quantities measured as prescribed in Section 423.4, Method of Measurement, shall be paid for at the Contract Unit Price for Stay Cable Systems which price and payment shall be full compensation for furnishing, fabricating, installing and testing all materials, including all labor, equipment, tools, and other incidentals necessary to complete the work prescribed in this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
423 (1)a	Stay Cable, Parallel Strand Cable	Lump Sum
423 (1)b	Stay Cable, Parallel Wire Cable	Lump Sum
423 (2)a	Stay Cable, Parallel Strand Cable	Kilogram
423 (2)b	Stay Cable, Parallel Wire Cable	Kilogram
423 (3)a	Tie Down Cable, Parallel Strand Cable	Lump Sum
423 (3)b	Tie Down Cable, Parallel Wire Cable	Lump Sum
423 (4)a	Tie Down Cable, Parallel Strand Cable	Kilogram
423 (4)b	Tie Down Cable, Parallel Wire Cable	Kilogram