

CEN

CWA 18046

WORKSHOP

December 2023

AGREEMENT

ICS 35.240.67

English version

Position markers for digital applications on construction sites, structural monitoring and BIM-applications

This CEN Workshop Agreement has been drafted and approved by a Workshop of representatives of interested parties, the constitution of which is indicated in the foreword of this Workshop Agreement.

The formal process followed by the Workshop in the development of this Workshop Agreement has been endorsed by the National Members of CEN but neither the National Members of CEN nor the CEN-CENELEC Management Centre can be held accountable for the technical content of this CEN Workshop Agreement or possible conflicts with standards or legislation.

This CEN Workshop Agreement can in no way be held as being an official standard developed by CEN and its Members.

This CEN Workshop Agreement is publicly available as a reference document from the CEN Members National Standard Bodies.

CEN and CENELEC members are the national standards bodies and national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

© 2023 All rights of exploitation in any form and by any means reserved worldwide for CEN national Members and for CEN/CENELEC Members.
C

Ref. No.:CWA 18046:2023 E

Contents	Page
European foreword	3
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	5
4 Marker	7
4.1 Functionality	7
4.2 Size and Layout	7
4.3 Marker ID number	9
4.4 Tags for data read-out	9
4.5 Fiducial tags for machine applications	9
4.6 Handling and application	9
5 Tags for data read-out	10
5.1 Functionality	10
5.2 Content	10
5.3 Layout and size	12
5.4 Naming convention	13
5.5 Handling and application	13
5.6 How to set up the URL	13
6 Fiducial tags	13
6.1 Functionality	13
6.2 Content	14
6.3 Layout and size	14
6.4 Naming convention	14
6.5 Handling and application	14
7 Workflow	14
7.1 Introduction	14
7.2 Workflow scheme	14
Annex A (informative) Example of implementation on European pilot construction sites ..	16
A.1 Use on construction sites	16
A.2 Markers	16
A.3 Use with different (fiducial) tags	18
A.4 Read-out data of QR code	18
A.5 Example of folder location in project	22
Annex B (informative) Cybersecurity	23
Bibliography	24

European foreword

This CEN Workshop Agreement has been developed in accordance with the CEN-CENELEC Guide 29 “CEN/CENELEC Workshop Agreements — A rapid prototyping to standardization” and with the relevant provisions of CEN/CENELEC Internal Regulations — Part 2. It was approved by a Workshop of representatives of interested parties on 2023-11-07, the constitution of which was supported by CEN following the public call for participation made on 2023-01-18. However, this CEN Workshop Agreement does not necessarily include all relevant stakeholders.

The final text of this CEN Workshop Agreement was provided to CEN for publication on 2023-11-28.

Results incorporated in this CWA received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 958450 (BIMprove).

The following organizations and individuals developed and approved this CEN Workshop Agreement:

- Zurich University of Applied Sciences (Ruprecht Altenburger, Antje Sydow)
- AFGruppen AS (Øyvind Kjøllesdal)
- Catenda AS (Dag Fjeld Edvardsen, Torvald Andresen)
- DigitalTwin Technology GmbH (Rahul Tomar, Rehan Khan)
- Fraunhofer Gesellschaft IAO (Matthias Aust)
- HRS Real Estate AG (Antonio Lopez-Rios, Mehdi Mdidech)
- RWTH Aachen University (Jörg Blankenbach)
- SINTEF Manufacturing (Gabor Sziebig)
- Vías y Construcciones, S.A. (Manuel Menéndez Muñiz)

Secretariat: DIN (Christian Grunewald, Yusuf Yilmaz)

Attention is drawn to the possibility that some elements of this document may be subject to patent rights. CEN-CENELEC policy on patent rights is described in CEN-CENELEC Guide 8 “Guidelines for Implementation of the Common IPR Policy on Patent”. CEN shall not be held responsible for identifying any or all such patent rights.

