New Edition of the Land Administration Domain Model Now Nearly Completed

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SUMMARY

The Land Administration Domain Model (LADM) was published in 2012 as an ISO International Standard as ISO 19152:2012 Geographic information - Land Administration Domain Model (LADM).

Each ISO International Standard is subject to a systematic review every five years, and this process was initiated for LADM in 2018. During the 48th plenary week of ISO/TC 211, it was decided to design the new LADM as a multi-part standard, to refine the existing content and to extend it with new content related to marine spaces as well as land value and land use aspects to cover all functions of land administration. The titles of the new parts of LADM are as follows:

- Part 1 - Generic conceptual model
- Part 2 - Land registration
- Part 3 - Marine georegulation
- Part 4 - Valuation information
- Part 5 - Spatial plan information
- Part 6 - Implementation aspects

All parts are standards in itself.

The systematic revision started in 2020. At the time of writing this abstract (February 2024), Parts 1 and 3 have been published as International Standards and Parts 2, 4 and 5 are being submitted to the ISO/TC 211 secretariat for balloting as Final Draft International Standard (FDIS) stage and each one of them is expected to be published as an ISO International Standard in 2025.

This paper seeks to inform interested parties about the progress of the new edition's development and to provide insights into the ongoing review process. Accordingly, the recent status of all parts of LADM Edition II is systematically presented to the reader.

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1. INTRODUCTION

The idea of creating a land administration (LA) standard was initiated at the 2002 FIG Congress in Washington D.C., United States. After six years of preparation within the International Federation of Surveyors (FIG), the standard development process within ISO/TC211 Geographic Information was initiated in 2008. This process has been successfully concluded with the publication of the ISO 19152:2012 Land Administration Domain Model (LADM). Detailed information about the development process and the development of the first edition of LADM can be found in Lemmen (2012), Lemmen et al. (2012), Van Oosterom et al. (2013) and Lemmen et al. (2013).

Following the publication of LADM as an international standard it has been widely used and implemented by various international organizations and countries (see Lemmen et al., 2020; Kalogianni et al., 2021; Kara et al., 2024). According to Kalogianni et al. (2021), more than 40 countries have developed a LADM country profile. In addition, several proposals have been made to extend the scope of LADM, such as marine georegulation, valuation information, spatial plan information, refined survey model, semantically enriched code lists, and so on.

During a meeting of the UN-GGIM Expert Group on Land Administration and Management in March 2017 in Delft, the Netherlands, it was concluded that a revision of LADM Edition I is needed in order to provide better tools for support in tenure security and more complete coverage of land administration, see UN-GGIM (2019). As a result of the vote (March 2018) on the systematic review of ISO 19152:2012, it became clear that the majority of ISO/TC 211 Participating Members (P-members) expressed their desire for the revision. Several FIG LADM workshops have been organized to discuss the systematic revision of LADM Edition I: One in Delft, Netherlands in March 2017 (FIG, 2017), one in Zagreb, Croatia in April 2018 (FIG, 2018), one in Kuala Lumpur, Malaysia in October 2019 (FIG, 2019), one online in June 2021 (FIG, 2021), one in Dubrovnik, Croatia in March/April 2022 (FIG, 2022), one in Gävle, Sweden in October 2023 (FIG, 2023) and the last one in Kuching, Malaysia on 24-26 September 2024 (FIG, 2024). See Figure 1 for some pictures from 12th International FIG Workshop on LADM & 3D LA 24-26 September 2024, Kuching, Malaysia.

Figure 1 – Photos from 12th LADM & 3D LA Workshop (credit: Alias Abdul Rahman)

At the 48th Plenary Meeting Week of ISO/TC 211, it was decided that LADM Edition II would be designed as a multipart standard. The following structure for the multipart option was agreed by the participants of this meeting:

- Part 1 – Fundamentals (later renamed Generic conceptual model)
- Part 2 – Land registration
- Part 3 – Marine space georegulation (later renamed Marine georegulation)
- Part 4 – Valuation information
- Part 5 – Spatial plan information
- Part 6 – Implementations (later renamed Implementation aspects)

The decision to publish LADM Edition II as a multi-part standard meant that a New Work Item Proposal (NWIP) had to be formulated separately for each part. For more details on the development process up to 2023, see Lemmen et al. (2019, 2021, 2023) and Kara et al. (2024).

