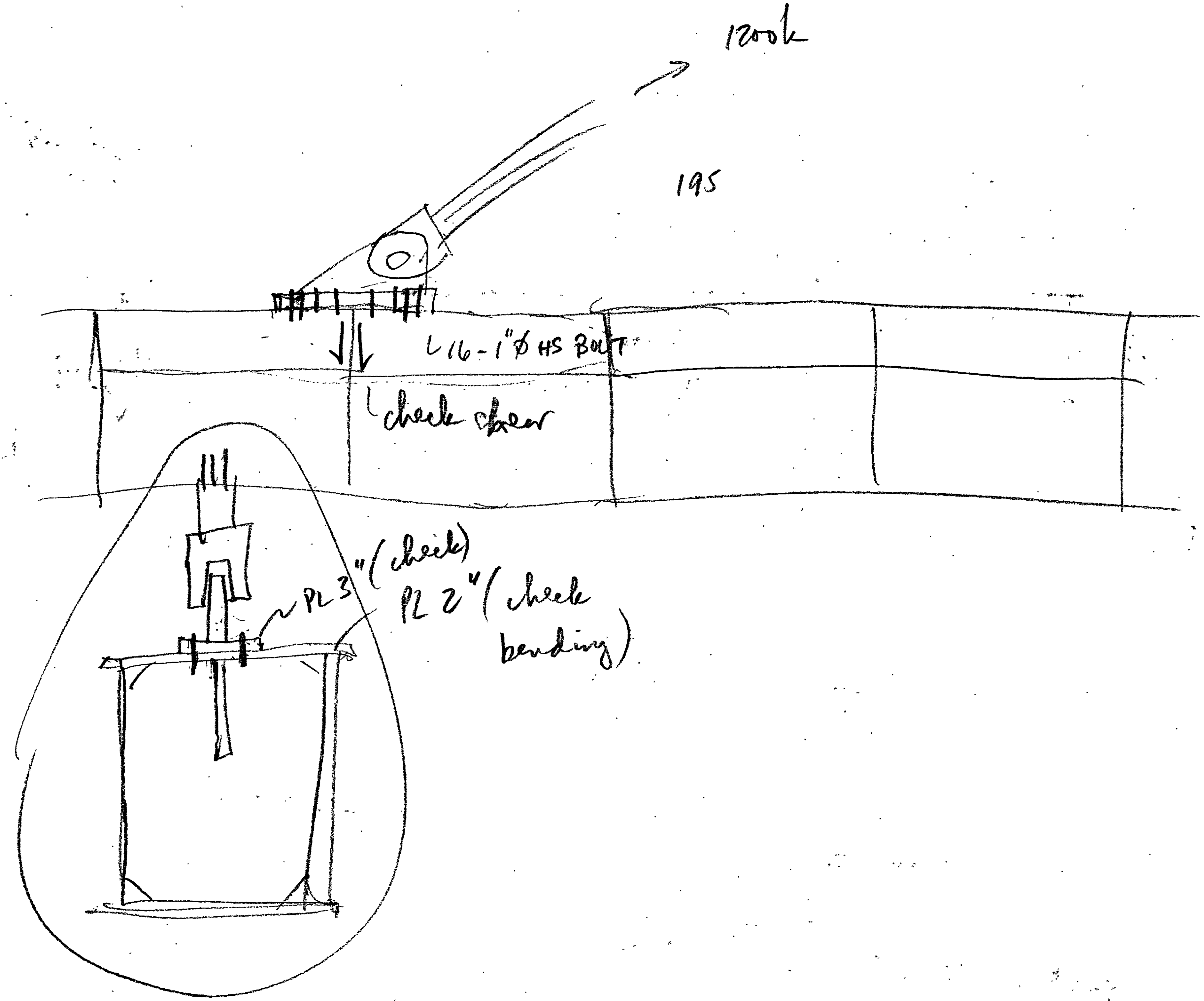
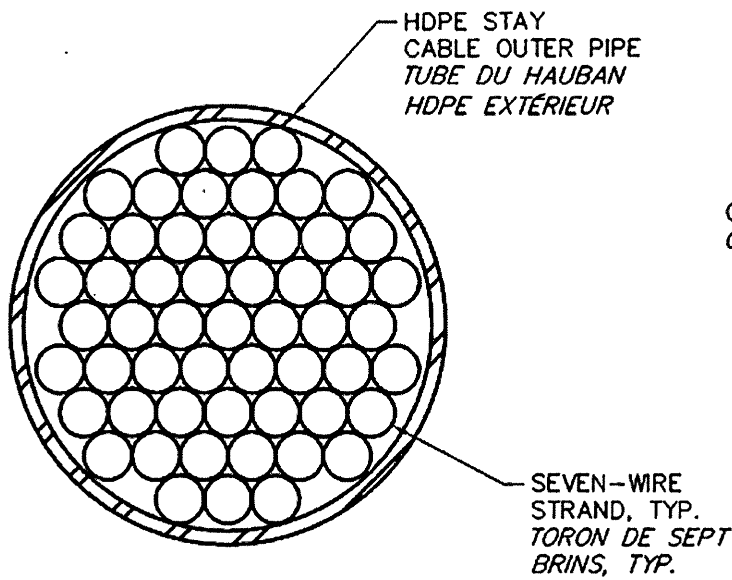
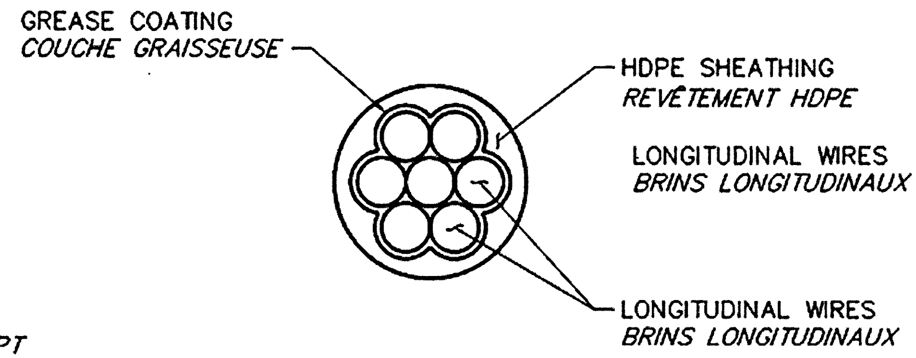


