

# DIN EN ISO 20524-2:2022-10 (E)

Erscheinungsdatum: 2022-09-23

Intelligent transport systems - Geographic Data Files (GDF) GDF5.1 - Part 2: Map data used in automated driving systems, Cooperative ITS, and multi-modal transport (ISO 20524-2:2020); English version prEN ISO 20524-2:2022, only on CD-ROM

## Contents

Page

|                                                                                  |     |
|----------------------------------------------------------------------------------|-----|
| Foreword .....                                                                   | xi  |
| Introduction .....                                                               | xii |
| 1 Scope .....                                                                    | 1   |
| 2 Normative references .....                                                     | 1   |
| 3 Terms and definitions .....                                                    | 1   |
| 4 Abbreviated terms, symbols and notation elements .....                         | 2   |
| 4.1 Abbreviated terms .....                                                      | 2   |
| 4.2 Symbols and notation elements .....                                          | 3   |
| 5 Overall conceptual data model .....                                            | 3   |
| 5.1 Conceptual data models in GDF .....                                          | 3   |
| 5.2 General data model of GDF .....                                              | 4   |
| 5.2.1 Feature model .....                                                        | 4   |
| 5.2.2 Belt concept .....                                                         | 6   |
| 5.2.3 Graph topology .....                                                       | 7   |
| 5.2.4 Levels in GDF .....                                                        | 13  |
| 5.2.5 Height modelling and time modelling .....                                  | 15  |
| 5.3 The Attribute model .....                                                    | 16  |
| 5.4 The Relationship model .....                                                 | 18  |
| 5.5 Linear referencing .....                                                     | 19  |
| 5.6 The Feature representation scheme .....                                      | 19  |
| 5.7 Time modelling .....                                                         | 20  |
| 5.8 Data management: organization of Feature data into Layers and Sections ..... | 21  |
| 6 Feature Catalogue .....                                                        | 24  |
| 6.1 Generic specifications .....                                                 | 24  |
| 6.1.1 Features and Feature Themes .....                                          | 24  |
| 6.1.2 Feature Class Codes .....                                                  | 25  |
| 6.1.3 Simple and Complex Features .....                                          | 25  |
| 6.1.4 Feature hierarchy .....                                                    | 25  |
| 6.1.5 Data model for the Feature Catalogue .....                                 | 25  |
| 6.1.6 Shareable Feature .....                                                    | 26  |
| 6.2 Abstract Belt Feature .....                                                  | 30  |
| 6.2.1 General .....                                                              | 30  |
| 6.2.2 RoadBelt .....                                                             | 33  |
| 6.2.3 RoadBeltElement .....                                                      | 35  |
| 6.2.4 IntersectionBelt .....                                                     | 36  |
| 6.2.5 RoundaboutBelt .....                                                       | 38  |
| 6.2.6 LaneBeltElement .....                                                      | 38  |
| 6.2.7 LaneBeltJoint .....                                                        | 41  |
| 6.2.8 PotentialEvadingArea .....                                                 | 42  |
| 6.2.9 BeltRepresentativeLine (BRL) .....                                         | 43  |
| 6.2.10 IntersectionConnectionPoint (ICP) .....                                   | 45  |
| 6.2.11 LaneConnectionPoint (LCP) .....                                           | 45  |
| 6.2.12 BeltOptionalPoint (BOP) .....                                             | 45  |
| 6.2.13 BeltPartitionLine .....                                                   | 46  |
| 6.3 Road Furniture Feature .....                                                 | 47  |
| 6.3.1 General overview .....                                                     | 47  |
| 6.3.2 Road Structural Component (RSC) .....                                      | 47  |

|          |                                                                  |           |
|----------|------------------------------------------------------------------|-----------|
| 6.3.3    | Road Marking-2 .....                                             | 48        |
| 6.3.4    | Safety Fixture .....                                             | 50        |
| 6.4      | Public Transport Feature .....                                   | 51        |
| 6.4.1    | General overview .....                                           | 51        |
| 6.4.2    | Public Transport Feature .....                                   | 53        |
| 6.4.3    | Public Transport Point .....                                     | 54        |
| 6.4.4    | Public Transport Point Sequence .....                            | 54        |
| 6.4.5    | Public Transport Point Sequence Part .....                       | 55        |
| 6.4.6    | Public Transport Point Set .....                                 | 55        |
| 6.4.7    | Public Transport Point Set Part .....                            | 56        |
| 6.4.8    | Public Transport Representative Point .....                      | 56        |
