— Verschiebung des Messgerätes von null während des Versuchs;

— Qualität der Versuchsvorbohrung;

— Variabilität des Bodens;

— Versuchsdurchführender.

Anhang F
(normativ)

Untersuchungsberichte für Pressiometerversuche

Während für den Inhalt der in F.1 und F.2 dargestellten Berichte Mindestanforderungen gelten, darf das Format frei gewählt werden.

F.1 und F.2 zeigen Datenblätter entsprechend der Anforderung des Feldprotokolls (7.2). Die grau hinterlegten Felder beziehen sich auf den Untersuchungsbericht (7.3) und liegen nach Erhalt der Pressiometer-Parameter vor.

F.1 Feldprotokoll - Datenblatt eines Pressiometerversuchs nach Ménard

NAME/ANSCHRIFT	DATEN DES PRESSIOMETER-VERSUCHS NACH MÉNARD entsprechend EN ISO 22476-4 CU-Typ A ☐ B ☐ C ☐	ORT		
			Datei	
			Land	
			Identifizierung des Ortes	
			Lageplan-Nr.	
			Sondierungs-Nr.	

MESSSONDE													VERSUCH		
MESSZELLEN-PARAMETER				**PARAMETER FÜR ROHR UND FLÜSSIGKEIT**						**DRUCKVERLUST-PARAMETER**			Nr. & Tiefe des Versuchs	
Code				**Typ**	Koaxial		**Flüssig-keit**	Art		Kalibrierdatenblatt-Nr.			Datum und Uhrzeit des Versuchs	
Länge		**Mantel**			Doppel-leitungen			Gewichtsein-heit γ_i/γ_w		Ultimativer Druckverlust p_{el} (MPa)			CU-Nr.	
310 mm		Gummi		**Gesamtlänge (m)**			**Gas**	Art		**VOLUMENVERLUST-PARAMETER**			Nr. der elektroni-schen Messwert-erfassungsanlage	
370 mm		Nylon-gewebe						Kompressi-bilität χ_g m^{-1}		Kalibrierdatenblatt-Nr.			Name des Durchführenden	
Typ		Stahl-gewebe		**MEMBRANPARAMETER**						Kalibrierzylinder-Durchmesser d_i (mm)			Druckdifferenz (MPa)	
E		mit Metall-streifen		**Lieferant, Typ und Code**						Kalibrierkoeffizient a (cm^3/MPa)			Beobachtungen	
G		Schlitz-rohr		**Druckverlust p_m (MPa)**						Messsondenvolumen V_c (cm^3)			(Wetter usw.)	

ABLESEWERTE VOR ORT									KORRIGIERTE DATEN (Untersuchungsbericht)			
Druckhalte-stufe Nr.	**DRUCK p_r (MPa)**				**VOLUMINA V_r (cm^3)**				**DRUCK p**	**VOL V**	**ANSTIEG m_i** $\Delta V/\Delta p$	**KRIECHEN** V 60/30
	1 s	15 s	30 s	60 s	1 s	15 s	30 s	60 s	MPa	cm^3	cm^3/MPa	cm^3
0												
1												
2												
3												
4												
5												
6												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												

STUFEN	DATUM	Stufen (m)	Relative Stufen
			+
			0 (Bohrloch-oberkante)
			–
			–

PRESSIOMETER-SONDIERUNG			
	Ortungs-system	X =	
		Y =	
	Bohrgerät		
	Bohrverfahren		
	Einsatz (Tabelle C.3 Abkürzungen)		
	Bohrwerkzeug	Typ	
		Durchmesser (mm)	
	Verrohrungs-sohle bei (m Tiefe)		
	Bohrflüssig-keit		
	Bohrtiefe vor Versuch	von Höhe (m)	
		auf Höhe (m)	
		Zeit (HH + mn)	

FIRMENLOGO/NAME/ANSCHRIFT	**BERICHT UND AUSWERTUNG DES MÉNARD-PRESSIOMETERVERSUCHS** Bohrlochaufweitungsversuch nach EN ISO 22476-4 CU-Typ A ☐ B ☐ C ☐

Datei	
Versuchs-Nr.	
Kennzeichnung des Versuchsorts	
Bohrloch	
Versuchstiefe	

(Pressiometer-Datenplots)

BERECHNETE ERGEBNISSE (Untersuchungsbericht)	
σ_{hs}	
p_1	
P_2	
p_f	
P_{LM} oder P_{LMH}	
E_M	
E_M / p_{LM}	

PARAMETER DES EXTRAPOLATIONSVERFAHRENS (Untersuchungsbericht)		
Volumen-kehrwerte — — —	A	
	B	
	Mittlerer Fehler (cm^3)	
Hyperboli-sche Kurve _____	A1	
	A2	
	A3	
	A4	
	A5	
	A6	
	Mittlerer Fehler (cm^3)	

BEMERKUNGEN	
Beispiel: Die Umkehrverfahren führen zum kleinsten Fehler und müssen zur Bestimmung von p_{IM} gewählt werden.	
Berechnungsprogramm Referenz und Versionsnr.	**Datum**

ANMERKUNG Bei CU-Typ A, bei dem Druck und Volumen nach 1 s nicht gemessen werden, sind die entsprechenden Spalten zu vernachlässigen.