Taking into account the suggestions of the TC 211 members and comments and feedback gathered from the workshops, the LADM revision started in 2018. The editors of LADM Edition II intend to publish papers on the developments on a regular basis. So far, Lemmen et al. (2019, 2021, 2023) and Kara et al. (2024) have been published to inform about the foundations of each stage of the revision of the standard and to allow them to follow the progress. The aim of this paper is to sum up the development process of LADM Edition II for each part from the beginning and to inform the reader about the latest developments. It is important to note that the LADM Edition II revision for some of its parts (i.e. parts 2, 4 and 5)

are still under development at the time of writing (February 2025) and may change at the time of the voting rounds.

The purpose of this paper is to report on the status of the LADM systematic revision process within ISO/TC211. First, an overview of the developments for each part of LADM Edition II is given in Section 3. The conclusions of the paper are presented in the last section.

2. DEVELOPMENTS IN EACH PART OF LADM EDITION II

2.1 ISO 19152-1:2024 Generic conceptual model

LADM Part 1 is designed as a high-level umbrella standard that supports all other parts of LADM Edition II, which is backward compatible with LADM Edition I. It provides an overview of each proposed part of LADM Edition II (Parts 2, 3, 4 and 5). It introduces the basic terms and concepts of LA and includes only the characteristics of the special classes: VersionedObject and LA_Source. The abstract class VersionedObject is introduced to manage and maintain versioned data. All LADM classes inherit (directly or indirectly) from VersionedObject, with the exception of LA_Source. The LA_Source class is introduced to support any type of source. In order to version the instances of LA_Source, association relationships (integrated source) are specified between the VersionedObject and LA_Source. All the concepts and definitions given in Part 1 are used as a basis by the other possible parts of LADM Edition II.

The NWIP for 19152-1 was prepared in the first half of 2020 and submitted to ISO/TC 211 by Standards Australia (SA) on behalf of the FIG, among others by the author team. The voting result was received in October 2020 and was positive (19-yes, 0-no, 17-abstain). The proposal was therefore approved for inclusion in the work programme of ISO/TC 211. In addition, 59 comments on Part 1/NWIP were submitted by ISO/TC211 members at this stage. From January 2021 to April 2021, the comments were discussed in several virtual meetings with the development team. Once the comments were agreed, they were processed and used to produce the Committee Draft (CD) version of the standard.

The ballot of ISO/CD 19152-1 was launched in the ISO eBalloting Portal in September 2021. The result of the ballot was received in November 2021 and was positive (21-yes, 1-no, 15-abstain). At this stage, 80 comments on Part 1/CD were submitted by ISO/TC211 members. These were discussed in several virtual meetings and Part 1 Draft International Standard (DIS) was prepared by the editors.

The ballot of ISO/DIS 19152-1 was launched on the ISO eBalloting Portal in October 2022. The result of the ballot was received in March 2023 and was positive (22-yes, 1-no, 12-abstention). This time 105 comments were received. Part 1 Final Draft International Standard (FDIS) was prepared by the editors taking into account the discussions on the resolution of the comments in project team meetings.

Part 1/FDIS was submitted to ISO/TC 211 and the ballot started in September 2023. The result of the ballot was received in November 2023 and was positive (25-yes, 1-no, 12-abstain). 41 comments were received at this stage.

After the latest revisions, ISO 19152-1:2024 Generic conceptual model was published by ISO as an International Standard (IS) in January 2024, see Figure 2.