| 6.4.9    | Public Transport Zone .....                                      | 56        |
| <b>7</b> | <b>Attribute Catalogue .....</b>                                 | <b>56</b> |
| 7.1      | Generic specifications .....                                     | 56        |
| 7.1.1    | Attribute Types .....                                            | 56        |
| 7.1.2    | Attribute Values .....                                           | 57        |
| 7.1.3    | Attribute Type Name .....                                        | 57        |
| 7.1.4    | Simple Attributes, Composite Attributes and Sub-Attributes ..... | 57        |
| 7.1.5    | Names in combination with a Language Code .....                  | 58        |
| 7.1.6    | Default Attribute Values .....                                   | 58        |
| 7.1.7    | Default Attribute units for measures .....                       | 58        |
| 7.1.8    | Attribute Type Codes .....                                       | 58        |
| 7.1.9    | User Defined Attributes .....                                    | 58        |
| 7.1.10   | Attribute mapping to Feature Themes and Relationships .....      | 59        |
| 7.1.11   | The data model for Attributes .....                              | 64        |
| 7.2      | Attributes .....                                                 | 70        |
| 7.2.1    | Alignment Portion Type .....                                     | 70        |
| 7.2.2    | Applied Direction .....                                          | 71        |
| 7.2.3    | Applied Feature Type .....                                       | 71        |
| 7.2.4    | Applied Side Line .....                                          | 71        |
| 7.2.5    | Approximated Curve .....                                         | 71        |
| 7.2.6    | Belt Overlapping .....                                           | 72        |
| 7.2.7    | Belt Representative Line Segment Characteristic .....            | 72        |
| 7.2.8    | Road Belt Element Segment Characteristic .....                   | 72        |
| 7.2.9    | Circular Curve Measure .....                                     | 73        |
| 7.2.10   | Clothoid Curve Measure .....                                     | 73        |
| 7.2.11   | Connection Type .....                                            | 73        |
| 7.2.12   | Context Of Point .....                                           | 73        |
| 7.2.13   | Context Of Point Set .....                                       | 74        |
| 7.2.14   | Context Of Point Sequence .....                                  | 74        |
| 7.2.15   | Cross-section .....                                              | 74        |
| 7.2.16   | Design Reference .....                                           | 74        |
| 7.2.17   | End Elevation Measure .....                                      | 75        |
| 7.2.18   | Existence Position .....                                         | 75        |
| 7.2.19   | Flexure Angle .....                                              | 75        |
| 7.2.20   | Flexure Point .....                                              | 75        |
| 7.2.21   | Gradient .....                                                   | 76        |
| 7.2.22   | Heading Angle .....                                              | 76        |
| 7.2.23   | Height Block Characteristics .....                               | 76        |
| 7.2.24   | Height Block Information .....                                   | 77        |
| 7.2.25   | Hierarchical Info .....                                          | 77        |
| 7.2.26   | Identifier Number .....                                          | 77        |
| 7.2.27   | Include Bicycle Lane .....                                       | 77        |
| 7.2.28   | Intersection Category .....                                      | 78        |
| 7.2.29   | Intersection Type .....                                          | 78        |
| 7.2.30   | Lane Block ID .....                                              | 78        |
| 7.2.31   | Lane Block Info .....                                            | 78        |
| 7.2.32   | Lane Transfer Characteristic .....                               | 79        |
| 7.2.33   | Lane Transfer Characteristic Type .....                          | 79        |
| 7.2.34   | Lane Number .....                                                | 80        |
| 7.2.35   | Lane Number Of Referencing .....                                 | 80        |
| 7.2.36   | Lane Belt Element Segment Characteristic .....                   | 80        |
| 7.2.37   | Lane Width Change .....                                          | 81        |

|        |                                                           |    |
|--------|-----------------------------------------------------------|----|
| 7.2.38 | Line Code.....                                            | 81 |
| 7.2.39 | Line Name.....                                            | 82 |
| 7.2.40 | Line Segment Information.....                             | 82 |
| 7.2.41 | Linear Portion Measure.....                               | 82 |
| 7.2.42 | Marking Type.....                                         | 82 |
| 7.2.43 | Maximum Tolerance.....                                    | 83 |
| 7.2.44 | Minimum Tolerance.....                                    | 83 |
| 7.2.45 | Number Of Lanes in Lane Section.....                      | 83 |
| 7.2.46 | Number Of Lane Section Block Info.....                    | 83 |
| 7.2.47 | Number Of Slope Measure.....                              | 84 |
| 7.2.48 | PEA Limitation.....                                       | 84 |
| 7.2.49 | Public Transport Operator.....                            | 84 |
| 7.2.50 | Road Alignment.....                                       | 84 |
| 7.2.51 | Road-facing Side.....                                     | 85 |