F.2 Untersuchungsbericht - Prüfprotokoll eines Pressiometerversuchs nach Ménard

Pressiometer-Protokoll Entsprechend EN ISO 22476-4 Typ A ☐ B ☐ C ☐	Pressiometer Sondierungs-Neigung (falls vorhanden)	Datei-Nr.
Netzpunkt x = y = z_N =	Sondierungs-Richtung Norden	Pressiometer-Bohrloch-Nr. Lageplan-Nr.

Höhe z (m)	Tiefe unter GOK (z_N) (m)	Angaben zu den Schichten des Baugrundes	Wasserstände	Bohrwerkzeuge Verfahren zur Herstellung der Vorbohrung mit Datumsangabe Datumsangabe Verrohrung und Versuch	Bohrparameter nach EN ISO 22476-15						Grenzdruck des Ménard-Pressiometers p_{LM}[a] • Pressiometer-Kriechdruck p_f[a] ◦ (MPa)	Ménard-Pressiometer-Modul E_M[a] (MPa)
	⓪				V_A	P_E	P_I	Q_I	V_R	C_R	0 1 2 3 4 5 0	0 0 0 0 0 0
	①										①	
	②										②	
	③										③	
	④										④	
	⑤										⑤	
	⑥										⑥	
	⑦										⑦	
	⑧										⑧	
	⑨										⑨	
	⑩										⑩	

Bemerkungen	Unternehmen	Name Unterschrift

[a] Arithmetische und logarithmische Skalen sind zulässig.

Literaturhinweise

Allgemeines Dokument

[1] MÉNARD, L., The Interpretation of Pressuremeter Tests Results, *Sols-Soils N°.26*, Paris, 1975 (Ausgaben in Französisch und Deutsch erhältlich)

[2] EN 1997-1, *Eurocode 7: Entwurf, Berechnung und Bemessung in der Geotechnik — Teil 1: Allgemeine Regeln*

[3] EN 1997-2, *Eurocode 7: Entwurf, Berechnung und Bemessung in der Geotechnik — Teil 2: Erkundung und Untersuchung des Baugrunds*

Anpassung der Pressiometerkurve

[4] BAUD J.-P., GAMBIN M., UPRICHARD S.T. Modeling and Automatic Analysis of a Ménard Pressuremeter Test, in: *Géotechnique et Informatique*, Proceedings of a Symposium Organised by ENPC in Paris, Presses des Ponts, Paris, 1992

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee [or Project Committee] ISO/TC [or ISO/PC] ###, *[name of committee]*, Subcommittee SC ##, *[name of subcommittee]*.

This second/third/… edition cancels and replaces the first/second/… edition (ISO #####:####), which has been technically revised.

The main changes compared to the previous edition are as follows:

— xxx xxxxxxx xxx xxxx

A list of all parts in the ISO ##### series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Geotechnical investigation and testing — Field testing —

Part 4:
Prebored pressuremeter test by Ménard procedure

1 Scope

This document deals with equipment requirements, the execution of and reporting on the Ménard pressuremeter test.

NOTE This part of ISO 22476 fulfils the requirement for the Ménard pressuremeter test, as part of geotechnical investigation and testing according to EN 1997-1 and EN 1997-2.

The present document describes the procedure for conducting a Ménard pressuremeter test in natural soils, treated or untreated fills and in rocks, either on land or off-shore.

The pressuremeter tests results of this document are suited to a quantitative determination of ground strength and deformation parameters. They may yield lithological information in conjunction with measuring while drilling performed when creating the hole (according to EN ISO 22476-15). They can also be combined with direct investigation (e;g; sampling according to EN ISO 22475-1) or compared with other in situ tests (see EN 1997-2, 2.4.1.4(2) P, 4.1 (1) P and 4.2.3(2) P).

The Ménard pressuremeter test is performed by the radial expansion of a cylindrical probe of a minimum slenderness of 6, placed in the ground (see Figure 1). During the injection of the liquid volume in the probe, the inflation of the measuring cell first brings the outer cover of the probe into contact with the pocket wall and then presses on them resulting in a soil displacement. Pressure applied to, and the associated radial expansion of the probe are measured either by volume or radial transducers and recorded so as to obtain the stress-strain relationship of the soil as tested.

Together with results of investigations with EN ISO 22475-1 being available or at least with identification and description of the ground according to ISO 14688-1 and ISO 14689-1 obtained during the pressuremeter test operations, the tests results of this document are suited for the quantitative determination of a ground profile, including

— the Ménard pressuremeter modulus E_M,

— the Ménard pressuremeter limit pressure p_{LM} and

— the Ménard creep pressure p_f.

This Standard refers to a probe historically described as the 60 mm (also called BX) G type probe with a pressure limitation of 5 MPa. If specified by the relevant authority or agreed for a specific project by the relevant parties, a higher pressure limitation may be required.

NOTE 1 G type probe refers to probes with an external cover creating guard cells (see 4.2).

NOTE 2 Ménard pressuremeter tests can be carried out with other diameter probes such as 32, 44 and 76 mm probes.

NOTE 3 Example of other probe and pocket drilling dimensions are indicated below:

Probe Designation	Probe Diameter mm	Drilling Diameter (mm)	
		Min	Max
AX	44	46	52