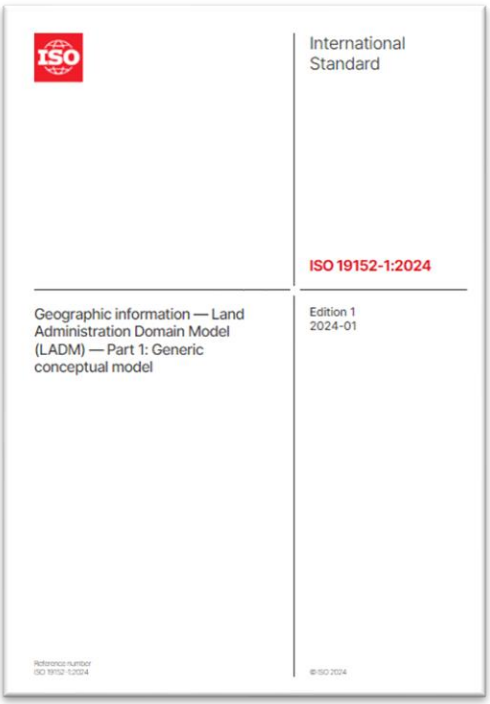

Figure 2 – Cover page of the ISO 19152-1:2024 (source: https://www.iso.org/standard/81263.html)

2.2 ISO 19152-2 Land registration

The focus of LADM Edition I (ISO 19152:2012) is on land registration. This is now the focus of Part 2 of LADM Edition II with some refinements: New subclasses for LA_SpatialUnit, refined survey model (derived from OGC's LandInfra/InfraGML standard), semantically enriched and versioned code list (metamodel for refined code list values), integration of LADM and OGC's IndoorGML, a set of possible representations of spatial units in 2D, 3D or mixed dimension, legal spaces in buildings, interface classes for SDG indicators, refined legal profiles and so on.

The NWIP for ISO 19152-2 was prepared in the second half of 2021 and submitted by FIG to ISO/TC 211. Part 2/NWIP was submitted to ISO/TC 211 and voting started in October 2021. The result of the vote was received in January 2022 and was positive (20 yes, 0 no, 16 abstain). The proposal was therefore approved for inclusion in the Work Programme of ISO/TC 211. In

addition, 29 comments were received from ISO/TC211 P-members for Part 2. From March 2022 to November 2022, many of the issues and comments were discussed in several virtual meetings with a proposed group of experts. Once the comments were agreed, they were processed and used to produce CD for Part 2.

Part 2/CD was submitted in December 2022 and voting started in February 2023. The result of the ballot was received in April 2023, and the experts from various countries and ISO submitted a total of 89 comments to be resolved before proceeding to the next stage, namely DIS. Taking into account the comments received and the outcome of the resolution meetings, Part 1/DIS was prepared by the editors.

Part 2/DIS was submitted in December 2023. DIS voting started in April 2024. The voting result for DIS 19152-2 was received in July 2024 and was positive (24-yes, 1-no, 16-abstain); therefore Part 2 is accepted as DIS. This meant that Part 2/FDIS could be submitted after the comments received in the DIS ballot had been addressed.

A total of 269 comments were received on the DIS ballot. Of these, 204 were editorial comments, 28 were technical comments and 37 were general comments. The editors organized four internal meetings in September to discuss the comments received and agreed to accept 242 comments. The accepted comments were processed first in Part 2. These accepted comments include the redrawing of all figures in Part 2 (about 100 figures) due to the change of rules (e.g., figure size, font, etc.) in ISO/TC 211.

This means that a total of 27 comments should be discussed with the project team in ISO/TC 211 project team meetings. Three online project team meetings were organized in October 2024 to discuss the remaining 27 comments with the project team. After agreement on all other comments, the agreed solutions were processed by the editors and ISO/FDIS 19152-2 was prepared and submitted to ISO/TC 211 in December 2024. The ballot for Part 2/FDIS will start in February 2025 and the ballot results will be received in April 2025.

Given the process for Part 2, the editors expect Part 2 to be published as an IS early in the second half of 2025.

2.3 ISO 19152-3 Marine georegulation

LADM Part 3 provides a model for the representation of rights, restrictions and responsibilities (RRRs) in the context of marine space and this part refers directly to IHO S-121 (the content is quite similar).