| 7.2.52 | Road Marking Common Attribute.....                        | 85 |
| 7.2.53 | Road Marking Individual Attribute.....                    | 85 |
| 7.2.54 | Road Marking Individual Characteristics.....              | 86 |
| 7.2.55 | Road Structural Component Common Attribute.....           | 86 |
| 7.2.56 | Road Structural Component Individual Attribute.....       | 86 |
| 7.2.57 | Road Structural Component Individual Characteristics..... | 86 |
| 7.2.58 | Safety Fixture Common Attribute.....                      | 87 |
| 7.2.59 | Safety Fixture Individual Attribute.....                  | 87 |
| 7.2.60 | Safety Fixture Individual Characteristics.....            | 87 |
| 7.2.61 | Segment Direction.....                                    | 87 |
| 7.2.62 | Slope Measure.....                                        | 88 |
| 7.2.63 | Sub Feature Class Code (Road Furniture).....              | 88 |
| 7.2.64 | Start Elevation Measure.....                              | 88 |
| 7.2.65 | Traffic Restriction.....                                  | 88 |
| 7.2.66 | Traffic Restriction Item.....                             | 89 |
| 7.2.67 | Traffic Restriction Type Code.....                        | 89 |
| 7.2.68 | Traffic Restriction Value.....                            | 89 |
| 7.2.69 | Transport Mode.....                                       | 89 |
| 7.2.70 | Traverse Point Location.....                              | 90 |
| 7.2.71 | Transverse Slope.....                                     | 90 |
| 7.2.72 | Type Of BeltRepresentativeLine.....                       | 91 |
| 7.2.73 | Type Of Public Transport Point.....                       | 91 |
| 7.2.74 | Type Of Public Transport Point Sequence.....              | 92 |
| 7.2.75 | Type Of Public Transport Point Set.....                   | 92 |
| 7.2.76 | Without Road shoulder.....                                | 93 |
| 7.2.77 | Zone Description.....                                     | 93 |
| 7.2.78 | Zone Name.....                                            | 93 |

|          |                                                                             |           |
|----------|-----------------------------------------------------------------------------|-----------|
| <b>8</b> | <b>Relationship Catalogue.....</b>                                          | <b>93</b> |
| 8.1      | Generic specifications.....                                                 | 93        |
| 8.1.1    | Feature and their Relationships.....                                        | 93        |
| 8.1.2    | Relationship Types.....                                                     | 108       |
| 8.1.3    | Relationship Type Codes.....                                                | 108       |
| 8.1.4    | Arity of a Relationship.....                                                | 109       |
| 8.1.5    | Roles and partners of a Relationship.....                                   | 109       |
| 8.1.6    | Homogeneous Relationships and their constraints.....                        | 109       |
| 8.2      | Relationship Types.....                                                     | 110       |
| 8.2.1    | Belt Representative Line Associated With Intersection Connection Point..... | 110       |
| 8.2.2    | Belt Representative Line Associated With Lane Connection Point.....         | 111       |
| 8.2.3    | Belt Representative Line Characteristic.....                                | 111       |
| 8.2.4    | Road Belt Element Associated With Intersection Belt.....                    | 112       |
| 8.2.5    | Road Belt Element Ownership Of Belt Representative Line.....                | 112       |
| 8.2.6    | Road Belt Element Segment Characteristic.....                               | 113       |
| 8.2.7    | Intersection Belt Ownership Of Belt Representative Line.....                | 114       |
| 8.2.8    | Lane Belt Element Associated With Lane Belt Joint.....                      | 114       |

|           |                                                                         |            |
|-----------|-------------------------------------------------------------------------|------------|
| 8.2.9     | Lane Belt Element Ownership Of Belt Representative Line .....           | 115        |
| 8.2.10    | Lane Belt Element Segment Characteristic .....                          | 115        |
| 8.2.11    | Lane Belt Joint Associated With Intersection Belt .....                 | 116        |
| 8.2.12    | Lane Section .....                                                      | 116        |
| 8.2.13    | Multi Public Transport Point Assignment .....                           | 117        |
| 8.2.14    | PEA Ownership Of Belt Representative Line .....                         | 118        |
| 8.2.15    | Public Transport Point In Correspondence With Road Element .....        | 118        |
| 8.2.16    | Road Belt Associated With Intersection Belt .....                       | 119        |
| 8.2.17    | Road Belt Ownership Of Belt Representative Line .....                   | 119        |
| 8.2.18    | Road Furniture Along Road Belt Element .....                            | 120        |
| 8.2.19    | Road Furniture Along Belt Representative Line .....                     | 121        |
| 8.2.20    | Road Furniture Along Intersection Belt .....                            | 121        |
| 8.2.21    | Road Furniture Along Lane Belt Element .....                            | 122        |
| 8.2.22    | Road Marking Along Road Belt Element .....                              | 123        |
| 8.2.23    | Road Marking Along Belt Representative Line .....                       | 124        |
| 8.2.24    | Road Marking Along Intersection Belt .....                              | 125        |
| 8.2.25    | Road Marking Along Lane Belt Element .....                              | 125        |