https://www.dsiamerica.com/uploads/media/DSI_DYWIDAG_Multistrand_Stay_Cable_Systems_ENG.pdf

CE 122/1232
HANDOUT

Suspence/Stay Sizing - NBSI





<u>SECTION A-A</u>
<u>COUPE A-A</u>
1:4

(SEE NOTE 1)
(VOIR NOTE 1)

<u>SEVEN-WIRE STRAND DETAIL</u>
<u>DÉTAIL DU TORON DE SEPT BRINS</u>
1:1

6. STAY CABLES SHALL BE COMPOSED OF GALVANIZED 15.7mm DIAMETER LOW RELAXATION STRAND MEETING THE REQUIREMENTS SPECIFIED IN ASTM A416 FOR GRADE 270 STRAND.
LES HAUBANS SERONT COMPOSÉS DE TORONS DE BASSE DÉTENTE GALVANISÉS ET DE DIAMÈTRE 15.7mm ET DOIVENT SATISFAIRE LES ÉXIGENCES DANS ASTM A416 POUR TORONS DE NUANCE 270.

'PROACH
SPANS
)RILLED
SHAFT

35

)N 6.6.8.

PLASTIC DUCT:

FRICTION COEFFICIENT:	U=0.14/RAD
WOBBLE COEFFICIENT:	K=0.001 RAD/M

FOR EXTERNAL TENDONS, WOBBLE COEFFICIENT (K) SHALL BE 0.