Although the Workshop parties have made every effort to ensure the reliability and accuracy of technical and non-technical descriptions, the Workshop is not able to guarantee, explicitly or implicitly, the correctness of this document. Anyone who applies this CEN Workshop Agreement shall be aware that neither the Workshop, nor CEN, can be held liable for damages or losses of any kind whatsoever. The use of this CEN Workshop Agreement does not relieve users of their responsibility for their own actions, and they apply this document at their own risk. The CEN Workshop Agreement should not be construed as legal advice authoritatively endorsed by CEN.

Introduction

The digitalization of the construction industry has brought numerous new digital technologies onto construction sites and existing infrastructure.

The spectrum ranges from digital measurement and quality control and the operation of robots and (partly) autonomous vehicles to visualization tasks using augmented and virtual reality systems (AR/VR). Each of these applications relies on precise geometric information about its own position and orientation. However, there are currently no common standards: these machines and applications use a wide variety of optical tags, some of which are proprietary, and all of them have their own data formats and processing strategies.

Precise position measurements on construction sites or in existing structures under monitoring are usually in the responsibility of surveyors. They create a network of control points (targets) whose positions are determined from the official survey points. These targets then serve as the basis for all further measurements. However, currently no standardized process has been available to make this geometry information available to other parties.

This workshop agreement aims to provide digital technologies with measured position data from surveys in a secure manner:

- by defining the properties of suitable position markers and showing example implementations
- by defining a flexible method with which any required tags can be attached at a defined distance to the marker in the course of the project
- by proposing an automated data transfer of the measurement data via «read-out tags»
- and allows to automatically provide/retrieve additional information, such as validity, accuracy of measurement, GUID of the associated BIM element or any other data relevant to the project.

The use of the defined position markers is advantageous:

- In the complexity of large construction sites, the many different trades and companies all use their own markers and tags without their content or information on their validity being accessible. The use of standardized markers avoids duplication and errors.
- Measuring and managing the survey data is in the hands of the commissioned surveyors or the BIM manager, so that the digital applications can work in the project coordinate reference system.
- The method described is ideally suited for use in BIM processes: It is recommended to store the position markers in a marker model in the BIM system. Authorized users can retrieve current, correct and uniform measurement data via the BIM system and password-protected “read-out tags”.

The position markers and their usage were originally developed and tested as part of the BIMprove project of the Horizon funding programme (No 958450). This document was commonly created by surveyors, drone scientists, VR specialists, BIM managers and BIM software specialists.

For the future revision of the CWA the authors are grateful for feedback on practical implementation and possible suggestions to marker@bimprove-h2020.eu.

1 Scope

This document is applicable to construction processes where the usual surveyor's control points are to be used not only for geometry control, but other applications such as laser scanning, localization of autonomous vehicles, photogrammetry, or VR/AR applications.

It provides a framework for making accurate survey point information available to digital applications and other trades. This includes the layout of markers, a naming convention for markers and a common digital interface for the read-out-data of markers.

The document builds on existing standards and conventions and collates them where applicable.

The document is intended to be used on construction sites and in existing buildings by planners (architects, civil engineers,...), surveyors, construction companies, software providers, UXV operators, BIM stakeholders, and on site machines/devices/systems.

The survey point information may be utilised not only during the construction but also during maintenance throughout the life of the facility.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 21778:2017, *Information technology — The JSON data interchange syntax*

ISO 19162, *Geographic information — Well-known text representation of coordinate reference systems*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

marker

physical mark attached to a building or object with known spatial position, carrying a unique marker ID number and allowing for defined later positioning of human- and/or machine-readable tags

Note 1 to entry: The main purpose of the marker is to establish a unique relationship between its ID number and its spatial position. Both information will usually be provided in machine-readable way by a tag, placed in the proximity of the marker. Further tags can be placed next to the marker, such that their spatial position is defined.

3.2

survey targets

targets

crosshairs of varying types that are attached to buildings or objects

Note 1 to entry: The spatial position of their centre is measured by surveyors, i.e. with theodolites.

3.3

tag

human- or machine-readable mark, or digital identity used to communicate information about an entity