| 8.2.26    | Segmented Edge Of PEA Belt .....                                        | 126        |
| 8.2.27    | Shareable Coverage Area Linked To Shareable Point .....                 | 127        |
| 8.2.28    | Shareable Coverage Area Linked To Shareable Point Sequence .....        | 127        |
| 8.2.29    | Shareable Coverage Area Linked To Shareable Point Set .....             | 128        |
| 8.2.30    | Shareable Representative Point Linked To Shareable Point Sequence ..... | 128        |
| 8.2.31    | Shareable Representative Point Linked To Shareable Point Set .....      | 129        |
| 8.2.32    | Structure Along Road Belt Element .....                                 | 129        |
| 8.2.33    | Structure Along Belt Representative Line .....                          | 130        |
| <b>9</b>  | <b>Feature representation rules .....</b>                               | <b>131</b> |
| 9.1       | General .....                                                           | 131        |
| 9.2       | Generic specifications .....                                            | 131        |
| 9.2.1     | Overview .....                                                          | 131        |
| 9.2.2     | Feature Categories .....                                                | 131        |
| 9.2.3     | Types of topology .....                                                 | 132        |
| 9.2.4     | Levels of representation .....                                          | 132        |
| 9.2.5     | Layers on level 0 .....                                                 | 134        |
| 9.2.6     | Rules for level 0 representation .....                                  | 134        |
| 9.3       | Abstract Belt Feature .....                                             | 134        |
| 9.3.1     | Introduction .....                                                      | 134        |
| 9.3.2     | Level 2 representation .....                                            | 134        |
| 9.3.3     | Level 1 representation .....                                            | 134        |
| 9.3.4     | Level 0 representation .....                                            | 137        |
| 9.4       | Road Furniture .....                                                    | 137        |
| 9.4.1     | Level 2 representation .....                                            | 137        |
| 9.4.2     | Level 1 representation .....                                            | 137        |
| 9.4.3     | Level 0 representation .....                                            | 137        |
| 9.5       | Shareable Feature .....                                                 | 137        |
| 9.5.1     | Level 2 representation .....                                            | 137        |
| 9.5.2     | Level 1 representation .....                                            | 138        |
| 9.5.3     | Level 0 representation .....                                            | 138        |
| 9.6       | Public Transport Feature .....                                          | 138        |
| 9.6.1     | Level 2 representation .....                                            | 138        |
| 9.6.2     | Level 1 representation .....                                            | 138        |
| 9.6.3     | Level 0 representation .....                                            | 138        |
| <b>10</b> | <b>Metadata Catalogue .....</b>                                         | <b>138</b> |
| <b>11</b> | <b>Logical Data Structures .....</b>                                    | <b>138</b> |
| 11.1      | Introduction .....                                                      | 138        |
| 11.1.1    | Data description language: ESN .....                                    | 138        |
| 11.1.2    | Sets, elements and ranges .....                                         | 138        |
| 11.1.3    | Summary of the syntax notation .....                                    | 138        |

|           |         |                                                                              |            |
|-----------|---------|------------------------------------------------------------------------------|------------|
|           | 11.1.4  | Useful consequences of the syntax notation.....                              | 139        |
|           | 11.1.5  | Diagrammatic overview of the overall structure.....                          | 139        |
| 11.2      |         | Logical GDF Album .....                                                      | 140        |
| 11.3      |         | Datasets.....                                                                | 141        |
| 11.4      |         | Layers.....                                                                  | 141        |
| 11.5      |         | Sections.....                                                                | 141        |
|           | 11.5.1  | Overview.....                                                                | 141        |
|           | 11.5.2  | SECTION .....                                                                | 141        |
|           | 11.5.3  | Section Metadata .....                                                       | 141        |
|           | 11.5.4  | Section Data .....                                                           | 141        |
| 11.6      |         | Time Domain Syntax.....                                                      | 157        |
| 11.7      |         | Update Information .....                                                     | 157        |
|           | 11.7.1  | Overview.....                                                                | 157        |
|           | 11.7.2  | UPDATE INFORMATION .....                                                     | 157        |
|           | 11.7.3  | GEO TOPO UPDATE INFORMATION .....                                            | 157        |