STAY CABLE SYSTEM:

STAY CABLE SYSTEM COMPONENTS SHALL BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH THE PROJECT SPECIFIC CRITERIA AND CAN/CSA-S6. WHERE DESIGN ISSUES ARE NOT ADDRESSED IN THESE REFERENCES, THE POST-TENSIONING INSTITUTE GUIDE SPECIFICATIONS "RECOMMENDATIONS FOR STAY CABLE DESIGN, TESTING, AND INSTALLATION, 6TH EDITION" MAY BE USED.

ALL STAY CABLE STRANDS SHALL BE GALVANIZED, GREASED AND SHEATHED SEVEN-WIRE, HIGH TENSILE STRENGTH, LOW-RELAXATION STRAND.

THE FOLLOWING PROPERTIES ARE ASSUMED:

NOMINAL DIAMETER:	15.7 mm
NOMINAL AREA:	150 mm^2
TENSILE STRENGTH:	1860 MPa
ELASTIC MODULUS OF SINGLE STRAND:	195000 MPa
MINIMUM BREAKING STRENGTH:	279 kN
MINIMUM LOAD AT 1% EXTENSION:	248 kN

FLAME CUTTING OF STRANDS SHALL NOT BE PERMITTED.

THE STRANDS SHALL BE INSTALLED PARALLEL TO EACH OTHER.

STAY CABLES SHALL BE PROTECTED AGAINST CORROSION, HEAT, ABRASION AND OTHER HARMFUL EFFECTS THROUGHOUT THE FABRICATION AND INSTALLATION PROCESS.

THE MINIMUM BENDING RADIUS OF THE CABLE DURING INSTALLATION SHALL BE 25 TIMES THE DIAMETER OF THE CABLE SHEATH.

8

THE STAY GUIDE PIPE SHALL BE FABRICATED PERPENDICULAR TO THE FACE OF THE BEARING SURFACE OF THE CABLE ANCHORAGE WITHIN 0.05 DEGREE (±) TOLERANCE. THE GUIDE PIPE ASSEMBLY SHALL BE INSTALLED WITHIN 0.3 DEGREE (±) OF PLANNED PIPE ALIGNMENT.

AT THE END OF CONSTRUCTION, THE ANCHORAGE RING NUT SHALL BE POSITIONED IN SUCH A WAY TO ALLOW FOR FUTURE STAY CABLE ADJUSTMENT AND DETENSIONING.

SURVEYS OF THE BRIDGE TOWERS AND SUPERSTRUCTURE SHALL BE CONDUCTED AFTER EACH STAY CABLE STRESSING OPERATION.

PERMANENT RECORDS SHALL BE ESTABLISHED FOLLOWING EACH STAY CABLE INSTALLATION INCLUDING CABLE FORCES AND ELONGATIONS, AMBIENT TEMPERATURE, DECK LOADING CONDITIONS, AND ALL OTHER USEFUL INFORMATION.

EXPANSION JOINTS:

EXPANSION JOINTS SHALL BE MODULAR BAR TYPE.

DRAINAGE SYSTEM:

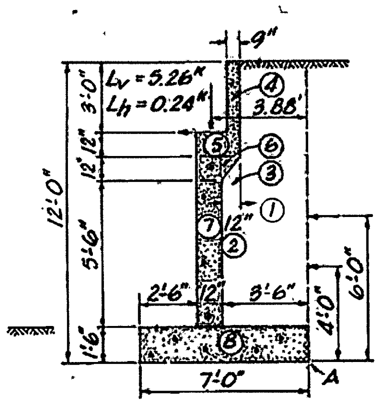
BRIDGE DRAINAGE SHALL BE THROUGH SCUPPERS. SCUPPERS SHALL BE DRAINED INTO THE RIVER AWAY FROM ENVIRONMENTALLY SENSITIVE AREAS. SCUPPERS OVER LAND SHALL BE DRAINED INTO MUNICIPAL STORMWATER SYSTEM.

DP 26-3
Bridge Abutment
Sh. 1 of 2

Design of Bridge Abutment. Stability Analysis of Front Wall

General Data:

Backfill-group 1 soil (see Fig. 26.9). Assume γ = 110 lb/cu.ft.
Equivalent surcharge = 3 ft.
Allowable soil pressure = 3.5 K/sq. ft.
Allowable shear between soil and base = 0.45ΣV



Note: All loads and moments are per lin. ft. of abutment.