The NWIP for ISO 19152-3 was prepared in early 2022 and submitted to ISO/TC 211. These documents were launched on the ISO eBallotting Portal in January 2022. The result of the ballot was received in May 2022 and was positive (17-yes, 0-no, 17-abstain). The proposal was therefore approved for inclusion in the work programme of ISO/TC 211. Several comments on Part 3 were also submitted by ISO/TC211 members at this stage. Following agreement on the

comments, they were processed and used to produce a Part 3/CD document. Part 3/CD was submitted for the next stage in October 2022. After agreement on the comments, they were processed and used to create the DIS document, which was submitted for the next stage in April 2023 and the voting result was positive (22-yes, 0-no, 17-abstain). Subsequently, Part 3/FDIS was submitted for the next stage in February 2024, taking into account the comments received in the DIS stage, and the result of the vote was positive (23-yes, 1-no, 17-abstain).

ISO 19152-3 was published as an IS in July 2024, see Figure 3. See also (Beaupré et al., 2022)

It should be noted that the authors of this paper have had no role other than to observe the process of this part of the LADM.

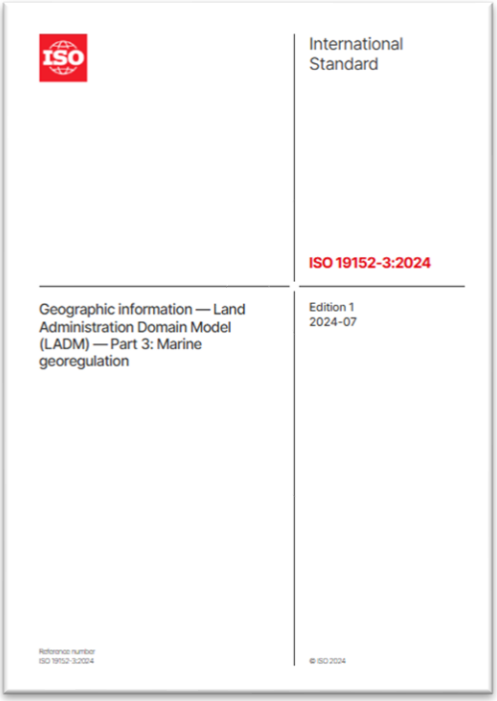

Figure 3 – Cover page of the ISO 19152-3:2024 (source: https://www.iso.org/standard/81265.html)

2.4 ISO 19152-4 Valuation information

LADM Part 4 is designed to represent information related to administrative property valuation. This Part is an extension of the core LADM. It provides a common basis for governments to guide the development of local and national databases and for the private sector to develop information technology products and services.

The NWIP for Part 4 was prepared in the second half of 2021 and was submitted to ISO/TC 211 by the FIG. It was launched on the ISO eBallotting Portal in September 2021. The voting

result was received in June 2022 and was positive (21-yes, 0-no, 14-abstain). The proposal is therefore approved for inclusion in the work programme of ISO/TC 211. In addition, 14 comments on Part 4 were submitted by ISO/TC211 P-members. In September 2022, many issues and the comments were discussed in virtual meetings with a group of experts. After agreement on the comments, they were processed and used to create the Part 4/CD version of the standard document.

The Part 4/CD was submitted for the next stage in December 2022. 52 comments were received from the experts. The responses of the main editors were formulated, and a project team meeting was held to resolve the comments. After processing the comments, Part 4/DIS was prepared and submitted in February 2024 for voting to proceed to the next stage, the DIS stage. The result of the vote on Part 4/DIS 19152-4 was received in August 2024 and was positive (19-yes, 1-no, 21-abstain); therefore Part 4 is accepted as a DIS. This meant that Part 4/FDIS could be submitted for ballot after the comments received in the DIS ballot had been addressed.