|           | 11.7.4  | OBJECT UPDATE INFORMATION .....                                              | 157        |
|           | 11.7.5  | Basic Data Types used by Update Information.....                             | 157        |
| 11.8      |         | Common Data Types.....                                                       | 158        |
|           | 11.8.1  | Overview.....                                                                | 158        |
|           | 11.8.2  | Pre-defined code lists and value lists.....                                  | 158        |
|           | 11.8.3  | Geodeticals.....                                                             | 158        |
|           | 11.8.4  | Units & measures.....                                                        | 158        |
|           | 11.8.5  | Coordinates.....                                                             | 158        |
|           | 11.8.6  | Geographics .....                                                            | 158        |
|           | 11.8.7  | Identifier types .....                                                       | 158        |
|           | 11.8.8  | Basic types.....                                                             | 164        |
| <b>12</b> |         | <b>Media Record Specifications .....</b>                                     | <b>164</b> |
| 12.1      |         | General specifications.....                                                  | 164        |
|           | 12.1.1  | Introduction.....                                                            | 164        |
|           | 12.1.2  | Partitioning.....                                                            | 164        |
|           | 12.1.3  | Logical Record.....                                                          | 164        |
|           | 12.1.4  | Media Record.....                                                            | 164        |
|           | 12.1.5  | Continuation Record.....                                                     | 164        |
|           | 12.1.6  | Null Record .....                                                            | 164        |
|           | 12.1.7  | Fields of variable and fixed length.....                                     | 164        |
|           | 12.1.8  | Repeating Fields.....                                                        | 164        |
|           | 12.1.9  | Repeating Field Groups.....                                                  | 165        |
|           | 12.1.10 | Nesting Of Repeating Fields.....                                             | 165        |
|           | 12.1.11 | Packing .....                                                                | 165        |
|           | 12.1.12 | Data Types.....                                                              | 165        |
|           | 12.1.13 | Character sets .....                                                         | 165        |
|           | 12.1.14 | Justification.....                                                           | 165        |
|           | 12.1.15 | Order of Records .....                                                       | 165        |
|           | 12.1.16 | Order of subrecords .....                                                    | 165        |
|           | 12.1.17 | Links between data records.....                                              | 166        |
| 12.2      |         | Field specifications.....                                                    | 173        |
|           | 12.2.1  | Field Name .....                                                             | 173        |
|           | 12.2.2  | Record Control Fields .....                                                  | 173        |
|           | 12.2.3  | Common fields.....                                                           | 177        |
|           | 12.2.4  | Fields in Global Records.....                                                | 180        |
|           | 12.2.5  | Fields in Data Records.....                                                  | 180        |
|           | 12.2.6  | Fields in Update Information Records .....                                   | 182        |
|           | 12.2.7  | Fields Catalogue.....                                                        | 183        |
| 12.3      |         | Additional Constraints for Topological Features.....                         | 197        |
|           | 12.3.1  | Order of multiple Coordinate tuples in Coordinate Records.....               | 197        |
|           | 12.3.2  | Order of Edges in Line Features, Belt Features, Area Features and Faces..... | 198        |
|           | 12.3.3  | Order of Features in Relationship Records .....                              | 198        |
|           | 12.3.4  | Order of Features in Relationship Records .....                              | 198        |

|           |                                                                                                                     |            |
|-----------|---------------------------------------------------------------------------------------------------------------------|------------|
| 12.4      | Additional Constraints for Non-Explicit Topological Features: Order of Coordinate triplets in Feature Records ..... | 198        |
| 12.5      | Mandatory Records .....                                                                                             | 198        |
| 12.6      | Record Format Specifications: Global Records .....                                                                  | 198        |
| 12.6.1    | Album Header Record [ALHDREC] .....                                                                                 | 198        |
| 12.6.2    | Dataset Header Record [DSHDREC] .....                                                                               | 198        |