$P_{hs} = 30(3.0)(12) = 1.08^K$

$P_h = \frac{1}{2}(30)(12^2) = 2.16^K$

Stability Computations:

Moments about A

Area		Force	Arm	Mom.
① 2.5 × 10.5 × 0.110		= 2.89K	1.25'	3.61'K
② 1.0 × 5.5 × 0.110		= 0.61	3.00	1.83
③ ½ × 1.0 × 1.0 × 0.110		= 0.06	2.83	0.15
④ 0.75 × 3.0 × 0.150		= 0.34	2.88	0.98
⑤ 2.0 × 1.0 × 0.150		= 0.30	3.50	1.05
⑥ ½ × 1.0 × 1.0 × 0.150		= 0.08	3.17	0.25
⑦ 10 × 6.5 × 0.150		= 0.97	4.00	3.88
⑧ 7.0 × 1.5 × 0.150		= 1.58	3.50	5.53
L_v		5.26	3.88	20.40
L_h	0.24		9.00	2.16
P_{hs}	1.08		6.00	6.48
P_h	2.16		4.00	8.64
	ΣH = 3.48K	ΣV = 12.09K		ΣM_A = 54.96'K

Ans. From curves *1* (Fig. 26.9), 3880 lb/ft.

5. A vertical anchor wall 9 ft high is pulled horizontally against a mass of sand with a horizontal ground surface. The sand has a unit weight of 120 lb/cu ft and a value of $\phi = 33°$. As it is pulled, the wall tends to rise with respect to the sand. The angle of wall friction is approximately $\frac{2}{3}\phi$. What is the horizontal component of the passive earth pressure?

Ans. From Fig. 26.5 and $\delta = 22°$, 7770 lb/ft.

6. If the anchor wall in Prob. 5 can be prevented from rising, what would be the horizontal component of the passive earth pressure?

Ans. 36,400 lb/ft.

7. A vertical retaining wall 15 ft high supports a cohesionless fill that weighs 110 lb/cu ft. The backfill rises from the crest of the wall at an angle of 20°

DP 26-3
Bridge Abutment
Sh. 2 of 2

Design of Bridge Abutment. Stability Analysis of Front Wall

Stability Computations:

Location of Resultant

From point A, $\frac{54.96}{12.09} = 4.55'$ then $e = 4.55 - \frac{7.0}{2} = \underline{1.05'} < \frac{7}{6}$ ok

Soil Pressure at Base:

At toe $q_{max.} = \frac{12.09}{7}\left(1 + \frac{6 \times 1.05}{7}\right)$

$\underline{q_{max}} = 1.73\,(1+0.9) = \underline{3.3^{K}/\text{sq. ft.} < 3.5 \text{ ok}}$

At heel $\underline{q_{min.}} = 1.73\,(1-0.9) = \underline{0.2^{K}/\text{sq. ft.}}$

Sliding:

Shear available along base $= 12.09^{K} \times 0.45 = \underline{5.43^{K}}$

Factor of safety $= \frac{5.43}{3.48} = \underline{1.6 > 1.5 \text{ ok}}$

with the horizontal. If $\phi = 28°$ and $\delta = +20°$, what is the total active earth pressure against the wall? Use the trial-wedge graphical construction.

Ans. 5700 lb/ft.

SUGGESTED READING

B. Baker (1881), "The Actual Lateral Pressure of Earthwork." *Min. Proc. Inst. Civ. Eng.*, London, *65*, 140–186. Experiences of one of the greatest of civil engineers, a contemporary of Rankine and Boussinesq, leading him to the conclusion "that the laws governing the lateral pressure of earthwork are not at present satisfactorily formulated."

K. Terzaghi (1934), "Large Retaining-Wall Tests. I," *Eng. News-Record*, *112*, 5, 136–140. First of a series of five articles presenting the fundamental relations between the displacements of a rigid wall and the