A total of 116 comments were received in the DIS ballot. Of these, 97 were editorial comments, 3 were technical comments and 16 were general comments. The editors organized two internal meetings in October to discuss the comments received and agreed to accept 111 comments, and these accepted comments were initially processed by the editors in Part 4. These accepted editorial comments include the redrawing of all figures in Part 4 (approximately 20 figures). An online project team meeting was organized in November 2024 to discuss the remaining 5 comments with the project team. After agreement on all comments, the agreed solutions were processed by the editors and FDIS for Part 4 was prepared.

ISO/FDIS 19152-4 was submitted to ISO/TC 211 in early January 2025. The editors expect the ballot results for Part 4 FDIS to be available in the second half of 2025.

Given the process for Part 4, the editors expect Part 4 to be published as an IS in the second half of 2025.

2.5 ISO 19152-5 Spatial plan information

LADM Part 5 contains planned land use (zoning) information to be converted into RRRs. It enables the integration of RRR information as a result of spatial planning into LADM.

The NWIP for Part 5 was prepared in the second half of 2021 and was submitted to ISO/TC 211 by FIG. It was launched in the ISO eBallotting Portal in September 2021. The voting result was received in September 2022 and was positive (19-yes, 1-no, 15-abstain). The proposal is therefore approved for inclusion in the Work Programme of ISO/TC 211. In addition, 44 comments on Part 5 were received from ISO/TC211 P-members. From September 2022 to October 2022, many issues and comments were discussed in several virtual meetings with a group of experts. Once all responses were agreed, the comments were processed and used to produce the Part 5/CD version of the standard document.

Part 5/CD was submitted for the next stage in January 2023. The experts provided 57 comments. The responses of the main editors were formulated, and a project team meeting was held to resolve the comments. Part 5/DIS was submitted for the next stage in March 2024. The voting result was received in September 2024 and was positive (25-yes, 1-no, 13-abstain); therefore Part 5 was accepted as DIS and went for submission for FDIS after addressing the comments received in the DIS ballot.

A total of 164 comments were received on the DIS ballot. Of these, 124 were editorial comments, 16 were technical comments and 24 were general comments. The editors organized three internal meetings in October 2024 to discuss the comments received and agreed to accept 130 comments, and these accepted comments were initially processed by the editors in Part 5. These accepted editorial comments included the redrawing of all figures in Part 5 (approximately 15 figures).

Two online project team meetings were organized in November 2024 to further discuss the comments. After agreement on all the other comments they were processed by the editors.

ISO/FDIS 19152-5 was submitted to ISO/TC 211 at the beginning of January 2025. The editors expect the ballot results for Part 5 FDIS to be available in the second half of 2025.

Given the process for Part 5, the editors expect Part 5 to be published as an IS in the second half of 2025.

2.6 ISO 19152-6 Implementation aspects

The preparation of this part has continued. This part will be prepared in collaboration with OGC and other stakeholders to support the implementation of LADM Edition II. The Land Administration Domain Model Standards Working Group has been formed by OGC and public comment on the charter is being sought (Unger et al., 2023). It should be noted that the OGC Standard Working Group (SWG) LADM has been approved for the development of Part 6.

This part will include several technical encodings (e.g. gml, geojson, rdf, etc.), a proposal for a service-oriented approach based on OGC APIs for LADM implementation, a methodology for developing a country profile, LA processes, semantically enriched code lists and more.

The first draft document for this part will be prepared in cooperation with OGC in 2025.

3. PLANS FOR THE DEVELOPMENT OF LADM EDITION II

The development of an ISO International Standard is an intensive process requiring expert meetings to discuss and resolve the comments provided by the P-members of ISO/TC 211 and to address all resolution results.

A progress report has been presented at each plenary meeting of ISO/TC 211, the latest being presented at the 59th plenary meeting of ISO/TC 211 in Sydney. The next progress report will be presented at the 60th plenary meeting of ISO/TC 211 in Wuhan, China, 19-25 May 2025.

The editors expect that Parts 2, 4 and 5 will be published as ISO International Standards in 2025.

As all ISO international standards are subject to systematic review, ISO 19152-1:2024 will be re-evaluated in 2029. The editors plan to set up a maintenance page to keep track of issues for improvement, not only for Part 1 but for all parts of LADM Edition II.