| 12.6.3    | Field Definition Record [FIELDDEFREC] .....                                                                         | 198        |
| 12.6.4    | Record Definition Record [RECDEFREC] .....                                                                          | 198        |
| 12.6.5    | Feature Definition Record [FEATDEFREC] .....                                                                        | 199        |
| 12.6.6    | Attribute Definition Record [ATDEFREC] .....                                                                        | 199        |
| 12.6.7    | Attribute Value Definition Record [ATTVALREC] .....                                                                 | 199        |
| 12.6.8    | Default Attribute Record [DATTVALLREC] .....                                                                        | 199        |
| 12.6.9    | Relationship Definition Record [RELDEFREC] .....                                                                    | 199        |
| 12.6.10   | Geopolitical Structure Definition Record [GPLSTRDREC] .....                                                         | 199        |
| 12.6.11   | Geopolitical Structure Component Definition Record [GPLCOMDREC] .....                                               | 199        |
| 12.6.12   | Spatial Domain Record [SPADOREC] .....                                                                              | 199        |
| 12.6.13   | Directory Record [DIREC] .....                                                                                      | 199        |
| 12.6.14   | Abbreviation Record [ABBRREC] .....                                                                                 | 199        |
| 12.6.15   | Network Specification Record [NWSPECSREC] .....                                                                     | 199        |
| 12.6.16   | Source Record [SRCEREC] .....                                                                                       | 199        |
| 12.6.17   | Geodetical Parameter Records .....                                                                                  | 201        |
| 12.6.18   | Layer Header Record [LAYHREC] .....                                                                                 | 201        |
| 12.6.19   | Section Header Record [SECHREC] .....                                                                               | 201        |
| 12.6.20   | Comment Record [COMMENTREC] .....                                                                                   | 201        |
| 12.6.21   | Volume Termination Record [VOLTERMREC] .....                                                                        | 201        |
| 12.7      | Record Format Specifications: Data Records .....                                                                    | 201        |
| 12.7.1    | 2D Coordinate Record [XYREC] .....                                                                                  | 201        |
| 12.7.2    | 3D Coordinate Record [XYZREC] .....                                                                                 | 202        |
| 12.7.3    | Node Record [NODEREC] .....                                                                                         | 202        |
| 12.7.4    | Edge Record [EDGEREC] .....                                                                                         | 202        |
| 12.7.5    | Face Record [FACEREC] .....                                                                                         | 202        |
| 12.7.6    | Point Feature Record (Explicit Point Topology sub-record) [POFEREC.01] .....                                        | 202        |
| 12.7.7    | Point Feature Record (Non-explicit Point Topology sub-record) [POFEREC.03] .....                                    | 202        |
| 12.7.8    | Line Feature Record (Explicit Line Topology sub-record) [LIFEREC.01] .....                                          | 202        |
| 12.7.9    | Line Feature Record (Non-Explicit Line Topology sub-record) [LIFEREC.03] .....                                      | 202        |
| 12.7.10   | Belt Feature Record (Full Rendering Belt Topology sub-record) [BEFEREC.01] .....                                    | 202        |
| 12.7.11   | Belt Feature (Connectivity Rendering Belt Topology sub-record) [BEFEREC.02] .....                                   | 203        |
| 12.7.12   | Belt Feature (Non-explicit Belt Topology sub-record) [BEFEREC.03] .....                                             | 205        |
| <b>13</b> | <b>XML schema specifications .....</b>                                                                              | <b>207</b> |
| 13.1      | Introduction .....                                                                                                  | 207        |
| 13.1.1    | Schema design principles .....                                                                                      | 208        |
| 13.2      | Data content .....                                                                                                  | 208        |
| 13.3      | GDF Part2 XML schema .....                                                                                          | 208        |
| 13.4      | Schema GDF_Main_Part2.xsd .....                                                                                     | 208        |
| 13.4.1    | Header .....                                                                                                        | 208        |
| 13.4.2    | GDF Main Part2 .....                                                                                                | 208        |
| 13.4.3    | Full Topology Belt Feature part2 .....                                                                              | 210        |
| 13.4.4    | Connectivity Topology Belt Feature part2 .....                                                                      | 211        |
| 13.4.5    | Non-explicit Topology Belt Feature part2 .....                                                                      | 212        |
| 13.4.6    | Explicit Point Feature part2 .....                                                                                  | 213        |
| 13.4.7    | Non-explicit Point Feature part2 .....                                                                              | 214        |
| 13.4.8    | Explicit Line Feature part2 .....                                                                                   | 214        |
| 13.4.9    | Non-explicit Line Feature part2 .....                                                                               | 215        |
| 13.4.10   | Full Topology Area Feature part2 .....                                                                              | 216        |
| 13.4.11   | Connectivity Topology Area Feature part2 .....                                                                      | 216        |

|                                                                                               |                                                              |            |
|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------|------------|
| 13.4.12                                                                                       | Non-explicit Topology Area Feature part2 .....               | 216        |
| 13.4.13                                                                                       | Explicit Topology Complex Feature part2 .....                | 217        |
| 13.4.14                                                                                       | Non-explicit Topology Complex Feature part2 .....            | 218        |
| 13.4.15                                                                                       | Attribute part2 .....                                        | 219        |
| 13.4.16                                                                                       | Relationship part2 .....                                     | 219        |
| 13.5                                                                                          | Schema GDF_data_dict_Part2.xsd .....                         | 220        |
| 13.5.1                                                                                        | Header .....                                                 | 220        |
| 13.5.2                                                                                        | Attribute Type code part2 .....                              | 220        |
| 13.5.3                                                                                        | Belt element pointer .....                                   | 220        |
| 13.5.4                                                                                        | Belt element type .....                                      | 220        |
| 13.5.5                                                                                        | Belt Feature ID .....                                        | 220        |
| 13.5.6                                                                                        | Defined Attribute Type code D part2 .....                    | 221        |
| 13.5.7                                                                                        | Defined Attribute Type code D Name part2 .....               | 221        |
| 13.5.8                                                                                        | Defined Attribute Type code D Value part2 .....              | 222        |
| 13.5.9                                                                                        | Defined Attribute Type code Data Type Code part2 .....       | 223        |
| 13.5.10                                                                                       | Defined Attribute Type code Definition part2 .....           | 224        |
| 13.5.11                                                                                       | Defined Attribute Type code Definition Reference part2 ..... | 225        |
| 13.5.12                                                                                       | Defined Attribute Code List Part2 .....                      | 226        |
| 13.5.13                                                                                       | Defined Feature Category Name part2 .....                    | 234        |
| 13.5.14                                                                                       | Defined Feature Category Value part2 .....                   | 234        |
| 13.5.15                                                                                       | Defined Feature Code part2 .....                             | 234        |
| 13.5.16                                                                                       | Defined Feature Code Name part2 .....                        | 234        |
| 13.5.17                                                                                       | Defined Feature Code Value part2 .....                       | 235        |
| 13.5.18                                                                                       | Feature Category part2 .....                                 | 235        |
| 13.5.19                                                                                       | Feature Code part2 .....                                     | 235        |
| 13.5.20                                                                                       | Record Type part2 .....                                      | 236        |