Figure 4 presents the status of developments of all parts of LADM Edition II within ISO/TC 211 as per February 2025.

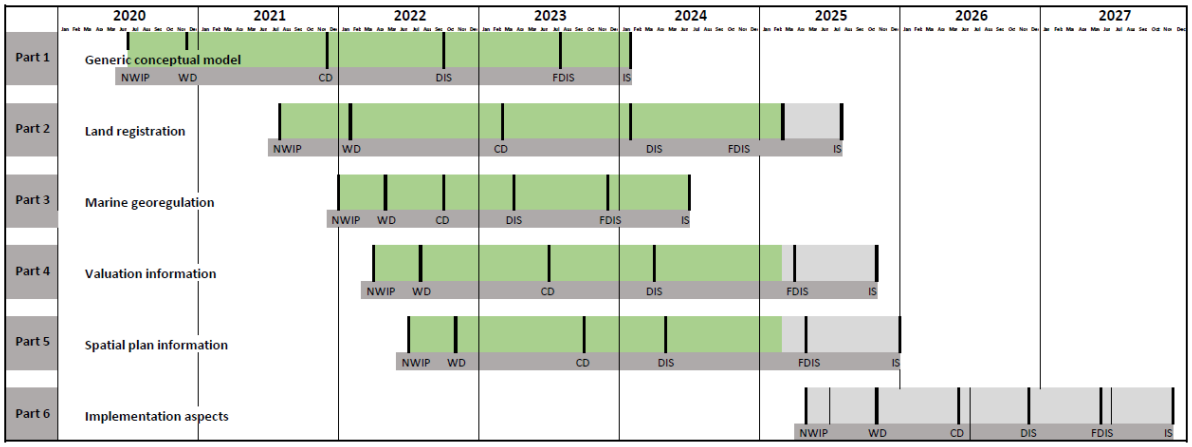

Figure 4 – Status development of all parts of LADM Edition II as per February 2025

4. CONCLUSION

LADM Edition II adds capabilities to support marine georegulation, valuation information, spatial plan information, and includes extensions in the following directions: refined legal modelling, links to (Geo)BIM, refined survey model/spatial representations, 3D/4D Cadastre, monitoring of SDG indicators, refined code list values, support for indoor navigation by managing the access and use of space for each party, and so on. This makes LADM Edition II's coverage of data represented in the land administration domain more complete.

Standardization is a never-ending process as humanity experiences the information technology age, including semantic web, artificial intelligence, remote sensing and many other technologies yet to be further developed. This also applies to the LA domain. It is expected that the future will bring further improvements in terms of LAS – based on future editions of the LADM

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BIOGRAPHICAL NOTES

Abdullah Kara holds a Ph.D. degree (2021) from Yıldız Technical University with a thesis on the extension of the Land Administration Domain Model (LADM) with valuation information, which is used as a basis for the development of LADM Part 4 – Valuation information. He worked as a post-doctoral researcher (2021-2024) with focus on LADM revision at the GIS Technology Section, Delft University of Technology. He works as an assistant professor at Gebze Technical University starting from 2024. He is actively involved in FIG working groups. He is currently one of the co-chairs of the FIG Working Group on '3D LA/LADM' (WG 7.3) and of 'Spatial Plan and Valuation Information in LADM Context (WG 8.5)'. He is one of the co-editors of the second edition of the LADM.

Peter van Oosterom obtained an MSc in Technical Computer Science in 1985 from Delft University of Technology, the Netherlands. In 1990 he received a PhD from Leiden University. From 1985 until 1995 he worked at the TNO-FEL laboratory in The Hague. From 1995 until 2000 he was senior information manager at the Dutch Cadastre, where he was involved in the renewal of the Cadastral database. Since 2000, he is Professor at Delft University of Technology, and head of the 'GIS Technology' Section, Faculty of Architecture and the Built Environment at Delft University of Technology, the Netherlands. He is the current chair of the FIG Working Group on '3D LA/LADM' and co-editor of the International Standard for the Land Administration Domain, ISO 19152.

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