| 13.5.21                                                                                       | Record Type Name part2 .....                                 | 236        |
| 13.5.22                                                                                       | Record Type Value part2 .....                                | 236        |
| 13.5.23                                                                                       | Record Type part2 (simple) .....                             | 236        |
| 13.5.24                                                                                       | Record Subtype part2 (simple) .....                          | 236        |
| 13.5.25                                                                                       | Relationship Code part2 .....                                | 236        |
| 13.5.26                                                                                       | Relationship Code D part2 .....                              | 236        |
| 13.5.27                                                                                       | Relationship Code Name part2 .....                           | 237        |
| 13.5.28                                                                                       | Relationship Code Value part2 .....                          | 237        |
| 13.5.29                                                                                       | Relationship Code Roles Definition part2 .....               | 238        |
| 13.5.30                                                                                       | Relationship Code Roles Definition part2 Declination .....   | 238        |
| 13.5.31                                                                                       | Relationship Feature part2 .....                             | 239        |
| 13.5.32                                                                                       | Relationship Role Code Lists part2 .....                     | 239        |
| 13.6                                                                                          | Schema GDF_userDefined_Part2.xsd .....                       | 254        |
| 13.6.1                                                                                        | Header .....                                                 | 254        |
| 13.6.2                                                                                        | Attribute Descriptor part2 .....                             | 254        |
| 13.6.3                                                                                        | Attribute Content part2 .....                                | 255        |
| 13.6.4                                                                                        | User-defined Attribute Type code part2 .....                 | 255        |
| 13.6.5                                                                                        | User-defined Attribute Type code Name part2 .....            | 255        |
| 13.6.6                                                                                        | User-defined Attribute Type code Value part2 .....           | 255        |
| 13.6.7                                                                                        | User-defined Feature Codes part2 .....                       | 255        |
| 13.6.8                                                                                        | User-defined Feature Code Name part2 .....                   | 255        |
| 13.6.9                                                                                        | User-defined Feature Code Value part2 .....                  | 255        |
| 13.6.10                                                                                       | User-defined Relationship Code part2 .....                   | 255        |
| 13.6.11                                                                                       | User-defined Relationship Code Name part2 .....              | 256        |
| 13.6.12                                                                                       | User-defined Relationship Code Value part2 .....             | 256        |
| <b>Annex A (normative) Semantic codes for GDF5.1 Part 2 .....</b>                             |                                                              | <b>257</b> |
| <b>Annex B (normative) Syntax for Time Domains of GDF5.1 Part 2 .....</b>                     |                                                              | <b>263</b> |
| <b>Annex C (normative) Sectioning GDF Datasets .....</b>                                      |                                                              | <b>287</b> |
| <b>Annex D (normative) Definition and description of the subtypes of Road Furniture .....</b> |                                                              | <b>290</b> |

|                                                                                                                |            |
|----------------------------------------------------------------------------------------------------------------|------------|
| <b>Annex E (normative) Definition and description of the subtypes of Public Transport Point Features .....</b> | <b>307</b> |
| <b>Annex F (normative) XML schema specification file for GDF5.1 Part1 and Part2.....</b>                       | <b>317</b> |
| <b>Annex G (informative) Examples of XML representation of GDF5.1 Part 2 (this document) in Japan.....</b>     | <b>544</b> |
| <b>Annex H (informative) UML notation .....</b>                                                                | <b>580</b> |
| <b>Annex I (informative) Examples of BeltProperty concepts.....</b>                                            | <b>586</b> |
| <b>Bibliography .....</b>                                                                                      | <b>589</b> |